

Physical and Chemical Data*

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GENERAL REFERENCES

PHYSICAL PROPERTIES OF PURE SUBSTANCES

Tables	
2-1	Physical Properties of the Elements and Inorganic Compounds 2-7
2-2	Physical Properties of Organic Compounds 2-28

VAPOR PRESSURES OF PURE SUBSTANCES

Units Conversions	2-48
Additional References	2-48
Tables	
2-3	Vapor Pressure of Water Ice from -15 to 0°C 2-48
2-4	Vapor Pressure of Liquid Water from -16 to 0°C 2-48
2-5	Vapor Pressure of Liquid Water from 0 to 100°C 2-49
2-6	Vapor Pressure of Inorganic and Organic Liquids 2-50
2-6a	Alphabetical Index to Substances in Tables 2-6, 2-30, 2-164, 2-193, 2-196, 2-198, and 2-221 2-55
2-7	Vapor Pressures of Inorganic Compounds, up to 1 atm 2-57
2-8	Vapor Pressures of Organic Compounds, up to 1 atm 2-61

VAPOR PRESSURES OF SOLUTIONS

Units Conversions	2-76
Tables and Figures	
2-9	Partial Pressures of Water over Aqueous Solutions of HCl 2-76
2-10	Partial Pressures of HCl over Aqueous Solutions of HCl 2-76

	Vapor Pressures of H ₃ PO ₄ Aqueous: Partial Pressure of H ₂ O Vapor (Fig. 2-1)	2-77
	Vapor Pressures of H ₃ PO ₄ Aqueous: Weight of H ₂ O in Saturated Air (Fig. 2-2)	2-77
2-11	Partial Pressures of H ₂ O and SO ₂ over Aqueous Solutions of Sulfur Dioxide	2-77
2-12	Water Partial Pressure, bar, over Aqueous Sulfuric Acid Solutions	2-78
2-13	Sulfur Trioxide Partial Pressure, bar, over Aqueous Sulfuric Acid Solutions	2-80
2-14	Sulfuric Acid Partial Pressure, bar, over Aqueous Sulfuric Acid	2-82
2-15	Total Pressure, bar, of Aqueous Sulfuric Acid Solutions	2-83
2-16	Partial Pressures of HNO ₃ and H ₂ O over Aqueous Solutions of HNO ₃	2-84
2-17	Partial Pressures of H ₂ O and HBr over Aqueous Solutions of HBr at 20 to 55°C	2-85
2-18	Partial Pressures of HI over Aqueous Solutions of HI at 25°C	2-85
2-19	Vapor Pressures of the System: Water-Sulfuric Acid-Nitric Acid	2-85
2-20	Total Vapor Pressures of Aqueous Solutions of CH ₃ COOH	2-85
2-21	Partial Pressures of H ₂ O over Aqueous Solutions of HN ₃	2-85
	Vapor Pressure of Aqueous Diethylene Glycol Solutions (Fig. 2-3)	2-85
2-22	Mole Percentages of H ₂ O over Aqueous Solutions of NH ₃	2-86
2-23	Partial Pressures of NH ₃ over Aqueous Solutions of NH ₃	2-87

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2-2 PHYSICAL AND CHEMICAL DATA

2-24	Total Vapor Pressures of Aqueous Solutions of NH ₃	2-88
2-25	Partial Pressures of H ₂ O over Aqueous Solutions of Sodium Carbonate	2-89
2-26	Partial Pressures of H ₂ O and CH ₃ OH over Aqueous Solutions of Methyl Alcohol	2-89
2-27	Partial Pressures of H ₂ O over Aqueous Solutions of Sodium Hydroxide	2-89

WATER-VAPOR CONTENT OF GASES

Chart for Gases at High Pressures	2-90
Water Content of Air (Fig. 2-4)	2-90

DENSITIES OF PURE SUBSTANCES

Units Conversions	2-91
Tables	
2-28 Density (kg/m ³) of Water from 0 to 100°C	2-91
2-29 Density (kg/m ³) of Mercury from 0 to 350°C	2-93
2-30 Densities of Inorganic and Organic Liquids	2-94

DENSITIES OF AQUEOUS INORGANIC SOLUTIONS

Units and Units Conversions	2-99
Additional References	2-99
Tables	
2-31 Aluminum Sulfate [Al ₂ (SO ₄) ₃]	2-99
2-32 Ammonia (NH ₃)	2-99
2-33 Ammonium Acetate (CH ₃ COONH ₄)	2-99
2-34 Ammonium Bichromate [(NH ₄) ₂ Cr ₂ O ₇]	2-99
2-35 Ammonium Chloride (NH ₄ Cl)	2-99
2-36 Ammonium Chromate [(NH ₄) ₂ CrO ₄]	2-99
2-37 Ammonium Nitrate (NH ₄ NO ₃)	2-99
2-38 Ammonium Sulfate [(NH ₄) ₂ SO ₄]	2-99
2-39 Arsenic Acid (H ₃ AsO ₄)	2-99
2-40 Barium Chloride (BaCl ₂)	2-100
2-41 Cadmium Nitrate [Cd(NO ₃) ₂]	2-100
2-42 Calcium Chloride (CaCl ₂)	2-100
2-43 Calcium Hydroxide [Ca(OH) ₂]	2-100
2-44 Calcium Hypochlorite (CaOCl ₂)	2-100
2-45 Calcium Nitrate [Ca(NO ₃) ₂]	2-100
2-46 Chromic Acid (CrO ₃)	2-100
2-47 Chromium Chloride (CrCl ₃)	2-100
2-48 Copper Nitrate [Cu(NO ₃) ₂]	2-100
2-49 Copper Sulfate (CuSO ₄)	2-100
2-50 Cuprous Chloride (Cu ₂ Cl ₂)	2-100
2-51 Ferric Chloride (FeCl ₃)	2-100
2-52 Ferric Sulfate [Fe ₂ (SO ₄) ₃]	2-101
2-53 Ferric Nitrate [Fe(NO ₃) ₃]	2-101
2-54 Ferrous Sulfate (FeSO ₄)	2-101
2-55 Hydrogen Bromide (HBr)	2-101
2-56 Hydrogen Cyanide (HCN)	2-101
2-57 Hydrogen Chloride (HCl)	2-101
2-58 Hydrogen Fluoride (HF)	2-101
2-59 Hydrogen Peroxide (H ₂ O ₂)	2-101
2-60 Hydrofluosilic Acid (H ₂ SiF ₆)	2-101
2-61 Magnesium Chloride (MgCl ₂)	2-101
2-62 Magnesium Sulfate (MgSO ₄)	2-101
2-63 Nickel Chloride (NiCl ₂)	2-101
2-64 Nickel Nitrate [Ni(NO ₃) ₂]	2-101
2-65 Nickel Sulfate (NiSO ₄)	2-101
2-66 Nitric Acid (HNO ₃)	2-102
2-67 Perchloric Acid (HClO ₄)	2-103
2-68 Phosphoric Acid (H ₃ PO ₄)	2-103
2-69 Potassium Bicarbonate (KHCO ₃)	2-103
2-70 Potassium Bromide (KBr)	2-103
2-71 Potassium Carbonate (K ₂ CO ₃)	2-104
2-72 Potassium Chromate (K ₂ CrO ₄)	2-104
2-73 Potassium Chlorate (KClO ₃)	2-104
2-74 Potassium Chloride (KCl)	2-104
2-75 Potassium Chrome Alum [K ₂ Cr ₂ (SO ₄) ₄]	2-104
2-76 Potassium Hydroxide (KOH)	2-104
2-77 Potassium Nitrate (KNO ₃)	2-104
2-78 Potassium Dichromate (K ₂ Cr ₂ O ₇)	2-104
2-79 Potassium Sulfate (K ₂ SO ₄)	2-104
2-80 Potassium Sulfite (K ₂ SO ₃)	2-104
2-81 Sodium Acetate (NaC ₂ H ₃ O ₂)	2-104
2-82 Sodium Arsenate (Na ₃ AsO ₄)	2-104
2-83 Sodium Bichromate (Na ₂ Cr ₂ O ₇)	2-104
2-84 Sodium Bromide (NaBr)	2-104
2-85 Sodium Formate (HCOONa)	2-104
2-86 Sodium Carbonate (Na ₂ CO ₃)	2-105
2-87 Sodium Chlorate (NaClO ₃)	2-105

2-88 Sodium Chloride (NaCl)	2-105
2-89 Sodium Chromate (Na ₂ CrO ₄)	2-105
2-90 Sodium Hydroxide (NaOH)	2-105
2-91 Sodium Nitrate (NaNO ₃)	2-105
2-92 Sodium Nitrite (NaNO ₂)	2-105
2-93 Sodium Silicates	2-105
2-94 Sodium Sulfate (Na ₂ SO ₄)	2-106
2-95 Sodium Sulfide (Na ₂ S)	2-106
2-96 Sodium Sulfite (Na ₂ SO ₃)	2-106
2-97 Sodium Thiosulfate (Na ₂ S ₂ O ₃)	2-106
2-98 Sodium Thiosulfate Pentahydrate (Na ₂ S ₂ O ₃ ·5H ₂ O)	2-106
2-99 Stannic Chloride (SnCl ₄)	2-106
2-100 Stannous Chloride (SnCl ₂)	2-106
2-101 Sulfuric Acid (H ₂ SO ₄)	2-107
2-102 Zinc Bromide (ZnBr ₂)	2-109
2-103 Zinc Chloride (ZnCl ₂)	2-109
2-104 Zinc Nitrate [Zn(NO ₃) ₂]	2-109
2-105 Zinc Sulfate (ZnSO ₄)	2-109

DENSITIES OF AQUEOUS ORGANIC SOLUTIONS

Units and Units Conversions	2-109
Tables	
2-106 Formic Acid (HCOOH)	2-109
2-107 Acetic Acid (CH ₃ COOH)	2-110
2-108 Oxalic Acid (H ₂ C ₂ O ₄)	2-111
2-109 Methyl Alcohol (CH ₃ OH)	2-111
2-110 Ethyl Alcohol (C ₂ H ₅ OH)	2-112
2-111 Densities of Mixtures of C ₂ H ₅ OH and H ₂ O at 20°C	2-113
2-112 Specific Gravity (60°/60°F [(15.56°/15.56°C)]) of Mixtures by Volume of C ₂ H ₅ OH and H ₂ O	2-114
2-113 <i>n</i> -Propyl Alcohol (C ₃ H ₇ OH)	2-115
2-114 Isopropyl Alcohol (C ₃ H ₇ OH)	2-115
2-115 Glycerol	2-116
2-116 Hydrazine (N ₂ H ₄)	2-116
2-117 Densities of Aqueous Solutions of Miscellaneous Organic Compounds	2-117

DENSITIES OF MISCELLANEOUS MATERIALS

Tables	
2-118 Approximate Specific Gravities and Densities of Miscellaneous Solids and Liquids	2-119
2-119 Density (kg/m ³) of Selected Elements as a Function of Temperature	2-120

SOLUBILITIES

Units Conversions	2-120
Tables	
2-120 Solubilities of Inorganic Compounds in Water at Various Temperatures	2-121
2-121 Acetylene (C ₂ H ₂)	2-125
2-122 Air	2-125
2-123 Ammonia (NH ₃)	2-125
2-124 Ammonia (NH ₃)—Low Pressures	2-125
2-125 Carbon Dioxide (CO ₂)	2-125
2-126 Carbon Monoxide (CO)	2-125
2-127 Carbonyl Sulfide (COS)	2-125
2-128 Chlorine (Cl ₂)	2-126
2-129 Chlorine Dioxide (ClO ₂)	2-126
2-130 Ethane (C ₂ H ₆)	2-126
2-131 Ethylene (C ₂ H ₄)	2-126
2-132 Helium (He)	2-126
2-133 Hydrogen (H ₂)—Temperature	2-126
2-134 Hydrogen (H ₂)—Pressure	2-127
2-135 Hydrogen Chloride (HCl)	2-127
2-136 Hydrogen Sulfide (H ₂ S)	2-127
2-137 Methane (CH ₄)	2-127
2-138 Nitrogen (N ₂)—Temperature	2-127
2-139 Nitrogen (N ₂)—Pressure	2-127
2-140 Oxygen (O ₂)—Temperature	2-127
2-141 Oxygen (O ₂)—Pressure	2-127
2-142 Ozone (O ₃)	2-128
2-143 Propylene (C ₃ H ₆)	2-128
2-144 Sulfur Dioxide (SO ₂)	2-128

THERMAL EXPANSION

Units Conversions	2-128
Additional References	2-128
Thermal Expansion of Gases	2-128
Tables	
2-145 Linear Expansion of the Solid Elements	2-129

2-146	Linear Expansion of Miscellaneous Substances.	2-130
2-147	Cubical Expansion of Liquids.	2-131
2-148	Cubical Expansion of Solids.	2-131

JOULE-THOMSON EFFECT

Units Conversions.	2-132	
Tables		
2-149	Additional References Available for the Joule-Thomson Coefficient.	2-132
2-150	Approximate Inversion-Curve Locus in Reduced Coordinates ($T_r = T/T_c$; $P_r = P/P_c$).	2-133
2-151	Joule-Thomson Data for Air.	2-133
2-152	Approximate Inversion-Curve Locus for Air.	2-133
2-153	Joule-Thomson Data for Argon.	2-133
2-154	Approximate Inversion-Curve Locus for Argon.	2-134
2-155	Joule-Thomson Data for Carbon Dioxide.	2-134
2-156	Approximate Inversion-Curve Locus for Carbon Dioxide.	2-134
2-157	Approximate Inversion-Curve Locus for Deuterium.	2-134
2-158	Approximate Inversion-Curve Locus for Ethane.	2-134
2-159	Joule-Thomson Data for Helium.	2-135
2-160	Approximate Inversion-Curve Locus for Normal Hydrogen.	2-135
2-161	Approximate Inversion-Curve Locus for Methane.	2-135
2-162	Joule-Thomson Data for Nitrogen.	2-135
2-163	Approximate Inversion-Curve Locus for Propane.	2-135

CRITICAL CONSTANTS

Additional References.	2-136	
Table		
2-164	Critical Constants and Acentric Factors of Inorganic and Organic Compounds.	2-136

COMPRESSIBILITIES

Introduction.	2-140	
Units Conversions.	2-140	
Tables		
2-165	Compressibility Factors for Air.	2-140
2-166	Compressibility Factors for Argon.	2-140
2-167	Compressibility Factors for Carbon Dioxide.	2-141
2-168	Compressibility Factors for Carbon Monoxide.	2-141
2-169	Compressibility Factors for Ethanol.	2-141
2-170	Compressibility Factors for Ethylene.	2-142
2-171	Compressibility Factors for Normal Hydrogen.	2-142
2-172	Compressibility Factors for KLEA 60.	2-142
2-173	Compressibility Factors for KLEA 61.	2-143
2-174	Compressibility Factors for KLEA 66.	2-143
2-175	Compressibility Factors for Krypton.	2-143
2-176	Compressibility Factors for Methane (R50).	2-144
2-177	Compressibility Factors for Methanol.	2-144
2-178	Compressibility Factors for Neon.	2-144
2-179	Compressibility Factors for Nitrogen.	2-145
2-180	Compressibility Factors for Oxygen.	2-145
2-181	Compressibility Factors for Refrigerant 32.	2-145
2-182	Compressibility Factors for Refrigerant 123.	2-146
2-183	Compressibility Factors for Refrigerant 124.	2-146
2-184	Compressibility Factors for Refrigerant 134a.	2-146
2-185	Compressibility Factors for Water Substance (fps units).	2-147
2-186	Compressibility Factors of Water Substance (SI units).	2-148
2-187	Compressibility Factors for Xenon.	2-149
2-188	Compressibilities of Liquids.	2-149
2-189	Compressibilities of Solids.	2-150

LATENT HEATS

Units Conversions.	2-150	
Tables		
2-190	Heats of Fusion and Vaporization of the Elements and Inorganic Compounds.	2-151
2-191	Heats of Fusion of Miscellaneous Materials.	2-153
2-192	Heats of Fusion of Organic Compounds.	2-154
2-193	Heats of Vaporization of Inorganic and Organic Compounds.	2-156

SPECIFIC HEATS OF PURE COMPOUNDS

Units Conversions.	2-161	
Additional References.	2-161	
Tables		
2-194	Heat Capacities of the Elements and Inorganic Compounds.	2-161
2-195	Specific Heat [kJ/(kg·K)] of Selected Elements.	2-169
2-196	Heat Capacities of Inorganic and Organic Liquids.	2-170
2-197	Specific Heats of Organic Solids.	2-175
2-198	Heat Capacities of Inorganic and Organic Compounds in the Ideal Gas State.	2-178

2-199	C_p/C_v : Ratios of Specific Heats of Gases at 1-atm Pressure.	2-183
2-200	Specific Heat Ratio, C_p/C_v , for Air.	2-183

SPECIFIC HEATS OF AQUEOUS SOLUTIONS

Units Conversions.	2-184	
Additional References.	2-184	
Tables		
2-201	Acetic Acid (at 38°C).	2-184
2-202	Ammonia.	2-184
2-203	Aniline (at 20°C).	2-184
2-204	Copper Chloride.	2-184
2-205	Ethyl Alcohol.	2-184
2-206	Glycerol.	2-184
2-207	Hydrochloric Acid.	2-184
2-208	Methyl Alcohol.	2-184
2-209	Nitric Acid.	2-184
2-210	Phosphoric Acid.	2-184
2-211	Potassium Chloride.	2-185
2-212	Potassium Hydroxide (at 19°C).	2-185
2-213	Normal Propyl Alcohol.	2-185
2-214	Sodium Carbonate.	2-185
2-215	Sodium Chloride.	2-185
2-216	Sodium Hydroxide (at 20°C).	2-185
2-217	Sulfuric Acid.	2-185
2-218	Zinc Sulfate.	2-185

SPECIFIC HEATS OF MISCELLANEOUS MATERIALS

Tables		
2-219	Specific Heats of Miscellaneous Liquids and Solids.	2-186
2-219a	Oils (Animal, Vegetable, Mineral Oils).	2-186

HEATS AND FREE ENERGIES OF FORMATION

Units Conversions.	2-186	
Table		
2-220	Heats and Free Energies of Formation of Inorganic Compounds.	2-187

HEATS OF COMBUSTION

Table		
2-221	Enthalpies and Gibbs Energies of Formation, Entropies, and Net Enthalpies of Combustion of Inorganic and Organic Compounds at 298.15 K.	2-195
2-222	Ideal Gas Sensible Enthalpies, $h_T - h_{298}$ (kJ/kgmol), of Combustion Products.	2-199
2-223	Ideal Gas Entropies, s° , kJ/kgmol·K, of Combustion Products.	2-200

HEATS OF SOLUTION

Tables		
2-224	Heats of Solution of Inorganic Compounds in Water.	2-201
2-225	Heats of Solution of Organic Compounds in Water (at Infinite Dilution and Approximately Room Temperature).	2-204

THERMODYNAMIC PROPERTIES

Explanation of Tables.	2-205	
Units Conversions.	2-205	
Additional References.	2-205	
Tables		
2-226	Thermophysical Properties of Saturated Acetone.	2-206
2-227	Saturated Acetylene.	2-206
2-228	Saturated Air.	2-207
2-229	Thermophysical Properties of Compressed Air.	2-208
2-230	Enthalpy and Psi Functions for Ideal-Gas Air.	2-212
	Temperature-Entropy Diagram for Air (Fig. 2-5).	2-213
2-231	Air.	2-214
2-232	Saturated Ammonia.	2-214
	Enthalpy-Log-Pressure Diagram for Ammonia (Fig. 2-6).	2-215
	Enthalpy-Concentration Diagram for Aqueous Ammonia (Fig. 2-7).	2-216
2-233	Saturated Argon (R740).	2-217
2-234	Thermodynamic Properties of Compressed Argon.	2-217
2-235	Liquid-Vapor Equilibrium Data for the Argon-Nitrogen-Oxygen System.	2-218
2-236	Thermodynamic Properties of the International Standard Atmosphere.	2-221
2-237	Saturated Benzene.	2-221
2-238	Saturated Bromine.	2-222
2-239	Saturated Normal Butane (R600).	2-222
2-240	Superheated Normal Butane.	2-223

2-241	Saturated Carbon Dioxide	2-224	2-303	Saturated Refrigerant 13B1	2-272
2-242	Superheated Carbon Dioxide	2-225	2-304	Saturated Refrigerant 21	2-272
2-243	Saturated Carbon Monoxide	2-225	2-305	Saturated Refrigerant 22	2-273
	Temperature-Entropy Diagram for Carbon Monoxide (Fig. 2-8)	2-226		Enthalpy-Log-Pressure Diagram for Refrigerant 22 (Fig. 2-20)	2-273
2-244	Thermophysical Properties of Saturated Carbon Tetrachloride	2-227	2-306	Thermophysical Properties of Compressed R22	2-274
2-245	Saturated Carbon Tetrafluoride (R14)	2-227	2-307	Saturated Refrigerant 23	2-274
2-246	Saturated Cesium	2-228	2-308	Thermophysical Properties of Saturated Difluoromethane (R32)	2-275
2-247	Thermophysical Properties of Saturated Chlorine	2-229	2-309	Specific Heat at Constant Pressure, Thermal Conductivity, Viscosity, and Prandtl of R32 Gas	2-276
	Enthalpy-Log-Pressure Diagram for Chlorine (Fig. 2-9)	2-230	2-310	Saturated SUVA MP 39	2-276
2-248	Saturated Chloroform (R20)	2-231	2-311	SUVA MP 39 at Atmospheric Pressure	2-276
2-249	Saturated Decane	2-231		Enthalpy-Log-Pressure Diagram for Refrigerant 32 (Fig. 2-21)	2-277
2-250	Saturated Normal Deuterium	2-232	2-312	Thermodynamic Properties of Saturated KLEA 60	2-278
2-251	Saturated Deuterium Oxide	2-232	2-313	Thermodynamic Properties of Saturated KLEA 61	2-278
2-252	Deuterium Oxide Gas at 1-kg/cm ³ Pressure	2-232		Enthalpy-Log-Pressure Diagram for KLEA 60 (Fig. 2-22)	2-279
2-253	Saturated Diphenyl	2-233		Enthalpy-Log-Pressure Diagram for KLEA 61 (Fig. 2-23)	2-280
2-254	Saturated Ethane (R170)	2-233	2-314	Saturated SUVA HP 62	2-281
2-255	Superheated Ethane	2-234	2-315	SUVA HP 62 at Atmospheric Pressure	2-281
2-256	Saturated Ethanol	2-235	2-316	Thermodynamic Properties of Saturated KLEA 66	2-281
	Enthalpy-Concentration Diagram for Aqueous Ethyl Alcohol (Fig. 2-10)	2-235		Enthalpy-Log-Pressure Diagram for KLEA 66 (Fig. 2-24)	2-282
2-257	Saturated Ethylene (Ethene—R1150)	2-236	2-317	Saturated SUVA MP 66	2-283
2-258	Compressed Ethylene	2-237	2-318	SUVA MP 66 at Atmospheric Pressure	2-283
2-259	Saturated Fluorine	2-239	2-319	Saturated SUVA HP 80	2-283
2-260	Fluorine Gas at Atmospheric Pressure	2-239	2-320	SUVA HP 80 at Atmospheric Pressure	2-284
2-261	Fluotec	2-239	2-321	Saturated SUVA HP 81	2-284
2-262	Halon	2-239	2-322	SUVA HP 81 at Atmospheric Pressure	2-284
2-263	Saturated Helium ³	2-239	2-323	Saturated Refrigerant 113	2-285
2-264	Saturated Helium ⁴	2-240	2-324	Saturated Refrigerant 114	2-286
2-265	Superheated Helium	2-241	2-325	Saturated Refrigerant 115	2-286
2-266	Helium ⁴ Gas at Atmospheric Pressure	2-241	2-326	Thermodynamic Properties of Refrigerant 123	2-287
2-267	Saturated <i>n</i> -Heptane	2-242	2-327	Saturated Refrigerant 124	2-287
2-268	Hexane	2-242		Enthalpy-Log-Pressure Diagram for Refrigerant 123 (Fig. 2-25)	2-288
2-269	Saturated Hydrazine	2-243	2-328	Thermophysical Properties of Saturated Refrigerant 125	2-289
2-270	Saturated <i>n</i> -Hydrogen	2-243	2-329	Thermophysical Properties of Refrigerant 134a	2-289
2-271	Compressed <i>n</i> -Hydrogen	2-244		Enthalpy-Log-Pressure Diagram for Refrigerant 125 (Fig. 2-26)	2-290
2-272	Saturated <i>para</i> -Hydrogen	2-246	2-330	Thermophysical Properties of Compressed Gaseous Refrigerant 134a	2-291
2-273	Saturated Hydrogen Peroxide	2-246	2-331	Refrigerant 141b	2-292
2-274	Hydrogen Sulfide	2-246		Enthalpy-Log-Pressure Diagram for Refrigerant 134a (Fig. 2-27)	2-293
	Enthalpy-Concentration Diagram for Aqueous Hydrogen Chloride at 1 atm (Fig. 2-11)	2-247	2-332	Refrigerant 142b	2-294
2-275	Saturated Isobutane (R600a)	2-248	2-333	Saturated Refrigerant R143a	2-294
2-276	Saturated Krypton	2-248	2-334	Saturated Refrigerant R152a	2-295
2-277	Compressed Krypton	2-249	2-335	Saturated Refrigerant 216	2-295
2-278	Saturated Lithium	2-249	2-336	Saturated Refrigerant 245	2-296
2-279	Lithium Bromide—Water Solutions	2-249	2-337	Refrigerant C 318	2-296
2-280	Saturated Mercury	2-250	2-338	Saturated Refrigerant 500	2-297
2-281	Saturated Methane	2-251	2-339	Saturated Refrigerant 502	2-297
	Enthalpy-Log-Pressure Diagram for Mercury (Fig. 2-12)	2-252	2-340	Saturated Refrigerant 503	2-298
2-282	Superheated Methane	2-253	2-341	Saturated Refrigerant 504	2-298
2-283	Thermophysical Properties of Saturated Methanol	2-254	2-342	Thermodynamic Properties of Refrigerant 507	2-298
2-284	Thermodynamic Properties of Compressed Methanol	2-255	2-343	Saturated Rubidium	2-299
2-285	Saturated Methyl Chloride	2-256	2-344	Thermophysical Properties of Saturated Seawater	2-299
2-286	Saturated Neon	2-256	2-345	Saturated Sodium	2-300
2-287	Compressed Neon	2-257		Mollier Diagram for Sodium (Fig. 2-28)	2-301
2-288	Saturated Nitrogen (R728)	2-257		Enthalpy-Concentration Diagram for Aqueous Sodium Hydroxide at 1 atm (Fig. 2-29)	2-302
	Temperature-Entropy Diagram for Nitrogen (Fig. 2-13)	2-258	2-346	Saturated Sulfur Dioxide	2-302
2-289	Thermophysical Properties of Nitrogen (R728) at Atmospheric Pressure	2-259	2-347	Thermodynamic Properties of Saturated Sulfur Hexafluoride (SF ₆)	2-303
2-290	Saturated Nitrogen Tetroxide	2-259		Enthalpy-Concentration Diagram for Aqueous Sulfuric Acid at 1 atm (Fig. 2-30)	2-303
2-291	Saturated Nitrous Oxide	2-259		Enthalpy-Log-Pressure Diagram for Sulfur Hexafluoride (Fig. 2-31)	2-303
	Mollier Diagram for Nitrous Oxide (Fig. 2-14)	2-260	2-348	Saturated SUVA AC 9000	2-304
2-292	Nonane	2-261	2-349	Saturated Toluene	2-304
2-293	Octane	2-261	2-350	Saturated Solid/Vapor Water	2-304
2-294	Saturated Oxygen (R732)	2-262	2-351	Saturated Water Substance—Temperature (fps units)	2-305
	Temperature-Entropy Chart for Oxygen (Fig. 2-15)	2-263	2-352	Saturated Water Substance—Temperature (SI units)	2-306
	Enthalpy-Concentration Diagram for Oxygen-Nitrogen Mixture at 1 atm (Fig. 2-16)	2-264	2-353	Saturated Liquid Water—Miscellaneous Properties	2-308
2-295	Pentane	2-264	2-354	Thermodynamic Properties of Compressed Steam	2-309
2-296	Saturated Potassium	2-264	2-355	Density, Specific Heats at Constant Pressure and at Constant Volume and Velocity of Sound for Compressed Water, 1–1000 bar, 0–150°C	2-311
	Mollier Diagram for Potassium (Fig. 2-17)	2-265	2-356	Specific Heat and Other Thermophysical Properties of Water Substance	2-313
2-297	Saturated Propane (R290)	2-266			
2-298	Saturated Propylene (Propene, R1270)	2-267			
2-299	Compressed Propylene (Propene, R1270)	2-268			
2-300	Saturated Refrigerant 11	2-269			
	Enthalpy-Log-Pressure Diagram for Refrigerant 11 (Fig. 2-18)	2-269			
2-301	Saturated Refrigerant 12	2-270			
2-302	Saturated Refrigerant 13	2-270			
	Enthalpy-Log-Pressure Diagram for Refrigerant 12 (Fig. 2-19)	2-271			

2-357 Thermodynamic Properties of Water Substance along the Melting Line 2-315
 2-358 Saturated Xenon 2-315
 2-359 Compressed Xenon 2-316
 2-360 Surface Tension (N/m) of Saturated Liquid Refrigerants 2-317
 2-361 Velocity of Sound (m/s) in Gaseous Refrigerants at Atmospheric Pressure 2-317
 2-362 Velocity of Sound (m/s) in Saturated Liquid Refrigerants 2-318

TRANSPORT PROPERTIES

Introduction 2-318
 Units Conversions 2-318
 Additional References Tables 2-318
 2-363 Transport Properties of Selected Gases at Atmospheric Pressure 2-319
 2-364 Viscosities of Gases: Coordinates for Use with Fig. 2-32. Nomograph for Determining (a) Absolute Viscosity of a Gas as a Function of Temperature Near Ambient Pressure and (b) Relative Viscosity of a Gas Compared with Air (Fig. 2-32) 2-320
 2-365 Viscosities of Liquids: Coordinates for Use with Fig. 2-33. Nomograph for Viscosities of Liquids at 1 atm (Fig. 2-33) 2-321
 2-366 Viscosity of Sucrose Solutions 2-322
 Nomograph for Thermal Conductivity of Organic Liquids (Fig. 2-34) 2-324
 2-367 Thermal Conductivity Nomograph Coordinates 2-324
 2-368 Prandtl Number of Air 2-325
 2-369 Prandtl Number of Liquid Refrigerants 2-325
 2-370 Thermophysical Properties of Miscellaneous Saturated Liquids 2-326
 2-371 Diffusivities of Pairs of Gases and Vapors (1 atm) 2-328
 2-372 Diffusivities in Liquids (25°C) 2-330
 2-373 Thermal Conductivities of Some Building and Insulating Materials 2-333
 2-374 Thermal-Conductivity-Temperature Table for Metals 2-334
 2-375 Thermal Conductivity of Chromium Alloys 2-335
 2-376 Thermal Conductivity of Some Alloys at High Temperature 2-335
 2-377 Thermal Conductivities of Some Materials for Refrigeration and Building Insulation 2-335
 2-378 Thermal Conductivities of Insulating Materials at High Temperatures 2-335
 2-379 Thermal Conductivities of Insulating Materials at Moderate Temperatures (Nusselt) 2-336
 2-380 Thermal Conductivities of Insulating Materials at Low Temperatures (Gröber) 2-336
 2-381 Thermal Diffusivity (m²/s) of Selected Elements 2-336
 2-382 Thermophysical Properties of Selected Nonmetallic Solid Substances 2-337

PREDICTION AND CORRELATION OF PHYSICAL PROPERTIES

Introduction 2-337
 Units 2-337
 Nomenclature 2-338
 References 2-339
 Pure Component Constants 2-340
 Critical Temperature 2-340
 Critical Pressure 2-340
 Example 1 Estimate the Critical Temperature and Critical Pressure of 2-Butanol Using the Ambrose Method 2-342
 Example 2 Estimate the Critical Temperature and Critical Pressure of 2-Butanol, Which Has an Experimental Normal Boiling Point of 372.7 K 2-342
 Critical Volume 2-344
 Example 3 Estimate the Critical Volume of 2-Butanol 2-344
 Critical Compressibility Factor 2-344
 Normal Freezing Temperature (Melting Point) 2-344
 Normal Boiling Temperature 2-344
 Example 4 Estimate the Normal Boiling Point of 2-Butanol 2-345
 Acentric Factor 2-345
 Miscellaneous Characterizing Constants 2-345
 Vapor Pressure 2-345
 Correlation Methods 2-345
 Prediction Methods 2-346
 Example 5 Estimate the Vapor Pressure of 1-Butene at 98°C 2-346
 Example 6 Estimate the Vapor Pressure of Tetralin at 150°C 2-346
 Example 7 Estimate the Vapor Pressure of Thiophene at 500 K 2-347
 Example 8 Estimate the Vapor Pressure of Acetaldehyde at 0°C 2-347
 Ideal Gas Thermal Properties 2-347

Heat Capacity, C_p° 2-347
 Example 9 Using Eq. 2-48 to Estimate the Ideal Gas Heat Capacity of Acetone (C₃H₆O) at 600 K 2-348
 Enthalpy of Formation 2-348
 Example 10 ΔH_f° of 2-Butanol 2-348
 Gibbs Energy of Formation 2-348
 Example 11 ΔG_f° of Phenol 2-348
 Entropy of Formation 2-348
 Enthalpy of Vaporization and Fusion 2-349
 Enthalpy of Vaporization 2-349
 Example 12 Estimate ΔH_v of Propionaldehyde at 350 K 2-350
 Example 13 Estimate ΔH_v of Ethyl Acetate 2-350
 Example 14 Estimate ΔH_v of Ethyl Acetate at 450 K 2-350
 Enthalpy of Fusion 2-350
 Solid and Liquid Heat Capacity 2-351
 Solid Heat Capacity 2-351
 Example 15 Estimate Solid Heat Capacity of Dinenzothiophene 2-351
 Liquid Heat Capacity 2-351
 Example 16 Estimate Liquid Heat Capacity of 2-Butanol 2-351
 Example 17 Estimate Liquid Heat Capacity of 1,4 Pentadiene 2-354
 Density 2-355
 Correlation Methods 2-355
 Vapor Density Prediction 2-355
 Example 18 Estimate the Molar Volume of Isobutane at 155°C and 1.0 MPa Pressure 2-355
 Example 19 Estimate the Molar Volume of Isobutane at 155°C and 8.6 MPa Pressure 2-357
 Liquid Density Prediction 2-358
 Example 20 Estimate the Density of Saturated Liquid Propane at 0°C 2-359
 Example 21 Estimate the Liquid Density of *n*-Nonane at 104.5°C and 6.893 MPa Pressure 2-360
 Solid Density Prediction 2-361
 Viscosity 2-361
 Correlation Methods 2-362
 Vapor Viscosity 2-362
 Example 22 Estimate the Vapor Viscosity of Propane at 101.3 kPa and 80°C 2-363
 Example 23 Estimate the Vapor Viscosity of a Mixture of Propane and Methane 2-363
 Example 24 Estimate the Vapor Viscosity of Isopropyl Alcohol at 251°C and Atmospheric Pressure 2-363
 Example 25 Estimate the Vapor Viscosity of Carbon Dioxide at 350 K and a Total Pressure of 20 MPa 2-364
 Liquid Viscosity 2-365
 Example 26 Estimate the Liquid Viscosity of *cis*-1,4-dimethylcyclohexane at 0°C 2-366
 Vapor and Liquid Thermal Conductivity 2-367
 Gases 2-367
 Example 27 Estimate Thermal Conductivity for *n*-Hexane 2-367
 Example 28 Estimate Thermal Conductivity of Carbon Dioxide at 370 K and Low Pressure 2-367
 Example 29 Estimate the Thermal Conductivity of Carbon Dioxide at 370 K and 10 MPa Pressure 2-368
 Example 30 Estimate Thermal Conductivity of a Mixture 2-368
 Liquids 2-368
 Example 31 Estimate Thermal Conductivity of *n*-Octane at 373.15 K 2-368
 Example 32 Estimate Thermal Conductivity of *n*-Octane at 473.15 K 2-369
 Example 33 Estimate Thermal Conductivity of *n*-Butanol 2-369
 Example 34 Estimate the Thermal Conductivity of *n*-Propionaldehyde 2-369
 Example 35 Estimate Thermal Conductivity of *n*-Butanol 2-369
 Example 36 Estimate Thermal Conductivity of a Mixture 2-370
 Diffusivity 2-370
 Gas Diffusivity 2-370
 Example 37 Estimate the Diffusivity of Benzene Vapor Diffusing into Air at 30°C and 96.5 kPa Total Pressure 2-370
 Example 38 Estimate the Diffusivity of Hydrogen (1) in Nitrogen (2) at 60°C and 17.23 MPa 2-371
 Example 39 Estimate the Infinite Dilution Diffusivity of Propane (1) in Chlorobenzene (2) at 25°C 2-371
 Liquid Diffusivity 2-371
 Surface Tension 2-372
 Example 40 Estimate Surface Tension for Mercaptan 2-372
 Example 41 Estimate Surface Tension for Isobutyric Acid 2-372
 Example 42 Estimate Surface Tension of a Mixture 2-372
 Example 43 Estimate Surface Tension of a Water-Methanol Mixture 2-373
 Flammability Properties 2-374

GENERAL REFERENCES

Considerations of reader interest, space availability, the system or systems of units employed, copyright considerations, etc., have all influenced the revision of material in previous editions for the present edition. Reference is made at numerous places to various specialized works and also, when appropriate, to more general works. A listing of general works may be useful to readers in need of further information.

ASHRAE Handbook—*Fundamentals*, IP and SI editions, ASHRAE, Atlanta, various dates; Beaton, C.F. and G.F. Hewitt, *Physical Property Data for the Design Engineer*, Hemisphere, New York, 1989 (394 pp.); Benedek, P. and F. Olti, *Computer-Aided Chemical Thermodynamics of Gases and Liquids*, Wiley, New York, 1985 (731 pp.); Daubert, T.E. and R.P. Danner, *Physical and Thermodynamic Properties of Pure Chemicals*, 4 vols., Hemisphere, New York, 1989 (2030 pp.); suppl. 1, 1991 (456 pp.); suppl. 2, 1992 (736 pp.); Gmehling, J., *Azeotropic Data*, 2 vols., VCH Weinheim, Germany, 1994 (1900 pp.); Kaye, S.M., *Encyclopedia of Explosives and Related Items*, U.S. Army R&D command, Dover, NJ, 1980; King, M.B., *Phase Equilibrium in Mixtures*, Pergamon, Oxford, 1969; Lyman, W.J., W.F. Reehl et al., *Handbook of Chemical Property Estimation Methods*, McGraw-Hill, N.Y., 1982 (929 pp.); Ohse, R.W., *Handbook of Thermodynamic and Transport Properties of Alkali Metals*, Blackwell Sci. Pubs., Oxford, England, 1985 (1020 pp.); Reid, R.C., J.M. Prausnitz et al., *The Properties of Gases and Liquids*, McGraw-Hill, New York, 1987 (742 pp.); Sterbacek, Z., B. Biskup et al., *Calculation of Properties Using Corresponding States Methods*, Elsevier, Amsterdam, 1979.

Compilations of critical data include Ambrose, D., "Vapor-Liquid Critical Properties," N.P.L. Teddington, Middx. rept. Chem 107, 1980 (62 pp.); Brule, M.R., L.L. Lee et al., *Chem. Eng.*, **86**, 25 (Nov. 19, 1979) 155–164; Kudchaker,

A.P., G.H. Alani et al., *Chem. Revs.*, **68** (1968) 659–735; Matthews, J.F., *Chem. Revs.*, **72** (1972) 71–100; Reid, R.C., J.M. Prausnitz et al., *The Properties of Gases and Liquids*, 4th ed., McGraw-Hill, New York, 1987 (741 pp.); Ohse, R.W. and H. von Tippelskirch, *High Temp.—High Press.*, **9** (1977) 367–385; Young, D.A., "Phase Diagrams of the Elements," UCRL Rept. 51902, 1975 (64 pp.); republished in expanded form by the University of California Press, 1991. Rothman, D. et al., *Max Planck Inst. f. Stromungsforschung*, Ber 6, 1978 (77 pp.).

PUBLICATIONS ON THERMOCHEMISTRY

Pedley, J.B., *Thermochemical Data and Structures of Organic Compounds*, 1, *Thermodyn. Res. Ctr.*, Texas A&M Univ., 1994 (976 pp., 3000 cpds.); Frenkel, M., G.J. Kabo et al., *Thermodynamics of Organic Compounds in the Gas State*, 2 vols., *Thermodyn. Res. Ctr.*, Texas A&M Univ., 1994 (1825 pp., 2000 cpds.); Barin, I., *Thermochemical Data of Pure Substances*, 2 vols., 2d ed., VCH Weinheim, Germany 1993 (1834 pp., 2400 substances); and Gurvich, L.V., I.V. Veyts et al., *Thermodynamic Properties of Individual Substances*, 3 vols., 4th ed., Hemisphere, New York, 1989, 1990, and 1993 (2520 pp.). See also Lide, D.R. and G.W.A. Milne, *Handbook of Data on Organic Compounds*, 7 vols., 3d ed., Chemical Rubber, Miami, 1993 (7000 pp.); Daubert, T.E., R.P. Danner et al., *Physical and Thermodynamic Properties of Pure Chemicals: Data Compilation*, extant 1995, Taylor & Francis, Bristol, PA, 1995; Database 11, N.I.S.T. Gaithersburg, MD. U.S. Bureau of Mines publications include *Bulletins* 584, 1960 (232 pp.); 592, 1961 (149 pp.); 595, 1961 (68 pp.); 654, 1970 (26 pp.) Chase, M.W., C.A. Davies et al., *JANAF Thermochemical Tables*, 3d ed., *J. Phys. Chem. Ref. Data* 14 suppl 1., 1986 (1896 pp.).

PHYSICAL PROPERTIES OF PURE SUBSTANCES

TABLE 2-1 Physical Properties of the Elements and Inorganic Compounds*

Abbreviations Used in the Table

a., acid A., specific gravity with reference to air = 1 abs., absolute ac., acetic acid act., acetone al., 95 percent ethyl alcohol alk, alkali (<i>i.e.</i> , aq. NaOH or KOH) am., amyl (C ₅ H ₁₁) amor., amorphous anh., anhydrous aq., aqueous or water aq. reg., aqua regia	atm., atmosphere or 760 mm. of mercury pressure bk., black brn., brown bz., benzene c., cold cb., cubic cc, cubic centimeter chl., chloroform col., colorless or white conc., concentrated cr., crystals or crystalline d., decomposes D., specific gravity with reference to hydrogen = 1	d. 50, decomposes at 50°C; 50 d., melts at 50°C with decomposition delq., deliquescent dil., dilute dk., dark eff., effloresces or efflorescent et., ethyl ether expl., explodes gel., gelatinous gly., glycerol (glycerin) gn., green h., hot hex., hexagonal	hyg., hygroscopic i., insoluble ign., ignites lq., liquid lt., light m. al., methyl alcohol mn., monochinic nd., needles NH ₃ , liquid ammonia NH ₄ OH, ammonium hydroxide solution oct., octahedral or., orange pd., powder	pl., plates pr., prisms or prismatic pyr., pyridine rhb., rhombic (orthorhombic) s., soluble satd., saturated sl., slightly soln., solution subl., sublimes sulf., sulfides tart. a., tartaric acid tet., tetragonal tr., transition tri., triclinic	trig., trigonal v., very vac., in vacuo vl., violet volt., volatile or volatilizes wh., white yel., yellow ∞, soluble in all proportions <, less than >, greater than 42±, about or near 42 -3H ₂ O, 100, loses 3 moles of water per formula weight at 100°C
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Formula weights are based upon the International Atomic Weights of 1941 and are computed to the nearest hundredth.

Refractive index, where given for a uniaxial crystal, is for the ordinary (ω) ray; where given for a biaxial crystal, the index given is for the median (β) value. Unless otherwise specified, the index is given for the sodium D-line ($\lambda = 589.3 \text{ m}\mu$).

Specific gravity values are given at room temperatures (15° to 20°C) unless otherwise indicated by the small figures which follow the value: thus, "5.6^{18°}" indicates a specific gravity of 5.6 for the substance at 18°C referred to water at 4°C. In this table the values for the specific gravity of gases are given with reference to air (A) = 1, or hydrogen (D) = 1.

Melting point is recorded in a certain case as "82 d." and in some other case as "d. 82," the distinction being made in this manner to indicate that the former is a melting point with decomposition at 82°C, while in the latter decomposition only occurs at 82°C. Where a value such as "-2H₂O, 82" is given it indicates loss of 2 moles of water per formula weight of the compound at a temperature of 82°C.

Boiling point is given at atmospheric pressure (760 mm. of mercury) unless otherwise indicated; thus, "82^{15mm.}" indicates the boiling point is 82°C when the pressure is 15 mm.

Solubility is given in parts by weight (of the formula shown at the extreme left) per 100 parts by weight of the solvent; the small superscript indicates the temperature. In the case of gases the solubility is often expressed in some manner as "5^{10°} cc" which indicates that at 10°C, 5 cc. of the gas are soluble in 100 g. of the solvent. The symbols of the common mineral acids: H₂SO₄, HNO₃, HCl, etc., represent dilute aqueous solutions of these acids. See also special tables on Solubility.

REFERENCES: The information given in this table has been collected mainly from the following sources: Mellor, *A Comprehensive Treatise on Inorganic and Theoretical Chemistry*, Longmans, New York, 1922. Abegg, *Handbuch der anorganischen Chemie*, S. Hirzel, Leipzig, 1905. Gmelin-Kraut, *Handbuch der anorganischen Chemie*, 7th ed., Carl Winter, Heidelberg; 8th ed., Verlag Chemie, Berlin, 1924. Friend, *Textbook of Inorganic Chemistry*, Griffin, London, 1914. Winchell, *Microscopic Character of Artificial Inorganic Solid Substances or Artificial Minerals*, Wiley, New York, 1931. *International Critical Tables*, McGraw-Hill, New York, 1926. *Tables annuelles internationales de constants et donnees numeriques*, McGraw-Hill, New York. *Annual Tables of Physical Constants and Numerical Data*, National Research Council, Princeton, N.J., 1943. Comey and Hahn, *A Dictionary of Chemical Solubilities*, Macmillan, New York, 1921. Seidell, *Solubilities of Inorganic and Metal Organic Compounds*, Van Nostrand, New York, 1940.

Name	Formula	Formula weight	Color, crystalline form and refractive index	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Cold water	Hot water	Other reagents
Aluminum acetate, normal	Al	26.97	silv., cb.	2.70 ^{20°}	660	2056	i.	i.	s. HCl, H ₂ SO ₄ , alk.
	Al(C ₂ H ₃ O ₂) ₃	204.10	wh. pd.		d. 200		s.	d.	
	Al(OH)(C ₂ H ₃ O ₂) ₂	162.07	wh., amor.		d.		i.		s. a.; i. NH ₄ salts
acetate, basic	AlBr ₃	266.72	trig.	3.01 ^{25°}	97.5	268	s.		s. al., act., CS ₂
	AlBr ₃ ·6H ₂ O	374.82	col., delq. cr.		d. 100		s.	s.	s. al., CS ₂
bromide	Al ₂ C ₃	143.91	yel., hex., 2.70	2.95	d. >2200		d. to CH ₄		s. a.; i. act.
	AlCl ₃	133.34	wh., delq., hex.	2.44 ^{25°}	194 ^{5.2atm.}	182.7 ^{752mm.}	69.87 ^{15°}	s. d.	s. et., chl., CCl ₄ ; i. bz.
chloride	AlCl ₃ ·6H ₂ O	241.44	col., delq., trig., 1.560				400	v. s.	50 al.; s. et.
	AlF ₃ ·H ₂ O	101.99	col., rhb., 1.490	2.17	d.		sl. s.		
fluoride	Al ₂ F ₆ ·7H ₂ O	294.05	wh., cr. pd.		-4H ₂ O, 120	-6H ₂ O, 250	i.	sl. s.	
	Al(OH) ₃	77.99	wh., mn.	2.42	-2H ₂ O, 300		0.000104 ^{18°}	i.	s. a., alk.; i. a.
hydroxide	Al(NO ₃) ₃ ·9H ₂ O	375.14	rhb., delq.		73	d. 134	v. s.	v. s. d.	s. al., CS ₂
	Al ₂ N ₃	81.96	yel., hex.	3.05 ^{25°}	2150 ^{4atm.}	d. >1400	d. slowly		s. alk. d.
nitrate	Al ₂ O ₃	101.94	col., hex., 1.67-8	3.99	1999 to 2032		i.	i.	v. sl. s. a., alk.
	Al ₂ O ₃	101.94	wh., trig., 1.768	4.00	1999 to 2032	2210	i.	i.	v. sl. s. a., alk.
oxide (corundum)	AlPO ₄	121.95	col., hex.	2.59			i.	i.	s. a., alk.; i. ac.
phosphate									

*By N. A. Lange, Ph.D., Handbook Publishers, Inc., Sandusky, Ohio. Abridged from table of Physical Constants of Inorganic Compounds in Lange, "Handbook of Chemistry."

TABLE 2-1 Physical Properties of the Elements and Inorganic Compounds (Continued)

Name	Formula	Formula weight	Color, crystalline form and refractive index	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts			
							Cold water	Hot water	Other reagents	
Aluminum (<i>Cont.</i>) potassium silicate (muscovite)	3Al ₂ O ₃ ·K ₂ O·6SiO ₂ ·2H ₂ O	796.40	mn., 1.590	2.9	d.			i.		
potassium silicate (orthoclase)	Al ₂ O ₃ ·K ₂ O·6SiO ₂	556.49	col., mn., 1.524	2.56	1450 (1150)			i.		
Aluminum potassium tartrate	AlK(C ₄ H ₄ O ₆) ₂	362.21	col.					s.	s.	
sodium fluorite (cryolite)	AlF ₃ ·3NaF	209.96	wh., mn., 1.3389	2.90	1000			sl. s.	i. HCl	
sodium silicate	Al ₂ O ₃ ·Na ₂ O·6SiO ₂	524.29	col., tri., 1.529	2.61	1100			i.	d. a.	
sulfate	Al ₂ (SO ₄) ₃	342.12	wh. cr.	2.71	d. 770			31.3 ^{0°}	89 ^{100°}	
Alum, ammonium (tschermigite)	Al ₂ (SO ₄) ₃ ·(NH ₄) ₂ SO ₄ ·24H ₂ O	906.64	col., oct., 1.4594	1.64 ^{20°} / ₄	93.5	-20H ₂ O, 120; -24H ₂ O, 200		3.9 ^{0°}	∞ 100°	i. al.
ammonium chrome	Cr ₂ (SO ₄) ₃ ·(NH ₄) ₂ SO ₄ ·24H ₂ O	956.72	gn. or vl., oct., 1.4842	1.72	100 d.			21.2 ^{25°}		s. al.
ammonium iron	Fe ₂ (SO ₄) ₃ ·(NH ₄) ₂ SO ₄ ·24H ₂ O	964.40	vl., oct., 1.485	1.71	40			124 ^{25°}		i. al.
potassium (kalinite)	Al ₂ (SO ₄) ₃ ·K ₂ SO ₄ ·24H ₂ O	948.76	col., mn., 1.4564	1.76 ^{26°} / ₄	92	-18H ₂ O, 64.5		5.7 ^{0°}	∞ ^{93°}	
potassium chrome	Cr ₂ (SO ₄) ₃ ·K ₂ SO ₄ ·24H ₂ O	998.84	red or gn., cb., 1.4814	1.83	89			20	50	i. al.
sodium	Al ₂ (SO ₄) ₃ ·Na ₂ SO ₄ ·24H ₂ O	916.56	col., oct., 1.4388	1.675 ^{20°} / ₄	61			106.4 ^{0°}	121.7 ^{45°}	i. al.
Ammonia†	NH ₃	17.03	col. gas, 1.325 (lq.)	0.817 ^{-79°} 0.5971 (A)	-77.7	-33.4		89.9 ^{0°}	7.4 ^{96°}	14.8 ^{20°} al.; s. et.
Ammonium acetate	NH ₄ C ₂ H ₃ O ₂	77.08	wh., hyg. cr.	1.073	114	d.		148 ^{4°}		s. al.; sl. s. act.
auricyanide	NH ₄ CN·Au(CN) ₃ ·H ₂ O	337.33	pl.		d. 200			s.	v. s.	i. al.
bicarbonate	NH ₄ HCO ₃	79.06	mn. or rhb., 1.5358	1.573	d. 35-60			11.9 ^{0°}	27 ^{30°}	i. al.
bromide	NH ₄ Br	97.96	col., cb., 1.7108	2.327 ^{15°} / ₄	subl. 542			68 ^{10°}	145.6 ^{100°}	s. al., et., act.
carbonate	(NH ₄) ₂ CO ₃ ·H ₂ O	114.11	col. pl.		d. 58			100 ^{15°}		i. al., CS ₂ , NH ₃
carbonate, carbamate	NH ₄ HCO ₃	157.11	wh. cr.		subl.			25 ^{15°}	67 ^{65°}	
carbonate, sesqui-	(NH ₄) ₂ CO ₃ ·2NH ₄ HCO ₃ ·H ₂ O	272.22	wh.		d.			20 ^{15°}	50 ^{49°}	
chloride (salammoniac)	NH ₄ Cl	53.50	wh., cb., 1.639, 1.6426	1.53 ^{17°}	d. 350	subl. 520		29.4 ^{0°}	77.3 ^{100°}	s. NH ₃ ; sl. s. al., m. al.
chloroplatinate	(NH ₄) ₂ PtCl ₆	444.05	yel., cb.	3.065	d.			0.7 ^{15°}	1.25 ^{100°}	0.005 al.
chloroplatinite	(NH ₄) ₂ PtCl ₄	373.14	tet.		d.			s.	v. s.	
chlorostannate	(NH ₄) ₂ SnCl ₆	367.52	pink., cb.	2.4				33.3 ^{15°}		
chromate	(NH ₄) ₂ CrO ₄	152.09	yel., mn.	1.917 ^{12°}	d. 180			40.5 ^{30°}	d.	sl. s. act., NH ₃ ; i. al.
cyanide	NH ₄ CN	44.06	col., cb.	0.79 ^{100°} (A)	36			s.	v. s.	s. al.
dichromate	(NH ₄) ₂ Cr ₂ O ₇	252.10	or., mn.	2.15	d. 185			47.2 ^{30°}	v. s.	s. al.; i. act.
ferrocyanide	(NH ₄) ₄ Fe(CN) ₆ ·6H ₂ O	392.21	mn.		d.			s.	i. al.	i. al.
fluoride	NH ₄ F	37.04	wh., hex.					v. s.	d.	s. al.; i. NH ₃
fluoride, acid	NH ₄ F·HF	57.05	wh., rhb., 1.390	2.21 ^{15°} / ₂				v. s.		
formate	HCO ₂ NH ₄	63.06	col., mn., delq.	1.266	114-116	d. 180; subl. in vac. subl. 120		102 ^{0°}	531 ^{80°}	s. al.
hydrosulfide	NH ₄ HS	51.11	col., rhb.		d.			v. s.		s. al.
hydroxide	NH ₄ OH	35.05	in soln. only					s.		
molybdate	(NH ₄) ₂ MoO ₄	196.03	mn.	2.27	d.			d.	d.	i. al., NH ₃
molybdate, hepta-	(NH ₄) ₆ Mo ₇ O ₂₄ ·4H ₂ O†	1235.95	col., mn.					44 ^{25°}		i. al.
nitrate (α), stable -16° to 32°	NH ₄ NO ₃	80.05	col., tet., 1.611	1.66 ^{25°} / ₄	169.6	d. 210		118.3 ^{0°}	241.8 ^{30°}	
nitrate (β), stable 32° to 84°	NH ₄ NO ₃	80.05	col., rhb. or mn.	1.725 ^{25°} / ₄		d. 210		365.8 ^{35°}	580 ^{80°}	3.8 ^{20°} al., 17.1 ^{20°} m. al.; v. s. NH ₃
nitrite	NH ₄ NO ₂	64.05	wh. nd.	1.69	expl.			s.	d.	s. al.
osmochloride	(NH ₄) ₂ OsCl ₆	439.02	cb.	2.93 ^{20°} / ₄						
oxalate	(NH ₄) ₂ C ₂ O ₄ ·H ₂ O	142.12	col., rhb.	1.501				2.5 ^{0°}	11.8 ^{50°}	sl. s. al.; i. NH ₃
oxalate, acid	NH ₄ H ₂ C ₂ O ₄ ·H ₂ O	125.08	col., trimetric	1.556	d.			s.		
perchlorate	NH ₄ ClO ₄	117.50	col., rhb., 1.4833	1.95	d.			10.9 ^{0°}	46.9 ^{100°}	2 ^{20°} al.; s. act.; i. et.
persulfate	(NH ₄) ₂ S ₂ O ₈	228.20	wh., mn., 1.5016	1.98	d. 120			58.2 ^{0°}	d.	
phosphate, monobasic	NH ₄ H ₂ PO ₄	115.04	col., tet., 1.5246	1.803 ^{19°} / ₄				22.7 ^{0°}	173.2 ^{100°}	i. ac.

phosphate, dibasic	(NH ₄) ₂ HPO ₄	132.07	col., mn., 1.53	1.619			131 ^{15°}		i. act.
phosphate, meta-	(NH ₄) ₂ P ₂ O ₇	388.08	col., mn.	2.21			s.		
Ammonium phosphomolybdate	(NH ₄) ₃ PO ₄ ·12MoO ₃ ·3H ₂ O (?)	1930.55	yel.		d.		0.03 ^{15°}	i.	s. alk.; i. al., HNO ₃
silicofluoride	(NH ₄) ₂ SiF ₆	178.14	cb., 1.3696	2.01		subl.	18.5 ^{17.3°}	55.5	s. al.; i. act.
sulfamate	NH ₄ ·SO ₃ ·NH ₂	114.12	col. pl.		132	d. 160	134 ^{0°}	357 ^{90°}	
sulfate (mascagnite)	(NH ₄) ₂ SO ₄	132.14	col., rhh., 1.5230	1.769 ^{20°}	235 d.		70.6 ^{0°}	103.3 ^{100°}	i. al., act., CS ₂
sulfate, acid	NH ₄ HSO ₄	115.11	col., rhh., 1.480	1.78	146.9	490	100		v. sl. s. al.; i. act.
sulfide	(NH ₄) ₂ S	68.14	yel.-wh.		d.		v. s.		120 ^{25°} NH ₃
sulfide, penta-	(NH ₄) ₂ S ₅	196.38	or.-red pr.				s.		
sulfite	(NH ₄) ₂ SO ₃ ·H ₂ O	134.16	col., mn.	1.41	d.		100 ^{12°}		i. al., act.
sulfate, acid	NH ₄ HSO ₃	99.11	rhh.	2.03 ^{1/4°}	d.		s.		
tartrate	(NH ₄) ₂ C ₄ H ₄ O ₆	184.15	col., mn.	1.60	d.		45 ^{0°}	87 ^{60°}	sl. s. al.
thiocyanate	NH ₄ CNS	76.12	col., mn., 1.685 ±	1.305	149.6	d. 170	120 ^{0°}	170 ^{20°}	s. al., act., NH ₃ , SO ₂
vanadate, meta-	NH ₄ VO ₃	116.99	col. cr.	2.326	d.		0.44 ^{18°}	3.05 ^{70°}	i. al., NH ₄ Cl
Antimony	Sb	121.76	tin wh., trig.	6.684 ^{25°}	630.5	1380	i.		s. aq. reg., h. conc.
chloride, tri- (butter of antimony)*	SbCl ₃	228.13	col., rhh., delq.	3.14 ^{20°}	73.4	220.2	601.6 ^{0°}	∞ ^{72°}	H ₂ SO ₄ s. al., HCl, HBr, H ₂ C ₄ H ₄ O ₆
oxide, tri- (valentinite)	Sb ₂ O ₃	291.52	rhh., 2.35	5.67	656	1570	v. sl. s.	sl. s.	s. HCl, KOH, H ₂ C ₄ H ₄ O ₆
oxide, tri- (senarmonite)	Sb ₂ O ₃	291.52	cb., 2.087	5.2	652				
sulfide, tri- (stibnite)	Sb ₂ S ₃	339.70	bk., rhh., 4.046	4.64	550		0.00017 ^{18°}	d.	s. HCl; alk., NH ₄ HS, K ₂ S; i. ac.
sulfide, penta-	Sb ₂ S ₅	403.82	golden	4.120 ^{0°}	-2S, 135		i.	i.	s. HCl, alk., NH ₄ HS
telluride, tri-	Sb ₂ Te ₃	626.35	gray		629				
Antimonyl potassium tartrate (tartar emetic)	(SbO)KC ₄ H ₄ O ₆ ·a H ₂ O	333.94	wh., rhh.	2.60	-a H ₂ O, 100		5.26 ^{8.7°}	35.7 ^{100°}	s. gly.; i. al.
sulfate, normal	(SbO) ₂ SO ₄	371.58	wh. pd.	4.89			d.	d.	
sulfate, basic	(SbO) ₂ SO ₄ ·Sb ₂ (OH) ₄	683.13	wh. pd.				i.	d.	5.15 ^{15°} gly.
Argon	A	39.94	col. gas	1.65 ^{-285°} ; 1.402 ^{-185.7°} ; 1.38 (A)	-189.2	-185.7	5.6 ^{0°} cc	2.23 ^{50°} cc	24 ^{25°} cc al.
Arsenic (crystalline) (α)	As ₄	299.64	met., hex.	5.727 ^{14°}	814 ^{36atm.}	subl. 615	i.	i.	s. HNO ₃
Arsenic (black) (β)	As ₄	299.64	bk., amor.	4.7 ^{20°}			i.	i.	s. HNO ₃ , aq. reg., aq. Cl ₂ , h. alk.
Arsenic (yellow)(γ)	As ₄	299.64	yel., cb.	2.0 ^{20°}	d. 358				
acid, ortho-	H ₃ AsO ₄ ·a H ₂ O	150.94	col., hyg.	2.0-2.5	35.5	-H ₂ O, 160	16.7	50	s. alk.
acid, meta-	HAsO ₃	123.92	wh., hyg.		d.		d. to form	H ₃ AsO ₄	
acid, pyro-	H ₄ As ₂ O ₇	265.85	col.		d. 206		d. to form	H ₃ AsO ₄	
pentoxide	As ₂ O ₅	229.82	wh., amor.	4.086		d.	59.5 ^{0°}	76.7 ^{100°}	s. alk., al.
sulfide, di- (realgar)	As ₂ S ₂	213.94	red, mn., 2.68	(α)3.506 ^{19°} ; (β)3.254 ^{19°}	(α)tr. 267; (β)307	565	i.	d.	s. K ₂ S, NaHCO ₃
sulfide, penta-	As ₂ S ₅	310.12	yel.			d. 500	0.000136 ^{0°}	i.	s. HNO ₃ , alk.
Arsenious chloride (butter of arsenic)	AsCl ₃	181.28	oily lq.	lq. 2.163	-18	130	d.	d.	s. HCl, HBr, PCl ₃
hydride (arsine)	AsH ₃	77.93	col. gas	2.695 (A)	-113.5	-55; d. 230	20 cc	sl. s.	sl. s. alk.
oxide (arsenolite)	As ₂ O ₃	197.82	col., cb., fibrous, 1.755	3.865 ^{25°}	subl.		sl. s.	sl. s.	i. al., et.
oxide (claudetite)	As ₂ O ₃	197.82	col., mn., 1.92	3.85	subl.		sl. s.	sl. s.	i. al., et.
oxide	As ₂ O ₃	197.82	amor. or vitreous	3.738	315		1.21 ^{0°}	2.93 ^{40°}	s. HCl, alk., Na ₂ CO ₃ ; i. al., et.
Auric chloride	AuCl ₃ ·2H ₂ O	339.60	or. cr.		d.		v. s.	v. s.	s. HCl, al., et.; sl. s. NH ₃
cyanide	Au(CN) ₃ ·6H ₂ O	383.35			d. 50		v. s.	v. s.	s. al.
Aurous chloride	AuCl	232.66	yel. cr.	7.4	AuCl ₃ , 170	d. 290	d.	d.	s. HCl, HBr; d. al.
cyanide	AuCN	223.22	yel. cr.		d.		i.	i.	s. KCN; i. al., et.
<i>Cf. also under Gold</i>									
Barium	Ba	137.36	silv. met.	3.5	850	1140	d.	d.	s. a.; d. al.
acetate	Ba(C ₂ H ₃ O ₂) ₂	255.45	col.	2.468			58.8 ^{0°}	75.0 ^{100°}	
acetate	Ba(C ₂ H ₃ O ₂) ₂ ·H ₂ O	273.46	wh., tri. pr., 1.517	2.19	-H ₂ O, 41		75 ^{30°} (anh.)	79 ^{40°} (anh.)	i. al.
bromide	BaBr ₂	297.19	col.	4.781 ^{24°}	847	d.	98 ^{0°}	149 ^{100°}	v. s. m. al.; v. sl. s. act.

*Usually the solution.

†See special tables.

‡Usual commercial form.

TABLE 2-1 Physical Properties of the Elements and Inorganic Compounds (Continued)

Name	Formula	Formula weight	Color, crystalline form and refractive index	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Cold water	Hot water	Other reagents
Barium (<i>Cont.</i>)									
bromide	BaBr ₂ ·2H ₂ O	333.22	col., mn., 1.7266	3.69	-2H ₂ O, 100	d.	v. s.	v. s.	s. al.
carbonate (witherite)	BaCO ₃	197.37	wh., rhb., 1.676	4.29	tr. 811 to α	d. 1450	0.0022 ^{18°}	0.0065 ^{100°}	s. a.; i. al.
carbonate (α)	BaCO ₃	197.37	wh., hex.		tr. 982 to β				
carbonate (β)	BaCO ₃	197.37	wh.		1740 ^{90atm}		0.0022 ^{18°}	0.0065 ^{100°}	s. a.; i. al.
Barium chlorate	Ba(ClO ₃) ₂	304.27	col.		414		20.35 ^{0°}	84.8 ^{80°}	
chlorate	Ba(ClO ₃) ₂ ·H ₂ O*	322.29	col., mn., 1.577	3.179	d. 120		s.		sl. s. al., act.
chloride	BaCl ₂	208.27	col., mn., 1.7361	3.856 ^{24°}	tr. 925	1560	31 ^{0°}	59 ^{100°}	sl. s. HCl, HNO ₃ ; i. al.
chloride	BaCl ₂	208.27	col., cb.		962	1560			
chloride	BaCl ₂ ·2H ₂ O†	244.31	col., mn., 1.646	3.097 ^{24°}	-2H ₂ O, 100		39.3 ^{0°}	76.8 ^{100°}	sl. s. HCl, HNO ₃ ; i. al.
hydroxide	Ba(OH) ₂	171.38	col., mn.	4.495			1.67 ^{0°}	101.4 ^{80°}	
hydroxide	Ba(OH) ₂ ·8H ₂ O	315.50	col., mn., 1.5017	2.188 ^{16°}	77.9	-8H ₂ O, 550	5.6 ^{15°}		v. sl. s. al.; i. et.
nitrate (nitrobarite)	Ba(NO ₃) ₂	261.38	col., cb., 1.572	3.244 ^{28°}	592	d.	5.0 ^{0°}	34.2 ^{100°}	sl. s. a.; i. al.
oxalate	BaC ₂ O ₄	225.38	wh. cr.	2.658			0.0016 ^{8°}	0.0024 ^{24°}	s. a., NH ₄ Cl; i. al.
oxide	BaO	153.36	col., cb., 1.98	5.72	1923	2000±	1.5 ^{0°}	90.8 ^{80°}	s. HCl, HNO ₃ , abs. al.; i. NH ₃ , act.
peroxide	BaO ₂ *	169.36	gray or wh. pd.	4.958	-O, 800		v. sl. s.	d.	s. dil. a.; i. act.
peroxide	BaO ₂ ·8H ₂ O	313.49	pearly sc.		-8H ₂ O, 100		0.168	d.	s. dil. a.; i. al., et., act.
phosphate, monobasic	BaH ₄ (PO ₄) ₂	331.35	tri.	2.9 ^{0°}			d.	d.	s. a.
phosphate, dibasic	BaHPO ₄	233.35	wh., rhb. nd., 1.635	4.165 ^{15°}			0.015		s. a., NH ₄ salts
phosphate, tribasic	Ba ₃ (PO ₄) ₂	602.04	wh., cb.	4.1 ^{16°}			i.		s. a.
phosphate, pyro-	Ba ₂ P ₂ O ₇	448.68	wh., rhb.	3.9 ^{20°}			0.01		s. a., NH ₄ salts
silicofluoride	BaSiF ₆	279.42	pr.	4.279 ^{15°}			0.026 ^{17°}	0.09 ^{100°}	sl. s. HCl, NH ₄ Cl; i. al.
sulfate (barite, barytes)	BaSO ₄	233.42	col., rhb., 1.636	4.499 ^{15°}	1580 d.	tr. to mn. 1149	0.000115 ^{0°}	0.000285 ^{30°}	s. conc. H ₂ SO ₄ ; 0.006, 3% HCl
sulfide, mono-	BaS	169.42	col., cb., 2.155	4.25 ^{15°}			d.	d.	d. HCl; i. al.
sulfide, tri-	BaS ₃	233.54	yel.-gn.		d. 400		s.	s.	
sulfide, tetra-	BaS ₄ ·2H ₂ O	301.63	red, rhb.	2.988 ^{20°}	d. 200		41 ^{15°}	v. s.	i. al., CS ₂
Beryllium (glucinum)	Be(Gl)	9.02	gray, met., hex.	1.816	1284	2767	i.	sl. s. d.	s. dil. a., alk.
Bismuth	Bi	209.00	silv. wh. or reddish, hex.	9.80 ^{20°}	271	1450	i.	i.	s. aq. reg., conc. H ₂ SO ₄ , HNO ₃
carbonate, sub-	Bi ₂ O ₃ ·CO ₂ ·H ₂ O	528.03	wh. pd.	6.86	d.		i.	i.	s. a.
chloride, di-	BiCl ₃ (?)	279.91	bk. nd.	4.86	163	d. 300	d.		
chloride, tri-	BiCl ₃ *	315.37	wh. cr.	4.75	230	447	d.		s. al.
nitrate	Bi(NO ₃) ₃ ·5H ₂ O	485.10	col., tri.	2.82	d. 30	-5H ₂ O, 80	d.		42 ^{13°} act.; s. a.; i. al.
nitrate, sub-	BiONO ₃ ·H ₂ O	305.02	hex. pl.	4.928 ^{15°}	d. 260		i.	i.	s. a.
oxide, tri-	Bi ₂ O ₃	466.00	yel., rhb.	8.9	820	1900±	i.	i.	s. a.
oxide, tri-	Bi ₂ O ₃	466.00	yel., tet.	8.55	860		i.	i.	s. a.
oxide, tri-	Bi ₂ O ₃	466.00	yel., cb.	8.20	tr. 704		i.	i.	s. a.
oxychloride	BiOCl	260.46	wh., amor.	7.72 ^{15°}			sl. s.	sl. s.	s. a.; i. act., NH ₃ , H ₂ C ₂ H ₄ O ₆
Boric acid	H ₃ BO ₃	61.84	wh., tri.	1.435 ^{15°}	185 d.		2.66 ^{0°}	40.2 ^{100°}	22.2 ^{20°} gly., 0.24 ^{25°} et.; s. al.
Boron	B	10.82	gray or bk., amor. or mn.	2.32	2300	2550	i.	i.	s. HNO ₃ ; i. al.
carbide	B ₄ C	55.29	bk. cr.	2.54	2450	>3500	i.	i.	i. a.
oxide	B ₂ O ₃	69.64	col. glass, 1.459	1.85	577	>1500	1.1 ^{0°}	15.7 ^{100°}	s. a., al., gly.
oxide (sassolite)	B ₂ O ₃ ·3H ₂ O	123.69	tri., 1.456	1.49	d.		sl. s.	s.	
Bromic acid	HBrO ₃	128.92	col.; in soln. only		d. 100		v. s.	d.	
Bromine	Br ₂	159.83	rhb., or red lq.	3.119 ^{20°} ; 5.87 (A)	-7.2	58.78	4.22 ^{0°}	3.13 ^{30°}	s. al., et., alk., CS ₂
hydrate	Br ₂ ·10H ₂ O	339.99	red, oct.		d. 6.8		s.		
Cadmium	Cd	112.41	silv. met., hex.	8.65 ^{20°}	320.9	767	i.	i.	s. a., NH ₄ NO ₃
acetate	Cd(C ₂ H ₃ O ₂) ₂	230.50	col.	2.341	256	d.	v. s.		s. m. al.
acetate	Cd(C ₂ H ₃ O ₂) ₂ ·2H ₂ O*	266.53	col., mn.	2.01	-H ₂ O, 130		v. s.		s. al.
carbonate	CdCO ₃	172.42	wh., trig.	4.258 ^{0°}	d. <500		i.	i.	s. a., KCN, NH ₄ salts; i. NH ₃
chloride	CdCl ₂	183.32	wh., cb.	4.047 ^{25°}	568	960	90 ^{0°}	147 ^{100°}	1.52 ^{15°} al.; i. et., act.

chloride	CdCl ₂ ·2a H ₂ O	228.36	col., mn., 1.6513	3.327	tr. 34		168 ^{20°}	180 ^{100°}	2.05 ^{15°} m. al.
cyanide	Cd(CN) ₂	164.45			d. >200		0.0247 ^{18°}		s. a.; NH ₄ OH, KCN
hydroxide	Cd(OH) ₂	146.43	wh., trig.	4.79 $\frac{14°}{4}$	d. 300		0.00026 ^{25°}		s. a., NH ₄ salts; i. alk.
nitrate	Cd(NO ₃) ₂	236.43	col.		350		109.7 ^{0°}	326 ^{59.5°}	v. s. a.
nitrate	Cd(NO ₃) ₂ ·4H ₂ O [°]	308.49	col. nd.	2.455 $\frac{17°}{4}$		132	215 ^{0°}		s. al., NH ₃ ; i. HNO ₃
oxide	CdO	128.41	brn., cb.	8.15			i.	i.	s. a., NH ₄ salts; i. alk.
oxide	CdO	128.41	brn., amor, 2.49	6.95	d. 900–1000		i.	i.	s. a., NH ₄ salts; i. alk.
oxide, sub-	Cd ₃ O	240.82	gn., amor.	8.192 $\frac{18°}{4}$	d.				d. a., alk.
Cadmium sulfate	CdSO ₄	208.47	rhb.	4.691 $\frac{24°}{4}$	1000		76.5 ^{0°}	60.8 ^{100°}	i.act., NH ₃
sulfate	CdSO ₄ ·H ₂ O	226.49	mn.	3.786 ^{20°}	tr. 108		s.	s.	
sulfate	3CdSO ₄ ·8H ₂ O [°]	769.54	col., mn., 1.565	3.09	tr. 41.5		114.2 ^{0°}	127.6 ^{60°}	i. al.
sulfate	CdSO ₄ ·H ₂ O	280.53	col.	3.05			s.	s.	i. al.
sulfate	CdSO ₄ ·7H ₂ O	334.58	mn.	2.48 $\frac{20°}{4}$	tr. 4		350 ^{-5°}		i. al.
sulfide (greenockite)	CdS	144.47	yel.-or., hex., 2.506	4.58	1750 ^{100atm}	subl. in N ₂ , 980	0.000001	Colloidal	s. a.; v. s. NH ₄ OH
Calcium	Ca	40.08	silv. met., cb.	1.55 ^{20°}	810	1200 ± 30	d.	d.	s. a.; sl. s. al.
acetate	Ca(C ₂ H ₃ O ₂) ₂ ·H ₂ O	176.18	wh. nd.		d.		52 ^{0°}	45.5 ^{80°}	sl. s. al.
aluminate	Ca(AlO ₃) ₂	158.02	col., rhb. or mn.	3.67 ^{20°}	1600		d.		s. HCl
aluminum silicate (anorthite)	CaO·Al ₂ O ₃ ·2SiO ₂	278.14	tri., 1.5832	2.765	1551				
arsenate	Ca ₃ (AsO ₄) ₂	398.06	wh. pd.				0.013 ^{25°}	i.	s. dil. a.
bromide	CaBr ₂	199.91	delq. nd.	3.353 $\frac{25°}{4}$	760	1810	125 ^{0°}	312 ^{105°}	s. al., act.; sl. s. NH ₃
carbonate (aragonite)	CaCO ₃	100.09	col., rhb., 1.6809	2.93	d. 825		0.0012 ^{20°} †	0.002 ^{100°}	s. a., NH ₄ Cl
carbonate (calcite)	CaCO ₃	100.09	col., hex., 1.550	2.711 $\frac{25°}{4}$	1339 ^{103atm}		0.0014 ^{25°}	0.002 ^{100°}	s. a., NH ₄ Cl
chloride (hydrophilite)	CaCl ₂ [°]	110.99	wh., delq., cb., 1.52	2.152 $\frac{15°}{4}$	772	>1600	59.5 ^{0°}	347 ^{260°}	s. al.
chloride	CaCl ₂ ·H ₂ O	129.01	col., delq.				s.	s.	s. al.
chloride	CaCl ₂ ·6H ₂ O	219.09	col., trig., 1.417	1.68 ^{17°}	29.92	-6H ₂ O, 200	v. s.	v. s.	s. al.
citrate	Ca ₃ (C ₆ H ₅ O ₇) ₂ ·4H ₂ O	570.50	col. nd.		-2H ₂ O, 130		0.085 ^{18°}	0.096 ^{26°}	0.0065 ^{18°} al.
cyanamide	CaCN ₂	80.11	col., rhombohedral				s. d.	d.	
ferrocyanide	Ca ₂ Fe(CN) ₆ ·12H ₂ O	508.31	yel., tri., 1.5818	1.7			s.	15 ^{90°}	i. al.
fluoride (fluorite)	CaF ₂	78.08	wh., cb., 1.4339	3.180 ^{20°}	1330		0.0016 ^{18°}	0.0017 ^{26°}	sl. s. a.
formate	Ca(HCO ₂) ₂	130.12	col., rhb.	2.015	d.		16.1 ^{0°}	18.4 ¹⁰⁰	i. al., et.
hydride	CaH ₂	42.10	wh. cr. or pd.	1.7	d. 675		d.		d. a.; i. bz.
hydroxide	Ca(OH) ₂	74.10	col., hex., 1.574	2.2	-H ₂ O, 580		0.185 ^{0°}	0.077 ^{100°}	s. NH ₄ Cl
hypochlorite	Ca(ClO) ₂ ·4H ₂ O	215.06	wh., feathery cr.		d.		delq.; d.	d.	d. a.
hypophosphate	Ca ₃ P ₂ O ₆ ·2H ₂ O	274.15	granular		-2H ₂ O, 200		i.		s. HCl, H ₄ P ₂ O ₆
lactate	Ca(C ₃ H ₅ O ₃) ₂ ·5H ₂ O	308.30	col., eff.		-3H ₂ O, 100		10.5	∞	∞h. al.; i. et.
magnesium carbonate (dolomite)	CaO·MgO·2CO ₂	184.42	trig., 1.68174	2.872	d. 730–760		0.032 ^{18°}		
magnesium silicate (diopside)	CaO·MgO·2SiO ₂	216.52	wh., mn.	3.3	1391		i.	i.	
nitrate (nitrocalcite)	Ca(NO ₃) ₂	164.10	col., cb.	2.36	561		102 ^{0°}	376 ^{151°}	14 ^{15°} al.; s. amyl al., NH ₃
nitrate	Ca(NO ₃) ₂ ·4H ₂ O [°]	236.16	col., mn., 1.498	1.82	42.7		266 ^{0°}	v. s.	
nitride	Ca ₃ N ₂	148.26	brn. cr.	2.63 ^{17°}	900		d.	d.	s. dil. a.; i. abs. al.
nitrite	Ca(NO ₂) ₂ ·H ₂ O	150.11	delq., hex.	2.23 ^{34°}			77 ^{0°}	41 ^{790°}	s. 90% al.
oxalate	CaC ₂ O ₄	128.10	col., cb.	2.2 ^{4°}	d.		0.00067 ^{13°}	0.0014 ^{95°}	s. a.; i. ac.
oxalate	CaC ₂ O ₄ ·H ₂ O	146.12	col.	2.2	-H ₂ O, 200		i.	i.	s. a.; i. ac
oxide	CaO	56.08	col., cb., 1.837	3.32	2570	2850	Forms Ca(OH) ₂		s. a.; i. al.
peroxide	CaO ₂ ·8H ₂ O	216.21	pearly, tet.		-8H ₂ O, 100	expl. 275	sl. s.	d.	s. a. d.; i. al., et.
phosphate, monobasic	CaH ₄ (PO ₄) ₂ ·H ₂ O	252.09	wh., tri.	2.220 $\frac{16°}{4}$	-H ₂ O, 100	d. 200	d.	d.	
phosphate, dibasic	CaHPO ₄ ·2H ₂ O	172.10	wh., mn. pl.	2.306 $\frac{16°}{4}$	d.		0.02 ^{24.5°}	0.075 ^{100°}	
phosphate, tribasic	Ca ₃ (PO ₄) ₂	310.20	wh., amor.	3.14	1670		0.0025	d.	s. a.; i. al., ac.
phosphate, meta-	Ca(PO ₃) ₂	198.04	wh., tet., 1.588	2.82	975		i.	i.	i. a.
phosphate, pyro-	Ca ₂ P ₂ O ₇	254.12	col., biaxial, 1.60	3.09	1230		i.	i.	s. a.
phosphate, pyro- (brushite)	Ca ₂ P ₂ O ₇ ·5H ₂ O	344.20	wh., mn.	2.25			sl. s.		s. a.; i. NH ₄ Cl
phosphide	Ca ₃ P ₂	182.20	red cr.	2.51 ^{15°}	>1600		d.		s. dil. a.; i. al., et.
silicate (α) (pseudowollastonite)	CaSiO ₃	116.14	col., pseudo hex., 1.6150 or mn. (?)	2.905	1540		0.0095 ^{17°}		s. HCl
silicate (β) (wollastonite)	CaSiO ₃	116.14	col., mn., 1.610	2.915	tr. 1190 to α				
sulfate (anhydrite)	CaSO ₄	136.14	col., rhb., 1.576, or mn., 1.50	2.96	1450(mn.)	tr. 1193 to rhb.	0.298 ^{20°}	0.1619 ^{100°}	s. a., Na ₂ S ₂ O ₃ , NH ₄ salts

[°]Usual commercial form.

†The solubility of CaCO₃ in H₂O is greatly increased by increasing the amount of CO₂ in the H₂O.

TABLE 2-1 Physical Properties of the Elements and Inorganic Compounds (Continued)

Name	Formula	Formula weight	Color, crystalline form and refractive index	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Cold water	Hot water	Other reagents
Calcium (<i>Cont.</i>) sulfate (gypsum)	CaSO ₄ ·2H ₂ O	172.17	col., mn., 1.5226	2.32	-1a H ₂ O, 128	-2H ₂ O, 163	0.223 ^{0°}	0.257 ^{50°}	s. a., gly., Na ₂ S ₂ O ₃ , NH ₄ salts
sulfhydrate	Ca(SH) ₂ ·6H ₂ O	214.31	col. pr.		d. 15		v. s.	v. s.	s. al.
sulfide (oldhamite)	CaS	72.14	col., cb.	2.8 ^{15°}			d.	d.	s. a.
sulfite	CaSO ₃ ·2H ₂ O	156.17	wh., cr., 1.595		-2H ₂ O, 100	d. 650	0.0043 ^{18°}	0.0027 ^{90°}	s. H ₂ SO ₃
tartrate	CaC ₄ H ₄ O ₆ ·4H ₂ O	260.22	col., rhb.		d.		0.037 ^{0°}	0.22 ^{55°}	sl. s. al.
thiocyanate	Ca(CNS) ₂ ·3H ₂ O	210.28	wh., delq. cr.				s.	v. s.	v. s. al.
thiosulfate	CaS ₂ O ₃ ·6H ₂ O	260.30	col., tri., 1.56	1.873 ^{16°}		d.	71.2 ^{9°}	d.	i. al.
tungstate (scheelite)	CaWO ₄	288.00	wh., tet., 1.9200	6.06			0.2		s. NH ₄ Cl; i. a.
Carbon, <i>cf.</i> table of organic compounds									
Carbon, amorphous	C	12.01	bk., amor.	1.8-2.1	>3500	4200	i.	i.	i. a., alk.
Carbon, diamond	C	12.01	col., cb., 2.4195	3.51 ^{20°}	>3500	4200	i.	i.	i. a., alk.
Carbon, graphite	C	12.01	bk., hex.	2.26 ^{20°}	>3500	4200	i.	i.	i. a., alk.
dioxide	CO ₂	44.01	col. gas	lq. 1.101 ^{-87°} ; 1.53 (A); solid 1.56 ^{-79°}	-56.6 ^{5.2atm.}	subl. -78.5	179.7 ^{0°} cc	90.1 ^{20°} cc	s. a., alk.
disulfide	CS ₂	76.13	col. lq.	lq. 1.261 ^{30°} ; 2.63 (A)	-108.6	46.3	0.2 ^{0°}	0.014 ^{50°}	s. al.; et.
monoxide	CO	28.01	col., poisonous, odorless gas	lq. 0.814 ^{-195°} ; 0.968 (A)	-207	-192	0.0044 ^{0°} ; 3.5 ^{0°} cc	0.0018 ^{50°} ; 2.32 ^{20°} cc	s. al., Cu ₂ Cl ₂
oxychloride (phosgene)	COCl ₂	98.92	poisonous gas	1.392 ^{19°}	-104	8.2 ^{756mm}	v. s. sl. d.	d.	s. ac., CCl ₄ , bs.; d.a.
oxysulfide	COS	60.07	gas	lq. 1.24 ^{-87°} ; 2.10 (A)	-138.2	-50.2 ^{760mm}	133 ^{0°} cc	40.3 ^{30°} cc	v. s. alk., al.
suboxide	C ₂ O ₂	68.03	gas	lq. 1.114 ^{0°}	-107	7 ^{761mm}	d.		s. et.
thionyl chloride	CSCl ₂	114.98	yel.-red lq.	1.509 ^{15°}		73.5			
Ceric hydroxide	2CeO ₂ ·3H ₂ O	398.31	yel., gelatinous				d.		s. a.; sl. s. alk. carb.; i. alk
hydroxynitrate	Ce(OH)(NO ₃) ₃ ·3H ₂ O	397.21	red, mn.				i.	i.	s. H ₂ SO ₄ , HCl
oxide	CeO ₂	172.13	wh. or pa. yel., cb.	7.3	1950		s. d.		s. dil. H ₂ SO ₄
sulfate	Ce(SO ₄) ₂ ·4H ₂ O	404.31	yel., rhb.	3.91			i.	Slowly oxidized	s. dil. a.; i. al.
Cerium	Ce	140.13	steel gray, cb. or hex.	6.9 ^{20°} cb.; 6.7 hex.	645	1400			
Cerous sulfate	Ce ₂ (SO ₄) ₃	568.44	wh., mn. or rhb.	3.91			18.98 ^{0°}	0.4 ^{100°}	
sulfate	Ce ₂ (SO ₄) ₃ ·8H ₂ O	712.57	tri.	2.886 ^{17°}	-8H ₂ O, 630		25 ^{0°}	7.6 ^{40°}	
Cesium	Ce	132.91	silv. met., hex.	1.90 ^{20°}	28.5	670	d.		s. a., al., NH ₃
Chloric acid	HClO ₃ ·7H ₂ O	210.58	lq.	1.282 ^{14.2°}	<-20	d. 40	v. s.		
Chlorine	Cl ₂	70.91	rhb., or gn.-yel. gas	lq. 1.56 ^{-33.6°} ; 2.49 ^{0°} (A)	-101.6	-34.6	1.46 ^{0°} ; 310 ^{10°} cc	0.57 ^{30°} ; 177 ^{30°} cc	s. alk.
hydrate	Cl ₂ ·8H ₂ O	215.04	rhb.	1.23	d. 9.6		s.		s. alk.
Chloroplatinic acid	H ₂ PtCl ₆ ·6H ₂ O	518.08	red-brn., delq.	2.431	60		v. s.	v. s.	s. al., et.
Chlorostannic acid	H ₂ SnCl ₆ ·6H ₂ O	441.55	delq.	1.971 ^{28°}	19.2		s.		
Chlorosulfonic acid	HO·SO ₂ ·Cl	116.52	col. lq.	1.787 ^{25°}	-80	151.5 ^{765mm}	d.		d. al.; i. CS ₂
Chromic acetate	Cr ₃ (C ₂ H ₃ O ₂) ₆ ·2H ₂ O	494.32	gn.				s.		4.76 ^{15°} m. al.
chloride	CrCl ₃	158.38	pink, trig.	2.757 ^{15°}		1200-1500 d.	i. §	sl. s.	i. a., act., CS ₂
chloride	CrCl ₃ ·6H ₂ O	266.48	vl. or gn., hex. pl.	1.835 ^{25°}	subl. 83		v. s. d.		s. al.; i. et.
fluoride	CrF ₃	109.01	gn., rhb.	3.8	>1000	d.	i.		sl. s. a.; i. al., NH ₃
hydroxide	Cr(OH) ₃	103.03	gn. or blue, gelatinous				i.		s. a., alk.; sl. s. NH ₃
hydroxide	Cr(OH) ₃ ·2H ₂ O	139.07	gn.		-2H ₂ O, 100		i.	i.	s. a., alk.
nitrate	Cr(NO ₃) ₃ ·9H ₂ O	400.18	purple pr.		36.5	d. 100	s.	s.	s. a., alk., al., act.
nitrate	Cr(NO ₃) ₃ ·7a H ₂ O	373.15	purple, mn.		100	d.	s.	s.	
oxide	Cr ₂ O ₃	152.02	dark gn., hex.	5.21	1900		i.	i.	sl. s. a.
sulfate	Cr ₂ (SO ₄) ₃	392.20	rose pd.	3.012			i. †		i. a.
sulfate	Cr ₂ (SO ₄) ₃ ·5H ₂ O	482.28	gn.				s.		s. al., H ₂ SO ₄
sulfate	Cr ₂ (SO ₄) ₃ ·15H ₂ O	662.44	vl.	1.867 ^{17°}	100	-10H ₂ O, 100	s.	d. 67°	sl. s. al.
sulfate	Cr ₂ (SO ₄) ₃ ·18H ₂ O	716.49	vl., cb., 1.564	1.7 ^{22°}		-12H ₂ O, 100	120 ^{20°}	d.	s. al.

sulfide	Cr ₂ S ₃	200.02	brn.-bk. pd.	3.77 ¹⁹	-S, 1350		i.	d.	s. h. HNO ₃
Chromium	Cr	52.01	gray, met., cb.	7.1	1615	2200	i.	i.	s. HCl, dil. H ₂ SO ₄ ; i. HNO ₃
trioxide (chromic acid)	Cr ₂ O ₃	100.01	red. rhb.	2.70	197 d.		164.9 ⁰	206.7 ¹⁰⁰	s. H ₂ SO ₄ , al., et. sl. s. al.; i. et.
Chromous chloride	CrCl ₂	122.92	wh., delq.	2.75			v. s.	v. s.	s. conc. a.
hydroxide	Cr(OH) ₂	86.03	yel.-brn.		d.		d.		i. dil. HNO ₃
oxide	CrO	68.01	bk. pd.				i.	i.	sl. s. al.
sulfate	CrSO ₄ ·7H ₂ O	274.18	blue				12.35 ⁰		v. s. a.
sulfide (daubrelite)	CrS	84.07	bk. pd.	3.97	1550		i.		s. et.
Chromyl chloride	CrO ₂ Cl ₂	154.92	dark red lq.	1.92	-96.5	117.6	d.		s. a.
Cobalt	Co	58.94	silv. met., cb.	8.9 ²⁰	1480	2900	i.	i.	s. a.
carbonyl	Co(CO) ₄	170.98	or. cr.	1.73 ¹⁸	51	d. 52	i.	d.	s. al., et., CS ₂
sulfide, di-	CoS ₂	123.06	bk., cb.	4.269			i.		s. HNO ₃ , aq. reg.
Cobaltic chloride	CoCl ₃	165.31	red cr.	2.94	subl.		s.	s.	
chloride, dichro	Co(NH ₃) ₃ Cl ₃ ·H ₂ O	234.42					s.		s. a.; al.
chloride, luteo	Co(NH ₃) ₆ Cl ₃	267.50	or., mn.	1.7016 ²⁰			4.26 ⁰	12.74 ^{46.5}	i. al., NH ₄ OH
chloride, praseo	Co(NH ₃) ₄ Cl ₃ ·H ₂ O	251.46	gn., rhb.	1.847			v. s.		s. a.; i. al.
Cobaltic chloride, purpureo	Co(NH ₃) ₅ Cl ₃	250.47	rhb.	1.819 ²⁵			0.232 ⁰	1.031 ^{46.5}	i. al.
chloride, roseo	Co(NH ₃) ₅ Cl ₃ ·H ₂ O	268.49	brick red				16.12 ⁰	24.87 ¹⁶	sl. s. HCl
hydroxide	Co(OH) ₃	109.96	bk.		d. 100		i.	i.	s. a.; i. al.
oxide	Co ₂ O ₃	165.88	bk.	5.18	-1a H ₂ O, 100		i.	i.	s. a.
sulfate	Co ₂ (SO ₄) ₃	406.06	blue cr.		d. 900		d.		s. H ₂ SO ₄
sulfide	Co ₂ S ₃	214.06	bk. cr.	4.8			i.		d. a.
Cobalto-cobaltic oxide	Co ₃ O ₄	240.82	bk., cb.	6.07			i.	i.	s. H ₂ SO ₄ ; i. HCl, HNO ₃
Cobaltous acetate	Co(C ₂ H ₃ O ₂) ₂ ·4H ₂ O	249.09	red-vl., mn., 1.542	1.7053 ^{18.7}	-4H ₂ O, 140		s.	s.	s. a., al.
chloride	CoCl ₂	129.85	blue cr.	3.356	subl.	1049	45 ⁰	105 ⁰	31 al.; 8.6 act.
chloride	CoCl ₂ ·6H ₂ O	237.95	red, mn.	1.924 ²⁵	86	-6H ₂ O, 110	116.5 ⁰	177 ⁹⁰	v. s. et., act.
nitrate	Co(NO ₃) ₂ ·6H ₂ O	291.05	red, mn., 1.4	1.883 ²⁵	<100	d.	84.03 ⁰ (anh.)	334.9 ⁹⁰	100 ^{12.5} al.; s. act.; sl. s. NH ₃
oxide	CoO	74.94	brn., cb.	5.68	d. 1800		i.	i.	s. a., NH ₄ OH; i. al.
sulfate	CoSO ₄	155.00	red pd.	3.710 ²⁵	d. 880		25.6 ⁰	83 ¹⁰⁰	1.04 ¹⁵ m. al.; i. NH ₃
sulfate	CoSO ₄ ·H ₂ O	173.02	red pd., mn.(?), 1.639	3.13	d.		s.	s.	
sulfate (biebeorite)	CoSO ₄ ·7H ₂ O	281.11	red, mn., 1.483	1.948 ²⁵	96.8	-7H ₂ O, 420	33 ⁸⁰	s.	2.5 ⁵ al.
sulfide (syeporite)	CoS	91.00	brn. nd.	5.45 ¹⁸	>1100		0.00038 ¹⁸		s. a., aq. reg.
Copper	Cu	63.57	yel.-red met., cb.	8.92 ²⁰	1083	2300	i.	i.	s. HNO ₃ , h. H ₂ SO ₄
Cupric acetate	Cu(C ₂ H ₃ O ₂) ₂	181.66		1.930 ²⁰			s.		
acetate	Cu(C ₂ H ₃ O ₂) ₂ ·H ₂ O	199.67	dark gn., mn.	1.882	115	240 d.	7.2	20	7 al.; s. et.; gly.
aceto-arsenite (Paris green)	(CuOAs ₂ O ₃) ₃ · Cu(C ₂ H ₃ O ₂) ₂	1013.83	gn.				i.		s. a., NH ₄ OH
ammonium chloride	CuCl ₂ ·2NH ₄ Cl·2H ₂ O	277.51	blue, tet., 1.670, 1.744	1.98	d. 110		33.8 ⁰	99.3 ⁸⁰	s. a.
ammonium sulfate	CuSO ₄ ·4NH ₃ ·H ₂ O	245.77	blue, rhb.	1.81	d. 150		18.05 ^{21.5}	d.	i. al.
carbonate, basic (azurite)	2CuCO ₃ ·Cu(OH) ₂	344.75	blue, mn., 1.758	3.88	d. 220		i.	d.	s. NH ₄ OH, h. aq. NaHCO ₃
carbonate, basic (malachite)	CuCO ₃ ·Cu(OH) ₂	221.17	dark gn., mn., 1.875	3.9	d.		i.	d.	s. KCN; 0.03 aq. CO
chloride (eriochalcite)	CuCl ₂	134.48	brn.-yel. pd.	3.054	498	Forms Cu ₂ Cl ₂ 993	70.7 ⁰	107.9 ¹⁰⁰	53 ¹⁵ al.; 68 ¹⁵ m. al.
chloride	CuCl ₂ ·2H ₂ O	170.52	gn., rhb., 1.684	2.39 ^{22.4}	-2H ₂ O, 110	d.	110.4 ⁰	192.4 ¹⁰⁰	s. al.; et., NH ₄ Cl
chromate, basic	CuCrO ₄ ·2CuO·2H ₂ O	374.75	yel.-brn.		-2H ₂ O, 260		i.		s. HNO ₃ , NH ₄ OH
cyanide	Cu(CN) ₂	115.61	yel.-gn.		d.		i.		s. KCN, C ₂ H ₅ N
dichromate	CuCr ₂ O ₇ ·2H ₂ O	315.62	bk., tri.	2.286 ¹⁸	-2H ₂ O, 100		sl. s.	d.	s. a.; NH ₄ OH
ferricyanide	Cu ₃ [Fe(CN) ₆] ₂	614.63	yel.-gn.				i.		s. NH ₄ OH; i. HCl
ferrocyanide	Cu ₂ Fe(CN) ₆ ·7H ₂ O	465.21	red-brn.				i.		s. NH ₄ OH; i. a., NH ₃
formate	Cu(HCO ₂) ₂	153.61	blue, mn.	1.831			12.5	d.	0.25 al.
hydroxide	Cu(OH) ₂	97.59	blue, gelatinous	3.368	-H ₂ O		i.	d.	s. a., NH ₄ OH, KCN, al.
lactate	Cu(C ₃ H ₅ O ₃) ₂ ·2H ₂ O	277.74	dark blue, mn.				16.7	d.	sl. s. al.
nitrate	Cu(NO ₃) ₂ ·3H ₂ O	241.63	blue, delq.	2.047 ^{3.9}	114.5	-HNO ₃ , 170	381 ⁴⁰	666 ⁸⁰	100 ^{12.5} al.
nitrate	Cu(NO ₃) ₂ ·6H ₂ O	295.68	blue, rhb.	2.074	-3H ₂ O, 26.4		243.7 ⁰	∞	s. al.

⁰Usual commercial form.

†Also a soluble modification.

TABLE 2-1 Physical Properties of the Elements and Inorganic Compounds (Continued)

Name	Formula	Formula weight	Color, crystalline form and refractive index	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Cold water	Hot water	Other reagents
Cupric acetate (<i>Cont.</i>)									
oxide (paramelaconite)	CuO	79.57	bk., cb.	6.40	d. 1026		i.	i.	s. a.; KCN, NH ₄ Cl
oxide (tenorite)	CuO	79.57	bk., tri., 2.63	6.45	d. 1026		i.	i.	s. a., KCN, NH ₄ Cl
oxychloride	CuCl ₂ ·2CuO·4H ₂ O	365.69	blue-gn.		-3H ₂ O, 140		i.		s. a.
phosphide	Cu ₃ P ₂	252.67	bk.	6.35	d.		i.		s. HNO ₃ ; i. HCl
sulfate (hydrocyanite)	CuSO ₄	159.63	gn.-wh., rhb.,	3.606 ^{15°}	d. >600	Forms CuO, 650	14.3 ^{0°}	75.4 ^{100°}	i. al.
sulfate (blue vitriol or chalcantite)	CuSO ₄ ·5H ₂ O ^o	249.71	1.733 blue, tri., 1.5368	2.286 ^{15.6°} / ₄	-4H ₂ O, 110	-5H ₂ O, 250	24.3 ^{0°}	205 ^{100°}	1.1 ^{8°} al.
sulfide (covellite)	CuS	95.63	blue, hex. or mn., 1.45	4.6	tr. 103	d. 220	0.000033 ^{18°}		s. HNO ₃ , KCN
tartate	Cu ₄ H ₄ O ₆ ·3H ₂ O	265.69	1 gn. pd.		d.		0.02 ^{15°}	0.14 ^{85°}	s. a., KOH
Cuprous ammonium iodide	CuI·NH ₄ I·H ₂ O	353.47	rhb. pl.				d.		s. NH ₄ I
carbonate	Cu ₂ CO ₃	187.15	yel.	4.4	d.		i.	i.	s. a., NH ₄ OH
chloride (nantokite)	Cu ₂ Cl ₂	198.05	wh., cb., 1.973	3.53	422	1366	1.52 ^{25°}		s. HCl, NH ₄ OH, al.
cyanide	Cu ₂ (CN) ₂	179.16	wh., mn.	2.9	474.5	d.	i.	i.	s. KCN, HCl, NH ₄ OH; sl. s. NH ₃
ferricyanide	Cu ₃ Fe(CN) ₆	402.67	bm.-red				i.		s. NH ₄ OH; i. HCl
ferrocyanide	Cu ₄ Fe(CN) ₆	466.24	bm.-red				i.		s. NH ₄ OH; i. NH ₄ Cl
fluoride	Cu ₂ F ₂	165.14	red cr.		908	subl. 1100	i.		s. HF, HCl, HNO ₃ ; i. al.
hydroxide	CuOH	80.58	yel.	3.4	-a H ₂ O, 360		i.	i.	s. a., NH ₄ OH
oxide (cuprite)	Cu ₂ O	143.14	red, cb., 2.705	6.0	1235	-O, 1800	i.	i.	s. HCl, NH ₄ Cl, NH ₄ OH
Cuprous phosphide	Cu ₆ P ₂	443.38	gray-bk.	6.4 to 6.8			i.		s. HNO ₃ ; i. HCl
sulfide (chalcocite)	Cu ₂ S	159.20	bk., rhb.	5.6	1100		0.0005 ^{18°}		s. HNO ₃ , NH ₄ OH; i. act.
sulfide	Cu ₂ S	159.20	bk., cb.	5.80	1130		0.0005 ^{18°}		s. HNO ₃ , NH ₄ OH; i. act.
Cyanogen	C ₂ N ₂	52.02	poisonous gas	lq. 0.866 ^{-17.2°} ; 1.806 (A)	-34.4	-20.5	450 ^{20°} cc		2300 ^{20°} cc al.; 500 ^{18°} cc et.
Cyanogen compounds, <i>cf.</i> table of organic compounds									
Ferric acetate, basic ammonium sulfate, <i>cf.</i> Alum chloride (molybite)	Fe(OH)(C ₂ H ₃ O ₂) ₂	190.95	bm., amor.				i.		s. a.; al.
chloride	FeCl ₃	162.22	bk.-brn., hex. delq.	2.804 ^{11°}	282	315	74.4 ^{0°}	535.8 ^{100°}	v. s. al.; et. +HCl
ferrocyanide (Prussian blue)	FeCl ₃ ·6H ₂ O ^o	270.32	red-yel., delq.		37	280	246 ^{0°}	∞	s. al., act., gly.
hydroxide	Fe(OH) ₃	106.87	red-brn.				i.	i.	s. a.; i. al., et.
lactate	Fe(C ₃ H ₅ O ₃) ₃	323.06	bm., amor., delq.	3.4 to 3.9	-1a H ₂ O, 500		v. s.	v. s.	i. et.
nitrate	Fe(NO ₃) ₃ ·6H ₂ O	349.97	rhb., delq.	1.684 ^{20°}	35	d.	150 ^{0°}	∞	s. al., act.
oxide (hematite)	Fe ₂ O ₃	159.70	red or bk., trig., 3.042	5.12	1560 d.		i.		s. HCl
sulfate	Fe ₂ (SO ₄) ₃	399.88	rhb., 1.814	3.097 ^{18°}	d. 480		sl. s.	d.	i. H ₂ SO ₄ , NH ₃
sulfate (coquimbite)	Fe ₂ (SO ₄) ₃ ·9H ₂ O	562.02	yel., trig.	2.1			440	d.	s. abs. al.
Ferroso-ferric chloride	FeCl ₃ ·2FeCl ₂ ·18H ₂ O	775.49	yel., delq.		d. 50		s.	s.	
ferricyanide (Prussian green)	Fe ₄ '''Fe ₂ '[Fe(CN) ₆] ₆	1662.70	gn.		d. 180		i.		s. d. h. HCl
oxide (magnetite; magnetic iron oxide)	Fe ₃ O ₄	231.55	bk., cb., 2.42	5.2	1538 d.		i.	i.	i. al.
oxide, hydrated	Fe ₃ O ₄ ·4H ₂ O	303.61	bk.		d.		i.	i.	s. a.
Ferrous ammonium sulfate	FeSO ₄ ·(NH ₄) ₂ SO ₄ ·6H ₂ O	392.15	blue-gn., mn., 1.4915	1.864	d.		18 ^{0°}	100 ^{75°}	i. al.
chloride (lawrencite)	FeCl ₂	126.76	gn.-yel., hex., 1.567	2.7		delq.	64.4 ^{10°}	105.7 ^{100°}	100 al.; s. act.; i. et.
chloroplatinate	FePtCl ₆ ·6H ₂ O	571.92	yel., hex.	2.714			v. s.	v. s.	
ferricyanide (Turnbull's blue)	Fe ₃ [Fe(CN) ₆] ₂	591.47	dark blue		d.		i.		i. dil. a., al.
ferrocyanide	Fe ₂ Fe(CN) ₆	323.66	blue-wh., amor.				i.		
formate	Fe(HCO ₂) ₂ ·2H ₂ O	181.92			d.		sl. s.		
hydroxide	Fe(OH) ₂	89.87	lt. gn.	3.4			0.00067		s. a., NH ₄ Cl
nitrate	Fe(NO ₃) ₂ ·6H ₂ O	287.96	cr.		60.5		200 ^{0°}	300 ^{35°}	
oxide	FeO	71.85	bk.	5.7	1420		i.	i.	s. a.; i. alk.

phosphate (vivianite)	$\text{Fe}_3(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$	501.64	blue, mn., 1.592, 1.603	2.58				i.	i.	s. a.; i. ac.
silicate	FeSiO_3	131.91	mn.	3.5	1550					
sulfate (siderotilite)	$\text{FeSO}_4 \cdot 5\text{H}_2\text{O}$	241.99	gn., tri., 1.536	2.2		$-5\text{H}_2\text{O}$, 300	s.	s.	i. al.	
sulfate (copperas)	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}^*$	278.02	blue-gn., mn.	1.899 ^{14.5°}	64	$-7\text{H}_2\text{O}$, 300	32.8 ^{0°}	149 ^{50°}	i. al.	
sulfide	FeS	87.91	bk., hex.	4.84	1193	d.	0.000616 ^{18°}		s. a.; i. NH_3	
<i>cf.</i> also under iron										
Fluoboric acid	HBF_4	87.83	col. lq.			130 d.	∞	∞	s. al.	
Fluorine	F_2	38.00	gn.-yel. gas	lq. 1.51 ^{-187°} ; 1.31 ^{13°} (A)	-223	-187	d.			
Fluosilicic acid	H_2SiF_6	144.08					s.	s.		
Gadolinium	Gd	156.9								
Callium bromide	GaBr_3	309.47	delq. cr.				s.	s.		
Glucinum <i>cf.</i> Beryllium										
Gold	Au	197.20	yel. met., cb.	19.3 ^{20°}	1063	2600	i.	i.	s. aq. reg., KCN; i. a.	
Gold, colloidal	Au	197.20	blue to vl.				s.		s. aq. reg., KCN; i. a.	
Gold salts <i>cf.</i> under Auric and Aurous										
Hafnium	Hf	178.6	hex.	12.1	>1700	>3200(?)				
Helium	He	4.00	col. gas	0.1368 (A)	<-272.2	-268.9	0.97 ^{0°} cc	1.08 ^{50°} cc	Absorbed by Pt	
Hydrazine	N_2H_4	32.05	col. lq.	1.011 $\frac{12°}{4}$	1.4	113.5	∞	∞	s. al.	
formate	$\text{N}_2\text{H}_4 \cdot 2\text{HCO}_2\text{H}$	124.10	cb.		128		s.			
hydrate	$\text{N}_2\text{H}_4 \cdot \text{H}_2\text{O}$	50.06	col.	1.03 ^{21°}	-40	118.5 ^{739.5mm}	∞	∞	∞ al.; i. et.	
hydrochloride	$\text{N}_2\text{H}_4 \cdot \text{HCl}$	68.51	yel. lq.				v. s.	v. s.	sl. s. al.	
hydrochloride, di-	$\text{N}_2\text{H}_4 \cdot 2\text{HCl}$	104.98	wh., cb.	1.42	198		s.	v. s.	s. al.	
nitrate	$\text{N}_2\text{H}_4 \cdot \text{HNO}_3$	95.06	cr.		70.7	subl. 140	174.9 ^{10°}			
nitrate, di-	$\text{N}_2\text{H}_4 \cdot 2\text{HNO}_3$	158.08	nd.		104	d.	v. s.			
sulfate	$\text{N}_2\text{H}_4 \cdot a \text{H}_2\text{SO}_4$	81.09	delq. pl.		85		v. s.		i. al.	
sulfate	$\text{N}_2\text{H}_4 \cdot \text{H}_2\text{SO}_4$	130.12	rhb.	1.378	254		3.055 ^{22°}	27.65 ^{60°}	v. sl. s. abs. al.	
Hydrazoic acid (azoimide)	HN_3	43.03	col. lq.		-80	37	∞	∞	∞ al.	
Hydriodic acid	HI	127.93	col. gas	4.4 ^{0°} (A)	-50.8	-35.5	42500 ^{10°} cc	v. s.	s. al.	
Hydriodic acid	HI· H_2O	145.94	col. lq.	1.7 ^{15°}		127 ^{774mm}	∞	∞	∞ al.	
Hydriodic acid	HI·2 H_2O	163.96	col. lq.		-43		∞	∞	s. al.	
Hydriodic acid	HI·3 H_2O	181.98	col. lq.		-48		∞	∞	s. al.	
Hydriodic acid	HI·4 H_2O	199.99	col. lq.		-36.5		∞	∞	s. al.	
Hydrobromic acid	HBr	80.92	col. gas; 1.325 (lq.)	2.71 ^{0°} (A)	-86	-67	221 ^{0°}	130 ^{100°}	s. al.	
Hydrobromic acid	HBr· H_2O	98.94	col. lq.	1.78					Stable at -15.5° and 1 atm., and at -11.3° and 2.5 atm.	
Hydrobromic acid	HBr (47.8% in H_2O)	80.92	col. lq.	1.486		126	∞	∞	s. al.	
Hydrobromic acid	HBr·2 H_2O	116.96	wh. cr.	2.11 ^{-15°}	-11		s.	s.		
Hydrochloric acid	HCl^\dagger	36.47	col. gas; 1.256 (lq.)	1.268 ^{0°} (A)	-111	-85	82.3 ^{0°}	56.1 ^{60°}	s. al., et.	
Hydrochloric acid	HCl (45.2% in H_2O)	36.47	col. lq.	1.48	-15.35		∞	∞	s. al.	
Hydrochloric acid	$\text{HCl} \cdot 2\text{H}_2\text{O}$	72.50	col. lq.	1.46 $\frac{-18.3°}{4}$	0	d.	∞	∞	s. al.	
Hydrochloric acid	$\text{HCl} \cdot 3\text{H}_2\text{O}$	90.51	col. lq.		-24.4	d.	∞	∞	s. al.	
Hydrocyanic acid (prussic acid)	HCN	27.03	poisonous gas or col. lq., 1.254	0.697 ^{18°}	-14	26	∞	∞	∞ al., et.	
Hydrofluoric acid	HF	20.01	gas or col. lq.	0.988 ^{13.6°}	-83	19.4	∞ 0° to 19.4°	v. s.		
Hydrofluoric acid	HF (35.35% in H_2O)	20.01	col. lq.	1.15	-35	120	v. s.			
Hydrogen	H_2	2.016	col. gas or cb.	lq. 0.0709 ^{-252.7°} 0.06948 (A)	-259.1	-252.7	2.1 ^{0°} cc	0.85 ^{50°} cc	sl. s. Fe, Pd, Pt	
peroxide	$\text{H}_2\text{O}_2^\ddagger$	34.02	col. lq., 1.333	1.438 $\frac{20°}{4}$	-0.89	151.4 ^{760mm}	∞	∞	s. a., et.; i. petr. et	
selenide	H_2Se	81.22	col. gas	2.12 ^{-42°}	-64	-42	377 ^{4°} cc	270 ^{22.5°} cc	s. CS_2 , COCl_2	
sulfide	H_2S	34.08	col. gas	1.1895 (A)	-82.9	-59.6	437 ^{0°} cc	186 ^{40°} cc	9.54 ^{15°} cc al.; s. CS_2	
Hydroxylamine	NH_2OH	33.03	rhb., delq.	1.35 ^{18°}	34	56.5 ^{22mm}	s.		s. a., al.	
hydrochloride	$\text{NH}_2\text{OH} \cdot \text{HCl}$	69.50	col., mn.	1.67 ^{17°}	151	d.	83.3 ^{17°}	v. s.	s. al.; i. et.	
nitrate	$\text{NH}_2\text{OH} \cdot \text{HNO}_3$	96.05	col. cr.		48	d. <100	v. s.		v. s. abs. al.	
sulfate	$\text{NH}_2\text{OH} \cdot a \text{H}_2\text{SO}_4$	82.07	col., mn.		170 d.		32.9 ^{0°}	68.5 ^{90°}	v. sl. s. al.; i. et., abs. al.	

*Usual commercial form.

†Usual commercial form about 31 percent.

‡Usual commercial forms 3 or 30 percent.

TABLE 2-1 Physical Properties of the Elements and Inorganic Compounds (Continued)

Name	Formula	Formula weight	Color, crystalline form and refractive index	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Cold water	Hot water	Other reagents
Hypobromous acid	HBrO	96.92	yel.			40 ^{50mm}	s.	d.	
Illinium	Il	146(?)							
Indium	In	114.76	soft, tet. met.	7.3 ^{20°}	155	1450	i.	i.	s. a.
Iodic acid	HIO ₃	175.93	col., rhb.	4.629 ^{9°}	110 d.		286 ^{6°}	576 ^{101°}	v. s. 87% al.; i. abs. al. et., chl.
Iodine	I ₂	253.84	blue-bk., rhb.	4.93 ^{30°}	113.5	184.35	0.0162 ^{0°}	0.09566 ^{60°}	s. al., KI, et.
oxide, penta-	I ₂ O ₅	333.84	wh., trimetric	4.799 ^{25°} ₄	d. 300		187.4 ^{12°}		i. abs. al., et., chl.
Iodoplatinic acid	H ₂ PtI ₆ ·9H ₂ O	1120.91	brn., delq. mn.				s. d.		
Iridium	Ir	193.10	wh. met., cb.	22.4 ^{20°}	2350	>4800	i.	i.	sl. s. aq. reg., aq. Cl ₂
Iron, cast†	Fe	55.85	gray	7.03	1275		i.	i.	s. a.; i. alk.
pure	Fe	55.85	silv. met., cb.	7.86 ^{30°}	1535	3000	i.	i.	s. a.; i. alk.
steel	Fe	55.85	silv. gray	7.6 to 7.8	1375		i.	i.	s. a.; i. alk.
white pig	Fe	55.85	gray	7.6 to 7.8	1075		i.	i.	s. a.; i. alk.
wrought	Fe	55.85	gray	7.86	1505		i.	i.	s. a.; i. alk.
carbide (cementite)	Fe ₂ C	179.56	pseudo hex.	7.4	1837		i.	i.	s. a.
carbonyl	Fe(CO) ₅	195.90	pa. yel. lq.	1.457 ^{21°}	-21	102.5 ^{760mm}	i.		s. al., H ₂ SO ₄ , alk.
nitride	Fe ₂ N	125.71	gray	6.35	d. >560		d.		s. HCl, H ₂ SO ₄
silicide	FeSi	83.91	yel.-gray, oct.	6.1 ^{20°} ₄			i.	i.	i. aq. reg.
sulfide, di- (marcasite)	FeS ₂	119.97	yel., rhb.	4.87	tr. 450	d.	0.00049		i. dil. a.
sulfide, di- (pyrite)	FeS ₂	119.97	yel., cb.	5.0	1171	d.	0.0005		i. dil. a.
sulfide (pyrrhotite)	Fe ₇ S ₈	647.43	hex.	4.6 ^{20°} ₄	d. >700		i.		
<i>Cf. also under ferric and ferrous</i>									
Krypton	Kr	83.70	col. gas	2.818 (A)	-169	-151.8	11.05 ^{0°} cc	3.57 ^{60°} cc	sl. s. al., bz.
Lanthanum	La	138.92	lead gray	6.15 ^{30°}	826	1800	d.		s. a.
Lead	Pb	207.21	silv. met., cb.	11.337 ^{20°} _{50°}	327.5	1620	i.	i.	s. HNO ₃ ; i. c. HCl, H ₂ SO ₄
acetate	Pb(C ₂ H ₃ O ₂) ₂	325.30	wh. cr.	3.251 ^{30°} ₄	280		19.7 ^{0°}	221 ^{50°}	s. gly.; v. sl. s. al.
acetate (sugar of lead)	Pb(C ₂ H ₃ O ₂) ₂ ·3H ₂ O†	379.35	wh., mn.	2.55	-3H ₂ O, 75		45.64 ^{15°}	200 ^{100°}	s. gly.; sl. s. al.
acetate	Pb(C ₂ H ₃ O ₂) ₂ ·IOH ₃ O	505.46	wh., rhb.	1.689	22		s.	s.	
acetate, basic	Pb ₂ (C ₂ H ₃ O ₂) ₃ ·OH	608.56	wh.				v. s.		sl. s. al.
acetate, basic	Pb(C ₂ H ₃ O ₂) ₂ ·Pb(OH) ₂ ·H ₂ O	584.54	wh. nd.				v. s.		s. al.
acetate, basic	Pb(C ₂ H ₃ O ₂) ₂ ·2Pb(OH) ₂	807.75	wh. nd.				5.55	18.2	s. al.
arsenate, monobasic	PbH ₄ (AsO ₄) ₂	489.06	tri., 1.82	4.46 ^{15°}	d. 140		d.		s. HNO ₃
arsenate, dibasic (schultenite)	PbHAsO ₄	347.13	wh., mn., 1.9097	5.94	d. >200	-H ₂ O, 280	i.	sl. s.	s. HNO ₃ , NaOH
arsenate, meta-	Pb(AsO ₃) ₂	453.03	hex.	6.42 ^{15°}			d.		s. HNO ₃
arsenate, pyro-	Pb ₂ As ₂ O ₇	676.24	rhb., 2.03	6.85 ^{15°} _{15°}	802		i.	d.	s. HCl, HNO ₃ ; i. sc.
Lead azide	Pb ₃ N ₆	291.26	col. nd.		expl. 350		i.	0.05 ^{100°}	v. s. ac.; i. NH ₄ OH
bromide	PbBr ₂	367.05	col., rhb.	6.66	373	918	0.4554 ^{0°}	4.75 ^{100°}	s. a., KBr; sl. s. NH ₃ ; i. al.
carbonate (cerussite)	PbCO ₃	267.22	wh., rhb., 2.0763	6.6	d. 315		0.00011 ^{20°}	d.	s. a., alk.; i. NH ₃ , al.
carbonate, basic (hydrocerussite; white lead)	2PbCO ₃ ·Pb(OH) ₂ †	775.67	wh., hex.	6.14	d. 400		i.	i.	s. ac.; sl. s. aq. CO ₂
chloride (cotunnite)	PbCl ₂	278.12	wh., rhb., 2.2172	5.80	501	954 ^{760mm}	0.673 ^{0°}	3.34 ^{100°}	sl. s. dil. HCl, NH ₃ , i. al.
chromate (crocoite)	PbCrO ₄	323.22	yel., mn., 2.42	6.12	844	d.	0.000007 ^{20°}		s. a., alk.; i. NH ₃ , ac.
chromate, basic	PbCrO ₄ ·PbO	546.43	or.-yel. nd.				i.	i.	s. a., alk.
formate	Pb(HCO ₂) ₂	297.25	wh., rhb.	4.56	d. 190		1.6 ^{16°}	18 ^{100°} d.	i. al.
hydroxide	3PbO·H ₂ O	687.65	cb.	7.592	-H ₂ O, 130		0.014		s. a., alk.
nitrate	Pb(NO ₃) ₂	331.23	col., cb. or mn., 1.7815	4.53	d. 470		38.8 ^{0°}	138.8 ^{100°}	8.8 ^{22°} al.
oxide, sub-	Pb ₂ O	430.42	bk., amor.	8.34	d. red heat		i.	i.	s. a., alk.
oxide, mono- (litharge)	PbO	223.21	yel., tet.	9.53	888		0.0068 ^{18°}		s. alk., PbAc, NH ₄ Cl, CaCl ₂
oxide, mono (massicotite)	PbO	223.21	yel., rhb., 2.61	8.0					

oxide, mono-	PbO	223.21	amor.	9.2 to 9.5			i.	i.	s. alk., PbAc, NH ₄ Cl, CaCl ₂
oxide, red (minium)	Pb ₃ O ₄	685.63	red, amor.	9.1	d. 500		i.	i.	s. ac., h. HCl
oxide, sesqui-	Pb ₂ O ₃	462.42	red-yel., amor.		d. 360		i.	i.	s. a., alk.
oxide, di- (plattnerite)	PbO ₂	239.21	brn., tet., 2.229	9.375	d. 290		i.	i.	s. ac., h. alk.; i. al.
silicate	PbSiO ₃	283.27	col., mn., 1.961	6.49	766		i.		s. a.
sulfate (anglesite)	PbSO ₄	303.27	wh., mn. or rhh., 1.8823	6.2	1170		0.0028 ^{0°}	0.0056 ^{40°}	s. conc. a., NH ₄ salts; i. al.
sulfate, acid	Pb(HSO ₄) ₂ ·H ₂ O	419.36	cr.		d.		0.0001 ^{18°}		sl. s. H ₂ SO ₄
sulfate, basic (lanarkite)	PbSO ₄ ·PbO	526.48	col., mn.	6.92	977		0.0044 ^{18°}		sl. s. H ₂ SO ₄
sulfide (galena)	PbS	239.27	lead gray, cb., 3.912	7.5	1120		0.00009 ^{18°}	i.	s. a.; i. alk.
thiocyanate	Pb(CNS) ₂	323.37	col., mn.	3.82	d. 190		0.05 ^{20°}	s.	s. KCNS, HNO ₃
Lithium	Li	6.94	silv. met. cb.	0.53 ^{30°}	186	1336 ± 5	d.	d.	s. a., NH ₃
benzoate	LiC ₇ H ₅ O ₂	128.05	wh. leaflets				33 ^{25°}	40 ^{100°}	7.7 ^{25°} , 10 ^{35°} al.
bromide	LiBr	86.86	wh., delq., cb., 1.784	3.464 ^{25°}	547	1265	143 ^{0°} (2H ₂ O)	266 ^{100°} (1H ₂ O)	s. al., act.
bromide	LiBr·2H ₂ O	122.89	wh. pr.		44		246 ^{20°}		s. al.
carbonate	Li ₂ CO ₃	73.89	col., mn., 1.567	2.11 ^{0°}	618	d.	1.54 ^{0°}	0.72 ^{100°}	s. dil. a.; i. al., act., NH ₃
chloride	LiCl	42.40	wh., delq., cb., 1.662	2.068 ^{25°}	614	1360	67 ^{0°}	127.5 ^{100°}	2.48 ^{15°} al.; s. et.
citrate	Li ₃ C ₆ H ₅ O ₇ ·4H ₂ O	281.98	wh. cr.		d.		61.2 ^{15°}	66.7 ^{100°}	sl. s. al., et.
fluoride	LiF	25.94	wh., cb., 1.3915	2.295 ^{21.5°}	870	1670	0.27 ^{18°}	0.135 ^{35°}	s. HF; i. act.
formate	LiHCO ₂ ·H ₂ O	69.97	col., rhh.	1.46	-H ₂ O, 94		49.2 ^{0°}	346.6 ^{104°}	sl. s. al., et.
hydride	LiH	7.95	wh., cb.	0.820	680		d.		i. et.
hydroxide	LiOH	23.95	wh. cr.	2.54	445	925 ±	12.7 ^{0°}	17.5 ^{100°}	sl. s. al.
hydroxide	LiOH·H ₂ O	41.96	col., mn.	1.83		d.	22.3 ^{10°}	26.8 ^{80°}	sl. s. al.
nitrate	LiNO ₃	68.95	col., trig., 1.735	2.38	261		53.4 ^{0°}	194 ^{70°}	s. al., NH ₃
nitrate	LiNO ₃ ·3H ₂ O	123.00	col.		29.88		v. s.	∞	
oxide	Li ₂ O	29.88	col., 1.644	2.013 ^{25°}		subl. <1000	forms LiOH		
phosphate, monobasic	LiH ₂ PO ₄	103.94	col.	2.461	>100				
phosphate, tribasic	Li ₃ PO ₄	115.80	wh., rhh.	2.537 ^{17.5°}	837		0.034 ^{18°}	v. sl. s.	s. a., NH ₄ Cl; i. act.
phosphate, tribasic	Li ₃ PO ₄ ·12H ₂ O	331.99	wh., trig.	1.645	100		v. sl. s.	v. sl. s.	
salicylate	LiC ₇ H ₅ O ₃	144.05	col.		d.		128 ^{26°}		v. s. al.
sulfate	Li ₂ SO ₄	109.94	col., mn., 1.465	2.22	860		35.34 ^{0°}	29.9 ^{100°}	i. act., 80% al.
sulfate	Li ₂ SO ₄ ·H ₂ O†	127.96	col., mn., 1.477	2.06	-H ₂ O, 130		43.6 ^{0°}	35 ^{100°}	i. 80% al.
sulfate, acid	LiHSO ₄	104.01	pr.	2.123 ^{13°}	170.5		d.		
Lutecium	Lu	174.99							
Magnesium	Mg	24.32	silv. met., hex.	1.74 ^{30°}	651	1110	i.	sl. s. d.	s. a., NH ₄ salts
acetate	Mg(C ₂ H ₃ O ₂) ₂	142.41	wh.	1.42	323		v. s.	v. s.	5.25 ^{15°} m. al.
acetate	Mg(C ₂ H ₃ O ₂) ₂ ·4H ₂ O†	214.47	wh., mn. pr., 1.491	1.454	80		v. s.	v. s.	v. s. al.
aluminate (spinel)	MgO·Al ₂ O ₃	142.26	col. cb., 1.718-23	3.6	2135		i.		v. sl. s. dil. HCl; i. dil. HNO ₃
ammonium chloride	MgCl ₂ ·NH ₄ Cl·6H ₂ O	256.83	wh., rhh., delq.	1.456	-4H ₂ O, 195		16.7	s.	
ammonium phosphate (struvite)	MgNH ₄ PO ₄ ·6H ₂ O	245.44	col., rhh., 1.496	1.715	d. 100		0.0231 ^{0°}	0.0195 ^{80°}	s. a.; i. al.
ammonium sulfate (bousingaultite)	MgSO ₄ ·(NH ₄) ₂ SO ₄ ·6H ₂ O	360.62	col., mn.	1.72	>120		16.86 ^{0°}	130 ^{100°}	
benzoate	Mg(C ₇ H ₅ O ₂) ₂ ·3H ₂ O	320.59	wh. pd.		-3H ₂ O, 110		4.5 ^{25°} (anh.)	s.	s. act.
carbonate (magnesite)	MgCO ₃	83.43	wh., trig. 1.700	3.037	d. 350		0.0106		s. a., aq. CO ₂ ; i. act., NH ₃
carbonate (nesquehonite)	MgCO ₃ ·3H ₂ O	138.38	col., rhh., 1.501	1.852	-H ₂ O, 100		0.1518 ^{19°}	d.	s. a., aq. CO ₂
carbonate, basic (hydromagnesite)	3MgCO ₃ ·Mg(OH) ₂ ·3H ₂ O	365.37	wh., rhh., 1.530	2.16	d.		0.04	0.011	s. a., NH ₄ salts; i. al.
Magnesium chloride (chloromagnesite)	MgCl ₂	95.23	col., hex., 1.675	2.325 ^{25°}	712	1412	52.8 ^{0°}	73 ^{100°}	50 al.
chloride (bischofite)	MgCl ₂ ·6H ₂ O†	203.33	wh., delq., mn., 1.507	1.56	118 d.	d.	281 ^{0°}	918 ^{100°}	50 al.
hydroxide (brucite)	Mg(OH) ₂	58.34	wh., trig., 1.5617	2.4	d.		0.0009 ^{18°}		s. NH ₄ salts, dil. a.
nitride	Mg ₃ N ₂	100.98	gn.-yel., amor.		d.		i.	d.	s. a.; i. al.
oxide (magnesia; periclase)	MgO	40.32	col., cb., 1.7364	3.65	2800	3600	0.00062		s. a., NH ₄ salts; i. al.
perchlorate	Mg(ClO ₄) ₂ †	223.23	wh., delq.	2.60 ^{25°}	d.		99.6 ^{25°}	v. s.	24 ²⁵ al., 51.8 ^{25°} m. al.; 0.29 et.

[°]See also a table of alloys.

†Usual commercial form.

TABLE 2-1 Physical Properties of the Elements and Inorganic Compounds (Continued)

Name	Formula	Formula weight	Color, crystalline form and refractive index	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Cold water	Hot water	Other reagents
Magnesium chloride (<i>Cont.</i>)									
peroxide	MgO ₂	56.32	wh. pd.		expl. 275		i.	i.	s. a.
phosphate, pyro-	Mg ₃ P ₂ O ₇	222.60	col., mn., 1.604	2.598 ^{22°}	1383		i.	i.	s. a.; i. alk.
phosphate, pyro-	Mg ₃ P ₂ O ₇ ·3H ₂ O	276.65	wh., amor.	2.56	-3H ₂ O, 100		i.	sl. s.	s. a.; i. al.
potassium chloride (carnallite)	MgCl ₂ ·KCl·6H ₂ O	277.88	delq., rhb., 1.475	1.60 ^{19.4°} ₄	265		64.5 ^{19°} d.	d.	d. al.
potassium sulfate (picromerite)	MgSO ₄ ·K ₂ SO ₄ ·6H ₂ O	402.73	mn., 1.4629	2.15	d. 72		19.26 ^{0°}	81.7 ^{75°}	
silicofluoride	MgSiF ₆ ·6H ₂ O	274.48	col., trig., 1.3439	1.788 ^{17.5°} ₄	d.		64.8 ^{17.5°}	s.	d. HF
sodium chloride	MgCl ₂ ·NaCl·H ₂ O	171.70	col.				s.	s.	
sulfate	MgSO ₄	120.38	col.	2.66	1185		26.9 ^{0°}	68.3 ^{100°}	s. al.
sulfate (epsom salt; epsomite)	MgSO ₄ ·7H ₂ O*	246.49	col., rhb., 1.4554	1.68	70 d.		72.4 ^{0°}	178 ^{40°}	s. al.
Manganese	Mn	54.93	gray-pink met.	7.2 ^{20°}	1260	1900	d.		s. dil. a.
acetate	Mn(C ₂ H ₃ O ₂) ₂	173.02		1.74 ^{20°} ₄			s.	s.	
acetate	Mn(C ₂ H ₃ O ₂) ₂ ·4H ₂ O*	245.08	pa. pink, mn.	1.589			s.	64.5 ^{50°}	s. al., m. al.
carbonate (rhodocrosite)	MnCO ₃	114.94	rose, trig., 1.817	3.125	d.		0.0065 ^{25°}		s. aq. CO ₂ , dil. a.; l. NH ₃ , al.
chloride (scacchite)	MnCl ₂	125.84	rose, delq., cb.	2.977 ^{25°} ₄	650	1190	63.4 ^{0°}	123.8 ^{100°}	s. al.; i. et., NH ₃
chloride	MnCl ₂ ·4H ₂ O*	197.91	rose red, delq., mn. 1.575	2.01	58.0	-H ₂ O, 106; -4H ₂ O, 200	151 ^{8°}	∞	s. al.; i. et.
chloride, per-	MnCl ₄	196.76	gn.				s.	s.	s. al., et.
hydroxide (ous) (pyrochroite)	Mn(OH) ₂	88.95	wh., trig.	3.258 ^{18°}	d.		0.002 ^{20°}		s. a., NH ₄ salts; i. alk.
hydroxide (ic) (manganite)	Mn ₂ O ₃ ·H ₂ O	175.88	brn., rhb., 2.24	3.258	d.		i.	i.	s. h. H ₂ SO ₄
nitrate	Mn(NO ₃) ₂ ·6H ₂ O	287.04	rose red, mn.	1.82 ^{21°}	25.8	129.5	426 ^{0°}	∞	v. s. al.
oxide (ous) (manganosite)	MnO	70.93	gray-gn., cb., 2.16	5.18	1650		i.	i.	s. a., NH ₄ Cl
oxide (ic)	Mn ₂ O ₃	157.86	brn.-bk., cb.	4.81	-0, 1080		i.	i.	s. a.; i. act.
oxide, di- (pyrolusite; polianite)	MnO ₂ *	86.93	bk., rhb.	5.026	-0, >230		i.	i.	s. HCl; i. HNO ₃ , act.
sulfate (ous)	MnSO ₄	150.99	red-wh.	3.235	700	d. 850	53 ^{0°}	73 ^{50°}	s. al.; i. et.
sulfate (ous) (szmikite)	MnSO ₄ ·H ₂ O	169.01	pa. pink, mn., 1.595	2.87	Stable 57 to 117		98.47 ^{48°}	79.77 ^{100°}	
sulfate (ous)	MnSO ₄ ·2H ₂ O	187.02		2.526 ^{15°}	Stable 40 to 57		85.27 ^{35°}	106.8 ^{55°}	
sulfate (ous)	MnSO ₄ ·3H ₂ O	205.04		2.356 ^{15°}	Stable 30 to 40		74.22 ^{5°}	99.31 ^{57°}	
sulfate (ous)	MnSO ₄ ·4H ₂ O*	223.05	pink, rhb. or mn., 1.518	2.107	Stable 18 to 30	-4H ₂ O, 450	136 ^{16°}	169 ^{50°}	i. al.
sulfate (ous)	MnSO ₄ ·5H ₂ O	241.07	pink, tri., 1.508	2.103 ^{15°}	Stable 8 to 18		142 ^{5°}	200 ^{35°}	
sulfate (ous)	MnSO ₄ ·6H ₂ O	259.09			Stable -5 to +8		204 ^{0°}	247 ^{9°}	
sulfate (ous)	MnSO ₄ ·7H ₂ O	277.10	pink, mn. or rhb.	2.092	Stable -10 to -5; 19 d.	-7H ₂ O, 280	176 ^{0°}	251 ^{14°}	
sulfate (ic)	Mn ₂ (SO ₄) ₃	398.04	gn., delq. cr.	3.24	d. 160		v. s.	d.	s. HCl, dil. H ₂ SO ₄ ; l. conc. H ₂ SO ₄ , HNO ₃
Masurium	Ma	98-99.5		11.5	2300 (?)				
Mercuric acetate	Hg(C ₂ H ₃ O ₂) ₂	318.70	wh. pl.	3.270	d.		25 ^{10°}	100 ^{100°}	s. al. sl. d.
bromide	HgBr ₂	360.44	wh., rhb.	6.053	237	322	0.5 ^{20°}	25 ^{100°}	25.2 ^{0°} al.; v. sl. s. et.
carbonate, basic	HgCO ₃ ·2HgO	693.84	brn.-red				i.		s. aq. CO ₂ , NH ₄ Cl
chloride (corrosive sublimate)	HgCl ₂	271.52	wh., rhb., 1.859	5.44	277	304	3.6 ^{0°}	61.3 ^{100°}	33 ^{25°} 99% al.; 33 et.
fulminate	Hg(CNO) ₂	284.65	cb.	4.42	expl.		sl. s.		s. NH ₄ OH, al.
hydroxide	Hg(OH) ₂	234.63			-H ₂ O, 175		i.	i.	s. a.
oxide (montroydite)	HgO	216.61	yel. or red, rhb., 2.5	11.14	d. 100		0.0052 ^{25°}	0.041 ^{100°}	s. a.; i. al.
oxychloride (kleinite)	HgCl ₂ ·3HgO	921.35	yel., hex.	7.93	d. 260		i.	d.	s. HCl
silicofluoride, basic	Hg ₂ SiF ₆ ·HgO·3H ₂ O	613.33	yel. nd.				d.		s. a.
sulfate	HgSO ₄	296.67	wh., rhb.	6.47	d.		d.		s. a.; i. al., act., NH ₃
sulfate, basic (turpeth)	HgSO ₄ ·2HgO	729.89	yel., tet.	6.44			0.005	0.167 ^{100°}	s. a.; i. al.
Mercurous acetate	Hg ₂ C ₂ H ₃ O ₂	259.65	wh. sc.		d.		0.75 ^{13°}	d.	s. H ₂ SO ₄ , HNO ₃ ; i. al.
bromide	Hg ₂ Br	280.53	wh., tet.	7.307	subl. 345		7 × 10 ⁻⁹	i.	s. a.; i. al., act.
carbonate	Hg ₂ CO ₃	461.23	yel. pd.		d. 130		i.	d.	s. NH ₄ Cl

chloride (calomel)	HgCl	236.07	wh., tet., 1.9733	7.150	302	383.7	0.0014 ^{0°}	0.0007 ^{43°}	s. aq. reg., Hg(NO ₃) ₂ ; sl. s. HNO ₃ , HCl; i. al., etc.
iodide	HgI	327.53	yel., tet.	7.70	290 d.	subl. 140; 310d.	2 × 10 ⁻⁸	v. sl. s.	s. KI; i. al.
nitrate	HgNO ₃ ·H ₂ O	280.63	wh. mn.	4.785 ^{3,9°}	70	expl.	v. s.	d.	s. HNO ₃ ; i. al., et.
Mercurous oxide	Hg ₂ O	417.22	bk.	9.8	d. 100		i.	0.0007	s. h. ac.; i. alk., dil. HCl, NH ₃
sulfate	Hg ₂ SO ₄	497.28	wh., mn.	7.56	d.		0.055 ^{16,5°}	0.092 ^{100°}	s. H ₂ SO ₄ , HNO ₃
Mercury†	Hg	200.61	silv. lq. or hex.(?)	13.546 ^{20°}	-38.87	356.9	i.	i.	s. HNO ₃ ; i. HCl
Molybdenum	Mo	95.95	gray, cb.	10.2	2620 ± 10	3700	i.	i.	s. h. conc. H ₂ SO ₄ ; i. HCl, HF, NH ₃ , dil. H ₂ SO ₄ , Hg
chloride, di-	MoCl ₂	166.85	yel., amor.	3.714 ^{25°}	d.		i.	i.	s. HCl, H ₂ SO ₄ , NH ₄ OH, al., et.
chloride, tri-	MoCl ₃	202.32	dark red pd.	3.578 ^{25°}	d.		i.	d.	s. HNO ₃ , H ₂ SO ₄ ; v. sl. s. al., et.
chloride, tetra-	MoCl ₄	237.78	brn., delq.		volt.	d.	s.	d.	s. HNO ₃ , H ₂ SO ₄ ; sl. s. al., et.
chloride, penta-	MoCl ₅	273.24	bk. cr.	2.928 ^{25°}	194	268	s.	d.	s. HNO ₃ , H ₂ SO ₄ ; i. abs. al., et.
oxide, tri- (molybdate)	MoO ₃	143.95	col., rhb.	4.50 ^{19,5°}	795	subl.	0.107 ^{18°}	2.106 ^{79°}	s. a., NH ₄ OH
sulfide, di- (molybdenite)	MoS ₂	160.07	bk., hex., 4.7	4.801 ^{14°}	1185		i.	i.	s. H ₂ SO ₄ , aq. reg.
sulfide, tri-	MoS ₃	192.13	red-brn.		d.		sl. s.	s.	s. alk. sulfides
sulfide, tetra-	MoS ₄	224.19	brn. pd.		d.		i.	i.	s. alk. sulfides; i. NH ₃
Molybdic acid	H ₂ MoO ₄	161.97	yel-wh., hex.		d. 115		v. sl. s.	sl. s.	s. NH ₄ OH, H ₂ SO ₄ ; i. NH
Molybdic acid	H ₂ MoO ₄ ·H ₂ O	179.98	yel., mn.	3.124 ^{15°}	-H ₂ O, 70	-2H ₂ O, 200	0.133 ^{15°}	2.13 ^{70°}	s. a., NH ₄ OH, NH ₄ , salts
Neodymium	Nd	144.27	yellowish	6.9 ^{20°}	840		d.	d.	
Neon	Ne	20.18	col. gas	lq. 1.204 ^{-245,9°}	-248.67	-245.9	2.6 ^{9°} cc	1.1 ^{45°} cc	s. lq. O ₂ , al., act., bz.
				0.674 (A)					
Neptunium	Np ²³⁹	239			Produced by Neutron bombardment of U ²³⁸				
Nickel	Ni	58.69	silv. met., cb.	8.90 ²⁰	1452	2900	i.	i.	s. dil. HNO ₃ ; sl. s. H ₂ SO ₄ , HCl; i. NH ₃
acetate	Ni(C ₂ H ₃ O ₂) ₂	176.78	gn. pr.	1.798	d.		16.6		i. al.
ammonium chloride	NiCl ₂ ·NH ₄ Cl·6H ₂ O	291.20	gn., delq., mn.	1.645			150 ^{25°}	v. s.	
ammonium sulfate	NiSO ₄ ·(NH ₄) ₂ SO ₄ · 6H ₂ O	394.99	blue-gn., mn., 1.5007	1.923			2.5 ^{3,3°}	39.2 ^{85°}	v. sl. s. (NH ₄) ₂ SO ₄
bromate	Ni(BrO ₃) ₂ ·6H ₂ O	422.62	gn., cb.	2.575	d.		28		s. NH ₄ OH
bromide	NiBr ₂	218.52	yel., delq.	4.64 ^{24°}	d.		112.8 ^{0°}	156 ^{100°}	s. al., et., NH ₄ OH
bromide	NiBr ₂ ·3H ₂ O	272.57	gn., delq.		d.	-3H ₂ O, 200	199 ^{9°}	316 ^{100°}	s. al., et., NH ₄ OH
bromide, ammonia	NiBr ₂ ·6NH ₃	320.71	vl. pd.	1.837			v. s.	d.	i. c. NH ₄ OH
bromoplatinate	NiPtBr ₆ ·6H ₂ O	841.51	trig.	3.715					
carbonate	NiCO ₃	118.70	lt. gn., rhb.		d.		0.0093 ^{25°}	i.	s. a.
carbonate, basic	2NiCO ₃ ·3Ni(OH) ₂ · 4H ₂ O	587.58	lt. gn.		d.		i.	d.	s. a., NH ₄ salts
carbonyl	Ni(CO) ₄	170.73	lq.	1.31 ^{17°}	-25	43 ^{751mm}	0.018 ^{9,6°}	i.	s. aq. reg., HNO ₃ , al., et.
chloride	NiCl ₂	129.60	yel., delq.	3.544	subl.	973	53.8 ^{0°}	87.6 ^{100°}	s. NH ₄ OH, al.; i. NH ₃
chloride	NiCl ₂ ·6H ₂ O ^o	237.70	gn., delq., mn., 1.57 ±				180	v. s.	v. s. al.
chloride, ammonia	NiCl ₂ ·6NH ₃	231.80					s.	d.	s. NH ₄ OH; i. al.
cyanide	Ni(CN) ₂ ·4H ₂ O	182.79	gn. pl.			-4H ₂ O, 200	i.	i.	s. KCN; i. dil. KCl
dimethylglyoxime	NiC ₈ H ₁₄ O ₄ N ₄	288.91	scarlet red cr.			subl. 250	i.	i.	s. abs. al., a.; i. ac., NH ₄ OH
formate	Ni(HCO ₂) ₂ ·2H ₂ O	184.76	gn. cr.	2.154	d.		s.		
hydroxide (ic)	Ni(OH) ₂	109.71	bk.		d.		i.	i.	s. a., NH ₄ OH, NH ₄ Cl
hydroxide (ous)	Ni(OH) ₂ ·d H ₂ O	97.21	lt. gn.	4.36	d.		v. sl. s.	v. sl. s.	s. a., NH ₄ OH; i. abs.
nitrate	Ni(NO ₃) ₂ ·6H ₂ O	290.80	gn., mn.	2.05	56.7	136.7	243.0 ^{0°}	∞ ^{56,7°}	s. NH ₄ OH; i. abs. al.
nitrate, ammonia	Ni(NO ₃) ₂ ·4NH ₃ ·2H ₂ O	286.87					v. s.	i.	i. al.
oxide, mono- (bunsenite)	NiO	74.69	gn.-bk., cb., 2.37	7.45	Forms Ni ₂ O ₃ at 400		i.	i.	s. a., NH ₄ OH
potassium cyanide	Ni(CN) ₂ ·2KCN·H ₂ O	258.97	red yel., mn.	1.875 ^{11°}	-H ₂ O, 100		s.	d. a.	d. a.
sulfate	NiSO ₄	154.75	yel., cb.	3.68	-SO ₃ , 840		27.2 ^{0°}	76.7 ^{100°}	i. al., et., act.

^oUsual commercial form.

†See also Tables 2-28 and 2-280.

TABLE 2-1 Physical Properties of the Elements and Inorganic Compounds (Continued)

Name	Formula	Formula weight	Color, crystalline form and refractive index	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Cold water	Hot water	Other reagents
Nickel (<i>Cont.</i>) sulfate	NiSO ₄ ·6H ₂ O ^o	262.85	gn. mn. or blue, tet., 1.5109	2.07	tr. 53.3	-6H ₂ O, 280	131 ^{50p}	280 ^{100p}	v. s. NH ₄ OH, al.
sulfate (morenosite)	NiSO ₄ ·7H ₂ O	280.86	gn., rhb., 1.4893	1.948	98-100	-6H ₂ O, 103	63.5 ^{5p}	117.8 ^{30p}	s. al.
Nitric acid	HNO ₃	63.02	col. lq.	1.502	-42	86	∞	∞	expl. with al.
Nitric acid	HNO ₃ ·H ₂ O	81.03	col. lq.		-38		∞	∞	d. al.
Nitric acid	HNO ₃ ·3H ₂ O	117.06	col. lq.		-18.5		263 ^{-20p}	∞	d. al.
Nitro acid sulfite	NO ₂ HSO ₃	127.08	col., rhb.		73 d.		d.		s. H ₂ SO ₄
Nitrogen	N ₂	28.02	col. gas or cb. cr.	1.026 ^{-252.5p} 0.808 ^{-195.8p} 12.5 ^{9p} (D)	-209.86	-195.8	2.35 ^{9p} cc	1.55 ^{20p} cc	sl. s. al.
Nitrogen oxide, mono- (ous)	N ₂ O	44.02	col. gas	lq. 1.226 ^{-89p} 1.530 (A)	-102.3	-90.7	130.52 ^{9p} cc	60.82 ^{24p} cc	s. H ₂ SO ₄ , al.
oxide, di- (ic)	NO or (NO) ₂	30.01 (60.02)	col. gas	lq. 1.269 ^{-150.2p} 1.0367 (A)	-161	-151	7.34 ^{9p} cc	0.0 ^{100p}	26.6 cc al.; 3.5 cc H ₂ SO ₄ s. aq. FeSO ₄
oxide, tri-	N ₂ O ₃	76.02	red-brn. gas or blue lq. or solid	1.447 ^{2p}	-102	3.5	s.		s. a., et.
oxide, tetra- (per- or di-)	NO ₂ or (NO ₂) ₂	46.01 (92.02)	yel. lq., col. solid, red-brn. gas	1.448 ^{20p}	-9.3	21.3	d.		s. HNO ₃ , H ₂ SO ₄ , chl., CS ₂
oxide, penta-	N ₂ O ₅	108.02	wh., rhb.	1.63 ^{18p}	30	47	s.	Forms HNO ₃	
oxybromide	NOBr	109.92	brn. lq.	>1.0	-55.5	-2	d.		
oxychloride	NOCl	65.47	red-yel. lq. or gas	1.417 ^{-12p} 2.31 (A)	-64.5	-5.5	d.		s. fuming H ₂ SO ₄
Nitroxyl chloride	NO ₂ Cl	81.47	yel.-brn. gas	lq. 1.32 ^{14p}	<-30	5	d.		
Osmium	Os	190.2	blue, hex.	22.48 ^{20p}	2700	>5300	i.	i.	sl. s. aq. reg., HNO ₃ ; i. NH ₃
chloride, di-	OsCl ₂	261.11	gn., delq.				s. d.		s. NaCl, al., et.
chloride, tri-	OsCl ₃	296.57	brn., cb.				sl. s.		s. a., alk., al.; sl. s. et.
chloride, tetra-	OsCl ₄	332.03	red-yel. nd.				s. d.		s. HCl, al.
Oxygen	O ₂	32.00	col. gas or hex. solid	1.14 ^{-188p} 1.426 ^{-252.5p} 1.1053 (A)	-218.4	-183	4.89 ^{9p} cc	2.6 ^{30p} cc 1.7 ^{100p} cc	sl. s. al., s. fused Ag
Ozone	O ₃	48.00	col. gas	1.71 ^{-183p} 3.03 ^{-80p} 1.658 (A)	-251	-112	0.494 ^{9p} cc	0 ^{60p} cc	s. oil turp., oil cinn.
Palladium	Pd	106.70	silv. met., cb.	12.0 ^{20p} 11 ^{1550p}	1555	2200	i.	i.	s. aq. reg., h. H ₂ SO ₄ ; i. NH ₃
bromide (ous)	PdBr ₃	266.53	brn.				i.	i.	s. HBr
chloride	PdCl ₂	177.61	brn., cb.		500 d.		s.	s.	s. HCl, act., al.
chloride	PdCl ₂ ·2H ₂ O	213.65	brn. pr.				s.	s.	s. HCl, act., al.
cyanide	Pd(CN) ₂	158.74	yel.		d.		i.	i.	s. HCN, KCN, NH ₄ OH; i. dil. a.
hydride	Pd ₂ H	214.41	met.	11.06	d.				
Palladous dichlorodiammine	Pd(NH ₃) ₂ Cl ₂	211.68	red or yel., tet.	2.5			s.		s. a., NH ₄ OH
Perchloric acid	HClO ₄	100.46	unstable, col. lq.	1.768 ^{24p}	-112	16 ^{18mm}	s.		
Perchloric acid	HClO ₄ ·H ₂ O	118.48	fairly stable nd.	1.88	50		d.		
Perchloric acid	HClO ₄ ·2H ₂ O ^o 73.6% anh.	136.50	stable lq., col.	1.71 ^{25p} 1.146 ^{25p}	-17.8	200	v. s.		s. al.
Periodic acid	HIO ₄	191.93	wh. cr.		d. 138	subl. 110	s.		
Periodic acid	HIO ₄ ·2H ₂ O	227.96	delq., mn.		d. 110		v. s.	v. s.	sl. s. al., et.
Permanganic acid	HMnO ₄	119.94	exists only in solution				v. s.	d.	d. al.
Permolybdic acid	HMoO ₄ ·2H ₂ O	196.99	wh. cr.				v. s.	v. s.	
Persulfuric acid	H ₂ S ₂ O ₈	194.14	hyg. cr.		<60		v. s.	d.	
Phosphamic acid	PONH ₂ ·(OH) ₂	97.02	cb.		d.		v. s.	v. s. d.	i. al.
Phosphatomolybdic acid	H ₇ P(Mo ₂ O ₇) ₆ ·28H ₂ O	2365.88	yel. cb.		78	-25H ₂ O, 140	s.		s. HNO ₃
Phosphine	PH ₃	34.00	col. gas	lq. 0.746 ^{-90p} 1.146 (A)	-132.5	-85	26 ^{17p} cc	i. 100 ^p	s. Cu ₂ Cl ₂ , al., et.
Phosphonium chloride	PH ₄ Cl	70.47	wh., cb.		28 ^{6atm}	subl.	d.		

Phosphoric acid, hypo-	H ₄ P ₂ O ₆	161.99	cr.		55	d. 70	s.	450 ^{62°}		
Phosphoric acid, meta-	HPO ₃	79.99	vitreous, delq.	2.2–2.5	subl.		s.	Forms H ₃ PO ₄	i. lq. CO ₂	
Phosphoric acid, ortho-	H ₃ PO ₄ †	98.00	col., rhb.	1.834 ^{18.2°}	42.35	–a H ₂ O, 213	2340 ^{26°}	v. s.	s. al.	
Phosphoric acid, pyro-	H ₄ P ₂ O ₇	177.99	wh. nd.		61		800 ^{28°}	Forms H ₃ PO ₄	v. s. al., et.	
Phosphorous acid, hypo-	H ₃ PO ₂	66.00	syrupey	1.493 ^{18.8°}	26.5	d.	∞	∞		
Phosphorous acid, ortho-	H ₃ PO ₃	82.00	col.	1.651 ^{21.2°}	74	d. 200	307.3 ^{0°}	730 ^{40°}		
Phosphorous acid, pyro-	H ₄ P ₂ O ₆	145.99	nd.		38	d. 130	d.			
Phosphorus, black	P ₄	123.92	rhombohedral	2.69		ign. in air, 400	i.	i.	i. CS ₂	
Phosphorus, red	P ₄	123.92	red, cb.	2.20 ^{20°}	590 ^{43atm}	ign. in air, 725	i.	i.	s. alk.; i. CS ₂ , NH ₃ , et.	
Phosphorus, yellow	P ₄	123.92	yel., hex., 2.1168	1.82 ^{20°} ; lq. 1.745 ^{44.5°}	44.1; ign. 34	280	0.0003	sl. s.	0.4 al.; 1000 ^{10°} CS ₂ ; 1.5 ^{0°} , 10 ^{81°} bs.; s. NH ₃	
chloride, tri-	PCl ₃	137.35	col., fuming lq.	1.574 ^{20.8°}	–111.8	75.95 ^{760mm}	d.		s. et., chl., CS ₂	
chloride, penta-	PCl ₅	208.27	delq., tet.	solid 1.6; 3.60 ^{235°} (A)	148 under pressure	subl. 250	d.		s. CS ₂ , C ₆ H ₅ COCl	
oxide, penta-	P ₂ O ₅	141.96	wh., delq., amor.	2.387			Forms H ₃ PO ₄	v. s.	s. H ₂ SO ₄ ; i. NH ₃ , act.	
oxychloride	POCl ₃	153.35	col., fuming lq.	1.675		2	107.2 ^{760mm}	d. al.	d. al.	
Phosphotungstic acid	P ₃ O ₇ ·2WO ₃ ·42H ₂ O	3681.67	yel.-gn. cr.				s.		s. al., et.	
Platinum	Pt	195.23	silv. met., cb.	21.45 ^{20°} lq. 19 ^{1735°}	1755	4300	i.	i.	s. aq. reg., fused alk.	
chloride (ic)	PtCl ₄	337.06	brn.					140 ^{25°}	v. s.	s. al., act.; sl. s. NH ₃ ; i. et.
chloride (ous)	PtCl ₂	266.14	brn.	5.87 ^{11°}		d. 581	i.	i.	s. HCl, NH ₄ OH; sl. s. NH ₃ ; i. al., et.	
chloride (ic)	PtCl ₄ ·8H ₂ O	481.19	red, mn.	2.43		–4H ₂ O, 100	v. s.	v. s.	s. al., et.	
cyanide (ous)	Pt(CN) ₂	247.27	yel.-brn.				i.	i.	i. alk.	
Plutonium	Pu	238		Produced by deuteron bombardment on U ²³⁸						
Plutonium	Pu	239		Produced by neutron bombardment on U ²³⁸						
Potassium	K	39.10	silv. met., cb.	0.86 ^{20°} lq. 0.83 ^{42°}	62.3	760	d.	Forms KOH	s. a., al., Hg	
acetate	KC ₂ H ₃ O ₂	98.14	wh. pd.	1.8	292			217 ^{0°}	336 ^{90°}	33 al.; i. et.
acetate, acid	KH(C ₂ H ₃ O ₂) ₂	158.19	delq. nd. or pl.		148	d. 200	d.			s. ac.
aluminate	K ₂ (AlO ₂) ₂ ·3H ₂ O	250.18	cr.				s.	d.		s. alk.; i. al.
amide	KNH ₂	55.12	yel.-grn.		338	subl. 400	d.			d. al.; 3.6 ^{25°} NH ₃
arsenate (monobasic)	KH ₂ AsO ₄	180.02	col., tet., 1.5674	2.867	288			18.87 ^{6°}	v. s.	i. al.
auricyanide	KAu(CN) ₄ ·1.5H ₂ O	367.39	pl.			d. 200	s.		v. s.	s. al.
aurocyanide	KAu(CN) ₂	288.33	rhb.					14.3	200 ^{100°}	sl. s. al.; i. et.
bicarbonate	KHCO ₃	100.11	mn., 1.482	2.17		d. 100–200		22.4 ^{0°}	60 ^{60°}	i. satd. K ₂ CO ₃ , al.
bisulfate	KHSO ₄	136.16	rhb., or mn., 1.480	2.35	210	d.		36.3 ^{0°}	121.6 ^{100°}	d. al.
bromate	KBrO ₃	167.01	trig.	3.27 ^{17.5°}	370 d.			3.11 ^{0°}	49.75 ^{100°}	sl. s. al.; i. act.
bromide	KBr	119.01	col., cb., 1.5594	2.75 ^{25°}	730	1380		53.5 ^{0°}	104 ^{100°}	sl. s. al., et.
carbonate	K ₂ CO ₃	138.20	wh., delq. pd., 1.531	2.29	891	d.		105.5 ^{0°}	156 ^{100°}	i. al.
carbonate	K ₂ CO ₃ ·2H ₂ O	174.23	rhb.	2.043				183 ^{0°}	331 ^{100°}	
carbonate	2K ₂ CO ₃ ·3H ₂ O	330.45	mn.	2.13				129.4 ^{0°}	268 ^{100°}	
chlorate	KClO ₃	122.56	col., mn., 1.5167	2.32	368	d. 400		3.3 ^{0°}	57 ^{100°}	0.83 al.; s. alk.
chloride (sylvite)	KCl	74.56	col., cb., 1.4904	1.988	790	1500		27.6 ^{0°}	56.7 ^{100°}	s. al., alk.
chloroplatinate	K ₂ PtCl ₆	486.16	yel., cb., 1.825±	3.499	d. 250			0.74 ^{0°}	5.2 ^{100°}	i. al., et.
chromate (tarapacaite)	K ₂ CrO ₄	194.20	yel., rhb., 1.7261	2.732 ^{18°}	975			58.0 ^{0°}	75.6 ^{100°}	i. al.
cyanate	KCNO	81.11	wh., tet.	2.048				s.	d.	v. sl. s. al.
cyanide	KCN	65.11	wh., cb., delq., 1.410	1.52 ^{16°}	634.5			s.	122.2 ^{108.8°}	s. gly.; 0.9 ^{19.5°} al.; 1.3 h. al.
dichromate	K ₂ Cr ₂ O ₇	294.21	red, tri.	2.69	398	d.		4.9 ^{0°}	80 ^{100°}	i. al.
ferricyanide	K ₃ Fe(CN) ₆	329.25	red, mn. pr., 1.5689	1.84				33 ^{4.4°}	77.5 ^{100°}	s. act.; sl. s. al.; i. NH ₃
ferrocyanide	K ₄ Fe(CN) ₆ ·3H ₂ O	422.39	yel., mn., 1.5772	1.853 ^{17°}	–3HO ₂ , 70			27.8 ^{12.2°}	90.6 ^{96.8°}	s. act.; i. NH ₃ , al., et.
formate	KHCO ₂	84.11	col., rhb.	1.91	167.5	d.		331 ^{18°}	657 ^{90°}	sl. s. al.; i. et.
hydride	KH	40.10	cb., 1.453	0.80				d.		i. et., bz., CS ₂
hydrosulfide	KHS	72.16	wh., delq., rhb.	2.0	455			s.	s. d.	s. al.
hydroxide	KOH	56.10	wh., delq., rhb.	2.044	380	1320		97 ^{0°}	178 ^{100°}	v. s. al., et.; i. NH ₃
iodate	KIO ₃	214.02	col., mn.	3.89	560			4.73 ^{0°}	32.2 ^{100°}	s. KI; i. al., NH ₃
iodide	KI	166.02	wh., cb., 1.6670	3.13	723	1330		127.5 ^{0°}	208 ^{100°}	4 ^{20°} al.; s. NH ₃ ; sl. s. et.

⁰One commercial form 70 to 72 per cent.

†Common commercial form 85 per cent H₃PO₄ in aqueous solution.

TABLE 2-1 Physical Properties of the Elements and Inorganic Compounds (Continued)

Name	Formula	Formula weight	Color, crystalline form and refractive index	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Cold water	Hot water	Other reagents
Potassium (<i>Cont.</i>)									
iodide, tri-	KI ₃	419.86	dark blue, delq., mn.	3.498	45	d. 225	v. s.		s. KI, al.
iodoplatinate	K ₂ PI ₆	1034.94	cb.	5.18			s.		
manganate	K ₂ MnO ₄	197.12	gn., rhb.		d. 190		d.		s. KOH
metabisulfite	K ₂ S ₂ O ₅	222.31	mn., pl.		d. 150		25 ^{0°}	120 ^{94°}	sl. s. al.; i. et.
nitrate (saltpeter)	KNO ₃	101.10	col., rhb., 1.5038	2.11 ^{10.6°}	tr. 129; 333	d. 400	13.3 ^{0°}	246 ^{100°}	0.130 ^{al.} ; i. et.
nitrite	KNO ₂	85.10	pr.	1.915	297	d. 350	281 ^{0°}	413 ^{100°}	v. s. NH ₃ ; sl. s. al.
oxalate	K ₂ C ₂ O ₄ ·H ₂ O	184.23	wh., mn.	2.13	d.		28.7 ^{0°}	83.2 ^{100°}	
oxalate, acid	KHC ₂ O ₄ ^o	128.12	mn., 1.545	2.0	d.		14.3 ^{50°}	48.1 ^{100°}	
oxalate, acid	KHC ₂ O ₄ ·a H ₂ O	137.13	trimetric		d.		2.2 ^{0°}	51.5 ^{100°}	
oxide	K ₂ O	94.19	wh., cb.	2.32 ^{20°}			Forms KOH	v. s.	s. al., et.
perchlorate	KClO ₄	138.55	col., rhb., 1.4737	2.524 ^{11°}	d. 400		0.75 ^{0°}	21.8 ^{100°}	0.105 ^{20°} m. al.; i. et.
permanganate	KMnO ₄	158.03	purple, rhb.	2.703	d. <240		2.83 ^{0°}	32.35 ^{75°}	s. H ₂ SO ₄ ; d. al.
persulfate	K ₂ S ₂ O ₈	270.31	wh., tri., 1.4669		d. <100		1.77 ^{0°}	10 ^{40°}	i. al.
phosphate, monobasic	KH ₂ PO ₄	136.09	col., delq., tet., 1.5095	2.338	256		14.8 ^{0°}	83.5 ^{90°}	i. al.
phosphate, dibasic	K ₂ HPO ₄	174.18	wh., delq.		d.		33 ^{25°}	v. s.	sl. s. al.
phosphate, tribasic	K ₃ PO ₄	212.27	wh., rhb.	2.564 ^{17°}	1340		193.1 ^{25°}	v. s.	i. al.
phosphate, meta-	KPO ₃	118.08	wh. pd.	2.258 ^{14.5°}	tr. 450; 798	1320	s.	s.	
phosphate, meta-	K ₂ P ₂ O ₇ ·2H ₂ O	508.34	amor.	2.264 ^{14.5°}	-2H ₂ O, 100	d.	s.	83	s. a.
phosphate, pyro-	K ₄ P ₂ O ₇ ·3H ₂ O	384.39	delq.	2.33	-2H ₂ O, 180		s.	v. s.	i. al.
phthalate, acid	KHC ₈ H ₄ O ₄	204.22	wh. cr.	1.63	d.		10.2 ^{25°}	36	
platinocyanide	K ₂ Pt(CN) ₄ ·3H ₂ O	431.54	yel., rhb., 1.62±	2.45 ^{16°}			sl. s.	v. s.	s. al., et.
silicate	K ₂ SiO ₃	154.25	hyg. 1.521±		976		s.	v. s.	i. al.
silicate, tetra-	K ₂ Si ₄ O ₉ ·H ₂ O	352.45	rhb., 1.530	2.417	d. 400		s.	s.	i. al.
sulfate (arcanite)	K ₂ SO ₄	174.25	col., rhb., 1.4947	2.662	tr. 588		7.35 ^{0°}	24.1 ^{100°}	i. al., act., CS ₂
Potassium sulfate, pyro-	K ₂ S ₂ O ₇	254.31	col.	2.277	300		s.	d.	
sulfide, mono-	K ₂ S·5H ₂ O	200.33	rhb., delq.		60	-3H ₂ O, 150	s.		s. al., gly.; i. et.
sulfite	K ₂ SO ₃ ·2H ₂ O	194.28	wh., rhb.		d.		100	>100	sl. s. al.; i. NH ₃
sulfite, acid	KHSO ₃	120.16	wh., mn.		d. 190		45.5 ^{15°}	91.5 ^{75°}	i. abs. al.
tartrate	K ₂ C ₄ H ₄ O ₆ ·a H ₂ O	235.27	col., mn., 1.526	1.98		d.	12.5 ^{17.5°}	278 ^{100°}	sl. s. al.
tartrate, acid	KHC ₄ H ₄ O ₆ ^o	188.18	col., rhb.	1.956			0.37 ^{0°}	6.1 ^{100°}	s. a., alk.; i. al., ac.
thiocyanate	KCNS	97.17	col., delq., mn., 1.660±	1.886	172.3	d. 500	177 ^{0°}	217 ^{20°}	20.8 ^{25°} act.; s. al.
thiosulfate	K ₂ S ₂ O ₃	190.31	col., cb.		d. 400		96.1 ^{0°}	311.2 ^{90°}	
thiosulfate	3K ₂ S ₂ O ₃ ·H ₂ O	588.95	delq., mn.	2.23	-H ₂ O, 180	d.			i. al.
Praseodymium	Pr	140.92	yel.	6.5 ^{20°}	940		d.		
Radium	Ra	226.05	wh., met.	5 [°]	960	1140	d. +H ₂		d. a.
bromide	RaBr ₂	385.88	wh., mn.	5.79	728	subl. 900	70 ^{20°}	s.	s. al.
Radon (Niton)	Rn	222.0	gas	lq. 5.5; 111 (D)	-71	-62	51 ^{0°} cc	8.5 ^{60°} cc	
Rhenium	Re	186.31	hex.		3440				i. HF, HCl; s. H ₂ SO ₄ ; HNO ₃
Rhodium	Rh	102.91	gray-wh., cb.	12.5	1955	>2500	i.	i.	sl. s. aq. reg., a.
chloride	RhCl ₃	209.28	red		d. 450	subl. 800±	i.	i.	v. sl. s. alk.; i. aq. reg., a.
chloride	RhCl ₃ ·4H ₂ O	281.35	dark red				v. s.		s. HCl, al.; i. et.
Rubidium	Rb	85.48	silv. wh.	lq. 1.475 ^{88.5°} ; 1.53 ^{20°}	38.5	700	d.		s. a., al.
Ruthenium	Ru	101.70	bk., porous	8.6	>1950		i.	i.	sl. s. aq. reg., a.
Ruthenium	Ru	101.70	gray, hex.	12.2 ^{20°}	2450	>2700	i.	i.	
Samarium	Sm (also Sa)	150.43		7.7	>1300				
Scandium	Sc	45.10		2.5 [°]	1200	2400			
Selenic acid	H ₂ SeO ₄	144.98	hex. pr.	2.950 ^{15°}	58	260	1300 ^{30°}	∞ ^{60°}	s. H ₂ SO ₄ ; d. al.; i. NH ₃
Selenic acid	H ₂ SeO ₄ ·H ₂ O	162.99	nd.	2.627 ^{15°}	26	205	v. s.		
Selenium	Se ₈	631.68	red pd., amor., 2.92	4.26 ^{25°}	50	688	i.	i.	s. CS ₂ , H ₂ SO ₄ , CH ₂ I ₂
Selenium	Se ₈	631.68	gray, trig., 3.00; red, hex.	4.80; 4.50	220	688	i.	i.	s. CS ₂ , H ₂ SO ₄

Selenium	Se ₈	631.68	steel gray	4.8 ^{25°}	217	688	i.	i.	i. CS ₂ ; s. H ₂ SO ₄
Selenous acid	H ₂ SeO ₃	128.98	hex.	3.004 ^{15°}	d.		90 ^{0°}	400 ^{90°}	v. s. al.; i. NH ₃
Silicic acid, meta-	H ₂ SiO ₃	78.08	amor., 1.41	2.1–2.3			i.	sl. s.	s. alk.; i. NH ₄ Cl
Silicic acid, ortho-	H ₄ SiO ₄	96.09	amor.	1.576 ^{17°}			sl. s.	sl. s.	s. alk.; i. NH ₄ Cl
Silicon, crystalline	Si	28.06	gray, cb., 3.736	2.4 ^{30°}	1420	2600	i.	sl. s.	s. HNO ₃ + HF, Ag; sl. s. Pb, Zn; i. HF
Silicon, graphitic	Si	28.06	cr.	2.0–2.5		2600	i.	i.	s. HNO ₃ + HF, fused alk.; i. HF
Silicon, amorphous	Si	28.06	brn., amor.	2		2600	i.	i.	s. HF, KOH
carbide	SiC	40.07	blue-bk., trig., 2.654	3.17	>2700	2200	i.	i.	s. fused alk.; i. a.
chloride, tri-	Si ₂ Cl ₆	268.86	lf. or lq.	1.5 ^{90°}	-1	144 ^{760mm}	d.	d.	d. alk.
chloride, tetra-	SiCl ₄	169.89	col., fuming lq., 1.412	1.50	-70	57.6	d.	d.	d. conc. H ₂ SO ₄ , al.
fluoride	SiF ₄	104.06	gas	3.57 (A)	-95.7	-65 ^{1810mm}	v. s. d.		s. HNO ₃ , al., et.
hydride (silane)	SiH ₄	32.09	col. gas	lq. 0.68 ^{-185°}	-185	-112 ^{760mm}	i.		i. al., et.; d. KOH
oxide, di- (opal)	SiO ₂ ·xH ₂ O		iridescent, amor.	2.2	1600–1750	1750	i.	i.	s. HF, h. alk., fused CaCl ₂
oxide, di- (cristobalite)	SiO ₂	60.06	col., cb. or tet., 1.487	2.32	1710	2230	i.	i.	s. HF; i. alk.
oxide, di- (lechatelierite)	SiO ₂	60.06		2.20		2230	i.	i.	s. HF; i. alk.
oxide, di- (quartz)	SiO ₂	60.06	hex., 1.5442	2.650 ^{20°}	tr. <1425	2230	i.	i.	s. HF; i. alk.
oxide, di- (tridymite)	SiO ₂	60.06	trig., rhb., 1.469	2.26	tr. 1670	2230	i.		s. HF; i. alk.
Silver	Ag	107.88	silv. met., cb.	10.5 ^{20°}	960.5	1950	i.	i.	s. HNO ₃ , h. H ₂ SO ₄ ; i. alk.
bromide (bromyrite)	AgBr	187.80	pa. yel., cb., 2.252	6.473 ^{25°}	434	d. 700	0.00002 ^{20°}	0.00037 ^{100°}	0.51 ^{18°} NH ₄ OH; s. KCN, Na ₂ S ₂ O ₃
carbonate	Ag ₂ CO ₃	275.77	yel. pd.	6.077	218 d.		0.003 ^{20°}	0.05 ^{100°}	s. NH ₄ OH, Na ₂ S ₂ O ₃ ; i. al.
chloride (cerargyrite)	AgCl	143.34	wh., cb., 2.071	5.56	455	1550	0.000089 ^{100°}	0.00217 ^{100°}	s. NH ₄ OH, KCN; sl. s. HCl
cyanide	AgCN	133.90	wh., 1.685 ±	3.95	-(CN) ₂ , 320		0.000022 ^{20°}		s. NH ₄ OH, KCN, HNO ₃
nitrate (lunar caustic)	AgNO ₃	169.89	col., rhb., 1.744	4.352 ^{19°}	212	444 d.	122 ^{9°}	952 ^{100°}	s. gly.; v. sl. s. al.
Sodium	Na	22.997	silv. met., cb.	0.97 ^{20°}	97.5	880	d., forms NaOH		i. bz.; d. al.
acetate	NaC ₂ H ₃ O ₂	82.04	wh., mn., 1.464	1.528	324		46.5 ^{20°}	170 ^{100°}	2.1 ^{18°} al.
acetate	NaC ₂ H ₃ O ₂ ·3H ₂ O	136.09	wh., mn.	1.45	58	-3H ₂ O, 120	v. s.	v. s.	7.8 ^{25°} abs. al.
aluminate	NaAlO ₂	81.97	amor.		1650		s.	v. s.	i. al.
amide	NaNH ₂	39.02	olive gn.		210	400	d.		d. al.
Sodium ammonium phosphate	NaNH ₄ HPO ₄ ·4H ₂ O	209.09	col., mn.	1.574	79 d.		16.7	100	i. al.
antimonate, meta-	2NaSbO ₃ ·7H ₂ O	511.63	cb.				0.031 ^{12.8°}		sl. s. al., NH ₄ salts; i. ac.
arsenate	Na ₃ AsO ₄ ·12H ₂ O	424.09	hex., 1.4589	1.759	86.3		26.7 ^{17°}		1.67 al., 50 ^{15°} gly.
arsenate, acid (monobasic)	NaH ₂ AsO ₄ ·H ₂ O	181.94	rhb., 1.5535	2.535	d. 100		s.		
arsenate, acid (dibasic)	Na ₂ HAsO ₄ ·7H ₂ O ^o	312.02	col., mn., 1.4658	1.871	125	-7H ₂ O, 100	61 ^{15°}	v. s.	sl. s. al.
arsenate, acid (dibasic)	Na ₂ HAsO ₄ ·12H ₂ O	402.10	mn., 1.4496	1.72	28	-12H ₂ O, 100	5.59 ^{0.1°}	140.7 ^{30°}	sl. s. al.
arsenite, acid	Na ₂ HAsO ₃	169.91	col.	1.87			v. s.		
benzoate	NaC ₇ H ₅ O ₂	144.11	col. cr.				62.5 ^{25°}	76.9 ^{100°}	2.3 ^{25°} , 8.3 ^{78°} al.
bicarbonate	NaHCO ₃	84.01	wh., mn., 1.500	2.20	-CO ₂ , 270		6.9 ^{9°}	16.4 ^{60°}	i. al.
bifluoride	NaHF ₂	62.00	col. cr.		d.		3.7 ^{20°}	s.	
bisulfate	NaHSO ₄	120.06	col., tri.	2.742	>315	d., -H ₂ O	50 ^{9°}	100 ^{100°}	d. al.; i. NH ₃
bisulfite	NaHSO ₃	104.06	col., mn., 1.526	1.48	741		sl. s.	s.	i. al., act.
borate, tetra-	Na ₂ B ₄ O ₇	201.27		2.367			1.3 ^{9°}	8.79 ^{40°}	i. al.
borate, tetra	Na ₂ B ₄ O ₇ ·5H ₂ O	291.35	col., rhb., 1.461	1.815			22 ^{62°} (anh.)	52.3 ^{100°}	
borate, tetra- (borax)	Na ₂ B ₄ O ₇ ·10H ₂ O ^o	381.43	wh., mn., 1.4694	1.73	75	-10H ₂ O, 200	1.3 ^{0.5} (anh.)	20.3 ^{80°}	s. gly.; i. abs. al.
bromate	NaBrO ₃	150.91	col., cb.	3.339 ^{17.5°}	381		27.5 ^{9°}	90.9 ^{100°}	i. al.
bromide	NaBr	102.91	col., cb., 1.6412	3.205 ^{17.5°}	755	1390	90 ^{20°}	121 ^{100°}	sl. s. al.
bromide	NaBr·2H ₂ O	138.95	col., mn.	2.176	50.7		79.5 ^{9°} (anh.)	118.3 ^{80°}	sl. s. al.
carbonate (soda ash)	Na ₂ CO ₃	106.00	wh. pd., 1.535	2.533	851	d.	7.1 ^{9°}	48.5 ^{104°}	i. al., et.
carbonate	Na ₂ CO ₃ ·H ₂ O	124.02	wh., rhb., 1.506–1.509	1.55	-H ₂ O, 100		s.	s.	s. gly.; i. al., et.
carbonate	Na ₂ CO ₃ ·7H ₂ O	232.12	rhb. or trig.	1.51	d. 35.1		s.	s.	
carbonate (sal soda)	Na ₂ CO ₃ ·10H ₂ O	286.16	wh., mn., 1.425	1.46			21.5 ^{9°}	238 ^{30°}	i. al.

^oUsual commercial form.

TABLE 2-1 Physical Properties of the Elements and Inorganic Compounds (Continued)

Name	Formula	Formula weight	Color, crystalline form and refractive index	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Cold water	Hot water	Other reagents
Sodium ammonium phosphate (Cont.)									
carbonate, sesqui- (trona)	Na ₃ H(CO ₃) ₂ ·2H ₂ O	226.05	wh., mn., 1.5073	2.112	d.		13 ^{0°}	42 ^{100°}	
chlorate	NaClO ₃	106.45	wh., cb., or trig., 1.5151	2.490 ^{15°}	248	d.	79 ^{0°}	230 ^{100°}	s. al.
chloride	NaCl	58.45	col., cb., 1.5443	2.163	800.4	1413	35.7 ^{0°}	39.8 ^{100°}	sl. s. al.; i. conc. HCl
chromate	Na ₂ CrO ₄	162.00	yel., rhb.	2.723	392		32 ^{0°}	126 ^{100°}	
chromate	Na ₂ CrO ₄ ·10H ₂ O	342.16	yel., delq., mn.	1.483	19.9		v. s.	∞	sl. s. al.
citrate	2Na ₃ C ₆ H ₅ O ₇ ·11H ₂ O	714.36	wh., rhb.	1.857 ^{23.5°} ₄	-11H ₂ O, 150	d.	91 ^{25°}	250 ^{100°}	i. al.
cyanide	NaCN	49.02	wh., cb., 1.452		563.7	1496	48 ^{10°}	82 ^{35°}	s. NH ₃ ; sl. s. al.
dichromate	Na ₂ Cr ₂ O ₇ ·2H ₂ O	298.05	red, mn., 1.6994	2.52 ^{15°}	-2H ₂ O, 84.6; 356 (anh.)	d. 400	238 ^{0°}	508 ^{80°}	
ferricyanide	Na ₃ Fe(CN) ₆ ·H ₂ O	298.97	red, delq.				18.9 ^{0°}	67 ^{100°}	i. al.
ferrocyanide	Na ₄ Fe(CN) ₆ ·10H ₂ O	484.11	yel., mn.	1.458			17.9 ^{20°} (anh.)	63 ^{98.5°} (anh.)	i. al.
fluoride (villiumite)	NaF	42.00	tet., 1.3258	2.79	992		4 ^{0°}	5 ^{100°}	v. sl. s. al.
formate	NaHCO ₂	68.01	wh., mn.	1.919	253		44 ^{0°}	160 ^{100°}	sl. s. al.; i. et.
hydride	NaH	24.005	silv. nd., 1.470	0.92	d. 800		d.		i. bz., CS ₂ , CCl ₄ , NH ₃ ; s. molten metal
hydrosulfide	NaSH·2H ₂ O	92.10	col., delq., nd.		d.		s.	s.	s. al.; d. a.
hydrosulfide	NaSH·3H ₂ O	110.11	rhb.		22	d.	s.	s.	s. al.; d. a.
hydrosulfite	Na ₂ S ₂ O ₄ ·2H ₂ O	210.15	col. cr.		d.		22 ^{20°}	d.	i. al.
hydroxide	NaOH	40.00	wh., delq.	2.130	318.4	1390	42 ^{0°}	347 ^{100°}	v. s. al., et., gly.; i. act.
hydroxide	NaOH·3a H ₂ O	103.06	mn.		15.5		s.	v. s.	
hypochlorite	NaOCl	74.45	pa. yel., in soln. only		d.		26 ^{0°}	158 ^{56°}	
iodide	NaI ^o	149.92	col., cb., 1.7745	3.667 ^{0°}	651	1300	158.7 ^{0°}	302 ^{100°}	v. s. al., act.
iodide	NaI·2H ₂ O	185.95	col., mn.	2.448			v. s.	v. s.	v. s. NH ₃
lactate	NaC ₃ H ₅ O ₃	112.07	col., amor.		d.		v. s.	v. s.	s. al.; i. et.
nitrate (soda niter)	NaNO ₃	85.01	col., trig., 1.5874	2.257	308	d. 380	73 ^{0°}	180 ^{100°}	s. NH ₃ ; sl. s. gly., al.
nitrite	NaNO ₂	69.01	pa. yel., rhb.	2.168 ^{0°}	271	d. 320	72.1 ^{0°}	163.2 ^{100°}	0.3 ^{30°} et.; 0.3 abs. al.; 4.4 ^{20°} m. al.; v. s. NH ₃
oxide	Na ₂ O	61.99	wh., delq.	2.27	subl.		Forms NaOH		d. al.
perborate	NaBO ₃ ·H ₂ O	99.83	wh. pd.		d. 40		sl. s.	d.	s. gly., alk.
perchlorate	NaClO ₄	122.45	rhb., 1.4617		482 d.		170 ^{0°}	320 ^{100°}	s. al.; 51 m. al.; 52 act.; i. et.
perchlorate	NaClO ₄ ·H ₂ O	140.47	hex.	2.02	d. 130		209 ^{15°}	284 ^{50°}	s. al.
peroxide	Na ₂ O ₂ ^o	77.99	yel.-wh. pd.	2.805	d.		s. d.	d.	s. dil. a.
peroxide	Na ₂ O ₂ ·8H ₂ O	222.12	wh., hex.		d. 30		s. d.	d.	
phosphate, monobasic	NaH ₂ PO ₄ ·H ₂ O ^o	138.01	col., rhb., 1.4852	2.040	-H ₂ O, 100	d. 200	71 ^{0°}	390 ^{83°}	i. al.
phosphate, monobasic	NaH ₂ PO ₄ ·2H ₂ O	156.03	col., rhb., 1.4629	1.91	60		91.1 ^{0°}	338 ^{40°}	
phosphate, dibasic	Na ₂ HPO ₄ ·7H ₂ O	268.09	col., mn., 1.4424	1.679	d.		185 ^{40°}	2000 ^{100°}	
phosphate, dibasic	Na ₂ HPO ₄ ·12H ₂ O	358.17	col., mn., 1.4361	1.52	34.6	-12H ₂ O, 180	4.3 ^{30°}	76.7 ^{30°}	i. al.
phosphate, tribasic	Na ₃ PO ₄	163.97	wh.	2.537 ^{17.5°}	1340		4.5 ^{0°}	77 ^{100°}	
phosphate, tribasic	Na ₃ PO ₄ ·12H ₂ O ^o	380.16	wh., trig., 1.4458	1.62	73.4	-11H ₂ O, 100	28.3 ^{15°}	∞	i. CS ₂
phosphate, meta-	Na ₄ P ₄ O ₁₂	407.91	col.	2.476	616 d.		s.	s.	s. a., alk.
phosphate, pyro-	Na ₄ P ₂ O ₇ ^o	265.95	wh.	2.45	988		2.26 ^{0°}	45 ^{96°}	d. a.
phosphate, pyro-	Na ₄ P ₂ O ₇ ·10H ₂ O	446.11	mn., 1.4525	1.82	d.		5.4 ^{0°}	93 ^{100°}	i. al., NH ₃
phosphate (pyrodisodium)	Na ₂ H ₂ P ₂ O ₇	221.97	col., mn., 1.510	1.862	d. 220		4.5 ^{0°}	21 ^{40°}	
phosphate (pyrodisodium)	Na ₂ H ₂ P ₂ O ₇ ·6H ₂ O	330.07	col., mn., 1.4645	1.848			6.9 ^{0°}	36 ^{40°}	
potassium tartrate	NaKC ₄ H ₄ O ₆ ·4H ₂ O	282.23	rhb., 1.493	1.790	70 to 80	-4H ₂ O, 215	26 ^{0°}	66 ^{26°}	sl. s. al.
silicate, meta-	Na ₂ SiO ₃	122.05	col., rhb., 1.520		1088		s.	s. d.	i. Na or K salts, al.
Sodium silicate, meta-	Na ₂ SiO ₃ ·9H ₂ O	284.20	rhb.		47	-6H ₂ O, 100	v. s.	v. s.	29 ^{18°} , a N NaOH
silicate, ortho-	Na ₄ SiO ₄	184.05	col., hex., 1.530		1018		s.	s.	
silicofluoride	Na ₂ SiF ₆	188.05	wh., hex., 1.312	2.679	d.		0.44 ^{0°}	2.45 ^{100°}	i. al.
stannate	Na ₂ SnO ₃ ·3H ₂ O	266.74	hex. tablets		d. 140		50 ^{0°}	67 ^{50°}	i. al., act.
sulfate (thenardite)	Na ₂ SO ₄	142.05	col., rhb., 1.477	2.698	tr. 100 to mn.		5 ^{0°}	42 ^{100°}	i. al.
sulfate	Na ₂ SO ₄	142.05	col., mn.		tr. 500 to hex.		48.8 ^{40°}	42.5 ^{100°}	d. HI; s. H ₂ SO ₄

sulfate	Na_2SO_4	142.05	col., hex.		884		19.4 ^{20°}	45.3 ^{60°}	
sulfate	$\text{Na}_2\text{SO}_4 \cdot 7\text{H}_2\text{O}$	268.17	tet.				44.9 ^{0°}	202.6 ^{26°}	
sulfate (Glauber's salt)	$\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$	322.21	col. mn., 1.396	1.464	32.4	-10H ₂ O, 100	36 ^{15°}	41.2 ^{34°}	i. al.
sulfide, mono-	Na_2S	78.05	pink or wh., amor.	1.856			15.4 ^{10°}	57.3 ^{90°}	sl. s. al.; i. et.
sulfide, tetra-	Na_2S_4	174.23	yel., cb.				s.		s. al.
sulfide, penta-	Na_2S_5	206.29	yel.				s.		s. al.
sulfite	Na_2SO_3	126.05	hex. pr., 1.565	2.633 ^{15°}			d.		
sulfite	$\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$	252.17	mn.	1.561		-7H ₂ O, 150	d.	13.9 ^{0°}	28.3 ^{84°}
tartrate	$\text{Na}_2\text{C}_4\text{H}_4\text{O}_6 \cdot 2\text{H}_2\text{O}$	230.10	rhb.	1.818				34.7 ^{2°}	67.8 ^{15°}
thiocyanate	NaCNS	81.08	delq., rhb., 1.625±					296 ^{6°}	66 ^{43°}
thiosulfate	$\text{Na}_2\text{S}_2\text{O}_3$	158.11	mn.	1.667		287		110 ^{10°}	225 ^{100°}
thiosulfate (hypo)	$\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}^\circ$	248.19	mn. pr., 1.5079	1.685		d. 48.0		50 ^{0°}	231 ^{80°}
tungstate	Na_2WO_4	293.91	wh., rhb.	4.179		692		74.7 ^{0°}	301.8 ^{60°}
tungstate	$\text{Na}_2\text{WO}_4 \cdot 2\text{H}_2\text{O}^\circ$	329.95	wh., rhb.	3.245		-2H ₂ O, 100		57.58 ^{0°}	97 ^{100°}
tungstate, para-	$\text{Na}_6\text{W}_7\text{O}_{24} \cdot 16\text{H}_2\text{O}$	2097.68	wh., tri.	3.987 ^{4°}		-16H ₂ O, 300		88 ^{0°}	123.5 ^{100°}
uranate	Na_2UO_4	348.06	yel.					8	d.
vanadate	$\text{Na}_3\text{VO}_4 \cdot 16\text{H}_2\text{O}$	472.20	col. nd.			866 (anh.)		i.	
vanadate, pyro-	$\text{Na}_4\text{V}_2\text{O}_7$	305.89	hex.			654		v. s.	d.
Stannic chloride	SnCl_4	260.53	col., fuming lq.	2.226		-30.2	114.1	s.	d.
oxide (cassiterite)	SnO_2	150.70	wh., tet., 1.9968	7.0		1127		s.	
sulfate	$\text{Sn}(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$	346.85	col., delq., hex.					i.	i.
Stannous bromide	SnBr_2	278.53	yel., rhb.	5.12 ^{17°}		215.5	620	v. s.	d.
chloride	SnCl_2	189.61	wh., rhb.			246.8	623		
chloride (tin salt)	$\text{SnCl}_2 \cdot 2\text{H}_2\text{O}^\circ$	225.65	wh., tri.	2.71 ^{15.5°}		37.7	d.	s.	269.8 ^{15°}
sulfate	SnSO_4	214.76	wh. cr.			-SO ₂ , 360		118.7 ^{0°}	∞
Strontium	Sr	87.63	silv. met.	2.6		800	1150	19 ^{19°}	18 ^{100°}
acetate	$\text{Sr}(\text{C}_2\text{H}_3\text{O}_2)_2$	205.72	wh. cr.	2.099			d.	d.	Forms
carbonate (strontianite)	SrCO_3	147.64	wh., rhb., 1.664	3.70		1497 ^{60atm}	-CO ₂ , 1350	36.9 ^{0°}	Sr(OH) ₂
chloride	SrCl_2	158.54	wh., cb., 1.6499	3.052		873		36.4 ^{97°}	36.4 ^{97°}
chloride	$\text{SrCl}_2 \cdot 6\text{H}_2\text{O}^\circ$	266.64	wh., rhb., 1.5364	1.933 ^{17°}		-4H ₂ O, 61	-6H ₂ O, 100	0.0011 ^{18°}	0.065 ^{100°}
hydroxide	$\text{Sr}(\text{OH})_2$	121.65	wh., delq.	3.625		375		43.5 ^{0°}	100.8 ^{100°}
hydroxide	$\text{Sr}(\text{OH})_2 \cdot 8\text{H}_2\text{O}^\circ$	265.77	col., tet., 1.499	1.90		-7H ₂ O in dry air		104 ^{0°}	198 ^{40°}
nitrate	$\text{Sr}(\text{NO}_3)_2^\circ$	211.65	col., cb., 1.5878	2.986		570		0.41 ^{0°}	21.83 ^{100°}
nitrate	$\text{Sr}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$	283.71	wh., mn.	2.2				0.90 ^{0°}	47.7 ^{100°}
oxide (strontia)	SrO	103.63	col., cb., 1.870	4.7		2430		40 ^{0°}	100 ^{89°}
peroxide	SrO_2	119.63	wh. pd.			d.		62.2 ^{0°}	124 ^{20°}
peroxide	$\text{SrO}_2 \cdot 8\text{H}_2\text{O}$	263.76	wh. cr.			-SH ₂ O, 100	d.	Forms	
sulfate (celestite)	SrSO_4	183.69	col., rhb., 1.6237	3.96		1580 d.		Sr(OH) ₂	d.
sulfate, acid	$\text{Sr}(\text{HSO}_4)_2$	281.77	col., granular			d.		0.008 ^{20°}	d.
Sulfamic acid	$\text{NH}_2\text{SO}_3\text{H}$	97.09	wh., rhb.	2.03 ^{12°}		205 d.		0.018 ^{20°}	d.
Sulfur, amorphous	S	32.06	pa. yel. pd., 2.0–2.9	2.046		120	444.6	0.0113 ^{0°}	0.0114 ^{32°}
Sulfur, monoclinic	S ₈	256.48	pa. yel., mn.	1.96		119.0	444.6	d.	
Sulfur, rhombic	S ₈	256.48	pa. yel., rhb.	2.07		112.8	444.6		
Sulfur bromide, mono-	S_2Br_2	223.95	red, fuming lq.	2.635		-46	54 ^{0.18mm}	20 ^{0°}	40 ^{70°}
chloride, mono-	S_2Cl_2	135.03	red-yel. lq.	1.687		-80			
chloride, di-	SCL_2	102.97	dark red fuming lq.	1.621 ^{15°}		-78			
chloride, tetra-	SCL_4	173.89	yel.-brn. lq.			-30			
oxide, di-	SO ₂	64.06	col. gas	lq., 1.434 ^{0°} ; 2.264 (A)		-75.5			
oxide, tri-(α)	SO ₃	80.06	col. pr.	lq., 1.923; 2.75 (A)		16.83	44.6		
oxide, tri-(β)	(SO ₃) ₃	160.12	col., silky, nd.	1.97 ^{20°}		50			
Sulfuric acid	H ₂ SO ₄ ^o	98.08	col., viscous lq.	1.834 ^{18°}		10.49	d. 340	Forms H ₂ SO ₄	∞
Sulfuric acid	H ₂ SO ₄ ·H ₂ O	116.09	pr. or lq.	1.842 ^{15°}		8.62	290	∞	∞

^oUsual commercial form.

TABLE 2-1 Physical Properties of the Elements and Inorganic Compounds (Concluded)

Name	Formula	Formula weight	Color, crystalline form and refractive index	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Cold water	Hot water	Other reagents
Sulfuric acid	H ₂ SO ₄ ·2H ₂ O	134.11	col. lq.	1.650 ^{0°} ₄	-38.9	167	∞	∞	d. al.
Sulfuric acid, pyro-	H ₂ S ₂ O ₇	178.14	cr.	1.9 ^{20°}	35	d.	d.	∞	d. al.
Sulfuric oxychloride	SO ₂ Cl ₂	134.97	col. lq.	1.667 ^{20°} ₄	-54.1	69.1 ^{760mm}	d.	d.	s. ac.; d. al.
Sulfurous oxybromide	SOBr ₂	207.89	or.-vel. lq.	2.68 ^{18°}	-50	68 ^{40mm}	d.	d.	s. bz., CS ₂ , CCl ₄ ; d. act.
Sulfurous oxychloride	SOCl ₂	118.97	col. lq.	1.638	-104.5	78.8	d.	d.	s. bz., chl.
Tantalum	Ta	180.88	bk.-gray, cb.	16.6	2850	>4100	i.	i.	s. fused alk., HF; i. HCl, HNO ₃ , H ₂ SO ₄
Tellurium	Te	127.61	met., hex.	(α) 6.24; (β) 6.00	452	1390	i.	i.	s. H ₂ SO ₄ , HNO ₃ , KCN, KOH, aq. reg.; i. CS ₂
Terbium	Tb	159.20							
Thallium	Tl	204.39	blue-wh., tet.	11.85	303.5	1650	i.	i.	s. HNO ₃ , H ₂ SO ₄ ; i. NH ₃
acetate	TlC ₂ H ₃ O ₂	263.43	silky nd.	3.68	110		v. s.		v. s. al.
chloride, mono-	TlCl	239.85	wh., cb.	7.00	430	806	0.21 ^{0°}	1.8 ^{100°}	sl. s. HCl; i. al., NH ₄ OH
chloride, sesqui-	Tl ₂ Cl ₃	515.15	yel., hex.	5.9	400-500	d.	0.26 ^{15°}	1.9 ^{100°}	
chloride, tri-	TlCl ₃	310.76	hex. pl.		25	d.	v. s.		s. al., et.
chloride, tri-	TlCl ₃ ·4H ₂ O	382.83	nd.		37	-4H ₂ O, 100	86.2 ^{17°}	d.	s. al., et.
sulfate (ic)	Tl ₂ (SO ₄) ₃ ·7H ₂ O	823.07	lf.		-6H ₂ O, 200	d.	d.	d.	s. dil. H ₂ SO ₄
sulfate (ous)	Tl ₂ SO ₄	504.84	col., rhb., 1.8671	6.77	632	d.	d.	18.45 ^{100°}	
sulfate, acid	THSO ₄	301.46	trimorphous		115 d.		2.70 ^{0°}		v. sl. s. dil. H ₂ SO ₄
Thio, <i>cf.</i> sulfo or sulfur									
Thorium	Th	232.12	cb.	11.2	1845	>3000	i.	i.	s. HCl, H ₂ SO ₄ ; sl. s.
oxide, di- (thorianite)	ThO ₂	264.12	wh., cb.	9.69	>2800	4400	i.		HNO ₃ ; i. HF, alk.
sulfate	Th(SO ₄) ₂	424.24		4.225 ^{17°}			0.74 ^{0°}	5.22 ^{50°}	s. h. H ₂ SO ₄ ; i. alk.
sulfate	Th(SO ₄) ₂ ·9H ₂ O	586.38	mn. pr.	2.77	-9H ₂ O, 400		sl. s.	sl. s.	
Thulium	Tm	169.40					i.	i.	
Tin	Sn	118.70	silv. met., tet.	7.31	231.85	2260	i.	i.	s. HCl, H ₂ SO ₄ , dil. HNO ₃
									h. aq. KOH
Tin	Sn	118.70	gray, cb.	5.750	Stable -163 to +18	2260	i.	i.	s. a., h. alk. solns.
Tin salts, <i>cf.</i> stannic and stannous									
Titanic acid	H ₂ TiO ₃	97.92	wh. pd.				i.	i.	s. alk.; v. sl. s. dil. a.; i. al.
Titanium	Ti	47.90	dark gray, cb.	4.50 ^{17.5°}	1800	>3000	i.	d.	s. a.
chloride, di-	TiCl ₂	118.81	bk., delq.		Unstable in air		d.		i. CS ₂ , et., chl.
					d. 440		s.	s.	
chloride, tri-	TiCl ₃	154.27	vl., delq.		lq., 1.726		s.	d.	s. dil. HCl
chloride, tetra-	TiCl ₄ ^o	189.73	col. lq.		3.84	-30	s.	d.	sl. s. alk.
oxide, di- (anatase)	TiO ₂	79.90	brn. or bk., tet., 2.534-2.564		4.17		i.	i.	
oxide, di- (brookite)	TiO ₂	79.90	brn. or bk., rhb., 2.586		4.17		i.	i.	
oxide, di- (rutile)	TiO ₂	79.90	col. if pure, tet., 2.615	4.26	1640 d.	<3000	i.	i.	s. H ₂ SO ₄ , alk.
Tungsten	W	183.92	gray-bk., cb.	19.3	3370	5900	i.	i.	s. h. conc. KOH; sl. s.
carbide	WC	195.93	gray pd., cb.	15.7 ^{18°}	2777	6000	i.	i.	NH ₃ , HNO ₃ , aq. reg.
carbide	W ₂ C	379.85	iron gray	16.06 ^{18°}	2877	6000	i.	i.	s. F ₂ ; i. a.
									s. h. HNO ₃ ; sl. s. HCl, H ₂ SO ₄
oxide, tri-	WO ₃	231.92	yel., rhb.	7.16	>2130		i.	i.	s. alk.; i. a.
Tungstic acid (tungstite)	H ₂ WO ₄	249.94	yel., rhb. 2.24	5.5	-a H ₂ O, 100; 1473		i.	sl. s.	s. HF, alk., NH ₃
					-H ₂ O, 250 to 300		i.	i.	s. a., alk. carb.; i. alk.
Uranic acid	H ₂ UO ₄	304.09	yel. pd.	5.926 ^{15°}			i.	i.	
Uranium	U	238.07	wh. cr.	18.485 ^{13°} ₄	1133	3500	i.	i.	s. a.; i. alk.
carbide	U ₂ C ₃	512.14	cr.	11.28	2400		d.		d. a.
oxide, di- (uraninite)	UO ₂	270.07	bk., rhb.	10.9	2176		i.	i.	s. HNO ₃ , conc. H ₂ SO ₄

oxide (pitchblende)	U ₃ O ₈	842.21	olive gn.	7.31	d.		i.		s. HNO ₃ , H ₂ SO ₄
sulfate (ous)	U(SO ₄) ₂ ·4H ₂ O	502.25	gn., rhb.		-4H ₂ O, 300		23 ^{11°}	i.	s. dil. a.
Uranyl acetate	UO ₂ (C ₂ H ₃ O ₂) ₂ ·2H ₂ O	424.19	yel., rhb.	2.89 ^{15°}	-2H ₂ O, 110		9.2 ^{17°}	d.	s. al., act.
carbonate (rutherfordine)	UO ₂ CO ₃	330.08	tet.	5.6					
nitrate	UO ₂ (NO ₃) ₂ ·6H ₂ O	502.18	yel., rhb., 1.4967	2.807	60.2	118	170.3 ^{0°}	∞ ^{60°}	v. s. ac., al., et.; i. dil., alk.
sulfate	UO ₂ SO ₄ ·3H ₂ O	420.18	yel. cr.	3.28 ^{16.5°}	d. 100		18.9 ^{13.2°}	230 ^{25°}	4 al.; s. a.
Vanadic acid, meta-	HVO ₃	99.96	yel. scales				i.		s. a., alk.; i. NH ₃
Vanadic acid, pyro-	H ₄ V ₂ O ₇	217.93	pa. yel., amor.				i.		s. a., alk., NH ₄ OH
Vanadium	V	50.95	lt. gray, cb.	5.96	1710	3000	i.	i.	s. HNO ₃ , H ₂ SO ₄ ; i. aq., alk.
chloride, di-	VCl ₂	121.86	gn., hex., delq.	3.23 ^{15°}			s.	d.	s. al., et.
chloride, tri-	VCl ₃	157.23	pink, tabular, delq.	3.00 ^{18°}	d.		s.	d.	s. abs. al., et.
chloride, tetra-	VCl ₄	192.78	red lq.	1.816 ^{30°}	-109	148.5 ^{75.5mm}	s. d.		s. abs. al., et., chl., ac.
oxide, di-	V ₂ O ₂	133.90	lt. gray cr.	3.64			i.	i.	s. a.
oxide, tri-	V ₂ O ₃	149.90	bk. cr.	4.87 ^{18°}	1970		sl. s.	s.	s. HNO ₃ , HF, alk.
oxide, tetra-	V ₂ O ₄	165.90	blue cr.	4.399	1967		i.	i.	s. a., alk.
oxide, penta-	V ₂ O ₅	181.90	red-yel., rhb.	3.357 ^{15°}	800	d. 1750	0.8 ^{20°}		s. a., alk.; i. abs. al.
oxychloride, mono-	VOCl	102.41	brn. pd.	2.824			i.		v. s. HNO ₃
Vanadyl chloride	(VO) ₂ Cl	169.36	yel. cr.	3.64	d. in air		i.		s. HNO ₃
chloride, di-	VOCl ₂	137.86	gn., delq.	2.88 ^{13°}			d.		s. abs. al., dil. HNO ₃
chloride, tri-	VOCl ₃	173.32	yel. lq.	1.829	<-15	127.19	s. d.		s. al., et., ∞Br ₂
Water†	H ₂ O	18.016	col. lq., 1.33300 ^{20°} ; hex. solid, 1.309	1.00 ^{4°} (lq.); 0.915 ^{0°} (ice)	0	100			∞ al.; sl. s. et.
Water, heavy	D ₂ O	20.029	col. lq., 1.32844 ^{20°}	1.107 ^{20°}	3.82	101.42	∞	∞	∞ al.; sl. s. et.
Xenon	Xe	131.30	col. gas	lq., 3.06 ^{-109.1} 2.7 ^{-140°} 4.53 (A)	-140	-109.1	24.2 ^{0°} cc	7.3 ^{50°} cc	
Ytterbium	Yb	173.04							
Yttrium	Y	88.92	dark gray, hex.	5.51	1490	2500	sl. d.	d.	v. s. dil. a., h. KOH
Zinc	Zn	65.38	silv. met., hex.	7.140	419.4	907	i.	i.	s. a., ac., alk.
acetate	Zn(C ₂ H ₃ O ₂) ₂	183.47	mn.	1.840	242	subl. in vac.	30 ^{25°}	44.6 ^{100°}	2.8 ^{25°} , 166 ^{79°} al.
acetate	Zn(C ₂ H ₃ O ₂) ₂ ·2H ₂ O*	219.50	wh., mn., 1.494	1.735	237	-2H ₂ O, 100	40 ^{25°}	66.6 ^{100°}	v. s. al.
bromide	ZnBr ₂	225.21	rhb.	4.219 ^{4°}	394	650	390 ^{0°}	670 ^{100°}	v. s. NH ₄ OH, al., et.
carbonate	ZnCO ₃	125.39	wh., trig., 1.818	4.42	-CO ₂ , 300		0.001 ^{15°}		s. a., alk., NH ₄ salts; i. act. NH ₃
chloride	ZnCl ₂	136.29	wh., delq., 1.687, uniaxial	2.91 ^{25°}	283	732	432 ^{25°}	615 ^{100°}	100 ^{15.5°} al.; v. s. et.; i. NH ₃
cyanide	Zn(CN) ₂	117.42	col., rhb.		d. 80		0.0005 ^{18°}	sl. s.	s. KCN, NH ₃ , alk.; i. al.
hydroxide	Zn(OH) ₂	99.40	col., rhb.	3.053	d. 125		0.00052 ^{18°}		s. a., alk., NH ₄ OH
iodide	ZnI ₂	319.22	cb.	4.666 ^{14.2°}	446	624	430 ^{0°}	510 ^{100°}	s. a., al., NH ₃ , aq. (NH ₄) ₂ CO ₃
nitrate	Zn(NO ₃) ₂ ·6H ₂ O	297.49	col., tet.	2.065 ^{14°}	36.4	-6H ₂ O, 105	324.5	∞ ^{36.4°}	v. s. al.
oxide (zincite)	ZnO	81.38	wh., hex., 2.004	5.606	>1800		0.00042 ^{18°}		s. a., alk., NH ₄ Cl; i. NH ₃
oxide	ZnO	81.38	wh., amor.	5.47	>1800		0.00042 ^{18°}		
peroxide	ZnO ₂	97.38	yel.	1.571	expl. 212		0.0022		i. NH ₄ OH; d. a.
phosphide	Zn ₃ P ₂	258.10	steel gray, cb.	4.55 ^{13°}	>420	1100	i.		s. dil. a.
silicate	ZnSiO ₃	141.44	hex. or rhb.; glass, 1.650	3.52	1437		i.		
sulfate (zincosite)	ZnSO ₄	161.44	wh., rhb., 1.669	3.74 ^{5°}	d. 740		42 ^{0°}	61 ^{100°}	sl. s. al.; s. gly.
sulfate	ZnSO ₄ ·H ₂ O	179.46	col.	3.28 ^{15°}	d. 238		s.	89.5 ^{100°}	
sulfate	ZnSO ₄ ·6H ₂ O	269.54	mn.	2.072 ^{15°}	-5H ₂ O, 70		s.	s.	sl. s. al.; i. act.; NH ₃
sulfate (goslarite)	ZnSO ₄ ·7H ₂ O*	287.55	rhb., 1.4801	1.966 ^{16.5°}	tr. 39	-7H ₂ O, 280	115.2 ^{0°}	653.6 ^{100°}	sl. s. al.; i. act.; NH ₃
sulfide (α) (wurzite)	ZnS	97.44	wh., hex., 2.356	4.102 ^{25°}	1850 ^{150atm}	subl. 1185	0.00069 ^{18°}	i.	v. s. a.; i. ac.
sulfide (β) (sphalerite)	ZnS	97.44	wh., cb.; glass (?) 2.18-2.25	4.102 ^{25°}	tr. 1020		i.	i.	s. a.
sulfide (blende)	ZnS	97.44	wh., granular	4.04			i.	i.	v. s. a.; i. ac.
sulfite	ZnSO ₃ ·2a H ₂ O	190.48	mn.		-2a H ₂ O, 100	d. 200	0.16	d.	s. H ₂ SO ₃ , NH ₄ OH; i. al.
Zirconium	Zr	91.22	cb., pd. ign. easily	6.4	1700	>2900	i.	i.	s. HF, aq. reg.; sl. s. a.
oxide, di- (baddeleyite)	ZrO ₂	123.22	yel. or brn., mn., 2.19	5.49	2700		i.	i.	s. H ₂ SO ₄ , HF
oxide, di- (free from Hf)	ZrO ₂	123.22	wh., mn.	5.73		4300	i.	i.	s. H ₂ SO ₄ , HF

*Usual commercial form.

†Cf. special tables on water and steam, Tables 2-3, 2-4, 2-5, 2-185, 2-186 and 2-351 through 2-357.

NOTE: °F = % °C + 32.

TABLE 2-2 Physical Properties of Organic Compounds*

Abbreviations Used in the Table

(A), density referred to air	cr., crystalline	i-, iso-, containing the group	nd., needles	s-, sec-, secondary	v. s., very soluble
al., ethyl alcohol	d., decomposes	(CH ₃) ₂ CH-	o-, ortho	silv., silvery	v. sl. s., very slightly soluble
amor., amorphous	d-, dextrorotatory	i., insoluble	or., orange	sl., slightly	wh., white
aq., aqua, water	dl-, dextro-laevorotatory	ign., ignites	p-, para	subl., sublimes	yel., yellow
brn., brown	et., ethyl ether	l-, laevorotatory	pd., powder	sym., symmetrical	(+), right rotation
bz., benzene	expl., explodes	lf., leaflets	pet., petroleum ether	t-, tertiary	>, greater than
c., cubic	gn., green	lq., liquid	pl., plates	tet., tetragonal	<, less than
cc., cubic centimeter	h., hot	m-, meta	pr., prisms	tri., triclinic	∞, infinitely
chl., chloroform	hex., hexagonal	mn., monoclinic	rhb., rhombic	uns., unsymmetrical	
col., colorless		n-, normal	s., soluble	v., very	

This table of the physical properties includes the organic compounds of most general interest. For the properties of other organic compounds, reference must be made to larger tables in Lange's *Handbook of Chemistry* (Handbook Publishers), *Handbook of Chemistry and Physics* (Chemical Rubber Publishing Co.), Van Nostrand's *Chemical Annual*, *International Critical Tables* (McGraw-Hill), and similar works.

The **molecular weights** are based on the 1941 atomic weight values. The **densities** are given for the temperature indicated and are usually referred to water at 4°C, e.g., 1.028^{95/4} a density of 1.028 at 95°C

referred to water at 4°C, the 4 being omitted when it is not clear whether the reference is to water at 4°C or at the temperature indicated by the upper figure. The melting and boiling points given have been selected from available data as probably the most accurate. The **solubility** is given in grams of the substance in 100 g. of the solvent. In the case of gases, the solubility is often expressed in some manner as "5¹⁰ cc." which indicates that, at 10°C, 5 cc. of the gas are soluble in 100 g. of the solvent.

Name	Synonym	Formula	Formula weight	Form and color	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
								Water	Alcohol	Ether
Abietic acid	sylic acid, abietinic acid	C ₂₀ H ₃₀ O ₂	302.44	lf.		182		i.	v. s.	v. s.
Acenaphthene	naphthylene ethylene	C ₁₀ H ₆ (CH ₂) ₂	154.20	rhb./al.	1.069 ^{95/95}	95	278-9	i.	s. h.	s. chl.
Acetal	acetaldehyde diethylacetal	CH ₃ CH(OC ₂ H ₅) ₂	118.17	lq.	0.821 ^{22/4}		102.2	6 ²⁵	∞	∞
Acet-aldehyde	ethanal	CH ₃ CHO	44.05	col. lq.	0.783 ^{18/4}	-123.5	20.2	∞	∞	∞
-aldehyde, par-	paraldehyde	(C ₂ H ₄ O) ₃	132.16	col. cr.	0.994 ^{20/4}	10.5-12	124.4 ^{73/2}	12 ¹³	∞	∞
-aldehyde ammonia		CH ₃ CHOHNH ₂	61.08	col. cr.		97	100-10 d.	v. s.	v. s.	sl. s.
-amide	ethanamide	CH ₃ CONH ₂	59.07	col. cr.	1.159	81(69.4)	222	s.	s.	v. sl. s.
-anilide	antifebrin	C ₆ H ₅ NHCOCH ₃	135.16	rhb./al.	1.21 ⁴	113-4	305	0.5 ⁶	21 ²⁰	7 ²⁵
-phenetidine (o-)	o-ethoxyacetanilide	CH ₃ CONHC ₂ H ₄ OC ₂ H ₅	179.21	lf./al.		79	>250	i.	s.	
(m-)	acetyl-m-phenetidine	CH ₃ CONHC ₂ H ₄ OC ₂ H ₅	179.21	lf./al.		96-7		sl. s.	s.	
-toluidide (o-)	N-tolylacetamide	CH ₃ C ₆ H ₄ NHCOCH ₃	149.19	rhb.	1.168 ¹⁵	110	296	0.86 ¹⁹	s.	s.
(p-)	N-tolylacetamide	CH ₃ C ₆ H ₄ NHCOCH ₃	149.19	rhb. or mn.	1.212 ¹⁵	153	306-7	0.09 ²²	10 ²⁵	s.
Acetic acid	ethanoic acid, vinegar acid	CH ₃ CO ₂ H	60.05	col. lq.	1.049 ^{20/4}	16.7	118.1	∞	∞	∞
anhydride	acetyl oxide, acetic oxide	(CH ₃ CO) ₂ O	102.09	col. lq.	1.082 ^{20/4}	-73	139.6	12 c.	∞	∞
nitrile	methyl cyanide	CH ₃ CN	41.05	col. lq.	0.783 ^{20/4}	-41	81.6-2.0	∞	∞	∞
Acetone	propanone, dimethyl ketone	CH ₃ COCH ₃	58.08	col. lq.	0.792 ^{20/4}	-94.6	56.5	∞	∞	∞
Acetonyl urea	dimethyl hydantoin	<NHCONHCO>(CH ₃) ₂	128.13	tri./al.		175	subl.	s.	s.	s.
Acetophenone benzoyl hydride	methyl-phenyl ketone	CH ₃ CO ₂ C ₆ H ₅	120.14	lf.	1.033 ^{15/15}	20.5	202.3 ^{7/49}	i.	s.	s.
Acetyl-chloride	ethanoyl chloride	CH ₃ COCl	78.50	col. lq.	1.105 ^{20/4}	-112.0	51-2	d.	d.	
-phenylenediamine (-p)	amino-acetanilide (p)	C ₂ H ₅ ONHC ₆ H ₄ NH ₂	150.18	nd./aq.		162		s. h.	v. s.	v. s.
Acetylene	ethyne; ethine	HC≡CH	26.04	col. gas	(A) 0.906	-81.5 ^{9/1}	-84 ^{7/0}	100 cc. ¹⁸	600 cc. ¹⁸	∞
dichloride (cis)	1,2-dichloroethene	CHCl:CHCl	96.95	col. lq.	1.291 ^{15/4}	-80.5	60.3	0.35 ²⁰	∞	∞
(trans)	dioform	CHCl:CHCl	96.95	col. lq.	1.265 ^{15/4}	-50	48.4	0.63 ²⁰	∞	∞
Aconitic acid	equisetic acid; citridic acid	C ₆ H ₅ (CO ₂ H) ₃	174.11	cr./aq.		192 d.		33 ¹⁵	sl. s.	v. sl. s.
Acridine		C ₈ H ₇ < (CH)(N) > C ₆ H ₄	179.21	rhb./aq. al.		110-1	346	sl. s. h.	s.	s.
Acrolein ethylene aldehyde	acrylic aldehyde, propenal	CH ₂ :CH-CHO	56.06	col. lq.	0.841 ^{20/4}	-87.7	52.5	40	s.	s.
Acrylic acid	propenoic acid	CH ₂ :CH-CO ₂ H	72.06	col. lq.	1.062 ^{16/4}	12-13	141-2	∞	∞	
nitrile	vinyl cyanide	CH ₂ :CH-CN	53.06	col. lq.	0.811 ²⁰	-82	78-9	s.	1.4 ¹⁵	0.6 ¹⁵
Adipic acid	hexandiolic acid, adipinic acid	(CH ₂ CH ₂ CO ₂ H) ₂	146.14	mn. pr.	1.360 ^{25/4}	151-3	265 ¹⁰	∞	v. s.	
amide		(CH ₂ CH ₂ CONH ₂) ₂	144.17	cr. pd.		226-7		0.4 ¹²		
nitrile	tetramethylene	(CH ₂ CH ₂ CN) ₂	108.14	col. oil	0.951 ^{19/19}	1	295	v. sl. s.	s.	v. sl. s.
Adrenaline (1-) (3,4,1)	1-suprarenine	C ₈ H ₉ (OH) ₂ (CHOHCH ₂ NHCH ₃)	183.20	col. pd.		d. 207-11		0.03 ²⁰	v. sl. s.	i.
Alanine (α) (dl-)		CH ₃ CH(NH ₂)CO ₂ H	89.09	nd./aq.		295 d.		22 ¹⁷	v. sl. s.	i.
Aldol acetaldol	2-hydroxybutylaldehyde	CH ₃ CH(OH)CH ₂ CO ₂ H	88.10	col. lq.	1.103 ^{20/4}			∞	∞	s.
Alizarin	Anthraquinone acid	C ₆ H ₄ (CO) ₂ C ₆ H ₃ (OH) ₂	240.20	red rhb.		289-90	430	0.03 ¹⁰⁰	v. s.	v. s.
Allyl alcohol	propen-1-ol-3, propenyl alcohol	CH ₂ :CH-CH ₂ OH	58.08	col. lq.	0.854 ^{20/4}	-129	96.6	∞	∞	∞
bromide	3-bromo-propene-1	CH ₂ :CH-CH ₂ Br	120.99	lq.	1.398 ^{20/4}	-119.4	70-1 ⁷⁵³	i.	∞	∞
chloride	3-chloro-propene-1	CH ₂ :CH-CH ₂ Cl	76.53	col. lq.	0.938 ^{20/4}	-136.4	44.6	<0.1	∞	∞
thiocyanate (i)	mustard oil	CH ₂ :CH-CH ₂ NCS	99.15	col. oil	1.013 ^{20/4}	-80	152	0.2	∞	∞
thiourea	thiosinamide	CH ₂ :CH-CH ₂ NHCSNH ₂	116.18	col. pr.	1.219 ^{20/20}	77-8		3 ⁰	s.	v. sl. s.
Aluminum ethoxide		Al(OCH ₂ CH ₃) ₃	164.15	pd.	1.142 ^{20/0}	150-60	200-5 ¹⁰	d.	i.	v. sl. s.
Amino-anthraquinone (α)		C ₆ H ₄ (CO) ₂ C ₆ H ₃ NH ₂	223.22	red nd.				subl.	s.	s.
(β)		C ₆ H ₄ (CO) ₂ C ₆ H ₃ NH ₂	223.22	red nd.				subl.	i.	i.
-azobenzene		C ₆ H ₅ :N:N-C ₆ H ₄ NH ₂	197.23	yel. mn.				subl.	sl. s. h.	s. h.
-benzoic acid (m-)		H ₂ N-C ₆ H ₄ CO ₂ H	137.13	nd./aq.	1.511 ⁴	173-4		v. sl. s.	2 ¹⁰	1.8 ⁶
(p-)	aminodracylic acid	H ₂ N-C ₆ H ₄ CO ₂ H	137.13	mn. pr.		187-8		0.3 ¹³	11 ¹⁰	8.2 ⁶

TABLE 2-2 Physical Properties of Organic Compounds (Continued)

Name	Formula	Formula weight	Form and color	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Water	Alcohol	Ether
Coumaric acid (<i>o</i> - (<i>p</i> -)	HOC ₆ H ₄ CH:CHCO ₂ H HOC ₆ H ₃ CH:CHCO ₂ H	164.15 164.15	nd./aq. cr./aq.		207-8 206-7 d.	subl.	sl. s. c. s. h.	s. v. s. h.	v. sl. s. v. s.
Coumarin	C ₉ H ₆ O ₂	146.14	rhb./et.	0.935 ^{20/4}	70	290-1	0.3 c.	v. s.	s.
Coumarone	C ₉ H ₆ O	118.13	oil	1.078 ^{5/15}	<-18	173-4	i.		s.
Creatine	C ₄ H ₉ N ₃ O ₂ ·H ₂ O	149.15	mn./aq.		295		1.4 ¹⁸	0.01 ¹⁷	i.
Creatinine	C ₄ H ₇ N ₃ O	113.12	mn.		260 d.		8.7 ¹⁶		∞
Creosol (3-,1-,4-)	CH ₃ O·C ₆ H ₃ (CH ₃)OH	138.16	pr.	1.092 ^{20/20}	5.5	221-2 ⁷⁰⁵	v. sl. s.	∞	∞
Crepidine (1-,2-,4-)	CH ₃ (NH ₂)C ₆ H ₃ ·OCH ₃	137.18	nd./pet.		93-4	235	v. sl. s.	s.	s.
Cresol (<i>o</i> -)	CH ₃ C ₆ H ₄ OH	108.13	cr.	1.048 ^{20/4}	30.8	190.8	2.5	∞ ³⁰	∞ ³⁰
(<i>m</i> -)	CH ₃ C ₆ H ₄ OH	108.13	lq.	1.034 ^{20/4}	10.9	202.8	0.5	∞	∞ ³⁶
(<i>p</i> -)	CH ₃ C ₆ H ₄ OH	108.13	pr.	1.035 ^{20/4}	35-6	202	1.8	∞ ³⁶	∞ ³⁶
Cresyl benzoate (<i>o</i> -)	C ₆ H ₅ CO ₂ C ₆ H ₄ CH ₃	212.24	lq.			308	i.		
(<i>m</i> -)	C ₆ H ₅ CO ₂ C ₆ H ₄ CH ₃	212.24	cr.		55	314	i.		
(<i>p</i> -)	C ₆ H ₅ CO ₂ C ₆ H ₄ CH ₃	212.24	cr.		71.5	316	i.		
Crotonic acid (α- acid (β-)(<i>cis</i> -) aldehyde (α)	CH ₃ CH:CHCO ₂ H CH ₃ CH:CHCHO	86.09 86.09	col. mn. nd.	0.964 ^{20.7} 1.031 ^{15/4}	72 15.5	189 170-1 d.	8.3 ¹⁵ ∞ ²⁵		
Cumene	CH ₃ CH(CH ₃) ₂	70.09	col. lq.	0.853 ^{20/20}	-69	102.2	18	∞	∞
Cumic acid (<i>p</i> -)	C ₆ H ₅ CH(CH ₃) ₂	120.19	col. lq.	0.862 ^{20/4}	-96.9	152.5	i.	∞	∞
Cumidine (<i>p</i> -)	(CH ₃) ₂ CH·C ₆ H ₄ CO ₂ H	164.20	tri.	1.162 ¹	116-7	subl.	0.02 ²⁵	s.	s.
Cyanamide	(CH ₃) ₂ CH·C ₆ H ₄ NH ₂	135.20	lq.	0.953	<-20	225 ⁷⁰¹	i.		
Cyanic acid	H ₂ N·CN	42.04	col. nd.	1.073 ^{16/4}	44-5	140 ¹⁹	v. s.	v. s.	v. s.
Cyanoacetic acid	HOCN or HNCO	43.03	gas	1.140 ⁹	-80	-64 ⁰	sl. s.		v. s.
Cyanogen	CH ₂ (CN)CO ₂ H	85.06	col. lq.			108 ^{0.2}	s.	s.	s.
bromide	(CN) ₂	52.04	col. gas	0.866 ¹⁷	-34.4	-21	450 ²⁰ cc.	2300 ²⁰ cc.	500 ²⁰ cc.
chloride	BrCN	105.93	nd.	2.015 ^{20/4}	52	61.3 ⁷⁵⁰	s.	s.	s.
Cyanuric acid	C ₃ N ₃ O ₃ ·2H ₂ O	165.11	mn./aq.	1.222 ⁹	-6.5	12.5-13	2500 ²⁰ cc.	v. s.	5000 ²⁰ cc.
Cyclo-butane	CH ₂ < (CH ₂) ₂ > CH ₂	56.10	col. gas	0.703 ^{9/4}	-50	d.	0.27 ¹⁷	0.1 ²²	
-heptane	CH ₂ < (CH ₂ CH ₂ CH ₂) ₂ >	98.18	oil	0.810 ^{20/4}	-12	118-20	i.	v. s.	
-hexane	CH ₂ < (CH ₂ CH ₂) ₂ > CH ₂	84.16	col. lq.	0.779 ^{20/4}	6.5	80-1	i.	∞	∞
-hexanol	CH ₂ < (CH ₂ CH ₂) ₂ > CHOH	100.16	col. nd.	0.962 ^{20/4}	23.9	160-1	3.6 ²⁰	s.	s.
-hexanone	CH ₂ < (CH ₂ CH ₂) ₂ > CO	98.14	col. oil	0.947 ^{19/4}	-45	155-6	s.	s.	v. s.
-hexene	(·CH ₂ ·CH ₂ CH ₂) ₂	82.14	lq.	0.810 ^{20/4}	-50	83.3	v. sl. s.	v. s.	v. s.
-hexyl acetate	CH ₃ CO ₂ C ₆ H ₁₁	142.19	oil	0.985 ^{9/4}		174 ⁷⁵⁰	i.	∞	∞
amine	CH ₂ < (CH ₂ CH ₂) ₂ > CHNH ₂	99.17	col. lq.	0.865 ^{20/0}		134	i.	s.	
bromide	CH ₂ < (CH ₂ CH ₂) ₂ > CHBr	163.06	col. lq.	1.324 ^{20/20}		165 ⁷¹⁴	i.	s.	s.
chloride	CH ₂ < (CH ₂ CH ₂) ₂ > CHCl	118.61	col. lq.	0.977 ^{15/4}	-43.9	142	i.	∞	∞
-pentadiene (1-,3-)	CH ₂ < (CH·CH) ₂ >	66.10	col. lq.	0.805 ^{19/4}	-85	41-2	i.	∞	∞
-pentane	CH ₂ < (CH ₂ CH ₂) ₂ >	70.13	col. oil	0.745 ^{20/4}	-93.3	49-50	i.		
-pentanone	< (CH ₂ CH ₂) ₂ > CO	84.11	col. oil	0.948 ²⁰	-58.2	129-30	v. sl. s.		
-propane	< CH ₂ CH ₂ CH ₂ >	42.08	col. gas	0.720 ⁷⁰	-126.6	-34 ⁷⁴⁹	i.	s.	s.
Cymene (<i>o</i> -)	CH ₃ ·C ₆ H ₃ CH(CH ₃) ₂	134.21	col. lq.	0.875 ^{20/4}		177	i.	s.	s.
(<i>m</i> -)	CH ₃ ·C ₆ H ₃ CH(CH ₃) ₂	134.21	col. lq.	0.862 ²⁰	<-25	175-6	i.	s.	s.
(<i>p</i> -)	CH ₃ ·C ₆ H ₃ CH(CH ₃) ₂	134.21	col. lq.	0.857 ^{20/4}	-73.5	176-7	i.	s.	s.
Cystine (<i>L</i> -)	[·SCH ₂ CH(NH ₂)CO ₂ H] ₂	240.29	pl.		d. 258-61		0.01 ¹⁹	i.	
Dambose	C ₆ H ₆ (OH) ₆	180.16	mn./aq.	1.752		253	319 ¹⁵	2 ¹²	i.
Decahydronaphthalene (<i>cis</i> - (<i>trans</i> -)	C ₁₀ H ₁₈	138.24	lq.	0.895 ^{18/4}	-51	193.3	i.	s.	s.
Decane (<i>n</i> -)	C ₁₀ H ₁₈	138.24	lq.	0.872 ^{20/4}	-32	185.3	i.	s.	s.
Decyl alcohol	CH ₃ (CH ₂) ₉ CH ₃	142.28	col. lq.	0.730 ²	-29.7	174.0	i.	∞	∞
Dextrin	CH ₃ (CH ₂) ₉ CH ₂ OH	158.28	col. oil	0.830 ^{20/4}	7	232.9	i.	s.	∞
Diacetone alcohol	(C ₆ H ₁₀ O ₂) _x	162.14	amor.	1.038			s.	i.	i.
Diamino-benzophenone (4-,4'- -diphenylamine (4-,4'- -diphenylmethane (4-,4'- -diphenylurea (4-,4'-)	(CH ₃) ₂ C(OH)·CH ₂ COCH ₃ H ₂ NC ₆ H ₄ COC ₆ H ₄ NH ₂ H ₂ NC ₆ H ₄ NHC ₆ H ₄ NH ₂ H ₂ NC ₆ H ₄ CH ₂ C ₆ H ₄ NH ₂ (H ₂ NC ₆ H ₄ NH) ₂ CO	116.16 212.24 199.25 198.26 242.28	lq. yel. nd. lf./aq. nd./aq. cr.						
Diamyl-amine (<i>i</i> - ether (<i>n</i> -) (<i>i</i> -)	[(CH ₃) ₂ CHCH ₂ CH ₂] ₂ NH (C ₂ H ₅ CH ₂ CH ₂ CH ₂) ₂ O [(CH ₃) ₂ CH(CH ₂) ₂] ₂ O	157.29 158.28 158.28	col. lq. col. lq. col. lq.	0.767 ^{21/4} 0.774 ^{20/4} 0.777 ^{20/4}					
Diamyl ketone (<i>i</i> - phthalate (<i>n</i> -) (<i>i</i> -) tartrate (<i>i</i> -)	[(CH ₃) ₂ CHCH ₂ CH ₂] ₂ CO C ₆ H ₄ (CO ₂ C ₅ H ₁₁) ₂ C ₆ H ₄ (CO ₂ C ₅ H ₁₁) ₂ (HOCH·CO ₂ C ₅ H ₁₁) ₂	170.29 306.39 306.39 290.35	yel. oil col. lq. col. lq. lq.	0.821 ^{25/4} 1.03 1.063 ^{15/4}					
Dianisidine (<i>o</i> -)(4-,3-) ₂	[NH ₂ (OCH ₃)C ₆ H ₃] ₂	244.28	col. lf.		131.5		i.	s.	s.
Diazo-aminobenzene	C ₆ H ₅ N·N·NHC ₆ H ₅	197.23	yel. lf.		96-8	expl.	i.	s. h.	v. s.
-aminotoluene (2-,2'-)	C ₇ H ₇ N·N·NHC ₆ H ₇	225.28	or. cr.		51		0.05		
-methane	CH ₂ N ₂	42.04	gas		-145	-23	d.		s.

Dibenzothiazyl-disulfide (2-,2'-)	$(C_6H_4NCS)_2S_2$	232.46	cr.	1.50	180	d.	i.		
Dibensoyl methane	$(C_6H_5CO)_2CH_2$	224.25	rhb./al.		78	219–21 ¹⁸	i.	4.4 ²⁰	s.
Dibensyl-amine	$(C_6H_5CH_2)_2NH$	197.27	col. oil	1.028 ^{6,25,25}	-26	268–71 ²⁵⁰	i.	s.	s.
-aniline	$C_6H_5N(CH_2C_6H_5)_2$	273.36	pr./al.		70–1	>300	i.	v. sl. h.	s.
ketone	$(C_6H_5CH_2)_2CO$	210.26	cr.		34–5	330.6	i.	s.	s.
phthalate (o-)	$C_6H_4(CO_2CH_2C_6H_5)_2$	346.36	pr./al.		42–3	274 ¹²	v. sl. s.	s.	s.
succinate	$(-CH_2CO_2CH_2C_6H_5)_2$	298.32	lf./al.		45–6	238 ¹⁴	i.	s.	s.
Dibromo-benzene (o-)	$C_6H_4Br_2$	235.92	col. lq.	1.956 ^{20/4}	1.8	221–2	i.	s.	s.
(m-)	$C_6H_4Br_2$	235.92	col. lq.	1.952 ^{20/4}	-6.9	219 ⁷⁵⁵	i.	s.	s.
(p-)	$C_6H_4Br_2$	235.92	pl./al.	2.261 ¹⁵	87–8	218.6 ⁷⁵⁵	i.	1.6	71 ²⁵
-diphenyl (4-,4'-)	$BrC_6H_4-C_6H_4Br$	312.02	mn. pr.	1.897	164–5	355–60	i.	v. sl. s. h.	
Dibutyl-adipate (n-)	$(-CH_2CH_2CO_2C_4H_9)_2$	258.35	col. lq.	0.965 ^{20/4}	-38	183 ¹⁴	i.	∞	∞
(i-)	$(-CH_2CH_2CO_2C_4H_9)_2$	258.35	col. lq.	0.950 ²⁵	-20	278–80	i.	∞	∞
-amine (n-)	$(C_4H_9CH_2CH_2)_2NH$	129.24	col. lq.	0.768 ^{20,20}		159 ⁷⁶¹	∞	∞	∞
(i-)	$[(CH_3)_2CHCH_2]_2NH$	129.24	col. lq.	0.741 ^{25/4}	-70	139–40	v. sl. s.	s.	s.
-p-aminophenol (s-)	$(C_6H_9)_2N-C_6H_4OH$	221.33	lq.			170 ¹⁰	i.	∞	∞
-aniline (n-)	$C_6H_5N(C_2H_5)_2$	205.33	lq.			262.8	i.	∞	∞
carbonate (n-)	$CO(OC_2H_5)_2$	174.23	col. lq.	0.924 ^{20/4}		207 ⁷⁴⁰	i.	s.	
(i-)	$CO(OC_2H_5)_2$	174.23	col. lq.	0.919 ¹⁵		190	i.		
(s-)	$CO(OC_2H_5)_2$	174.23	col. lq.			178–80			
ether (n-)	$(C_2H_5CH_2CH_2)_2O$	130.22	lq.	0.769 ^{20,20}	-98	142.4	<0.05	∞	∞
(i-)	$[(CH_3)_2CHCH_2]_2O$	130.22	lq.	0.762 ¹⁵		122.5	i.	∞	∞
(s-)	$[C_2H_5(CH_2)_2CH]_2O$	130.22	lq.	0.756 ²¹		121	i.	∞	∞
ketone (n-)	$(C_2H_5CH_2CH_2)_2CO$	142.23	lq.	0.827 ^{18/4}	-5.9	187.7	i.	s.	v. s.
(i-)	$[(CH_3)_2CHCH_2]_2CO$	142.23	oil	0.805 ^{25,14}		168.1	<0.06	∞	∞
malate (l-)(n-)	$C_2H_5O(CO_2C_2H_5)_2$	246.30	lq.	1.038 ^{20/4}		170–1 ¹⁸	v. sl. s.		
oxalate (n-)	$(-CO_2C_2H_5)_2$	202.24	col. lq.	0.986 ^{20/4}	-29.6	245.5	i.	s.	s.
phthalate (n-)	$C_6H_4(CO_2C_2H_5)_2$	278.34	col. lq.	1.045 ²¹		340	0.04 ²⁵	∞	∞
tartrate (d-)(n-)	$(CHOHCOC_2H_5)_2$	262.30	pr.	1.098 ¹⁵	22–2.5	200–3 ¹⁸	i.		
(d-)(i-)	$(CHOHCOC_2H_5)_2$	262.30	cr.	1.031 ^{75/4}	73–4	323–5	v. sl. s.		
Dichloro-acetic acid	Cl_2CH-CO_2H	128.95	lq.	1.560 ^{25,25}	9.7(–4)	194.4	∞	∞	∞
-acetone (αα-)	$Cl_2CHCOCH_3$	126.98	lq.	1.234 ¹⁵		120	v. sl. s.	s.	s.
-aniline (2-,5-)	$Cl_2C_6H_3NH_2$	162.02	nd.			50	v. sl. s.	s.	s.
-anthraquinone (1-,3-)	$C_{10}H_6(CO)_2-C_6H_4Cl_2$	277.10	yel. nd.			208–9	i.	i.	
(1-,4-)	$C_{10}H_6(CO)_2-C_6H_4Cl_2$	277.10	yel. nd.			187.5	i.	v. sl. s.	v. sl. s.
(1-,5-)	$C_{10}H_6Cl(CO)_2-C_6H_4Cl$	277.10	yel. nd.			251	i.	sl. s.	
(1-,6-)	$C_{10}H_6Cl_2(CO)_2-C_6H_3Cl$	277.10	yel. nd.			203–4	i.		
(1-,8-)	$C_{10}H_6Cl(CO)_2-C_6H_4Cl$	277.10	yel. nd.			202–3	i.	sl. s.	
(2-,3-)	$C_{10}H_6(CO)_2-C_6H_4Cl_2$	277.10	yel. nd.			268–70	i.	sl. s.	
(2-,6-)	$C_{10}H_6Cl(CO)_2-C_6H_4Cl$	277.10	yel. nd.			282	i.		
(2-,7-)	$C_{10}H_6Cl(CO)_2-C_6H_4Cl$	277.10	yel. nd.			210–11	i.		
-benzene (o-)	$C_6H_4Cl_2$	147.01	col. lq.	1.305 ^{20/4}	-17.6	179	i.	∞	∞
(m-)	$C_6H_4Cl_2$	147.01	col. lq.	1.288 ^{20/4}	-24.8	172 ⁷⁶⁶	i.	s.	s.
(p-)	$C_6H_4Cl_2$	147.01	col. mn.	1.458 ²¹	53	174 ⁷⁶⁴	i.	v. s.	v. s.
-butane (n-)(1-,4-)	$ClCH_2(CH_2)_3CH_2Cl$	127.02	lq.		-38.7	161–3			
-diphenyl (4-,4'-)	$ClC_6H_4-C_6H_4Cl$	223.10	pr.	1.442 ^{20/4}	148	315–9	i.	v. sl. s.	4 ²⁵
-ethane (1-,2-)	$ClCH_2-CH_2Cl$	98.97	col. lq.	1.256 ^{20,20}	-35.3	83.7	0.9 ⁹	∞	∞
-naphthalene (β-)(1-,4-)	$C_{10}H_6Cl_2$	197.06	nd./al.	1.300 ^{76/4}	67–8	286–7 ⁷⁴⁰	i.	v. sl. s.	
(γ-)(1-,5-)	$C_{10}H_6Cl_2$	197.06	lf./al.		107	subl.	i.	s.	s.
-nitrobenzene (2-,5-)	$Cl_2C_6H_3NO_2$	192.01	tri./al.	1.669 ²²	54.6	266	i.	v. s. h.	
-pentane (1-,5-)	$ClCH_2(CH_2)_3CH_2Cl$	141.04	col. lq.	1.094 ^{25/4}		180–1	i.	s.	s.
-phenol (2-,4-)	$Cl_2C_6H_4OH$	163.01	nd.	1.383 ^{90,25}	45	209–10	0.45 ²⁰	v. s.	v. s.
Dichloramine T (p-)	$CH_2Cl_2HSO_2NCl_2$	240.11	cr.		83		sl. s.		
Dicyandiamide	$H_2N-C_2(NH)-NH-CN$	84.08	mn. pl.	1.40 ¹⁴	207–8	d.	2.3 ¹⁸	1.3 ¹⁸	0.01 ¹⁸
Diethanolamine	$HN(CH_2CH_2OH)_2$	105.14	pr.	1.097 ^{20/4}	28	270 ⁷⁴⁸	∞	∞	v. sl. s.
Diethyl adipate	$(-CH_2CH_2CO_2C_2H_5)_2$	202.24	col. lq.	1.009 ^{20/4}	-21	239–41 ⁷⁶¹	0.43 ⁹⁰	s.	s.
-amine	$(C_2H_5)_2NH$	73.14	col. lq.	0.712 ^{15/13}	-38.9	55.5 ⁷⁵⁹	v. s.	∞	∞
-aminophenol (m-)	$(C_2H_5)_2N-C_6H_4-OH$	165.23	rhb.		78	276–80	s.		
-aniline	$(C_2H_5)_2NC_6H_5$	149.23	oil	0.934 ^{20/4}	-34.4	216	1.4 ¹²	s.	s.
sulfonic acid (m-)	$(C_2H_5)_2NC_6H_4SO_3H$	229.29	cr.			270 d.	s.		
carbonate	$OC(OC_2H_5)_2$	118.13	col. lq.	0.975 ^{20/4}	-43	126 ⁷⁵⁹	i.	∞	∞
diethyl malonate	$(C_2H_5)_2C(CO_2C_2H_5)_2$	216.27	col. lq.	0.985 ^{20/4}		230	i.	∞	∞
Diethyl dimethyl malonate	$(CH_3)_2C(CO_2C_2H_5)_2$	188.22	col. lq.	0.994 ^{25,25}		196.7	i.	∞	∞
glutarate	$CH_2(CH_2CO_2C_2H_5)_2$	188.22	syrup	1.025 ²¹	-24	237	0.88 ²⁰	v. s.	s.
ketone	$(C_2H_5)_2CO$	86.13	col. lq.	0.816 ^{19/4}	-42	101.7	4.7 ²⁰	v. s.	s.
malonate	$CH_2(CO_2C_2H_5)_2$	160.17	col. lq.	1.055 ^{20/4}	-49.8	198.9	2.08 ²⁰	∞	∞
-malonic acid	$(C_2H_5)_2C(CO_2H)_2$	160.17	pr./aq.		125	d. 170–80	65 ¹⁶	v. s.	v. s.
-naphthylamine (α-)	$C_{10}H_7N(C_2H_5)_2$	199.28	col. oil	1.005		285–90	i.	∞	∞
(β-)	$C_{10}H_7N(C_2H_5)_2$	199.28	col. oil	1.026		318	i.	∞	∞
oxalate	$(-CO_2C_2H_5)_2$	146.14	col. lq.	1.079 ^{20/4}	-40.6	186	v. sl. s.	∞	∞
phthalate (o-)	$C_6H_4(CO_2C_2H_5)_2$	222.23	col. lq.	1.121 ^{25,25}		298–9	i.	∞	∞
sulfate	$O_2S(OC_2H_5)_2$	154.18	col. lq.	1.172 ^{25/4}	-25	210	i.	s.	∞
sulfide	$(C_2H_5)_2S$	90.18	col. lq.	0.837 ^{20/4}	-99.5	92–3 ⁷⁵⁴	0.31 ²⁰	∞	∞

TABLE 2-2 Physical Properties of Organic Compounds (Continued)

Name	Formula	Formula weight	Form and color	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Water	Alcohol	Ether
tartrate (<i>dl</i>)	(CHOH·CO ₂ C ₂ H ₅) ₂	206.19	lq.	1.204 ²⁰⁴	17	280	sl. s.	∞	∞
-toluidine (<i>o</i> -)	CH ₃ ·C ₆ H ₄ ·N(C ₂ H ₅) ₂	163.25	lq.			208-9 ⁷⁵⁵	i.	s.	s.
(<i>m</i> -)	CH ₃ ·C ₆ H ₄ ·N(C ₂ H ₅) ₂	163.25	lq.			231-2	i.	s.	s.
(<i>p</i> -)	CH ₃ ·C ₆ H ₄ ·N(C ₂ H ₅) ₂	163.25	lq.	0.924 ^{15.5}		228-9	i.		
Diethyleneglycol dinitrate	O(CH ₂ CH ₂ ONO ₂) ₂	196.12	lq.	1.377 ^{25/4}	-11.3		i.		
Difluorodichloromethane	F ₂ CCl ₂	120.92	gas	1.486 ⁻³⁰	-155	-29.2	5.7 cc. ²⁶	s.	s.
Diglycerol	[(HO) ₂ C ₂ H ₅] ₂ O	166.17	lq.			220-30 ¹⁰	s. h.		i.
Dihydroxy-dinaphthyl (α -)	(HO·C ₁₀ H ₆) ₂	286.31	pl./al.		300		i.	s.	v. s.
(-2-,2',-1,-1')	(HO·C ₁₀ H ₆) ₂	286.31	nd./al.		218	subl.	i.	s.	v. s.
-diphenyl (4-,4')	(HO·C ₆ H ₄) ₂	186.20	rhb./al.	1.25	270-2	subl.	sl. s.	v. s.	v. s.
-ethyl formal (β -)	CH ₂ (OCH ₂ CH ₂ OH) ₂	136.15	lq.	1.154 ²⁵	-5.3	264	∞		
-naphthalene (1-,5-)	C ₁₀ H ₆ (OH) ₂	160.16	pr./aq.		258-60		sl. s.	s.	v. s.
(1-,8-)	C ₁₀ H ₆ (OH) ₂	160.16	nd.		140		sl. s. h.		v. s.
Dimethoxy-benzene (<i>p</i> -)	(CH ₃ O) ₂ C ₆ H ₄	138.16	lf.	1.053 ^{55/55}	56	212.6	v. sl. s.	v. s.	v. s.
-diphenylamine (4-,4')	HN(C ₆ H ₄ OCH ₃) ₂	229.26	cr.		103		i.		
-ethyl adipate	(CH ₂) ₄ (CO ₂ C ₂ H ₅ OCH ₃) ₂	262.30	lq.	1.075 ^{15.6}		145-50 ²	5		
Dimethyl adipate	[(CH ₂) ₄ CO ₂ CH ₃] ₂	174.19	col. lq.	1.063 ^{20/4}	10-1	115 ¹⁸	i.		
-amine	(CH ₃) ₂ NH	45.08	col. lq.	0.680 ^{10/4}	-96	7.4	v. s.	s.	s.
-aminoasobenzene (<i>p</i> -)	C ₆ H ₅ N=N·C ₆ H ₄ N(CH ₃) ₂	225.28	yel./al.		116-7		d.		
-aminoethanol	(CH ₃) ₂ NCH ₂ CH ₂ OH	89.14	col. lq.	0.887 ^{20/4}		135 ⁷⁵⁶	∞	s.	s.
-aminophenol (<i>m</i> -)	(CH ₃) ₂ N·C ₆ H ₄ OH	137.18	nd.		85	265-8	sl. s. h.	s.	s.
-aniline	(CH ₃) ₂ N·C ₆ H ₅	121.18	yel. lq.	0.956 ^{20/4}	2.5	193	i.	s.	s.
sulfonic acid (<i>m</i> -)	(CH ₃) ₂ N·C ₆ H ₄ SO ₃ H	201.24	cr.		d. 266		s.		
(<i>p</i> -)	(CH ₃) ₂ N·C ₆ H ₄ SO ₃ H·H ₂ O	219.25	pr.		257		s. h.	v. sl. s.	v. sl. s.
carbonate	OC(OCH ₃) ₂	90.08	col. lq.	1.070 ^{20/4}	0.5	89-90	i.	∞	∞
ether	CH ₂ OCH ₃	46.07	gas		-138.5	-23.7	3700 cc. ¹⁸	s.	s.
-formamide	HCON(CH ₃) ₂	73.09	lq.	0.945 ²⁵	∞	152.8	∞		
fumarate	(·CHCO ₂ CH ₃) ₂	144.12	col. tri.		102	192	i.	sl. s.	sl. s.
glutarate	(CH ₂) ₃ (CO ₂ CH ₃) ₂	160.17	lq.	1.089 ^{15.6}	-37	130 ²⁰			
glyoxime	(CH ₃ ·C·NOH) ₂	116.12	col. cr.			240-6	0.06 ²⁰	v. s.	v. s.
-naphthalene (1-,4-)	C ₁₀ H ₆ (CH ₃) ₂	156.22	lq.	1.016 ^{20/4}		<-18	264-6		
(2-,3-)	C ₁₀ H ₆ (CH ₃) ₂	156.22	lf./al.		104	265 ⁹⁷	i.	sl. s.	
-naphthylamine (α -)	C ₁₀ H ₇ N(CH ₃) ₂	171.23	col. oil	1.042 ²⁰		274.5 ⁷¹¹	i.	s.	s.
(β -)	C ₁₀ H ₇ N(CH ₃) ₂	171.23	col. cr.	1.039 ^{70/70}	46	304-5	i.	s.	s.
oxalate	(·CO ₂ CH ₃) ₂	118.09	col. mn.	1.148 ^{5/4}	54	163.3	6	s.	s.
phthalate (<i>o</i> -)	C ₆ H ₄ (CO ₂ CH ₃) ₂	194.18	col. lq.	1.189 ^{25/25}		280 ⁷¹⁴	0.43		
sulfate	(CH ₃ O) ₂ SO ₂	126.13	col. oil	1.352 ^{10/4}	-26.8	188.3	v. sl. s.	∞	∞
sulfide	(CH ₃) ₂ S	62.13	oil	0.846 ^{21/4}	-83.2	37.3	i.	∞	∞
tartrate (<i>dl</i>)	(CHOH·CO ₂ CH ₃) ₂	178.14	cr.	1.328 ^{20/4}	61.5	280	s.	200 ¹⁵	
-vinyl-ethenyl carbinol	(CH ₃) ₂ COH·C·C·CH ₂ CH ₂	110.15	lq.	0.887 ^{20/4}		150	6 ²⁰		
Dinaphthyl ($\alpha\alpha$ -)	C ₁₀ H ₇ ·C ₁₀ H ₇	254.31	lf./al.		160	240-4 ¹²	i.	s. h.	s.
-methane ($\alpha\alpha'$ -)	(C ₁₀ H ₇) ₂ CH ₂	268.34	pr./al.		109		i.	0.8 c.	v. s.
($\beta\beta'$ -)	(C ₁₀ H ₇) ₂ CH ₂	268.34	nd./al.		92		i.	s.	
Dinitro-anisole (1-)(2-,4-)	CH ₃ OC ₆ H ₃ (NO ₂) ₂	198.13	col. mn.	1.341 ²⁰	94-5		sl. s. h.	1.5 ²⁰	
-benzene (<i>o</i> -)	C ₆ H ₄ (NO ₂) ₂	168.11	col. mn.	1.59 ¹⁸	117-8	319 ⁷⁷⁴	0.01 c.	1.9 ²¹	
(<i>m</i> -)	C ₆ H ₄ (NO ₂) ₂	168.11	col. rhb.	1.575 ^{20/4}	89.8	300-2	0.3 ⁹⁹	3 ²⁰	
(<i>p</i> -)	C ₆ H ₄ (NO ₂) ₂	168.11	col. mn.	1.625 ¹⁸	173-4	299 ⁷⁷⁷	0.18 ¹⁰⁰	0.18 ²¹	
sulfonic acid (2-,4-)(1-)	(NO ₂) ₂ C ₆ H ₃ SO ₃ H·3H ₂ O	302.22	pr.		106-8		s.	s.	v. sl. s.
-benzoic acid (2-,4-)	(NO ₂) ₂ C ₆ H ₃ CO ₂ H	212.12	cr./aq.		179-80		1.85 ²⁵	s.	
(3-,5-)	(NO ₂) ₂ C ₆ H ₃ CO ₂ H	212.12	mn. pr.		204-5	subl.	s. h.	v. s.	sl. s.
-benzophenone (4-,4')	(NO ₂ C ₆ H ₄) ₂ CO	272.21	col. nd.		189		i.		
-diphenyl (4-,4')	(NO ₂ C ₆ H ₄) ₂	244.20	nd./al.	1.445	233		i.	1.5 ²⁰	
(2-,4')	(NO ₂ C ₆ H ₄) ₂	244.20	mn.	1.474	93.5		i.	v. s. h.	
-naphthalene (1-,5-)	C ₁₀ H ₆ (NO ₂) ₂	218.16	nd.		216	subl.	i.		
(1-,8-)	C ₁₀ H ₆ (NO ₂) ₂	218.16	rhb.		170-2		i.	0.2 c.	
Dinitro-phenol (2-,3-)	(NO ₂) ₂ C ₆ H ₄ OH	184.11	yel. mn.	1.681 ²⁰	144-5		sl. s.	v. s. h.	v. s.
(2-,4-)	(NO ₂) ₂ C ₆ H ₄ OH	184.11	yel. rhb.	1.683 ²⁴	114-5	subl.	0.5 c.	4 ²⁰	v. s. h.
(2-,6-)	(NO ₂) ₂ C ₆ H ₄ OH	184.11	yel. rhb.		63-4		s. h.	s. h.	s.
-salicylic acid (3-,5-)	(NO ₂) ₂ C ₆ H ₃ (OH)CO ₂ H·H ₂ O	246.13	pl./aq.		173 d.		s. c.	v. s.	v. s.
-stilbene (4-,4')	(NO ₂ C ₆ H ₄ CH ₂) ₂	270.24	yel. lf.		210-6		i.	v. sl. s.	v. sl. s.
-toluene (2-,4-)	(NO ₂) ₂ C ₆ H ₃ CH ₃	182.13	nd.	1.321 ⁷¹	70	300	0.03 ²²	1.2 ¹⁵	9 ¹⁶
(3-,4-)	(NO ₂) ₂ C ₆ H ₃ CH ₃	182.13	nd.	1.259 ¹¹¹	60-1		i.		
(3-,5-)	(NO ₂) ₂ C ₆ H ₃ CH ₃	182.13	mn. pr.	1.277 ¹¹¹	92-3	subl.	sl. s.	s. h.	s.
Dioxane	O < (CH ₂ ·CH ₂) ₂ > O	88.10	col. lq.	1.033 ^{20/4}	9.5-10.5		∞	s.	s.
Dipentene	C ₁₃ H ₁₈	136.23	col. lq.	0.865 ¹⁸		178	i.		

Diphenyl	$C_6H_5 \cdot C_6H_5$	154.20	col. mn.	0.992 ⁷³⁴	69-70	254.9	i.	10 ²⁰	6.6 ²⁰
-amine	$C_6H_5NH_2$	169.22	col. mn.	1.160 ^{20/20}	52.9	302	0.03 ²⁵	56 ^{19.5}	s.
carbonate	$O(COC_6H_5)_2$	214.21	nd/al.	1.272 ¹⁴	80	302-6	i.	v. s.	s.
-chloroarsine	$(C_6H_5)_2AsCl$	264.57	rhb.	1.583 ⁴⁰	43-4	d. 327	0.2 d.	20	s.
-ethane	$(C_6H_5CH_2)_2$	182.25	col. pr.	0.978 ^{50/50}	52-3	284	i.	s.	v. s.
ether	$C_6H_5OC_6H_5$	170.20	col. rhb.	1.073 ²⁰	27	259	v. sl. s.	s.	∞
guanidine	$(C_6H_5NH)_2C:NH$	211.26	mn/al.		147-8	d. > 170	v. sl. s.	9 ²⁰	sl. s.
-methane	$(C_6H_5)_2CH_2$	168.23	col. pr.	1.001 ^{26/4}	26-7	265	i.	v. s.	v. s.
phenylenediamine (<i>p</i> -)	$(C_6H_5NH)_2$	260.32	cr.		152		i.		
succinate	$(-CH_2CO_2C_6H_5)_2$	270.27	lf/al.		122-3	330	i.		
sulfide	$(C_6H_5)_2S$	186.26	col. lq.	1.119 ^{15/15}	<-40	296-7	i.	s. h.	∞
sulfone	$(C_6H_5)_2SO_2$	218.26	nd/aq.	1.248 ^{25/4}	128-9	379	sl. s. h.	s. h.	∞
urea (uns.)	$(C_6H_5)_2NCONH_2$	212.24	rhb.	1.276	189		v. sl. s.	s.	s.
Diphenylene oxide	< $(C_6H_4)_2O$	168.18	lf/al.		86-7	287-8	i.	s. h.	v. s.
Dipropyl adipate (<i>n</i> -)	$(-CH_2CH_2CO_2C_3H_7)_2$	230.30	col. lq.	0.979 ^{20/4}	-20.3	143-5 ¹⁰	i.	s.	∞
-amine (<i>n</i> -)	$(C_3H_7CH_2)_2NH$	101.19	col. lq.	0.739 ^{20/4}	-39.6	110-1	s.	∞	∞
(<i>i</i> -)	$[(CH_2)_3CH]_2NH$	101.19	col. lq.	0.722 ²²	-61	83.5 ^{7/3}	s.	∞	∞
aniline (<i>n</i> -)	$C_6H_5N(C_2H_5)_2$	177.28	yel. oil	0.910 ²⁰		245.4	i.	s.	s.
carbonate (<i>n</i> -)	$O(COCH_2C_2H_5)_2$	146.18	col. lq.	0.968 ²²		168.2	v. sl. s.		
ether (<i>n</i> -)	$(C_2H_5CH_2)_2O$	102.17	col. lq.	0.744 ^{21/0}	-122	91	sl. s.	∞	∞
(<i>i</i> -)	$[(CH_3)_2CH]_2O$	102.17	col. lq.	0.725 ^{21/0}	-60	69	0.2	∞	∞
ketone (<i>n</i> -)	$(C_2H_5CH_2)_2CO$	114.18	col. lq.	0.822 ^{20/4}	-32.6	144.2	0.43	∞	∞
(<i>i</i> -)	$[(CH_3)_2CH]_2CO$	114.18	col. lq.	0.806 ^{20/4}		123.7	v. sl. s.	∞	∞
oxalate (<i>n</i> -)	$(CO_2CH_2C_2H_5)_2$	174.19	col. lq.	1.038 ^{10/0}	-51.7	213.5	d. h.		
(<i>i</i> -)	$[CO_2CH(CH_3)_2]_2$	174.19	col. lq.			190			
Disalicylal ethylenediamine	$[HOCH_2CH(NH_2)_2]_2$	268.30	cr.	1.34	125-6		0.03 ²⁸		
Ditolyl guanidine (<i>o</i> -)	$(C_7H_7NH)_2C:NH$	239.31	cr.	1.110 ^{20/4}	178-9		v. sl. s.	s. h.	s.
Divinyl acetylene	$(H_3C \cdot C \cdot CH \cdot C)_2$	78.11	lq.	0.776 ^{20/4}		85	i.		
Docosane (<i>n</i> -)	$CH_3(CH_2)_{20}CH_3$	310.59	cr.	0.778 ^{44/4}	44.5	224.5 ¹⁵	i.	4 h.	v. s.
Dodecane (<i>n</i> -)	$CH_3(CH_2)_{10}CH_3$	170.33	lq.	0.751 ^{20/4}	-9.6	214.5	i.	v. s.	v. s.
Dulcitol	$CH_2OH(CHOH)_4CH_2OH$	182.17	mn.	1.466 ¹⁵	189	290-5 ³	3.2 ¹⁵	v. sl. s.	i.
Durene (1-,2-,4-,5-)	$(CH_3)_4C_6H_2$	134.21	mn.	0.838 ^{81/4}	79-80	193-5	i.	v. s.	v. s.
Elaidic acid	$C_8H_{17}CH=CH(CH_2)_7CO_2H$	282.45	lf/al.	0.851 ^{70/4}	51-2	288 ¹⁰⁰	i.	v. s.	v. s.
Eosine	$C_{20}H_3O_3Br_4$	647.93	col. cr.				i.	s.	
Ephedrine (<i>l</i> -)	$C_9H_{17}CHOHCH(CH_3)NHCH_3$	165.23	cr./et.		40	255	5	500	s.
Epichlorhydrin (α -)	$C_2H_5O \cdot CH_2Cl$	92.53	lq.	1.183 ^{25/25}	-25.6	117 ^{75/6}	<5	∞	∞
Epidichlorohydrin (α -)	$CH_2 \cdot CCl \cdot CH_2Cl$	110.98	col. lq.	1.204 ²⁵		94	i.	∞	∞
Erythritol (<i>dl</i> -)	$CH_2OH(CHOH)_2CH_2OH$	122.12	tet. pr.	1.451 ^{20/4}		126	329-31	60	sl. s. c.
tetranitrate	$C_4H_6(ONO_2)_4$	302.12	lf/al.		61	expl.	i. c.	4.7 cc. ²⁰	i. s.
Ethane	CH_3CH_3	30.07	col. gas	0.546 ⁻⁸⁸	-172	-88.6	4.7 cc. ²⁰	150 cc.	∞
Ethanol-amine	$HOCH_2CH_2NH_2$	61.08	col. oil	1.022 ²⁰	10.5	171 ^{75/7}	∞	∞	1
formamide	$HCONHCH_2CH_2OH$	89.09	lq.	1.169 ²⁵	<-40	d.	∞	∞	
Ether	$(CH_3CH_2)_2O$	74.12	col. lq.	0.708 ^{25/4}	-116.3	34.6	7.5 ²⁰	∞	
Ethyl abietate	$C_{19}H_{30}CO_2C_2H_5$	330.49	lq.	1.020 ^{20/20}		200 ⁴	i.		
acetate	$CH_3CO_2C_2H_5$	88.10	col. lq.	0.901 ^{20/4}	-82.4	77.1	8.5 ¹⁵	∞	∞
acetoacetate	$CH_3COCH_2CO_2C_2H_5$	130.14	col. lq.	1.025 ^{20/4}	-45	180 ^{75/5}	13 ¹⁷	∞	∞
alcohol	CH_3CH_2OH	46.07	col. lq.	0.789 ^{20/4}	-112	78.4	∞	∞	∞
-amine	$C_2H_5NH_2$	45.08	col. lq.	0.689 ^{15/15}	-80.6	16.6	∞	∞	∞
hydrochloride	$C_2H_5NH_2 \cdot HCl$	81.55	mn.	1.216	108-9		240 ¹⁷	v. s.	i.
aniline	$C_6H_5NHC_2H_5$	121.18	lq.	0.963 ^{20/4}	-63.5	204	i.	∞	∞
sulfonic acid (<i>m</i> -)	$C_2H_5NH_2 \cdot H_2SO_4$	201.24	nd/aq.		d. 294		2.15 ¹⁵	∞	∞
anilate (<i>p</i> -)	$(CH_3)_3CHCO_2C_2H_5$	180.20	lq.	1.103 ^{25/25}	7-8	269-70	i.	s.	s.
anthranilate (<i>o</i> -)	$NH_2C_6H_4CO_2C_2H_5$	165.19	cr.	1.117 ^{20/4}	13	266-8	v. sl. s.	s.	∞
benzene	C_6H_6	78.11	col. lq.	0.867 ^{20/4}	-94.4	136.2	0.01 ¹⁵	∞	∞
benzoate	$C_6H_5CO_2C_2H_5$	150.17	col. lq.	1.052 ^{15/15}	-34.6	211-2	0.08 ²⁰	∞	∞
-benzyl-aniline	$C_6H_5N(C_2H_5)CH_2C_6H_5$	211.29	yel. oil	1.034 ^{18.5}		285 ¹⁰	i.	18	∞
bromide	C_2H_5Br	108.98	col. lq.	1.431 ^{20/4}	-117.8	38.4	1.06 ⁰	∞	∞
butyrate (<i>n</i> -)	$C_3H_7CO_2C_2H_5$	116.16	col. lq.	0.879 ^{20/4}	-93.3	120-1	0.68 ²⁵	∞	∞
(<i>i</i> -)	$(CH_3)_3CHCO_2C_2H_5$	116.16	col. lq.	0.871 ^{20/4}	-88.2	110-1	sl. s.	∞	∞
caprate (<i>n</i> -)	$CH_3(CH_2)_8CO_2C_2H_5$	200.31	lq.	0.859 ²⁵	-20	244.6 ⁷³⁸	0.002 ²⁰	∞	∞
Ethyl caproate (<i>n</i> -)	$CH_3(CH_2)_6CO_2C_2H_5$	144.21	col. lq.	0.873 ^{20/20}	-67.5	165-6 ⁷³⁶	∞	∞	∞
caprylate (<i>n</i> -)	$CH_3(CH_2)_8CO_2C_2H_5$	172.26	col. lq.	0.878 ¹⁷	-45	207-8 ⁷³³	i.	∞	∞
chloride	CH_3CH_2Cl	64.52	col. lq.	0.917 ^{6/6}	-139	13	0.45 ⁰	∞	∞
chloroacetate	$ClCH_2CO_2C_2H_5$	122.55	col. lq.	1.159 ^{20/4}	-26	144	i.	∞	∞
chlorocarbonate	$ClCO_2CH_2CH_3$	108.53	col. lq.	1.138 ^{20/4}	-80.6	94-5	d.	∞	∞
cinnamate (<i>trans</i> -)	$C_6H_5CH=CHCO_2H$	176.21	col. lq.	1.049 ^{20/4}	12	271	i.	∞	∞
cianoacetate	$CH_3(CN)CO_2C_2H_5$	113.11	col. lq.	1.062 ^{20/4}	-22.5	208 ⁷³³	2 ²⁵	∞	∞
formate	$HCO_2CH_2CH_3$	74.08	col. lq.	0.923 ^{20/4}	-79	54 ⁷⁶⁰	11 ¹⁸	∞	∞
furoate (α)	$OC_4H_7CO_2C_2H_5$	140.13	lf.	1.117 ^{21/4}	34	195 ⁷⁶⁶	i.	∞	∞
heptoate	$CH_3(CH_2)_5CO_2C_2H_5$	158.23	col. lq.	0.872 ^{20/20}	-66.1	187-8	0.029 ²⁰	∞	∞
hypochlorite	$ClOCH_2CH_3$	80.52	yel. lq.	1.013 ^{-6/4}	expl.	36 ⁷⁵²		∞	∞
iodide	CH_3CH_2I	155.98	col. lq.	1.933 ^{20/4}	-105	72.4	0.4 ²⁰	∞	∞
lactate	$CH_3CH(OH)CO_2C_2H_5$	118.13	oil	1.030 ^{25/4}		155	∞	∞	∞

Methoxy-methoxyethanol	$\text{CH}_3(\text{OCH}_2)_2\text{CH}_2\text{OH}$	106.12	lq.	1.038 ²⁵	<-70	167.5	∞		
Methyl acetate	$\text{CH}_3\text{CO}_2\text{CH}_3$	74.08	col. lq.	0.924 ²⁰⁴	-98.7	57.1	33 ²²	∞	∞
acrylic acid (α -)	$\text{CH}_2=\text{C}(\text{CH}_3)\text{CO}_2\text{H}$	86.09	pr.	1.015 ²⁰⁴	15-16	161-3	s. h.	∞	∞
alcohol	CH_3OH	32.04	col. lq.	0.792 ²⁰⁴	-97-8	64.7	∞	∞	∞
-amine	CH_3NH_2	31.06	col. gas	0.699 ⁻¹¹	-92.5	-6.7 ⁷⁵⁸	v. s.	v. s.	∞
-amine hydrochloride	$\text{CH}_3\text{NH}_2 \cdot \text{HCl}$	67.52	pl./al.	1.23	226-8	230 ¹⁵	v. s.	23 h.	i.
aniline	$\text{C}_6\text{H}_5\text{NHCH}_3$	107.15	lq.	0.989 ²⁰⁴	-57	195.5	0.01 ²⁵	s.	∞
anthracene (α -)	$\text{C}_6\text{H}_4:(\text{CH}_2)_2\text{C}_6\text{H}_4\text{CH}_3$	192.25	lf./al.	1.047 ⁹⁴	86		i.		
(β -)	$\text{C}_6\text{H}_4:(\text{CH}_2)_2\text{C}_6\text{H}_4\text{CH}_3$	192.25	col. lf.	1.181 ¹⁰⁴	207		i.	v. sl. s.	v. sl. s.
anthranilate (<i>o</i> -)	$\text{NH}_2\text{C}_6\text{H}_4\text{CO}_2\text{CH}_3$	151.16	col. lq.	1.168 ¹⁹⁴	24	135.5 ¹⁵	sl. s.	s.	s.
anthraquinone (2-)	$\text{C}_6\text{H}_4:(\text{CO})_2\text{C}_6\text{H}_3\text{CH}_3$	222.23	col. nd.		176-7		subl.	s.	s.
benzoate	$\text{C}_6\text{H}_5\text{CO}_2\text{CH}_3$	136.14	col. lq.	1.087 ²⁵²⁵	-12.5	198-9	0.02 ³⁰	∞	∞
benzylaniline	$\text{C}_6\text{H}_5\text{N}(\text{CH}_3)\text{CH}_2\text{C}_6\text{H}_5$	197.27	lq.			305-6	i.	s.	s.
bromide	CH_3Br	94.95	gas	1.732 ⁰⁰	-93	4.5 ⁷⁸⁸	v. sl. s.	s.	s.
butyrate (<i>n</i> -)	$\text{CH}_3(\text{CH}_2)_3\text{CO}_2\text{CH}_3$	102.13	col. lq.	0.898 ²⁰⁴	<-95	102.3	1.7	∞	∞
(<i>i</i> -)	$(\text{CH}_3)_2\text{CHCO}_2\text{CH}_3$	102.13	col. lq.	0.891 ²⁰⁴	-84.7	92.6	v. sl. s.	∞	∞
caprate	$\text{CH}_3(\text{CH}_2)_8\text{CO}_2\text{CH}_3$	186.29	lq.			223-4	i.	∞	∞
caproate (<i>n</i> -)	$\text{CH}_3(\text{CH}_2)_4\text{CO}_2\text{CH}_3$	130.18	col. lq.	0.904 ⁰⁰		149.5	i.	∞	∞
caprylate	$\text{CH}_3(\text{CH}_2)_6\text{CO}_2\text{CH}_3$	158.23	col. lq.	0.887 ¹⁸	-40	192-4	i.	∞	∞
cellosolve	$\text{CH}_3\text{OCH}_2\text{C}_2\text{H}_4\text{OH}$	76.09	col. lq.	0.965 ²⁰⁴		124-5	∞	∞	∞
chloride	CH_3Cl	50.49	gas	0.952 ⁰	-97.7	-24	280 ¹⁶ cc.	v. s.	v. s.
chloroacetate	$\text{ClCH}_2\text{CO}_2\text{CH}_3$	108.53	col. lq.	1.236 ²⁰⁴	-32.7	130 ⁷⁴⁰	v. sl. s.	∞	∞
chloroformate	ClCO_2CH_3	94.50	col. lq.	1.236 ¹⁵		71-2	d.	∞	∞
cinnamate	$\text{C}_6\text{H}_5\text{CH}=\text{CHCO}_2\text{CH}_3$	162.18	cr.	1.042 ³⁶⁰	33.4	263	i.	v. s.	v. s.
cyclohexane	$\text{CH}_2 < (\text{CH}_2\text{CH}_2)_5 > \text{CHCH}_3$	98.18	col. lq.	0.769 ²⁰⁴	-126.3	101	i.	s.	s.
ethyl carbonate	$\text{CH}_3\text{O}-\text{CO}-\text{OC}_2\text{H}_5$	104.10	lq.	1.002 ²⁷		109.2	i.	∞	∞
ethyl ketone	$\text{CH}_3\text{CO}-\text{C}_2\text{H}_5$	72.10	col. lq.	0.805 ²⁰⁴	-85.9	79.6	35 ¹⁰	∞	∞
ethyl oxalate	$\text{CH}_3\text{OCO}-\text{CO}_2\text{C}_2\text{H}_5$	132.11	lq.	1.156 ⁰⁰		173.7	i.	v. s.	v. s.
formate	HCO_2CH_3	60.05	lq.	0.974 ²⁰⁴	-99.8	32	30 ²⁰	∞	∞
furoate	$\text{C}_4\text{H}_5\text{O}-\text{CO}_2\text{CH}_3$	126.11	col. lq.	1.179 ²¹⁴		181.3	i.	∞	∞
glucamine	$\text{CH}_2\text{OH}(\text{CHOH})_4\text{CH}_2\text{NHCH}_3$	195.21							
glycolate	$\text{HOCH}_2\text{CO}_2\text{CH}_3$	90.08	lq.	1.168 ¹⁸		151.2			
heptate	$\text{CH}_3(\text{CH}_2)_6\text{CO}_2\text{CH}_3$	144.21	lq.	0.881 ¹⁵⁴		172-3	i.		
hypochlorite	ClOCH_3	66.49	gas			12 ⁷²⁶			
iodide	CHI_3	141.95	col. lq.	2.279 ²⁰⁴	-64.4	42.4	1.8 ¹⁵	∞	∞
lactate	$\text{CH}_3\text{CH}(\text{OH})\text{CO}_2\text{CH}_3$	104.10	lq.	1.090 ¹⁹		144.8	∞	s.	s.
laurate	$\text{CH}_3(\text{CH}_2)_{10}\text{CO}_2\text{CH}_3$	214.34	lq.		5	148 ¹⁸	i.	∞	∞
mercaptan	CH_3SH	48.10	gas	0.896 ⁰	-121	5.8 ⁷⁵²	s.	v. s.	v. s.
methacrylate	$\text{CH}_2=\text{C}(\text{CH}_3)\text{CO}_2\text{CH}_3$	100.11	lq.	0.950 ^{15.6}	-48	100.3	i.	∞	∞
myristate	$\text{CH}_3(\text{CH}_2)_{12}\text{CO}_2\text{CH}_3$	242.39	cr./al.		18-9	295 ⁷¹⁵	i.	∞	∞
naphthalene (α -)	$\text{C}_{10}\text{H}_7\text{CH}_3$	142.19	oil	1.025 ¹⁴⁴	-19	244.6	i.	v. s.	v. s.
(β -)	$\text{C}_{10}\text{H}_7\text{CH}_3$	142.19	mn.	0.994 ⁴⁰⁴	35-6	241-2	i.	v. s.	v. s.
nitrate	CH_3ONO_2	77.04	lq.	1.203 ²⁵	expl.	65	sl. s.	∞	∞
nitrite	CH_3ONO	61.04	gas	0.991 ¹⁵		-12	s.	s.	s.
nonyl ketone (<i>n</i> -)	$\text{CH}_3(\text{CH}_2)_8\text{COCH}_3$	170.29	col. oil	0.828 ²⁰²⁰	13.5	228	i.	s.	s.
oleate	$\text{C}_{17}\text{H}_{33}\text{CO}_2\text{CH}_3$	296.48	oil	0.879 ¹⁸		190-1 ¹⁰	i.	∞	∞
orange	$(\text{CH}_3)_2\text{NC}_6\text{H}_4\text{N}_2\text{C}_6\text{H}_4\text{SO}_3\text{Na}$	327.33	red pd.				0.2 c.		
palmitate	$\text{CH}_3(\text{CH}_2)_{14}\text{CO}_2\text{CH}_3$	270.44	col. cr.		30-1	196 ¹⁵	i.	s.	s.
phosphine	CH_3PH_2	48.03	gas			-14 ⁷⁵⁹	i.	sl. s.	∞
propionate	$\text{CH}_3\text{CH}_2\text{CO}_2\text{CH}_3$	88.10	col. lq.	0.915 ²⁰⁴	-87.5	79.7	0.5 ²⁰	∞	∞
propyl ketone (<i>n</i> -)	$\text{CH}_3\text{COCH}_2\text{CH}_2\text{CH}_3$	86.13	col. lq.	0.812 ¹⁵¹⁵	-77.8	102	v. sl. s.	∞	∞
salicylate (<i>o</i> -)	$\text{HO}-\text{C}_6\text{H}_4\text{CO}_2\text{CH}_3$	152.14	col. lq.	1.182 ²⁵²⁵	-8.3	222.2	0.07 ³⁰	∞	∞
stearate	$\text{CH}_3(\text{CH}_2)_{16}\text{CO}_2\text{CH}_3$	298.49	col. cr.		38-9	215 ¹⁵	i.	s.	s.
toluate (<i>o</i> -)	$\text{CH}_3-\text{C}_6\text{H}_4\text{CO}_2\text{CH}_3$	150.17	col. lq.	1.073 ¹⁵	<-50	213	i.	∞	∞
(<i>m</i> -)	$\text{CH}_3-\text{C}_6\text{H}_4\text{CO}_2\text{CH}_3$	150.17	col. lq.	1.066 ¹⁵		215	i.	∞	∞
(<i>p</i> -)	$\text{CH}_3-\text{C}_6\text{H}_4\text{CO}_2\text{CH}_3$	150.17	cr.		33-4	217	i.	v. s.	v. s.
Methyl toluidine (<i>o</i> -)	$\text{CH}_3-\text{C}_6\text{H}_4\text{NHCH}_3$	121.18	lq.	0.973 ¹⁵		206-7	i.	∞	∞
(<i>m</i> -)	$\text{CH}_3-\text{C}_6\text{H}_4\text{NHCH}_3$	121.18	lq.			206-7	i.	∞	∞
(<i>p</i> -)	$\text{CH}_3-\text{C}_6\text{H}_4\text{NHCH}_3$	121.18	lq.	0.935 ⁵⁵⁴		211 ⁷⁶¹	i.	∞	∞
valerate (<i>n</i> -)	$\text{CH}_3(\text{CH}_2)_3\text{CO}_2\text{CH}_3$	116.16	lq.	0.895 ¹⁵⁴	-91	127.3	v. sl. s.	∞	∞
(<i>i</i> -)	$(\text{CH}_3)_2\text{CHCH}_2\text{CO}_2\text{CH}_3$	116.16	col. lq.	0.881 ²⁰⁴		116.7 ⁷⁶⁴	v. sl. s.	∞	∞
vinyl ketone	$\text{CH}_3\text{COCH}=\text{CH}_2$	70.09	lq.	0.836 ²⁰⁴		81	>85	∞	∞
Methylal	$\text{HCH}(\text{OCH}_3)_2$	76.09	col. lq.	0.866 ¹⁵⁴	-104.8	42-3	33	∞	∞
Methylene-bis-(phenyl-4-isocyanate)	$(\text{OCN}-\text{C}_6\text{H}_4)_2\text{CH}_2$	250.25	lq.	1.222 ³⁰		210-2 ¹³	d.	d.	∞
bromide	CH_3Br_2	173.86	col. lq.	2.495 ²⁰⁴	-52.8	98.5 ⁷⁵⁶	1.17 ⁹	∞	∞
chloride	CH_2Cl_2	84.94	col. lq.	1.336 ²⁰⁴	-96.7	40-1	2 ²⁰	∞	∞
dianiline	$(\text{C}_6\text{H}_5\text{NH})_2\text{CH}_2$	198.26	cr.		65	208-9 d.	i.	s.	s.
iodide	CHI_2	267.87	col. lq.	3.325 ²⁰⁴		180 d.	1.4 ²⁰	∞	∞
Michler's hydrol (<i>p</i> - <i>p'</i> -)	$[(\text{CH}_3)_2\text{NC}_6\text{H}_4]_2\text{CHOH}$	270.36	gn.		96-7		i.	s. h.	s.
ketone	$[(\text{CH}_3)_2\text{NC}_6\text{H}_4]_2\text{CO}$	268.35	lf./al.		174	>360 d.	i.	sl. s.	v. sl. s.
Morphine	$\text{C}_{17}\text{H}_{19}\text{O}_3\text{N} \cdot \text{H}_2\text{O}$	303.35	pr./al.	1.317		254 d.	sl. s.	s.	s.
Mucic acid	$(-\text{CHOHCHOHCO}_2\text{H})_2$	210.14	pd.		206-14		0.33 ¹⁴	i.	i.

TABLE 2-2 Physical Properties of Organic Compounds (Continued)

Name	Formula	Formula weight	Form and color	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Water	Alcohol	Ether
Mustard gas	(ClCH ₂ :CH ₂) ₂ S	159.08	oil	1.275 ²⁰⁴	13–4	217	0.07 ²⁵	s.	s.
Myricyl alcohol	C ₃₁ H ₆₃ OH(?)	452.82	cr.	0.777 ⁹⁵	88		i.	v. sl. s.	v. s.
Myristic acid	CH ₃ (CH ₂) ₁₂ CO ₂ H	228.36	col. lf.	0.853 ⁷⁰⁴	57–8	250.5 ¹⁰⁰	i.	v. s.	v. s.
Myristyl alcohol	CH ₃ (CH ₂) ₁₂ CH ₂ OH	214.38	cr.	0.824 ³⁸⁴	38	167 ¹⁵	<0.02	sl. s.	v. s.
Naphthalene	C ₁₀ H ₈	128.16	pl./al.	1.145 ²⁰⁴	80.2	217.9	0.003 ²⁵	9.5 ²⁰	s.
disulfonic acid (1,5-)	C ₁₀ H ₆ (SO ₃ H) ₂	288.28	lf.		d.		102 ²⁰	s.	i.
(1,6-)	C ₁₀ H ₆ (SO ₃ H) ₂	288.28	cr.		d. 125		164 ²⁰	s.	i.
sulfonic acid (α-)	C ₁₀ H ₇ SO ₃ H·2H ₂ O	244.26	cr.		90		v. s.	v. s.	sl. s.
(β-)	C ₁₀ H ₇ SO ₂ H·H ₂ O	226.24	cr.		125		77 ²⁰		
Naphthasultam (1,8-)	C ₁₀ H ₇ O ₂ NS	205.22	nd.		177–8		s. h.	sl. s.	s.
disulfonate Na (1,8-)	C ₁₀ H ₆ O ₄ NS ₂ Na ₂ ·2H ₂ O	445.35	cr.				v. s.		
(2,4-)	C ₁₀ H ₆ O ₄ NS ₂ Na ₂ ·8a H ₂ O	584.45	lf.				v. s.	sl. s.	
Naphthoic acid (α-)	C ₁₀ H ₇ CO ₂ H	172.17	nd.		160–1	300	v. sl. s. h.	sl. s.	s.
(β-)	C ₁₀ H ₇ CO ₂ H	172.17	mn.	1.077 ¹⁰⁰⁴	184	>300	0.007 ²⁵	s.	v. s.
Naphthol (α-)	C ₁₀ H ₇ OH	144.16	mn.	1.224 ⁴	96	278–80	sl. s. h.	v. s.	v. s.
(β-)	C ₁₀ H ₇ OH	144.16	mn.	1.217 ⁴	122–3	285–6	0.074 ²⁵	v. s.	v. s.
sulfonic acid (α-)(1,2-)	HO·C ₁₀ H ₆ SO ₃ H	224.22	pl./aq.		>250		v. s. h.		i.
(β-)(2,6-)	HO·C ₁₀ H ₆ SO ₃ H	224.22	lf.		125		v. s.	v. s.	
Naphthyl acetate (α-)	CH ₃ CO ₂ C ₁₀ H ₇	186.20	nd/al.		46–9		sl. s. h.	s.	s.
(β-)	CH ₃ CO ₂ C ₁₀ H ₇	186.20	nd/al.		69–70		i.	s.	s.
amine (α-)	C ₁₀ H ₇ NH ₂	143.18	rhb.	1.123 ^{25/25}	50	300.8	0.17 c.	v. s.	v. s.
(β-)	C ₁₀ H ₇ NH ₂	143.18	lf./aq.	1.061 ^{98/4}	111–2		v. s. h.	s.	s.
amine hydrochloride (α-)	C ₁₀ H ₇ NH ₂ ·HCl	179.65	nd.			subl.	3.8 ²⁰	s.	s.
(β-)	C ₁₀ H ₇ NH ₂ ·HCl	179.65	lf.				v. s.	v. s.	
amine sulfonic acid (1,4-)	NH ₂ ·C ₁₀ H ₆ ·SO ₃ H	223.24	nd.		d.		0.2 ¹⁰⁰	i.	i.
(1,5-)	NH ₂ ·C ₁₀ H ₆ ·SO ₃ H·H ₂ O	241.26	cr.				sl. s.		
(1,7-)	NH ₂ ·C ₁₀ H ₆ ·SO ₃ H·H ₂ O	241.26	cr.				0.46 ²⁵		
(1,8-)	NH ₂ ·C ₁₀ H ₆ ·SO ₃ H·H ₂ O	241.26	cr.				0.42 ¹⁰⁰		
(2,5-)	NH ₂ ·C ₁₀ H ₆ ·SO ₃ H	223.24	cr.				0.08		
(2,6-)	NH ₂ ·C ₁₀ H ₆ ·SO ₃ H·H ₂ O	241.26	cr.				0.38 ¹⁰⁰		
(2,7-)	NH ₂ ·C ₁₀ H ₆ ·SO ₃ H·H ₂ O	241.26	cr.				0.28 ¹⁰⁰		
isocyanate (α-)	C ₁₀ H ₇ N:CO	169.17	col. lq.	1.18		269–70	d.	s.	s.
Nicotine	C ₁₀ H ₁₄ N ₂	162.23	oil	1.009 ²⁰⁴	<–80		s.	∞	∞
Nicotinic acid (3-)	C ₈ H ₇ NCO ₂ H	123.11	nd/al.		235.2	subl.	s. h.	sl. h.	v. sl. s.
(i-)(4-)	C ₈ H ₇ NCO ₂ H	123.11	nd/aq.		317	d.	s. h.	sl. s. h.	v. sl. s.
Nitro-acetanilide (p-)	CH ₃ CONHC ₆ H ₄ NO ₂	180.16	rhb.		215–6		s. h.	s.	s.
-acetophenone (m-)	CH ₃ COC ₆ H ₄ NO ₂	165.14	nd.			202	i.	s.	
-aminoanisole (4,1,2-)	NO ₂ ·C ₆ H ₃ (OCH ₃)NH ₂	168.15	red nd.	1.207 ¹⁵⁶	118		i.	s.	
(5,1,2-)	NO ₂ ·C ₆ H ₃ (OCH ₃)NH ₂	168.15	yel. nd.	1.211 ¹⁵⁶	139–40				
(3,1,4-)	NO ₂ ·C ₆ H ₃ (OCH ₃)NH ₂	168.15	red		123		sl. s.	s.	s.
-aminophenol (4,2,1-)	NO ₂ ·C ₆ H ₃ (NH ₂)OH	154.12	or. pr.		142–3		sl. s. c.	v. s.	v. s.
-aniline (o-)	NO ₂ ·C ₆ H ₄ NH ₂	138.12	yel. rhb.	1.442 ¹⁵	71.5	284.1	s. h.	v. s.	v. s.
(m-)	NO ₂ ·C ₆ H ₄ NH ₂	138.12	yel. rhb.	1.43	114	306.4	0.11 ²⁰	7.1 ²⁰	7.9 ²⁰
(p-)	NO ₂ ·C ₆ H ₄ NH ₂	138.12	yel. mn.	1.437 ¹⁴	146–7	331.7	0.08 ¹⁰	5.8 ²⁰	6.1 ²⁰
-anisole (o-)	CH ₃ OC ₆ H ₄ NO ₂	153.13	col. cr.	1.254 ²⁰⁴	9.4	272–3	∞	∞	∞
(p-)	CH ₃ OC ₆ H ₄ NO ₂	153.13	pr/al.	1.233 ²⁰	54	274	0.06 ²⁰	v. s.	v. s.
-anthraquinone (α-)	C ₁₄ H ₈ (CO) ₂	253.20	nd.		230	270 ⁷	i.	sl. s.	v. sl. s.
-anthraquinone sulfonic acid (1,5-)	NO ₂ ·C ₁₄ H ₆ O ₂ ·SO ₃ H	333.26	yel. cr.				s.	i.	
-benzal chloride (m-)	NO ₂ ·C ₆ H ₄ ·CHCl ₂	206.03	mn.		65		i.	v. s. h.	v. s.
-benzaldehyde (m-)	NO ₂ ·C ₆ H ₄ CHO	151.12	nd/aq.		58	164 ²³	1.95 ¹¹²	v. s. h.	v. s.
Nitro-benzene	C ₆ H ₅ NO ₂	123.11	yel. lq.	1.205 ^{18/4}	5.7	210.9	0.19 ²⁰	v. s.	∞
-benzidine (2-)	NH ₂ ·C ₆ H ₄ ·C ₆ H ₃ (NH ₂)NO ₂	229.23	red nd.		143		sl. s. h.		
-benzoic acid (o-)	NO ₂ ·C ₆ H ₄ ·CO ₂ H	167.12	tri./aq.	1.575 ^{4/4}	147.5		0.65 ²⁰	28 ¹¹	22 ¹¹
(m-)	NO ₂ ·C ₆ H ₄ ·CO ₂ H	167.12	mn.	1.494 ^{4/4}	140–1		0.24 ¹⁶⁵	31 ¹²	25 ¹⁰
(p-)	NO ₂ ·C ₆ H ₄ ·CO ₂ H	167.12	yel. mn.	1.550 ^{22/4}	240–2	subl.	0.02 ¹⁵	0.9 ¹⁰	2.2 ¹⁵
-benzyl alcohol (m-)	NO ₂ ·C ₆ H ₄ ·CH ₂ OH	153.13	cr.		27	175–80 ³			
-benzyl bromide (p-)	NO ₂ ·C ₆ H ₄ CH ₂ Br	216.04	nd/al.		99–100		i.	2 ¹⁰	v. s.
-chlorotoluene (1,2,6-)	CH ₃ ·C ₆ H ₃ (NO ₂)Cl	171.58	cr.		37.5	238	i.		
-cresol (1,3,4-)	CH ₃ ·C ₆ H ₃ (NO ₂)OH	153.13	yel.	1.240 ^{89/4}	32	125 ²²	v. sl. s.	v. s.	v. s.
-cymene (1,2,4-)	CH ₃ ·C ₆ H ₃ (NO ₂)CH(CH ₃) ₂	179.21	oil	1.067 ²⁰⁴		152 ¹⁵	i.		
-dimethylaniline (o-)	NO ₂ ·C ₆ H ₃ NHCH ₃	166.18	yel. oil	1.179 ²⁰⁴		151–3 ²⁰	v. sl. s.	v. s.	v. s.
(m-)	NO ₂ ·C ₆ H ₄ NHCH ₃	166.18	red mn.	1.313 ¹⁷	60–1	280–5	i.	s.	s.
(p-)	NO ₂ ·C ₆ H ₄ NHCH ₃	166.18	yel. nd.		163–4		i.	s. h.	
-diphenyl (o-)	C ₆ H ₅ ·C ₆ H ₄ NO ₂	199.20	rhb.	1.44	37	320	i.	s.	v. s.
(p-)	C ₆ H ₅ ·C ₆ H ₄ NO ₂	199.20	nd/al.		113–4	340	i.	sl. s. c.	v. s.
-diphenylamine (o-)	C ₆ H ₅ ·NH·C ₆ H ₄ NO ₂	214.22	or. cr.		75–6				
-guanidine	H ₂ NCH(NH)NHNO ₂	104.07	nd/aq.		246–7		9 ¹⁰⁰	sl. s.	v. sl. s.

-naphthalene (α -)	$C_{10}H_7NO_2$	173.16	yel./al.	1.223 ⁶²	59-60	304	i.	s.	s.
(β -)	$C_{10}H_7NO_2$	173.16	col./al.		79	165 ¹⁵	i.	v. s.	v. s.
-phenol (<i>o</i> -)	$NO_2 \cdot C_6H_4 \cdot OH$	139.11	yel. mn.	1.295 ⁴⁵	44-5	214.5		1.08 ¹⁰⁰	v. s.
(<i>m</i> -)	$NO_2 \cdot C_6H_4 \cdot OH$	139.11	col. mn.	1.485 ²⁰	96-7	194 ²⁰		1.35 ²⁰	v. s.
(<i>p</i> -)	$NO_2 \cdot C_6H_4 \cdot OH$	139.11	yel. pr.	1.479 ²⁰	113-4	subl.		1.6 ²⁵	v. s.
-phenol sulfonic acid (1-,4-,2-)	$HO \cdot C_6H_3(NO_2)SO_3H \cdot 3H_2O$	273.22	nd.		d. 110		v. s.	v. s.	v. s.
(1-,2-,4-)	$HO \cdot C_6H_3(NO_2)SO_3H \cdot 3H_2O$	273.22	nd./aq.		51.5		v. s.	v. s.	
-phthalic acid (3-)	$NO_2 \cdot C_6H_3(CO_2H)_2$	211.13	yel./aq.		222		2.05 ²⁵	v. s. h.	sl. s.
(4-)	$NO_2 \cdot C_6H_3(CO_2H)_2$	211.13	yel. cr.		164-5		v. s.	v. s.	s.
-toluene (<i>o</i> -)	$CH_3 \cdot C_6H_4 \cdot NO_2$	137.13	yel. lq.	1.163 ²⁰⁴	-4.1	222.3		0.07 ⁵⁰	∞
(<i>m</i> -)	$CH_3 \cdot C_6H_4 \cdot NO_2$	137.13	lq.	1.160 ¹⁸⁴	15-16	230-1		0.05 ⁵⁰	∞
(<i>p</i> -)	$CH_3 \cdot C_6H_4 \cdot NO_2$	137.13	rhb.	1.139 ^{55/55}	51.9	237.7		0.04 ⁵⁰	8.6 ¹⁵
-toluene sulfonic acid (1-,4-,2-)	$CH_3 \cdot C_6H_3(NO_2)SO_3H \cdot 2H_2O$	253.23	pl./aq.		130		47.7 ²⁸	v. s.	v. s.
-toluidine (4-,1-,2-)	$NO_2 \cdot C_6H_3(CH_3)NH_2$	152.15	yel. mn.	1.365 ¹⁵	105-7		v. sl. s.	s.	s.
(3-,1-,4-)	$NO_2 \cdot C_6H_3(CH_3)NH_2$	152.15	red mn.	1.312 ¹⁷	116-7		sl. s. h.	s.	v. sl. s.
Nitron	$C_{20}H_{16}N_4$	312.36	yel. lf.		189-90 d.		i.	s. h.	v. sl. s.
Nitroso-dimethylaniline (<i>p</i> -)	$ON \cdot C_6H_4N(CH_3)_2$	150.18	gn. tri.		86-7		i.	s.	s.
-naphthol (β -)(1-)	$ON \cdot C_{10}H_6OH$	173.16	brn. pr.		109.5		0.1 ²⁰	2.4 ¹⁸	v. sl. s.
Nonadecane (<i>n</i> -)	$CH_3(CH_2)_{17}CH_3$	268.51	cr.	0.777 ^{32/4}	32	330	i.	sl. s.	s.
Nonane (<i>n</i> -)	$CH_3(CH_2)_7CH_3$	128.25	col. lq.	0.718 ²⁰⁴	-53.7	150.5 ⁷⁹	i.	sl. s.	s.
Octadecane (<i>n</i> -)	$CH_3(CH_2)_{16}CH_3$	254.48	cr.	0.775 ^{28/4}	28	317	i.	sl. s.	s.
Octane (<i>n</i> -)	$CH_3(CH_2)_6CH_3$	114.22	col. lq.	0.703 ²⁰⁴	-56.5	125.7		0.002 ¹⁶	sl. s.
(iso-)	$(CH_3)_2CCH_2CH(CH_3)_2$	114.22	col. lq.	0.692 ²⁰⁴	-107.4	99.3 ⁷⁶⁰	i.	sl. s.	s.
Octyl acetate (<i>n</i> -)	$CH_3CO_2CH_2(CH_2)_6CH_3$	172.26	col. lq.	0.885 ^{0/4}	-38.5	210	i.	sl. s.	s.
(<i>sec</i> -)	$CH_3CO_2CH(CH_3)C_6H_{13}$	172.26	col. lq.	0.863 ^{14/4}		195	i.	s.	s.
alcohol (<i>n</i> -)	$CH_3(CH_2)_6CH_2OH$	130.22	col. lq.	0.827 ²⁰⁴	-16	194-5		0.054 ²⁵	∞
(<i>sec</i> -)	$CH_3(CH_2)_5CH(OH)CH_3$	130.22	col. lq.	0.822 ²⁰⁴	-38.6	179-80		0.096 ²⁵	∞
Octylene (<i>n</i> -)	$CH_3(CH_2)_7CH_2CH_2$	112.21	lq.	0.721 ^{18/4}		126	i.	∞	∞
Oleic acid	$C_{18}H_{34}O_2$	282.45	col. nd.	0.854 ^{78/4}	14	285-6 ¹⁰⁰	i.	∞	∞
Orcinol (1-,3-,5-)	$(HO)_2C_6H_3 \cdot CH_3$	124.13	pr./bz.	1.290 ⁴	107-8	287-90	v. s.	v. s.	v. s.
Oxalic acid	$HO_2C \cdot CO_2H \cdot 2H_2O$	126.07	col. mn.	1.653 ^{19/4}	101.5	subl.	s.	s.	1.3
Palmitic acid	$CH_3(CH_2)_{14}CO_2H$	256.42	col. pl.	0.849 ^{70/4}	63-4	271.5 ¹⁰⁰	i.	9 ²⁰	v. s.
Pelargonic acid	$CH_3(CH_2)_7CO_2H$	158.23	col. oil	0.906 ²⁰⁴	12.5	253-4	v. sl. s.	s.	s.
Penta-chloroethane	$CHCl_2 \cdot CCl_3$	202.31	col. lq.	1.671 ^{25/4}	-22	162		0.05 ²⁰	∞
-decane (<i>n</i> -)	$CH_3(CH_2)_9CH_3$	212.41	col. lq.	0.770 ²⁰⁴	10	270.5	i.	v. s.	v. s.
-erythritol	$C(CH_2OH)_4$	136.15	cr.		262	276 ³⁰		5.6 ¹⁵	v. sl. s.
Pentandiol	$HOCH_2(CH_2)_3CH_2OH$	104.15	lq.	0.994 ²⁰⁴		239.4	∞	∞	i.
Pentane (<i>n</i> -)	$CH_3(CH_2)_4CH_3$	72.15	col. lq.	0.630 ^{18/4}	-129.7	36.3		0.036 ¹⁶	∞
(<i>i</i> -)	$(CH_3)_2CHCH_2CH_3$	72.15	col. lq.	0.621 ¹⁹	-160.0	27.95	i.	∞	∞
(neo-)	$(CH_3)_3C(CH_2)_2$	72.15	col. lq.	0.613 ^{20/4}	-20	9.5	i.	s.	s.
Phenacetin	$C_8H_9O_2$	179.21	col. mn.		134-5		d.	0.7 ²⁰	40 h.
Phenanthrene	$<C_{10}H_8CH_2>$	178.22	pl./al.	1.179 ²⁵	99-100	340	i.	10 h.	v. s.
Phenetidine (<i>o</i> -)	$C_8H_9O \cdot C_6H_4 \cdot NH_2$	137.18	oil		<-21	228-9	i.	s.	v. s.
(<i>p</i> -)	$C_8H_9O \cdot C_6H_4 \cdot NH_2$	137.18	lq.	1.061 ¹⁵	3-4	254-5	i.	s.	s.
Phenetole	$C_8H_9O \cdot C_6H_5$	122.16	col. lq.	0.967 ²⁰⁴	-30.2	172	i.	∞	∞
Phenol	C_6H_5OH	94.11	col. nd.	1.071 ^{25/4}	42-3	181.4		8.2 ¹⁵	∞
-phthalein	$C_{20}H_{14}O_4$	318.31	col. rhb.	1.299 ^{25/4}	261-2			0.2 ²⁰	10 ²⁵
-sulfonic acid (<i>o</i> -)	$HO \cdot C_6H_4 \cdot SO_3H \cdot e \cdot H_2O$	187.68	cr.		50 d.		v. s.	v. s.	5.9 c.
Phenyl acetaldehyde	$C_6H_5CH_2CHO$	120.14	lq.	1.025 ²⁰		193-4	v. sl. s.	∞	∞
acetic acid	$C_6H_5CH_2CO_2H$	136.14	lf.	1.081 ^{80/4}	76-7	265.5		1.66 ²⁰	v. s.
-acetylene	$C_6H_5C \cdot CH$	102.13	col. lq.	0.930 ²⁰⁴	-43	142-3	i.	∞	∞
aniline (<i>o</i> -)	$C_6H_5 \cdot C_6H_4 \cdot NH_2$	169.22	cr.		45-6	299 ⁷⁹⁰	v. sl. s.	s.	s.
(<i>p</i> -)	$C_6H_5 \cdot C_6H_4 \cdot NH_2$	169.22	lf.		50-2	302	s. h.	s.	s.
Phenyl-ethyl alcohol	$C_6H_5CH_2CH_2OH$	122.16	col. oil	1.023 ^{18/4}		219-21 ⁷⁵⁰		1.6 ²⁰	∞
-glycine	$C_6H_5NHCH_2CO_2H$	151.16	cr.		127		s.	s.	sl. s.
-hydrazine	$C_6H_5NH \cdot NH_2$	108.14	yel. oil	1.097 ^{23/4}	19.6	243.5	sl. s. h.	∞	∞
-hydrazine sulfonic acid (<i>p</i> -)	$H_2NNHC_6H_4SO_3H$	188.20	cr./al.		286			0.6 ¹²	sl. s.
isocyanate	$C_6H_5N \cdot CO$	119.12	lq.	1.096 ^{20/4}		166 ⁷⁹	d.		v. s.
-methylpyrazolone (3-)(<i>N</i> -)	$C_8H_9ON_2 \cdot C_6H_5$	174.20	pr./aq.		128	191 ¹⁷	1 ²⁰	v. s. h.	v. sl. s.
-mustard oil	$C_6H_5N \cdot CS$	135.18	col. lq.	1.138 ^{15/15}	-21	219-20			s.
naphthalene (α -)	$C_{10}H_7 \cdot C_6H_5$	204.26	waxy		45	336-7	i.	v. s.	v. s.
(β -)	$C_{10}H_7 \cdot C_6H_5$	204.26	lf./al.		102.5	345-6	i.	sl. s.	sl. s.
naphthylamine (α -)	$C_{10}H_7NHC_6H_5$	219.27	pr./al.	1.17	62	335 ³⁵⁸		0.08 ⁶⁰	s.
(β -)	$C_{10}H_7NHC_6H_5$	219.27	rhb.	1.18	107-8	399.5		0.4 ⁶⁰	v. s. h.
phenol (<i>o</i> -)	$C_6H_5 \cdot C_6H_4 \cdot OH$	170.20	nd.		56-7	275	i.	v. s.	s.
(<i>p</i> -)	$C_6H_5 \cdot C_6H_4 \cdot OH$	170.20	nd.		164-5	305-8	i.	s.	s.
propyl alcohol (γ -)	$C_6H_5(CH_2)_3OH$	136.19	oil	1.008 ^{20/4}	<-18	235-7	sl. s.	∞	∞
quinoline (2-)(α -)	$C_8H_5 \cdot C_6H_6N$	205.25	nd.		86	363	sl. s.	s. h.	s.
(8-)(<i>o</i> -)	$C_8H_5 \cdot C_6H_6N$	205.25	lq.			283 ¹⁸⁷	sl. s.	s.	s.
salicylate, salol	$HO \cdot C_6H_4 \cdot CO_2C_6H_5$	214.21	rhb./al.	1.250 ^{20/4}	42-3	172-3 ¹²		0.015 ²⁵	v. s.
stearate	$CH_3(CH_2)_{16}CO_2C_6H_5$	360.56	cr.		52	267 ¹⁵	i.		s.
urethane	$C_6H_5NHCOC_2H_5$	165.19	pl./al.	1.106 ^{30/4}	52-3	237-8	i. c.	s.	s.

TABLE 2-2 Physical Properties of Organic Compounds (Continued)

Name	Formula	Formula weight	Form and color	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Water	Alcohol	Ether
Phenylene-diamine (<i>o-</i>) (<i>m-</i>) (<i>p-</i>)	$C_6H_4(NH_2)_2$	108.14	lf./aq.		103-4	256-8	733 ⁸¹	v. s.	v. s.
	$C_6H_4(NH_2)_2$	108.14	rhb.	1.139 ^{15/15}	62.8	284-7	35.1 ²⁵	v. s.	s.
	$C_6H_4(NH_2)_2$	108.14	mn.		140	267	669 ¹⁰⁷	v. s.	s.
Phloroglucinol (1,3,5-)	$C_6H_3(OH)_3 \cdot 2H_2O$	162.14	rhb.		117	subl.	1.13 ²⁵	v. s.	v. s.
	$[(CH_3)_3C \cdot CH]_2CO$	138.20	yel. pr.		28	197.2 ⁷⁴³	0.1 ⁵⁰	s.	s.
Phlorone	$OCCl_2$	98.92	gas	1.392 ¹⁹⁴	-104	8.2 ⁷⁵⁶	v. sl. s.		
Phosgene	$OCCl_2$	98.92	gas	1.593 ²⁰⁴	208	d.	0.70 ²⁵	12 ¹⁸	0.68 ¹⁵
Phthalic acid (<i>o-</i>) (<i>m-</i>)(iso-)	$C_6H_4(CO_2H)_2$	166.13	mn./aq.		330	subl.	0.2 ¹⁰⁰		
	$C_6H_4 < (CO)_2 > O$	148.11	rhb.	1.527 ⁴	130.8	284.5	v. sl. s.	s.	sl. s.
anhydride (<i>o-</i>) nitrile (<i>o-</i>)	$C_6H_4(CN)_2$	128.13	cr.		141		sl. s. c.		
	$C_6H_4(CH_2)(CO) > O$	134.13	nd./aq.	1.164 ^{99/4}	73(65)	290	v. sl. s.	s.	
Phthalide	$C_6H_4 < (CO)_2 > NH$	147.13	cr./et.		238	subl.	0.04 ²⁵	5	s. h.
Phthalimide (<i>o-</i>)	$C_6H_4N \cdot CH_3$	93.12	col. lq.	0.950 ^{15/4}	-70	128.8	v. s.	∞	∞
Picoline (α -) (β -) (γ -)	$C_5H_4N \cdot CH_3$	93.12	col. lq.	0.961 ^{15/4}		143.5	∞	∞	∞
	$C_5H_4N \cdot CH_3$	93.12	lq.	0.957 ^{15/4}		143.1	∞	∞	∞
Picramic acid (1,2,4,6-)	$HO \cdot C_6H_3(NH_2)(NO_2)_2$	199.12	red nd.		169	0.14 ²²	s.		sl. s.
Picric acid (2,4,6-)	$HO \cdot C_6H_2(NO_2)_3$	229.11	yel. rhb.	1.763 ²⁰⁴	121.8	expl.	1.23 ³⁰	6 ²⁰	1 ¹³
Picryl chloride (2,4,6-)	$ClC_6H_2(NO_2)_3$	247.56	yel. mn.	1.797 ²⁰	83	d.	0.018 ¹⁵	4.8 ¹⁷	7 ¹⁷
Pinacol	$[(CH_3)_2C \cdot OH]_2$	118.17	col. nd.	0.967 ¹⁵	43(38)	171-2 ⁷⁵⁰	sl. s. c.	v. s.	v. s.
Pinacoline	$CH_3CO \cdot C(CH_3)_3$	100.16	col. lq.	0.800 ¹⁶	-52.5	106.2	2.5 ¹⁵	s.	s.
Pinene (α -)(<i>dl</i> -) hydrochloride	$C_{10}H_{16}$	136.23	col. lq.	0.878 ^{20/4}	-55	154-6	v. sl. s.	s.	∞
	$C_{10}H_{17}Cl$	172.69	lf.		131-2	207-8	i.	33	∞
Pinol (<i>dl</i> -)	$C_{10}H_{16}O$	152.23	lq.	0.953 ^{20/20}		183-4	s.	s.	s.
Piperidine	$CH_2 < (CH_2CH_2) > NH$	85.15	lq.	0.860 ^{20/4}	-9	106	∞	∞	∞
carboxylic acid (α -)(<i>dl</i> -)	$HO_2C \cdot CH < (CH_2CH_2)_2 > NH$	129.16	cr.		264		s.		
Piperidinum pentamethylene dithiocarbamate	$(CH_2)_5CS_2H \cdot HN(CH_2)_5$	232.41	cr.	1.13	175	6 ²⁸	∞	∞	∞
Propane	$CH_3CH_2CH_3$	44.09	gas	0.585 ^{-45/4}	-187.1	-42.2	6.5 ¹⁸ cc.	s.	v. s.
Propionic acid aldehyde anhydride	$CH_3CH_2CO_2H$	74.08	col. lq.	0.992 ^{20/4}	-22	141.1	∞	∞	∞
	CH_3CH_2CHO	58.08	col. lq.	0.807 ^{20/4}	-81	49.5 ⁷⁴⁰	20 ²⁰	∞	∞
Propyl acetate (<i>n</i> -) (<i>i</i> -)	$(CH_3CH_2CO)_2O$	130.14	col. lq.	1.012 ^{20/4}	-45	168.8 ⁷⁸⁰	d.	d.	
	$CH_3CO_2CH_2CH_2CH_3$	102.13	col. lq.	0.886 ^{20/4}	-92.5	101.6	1.6 ¹⁶	∞	∞
alcohol (<i>n</i> -) (<i>i</i> -)	$CH_3CO_2CH(CH_3)_2$	102.13	col. lq.	0.874 ^{20/4}	-73.4	88.4	3 ²⁰	∞	∞
	$CH_3CH_2CH_2OH$	60.09	col. lq.	0.804 ^{20/4}	-127	97.8	∞	∞	∞
amine (<i>n</i> -) (<i>i</i> -)	$(CH_3)_2CHOH$	60.09	col. lq.	0.789 ^{20/4}	-85.8	82.5	∞	∞	∞
	$CH_3CH_2CH_2NH_2$	59.11	col. lq.	0.718 ^{20/20}	-83	49-50 ⁷⁶¹	∞	∞	∞
aniline (<i>n</i> -) benzoate (<i>n</i> -) (<i>i</i> -)	$(CH_3)_2CHNH_2$	59.11	col. lq.	0.694 ^{15/4}	-101	33-4	∞	∞	∞
	$C_6H_5NHCH_2CH_2CH_3$	135.20	lq.	0.949 ¹⁸		222	i.	v. s.	v. s.
bromide (<i>n</i> -) (<i>i</i> -)	$C_6H_5CO_2CH_2CH_2CH_3$	164.20	col. lq.	1.021 ^{25/25}	-51.6	231	i.	s.	s.
	$C_6H_5CO_2CH(CH_3)_2$	164.20	col. lq.	1.010 ^{25/25}		218.5	i.	s.	s.
<i>n</i> -butyrate (<i>n</i> -) <i>i</i> -butyrate (<i>n</i> -) <i>n</i> -butyrate (<i>i</i> -) <i>i</i> -butyrate (<i>i</i> -) chloride (<i>n</i> -) (<i>i</i> -)	$CH_3CH_2CH_2Br$	123.00	col. lq.	1.353 ^{20/4}	-109.9	70.8	0.25 ²⁰	∞	∞
	$(CH_3)_2CHBr$	123.00	col. lq.	1.310 ^{20/4}	-89	60	0.32 ²⁰	∞	∞
mercaptan (<i>n</i> -) (<i>i</i> -)	$C_4H_9SCH_3$	130.18	col. lq.	0.879 ¹⁵	-95.2	142.7	0.17 ¹⁷	∞	∞
	$(CH_3)_2CHCO_2CH_2C_6H_5$	130.18	col. lq.	0.884 ^{10/4}		134-5	v. sl. s.		
propionate (<i>n</i> -) (<i>i</i> -)	$C_4H_9SCH_3$	130.18	col. lq.	0.865 ¹⁸		128	v. sl. s.		
	$C_4H_9SCH_3$	130.18	col. lq.	0.869 ^{10/4}		120.8	v. sl. s.		
thiocyanate (<i>i</i> -) <i>n</i> -valerate (<i>n</i> -) <i>i</i> -valerate (<i>n</i> -) <i>i</i> -valerate (<i>i</i> -)	$(CH_3)_2CHCO_2CH(CH_3)_2$	130.18	col. lq.	0.890 ^{20/4}	-122.8	46.4	0.27 ²⁰	∞	∞
	$(CH_3)_2CHCO_2CH(CH_3)_2$	78.54	col. lq.	0.859 ²⁰	-117	36.5	0.31 ²⁰	∞	∞
Propyl formate (<i>n</i> -) (<i>i</i> -)	$(CH_3)_2CHCl$	78.54	col. lq.	0.901 ^{20/4}	-92.9	81.3	12.2 ²²	∞	∞
	$HCO_2CH_2CH_2CH_3$	88.10	col. lq.	0.873 ^{20/4}		68-71 ⁷⁵¹	∞	∞	∞
furoate (<i>n</i> -) lactate (<i>n</i> -) (<i>i</i> -)	$HCO_2CH(CH_3)_2$	88.10	col. lq.	1.075 ^{26/4}		211	v. sl. s.	s.	s.
	$C_4H_8O \cdot CO_2C_6H_5$	154.16	col. lq.			122-3 ¹⁵⁰	s.	s.	s.
mercaptopan (<i>n</i> -) (<i>i</i> -)	$CH_2CH(OH)CO_2CH_2C_6H_5$	132.16	col. lq.			167.5	s.	s.	s.
	$CH_2CH_2CH_2SH$	76.15	lq.	0.836 ^{25/4}	-112	67-8	v. sl. s.	s.	s.
propionate (<i>n</i> -) (<i>i</i> -)	$(CH_3)_2CHSH$	76.15	lq.	0.809 ^{25/4}	-130.7	58-60	v. sl. s.	∞	∞
	$C_6H_5CO_2CH_2C_6H_5$	116.16	col. lq.	0.883 ^{20/4}	-76	122-3	0.56 ²⁵	∞	∞
thiocyanate (<i>i</i> -) <i>n</i> -valerate (<i>n</i> -) <i>i</i> -valerate (<i>n</i> -) <i>i</i> -valerate (<i>i</i> -)	$C_6H_5CO_2CH(CH_3)_2$	116.16	col. lq.	0.893 ⁰		109-11 ⁷⁵⁰	0.6 ²⁵	∞	∞
	$(CH_3)_2CH \cdot CNS$	101.16	lq.	0.963 ²⁰		152-3 ⁷⁵⁴	i.	∞	∞
Propylene bromide chlorohydrin chloride glycol oxide	$H_3C(CH_2)_2CO_2CH_2C_6H_5$	144.21	lq.	0.874 ¹⁵	-70.7	67.5	i.	∞	∞
	$(CH_3)_2CHCH_2CO_2C_6H_5$	144.21	col. lq.	0.863 ^{20/4}		155.9	i.	∞	∞
Protocatechuic acid (3-,4-)	$(CH_3)_2CHCH_2CO_2C_6H_5$	144.21	col. lq.	0.854 ¹⁷		142 ⁷⁵⁶			
	$CH_2CH \cdot CH_2$	42.08	gas	0.609 ^{-47/4}	-185	-48 ⁷⁴⁰	44.6 cc.	1200 cc.	
bromide chlorohydrin chloride glycol oxide	$CH_3CHBrCH_2Br$	201.91	col. lq.	1.933 ^{20/4}	-55.5	141.6	0.25 ²⁰	s.	v. s.
	$CH_2CHClCH_2OH$	94.54	col. lq.	1.103 ²⁰		133-4	s.	s.	s.
Protocatechuic acid (3-,4-)	$CH_2CHClCH_2Cl$	112.99	col. lq.	1.159 ^{20/20}	<-70	96.8	0.27 ²⁰	v. s.	v. s.
	$CH_2CH(OH)CH_2OH$	6.09	col. oil	1.040 ^{19/4}		188-9	∞	∞	∞
Protocatechuic acid (3-,4-)	$CH_3(CH_2)_2O$	58.08	col. lq.	0.831 ^{20/20}		35	33 ²⁰	∞	∞
	$(HO)_2C_6H_3CO_2H \cdot H_2O$	172.13	nd./aq.	1.542 ^{4/4}	199 d.		1.82 ¹⁴	v. s.	s.

Pulegol (iso-)(<i>d</i> -)	C ₁₀ H ₁₇ OH	154.24	col. lq.	0.911 ²⁰⁴		86-9 ¹⁰	v. sl. s.		
Pulegone	C ₁₀ H ₁₆ O	152.23	col. lq.	0.932 ²⁰²⁰		224 ⁷⁵⁴	i.	∞	∞
Pyrazole	—NH·N:CH·CH·CH—	68.08	nd/et.		70	186-8	s.	s.	s.
Pyrazoline	—NH·N:CH·CH ₂ CH ₂ —	70.09	lq.			144	∞	∞	sl. s.
Pyrazolone	—NH·CO·CH ₂ CH·N—	84.08	nd.		165	subl. d.	s.	∞	v. sl. s.
Pyrene	C ₁₆ H ₁₀	202.24	yel. pr.	1.277 ¹⁰⁴	149-50	>360	i.	3 h.	v. s.
Pyridazine	N ₂ < (CHCH) ₂ >	80.09	lq.	1.107 ²⁰⁴	-8	208	∞	s.	s.
Pyridine	CH < (CHCH) ₂ > N	79.10	col. lq.	0.982 ²⁰⁴	-42	115-6	∞	∞	s.
Pyrocatechol (<i>o</i> -)	C ₆ H ₄ (OH) ₂	110.11	nd/aaq.	1.344 ⁴	104-5	240-5	45.1 ²⁰	v. s.	v. s.
Pyrogallol (1-,2-,3-)	C ₆ H ₃ (OH) ₃	126.11	nd.	1.453 ⁴	nd.	309	40 ¹³	s.	s.
Pyrone	CO < (CHCH) ₂ > O	96.08	cr.	1.190 ^{40,3}	32.5	215-7	v. sl. s.	s.	v. s.
Pyrrrole	< (CH·CH) ₂ > NH	67.09	lq.	0.948 ²⁰⁴		131	i.	s.	s.
Pyrrolidine	< (CH ₂ ·CH ₂) ₂ > NH	71.12	lq.	0.852 ^{22,5}		87-8	∞	∞	∞
Pyrroline	< (CH·CH ₂) ₂ > NH	69.10	lq.	0.910 ²⁰⁴		90-1	v. s.	∞	∞
Pyruvic acid	CH ₃ COCO ₂ H	88.06	col. lq.	1.267 ²⁰⁴	13.6	165	∞	∞	∞
Quercitrin	C ₂₁ H ₃₀ O ₁₁ ·2H ₂ O	484.40	yel. nd.		182-5		0.04 ²⁰	s.	sl. s.
Quinaldine (<i>py</i> -2)	CH ₂ ·C ₉ H ₆ N	143.18	lq.	1.059 ²⁰⁴		244-5 ⁷⁵⁰	v. sl. s.		s.
Quinoline	C ₉ H ₇ N	129.15	lq.	1.095 ²⁰	-15	237.1 ⁷⁴⁷	6	∞	∞
(iso-)	C ₉ H ₇ N	129.15	pl.	1.099 ²¹⁴	24.6	240.5 ⁷⁵³	sl. s.	∞	s.
-diol (1-,3-)	—C ₆ H ₃ C(OH)·C(OH)—	161.15	cr.		237		v. sl. s.		
Quinone (<i>p</i> -)	CO < (CHCH) ₂ > CO	108.09	yel. mn.	1.318 ²⁰⁴	115.7	subl.	sl. s. h.	s.	s.
R-acid Ca salt (2-)(3-,6-)	HOC ₁₀ H ₅ (SO ₃) ₂ Ca	342.35	cr.				30.6 ²⁵		
K salt	HOC ₁₀ H ₅ (SO ₃) ₂ K	380.46	cr.				29.5 ²⁵		
Na salt	HOC ₁₀ H ₅ (SO ₃) ₂ Na	348.26	cr.				25.2 ²⁵		
Raffinose	C ₁₈ H ₃₂ O ₁₆ ·5H ₂ O	594.52	cr./aq.	1.465 ⁰	119	d. 130	14.3 ²⁰	0.1 ²⁰	
Resorcinol (<i>m</i> -)	C ₆ H ₄ (OH) ₂	110.11	col. rhb.	1.272 ¹⁵	110.7	276.5	147 ¹²	v. s.	v. s.
Retene	C ₁₈ H ₁₈	234.32	lf/al.	1.13 ¹⁶	98-9	390-4	i.	69 h.	v. s. h.
Rhamnose (β-)	CH ₂ (CHOH)·CHO·H ₂ O	182.17	col. mn.	1.471 ²⁰⁴	126		60.8 ²¹		i.
Ricinoleic acid	C ₁₇ H ₃₂ (OH)·CO ₂ H	298.45	lq.	0.954 ¹⁶	4-5	226-8 ¹⁰	i.	∞	∞
Rosamiline	C ₂₀ H ₂₁ ON ₃	319.39	col. nd.		186 d.		v. sl. s.	sl. s.	
Rosolic acid	C ₂₀ H ₁₆ O ₃	304.33	red lf.		308-10 d.		v. s. h.	sl. s.	
Saccharin	C ₆ H ₄ (CO)(SO ₂) > NH	183.18	mn.		225-8	subl.	0.4 ²⁵	3.1 c.	1.05 c.
Safrole (1-,3-,4-)	CH ₂ ·CHCH ₂ ·C ₆ H ₃ ·O ₂ CH ₂	162.18	col. mn.	1.100 ²⁰⁴	11.2	233-4	i.	∞	∞
(iso-)(1-,3-,4-)	CH ₂ ·CH·CH·C ₆ H ₃ ·O ₂ CH ₂	162.18	col. lq.	1.122 ²⁰⁴	6-7	252-3	i.	∞	∞
Salicylic acid (<i>o</i> -)	HO·C ₆ H ₄ ·CO ₂ H	138.12	mn.	1.443 ²⁰⁴	159	211 ²⁰	0.2 ²³	49 ¹⁵	51 ¹⁵
aldehyde (<i>o</i> -)	HO·C ₆ H ₄ ·CHO	122.12	col. oil	1.153 ²⁰⁴	-7	196.5	1.7 ⁸⁶	∞	∞
Saligenin	HO·C ₆ H ₄ ·CH ₂ OH	124.13	rhb./aq.	1.161 ²⁵	86-7	subl.	6.6 ¹⁵	v. s.	v. s.
Schaeffer's salt, Ca	(HOC ₁₀ H ₆ SO ₃) ₂ Ca·5H ₂ O	576.59	cr.				4.76 ²⁰		
K	HOC ₁₀ H ₆ SO ₃ K	262.31	cr.				3.46 ²⁵		
Na	HOC ₁₀ H ₆ SO ₃ Na	246.21	cr.				6.29 ²⁵		
Semicarbazide	NH ₂ ·CO·NH·NH ₂	75.07	pr./al.		96		v. s.		i.
hydrochloride	NH ₂ ·CO·NH·NH ₃ Cl	111.54	pr.		173 d.		v. s.	sl. s.	i.
Skatole (3-)	CH ₂ ·C ₉ H ₆ N	131.17	lf.		95	265-6 ⁷⁵⁵	0.05 c.	s.	s.
Sodium methylate	CH ₃ ONa	54.03	pd.		d. 300		d.		
Sorbitol	[CH ₂ OH(CHOH) ₂] ₂	182.17	cr.		110-2		v. s.	v. s. h.	
Sorboside (<i>d</i> - or <i>l</i> -)	C ₆ H ₁₂ O ₆	180.16	rhb.	1.654 ¹⁵	165		55 ¹⁷	sl. s.	
Sorghum	(C ₆ H ₁₀ O ₅) _x	162.14	amor.	1.50 ²¹	d.		i.	i.	i.
Stearic acid	CH ₃ (CH ₂) ₁₆ CO ₂ H	284.47	mn.	0.847 ^{69,3}	70-1	291 ¹¹⁰	0.03 ²⁵	2 ²⁰	6 ⁵
amide	CH ₃ (CH ₂) ₁₆ CONH ₂	283.48	col. cr.		108-9		i.	s. h.	s. h.
Styrene	C ₆ H ₅ CH=CH ₂	104.14	col. lq.	0.903 ²⁰⁴	-31	145-6	v. sl. s.	∞	∞
Siberic acid	HO ₂ C(CH ₂) ₆ CO ₂ H	174.19	nd/aaq.	1.266 ²⁵⁴	140-4	279 ¹⁰⁰	0.14 ¹⁶	s.	0.8 ¹⁵
Succinic acid	HO ₂ C(CH ₂) ₂ CO ₂ H	118.09	col. mn.	1.572 ²⁵⁴	189-90	235 d.	6.8 ²⁰	9.9 ¹⁵	1.2 ¹⁵
Sucrose	C ₁₂ H ₂₂ O ₁₁	342.30	col. mn.	1.588 ¹⁵	170-86 d.		179 ⁹⁰	0.9	i.
Sulfanilic acid (<i>p</i> -)	H ₂ N·C ₆ H ₄ ·SO ₃ H	173.18	col. cr.		d. > 280		0.8 ¹⁰	v. sl. s.	v. sl. s.
Sylvestrene (<i>d</i> -)	C ₁₀ H ₁₆	136.23	lq.	0.863 ²⁰⁴		176-7			
Tartaric acid (meso-)	(CHOHCO ₂ H) ₂	150.09	cr.	1.737	159-60		120 ¹⁵		
(racemic)	(CHOHCO ₂ H) ₂ ·H ₂ O	168.10	tri.	1.697 ²⁰⁴	205-6		20.6 ²⁰	2 ⁰	0.09
(<i>d</i> - or <i>l</i> -)	(CHOHCO ₂ H) ₂	150.09	mn.	1.760 ²⁰⁴	168-70	d.	139 ²⁰	25 ¹⁵	0.4 ¹⁵
Tartronic acid	CH(OH)(CO ₂ H) ₂ ·a H ₂ O	129.07	pr./aq.		d. 155-8	subl.	v. s.	v. s.	i.
Terephthalic acid (<i>p</i> -)	C ₆ H ₄ (CO ₂ H) ₂	166.13	subl.	1.510			0.001 c.	v. s. h.	i.
Terpin hydrate (<i>cis</i> -)	C ₁₀ H ₁₈ O ₂ ·H ₂ O	190.28	rhb.		117	d.	0.4 ¹⁵	10 ¹⁵	1 ¹⁵
Terpineol (α-)(<i>d</i> - or <i>l</i> -)	C ₁₀ H ₁₈ O	154.24	col. cr.	0.935 ¹⁵	38-40		i.	v. s.	v. s.
(<i>dl</i> -)	C ₁₀ H ₁₈ O	154.24	col. cr.	0.935 ²⁰²⁰	35	218-9 ⁷⁵²	i.	v. s.	v. s.
Terpinyl acetate (α-)(<i>dl</i> -)	CH ₃ CO ₂ ·C ₁₀ H ₁₇	196.28	lq.	0.966 ²⁰⁴	< -50	220 d.	i.	20	∞
Tetrabromo-ethane (sym)	Br ₂ CH·CHBr ₂	345.70	col. lq.	2.964 ²⁰⁴	-1.0	151 ¹⁴	i.	∞	∞
(uns)	Br ₃ C·CH ₂ Br	345.70	col. lq.	2.875 ²⁰⁴	0	104 ¹³	s.	∞	∞
Tetrachloro-ethane (sym)	Cl ₂ CH·CHCl ₂	167.86	col. lq.	1.600 ²⁰⁴	-36	146.3	0.29 ²⁰	∞	∞
(uns)	Cl ₃ C·CH ₂ Cl	167.86	lq.	1.588 ²⁰⁴		129-30	i.	∞	∞
-ethylene	Cl ₂ C·CCl ₂	165.85	col. lq.	1.624 ¹⁵⁴	-19	120.8	∞	∞	∞
Tetracosane (<i>n</i> -)	CH ₃ (CH ₂) ₂₂ CH ₃	338.64	cr.	0.779 ⁵¹⁴	51.1	324			s.
Tetradecane (<i>n</i> -)	CH ₃ (CH ₂) ₁₂ CH ₃	198.38	col. lq.	0.765 ²⁰⁴	5.5	252.5	i.	v. s.	v. s.
Tetraethyl-thiuram disulfide	[(C ₂ H ₅) ₂ NCS] ₂ S ₂	296.52	cr.	1.17	70		i.		v. s.

TABLE 2-2 Physical Properties of Organic Compounds (Concluded)

Name	Formula	Formula weight	Form and color	Specific gravity	Melting point, °C	Boiling point, °C	Solubility in 100 parts		
							Water	Alcohol	Ether
Tetrafluoro-ethylene	F ₂ C:CF ₂	100.02	gas	1.58 ⁻⁷⁸	-142.5	-76.3	0.01 ³⁰		
Tetrahydro-furan	—CH ₂ (CH ₂) ₃ CH ₂ :O—	72.10	col. liq.	0.888 ^{21/4}	-65	65-6	s.	s.	s.
-furfuryl alcohol	C ₄ H ₆ O:CH ₂ OH	102.13	col. liq.	1.050 ^{20/4}		177-8 ⁷⁴³	∞	∞	∞
-pyran	—CH ₂ (CH ₂) ₃ CH ₂ :O—	86.13	liq.	0.881 ^{20/4}		88	s.		
Tetralin	—C ₁₀ H ₇ (CH ₂) ₂ CH ₂ —	132.20	col. liq.	0.973 ^{18/4}		206 ⁷⁶⁴	i.	s.	s.
Tetramethyl-thiuram disulfide	[(CH ₃) ₂ NCS] ₂ S ₂	240.41	cr.	1.29		155-6	i.		
Tetryl (2-,4-,6-)	(NO ₂) ₃ C ₆ H ₂ :N(CH ₃)NO ₂	257.15	yel. mn.	1.57 ¹⁹		130.5	i.	s. h.	s.
Theobromine	C ₇ H ₈ O ₂ N ₄	180.17	rhb.			330	0.06 ¹⁵	0.06 c.	0.03 h.
Thio-acetic acid	CH ₃ :CO:SH	76.11	yel. liq.	1.074 ¹⁰	< -17	93	s.	∞	∞
-aniline (4-, 4'-)	(NH ₂ :C ₆ H ₄) ₂ S	216.29	nd/aq.			108	sl. s. h.	∞	s.
-carbanilide	(C ₆ H ₅ :NH) ₂ CS	228.30	rhb./al.	1.3 ²⁴		154	i.	v. s.	v. s.
-naphthol (β-)	C ₁₀ H ₇ :SH	160.22	cr./al.			81	v. sl. s.	v. s.	v. s.
-phenol	C ₆ H ₅ :SH	110.17	col. liq.	1.074 ^{23/4}		168-9	v. sl. s.	v. s.	∞
-salicylic acid (o-)	HS:C ₆ H ₄ :CO ₂ H	154.18	yel. nd.			164	sl. s. h.	s.	
-urea	NH ₂ :CS:NH ₂	76.12	rhb./al.	1.405 ^{20/4}		180-2	d.	9.2 ¹³	sl. s.
Thiophene	<(CH:CH) ₂ >S	84.13	col. liq.	1.070 ^{15/4}	-30	84	i.	s.	
Thymol (5-2-,1-)	(CH ₃)(C ₆ H ₄)C ₆ H ₄ OH	150.21	cr.	0.972 ^{25/25}		51.5	0.09 ¹⁹	v. s.	v. s.
Tolidine (0)-(3-,3'-,4-,4'-)	[CH ₃ (NH ₂)C ₆ H ₃] ₂	212.28	lf.			128-9	v. sl. s.	s.	s.
Toluene	C ₆ H ₅ :CH ₃	92.13	col. liq.	0.866 ^{20/4}		-95	110.8	0.05 ¹⁶	∞
sulfonic acid (o-)	CH ₃ :C ₆ H ₄ :SO ₃ H:2H ₂ O	208.23	cr.			d.	128.8 ⁰	v. s.	s.
(p-)	CH ₃ :C ₆ H ₄ :SO ₃ H:H ₂ O	190.21	mn.			104-5	v. s.	s.	
sulfonic amide (p-)	CH ₃ :C ₆ H ₄ :SO ₂ NH ₂	171.21	mn.			137	0.2 ⁹	7.4 ⁵	
sulfonic chloride (p-)	CH ₃ :C ₆ H ₄ :SO ₂ Cl	190.64	tri.			69	134.5 ¹⁰	i.	s.
Toluic acid (o-)	CH ₃ :C ₆ H ₄ :CO ₂ H	136.14	cr./aq.	1.062 ^{115/4}		104-5	259 ³¹	2.17 ¹⁰⁰	v. s.
(m-)	CH ₃ :C ₆ H ₄ :CO ₂ H	136.14	pr./aq.	1.054 ^{112/4}		110-1	263	1.6 ¹⁰⁰	v. s.
(p-)	CH ₃ :C ₆ H ₄ :CO ₂ H	136.14	cr./aq.			179-80	274-5	1.3 ¹⁰⁰	v. s.
Toluidine (o-)	CH ₃ :C ₆ H ₄ :NH ₂	107.15	col. liq.	0.999 ^{20/4}	-16.3	199.7	1.5 ²⁵	∞	∞
(m-)	CH ₃ :C ₆ H ₄ :NH ₂	107.15	col. liq.	0.989 ^{20/4}	-31.5	203.3	∞	∞	∞
(p-)	CH ₃ :C ₆ H ₄ :NH ₂	107.15	cr.	1.046 ^{20/4}		200.3	0.74 ²¹	v. s.	v. s.
hydrochloride (o-)	CH ₃ :C ₆ H ₄ :NH ₂ Cl	143.62	mn. pr.			218-20	242	s.	sl. s.
sulfonic acid (1-,2-,3-)	CH ₃ (NH ₂)C ₆ H ₃ SO ₃ H	187.21	cr.				0.97 ¹¹		
Tolylendiamine (1-,2-,4-)	CH ₃ :C ₆ H ₃ (NH ₂) ₂	122.17	rhb.			99	283-5	s. h.	s.
Tolylene diisocyanate (1-,2-,4-)	CH ₃ :C ₆ H ₃ (NCO) ₂	174.15	liq.	1.23 ²⁸			134.5 ²⁰	d.	
Trehalose	C ₁₂ H ₂₂ O ₁₁ :2H ₂ O	378.33	rhb./al.			97	s. h.	sl. s. h.	i.
Triamylamine (n-)	[(CH ₃ (CH ₂) ₃ CH ₂) ₃ N]	227.42	liq.				240-5	i.	
(i-)	[(CH ₃) ₂ CH(CH ₂) ₂] ₃ N	227.42	col. liq.	0.786 ^{20/4}			235	i.	
Tributyl-amine (n-)	[(CH ₃ (CH ₂) ₂ CH ₂) ₃ N]	185.34	col. liq.	0.778 ^{20/20}			216.5 ⁷⁰¹	i.	∞
phosphite	[(CH ₃ (CH ₂) ₂ CH ₂) ₃ P]	250.32	liq.	0.925 ^{20/4}			122-3 ¹²	i.	
Trichloro-acetic acid	Cl ₃ C:CO ₂ H	163.40	cr.	1.617 ^{16/15}		58	195.5 ⁷⁵⁴	120 ²⁵	s.
-benzene (s-)(1-,3-,5-)	C ₆ H ₃ Cl ₃	181.46	nd.			63.5	208.5 ⁷⁶⁴	∞	sl. s.
-ethane (1-,1-,1-)	Cl ₃ C:CH ₃	133.42	liq.	1.325 ^{26/4}			74.1	i.	∞
-ethylene	Cl ₂ C:CHCl	131.40	col. liq.	1.466 ^{20/20}	-73		87.2	0.1 ²⁵	∞
-phenol	Cl ₃ C ₆ H ₂ OH	197.46	nd.	1.490 ^{75/4}		68-9	246	0.09 ²⁵	v. s.
Tricosane (n-)	CH ₃ (CH ₂) ₂₁ :CH ₃	324.61	lf.	0.779 ^{18/4}		47.7	234 ¹⁵	i.	
Tricresyl phosphate (o-)	OP(O)(C ₆ H ₄ CH ₃) ₃	368.36	liq.					i.	
Tridecane (n-)	CH ₃ (CH ₂) ₁₁ :CH ₃	184.35	col. liq.	0.757 ^{20/4}	-6.2		234	∞	v. s.
Triethanol amine	(HOCH ₂ CH ₂) ₃ N	149.19	col. liq.	1.126 ^{20/20}			277-9 ¹⁵⁰	∞	∞
Triethyl-amine	(CH ₃ CH ₂) ₃ N	101.19	col. oil	0.729 ^{20/20}	-114.8		89.4	∞ > 19 ⁹	∞
-benzene (1-,3-,5-)	(C ₂ H ₅) ₃ C ₆ H ₃	162.26	liq.	0.861 ^{20/4}			215	i.	s.
(1-,2-,4-)	(C ₂ H ₅) ₃ C ₆ H ₃	162.26	liq.	0.882 ^{17/4}			217-8 ⁷³⁵	i.	s.
borate	B(OCH ₂ CH ₂) ₃	146.00	liq.	0.864 ^{20/20}			120	d.	
citrate	HOC ₂ H ₄ (CO ₂ C ₂ H ₅) ₃	276.28	oil	1.137 ^{20/4}			294	i.	∞
Triethylene glycol	(-CH ₂ OCH ₂ CH ₂ OH) ₂	150.17	col. liq.	1.125 ^{20/20}		-5	290	∞	∞
Trifluoro-chloromethane	CF ₃ Cl	104.47	gas	1.726 ⁻¹³⁰		-182	-80	d.	
chloroethylene	F ₂ C:CFCl	116.48	gas			-157.5	-27.9	d.	
-trichloroethane	Cl ₃ CF:CClF ₂	187.39	liq.	1.576 ^{20/4}		-35	47.6	i.	∞
Trimethoxybutane (1-,3-,3-)	CH ₃ (OCH ₃) ₂ CH ₂ C(OCH ₃) ₂ CH ₃	148.20	liq.	0.932			63-5 ²⁵	d.	
Trimethylamine	(CH ₃) ₃ N	59.11	gas	0.662 ⁻⁵	-124		3.5	41 ¹⁹	s.
Trimethylene bromide	BrCH ₂ CH ₂ CH ₂ Br	201.91	liq.	1.987 ^{15/4}			167.5	0.17 ³⁰	s.
chloride	ClCH ₂ CH ₂ CH ₂ Cl	112.99	liq.	1.201 ¹⁵			123-5	0.27 ²⁵	s.
glycol	HOCH ₂ CH ₂ CH ₂ OH	76.09	oil	1.060 ^{20/4}			214	∞	∞
Trinitro-benzene (1-,3-,5-)	C ₆ H ₃ (NO ₂) ₃	213.11	col. rhb.	1.688 ^{20/4}		121	0.03 ¹⁵	1.9 ¹⁸	1.5 ¹⁸
-benzoic acid (2-,4-,6-)	(NO ₂) ₃ C ₆ H ₂ CO ₂ H	257.12	rhb./aq.			210-20 d.	2.05 ²⁴		
-tert-butylxylene	(NO ₂) ₃ C ₆ (CH ₃) ₂ C ₆ H ₃	297.26	nd/al.			110		sl. s.	s.
-naphthalene (α-)(1-,3-,5-)	C ₁₀ H ₅ (NO ₂) ₃	263.16	rhb.			122-3	i.	s.	
(β-)(1-,3-,8-)	C ₁₀ H ₅ (NO ₂) ₃	263.16	cr./al.			218-9	0.02 ¹⁰⁰	0.05 ²³	0.13 ¹⁵
(γ-)(1-,4-,5-)	C ₁₀ H ₅ (NO ₂) ₃	263.16	yel. cr.			148-9	i.	0.11 ¹⁹	0.4 ¹⁹

-phenol (2-,3-6-)	(NO ₂) ₃ C ₆ H ₃ OH	229.11	nd.		117-8		s. h.	v. s.	v. s.
-toluene (β-)(2-,3-,4-)	CH ₃ C ₆ H ₃ (NO ₂) ₃	227.13	cr.	1.620 ²⁰⁴	112	expl.	i.	sl. s. c.	s.
(γ-)(2-,4-,5-)	CH ₃ C ₆ H ₃ (NO ₂) ₃	227.13	yel. pl.	1.620 ²⁰⁴	104	expl.	i.	s. h.	v. s.
(α-)(2-,4-,6-)	CH ₃ C ₆ H ₃ (NO ₂) ₃	227.13	cr./al.	1.654	80.8	expl.	0.01 ²⁰	1.5 ²²	5 ⁵³
Trional	C ₆ H ₅ (CH ₃) ₃ C(SO ₂ C ₂ H ₅) ₃	242.34	pl./al.	1.199 ^{85/4}	76	d.	0.3 ¹⁵	5 ⁰	6.6 ¹⁵
Triphenyl-arsine	(C ₆ H ₅) ₃ As	306.21	pl.	1.306	59-60	>360		s.	v. s.
carbinol	(C ₆ H ₅) ₃ COH	260.32	cr.	1.188 ²⁰⁴	162.5	>360	i.	v. s.	v. s.
guanidine (α-)	C ₆ H ₅ N:C(NHC ₆ H ₅) ₂	287.35	rbh./al.	1.13	144-5	d.	4 ⁰		
methane	(C ₆ H ₅) ₃ CH	244.32	cr.	1.014 ^{99/4}	93.4	359 ²⁵⁴	i.	v. s. h.	v. s.
methyl	(C ₆ H ₅) ₃ C . . .	243.31	col. cr.		145-7	d.	i.	sl. s. h.	
phosphate	OP(OC ₆ H ₅) ₃	326.28	pr./al.	1.206 ^{58/4}	49-50	245 ¹¹	i.	155 ²⁵	
Tripropylamine (n-)	(CH ₃ CH ₂ CH ₂) ₃ N	143.27	col. lq.	0.757 ²⁰⁴	-93.5	v. sl. s.	v. sl. s.	∞	∞
Undecane (n-)	CH ₃ (CH ₂) ₉ CH ₃	156.30	col. lq.	0.741 ²⁰⁴	-25.6	194.5	i.	∞	∞
Urea	H ₂ N:CO-NH ₂	60.06	col. pr.	1.335 ²⁰⁴	132.7	d.	100 ¹⁷	20 ³⁰	sl. s.
nitrate	CO(NH ₂) ₂ ·HNO ₃	123.07	col. mn.		152 d.		v. s. h.	s.	
Uric acid	C ₅ H ₄ O ₃ N ₄	168.11	cr.	1.893 ²⁰	d.		0.06 h.	i.	i.
Valeric acid (n-)	C ₅ H ₉ CH ₂ CO ₂ H	102.13	col. lq.	0.939 ²⁰⁴	-34.5	187		∞	∞
(i-)	(CH ₃) ₂ CHCH ₂ CO ₂ H	102.13	col. lq.	0.931 ^{20/20}	-37.6	176		4.2 ²⁰	∞
aldehyde (n-)	C ₅ H ₉ CH ₂ CHO	86.13	lq.	0.819 ¹¹	-92	103.4	v. sl. s.	s.	∞
(i-)	(CH ₃) ₂ CHCH ₂ CHO	86.13	col. lq.	0.803 ¹⁷	-51	92.5	sl. s.	s.	s.
amide (n-)	C ₅ H ₉ CH ₂ CONH ₂	101.15	mn. pl.	1.023	106		v. s.	v. s.	v. s.
(i-)	(CH ₃) ₂ CHCH ₂ CONH ₂	101.15	mn.	0.965 ²⁰⁴	135-7	232	s.	s.	s.
Vanillic acid (3-,4-,1-)	CH ₃ O(OH)C ₆ H ₃ CO ₂ H	168.14	nd./aq.		207	subl.	0.12 ¹⁴	v. s.	v. s.
alcohol (3-,4-,1-)	CH ₃ O(OH)C ₆ H ₃ CH ₂ OH	154.16	mn./aq.		115	d.	v. s. h.	v. s.	v. s.
hyl-thiuram disulfide	[(C ₂ H ₅) ₂ NCS] ₂ S ₂	296.52	cr.	1.17	70		i.		
Vanillin (3-,4-,1-)	CH ₃ O(OH)C ₆ H ₃ CHO	152.14	mn.	1.056	81-2	285	1 ¹⁴	v. s.	v. s.
Veratrole (o-)	C ₆ H ₄ (OCH ₃) ₂	138.16	cr.	1.091 ^{15/15}	22.5	207.1	v. sl. s.	s.	s.
Vinyl acetate	CH ₃ CO ₂ CH=CH ₂	86.09	col. lq.	0.932 ²⁰⁴	<-60	72-3	2 ²⁰	∞	∞
(poly-)	(CH ₃ CO ₂ CH=CH ₂) _x	(86.09)		1.19 ²⁰	100-25		i.		
acetic acid	CH ₃ ·CH=CH ₂ CO ₂ H	86.09	col. lq.	1.013 ^{15/15}	-39	163	s.	∞	∞
acetylene	CH ₃ ·CH=C·CH	52.07	gas	0.705 ^{1.5}		5.5	0.67 ^{0.6}		
alcohol	CH ₃ ·CHOH	44.06							
(poly-)	(CH ₂ ·CHOH) _x	(44.06)		1.3 ²⁰	d. >200		s.		
chloride	CH ₂ ·CHCl	62.50	gas	0.908 ^{25/25}	-160	-12	sl. s.	s.	v. s.
propionate	C ₆ H ₅ CO ₂ CH=CH ₂	100.11	lq.		93-5		v. sl. s.		
Xylene (o-)	C ₆ H ₄ (CH ₃) ₂	106.16	col. lq.	0.881 ²⁰⁴	-25	144	i.	s.	∞
(m-)	C ₆ H ₄ (CH ₃) ₂	106.16	col. lq.	0.867 ^{17/4}	-47.4	139.3	i.	s.	∞
(p-)	C ₆ H ₄ (CH ₃) ₂	106.16	col. lq.	0.861 ²⁰⁴	13.2	138.5	i.	s.	v. s.
sulfonic acid (1-,4-,2-)	(CH ₃) ₂ C ₆ H ₃ SO ₃ H·2H ₂ O	222.25	col. lf.		86	149 ^{9.1}	s.		
Xylidine (1:2)(3-)	(CH ₃) ₂ C ₆ H ₃ NH ₂	121.18	lq.	0.991 ¹⁵	<-15	223	v. sl. s.	s.	s.
(1:2)(4-)	(CH ₃) ₂ C ₆ H ₃ NH ₂	121.18	pr.	1.076 ^{17.5}	49-50	224-6	v. sl. s.		
(1:3)(2-)	(CH ₃) ₂ C ₆ H ₃ NH ₂	121.18	lq.	0.980 ¹⁵		216-7	v. sl. s.		
(1:3)(4-)	(CH ₃) ₂ C ₆ H ₃ NH ₂	121.18	lq.	0.978 ²⁰⁴		213-4	v. sl. s.		
(1:3)(5-)	(CH ₃) ₂ C ₆ H ₃ NH ₂	121.18	oil	0.972 ²⁰⁴		221-2	v. sl. s.		
(1:4)(2-)	(CH ₃) ₂ C ₆ H ₃ NH ₂	121.18	oil	0.979 ^{21/4}	15.5	215 ⁷⁸⁹	v. sl. s.		
Xylose (l-)(+)	CH ₂ OH(CHOH) ₃ CHO	150.13	nd.	1.535 ⁰	153-4		117 ²⁰	v. sl. s.	i.
Xylylene dichloride (p-)	C ₆ H ₄ (CH ₂ Cl) ₂	175.06	mn.	1.417 ⁰	100.5	240-5 d.	i.	s.	v. sl. s.
Zinc diethyl	Zn(CH ₂ CH ₃) ₂	123.50	col. lq.	1.182 ¹⁸	-28	118	d.	d.	
dimethyl	Zn(CH ₃) ₂	95.45	col. lq.	1.386 ¹¹	-40	46	d.	d.	
dimethyl-dithiocarbamate	Zn[S ₂ CN(CH ₃) ₂] ₂	305.79		2.00 ^{40/4}	248-50		i.		

NOTE: °F = % °C + 32.

VAPOR PRESSURES OF PURE SUBSTANCES

UNITS CONVERSIONS

For this subsection, the following units conversions are applicable:

$$^{\circ}\text{F} = \% ^{\circ}\text{C} + 32.$$

To convert millimeters of mercury to pounds-force per square inch, multiply by 0.01934.

TABLE 2-3 Vapor Pressure of Water Ice from -15 to 0°C^*

$t, ^{\circ}\text{C}$	mmHg									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
-14	1.361	1.348	1.336	1.324	1.312	1.300	1.288	1.276	1.264	1.253
-13	1.490	1.477	1.464	1.450	1.437	1.424	1.411	1.399	1.386	1.373
-12	1.632	1.617	1.602	1.588	1.574	1.559	1.546	1.532	1.518	1.504
-11	1.785	1.769	1.753	1.737	1.722	1.707	1.691	1.676	1.661	1.646
-10	1.950	1.934	1.916	1.899	1.883	1.866	1.849	1.833	1.817	1.800
-9	2.131	2.112	2.093	2.075	2.057	2.039	2.021	2.003	1.985	1.968
-8	2.326	2.306	2.285	2.266	2.246	2.226	2.207	2.187	2.168	2.149
-7	2.537	2.515	2.493	2.472	2.450	2.429	2.408	2.387	2.367	2.346
-6	2.765	2.742	2.718	2.695	2.672	2.649	2.626	2.603	2.581	2.559
-5	3.013	2.987	2.962	2.937	2.912	2.887	2.862	2.838	2.813	2.790
-4	3.280	3.252	3.225	3.198	3.171	3.144	3.117	3.091	3.065	3.039
-3	3.568	3.539	3.509	3.480	3.451	3.422	3.393	3.364	3.336	3.308
-2	3.880	3.848	3.816	3.785	3.753	3.722	3.691	3.660	3.630	3.599
-1	4.217	4.182	4.147	4.113	4.079	4.045	4.012	3.979	3.946	3.913
0	4.579	4.542	4.504	4.467	4.431	4.395	4.359	4.323	4.287	4.252

*For data at 0(0.2)-30(2)-98 $^{\circ}\text{C}$ see p. 2324, *Handbook of Chemistry and Physics*, 40th ed., Chemical Rubber Publishing Co.

ADDITIONAL REFERENCES

Additional compilations of vapor-pressure data include Boublik, Friedl, and Hala, *The Vapor Pressures of Pure Substances*, Elsevier, Amsterdam, 1984. See also Hirata, Ohe, and Nagahama, *Computer Aided Data Book of Vapor-Liquid Equilibria*, Kodansha/Elsevier, Tokyo, 1975; Weishaupt, *Landolt-Börnstein New Series Group IV*, vol. 3; *Thermodynamic Equilibria of Boiling Mixtures*, Springer-Verlag, Berlin, 1975; Wichterle, Linek, and Hala, *Vapor-Liquid Equilibrium Data Bibliography*, Elsevier, Amsterdam, 1973; suppl. 1, 1976; suppl. 2, 1982.

TABLE 2-4 Vapor Pressure of Liquid Water from -16 to 0°C^*

$t, ^{\circ}\text{C}$	mmHg									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
-15	1.436	1.425	1.414	1.402	1.390	1.379	1.368	1.356	1.345	1.334
-14	1.560	1.547	1.534	1.522	1.511	1.497	1.485	1.472	1.460	1.449
-13	1.691	1.678	1.665	1.651	1.637	1.624	1.611	1.599	1.585	1.572
-12	1.834	1.819	1.804	1.790	1.776	1.761	1.748	1.734	1.720	1.705
-11	1.987	1.971	1.955	1.939	1.924	1.909	1.893	1.878	1.863	1.848
-10	2.149	2.134	2.116	2.099	2.084	2.067	2.050	2.034	2.018	2.001
-9	2.326	2.307	2.289	2.271	2.254	2.236	2.219	2.201	2.184	2.167
-8	2.514	2.495	2.475	2.456	2.437	2.418	2.399	2.380	2.362	2.343
-7	2.715	2.695	2.674	2.654	2.633	2.613	2.593	2.572	2.553	2.533
-6	2.931	2.909	2.887	2.866	2.843	2.822	2.800	2.778	2.757	2.736
-5	3.163	3.139	3.115	3.092	3.069	3.046	3.022	3.000	2.976	2.955
-4	3.410	3.384	3.359	3.334	3.309	3.284	3.259	3.235	3.211	3.187
-3	3.673	3.647	3.620	3.593	3.567	3.540	3.514	3.487	3.461	3.436
-2	3.956	3.927	3.898	3.871	3.841	3.813	3.785	3.757	3.730	3.702
-1	4.258	4.227	4.196	4.165	4.135	4.105	4.075	4.045	4.016	3.986
0	4.579	4.546	4.513	4.480	4.448	4.416	4.385	4.353	4.320	4.289

*Computed from the above table with the aid of the thermodynamic equation

$$\log_{10} \frac{p_w}{p_i} = \frac{-1.1489t}{273.1+t} - 1.330 \times 10^{-5}t^2 + 9.084 \times 10^{-8}t^3$$

TABLE 2-5 Vapor Pressure of Liquid Water from 0 to 100°C*
mmHg

<i>t</i> , °C	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	4.579	4.613	4.647	4.681	4.715	4.750	4.785	4.820	4.855	4.890
1	4.926	4.962	4.998	5.034	5.070	5.107	5.144	5.181	5.219	5.256
2	5.294	5.332	5.370	5.408	5.447	5.486	5.525	5.565	5.605	5.645
3	5.685	5.725	5.766	5.807	5.848	5.889	5.931	5.973	6.015	6.058
4	6.101	6.144	6.187	6.230	6.274	6.318	6.363	6.408	6.453	6.498
5	6.543	6.589	6.635	6.681	6.728	6.775	6.822	6.869	6.917	6.965
6	7.013	7.062	7.111	7.160	7.209	7.259	7.309	7.360	7.411	7.462
7	7.513	7.565	7.617	7.669	7.722	7.775	7.828	7.882	7.936	7.990
8	8.045	8.100	8.155	8.211	8.267	8.323	8.380	8.437	8.494	8.551
9	8.609	8.668	8.727	8.786	8.845	8.905	8.965	9.025	9.086	9.147
10	9.209	9.271	9.333	9.395	9.458	9.521	9.585	9.649	9.714	9.779
11	9.844	9.910	9.976	10.042	10.109	10.176	10.244	10.312	10.380	10.449
12	10.518	10.588	10.658	10.728	10.799	10.870	10.941	11.013	11.085	11.158
13	11.231	11.305	11.379	11.453	11.528	11.604	11.680	11.756	11.833	11.910
14	11.987	12.065	12.144	12.223	12.302	12.382	12.462	12.543	12.624	12.706
15	12.788	12.870	12.953	13.037	13.121	13.205	13.290	13.375	13.461	13.547
16	13.634	13.721	13.809	13.898	13.987	14.076	14.166	14.256	14.347	14.438
17	14.530	14.622	14.715	14.809	14.903	14.997	15.092	15.188	15.284	15.380
18	15.477	15.575	15.673	15.772	15.871	15.971	16.071	16.171	16.272	16.374
19	16.477	16.581	16.685	16.789	16.894	16.999	17.105	17.212	17.319	17.427
20	17.535	17.644	17.753	17.863	17.974	18.085	18.197	18.309	18.422	18.536
21	18.650	18.765	18.880	18.996	19.113	19.231	19.349	19.468	19.587	19.707
22	19.827	19.948	20.070	20.193	20.316	20.440	20.565	20.690	20.815	20.941
23	21.068	21.196	21.324	21.453	21.583	21.714	21.845	21.977	22.110	22.243
24	22.377	22.512	22.648	22.785	22.922	23.060	23.198	23.337	23.476	23.616
25	23.756	23.897	24.039	24.182	24.326	24.471	24.617	24.764	24.912	25.060
26	25.209	25.359	25.509	25.660	25.812	25.964	26.117	26.271	26.426	26.582
27	26.739	26.897	27.055	27.214	27.374	27.535	27.696	27.858	28.021	28.185
28	28.349	28.514	28.680	28.847	29.015	29.184	29.354	29.525	29.697	29.870
29	30.043	30.217	30.392	30.568	30.745	30.923	31.102	31.281	31.461	31.642
30	31.824	32.007	32.191	32.376	32.561	32.747	32.934	33.122	33.312	33.503
31	33.695	33.888	34.082	34.277	34.471	34.667	34.864	35.062	35.261	35.462
32	35.663	35.865	36.068	36.272	36.477	36.683	36.891	37.099	37.308	37.518
33	37.729	37.942	38.155	38.369	38.584	38.801	39.018	39.237	39.457	39.677
34	39.898	40.121	40.344	40.569	40.796	41.023	41.251	41.480	41.710	41.942
35	42.175	42.409	42.644	42.880	43.117	43.355	43.595	43.836	44.078	44.320
36	44.563	44.808	45.054	45.301	45.549	45.799	46.050	46.302	46.556	46.811
37	47.067	47.324	47.582	47.841	48.102	48.364	48.627	48.891	49.157	49.424
38	49.692	49.961	50.231	50.502	50.774	51.048	51.323	51.600	51.879	52.160
39	52.442	52.725	53.009	53.294	53.580	53.867	54.156	54.446	54.737	55.030
40	55.324	55.61	55.91	56.21	56.51	56.81	57.11	57.41	57.72	58.03
41	58.34	58.65	58.96	59.27	59.58	59.90	60.22	60.54	60.86	61.18
42	61.50	61.82	62.14	62.47	62.80	63.13	63.46	63.79	64.12	64.46
43	64.80	65.14	65.48	65.82	66.16	66.51	66.86	67.21	67.56	67.91
44	68.26	68.61	68.97	69.33	69.69	70.05	70.41	70.77	71.14	71.51
45	71.88	72.25	72.62	72.99	73.36	73.74	74.12	74.50	74.88	75.26
46	75.65	76.04	76.43	76.82	77.21	77.60	78.00	78.40	78.80	79.20
47	79.60	80.00	80.41	80.82	81.23	81.64	82.05	82.46	82.87	83.29
48	83.71	84.13	84.56	84.99	85.42	85.85	86.28	86.71	87.14	87.58
49	88.02	88.46	88.90	89.34	89.79	90.24	90.69	91.14	91.59	92.05

<i>t</i> , °C	0	1	2	3	4	5	6	7	8	9
50	92.51	97.20	102.09	107.20	112.51	118.04	123.80	129.82	136.08	142.60
60	149.38	156.43	163.77	171.38	179.31	187.54	196.09	204.96	214.17	223.73
70	233.7	243.9	254.6	265.7	277.2	289.1	301.4	314.1	327.3	341.0
80	355.1	369.7	384.9	400.6	416.8	433.6	450.9	468.7	487.1	506.1
90	525.76	527.76	529.77	531.78	533.80	535.82	537.86	539.90	541.95	544.00
91	546.05	548.11	550.18	552.26	554.35	556.44	558.53	560.64	562.75	564.87
92	566.99	569.12	571.26	573.40	575.55	577.71	579.87	582.04	584.22	586.41
93	588.60	590.80	593.00	595.21	597.43	599.66	601.89	604.13	606.38	608.64
94	610.90	613.17	615.44	617.72	620.01	622.31	624.61	626.92	629.24	631.57
95	633.90	636.24	638.59	640.94	643.30	645.67	648.05	650.43	652.82	655.22
96	657.62	660.03	662.45	664.88	667.31	669.75	672.20	674.66	677.12	679.69
97	682.07	684.55	687.04	689.54	692.05	694.57	697.10	699.63	702.17	704.71
98	707.27	709.83	712.40	714.98	717.56	720.15	722.75	725.36	727.98	730.61
99	733.24	735.88	738.53	741.18	743.85	746.52	749.20	751.89	754.58	757.29
100	760.00	762.72	765.45	768.19	770.93	773.68	776.44	779.22	782.00	784.78
101	787.57	790.37	793.18	796.00	798.82	801.66	804.50	807.35	810.21	813.06

*From the Physikalisch-technische Reichsanstalt, Holborn, Scheel, and Henning, *Wärmetabellen*, Friedrich Vieweg & Sohn, Brunswick, 1909. By permission. For data at 50(0.2)101.8°C, see *Handbook of Chemistry and Physics*, 40th ed., p. 2326, Chemical Rubber Publishing Co. For a tabulation of temperature for pressures 700(1)779 mm Hg, see Atack, *Handbook of Chemical Data*, p. 117, Reinhold, New York, 1957. For a tabulation of pressure for 105(5)200(10)370°C, see Atack, p. 134, and for 100(1)374°C, see *Handbook of Chemistry and Physics*, 40th ed., pp. 2328-2330, Chemical Rubber Publishing Co.

TABLE 2-6 Vapor Pressure of Inorganic and Organic Liquids

Cmpd. no.	Name	Formula	CAS no.	C1	C2	C3	C4	C5	T_{min} , K	P_v at T_{min}	T_{max} , K	P_v at T_{max}
1	Methane	CH ₄	74828	39.205	-1324.4	-3.4366	3.1019E-05	2	90.69	1.1687E+04	190.56	4.5897E+06
2	Ethane	C ₂ H ₆	74840	51.857	-2598.7	-5.1283	1.4913E-05	2	90.35	1.1273E+00	305.32	4.8522E+06
3	Propane	C ₃ H ₈	74986	59.078	-3492.6	-6.0669	1.0919E-05	2	85.47	1.6788E-04	369.83	4.2135E+06
4	<i>n</i> -Butane	C ₄ H ₁₀	106978	66.343	-4363.2	-7.046	9.4509E-06	2	134.86	6.7441E-01	425.12	3.7699E+06
5	<i>n</i> -Pentane	C ₅ H ₁₂	109660	78.741	-5420.3	-8.8253	9.6171E-06	2	143.42	6.8642E-02	469.7	3.3642E+06
6	<i>n</i> -Hexane	C ₆ H ₁₄	110543	104.65	-6995.5	-12.702	1.2381E-05	2	177.83	9.0169E-01	507.6	3.0449E+06
7	<i>n</i> -Heptane	C ₇ H ₁₆	142825	87.829	-6996.4	-9.8802	7.2099E-06	2	182.57	1.8269E-01	540.2	2.7192E+06
8	<i>n</i> -Octane	C ₈ H ₁₈	111659	96.084	-7900.2	-11.003	7.1802E-06	2	216.38	2.1083E+00	568.7	2.4673E+06
9	<i>n</i> -Nonane	C ₉ H ₂₀	111842	109.35	-9030.4	-12.882	7.8544E-06	2	219.66	4.3058E-01	594.6	2.3054E+06
10	<i>n</i> -Decane	C ₁₀ H ₂₂	124185	112.73	-9749.6	-13.245	7.1266E-06	2	243.51	1.3930E+00	617.7	2.0908E+06
11	<i>n</i> -Undecane	C ₁₁ H ₂₄	1120214	131	-11143	-15.855	8.1871E-06	2	247.57	4.0836E-01	639	1.9493E+06
12	<i>n</i> -Dodecane	C ₁₂ H ₂₆	112403	137.47	-11976	-16.698	8.0906E-06	2	263.57	6.1534E-01	658	1.8223E+06
13	<i>n</i> -Tridecane	C ₁₃ H ₂₈	629505	137.45	-12549	-17.543	7.1275E-06	2	267.76	2.5096E-01	675	1.6786E+06
14	<i>n</i> -Tetradecane	C ₁₄ H ₃₀	629594	140.47	-13231	-16.859	6.5877E-06	2	279.01	2.5268E-01	693	1.5693E+06
15	<i>n</i> -Pentadecane	C ₁₅ H ₃₂	629629	135.57	-13478	-15.022	5.6136E-06	2	283.07	1.2884E-01	708	1.4743E+06
16	<i>n</i> -Hexadecane	C ₁₆ H ₃₄	544763	156.06	-15015	-18.941	6.8172E-06	2	291.31	9.2265E-02	723	1.4106E+06
17	<i>n</i> -Heptadecane	C ₁₇ H ₃₆	629787	156.95	-15557	-18.966	6.4559E-06	2	295.13	4.6534E-02	736	1.3438E+06
18	<i>n</i> -Octadecane	C ₁₈ H ₃₈	593453	157.68	-16093	-18.954	5.9272E-06	2	301.31	3.3909E-02	747	1.2555E+06
19	<i>n</i> -Nonadecane	C ₁₉ H ₄₀	629925	182.54	-17897	-22.498	7.4008E-06	2	305.04	1.5909E-02	758	1.2078E+06
20	<i>n</i> -Eicosane	C ₂₀ H ₄₂	112958	203.66	-19441	-25.525	8.8382E-06	2	309.58	9.2574E-03	768	1.1746E+06
21	2-Methylpropane	C ₄ H ₁₀	75285	100.18	-4841.9	-13.541	2.0063E-02	1	113.54	1.4051E-02	408.14	3.6199E+06
22	2-Methylbutane	C ₅ H ₁₂	78784	72.35	-5010.9	-7.883	8.9795E-06	2	113.25	1.1569E-04	460.43	3.3709E+06
23	2,3-Dimethylbutane	C ₆ H ₁₄	79298	77.235	-5695.9	-8.5109	8.0163E-06	2	145.19	1.5081E-02	499.98	3.1255E+06
24	2-Methylpentane	C ₆ H ₁₄	107835	77.36	-5791.7	-8.4912	7.7939E-06	2	119.55	9.2204E-06	497.5	3.0192E+06
25	2,3-Dimethylpentane	C ₇ H ₁₆	565593	78.282	-6347	-8.502	6.4169E-06	2	160	1.2631E-02	537.35	2.8823E+06
26	2,3,3-Trimethylpentane	C ₈ H ₁₈	560214	83.105	-6903.7	-9.1858	6.4703E-06	2	172.22	1.6820E-02	573.5	2.8116E+06
27	2,2,4-Trimethylpentane	C ₈ H ₁₈	540841	87.868	-6831.7	-9.9783	7.7729E-06	2	165.78	1.6187E-02	543.96	2.5630E+06
28	Ethylene	C ₂ H ₄	74851	74.242	-2707.2	-9.8462	2.2457E-02	1	104	1.2361E+02	282.34	5.0296E+06
29	Propylene	C ₃ H ₆	115071	57.263	-3382.4	-5.7707	1.0431E-05	2	87.89	9.3867E-04	365.57	4.6346E+06
30	1-Butene	C ₄ H ₈	106989	68.49	-4350.2	-7.4124	1.0503E-05	2	87.8	7.1809E-07	419.95	4.0391E+06
31	<i>cis</i> -2-Butene	C ₄ H ₈	590181	102.62	-5260.3	-13.764	1.9183E-02	1	134.26	2.4051E-01	435.58	4.2388E+06
32	<i>trans</i> -2-Butene	C ₄ H ₈	624646	70.589	-4530.4	-7.7229	1.0928E-05	2	167.62	7.4729E+01	428.63	4.0811E+06
33	1-Pentene	C ₅ H ₁₀	109671	120.15	-6192.4	-16.597	2.1922E-02	1	107.93	3.5210E-06	464.78	3.5557E+06
34	1-Hexene	C ₆ H ₁₂	592416	85.3	-6171.7	-9.702	8.9604E-06	2	133.39	2.5272E-04	504.03	3.1397E+06
35	1-Heptene	C ₇ H ₁₄	592767	92.68	-7055.2	-10.679	8.4459E-06	2	154.27	1.2810E-03	537.29	2.8225E+06
36	1-Octene	C ₈ H ₁₆	111660	97.57	-7836	-11.272	7.7267E-06	2	171.45	2.7570E-03	566.65	2.5735E+06
37	1-Nonene	C ₉ H ₁₈	124118	144.45	-9676.2	-19.446	1.8031E-02	1	191.78	8.5514E-03	593.25	2.3308E+06
38	1-Decene	C ₁₀ H ₂₀	872059	78.808	-8367.9	-7.9553	8.7442E-18	6	206.89	1.7308E-02	616.4	2.2092E+06
39	2-Methylpropene	C ₄ H ₈	115117	102.5	-5021.8	-13.88	2.0296E-02	1	132.81	6.2213E-01	417.9	3.9760E+06
40	2-Methyl-1-butene	C ₅ H ₁₀	563462	97.33	-5631.8	-12.589	1.5395E-02	1	135.58	1.9687E-02	465	3.4544E+06
41	2-Methyl-2-butene	C ₅ H ₁₀	513359	82.605	-5606.6	-9.4236	1.0512E-05	2	139.39	1.9447E-02	471	3.3769E+06
42	1,2-Butadiene	C ₄ H ₆	590192	39.714	-3769.9	-2.6407	6.9379E-18	6	136.95	4.4720E-01	452	4.3613E+06
43	1,3-Butadiene	C ₄ H ₆	106990	73.522	-4564.3	-8.1958	1.1580E-05	2	164.25	6.9110E+01	425.17	4.3041E+06
44	2-Methyl-1,3-butadiene	C ₅ H ₈	78795	79.656	-5239.6	-9.4314	9.5850E-03	1	127.27	2.4768E-03	484	3.8509E+06
45	Acetylene	C ₂ H ₂	74862	172.06	-5318.5	-27.223	5.4619E-02	1	192.4	1.2603E+05	308.32	6.1467E+06
46	Methylacetylene	C ₃ H ₄	74997	119.42	-5364.5	-16.81	2.5523E-02	1	170.45	3.7264E+02	402.39	5.6206E+06
47	Dimethylacetylene	C ₄ H ₄	503173	66.592	-4999.8	-6.8387	6.6793E-06	2	240.91	6.1212E+03	473.2	4.8699E+06
48	3-Methyl-1-butyne	C ₆ H ₈	598232	69.459	-5250	-7.1125	7.9289E-17	6	183.45	4.3551E+01	463.2	4.1986E+06
49	1-Pentyne	C ₅ H ₈	627190	82.805	-5683.8	-9.4301	1.0767E-05	2	167.45	2.3990E+00	481.2	4.1701E+06
50	2-Pentyne	C ₅ H ₈	627214	137.29	-7447.1	-19.01	2.1415E-02	1	163.83	2.0462E-01	519	4.0198E+06
51	1-Hexyne	C ₆ H ₁₀	693027	133.2	-7492.9	-18.405	2.2062E-02	1	141.25	3.9157E-04	516.2	3.6352E+06
52	2-Hexyne	C ₆ H ₁₀	764352	123.71	-7639	-16.451	1.6495E-02	1	183.65	5.4026E-01	549	3.5301E+06
53	3-Hexyne	C ₆ H ₁₀	928494	47.091	-5104	-3.6371	5.1621E-04	1	170.05	2.1950E-01	544	3.5397E+06
54	1-Heptyne	C ₇ H ₁₂	628717	66.447	-6395.6	-6.3848	1.1250E-17	6	192.22	6.7026E-01	559	3.1343E+06
55	1-Octyne	C ₈ H ₁₄	629050	82.353	-7240.6	-9.1843	5.8038E-03	1	193.55	1.0092E-01	585	2.8202E+06
56	Vinylacetylene ¹	C ₄ H ₄	689974	55.682	-4439.3	-5.0136	1.9650E-17	6	173.15	6.6899E+01	454	4.8874E+06

57	Cyclopentane	C ₅ H ₁₀	287923	51.434	-4770.6	-4.3515	1.9605E-17	6	179.28	9.4420E+00	511.76	4.5028E+06
58	Methylcyclopentane	C ₆ H ₁₂	96377	79.673	-6086.6	-8.7933	7.4046E-06	2	130.73	6.7059E-05	532.79	3.7808E+06
59	Ethylcyclopentane	C ₇ H ₁₄	1640897	88.622	-7011	-10.038	7.4481E-06	2	134.71	3.7061E-06	569.52	3.3970E+06
60	Cyclohexane	C ₆ H ₁₂	110827	116.51	-7103.3	-15.49	1.6959E-02	1	279.69	5.3802E+03	553.58	4.0958E+06
61	Methylcyclohexane	C ₇ H ₁₄	108872	92.611	-7077.8	-10.684	8.1239E-06	2	146.58	1.5256E-04	572.19	3.4828E+06
62	1,1-Dimethylcyclohexane	C ₈ H ₁₆	590669	81.184	-6927	-8.8498	5.4580E-06	2	239.66	6.0584E+01	591.15	2.9387E+06
63	Ethylcyclohexane	C ₈ H ₁₆	1678917	80.208	-7203.2	-8.6023	4.5901E-06	2	161.84	3.5747E-04	609.15	3.0411E+06
64	Cyclopentene	C ₅ H ₈	142290	49.88	-4649.7	-4.1191	1.9564E-17	6	138.13	1.6884E-02	507	4.8062E+06
65	1-Methylcyclopentene	C ₆ H ₁₀	693890	52.732	-5286.9	-4.4509	1.0883E-17	6	146.62	3.9787E-03	542	4.1303E+06
66	Cyclohexene	C ₆ H ₁₀	110838	88.184	-6624.9	-10.059	8.2566E-06	2	169.67	1.0377E-01	560.4	4.3922E+06
67	Benzene	C ₆ H ₆	71432	83.918	-6517.7	-9.3453	7.1182E-06	2	278.68	4.7620E+03	562.16	4.8819E+06
68	Toluene	C ₇ H ₈	108883	80.877	-6902.4	-8.7761	5.8034E-06	2	178.18	4.2348E-02	591.8	4.1012E+06
69	<i>o</i> -Xylene	C ₈ H ₁₀	95476	90.356	-7948.7	-10.081	5.9756E-06	2	247.98	2.1968E+01	630.33	3.7424E+06
70	<i>m</i> -Xylene	C ₈ H ₁₀	108383	84.782	-7598.3	-9.2612	5.5445E-06	2	225.3	3.2099E-06	617.05	3.5286E+06
71	<i>p</i> -Xylene	C ₈ H ₁₀	106423	85.475	-7595.8	-9.378	5.6875E-06	2	286.41	5.8144E+02	616.23	3.4984E+06
72	Ethylbenzene	C ₈ H ₁₀	100414	88.09	-7688.3	-9.7708	5.8844E-06	2	178.15	4.0140E-03	617.2	3.5968E+06
73	Propylbenzene	C ₉ H ₁₂	103651	136.83	-9544.8	-18.190	1.6590E-02	1	324.18	2.0014E+03	638.32	3.2001E+06
74	1,2,4-Trimethylbenzene	C ₉ H ₁₂	95636	60.658	-7260.4	-5.3772	4.5816E-18	6	229.33	7.9735E-01	649.13	3.2533E+06
75	Isopropylbenzene	C ₉ H ₁₂	98828	143.62	-9687.7	-19.305	1.7703E-02	1	177.14	3.8034E-04	631.1	3.1837E+06
76	1,3,5-Trimethylbenzene	C ₉ H ₁₂	108678	48.603	-6545.2	-3.6412	1.9307E-18	6	228.42	1.1889E+00	637.36	3.1119E+06
77	<i>p</i> -Isopropyltoluene	C ₁₀ H ₁₄	99876	107.71	-9402.7	-12.545	6.6661E-06	2	205.25	9.9261E-03	653.15	2.7957E+06
78	Naphthalene	C ₁₀ H ₈	91203	62.447	-8109	-5.5571	2.0800E-18	6	353.43	9.9229E+02	748.35	3.9941E+06
79	Biphenyl	C ₁₂ H ₁₀	92524	76.811	-9878.5	-7.4384	2.0436E-18	6	342.2	9.3752E+01	789.26	3.8615E+06
80	Styrene	C ₈ H ₈	100425	105.93	-8685.9	-12.42	7.5583E-06	2	242.54	1.0613E+01	636	3.8234E+06
81	<i>m</i> -Terphenyl	C ₁₈ H ₁₄	92068	88.044	-13367	-8.6482	8.7874E-19	6	360	1.0112E+00	924.85	3.5297E+06
82	Methanol	CH ₄ O	67561	81.768	-6876	-8.7078	7.1926E-06	2	175.47	1.1147E-01	512.64	8.1402E+06
83	Ethanol	C ₂ H ₆ O	64175	74.475	-7164.3	-7.327	3.1340E-06	2	159.05	4.8459E-04	513.92	6.1171E+06
84	1-Propanol	C ₃ H ₈ O	71238	88.134	-8498.6	-9.0766	8.3303E-18	6	146.95	3.0828E-07	536.78	5.1214E+06
85	1-Butanol	C ₄ H ₁₀ O	71363	93.173	-9185.9	-9.7464	4.7796E-18	6	184.51	5.7220E-04	563.05	4.3392E+06
86	2-Butanol	C ₄ H ₁₀ O	78922	152.54	-11111	-19.025	1.0426E-05	2	158.45	1.1323E-06	536.05	4.2014E+06
87	2-Propanol	C ₃ H ₈ O	67630	76.964	-7623.8	-7.4924	5.9436E-18	6	185.28	3.6606E-02	508.3	4.7908E+06
88	2-Methyl-2-propanol	C ₄ H ₁₀ O	75650	172.31	-11590	-22.118	1.3709E-05	2	298.97	5.9356E+03	506.21	3.9910E+06
89	1-Pentanol	C ₅ H ₁₂ O	71410	168.96	-12659	-21.366	1.1591E-05	2	195.56	3.1816E-04	586.15	3.8657E+06
90	2-Methyl-1-butanol	C ₅ H ₁₂ O	137326	410.44	-20262	-62.366	6.3353E-02	1	203	3.7992E-04	565	3.8749E+06
91	3-Methyl-1-butanol	C ₅ H ₁₂ O	123513	107.02	-10237	-11.695	6.8003E-18	6	155.95	2.1036E-08	577.2	3.9013E+06
92	1-Hexanol	C ₆ H ₁₄ O	111273	117.31	-11239	-13.149	9.3676E-18	6	228.55	3.7401E-02	611.35	3.4557E+06
93	1-Heptanol	C ₇ H ₁₆ O	111706	160.08	-14095	-19.211	1.7043E-17	6	239.15	1.6990E-02	631.9	3.1810E+06
94	Cyclohexanol	C ₆ H ₁₂ O	108930	135.01	-12238	-15.702	1.0349E-17	6	296.6	7.9382E+01	650	4.2456E+06
95	Ethylene glycol	C ₂ H ₆ O ₂	107211	79.276	-10105	-7.521	7.3408E-19	6	260.15	2.4834E-01	719.7	7.7100E+06
96	1,2-Propylene glycol	C ₃ H ₈ O ₂	57556	212.8	-15420	-28.109	2.1564E-05	2	213.15	9.2894E-05	626	6.0413E+06
97	Phenol	C ₆ H ₆ O	108952	95.444	-10113	-10.09	6.7603E-18	6	314.06	1.8798E+02	694.25	6.0585E+06
98	<i>o</i> -Cresol	C ₇ H ₈ O	95487	210.88	-13928	-29.483	2.5182E-02	1	304.19	6.5326E+01	697.55	5.0583E+06
99	<i>m</i> -Cresol	C ₇ H ₈ O	108394	95.403	-10581	-10.004	4.3032E-18	6	285.39	5.8624E+00	705.85	4.5221E+06
100	<i>p</i> -Cresol	C ₇ H ₈ O	106445	118.53	-11957	-13.293	8.6988E-18	6	307.93	3.4466E+01	704.65	5.1507E+06
101	Dimethyl ether	C ₂ H ₆ O	115106	44.704	-3525.6	-3.4444	5.4574E-17	6	131.65	3.0496E+00	400.1	5.2735E+06
102	Methyl ethyl ether	C ₃ H ₈ O	540670	205.79	-9834.5	-28.739	3.5317E-05	2	160	5.3423E-01	437.8	4.4658E+06
103	Methyl <i>n</i> -propyl ether	C ₄ H ₁₀ O	557175	50.83	-4781.7	-4.1773	9.4076E-18	6	133.97	4.8875E-03	476.3	3.7721E+06
104	Methyl isopropyl ether	C ₄ H ₁₀ O	598538	55.096	-4793.2	-4.8689	2.9518E-17	6	127.93	2.4971E-03	464.5	3.8892E+06
105	Methyl <i>n</i> -butyl ether	C ₅ H ₁₂ O	628284	102.04	-6954.9	-12.278	1.2131E-05	2	157.48	1.9430E-02	510	3.3089E+06
106	Methyl isobutyl ether	C ₅ H ₁₂ O	625445	58.165	-5362.1	-5.2568	2.0194E-17	6	150	1.9801E-02	497	3.4130E+06
107	Methyl <i>tert</i> -butyl ether	C ₅ H ₁₂ O	1634044	55.875	-5131.6	-4.9604	1.9123E-17	6	164.55	5.3566E-01	497.1	3.4106E+06
108	Diethyl ether	C ₄ H ₁₀ O	60297	136.9	-6954.3	-19.254	2.4508E-02	1	156.85	3.9545E-01	466.7	3.6412E+06
109	Ethyl propyl ether	C ₅ H ₁₂ O	628320	143.11	-8353.7	-18.751	2.0620E-05	2	145.65	7.3931E-04	500.23	3.3729E+06
110	Ethyl isopropyl ether	C ₅ H ₁₂ O	625547	57.723	-5236.9	-5.2136	2.2998E-17	6	140	4.3092E-03	489	3.4145E+06
111	Methyl phenyl ether	C ₇ H ₈ O	100663	128.06	-9307.7	-16.693	1.4919E-02	1	235.65	2.4466E+00	645.6	4.2731E+06
112	Diphenyl ether	C ₁₂ H ₁₀ O	101848	59.969	-8585.5	-5.1538	1.9983E-18	6	300.03	7.0874E+00	766.8	3.0971E+06

TABLE 2-6 Vapor Pressure of Inorganic and Organic Liquids (Continued)

Cmpd. no.	Name	Formula	CAS no.	C1	C2	C3	C4	C5	T_{min} , K	P_v at T_{min}	T_{max} , K	P_v at T_{max}
113	Formaldehyde	CH ₂ O	50000	101.51	-4917.2	-13.765	2.2031E-02	1	181.15	8.8700E+02	408	6.5935E+06
114	Acetaldehyde	C ₂ H ₄ O	75707	193.69	-8036.7	-29.502	4.3678E-02	1	150.15	3.2320E-01	466	5.5652E+06
115	1-Propanal	C ₃ H ₆ O	123386	80.581	-5896.1	-8.9301	8.2236E-06	2	170	1.3133E+00	504.4	4.9189E+06
116	1-Butanal	C ₄ H ₈ O	123728	99.33	-7083.6	-11.733	1.0027E-05	2	176.75	3.1699E-01	537.2	4.3232E+06
117	1-Pentanal	C ₅ H ₁₀ O	110623	149.58	-8890	-20.697	2.2101E-02	1	182	5.2282E-02	566.1	3.9685E+06
118	1-Hexanal	C ₆ H ₁₂ O	66251	81.507	-7776.8	-8.4516	1.5143E-07	6	217.15	1.2473E+00	591	3.4607E+06
119	1-Heptanal	C ₇ H ₁₄ O	111717	107.17	-9070.3	-12.503	7.4446E-06	2	229.8	1.1177E+00	617	3.1829E+06
120	1-Octanal	C ₈ H ₁₆ O	124130	250.25	-16162	-33.927	2.2349E-05	2	246	4.1640E-01	638.1	2.9704E+06
121	1-Nonanal	C ₉ H ₁₈ O	124196	337.71	-18506	-50.224	4.7345E-02	1	255.15	3.4172E-01	658	2.7430E+06
122	1-Decanal	C ₁₀ H ₂₀ O	112312	201.64	-15133	-26.264	1.4625E-05	2	267.15	4.8648E-01	674.2	2.5989E+06
123	Acetone	C ₃ H ₆ O	67641	69.006	-5599.6	-7.0985	6.2237E-06	2	178.45	2.7851E+00	508.2	4.7091E+06
124	Methyl ethyl ketone	C ₅ H ₈ O	78933	72.698	-6143.6	-7.5779	5.6476E-06	2	186.48	1.3904E+00	535.5	4.1201E+06
125	2-Pentanone	C ₅ H ₁₀ O	107879	84.635	-7078.4	-9.3	6.2702E-06	2	196.29	7.5235E-01	561.08	3.7062E+06
126	Methyl isopropyl ketone	C ₅ H ₁₀ O	563804	308.74	-13693	-47.557	5.7002E-02	1	181.15	2.2648E-02	553	3.8413E+06
127	2-Hexanone	C ₆ H ₁₂ O	591786	65.841	-7042	-6.1376	7.2196E-18	6	217.35	1.5111E+00	587.05	3.3120E+06
128	Methyl isobutyl ketone	C ₆ H ₁₂ O	108110	153.23	-10055	-19.848	1.6426E-05	2	189.15	3.3536E-02	571.4	3.2659E+06
129	3-Methyl-2-pentanone	C ₆ H ₁₂ O	565617	64.641	-6457.4	-6.218	3.4543E-06	2	167.15	3.2662E-03	573	3.3213E+06
130	3-Pentanone	C ₅ H ₁₀ O	96220	44.286	-5415.1	-3.0913	1.8580E-18	6	234.18	7.3422E+01	560.95	3.6993E+06
131	Ethyl isopropyl ketone	C ₆ H ₁₂ O	565695	206.77	-12537	-27.894	2.2462E-05	2	200	6.0339E-02	567	3.3424E+06
132	Diisopropyl ketone	C ₇ H ₁₄ O	565800	96.919	-8014.2	-11.093	7.3452E-06	2	204.81	3.9036E-01	576	3.0606E+06
133	Cyclohexanone	C ₆ H ₁₀ O	108941	95.118	-8300.4	-7.966	6.5037E-06	2	242	6.9667E+00	653	4.0126E+06
134	Methyl phenyl ketone	C ₈ H ₈ O	98862	62.688	-8088.8	-5.5434	2.0774E-18	6	292.81	3.5899E+01	709.5	3.8451E+06
135	Formic acid	CH ₂ O ₂	64186	50.323	-5378.2	-4.203	3.4697E-06	2	281.45	2.4024E+03	588	5.8074E+06
136	Acetic acid	C ₂ H ₄ O ₂	64197	53.27	-6304.5	-4.2985	8.8865E-18	6	289.81	1.2769E+03	591.95	5.7390E+06
137	Propionic acid	C ₃ H ₆ O ₂	79094	54.552	-7149.4	-4.2769	1.1843E-18	6	252.45	1.3142E+01	600.81	4.6080E+06
138	<i>n</i> -Butyric acid	C ₄ H ₈ O ₂	107926	93.815	-9942.2	-9.8019	9.3124E-18	6	267.95	6.7754E+00	615.7	4.0705E+06
139	Isobutyric acid	C ₄ H ₈ O ₂	79312	110.38	-10540	-12.262	1.4310E-17	6	227.15	7.8244E-02	605	3.6834E+06
140	Benzoic acid	C ₇ H ₆ O ₂	65850	85.513	-11829	-8.6826	2.3248E-19	6	395.45	7.9550E+02	751	4.4691E+06
141	Acetic anhydride	C ₄ H ₆ O ₃	108247	100.95	-8873.2	-11.451	6.1316E-06	2	200.15	2.1999E-02	606	3.9702E+06
142	Methyl formate	C ₂ H ₄ O ₂	107313	77.184	-5606.1	-8.392	7.8468E-06	2	174.15	6.8808E+00	487.2	5.9829E+06
143	Methyl acetate	C ₃ H ₆ O ₂	79209	61.267	-5618.6	-5.6473	2.1080E-17	6	175.15	1.0170E+00	506.55	4.6948E+06
144	Methyl propionate	C ₄ H ₈ O ₂	554121	70.717	-6439.7	-6.9845	2.0129E-17	6	185.65	6.3409E-01	530.6	4.0278E+06
145	Methyl <i>n</i> -butyrate	C ₅ H ₁₀ O ₂	623427	71.87	-6885.7	-7.0944	1.4903E-17	6	187.35	1.3435E-01	554.5	3.4797E+06
146	Ethyl formate	C ₃ H ₆ O ₂	109944	73.833	-5817	-7.809	6.3200E-06	2	193.55	1.8119E+01	508.4	4.7080E+06
147	Ethyl acetate	C ₄ H ₈ O ₂	141786	66.824	-6227.6	-6.41	1.7914E-17	6	189.6	1.4318E+00	523.3	3.8502E+06
148	Ethyl propionate	C ₅ H ₁₀ O ₂	105373	105.64	-8007	-12.477	9.0000E-06	2	199.25	7.7988E-01	546	3.3365E+06
149	Ethyl <i>n</i> -butyrate	C ₆ H ₁₂ O ₂	105544	57.661	-6346.5	-5.032	8.2534E-18	6	175.15	1.0390E-02	571	2.9352E+06
150	<i>n</i> -Propyl formate	C ₄ H ₈ O ₂	110747	104.08	-7535.9	-12.348	9.6020E-06	2	180.25	2.1101E-01	538	4.0310E+06
151	<i>n</i> -Propyl acetate	C ₅ H ₁₀ O ₂	109604	115.16	-8433.9	-13.934	1.0346E-05	2	178.15	1.7113E-02	549.73	3.3657E+06
152	<i>n</i> -Butyl acetate	C ₆ H ₁₂ O ₂	123864	71.34	-7285.8	-6.9459	9.9895E-18	6	199.65	1.4347E-01	579.15	3.1097E+06
153	Methyl benzoate	C ₈ H ₈ O ₂	93583	82.976	-9226.1	-8.4427	5.9115E-18	6	260.75	1.8653E+00	693	3.5896E+06
154	Ethyl benzoate	C ₉ H ₁₀ O ₂	93890	53.024	-7676.8	-4.1593	1.6850E-18	6	238.45	1.4385E-01	698	3.2190E+06
155	Vinyl acetate	C ₄ H ₆ O ₂	108054	57.406	-5702.8	-5.0307	1.1042E-17	6	180.35	7.0586E-01	519.13	3.9298E+06
156	Methylamine	CH ₃ N	74895	75.206	-5082.8	-8.0919	8.1130E-06	2	179.69	1.7671E+02	430.05	7.4139E+06
157	Dimethylamine	C ₂ H ₇ N	124403	71.738	-5302	-7.3324	6.4200E-17	6	180.96	7.5575E+01	437.2	5.2583E+06
158	Trimethylamine	C ₃ H ₉ N	75503	134.68	-6055.8	-19.415	2.8619E-02	1	156.08	9.9206E+00	433.25	4.1020E+06
159	Ethylamine	C ₂ H ₇ N	75047	81.56	-5596.9	-9.0779	8.7920E-06	2	192.15	1.5183E+02	456.15	5.5937E+06
160	Diethylamine	C ₄ H ₁₁ N	109897	49.314	-4949	-3.9256	9.1978E-18	6	223.35	3.7411E+02	496.6	3.6744E+06
161	Triethylamine	C ₆ H ₁₅ N	121448	56.55	-5681.9	-4.9815	1.2363E-17	6	158.45	1.0646E-02	535.15	3.0373E+06
162	<i>n</i> -Propylamine	C ₃ H ₉ N	107108	58.398	-5312.7	-5.2876	1.9913E-06	2	188.36	1.3004E+01	496.95	4.7381E+06
163	di- <i>n</i> -Propylamine	C ₆ H ₁₅ N	142847	54	-6018.5	-4.4981	9.9684E-18	6	210.15	3.6942E+00	550	3.1113E+06
164	Isopropylamine	C ₃ H ₉ N	75310	136.66	-7201.5	-18.934	2.2255E-02	1	177.95	7.7251E+00	471.85	4.5404E+06
165	Diisopropylamine	C ₆ H ₁₅ N	108189	462.84	-18227	-73.734	9.2794E-02	1	176.85	4.4724E-03	523.1	3.1987E+06
166	Aniline	C ₆ H ₇ N	62533	66.287	-8207.1	-6.0132	2.8414E-18	6	267.13	7.1322E+00	699	5.3514E+06

167	N-Methylaniline	C ₇ H ₉ N	100618	70.843	-8517.5	-6.7007	5.6411E-18	6	216.15	1.0207E-02	701.55	5.1935E+06
168	N,N-Dimethylaniline	C ₈ H ₁₁ N	121697	51.352	-7160	-4.0127	8.1481E-07	2	275.6	1.7940E+01	687.15	3.6262E+06
169	Ethylene oxide	C ₂ H ₄ O	75218	91.944	-5293.4	-11.682	1.4902E-02	1	160.65	7.7879E+00	469.15	7.2553E+06
170	Furan	C ₄ H ₄ O	110009	74.738	-5417	-8.0636	7.4700E-06	2	187.55	5.0026E+01	490.15	5.5497E+06
171	Thiophene	C ₄ H ₄ S	110021	89.171	-6860.3	-10.104	7.4769E-06	2	234.94	1.8538E+02	579.35	5.7145E+06
172	Pyridine	C ₅ H ₅ N	110861	82.154	-7211.3	-8.8646	5.2528E-06	2	231.51	2.0535E+01	619.95	5.6356E+06
173	Formamide	CH ₃ NO	75127	100.3	-10763	-10.946	3.8503E-06	2	275.6	1.0350E+00	771	7.7514E+06
174	N,N-Dimethylformamide	C ₃ H ₇ NO	68122	82.762	-7955.5	-8.8038	4.2431E-06	2	212.72	1.9532E-01	649.6	4.3653E+06
175	Acetamide	C ₂ H ₅ NO	60355	125.81	-12376	-14.589	5.0824E-06	2	353.33	3.3637E+02	761	6.5688E+06
176	N-Methylacetamide	C ₃ H ₇ NO	79163	79.128	-9523.9	-7.7355	3.1616E-18	6	301.15	2.8618E+01	718	4.9973E+06
177	Acetonitrile	C ₂ H ₃ N	75058	58.302	-5385.6	-5.4954	5.3634E-06	2	229.32	1.8694E+02	545.5	4.8517E+06
178	Propionitrile	C ₃ H ₅ N	107120	62.699	-6703.5	-9.1506	7.5424E-06	2	180.26	1.6936E-01	564.4	4.1906E+06
179	n-Butyronitrile	C ₄ H ₇ N	109740	66.32	-6714.9	-6.3087	1.3516E-17	6	161.25	6.1777E-04	582.25	3.7870E+06
180	Benzonitrile	C ₇ H ₅ N	100470	55.463	-7430.8	-4.548	1.7501E-18	6	260.4	5.1063E+00	699.35	4.2075E+06
181	Methyl mercaptan	CH ₃ S	74931	54.15	-4337.7	-4.8127	4.5000E-17	6	150.18	3.1479E+00	469.95	7.2309E+06
182	Ethyl mercaptan	C ₂ H ₅ S	75081	65.551	-5027.4	-6.6853	6.3208E-06	2	125.26	1.1384E-03	499.15	5.4918E+06
183	n-Propyl mercaptan	C ₃ H ₇ S	107039	62.165	-5624	-5.8595	2.0597E-17	6	159.95	6.5102E-02	536.6	4.6272E+06
184	n-Butyl mercaptan	C ₄ H ₁₀ S	109795	65.382	-6262.4	-6.2585	1.4943E-17	6	157.46	2.3532E-03	570.1	3.9730E+06
185	Isobutyl mercaptan	C ₄ H ₁₀ S	513440	61.736	-5909.2	-5.7554	1.5119E-17	6	128.31	4.7502E-06	559	4.0603E+06
186	sec-Butyl mercaptan	C ₄ H ₁₀ S	513531	60.649	-5785.9	-5.6113	1.5877E-17	6	133.02	3.3990E-05	554	4.0598E+06
187	Dimethyl sulfide	C ₂ H ₆ S	75183	83.485	-5711.7	-9.4999	9.8449E-06	2	174.88	7.9009E+00	503.04	5.5324E+06
188	Methyl ethyl sulfide	C ₃ H ₈ S	624895	79.07	-6114.1	-8.631	6.5333E-06	2	167.23	2.2456E-01	533	4.2610E+06
189	Diethyl sulfide	C ₄ H ₁₀ S	352932	60.867	-5969.6	-5.5979	1.4530E-17	6	169.2	4.3401E-02	557.15	3.9629E+06
190	Fluoromethane	CH ₃ F	593533	59.123	-3043.7	-6.1845	1.6637E-05	2	131.35	4.3287E+02	317.42	5.8754E+06
191	Chloromethane	CH ₃ Cl	74873	64.697	-4048.1	-6.8066	1.0371E-05	2	175.43	8.7091E+02	416.25	6.6905E+06
192	Trichloromethane	CHCl ₃	67663	146.43	-7792.3	-20.614	2.4578E-02	1	207.15	5.2515E+01	536.4	5.5543E+06
193	Tetrachloromethane	CCl ₄	56235	78.441	-6128.1	-8.5766	6.8465E-06	2	250.33	1.1225E+03	556.35	4.5436E+06
194	Bromomethane	CH ₃ Br	74839	72.586	-4698.6	-7.9966	1.1553E-05	2	179.47	1.9544E+02	467	7.9972E+06
195	Fluoroethane	C ₂ H ₅ F	353366	56.639	-3576.5	-5.5801	9.8969E-06	2	129.95	8.3714E+00	375.31	5.0060E+06
196	Chloroethane	C ₂ H ₅ Cl	75003	70.159	-4786.7	-7.5387	9.3370E-06	2	134.8	1.1658E-01	460.35	5.4578E+06
197	Bromoethane	C ₂ H ₅ Br	74964	62.217	-5113.3	-5.9761	4.7174E-17	6	154.55	3.7155E-01	503.8	6.2903E+06
198	1-Chloropropane	C ₃ H ₇ Cl	540545	79.24	-5718.8	-8.789	8.4486E-06	2	150.35	6.9630E-02	503.15	4.5812E+06
199	2-Chloropropane	C ₃ H ₇ Cl	75296	46.854	-4445.5	-3.6533	1.3260E-17	6	155.97	9.0844E-01	489	4.5097E+06
200	1,1-Dichloropropane	C ₃ H ₆ Cl ₂	78999	83.495	-6661.4	-9.2386	6.7652E-06	2	200	4.5248E+00	560	4.2394E+06
201	1,2-Dichloropropane	C ₃ H ₆ Cl ₂	78875	65.955	-6015.6	-6.5509	4.3172E-06	2	172.71	8.2532E-02	572	4.2319E+06
202	Vinyl chloride	C ₂ H ₃ Cl	75014	91.432	-5141.7	-10.981	1.4318E-05	2	119.36	1.9178E-02	432	5.7495E+06
203	Fluorobenzene	C ₆ H ₅ F	462066	51.915	-5439	-4.2896	8.7527E-18	6	230.94	1.5142E+02	560.09	4.5437E+06
204	Chlorobenzene	C ₆ H ₅ Cl	108907	54.144	-6244.4	-4.5343	4.7030E-18	6	227.95	8.4456E+00	632.35	4.5293E+06
205	Bromobenzene	C ₆ H ₅ Br	108861	63.749	-7130.2	-5.879	5.2136E-18	6	242.43	7.8364E+00	670.15	4.5196E+06
206	Air ³		132259100	21.662	-692.39	-0.39208	4.7574E-03	1	59.15	5.6421E+03	132.45	3.7934E+06
207	Hydrogen	H ₂	1333740	12.69	-94.896	1.1125	3.2915E-04	2	13.95	7.2116E+03	33.19	1.3154E+06
208	Helium-4 ⁴	He	7440597	11.533	-8.99	0.6724	2.7430E-01	1	1.76	1.4625E+03	5.2	2.2845E+05
209	Neon	Ne	7440019	29.755	-271.06	-2.6081	5.2700E-04	2	24.56	4.3800E+04	44.4	2.6652E+06
210	Argon	Ar	7440371	42.127	-1093.1	-4.1425	5.7254E-05	2	83.78	6.8721E+04	150.86	4.8963E+06
211	Fluorine	F ₂	7782414	42.393	-1103.3	-4.1203	5.7815E-05	2	53.48	2.5272E+02	144.12	5.1674E+06
212	Chlorine	Cl ₂	7782505	71.334	-3855	-8.5171	1.2378E-02	1	172.12	1.3660E+03	417.15	7.7930E+06
213	Bromine	Br ₂	7726956	108.26	-6592	-14.16	1.6043E-02	1	265.85	5.8534E+03	584.15	1.0276E+07
214	Oxygen	O ₂	7782447	51.245	-1200.2	-6.4361	2.8405E-02	1	54.36	1.4754E+02	154.58	5.0206E+06
215	Nitrogen	N ₂	7727379	58.282	-1084.1	-8.3144	4.4127E-02	1	63.15	1.2508E+04	126.2	3.3906E+06
216	Ammonia	NH ₃	7664417	90.483	-4669.7	-11.607	1.7194E-02	1	195.41	6.1111E+03	405.65	1.1301E+07
217	Hydrazine	N ₂ H ₄	302012	76.858	-7245.2	-8.22	6.1557E-03	1	274.69	4.0847E+02	653.15	1.4731E+07
218	Nitrous oxide	N ₂ O	10024972	96.512	-4045	-12.277	2.8860E-05	2	182.3	8.6908E+04	309.57	7.2782E+06

TABLE 2-6 Vapor Pressure of Inorganic and Organic Liquids (Concluded)

Cmpd. no.	Name	Formula	CAS no.	C1	C2	C3	C4	C5	T_{\min} , K	P_a at T_{\min}	T_{\max} , K	P_a at T_{\max}
219	Nitric oxide	NO	10102439	72.974	-2650	-8.261	9.7000E-15	6	109.5	2.1956E+04	180.15	6.5156E+06
220	Cyanogen	C ₂ N ₂	460195	88.589	-5059.9	-10.483	1.5403E-05	2	245.25	7.3385E+04	400.15	5.9438E+06
221	Carbon monoxide	CO	630080	45.698	-1076.6	-4.8814	7.5673E-05	2	68.15	1.5430E+04	132.92	3.4940E+06
222	Carbon dioxide	CO ₂	124389	140.54	-4735	-21.268	4.0909E-02	1	216.58	5.1867E+05	304.21	7.3896E+06
223	Carbon disulfide	CS ₂	75150	67.114	-4820.4	-7.5303	9.1695E-03	1	161.11	1.4944E+00	552	8.0408E+06
224	Hydrogen fluoride	HF	7664393	59.544	-4143.8	-6.1764	1.4161E-05	2	189.79	3.3683E+02	461.15	6.4872E+06
225	Hydrogen chloride	HCl	7647010	104.27	-3731.2	-15.047	3.1340E-02	1	158.97	1.3522E+04	324.65	8.3564E+06
226	Hydrogen bromide ²	HBr	10035106	29.315	-2424.5	-1.1354	2.3806E-18	6	185.15	2.9501E+04	363.15	8.4627E+06
227	Hydrogen cyanide	HCN	74908	36.75	-3927.1	-2.1245	3.8948E-17	6	259.83	1.8687E+04	456.65	5.3527E+06
228	Hydrogen sulfide	H ₂ S	7783064	85.584	-3839.9	-11.199	1.8848E-02	1	187.68	2.2873E+04	373.53	8.9988E+06
229	Sulfur dioxide	SO ₂	7446095	47.365	-4084.5	-3.6469	1.7990E-17	6	197.67	1.6743E+03	430.75	7.8596E+06
230	Sulfur trioxide	SO ₃	7446119	180.99	-12060	-22.839	7.2350E-17	6	289.95	2.0934E+04	490.85	8.1919E+06
231	Water	H ₂ O	7732185	73.649	-7258.2	-7.3037	4.1653E-06	2	273.16	6.1056E+02	647.13	2.1940E+07

All substances are listed in alphabetical order in Table 2-6a.

Compiled from Daubert, T. E., R. P. Danner, H. M. Sibul, and C. C. Stebbins, DIPPR Data Compilation of Pure Compound Properties, Project 801 Sponsor Release, July, 1993, Design Institute for Physical Property Data, AIChE, New York, NY; and from Thermodynamics Research Center, "Selected Values of Properties of Hydrocarbons and Related Compounds," Thermodynamics Research Center Hydrocarbon Project, Texas A&M University, College Station, Texas (extant 1994).

Temperatures are in K; vapor pressures are in Pa.

$P_a \times 9.869233E-06 = \text{atm}$; $P_a \times 1.450377E-04 = \text{psia}$; vapor pressure = $\exp [C1 + (C2/T) + C3 \times \ln(T) + C4 \times T^{C5}]$.

¹ Decomposes violently on heating. Forms explosive peroxides with air or oxygen. Polymerizes under pressure and heat.

² Coefficients are hypothetical above the decomposition temperature.

³ At the bubble point.

⁴ Exhibits superfluid properties below 2.2 K.

TABLE 2-6a Alphabetical Index to Substances in Tables 2-6, 2-30, 2-164, 2-193, 2-196, 2-198, and 2-221

Name	Synonym	Cmpd. no.	Formula	Name	Synonym	Cmpd. no.	Formula
Acetaldehyde	Ethanal	114	C ₂ H ₄ O	1-Hexene		34	C ₆ H ₁₂
Acetamide		175	C ₂ H ₅ NO	1-Hexyne		51	C ₆ H ₁₀
Acetic acid	Ethanoic acid	136	C ₂ H ₄ O ₂	2-Hexyne		52	C ₆ H ₁₀
Acetic anhydride		141	C ₄ H ₆ O ₃	3-Hexyne		53	C ₆ H ₁₀
Acetone	2-Propanone	123	C ₃ H ₆ O	Hydrazine		217	N ₂ H ₄
Acetonitrile	Methyl cyanide	177	C ₂ H ₃ N	Hydrogen		207	H ₂
Acetophenone	Methyl phenyl ketone	134	C ₈ H ₈ O	Hydrogen bromide		226	HBr
Acetylene		45	C ₂ H ₂	Hydrogen chloride		225	HCl
Air		206		Hydrogen cyanide		227	HCN
Ammonia		216	NH ₃	Hydrogen fluoride		224	HF
Aniline		166	C ₆ H ₇ N	Hydrogen sulfide		228	H ₂ S
Anisole	Methyl phenyl ether	111	C ₇ H ₈ O				
Argon		210	Ar	Isobutyl mercaptan	2-Methyl-1-propanethiol	185	C ₄ H ₁₀ S
				Isobutyric acid	2-Methylpropanoic acid	139	C ₄ H ₈ O ₂
Benzene		67	C ₆ H ₆	Isooctane	2,2,4-Trimethylpentane	27	C ₈ H ₁₈
Benzoic acid		140	C ₇ H ₆ O ₂	Isoprene	2-Methyl-1,3-butadiene	44	C ₅ H ₈
Benzonitrile	Phenyl cyanide	180	C ₇ H ₅ N	Isopropylamine		164	C ₃ H ₉ N
Biphenyl	1,1'-Biphenyl	79	C ₁₂ H ₁₀				
Bromine		213	Br ₂	Mesitylene	1,3,5-Trimethylbenzene	76	C ₉ H ₁₂
Bromobenzene		205	C ₆ H ₅ Br	Methane		1	CH ₄
Bromoethane	Ethyl bromide	197	C ₂ H ₅ Br	Methanol	Methyl alcohol	82	CH ₃ O
Bromomethane	Methyl bromide	194	CH ₃ Br	N-Methylacetamide		176	C ₃ H ₇ NO
1,2-Butadiene		42	C ₄ H ₆	Methyl acetate		143	C ₃ H ₆ O ₂
1,3-Butadiene		43	C ₄ H ₆	Methylacetylene		46	C ₃ H ₄
n-Butane		4	C ₄ H ₁₀	Methylamine		156	CH ₃ N
1-Butanol		85	C ₄ H ₁₀ O	N-Methylaniline		167	C ₇ H ₉ N
2-Butanol	sec-Butyl alcohol	86	C ₄ H ₁₀ O	Methyl benzoate		153	C ₈ H ₈ O ₂
1-Butene		30	C ₄ H ₈	2-Methylbutane	Isopentane	22	C ₅ H ₁₂
cis-2-Butene	Z-2-Butene	31	C ₄ H ₈	2-Methyl-1-butanol		90	C ₅ H ₁₂ O
trans-2-Butene	E-2-Butene	32	C ₄ H ₈	3-Methyl-1-butanol	Isoamyl alcohol	91	C ₅ H ₁₂ O
n-Butyl acetate		152	C ₆ H ₁₂ O ₂	2-Methyl-1-butene		40	C ₅ H ₁₀
n-Butyl mercaptan	1-Butanethiol	184	C ₄ H ₁₀ S	2-Methyl-2-butene	Amylene	41	C ₅ H ₁₀
sec-Butyl mercaptan	2-Butanethiol	186	C ₄ H ₁₀ S	Methyl butyl ether		105	C ₇ H ₁₆ O
Butyraldehyde	Butanal	116	C ₄ H ₈ O	3-Methyl-1-butyne		48	C ₅ H ₈
n-Butyric acid		138	C ₄ H ₈ O ₂	Methyl butyrate		145	C ₅ H ₁₀ O ₂
n-Butyronitrile	Propyl cyanide	179	C ₄ H ₇ N	Methylcyclohexane		61	C ₇ H ₁₄
				Methylcyclopentane		58	C ₆ H ₁₂
Carbon dioxide		222	CO ₂	1-Methylcyclopentene		65	C ₆ H ₁₀
Carbon disulfide		223	CS ₂	Methyl ethyl ether		102	C ₃ H ₈ O
Carbon monoxide		221	CO	Methyl ethyl ketone	2-Butanone	124	C ₄ H ₈ O
Carbon tetrachloride	Tetrachloromethane	193	CCl ₄	Methyl ethyl sulfide	2-Thiabutane	188	C ₃ H ₈ S
Chlorine		212	Cl ₂	Methyl formate		142	C ₂ H ₄ O ₂
Chlorobenzene		204	C ₆ H ₅ Cl	Methyl isobutyl ether		106	C ₅ H ₁₂ O
Chloroethane	Ethyl chloride	196	C ₂ H ₅ Cl	Methyl isobutyl ketone		128	C ₆ H ₁₂ O
Chloroform	Trichloromethane	192	CHCl ₃	Methyl isopropyl ether		104	C ₄ H ₁₀ O
Chloromethane	Methyl chloride	191	CH ₃ Cl	Methyl isopropyl ketone		126	C ₅ H ₁₀ O
1-Chloropropane	Propyl chloride	198	C ₃ H ₇ Cl	Methyl mercaptan	Methanethiol	181	CH ₃ S
2-Chloropropane	Isopropyl chloride	199	C ₃ H ₇ Cl	2-Methylpentane	Isohexane	24	C ₆ H ₁₄
o-Cresol	2-Methylphenol	98	C ₇ H ₈ O	3-Methyl-2-pentanone	Methyl sec-butyl ketone	129	C ₆ H ₁₂ O
m-Cresol	3-Methylphenol	99	C ₇ H ₈ O	2-Methylpropane	Isobutane	21	C ₄ H ₁₀
p-Cresol	4-Methylphenol	100	C ₇ H ₈ O	2-Methyl-2-propanol	tert-Butyl alcohol	88	C ₄ H ₁₀ O
Cumene	Isopropylbenzene	75	C ₉ H ₁₂	2-Methylpropene	Isobutene	39	C ₄ H ₈
Cyanogen		220	C ₂ N ₂	Methyl propionate		144	C ₄ H ₈ O ₂
Cyclohexane		60	C ₆ H ₁₂	Methyl propyl ether		103	C ₄ H ₁₀ O
Cyclohexanol	Cyclohexyl alcohol	94	C ₆ H ₁₂ O	Methyl tert-butyl ether		107	C ₅ H ₁₂ O
Cyclohexanone	Cyclohexyl ketone	133	C ₆ H ₁₀ O				
Cyclohexene		66	C ₆ H ₁₀	Naphthalene		78	C ₁₀ H ₈
Cyclopentane		57	C ₅ H ₁₀	Neon		209	Ne
Cyclopentene		64	C ₅ H ₈	Nitric oxide		219	NO
p-Cymene	p-Isopropyltoluene	77	C ₁₀ H ₁₄	Nitrogen		215	N ₂
				Nitrous oxide		218	N ₂ O
1-Decanal		122	C ₁₀ H ₂₀ O	n-Nonadecane		19	C ₁₉ H ₄₀
n-Decane		10	C ₁₀ H ₂₂	1-Nonanal	n-Nonaldehyde	121	C ₉ H ₁₈ O
1-Decene		38	C ₁₀ H ₂₀	n-Nonane		9	C ₉ H ₂₀
1,1-Dichloropropane		200	C ₃ H ₆ Cl ₂	1-Nonene		37	C ₉ H ₁₈
1,2-Dichloropropane		201	C ₃ H ₆ Cl ₂				
Diethylamine		160	C ₄ H ₁₁ N	n-Octadecane		18	C ₁₈ H ₃₈
Diethyl ether	Ethyl ether	108	C ₄ H ₁₀ O	1-Octanal	n-Octaldehyde	120	C ₈ H ₁₆ O
Diethyl sulfide	Ethyl sulfide	189	C ₄ H ₁₀ S	n-Octane		8	C ₈ H ₁₈
Diisopropylamine		165	C ₆ H ₁₅ N	1-Octene		36	C ₈ H ₁₆
Diisopropyl ketone	2,4-Dimethyl-3-pentanone	132	C ₇ H ₁₄ O	1-Octyne		55	C ₈ H ₁₄
Dimethylacetylene	2-Butyne	47	C ₄ H ₆	Oxygen		214	O ₂
Dimethylamine		157	C ₂ H ₇ N				
N,N-Dimethylaniline	N,N-Dimethylbenzamine	168	C ₈ H ₁₁ N	n-Pentadecane		15	C ₁₅ H ₃₂
2,3-Dimethylbutane	Diisopropyl	23	C ₆ H ₁₄	1-Pentanal	Valeraldehyde	117	C ₅ H ₁₀ O
1,1-Dimethylcyclohexane		62	C ₈ H ₁₆	n-Pentane		5	C ₅ H ₁₂
Dimethyl ether	Methyl ether	101	C ₂ H ₆ O	1-Pentanol	n-Amyl alcohol	89	C ₅ H ₁₂ O

TABLE 2-6a Alphabetical Index to Substances in Tables 2-6, 2-30, 2-164, 2-193, 2-196, 2-198, and 2-221 (Concluded)

Name	Synonym	Cmpd. no.	Formula	Name	Synonym	Cmpd. no.	Formula
<i>N,N</i> -Dimethylformamide		174	C ₃ H ₇ NO	2-Pentanone	Methyl <i>n</i> -propyl ketone	125	C ₅ H ₁₀ O
2,3-Dimethylpentane		25	C ₇ H ₁₆	3-Pentanone	Diethyl ketone	130	C ₅ H ₁₀ O
Dimethyl sulfide	Methyl sulfide	187	C ₂ H ₆ S	1-Pentene		33	C ₅ H ₁₀
Diphenyl ether		112	C ₁₂ H ₁₀ O	1-Pentyne		49	C ₅ H ₈
<i>n</i> -Dodecane		12	C ₁₂ H ₂₆	2-Pentyne		50	C ₅ H ₈
				Phenol		97	C ₆ H ₆ O
<i>n</i> -Eicosane		20	C ₂₀ H ₄₂	1-Propanal	Propionaldehyde	115	C ₃ H ₆ O
Ethane		2	C ₂ H ₆	<i>n</i> -Propane		3	C ₃ H ₈
Ethanol	Ethyl alcohol	83	C ₂ H ₆ O	1-Propanol	<i>n</i> -Propyl alcohol	84	C ₃ H ₈ O
Ethyl acetate		147	C ₄ H ₈ O ₂	2-Propanol	Isopropyl alcohol	87	C ₃ H ₈ O
Ethylamine		159	C ₂ H ₇ N	<i>n</i> -Propionic acid		137	C ₃ H ₆ O ₂
Ethylbenzene	Phenylethane	72	C ₈ H ₁₀	<i>n</i> -Propionitrile	Ethyl cyanide	178	C ₃ H ₅ N
Ethyl benzoate		154	C ₉ H ₁₀ O ₂	<i>n</i> -Propyl acetate		151	C ₅ H ₁₀ O ₂
Ethyl butyrate		149	C ₆ H ₁₂ O ₂	<i>n</i> -Propylamine		162	C ₃ H ₉ N
Ethylcyclohexane		63	C ₈ H ₁₆	di- <i>n</i> -Propylamine		163	C ₆ H ₁₅ N
Ethylcyclopentane		59	C ₇ H ₁₄	<i>n</i> -Propylbenzene		73	C ₉ H ₁₂
Ethylene		28	C ₂ H ₄	Propylene		29	C ₃ H ₆
Ethylene glycol	1,2-Ethanediol	95	C ₂ H ₆ O ₂	1,2-Propylene glycol	1,2-Propanediol	96	C ₃ H ₈ O ₂
Ethylene oxide	1,2-Epoxyethane	169	C ₂ H ₄ O	<i>n</i> -Propyl formate		150	C ₃ H ₈ O ₂
Ethyl formate		146	C ₃ H ₆ O ₂	<i>n</i> -Propyl mercaptan	Propanethiol	183	C ₃ H ₆ S
Ethyl isopropyl ether		110	C ₅ H ₁₂ O	Pyridine		172	C ₅ H ₅ N
Ethyl isopropyl ketone		131	C ₆ H ₁₂ O				
Ethyl mercaptan	Ethanethiol	182	C ₂ H ₆ S	Styrene		80	C ₈ H ₈
Ethyl propionate		148	C ₅ H ₁₀ O ₂	Sulfur dioxide		229	SO ₂
Ethyl propyl ether		109	C ₅ H ₁₂ O	Sulfur trioxide		230	SO ₃
Fluorine		211	F ₂	<i>m</i> -Terphenyl		81	C ₁₈ H ₁₄
Fluorobenzene		203	C ₆ H ₅ F	<i>n</i> -Tetradecane		14	C ₁₄ H ₃₀
Fluoroethane	Ethyl fluoride	195	C ₂ H ₅ F	Thiophene		171	C ₄ H ₄ S
Fluoromethane	Methyl fluoride	190	CH ₃ F	Toluene		68	C ₇ H ₈
Formaldehyde	Methanal	113	CH ₂ O	<i>n</i> -Tridecane		13	C ₁₃ H ₂₈
Formamide		173	CH ₃ NO	Triethylamine		161	C ₆ H ₁₅ N
Formic acid	Methanoic acid	135	CH ₂ O ₂	Trimethylamine		158	C ₃ H ₉ N
Furan		170	C ₄ H ₄ O	1,2,4-Trimethylbenzene		74	C ₉ H ₁₂
				2,3,3-Trimethylpentane		26	C ₈ H ₁₈
Helium-4		208	He				
<i>n</i> -Heptadecane		17	C ₁₇ H ₃₆	<i>n</i> -Undecane		11	C ₁₁ H ₂₄
1-Heptanal	<i>n</i> -Heptaldehyde	119	C ₇ H ₁₄ O				
<i>n</i> -Heptane		7	C ₇ H ₁₆	Vinyl acetate		155	C ₄ H ₆ O ₂
1-Heptanol	<i>n</i> -Heptyl alcohol	93	C ₇ H ₁₆ O	Vinylacetylene		56	C ₄ H ₄
1-Heptene		35	C ₇ H ₁₄	Vinyl chloride		202	C ₂ H ₃ Cl
1-Heptyne		54	C ₇ H ₁₂				
<i>n</i> -Hexadecane		16	C ₁₆ H ₃₄	Water		231	H ₂ O
1-Hexanal	Caproaldehyde	118	C ₆ H ₁₂ O				
<i>n</i> -Hexane		6	C ₆ H ₁₄	<i>o</i> -Xylene	1,2-Dimethylbenzene	69	C ₈ H ₁₀
1-Hexanol	<i>n</i> -Hexyl alcohol	92	C ₆ H ₁₄ O	<i>m</i> -Xylene	1,3-Dimethylbenzene	70	C ₈ H ₁₀
2-Hexanone	Methyl <i>n</i> -butyl ketone	127	C ₆ H ₁₂ O	<i>p</i> -Xylene	1,4-Dimethylbenzene	71	C ₈ H ₁₀

TABLE 2-7 Vapor Pressures of Inorganic Compounds, up to 1 atm*

Compound		Pressure, mm Hg										Melting point, °C	
Name	Formula	1	5	10	20	40	60	100	200	400	760		
		Temperature, °C											
Aluminum	Al	1284	1421	1487	1555	1635	1684	1749	1844	1947	2056	660	
	borohydride	Al(BH ₄) ₃		-52.2	-42.9	-32.5	-20.9	-13.4	-3.9	+11.2	28.1	45.9	-64.
	bromide	AlBr ₃	81.3	103.8	118.0	134.0	150.6	161.7	176.1	199.8	227.0	256.3	97.
	chloride	Al ₂ Cl ₆	100.0	116.4	123.8	131.8	139.9	145.4	152.0	161.8	171.6	180.2	192.4
	fluoride	AlF ₃	1238	1298	1324	1350	1378	1398	1422	1457	1496	1537	1040
	iodide	AlI ₃	178.0	207.7	225.8	244.2	265.0	277.8	294.5	322.0	354.0	385.5	
	oxide	Al ₂ O ₃	2148	2306	2385	2465	2549	2599	2665	2766	2874	2977	2050
	Ammonia	NH ₃	-109.1	-97.5	-91.9	-85.8	-79.2	-74.3	-68.4	-57.0	-45.4	-33.6	-77.7
	heavy	ND ₃						-74.0	-67.4	-57.0	-45.4	-33.4	-74.0
Ammonium bromide	NH ₄ Br	198.3	234.5	252.0	270.6	290.0	303.8	320.0	345.3	370.8	396.0		
carbamate	N ₂ H ₆ CO ₂	-26.1	-10.4	-2.9	+5.3	14.0	19.6	26.7	37.2	48.0	58.3		
chloride	NH ₄ Cl	160.4	193.8	209.8	226.1	245.0	256.2	271.5	293.2	316.5	337.8	520	
cyanide	NH ₄ CN	-50.6	-35.7	-28.6	-20.9	-12.6	-7.4	-0.5	+9.6	20.5	31.7	36	
hydrogen sulfide	NH ₄ HS	-51.1	-36.0	-28.7	-20.8	-12.3	-7.0	0.0	+10.5	21.8	33.3		
iodide	NH ₄ I	210.9	247.0	263.5	282.8	302.8	316.0	331.8	355.8	381.0	404.9		
Antimony	Sb	886	984	1033	1084	1141	1176	1223	1288	1364	1440	630.5	
tribromide	SbBr ₃	93.9	126.0	142.7	158.3	177.4	188.1	203.5	225.7	250.2	275.0	96.6	
trichloride	SbCl ₃	49.2	71.4	85.2	100.6	117.8	128.3	143.3	165.9	192.2	219.0	73.4	
pentachloride	SbCl ₅	22.7	48.6	61.8	75.8	91.0	101.0	114.1				2.8	
triiodide	SbI ₃	163.6	203.8	223.5	244.8	267.8	282.5	303.5	333.8	368.5	401.0	167	
trioxide	Sb ₂ O ₆	574	626	666	729	812	873	957	1085	1242	1425	656	
Argon	A	-218.2	-213.9	-210.9	-207.9	-204.9	-202.9	-200.5	-195.6	-190.6	-185.6	-189.2	
Arsenic	As	372	416	437	459	483	498	518	548	579	610	814	
Arsenic tribromide	AsBr ₃	41.8	70.6	85.2	101.3	118.7	130.0	145.2	167.7	193.6	220.0		
trichloride	AsCl ₃	-11.4	+11.7	+23.5	36.0	50.0	58.7	70.9	89.2	109.7	130.4	-18	
trifluoride	AsF ₃					-2.5	+4.2	13.2	26.7	41.4	56.3	-5.9	
ptafluoride	AsF ₅	-117.9	-108.0	-103.1	-98.0	-92.4	-88.5	-84.3	-75.5	-64.0	-52.8	-79.8	
trioxide	As ₂ O ₃	212.5	242.6	259.7	279.2	299.2	310.3	332.5	370.0	412.2	457.2	312.8	
Arsine	AsH ₃	-142.6	-130.8	-124.7	-117.7	-110.2	-104.8	-98.0	-87.2	-75.2	-62.1	-116.3	
Barium	Ba		984	1049	1120	1195	1240	1301	1403	1518	1638	850	
Beryllium borohydride	Be(BH ₄) ₂	+1.0	19.8	28.1	36.8	46.2	51.7	58.6	69.0	79.7	90.0	123	
bromide	BeBr ₂	289	325	342	361	379	390	405	427	451	474	490	
chloride	BeCl ₂	291	328	346	365	384	395	411	435	461	487	405	
iodide	BeI ₂	283	322	341	361	382	394	411	435	461	487	488	
Bismuth	Bi	1021	1099	1136	1177	1217	1240	1271	1319	1370	1420	271	
tribromide	BiBr ₃		261	282	305	327	340	360	392	425	461	218	
trichloride	BiCl ₃		242	264	287	311	324	343	372	405	441	230	
Diborane hydrobromide	B ₂ H ₄ Br	-93.3	-75.3	-66.3	-56.4	-45.4	-38.2	-29.0	-15.4	0.0	+16.3	-104.2	
Borine carbonyl	BH ₃ CO	-139.2	-127.3	-121.1	-114.1	-106.6	-101.9	-95.3	-85.5	-74.8	-64.0	-137.0	
triamine	B ₃ N ₃ H ₆	-63.0	-45.0	-35.3	-25.0	-13.2	-5.8	+4.0	18.5	34.3	50.6	-58.2	
Boron hydrides													
dihydrodecaborane	B ₁₀ H ₁₄	60.0	80.8	90.2	100.0	117.4	127.8	142.3	163.8			99.6	
dihydrodiborane	B ₂ H ₆	-159.7	-149.5	-144.3	-138.5	-131.6	-127.2	-120.9	-111.2	-99.6	-86.5	-169	
dihydropentaborane	B ₅ H ₉		-40.4	-30.7	-20.0	-8.0	+0.4	+9.6	24.6	40.8	58.1	-47.0	
tetrahydropentaborane	B ₅ H ₁₁	-50.2	-29.9	-19.9	-9.2	+2.7	10.2	20.1	34.8	51.2	67.0		
tetrahydotetraborane	B ₄ H ₁₀	-90.9	-73.1	-64.3	-54.8	-44.3	-37.4	-28.1	-14.0	+0.8	16.1	-119.9	
Boron tribromide	BBr ₃	-41.4	-20.4	-10.1	+1.5	14.0	22.1	33.5	50.3	70.0	91.7	-45	
trichloride	BCl ₃	-91.5	-75.2	-66.9	-57.9	-47.8	-41.2	-32.4	-18.9	-3.6	+12.7	-107	
trifluoride	BF ₃	-154.6	-145.4	-141.3	-136.4	-131.0	-127.6	-123.0	-115.9	-108.3	-100.7	-126.8	
Bromine	Br ₂	-48.7	-32.8	-25.0	-16.8	-8.0	-0.6	+9.3	24.3	41.0	58.2	-7.3	
ptafluoride	BrF ₅	-69.3	-51.0	-41.9	-32.0	-21.0	-14.0	-4.5	+9.9	25.7	40.4	-61.4	
Cadmium	Cd	394	455	484	516	553	578	611	658	711	765	320.9	
chloride	CdCl ₂		618	656	695	736	762	797	847	908	967	568	
fluoride	CdF ₂	1112	1231	1286	1344	1400	1436	1486	1561	1651	1751	520	
iodide	CdI ₂	416	481	512	546	584	608	640	688	742	796	385	
oxide	CdO	1000	1100	1149	1200	1257	1295	1341	1409	1484	1559		
Calcium	Ca		926	983	1046	1111	1152	1207	1288	1388	1487	851	
Carbon (graphite)	C	3586	3828	3946	4069	4196	4273	4373	4516	4660	4827		
dioxide	CO ₂	-134.3	-124.4	-119.5	-114.4	-108.6	-104.8	-100.2	-93.0	-85.7	-78.2	-57.5	
disulfide	CS ₂	-73.8	-54.3	-44.7	-34.3	-22.5	-15.3	-5.1	+10.4	28.0	46.5	-110.8	
monoxide	CO	-222.0	-217.2	-215.0	-212.8	-210.0	-208.1	-205.7	-201.3	-196.3	-191.3	-205.0	
oxyselenide	COSe	-117.1	-102.3	-95.0	-86.3	-76.4	-70.2	-61.7	-49.8	-35.6	-21.9		
oxysulfide	COS	-132.4	-119.8	-113.3	-106.0	-98.3	-93.0	-85.9	-75.0	-62.7	-49.9	-138.8	
selenosulfide	CSeS	-47.3	-26.5	-16.0	-4.4	+8.6	17.0	28.3	45.7	65.2	85.6	-75.2	
subulfide	C ₅ S ₂	14.0	41.2	54.9	69.3	85.6	96.0	109.9	130.8			+0.4	
tetrabromide	CBR ₄					96.3	106.3	119.7	139.7	163.5	189.5	90.1	
tetrachloride	CCl ₄	-50.0	-30.0	-19.6	-8.2	+4.3	12.3	23.0	38.3	57.8	76.7	-22.6	
tetrafluoride	CF ₄	-184.6	-174.1	-169.3	-164.3	-158.8	-155.4	-150.7	-143.6	-135.5	-127.7	-183.7	
Cesium	Cs	279	341	375	409	449	474	509	561	624	690	28.5	
bromide	CsBr	748	838	887	938	993	1026	1072	1140	1221	1300	636	
chloride	CsCl	744	837	884	934	989	1023	1069	1139	1217	1300	646	
fluoride	CsF	712	798	844	893	947	980	1025	1092	1170	1251	683	
iodide	CsI	738	828	873	923	976	1009	1055	1124	1200	1280	621	

*Compiled from the extended tables published by D. R. Stull in Ind. Eng. Chem., 39, 517 (1947).

TABLE 2-7 Vapor Pressures of Inorganic Compounds, up to 1 atm (Continued)

Compound		Pressure, mm Hg										Melting point, °C
Name	Formula	1	5	10	20	40	60	100	200	400	760	
		Temperature, °C										
Chlorine	Cl ₂	-118.0	-106.7	-101.6	-93.3	-84.5	-79.0	-71.7	-60.2	-47.3	-33.8	-100.7
fluoride	ClF	-143.4	-139.0	-134.3	-128.8	-125.3	-120.8	-114.4	-107.0	-100.5	-145	-145
trifluoride	ClF ₃	-80.4	-71.8	-62.3	-51.3	-44.1	-34.7	-20.7	-4.9	+11.5	-83	-83
monoxide	Cl ₂ O	-98.5	-81.6	-73.1	-64.3	-54.3	-48.0	-39.4	-26.5	-12.5	+2.2	-116
dioxide	ClO ₂			-59.0	-51.2	-42.8	-37.2	-29.4	-17.8	-4.0	+11.1	-59
heptoxide	Cl ₂ O ₇	-45.3	-23.8	-13.2	-2.1	+10.3	+18.2	29.1	44.6	62.2	78.8	-91
Chlorosulfonic acid	H ₂ SO ₃ Cl	32.0	53.5	64.0	75.3	87.6	95.2	105.3	120.0	136.1	151.0	-80
Chromium	Cr	1616	1768	1845	1928	2013	2067	2139	2243	2361	2482	1615
carbonyl	Cr(CO) ₆	36.0	58.0	68.3	79.5	91.2	98.3	108.0	121.8	137.2	151.0	
oxychloride	CrO ₃ Cl ₂	-18.4	+3.2	13.8	25.7	38.5	46.7	58.0	75.2	95.2	117.1	
Cobalt chloride	CoCl ₂					77.0	80.1	84.3	90.4	97.4	105.0	735
nitrosyl tricarbonyl	Co(CO) ₃ NO				-1.3	+11.0	18.5	29.0	44.4	62.0	80.0	-11
Columbium fluoride	CbF ₅			86.3	103.0	121.5	133.2	148.5	172.2	198.0	225.0	75.5
Copper	Cu	1628	1795	1879	1970	2067	2127	2207	2325	2465	2595	1083
Cuprous bromide	Cu ₂ Br ₂	572	666	718	777	844	887	951	1052	1189	1355	504
chloride	Cu ₂ Cl ₂	546	645	702	766	838	886	960	1077	1249	1490	422
iodide	Cu ₂ I ₂		610	656	716	786	836	907	1018	1158	1336	605
Cyanogen	C ₂ N ₂	-95.8	-83.2	-76.8	-70.1	-62.7	-57.9	-51.8	-42.6	-33.0	-21.0	-34.4
bromide	CNBr	-35.7	-18.3	-10.0	-1.0	+8.6	14.7	22.6	33.8	46.0	61.5	58
chloride	CNCl	-76.7	-61.4	-53.8	-46.1	-37.5	-32.1	-24.9	-14.1	-2.3	+13.1	-6.5
fluoride	CNF	-134.4	-123.8	-118.5	-112.8	-106.4	-102.3	-97.0	-89.2	-80.5	-72.6	
Deuterium cyanide	DCN	-68.9	-54.0	-46.7	-38.8	-30.1	-24.7	-17.5	-5.4	+10.0	26.2	-12
Fluorine	F ₂	-223.0	-216.9	-214.1	-211.0	-207.7	-205.6	-202.7	-198.3	-193.2	-187.9	-223
oxide	F ₂ O	-196.1	-186.6	-182.3	-177.8	-173.0	-170.0	-165.8	-159.0	-151.9	-144.6	-223.9
Germanium bromide	GeBr ₄		43.3	56.8	71.8	88.1	98.8	113.2	135.4	161.6	189.0	26.1
chloride	GeCl ₄	-45.0	-24.9	-15.0	-4.1	+8.0	16.2	27.5	44.4	63.8	84.0	-49.5
hydride	GeH ₄	-163.0	-151.0	-145.3	-139.2	-131.6	-126.7	-120.3	-111.2	-100.2	-88.9	-165
Trichlorogermane	GeHCl ₃	-41.3	-22.3	-13.0	-3.0	+8.8	16.2	26.5	41.6	58.3	75.0	-71.1
Tetramethylgermane	Ge(CH ₃) ₄	-73.2	-54.6	-45.2	-35.0	-23.4	-16.2	-6.3	+8.8	26.0	44.0	-88
Trigermene	Ge ₃ H ₆	-88.7	-69.8	-60.1	-49.9	-38.2	-30.7	-20.3	-4.7	+13.3	31.5	-109
Trigermene	Ge ₃ H ₈	-36.9	-12.8	-0.9	+11.8	26.3	35.5	47.9	67.0	88.6	110.8	-105.6
Gold	Au	1869	2059	2154	2256	2363	2431	2521	2657	2807	2966	1063
Helium	He	-271.7	-271.5	-271.3	-271.1	-270.7	-270.6	-270.3	-269.8	-269.3	-268.6	
para-Hydrogen	H ₂	-263.3	-261.9	-261.3	-260.4	-259.6	-258.9	-257.9	-256.3	-254.5	-252.5	-259.1
Hydrogen bromide	HBr	-138.8	-127.4	-121.8	-115.4	-108.3	-103.8	-97.7	-88.1	-78.0	-66.5	-87.0
chloride	HCl	-150.8	-140.7	-135.6	-130.0	-123.8	-119.6	-114.0	-105.2	-95.3	-84.8	-114.3
cyanide	HCN	-71.0	-55.3	-47.7	-39.7	-30.9	-25.1	-17.8	-5.3	+10.2	25.9	-13.2
fluoride	H ₂ F ₂		-74.7	-65.8	-56.0	-45.0	-37.9	-28.2	-13.2	+2.5	19.7	-83.7
iodide	HI	-123.3	-109.6	-102.3	-94.5	-85.6	-79.8	-72.1	-60.3	-48.3	-35.1	-50.9
oxide (water)	H ₂ O	-17.3	+1.2	11.2	22.1	34.0	41.5	51.6	66.5	83.0	100.0	0.0
sulfide	H ₂ S	-134.3	-122.4	-116.3	-109.7	-102.3	-97.9	-91.6	-82.3	-71.8	-60.4	-85.5
disulfide	HSSH	-43.2	-24.4	-15.2	-5.1	+6.0	12.8	22.0	35.3	49.6	64.0	-89.7
selenide	H ₂ Se	-115.3	-103.4	-97.9	-91.8	-84.7	-80.2	-74.2	-65.2	-53.6	-41.1	-64
telluride	H ₂ Te	-96.4	-82.4	-75.4	-67.8	-59.1	-53.7	-45.7	-32.4	-17.2	-2.0	-49.0
Iodine	I ₂	38.7	62.2	73.2	84.7	97.5	105.4	116.5	137.3	159.8	183.0	112.9
heptafluoride	IF ₇	-87.0	-70.7	-63.0	-54.5	-45.3	-39.4	-31.9	-20.7	-8.3	+4.0	5.5
Iron	Fe	1787	1957	2039	2128	2224	2283	2360	2475	2605	2735	1535
pentacarbonyl	Fe(CO) ₅		-6.5	+4.6	16.7	30.3	39.1	50.3	68.0	86.1	105.0	-21
Ferric chloride	Fe ₂ Cl ₆	194.0	221.8	235.5	246.0	256.8	263.7	272.5	285.0	298.0	319.0	304
Ferrous chloride	FeCl ₂			700	737	779	805	842	897	961	1026	
Krypton	Kr	-199.3	-191.3	-187.2	-182.9	-178.4	-175.7	-171.8	-165.9	-159.0	-152.0	-156.7
Lead	Pb	973	1099	1162	1234	1309	1358	1421	1519	1630	1744	327.5
bromide	PbBr ₂	513	578	610	646	686	711	745	796	856	914	373
chloride	PbCl ₂	547	615	648	684	725	750	784	833	893	954	501
fluoride	PbF ₂		861	904	950	1003	1036	1080	1144	1219	1293	855
iodide	PbI ₂	479	540	571	605	644	668	701	750	807	872	402
oxide	PbO	943	1039	1085	1134	1189	1222	1265	1330	1402	1472	890
sulfide	PbS	852	928	975	1005	1048	1074	1108	1160	1221	1281	1114
Lithium	Li	723	838	881	940	1003	1042	1097	1178	1273	1372	186
bromide	LiBr	748	840	888	939	994	1028	1076	1147	1226	1310	547
chloride	LiCl	783	880	932	987	1045	1081	1129	1203	1290	1382	614
fluoride	LiF	1047	1156	1211	1270	1333	1372	1425	1503	1591	1681	870
iodide	LiI	723	802	841	883	927	955	993	1049	1110	1171	446
Magnesium	Mg	621	702	743	789	838	868	909	967	1034	1107	651
chloride	MgCl ₂	778	877	930	988	1050	1088	1142	1223	1316	1418	712
Manganese	Mn	1292	1434	1505	1583	1666	1720	1792	1900	2029	2151	1260
chloride	MnCl ₂		736	778	825	879	913	960	1028	1108	1190	650
Mercury	Hg	126.2	164.8	184.0	204.6	228.8	242.0	261.7	290.7	323.0	357.0	-38.9
Mercuric bromide	HgBr ₂	136.5	165.3	179.8	194.3	211.5	221.0	237.8	262.7	290.0	319.0	237
chloride	HgCl ₂	136.2	166.0	180.2	195.8	212.5	222.2	237.0	256.5	275.5	304.0	277
iodide	HgI ₂	157.5	189.2	204.5	220.0	238.2	249.0	261.8	291.0	324.2	354.0	259
Molybdenum	Mo	3102	3393	3535	3690	3859	3964	4109	4322	4553	4804	2622
hexafluoride	MoF ₆	-65.5	-49.0	-40.8	-32.0	-22.1	-16.2	-8.0	+4.1	17.2	36.0	17
oxide	MoO ₃	734	785	814	851	892	917	955	1014	1082	1151	795

TABLE 2-7 Vapor Pressures of Inorganic Compounds, up to 1 atm (Continued)

Compound		Pressure, mm Hg										Melting point, °C
Name	Formula	1	5	10	20	40	60	100	200	400	760	
		Temperature, °C										
Neon	Ne	-257.3	-255.5	-254.6	-253.7	-252.6	-251.9	-251.0	-249.7	-248.1	-246.0	-248.7
Nickel	Ni	1810	1979	2057	2143	2234	2289	2364	2473	2603	2732	1452
carbonyl chloride	Ni(CO) ₄					-23.0	-15.9	-6.0	+8.8	25.8	42.5	-25
	NiCl ₂	671	731	759	789	821	840	866	904	945	987	1001
Nitrogen	N ₂	-226.1	-221.3	-219.1	-216.8	-214.0	-212.3	-209.7	-205.6	-200.9	-195.8	-210.0
Nitric oxide	NO	-184.5	-180.6	-178.2	-175.3	-171.7	-168.9	-166.0	-162.3	-156.8	-151.7	-161
Nitrogen dioxide	NO ₂	-55.6	-42.7	-36.7	-30.4	-23.9	-19.9	-14.7	-5.0	+8.0	21.0	-9.3
Nitrogen pentoxide	N ₂ O ₅	-36.8	-23.0	-16.7	-10.0	-2.9	+1.8	7.4	15.6	24.4	32.4	30
Nitrous oxide	N ₂ O	-143.4	-133.4	-128.7	-124.0	-118.3	-114.9	-110.3	-103.6	-96.2	-85.5	-90.9
Nitrosyl chloride fluoride	NOCl					-60.2	-54.2	-46.3	-34.0	-20.3	-6.4	-64.5
	NOF	-132.0	-120.3	-114.3	-107.8	-100.3	-95.7	-88.8	-79.2	-68.2	-56.0	-134
Osmium tetroxide (yellow)	OsO ₄	3.2	22.0	31.3	41.0	51.7	59.4	71.5	89.5	109.3	130.0	56
(white)	OsO ₄	-5.6	+15.6	26.0	37.4	50.5	59.4	71.5	89.5	109.3	130.0	42
Oxygen	O ₂	-219.1	-213.4	-210.6	-207.5	-204.1	-201.9	-198.8	-194.0	-188.8	-183.1	-218.7
Ozone	O ₃	-180.4	-168.6	-163.2	-157.2	-150.7	-146.7	-141.0	-132.6	-122.5	-111.1	-251
Phosgene	COCl ₂	-92.9	-77.0	-69.3	-60.3	-50.3	-44.0	-35.6	-22.3	-7.6	+8.3	-104
Phosphorus (yellow)	P	76.6	111.2	128.0	146.2	166.7	179.8	197.3	222.7	251.0	280.0	44.1
(violet)	P	237	271	287	306	323	334	349	370	391	417	590
tribromide	PBr ₃	7.8	34.4	47.8	62.4	79.0	89.8	103.6	125.2	149.7	175.3	-40
trichloride	PCl ₃	-51.6	-31.5	-21.3	-10.2	+2.3	10.2	21.0	37.6	56.9	74.2	-111.8
pentachloride	PCl ₅	55.5	74.0	83.2	92.5	102.5	108.3	117.0	131.3	147.2	162.0	
Phosphine	PH ₃					-129.4	-125.0	-118.8	-109.4	-98.3	-87.5	-132.5
Phosphonium bromide chloride	PH ₄ Br	-43.7	-28.5	-21.2	-13.3	-5.0	+0.3	7.4	17.6	28.0	38.3	
	PH ₄ Cl	-91.0	-79.6	-74.0	-68.0	-61.5	-57.3	-52.0	-44.0	-35.4	-27.0	-28.5
iodide	PH ₄ I	-25.2	-9.0	-1.1	+7.3	16.1	21.9	29.3	39.9	51.6	62.3	
Phosphorus trioxide pentoxide	P ₂ O ₅		39.7	53.0	67.8	84.0	94.2	108.3	129.0	150.3	173.1	22.5
	P ₂ O ₁₀	384	424	442	462	481	493	510	532	556	591	569
oxychloride	POCl ₃			2.0	13.6	27.3	35.8	47.4	65.0	84.3	105.1	2
thiobromide	PSeBr ₃	50.0	72.4	83.6	95.5	108.0	116.0	126.3	141.8	157.8	175.0	38
thiochloride	PSeCl ₃	-18.3	+4.6	16.1	29.0	42.7	51.8	63.8	82.0	102.3	124.0	-36.2
Platinum	Pt	2730	3007	3146	3302	3469	3574	3714	3923	4169	4407	1755
Potassium	K	341	408	443	483	524	550	586	643	708	774	62.3
bromide	KBr	795	892	940	994	1050	1087	1137	1212	1297	1383	730
chloride	KCl	821	919	968	1020	1078	1115	1164	1239	1322	1407	790
fluoride	KF	885	988	1039	1096	1156	1193	1245	1323	1411	1502	880
hydroxide	KOH	719	814	863	918	976	1013	1064	1142	1233	1327	380
iodide	KI	745	840	887	938	995	1030	1080	1152	1238	1324	723
Radon	Rn	-144.2	-132.4	-126.3	-119.2	-111.3	-106.2	-99.0	-87.7	-75.0	-61.8	-71
Rhenium heptoxide	Re ₂ O ₇	212.5	237.5	248.0	261.0	272.0	280.0	289.0	307.0	336.0	362.4	296
Rubidium	Rb	297	358	389	422	459	482	514	563	620	679	38.5
bromide	RbBr	781	876	923	975	1031	1066	1114	1186	1267	1352	682
chloride	RbCl	792	887	937	990	1047	1084	1133	1207	1294	1381	715
fluoride	RbF	921	982	1016	1052	1096	1123	1168	1239	1322	1408	760
iodide	RbI	748	839	884	935	991	1026	1072	1141	1223	1304	642
Selenium	Se	356	413	442	473	506	527	554	594	637	680	217
dioxide	SeO ₂	157.0	187.7	202.5	217.5	234.1	244.6	258.0	277.0	297.7	317.0	340
hexafluoride	SeF ₆	-118.6	-105.2	-98.9	-92.3	-84.7	-80.0	-73.9	-64.8	-55.2	-45.8	-34.7
oxychloride	SeOCl ₂	34.8	59.8	71.9	84.2	98.0	106.5	118.0	134.6	151.7	168.0	8.5
tetrachloride	SeCl ₄	74.0	96.3	107.4	118.1	130.1	137.8	147.5	161.0	176.4	191.5	
Silicon	Si	1724	1835	1888	1942	2000	2036	2083	2151	2220	2287	1420
dioxide	SiO ₂			1732	1798	1867	1911	1969	2053	2141	2227	1710
tetrachloride	SiCl ₄	-63.4	-44.1	-34.4	-24.0	-12.1	-4.8	+5.4	21.0	38.4	56.8	-68.8
tetrafluoride	SiF ₄	-144.0	-134.8	-130.4	-125.9	-120.8	-117.5	-113.3	-107.2	-100.7	-94.8	-90
Trichlorofluorosilane	SiFCl ₃	-92.6	-76.4	-68.3	-59.0	-48.8	-42.2	-33.2	-19.3	-4.0	+12.2	-120.8
Iodosilane	SiH ₂ I		-53.0	-47.7	-33.4	-21.8	-14.3	-4.4	+10.7	27.9	45.4	-57.0
Diiodosilane	SiH ₂ I ₂		3.8	18.0	34.1	52.6	64.0	79.4	101.8	125.5	149.5	-1.0
Disiloxan	(SiH ₃) ₂ O	-112.5	-95.8	-88.2	-79.8	-70.4	-64.2	-55.9	-43.5	-29.3	-15.4	-144.2
Trisilane	Si ₃ H ₈	-68.9	-49.7	-40.0	-29.0	-16.9	-9.0	+1.6	17.8	35.5	53.1	-117.2
Trisilazane	(SiH ₃) ₃ N	-68.7	-49.9	-40.4	-30.0	-18.5	-11.0	-1.1	+14.0	31.0	48.7	-105.7
Tetrasilane	Si ₄ H ₁₀	-27.7	-6.2	+4.3	15.8	28.4	36.6	47.4	63.6	81.7	100.0	-93.6
Octachlorotrisilane	Si ₃ Cl ₈	46.3	74.7	89.3	104.2	121.5	132.0	146.0	166.2	189.5	211.4	
Hexachlorodisiloxane	(SiCl ₃) ₂ O	-5.0	17.8	29.4	41.5	55.2	63.8	75.4	92.5	113.6	135.6	-33.2
Hexachlorodisilane	Si ₂ Cl ₆	+4.0	27.4	38.8	51.5	65.3	73.9	85.4	102.2	120.6	139.0	-1.2
Tribromosilane	SiHBr ₃	-30.5	-8.0	+3.4	16.0	30.0	39.2	51.6	70.2	90.2	111.8	-73.5
Trichlorosilane	SiHCl ₃	-80.7	-62.6	-53.4	-43.8	-32.9	-25.8	-16.4	-1.8	+14.5	31.8	-126.6
Trifluorosilane	SiHF ₃	-152.0	-142.7	-138.2	-132.9	-127.3	-123.7	-118.7	-111.3	-102.8	-95.0	-131.4
Dibromosilane	SiH ₂ Br ₂	-60.9	-40.0	-29.4	-18.0	-5.2	+3.2	14.1	31.6	50.7	70.5	-70.2
Difluorosilane	SiH ₂ F ₂	-146.7	-136.0	-130.4	-124.3	-117.6	-113.3	-107.3	-98.3	-87.6	-77.8	
Monobromosilane	SiH ₃ Br		-85.7	-77.3	-68.3	-57.8	-51.1	-42.3	-28.6	-13.3	+2.4	-93.9
Monochlorosilane	SiH ₃ Cl	-117.8	-104.3	-97.7	-90.1	-81.8	-76.0	-68.5	-57.0	-44.5	-30.4	
Monofluorosilane	SiH ₃ F	-153.0	-145.5	-141.2	-136.3	-130.8	-127.2	-122.4	-115.2	-106.8	-98.0	
Tribromofluorosilane	SiFBr ₃	-46.1	-25.4	-15.1	-3.7	+9.2	17.4	28.6	45.7	64.6	83.8	-82.5
Dichlorodifluorosilane	SiF ₂ Cl ₂	-124.7	-110.5	-102.9	-94.5	-85.0	-78.6	-70.3	-58.0	-45.0	-31.8	-139.7
Trifluorobromosilane	SiF ₃ Br								-69.8	-55.9	-41.7	-70.5

TABLE 2-7 Vapor Pressures of Inorganic Compounds, up to 1 atm (Concluded)

Compound		Pressure, mm Hg										Melting point, °C
Name	Formula	1	5	10	20	40	60	100	200	400	760	
		Temperature, °C										
Trifluorochlorosilane	SiF ₃ Cl	-144.0	-133.0	-127.0	-120.5	-112.8	-108.2	-101.7	-91.7	-81.0	-70.0	-142
Hexafluorodisilane	Si ₂ F ₆	-81.0	-68.8	-63.1	-57.0	-50.6	-46.7	-41.7	-34.2	-26.4	-18.9	-18.6
Dichlorofluorobromosilane	SiFCl ₂ Br	-86.5	-68.4	-59.0	-48.8	-37.0	-29.0	-19.5	-3.2	+15.4	35.4	-112.3
Dibromochlorofluorosilane	SiFClBr ₂	-65.2	-45.5	-35.6	-24.5	-12.0	-4.7	+6.3	23.0	43.0	59.5	-99.3
Silane	SiH ₄	-179.3	-168.6	-163.0	-156.9	-150.3	-146.3	-140.5	-131.6	-122.0	-111.5	-185
Disilane	Si ₂ H ₆	-114.8	-99.3	-91.4	-82.7	-72.8	-66.4	-57.5	-44.6	-29.0	-14.3	-132.6
Silver	Ag	1357	1500	1575	1658	1743	1795	1865	1971	2090	2212	960.5
chloride	AgCl	912	1019	1074	1134	1200	1242	1297	1379	1467	1564	455
iodide	AgI	820	927	983	1045	1111	1152	1210	1297	1400	1506	552
Sodium	Na	439	511	549	589	633	662	701	758	823	892	97.5
bromide	NaBr	806	903	952	1005	1063	1099	1148	1220	1304	1392	755
chloride	NaCl	865	967	1017	1072	1131	1169	1220	1296	1379	1465	800
cyanide	NaCN	817	928	983	1046	1115	1156	1214	1302	1401	1497	564
fluoride	NaF	1077	1186	1240	1300	1363	1403	1455	1531	1617	1704	992
hydroxide	NaOH	739	843	897	953	1017	1057	1111	1192	1286	1378	318
iodide	NaI	767	857	903	952	1005	1039	1083	1150	1225	1304	651
Strontium	Sr		847	898	953	1018	1057	1111	1192	1285	1384	800
Strontium oxide	SrO	2068	2198	2262	2333	2410						2430
Sulfur	S	183.8	223.0	243.8	264.7	288.3	305.5	327.2	359.7	399.6	444.6	112.8
monochloride	S ₂ Cl ₂	-7.4	+15.7	27.5	40.0	54.1	63.2	75.3	93.5	115.4	138.0	-80
hexafluoride	SF ₆	-132.7	-120.6	-114.7	-108.4	-101.5	-96.8	-90.9	-82.3	-72.6	-63.5	-50.2
Sulfuryl chloride	SO ₂ Cl ₂		-35.1	-24.8	-13.4	-1.0	+7.2	17.8	33.7	51.3	69.2	-54.1
Sulfur dioxide	SO ₂	-95.5	-83.0	-76.8	-69.7	-60.5	-54.6	-46.9	-35.4	-23.0	-10.0	-73.2
trioxide (α)	SO ₃	-39.0	-23.7	-16.5	-9.1	-1.0	+4.0	10.5	20.5	32.6	44.8	16.8
trioxide (β)	SO ₃	-34.0	-19.2	-12.3	-4.9	+3.2	8.0	14.3	23.7	32.6	44.8	32.3
trioxide (γ)	SO ₃	-15.3	-2.0	+4.3	11.1	17.9	21.4	28.0	35.8	44.0	51.6	62.1
Tellurium	Te	520	605	650	697	753	789	838	910	997	1087	452
chloride	TeCl ₄			233	253	273	287	304	330	360	392	224
fluoride	TeF ₆	-111.3	-98.8	-92.4	-86.0	-78.4	-73.8	-67.9	-57.3	-48.2	-38.6	-37.8
Thallium	Tl	825	931	983	1040	1103	1143	1196	1274	1364	1457	303.5
Thallos bromide	TlBr		490	522	559	598	621	653	703	759	819	460
chloride	TlCl		487	517	550	589	612	645	694	748	807	430
iodide	TlI	440	502	531	567	607	631	663	712	763	823	440
Thionyl bromide	SOBr ₂	-6.7	+18.4	31.0	44.1	58.8	68.3	80.6	99.0	119.2	139.5	-52.2
Thionyl chloride	SOCl ₂	-52.9	-32.4	-21.9	-10.5	+2.2	10.4	21.4	37.9	56.5	75.4	-104.5
Tin	Sn	1492	1634	1703	1777	1855	1903	1968	2063	2169	2270	231.9
Stannic bromide	SnBr ₄		58.3	72.7	88.1	105.5	116.2	131.0	152.8	177.7	204.7	31.0
Stannous chloride	SnCl ₂	316	366	391	420	450	467	493	533	577	623	246.8
Stannic chloride	SnCl ₄	-22.7	-1.0	+10.0	22.0	35.2	43.5	54.7	72.0	92.1	113.0	-30.2
iodide	SnI ₄		156.0	175.8	196.2	218.8	234.2	254.2	283.5	315.5	348.0	144.5
hydride	SnH ₄	-140.0	-125.8	-118.5	-111.2	-102.3	-96.6	-89.2	-78.0	-65.2	-52.3	-149.9
Tin tetramethyl	Sn(CH ₃) ₄	-51.3	-31.0	-20.6	-9.3	+3.5	11.7	22.8	39.8	58.5	78.0	
trimethyl-ethyl	Sn(CH ₃) ₃ C ₂ H ₅	-30.0	-7.6	+3.8	16.1	30.0	38.4	50.0	67.3	87.6	108.8	
trimethyl-propyl	Sn(CH ₃) ₃ C ₃ H ₇	-12.0	+10.7	21.8	34.0	48.5	57.5	69.8	88.0	109.6	131.7	
Titanium chloride	TiCl ₄	-13.9	+9.4	21.3	34.2	48.4	58.0	71.0	90.5	112.7	136.0	-30
Tungsten	W	3990	4337	4507	4690	4886	5007	5168	5403	5666	5927	3370
Tungsten hexafluoride	WF ₆	-71.4	-56.5	-49.2	-41.5	-33.0	-27.5	-20.3	-10.0	+1.2	17.3	-0.5
Uranium hexafluoride	UF ₆	-38.8	-22.0	-13.8	-5.2	+4.4	10.4	18.2	30.0	42.7	55.7	69.2
Vanadyl trichloride	VOCl ₃	-23.2	+0.2	12.2	26.6	40.0	49.8	62.5	82.0	103.5	127.2	
Xenon	Xe	-168.5	-158.2	-152.8	-147.1	-141.2	-137.7	-132.8	-125.4	-117.1	-108.0	-111.6
Zinc	Zn	487	558	593	632	673	700	736	788	844	907	419.4
chloride	ZnCl ₂	428	481	508	536	566	584	610	648	689	732	365
fluoride	ZnF ₂	970	1055	1086	1129	1175	1207	1254	1329	1417	1497	872
diethyl	Zn(C ₂ H ₅) ₂	-22.4	0.0	+11.7	24.2	38.0	47.2	59.1	77.0	97.3	118.0	-28
Zirconium bromide	ZrBr ₄	207	237	250	266	281	289	301	318	337	357	450
chloride	ZrCl ₄	190	217	230	243	259	268	279	295	312	331	437
iodide	ZrI ₄	264	297	311	329	344	355	369	389	409	431	499

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm*

Compound		Pressure, mm Hg									Melting point, °C	
		1	5	10	20	40	60	100	200	400		760
Name	Formula	Temperature, °C										
Acenaphthalene	C ₁₂ H ₁₀		114.8	131.2	148.7	168.2	181.2	197.5	222.1	250.0	277.5	95
Acetal	C ₆ H ₁₄ O ₂	-23.0	-2.3	+8.0	19.6	31.9	39.8	50.1	66.3	84.0	102.2	
Acetaldehyde	C ₂ H ₄ O	-81.5	-65.1	-56.8	-47.8	-37.8	-31.4	-22.6	-10.0	+4.9	20.2	-123.5
Acetamide	C ₂ H ₅ NO	65.0	92.0	105.0	120.0	135.8	145.8	158.0	178.3	200.0	222.0	81
Acetanilide	C ₈ H ₉ NO	114.0	146.6	162.0	180.0	199.6	211.8	227.2	250.5	277.0	303.8	113.5
Acetic acid	C ₂ H ₄ O ₂	-17.2	+6.3	17.5	29.9	43.0	51.7	63.0	80.0	99.0	118.1	16.7
anhydride	C ₄ H ₆ O ₃	1.7	24.8	36.0	48.3	62.1	70.8	82.2	100.0	119.8	139.6	-73
Acetone	C ₃ H ₆ O	-59.4	-40.5	-31.1	-20.8	-9.4	-2.0	+7.7	22.7	39.5	56.5	-94.6
Acetonitrile	C ₂ H ₃ N	-47.0	-26.6	-16.3	-5.0	+7.7	15.9	27.0	43.7	62.5	81.8	-41
Acetophenone	C ₈ H ₈ O	37.1	64.0	78.0	92.4	109.4	119.8	133.6	154.2	178.0	202.4	20.5
Acetyl chloride	C ₂ H ₃ OCl	-50.0	-35.0	-27.6	-19.6	-10.4	-4.5	+3.2	16.1	32.0	50.8	-112.0
Acetylene	C ₂ H ₂	-142.9	-133.0	-128.2	-122.8	-116.7	-112.8	-107.9	-100.3	-92.0	-84.0	-81.5
Acridine	C ₁₃ H ₉ N	129.4	165.8	184.0	203.5	224.2	238.7	256.0	284.0	314.3	346.0	110.5
Acrolein (2-propenal)	C ₃ H ₄ O	-64.5	-46.0	-36.7	-26.3	-15.0	-7.5	+2.5	17.5	34.5	52.5	-87.7
Acrylic acid	C ₃ H ₄ O ₂	+3.5	27.3	39.0	52.0	66.2	75.0	86.1	103.3	122.0	141.0	14
Adipic acid	C ₆ H ₁₀ O ₄	159.5	191.0	205.5	222.0	240.5	251.0	265.0	287.8	312.5	337.5	152
Allene (propadiene)	C ₃ H ₄	-120.6	-108.0	-101.0	-93.4	-85.2	-78.8	-72.5	-61.3	-48.5	-35.0	-136
Allyl alcohol (propen-1-ol-3)	C ₃ H ₆ O	-20.0	+0.2	10.5	21.7	33.4	40.3	50.0	64.5	80.2	96.6	-129
chloride (3-chloropropene)	C ₃ H ₅ Cl	-70.0	-52.0	-42.9	-32.8	-21.2	-14.1	-4.5	10.4	27.5	44.6	-136.4
isopropyl ether	C ₆ H ₁₂ O	-43.7	-23.1	-12.9	-1.8	+10.9	18.7	29.0	44.3	61.7	79.5	
isothiocyanate	C ₄ H ₅ NS	-2.0	+25.3	38.3	52.1	67.4	76.2	89.5	108.0	129.8	150.7	-80
n-propyl ether	C ₆ H ₁₂ O	-39.0	-18.2	-7.9	+3.7	16.4	25.0	35.8	52.6	71.4	90.5	
4-Allylveratrole	C ₁₁ H ₁₄ O ₂	85.0	113.9	127.0	142.8	158.3	169.6	183.7	204.0	226.2	248.0	
iso-Amyl acetate	C ₇ H ₁₄ O ₂	0.0	+23.7	35.2	47.8	62.1	71.0	83.2	101.3	121.5	142.0	
n-Amyl alcohol	C ₅ H ₁₂ O	+13.6	34.7	44.9	55.8	68.0	75.5	85.8	102.0	119.8	137.8	
iso-Amyl alcohol	C ₅ H ₁₂ O	+10.0	30.9	40.8	51.7	63.4	71.0	80.7	95.8	113.7	130.6	-117.2
sec-Amyl alcohol (2-pentanol)	C ₅ H ₁₂ O	+1.5	22.1	32.2	42.6	54.1	61.5	70.7	85.7	102.3	119.7	
tert-Amyl alcohol	C ₅ H ₁₂ O	-12.9	+7.2	17.2	27.9	38.8	46.0	55.3	69.7	85.7	101.7	-11.9
sec-Amylbenzene	C ₁₁ H ₁₆	29.0	55.8	69.2	83.8	100.0	110.4	124.1	145.2	168.0	193.0	
iso-Amyl benzoate	C ₁₂ H ₁₆ O ₂	72.0	104.5	121.6	139.7	158.3	171.4	186.8	210.2	235.8	262.0	
bromide (1-bromo-3-methylbutane)	C ₅ H ₁₁ Br	-20.4	+2.1	13.6	26.1	39.8	48.7	60.4	78.7	99.4	120.4	
n-butyrate	C ₉ H ₁₈ O ₂	21.2	47.1	59.9	74.0	90.0	99.8	113.1	133.2	155.3	178.6	
formate	C ₆ H ₁₂ O ₂	-17.5	+5.4	17.1	30.0	44.0	53.3	65.4	83.2	102.7	123.3	
iodide (1-iodo-3-methylbutane)	C ₅ H ₁₁ I	-2.5	+21.9	34.1	47.6	62.3	71.9	84.4	103.8	125.8	148.2	
isobutyrate	C ₉ H ₁₈ O ₂	14.8	40.1	52.8	66.6	81.8	91.7	104.4	124.2	146.0	168.8	
Amyl isopropionate	C ₈ H ₁₆ O ₂	+8.5	33.7	46.3	60.0	75.5	85.2	97.6	117.3	138.4	160.2	
iso-Amyl isovalerate	C ₁₀ H ₂₀ O ₂	27.0	54.4	68.6	83.8	100.6	110.3	125.1	146.1	169.5	194.0	
n-Amyl levulinate	C ₁₀ H ₁₈ O ₃	81.3	110.0	124.0	139.7	155.8	165.2	180.5	203.1	227.4	253.2	
iso-Amyl levulinate	C ₁₀ H ₁₈ O ₃	75.6	104.0	118.8	134.4	151.7	162.6	177.0	198.1	222.7	247.9	
nitrate	C ₅ H ₁₁ NO ₃	+5.2	28.8	40.3	53.5	67.6	76.3	88.6	106.7	126.5	147.5	
4-tert-Amylphenol	C ₁₁ H ₁₆ O	109.8	125.5	142.3	160.3	172.6	189.0	213.0	239.5	266.0	293.0	93
Anethole	C ₁₀ H ₁₂ O	62.6	91.6	106.0	121.8	139.3	149.8	164.2	186.1	210.5	235.3	22.5
Acetonitrile	C ₂ H ₃ N	-8.0	+15.0	28.0	41.0	55.8	65.2	77.5	96.3	117.7	140.0	
Aniline	C ₆ H ₇ N	34.8	57.9	69.4	82.0	96.7	106.0	119.9	140.1	161.9	184.4	-6.2
2-Anilinoethanol	C ₈ H ₁₁ NO	104.0	134.3	149.6	165.7	183.7	194.0	209.5	230.6	254.7	279.6	
Anisaldehyde	C ₈ H ₈ O ₂	73.2	102.6	117.8	133.5	150.5	161.7	176.7	199.0	223.0	248.0	2.5
o-Anisidine (2-methoxyaniline)	C ₇ H ₉ NO	61.0	88.0	101.7	116.1	132.0	142.1	155.2	175.3	197.3	218.5	5.2
Anthracene	C ₁₄ H ₁₀	145.0	173.5	187.2	201.9	217.5	231.8	250.0	279.0	310.2	342.0	217.5
Anthraquinone	C ₁₄ H ₈ O ₂	190.0	219.4	234.2	248.3	264.3	273.3	285.0	314.6	346.2	379.9	286
Azelaic acid	C ₉ H ₁₆ O ₄	178.3	210.4	225.5	242.4	260.0	271.8	286.5	309.6	332.8	356.5	106.5
Azaldehyde	C ₉ H ₈ O	33.3	58.4	71.6	85.0	100.2	110.0	123.0	142.1	163.4	185.0	
Azobenzene	C ₁₂ H ₁₀ N ₂	103.5	135.7	151.5	168.3	187.9	199.8	216.0	240.0	266.1	293.0	68
Benzal chloride (α,α-Dichlorotoluene)	C ₇ H ₆ Cl ₂	35.4	64.0	78.7	94.3	112.1	123.4	138.3	160.7	187.0	214.0	-16.1
Benzaldehyde	C ₇ H ₆ O	26.2	50.1	62.0	75.0	90.1	99.6	112.5	131.7	154.1	179.0	-26
Benzanthrone	C ₁₇ H ₁₀ O	225.0	274.5	297.2	322.5	350.0	368.8	390.0	426.5		174	
Benzene	C ₆ H ₆	-36.7	-19.6	-11.5	-2.6	+7.6	15.4	26.1	42.2	60.6	80.1	+5.5
Benzenesulfonylchloride	C ₆ H ₅ ClO ₂ S	65.9	96.5	112.0	129.0	147.7	158.2	174.5	198.0	224.0	251.5	14.5
Benzil	C ₁₄ H ₁₀ O ₂	128.4	165.2	183.0	202.8	224.5	238.2	255.8	283.5	314.3	347.0	95
Benzoic acid	C ₇ H ₆ O ₂	96.0	119.5	132.1	146.7	162.6	172.8	186.2	205.8	227.0	249.2	121.7
anhydride	C ₁₄ H ₁₀ O ₃	143.8	180.0	198.0	218.0	239.8	252.7	270.4	299.1	328.8	360.0	42
Benzoin	C ₁₄ H ₁₂ O ₂	135.6	170.2	188.1	207.0	227.6	241.7	258.0	284.4	313.5	343.0	132
Benzonitrile	C ₇ H ₅ N	28.2	55.3	69.2	83.4	99.6	109.8	123.5	144.1	166.7	190.6	-12.9
Benzophenone	C ₁₃ H ₁₀ O	108.2	141.7	157.6	175.8	195.7	208.2	224.4	249.8	276.8	305.4	48.5
Benzotrifluoride (α,α,α-Trichlorotoluene)	C ₇ H ₅ Cl ₃	45.8	73.7	87.6	102.7	119.8	130.0	144.3	165.6	189.2	213.5	-21.2
Benzotrifluoride (α,α,α-Trifluorotoluene)	C ₇ H ₅ F ₃	-32.0	-10.3	-0.4	12.2	25.7	34.0	45.3	62.5	82.0	102.2	-29.3
Benzoyl bromide	C ₇ H ₅ BrO	47.0	75.4	89.8	105.4	122.6	133.4	147.7	169.2	193.7	218.5	0
chloride	C ₇ H ₅ ClO	32.1	59.1	73.0	87.6	103.8	114.7	128.0	149.5	172.8	197.2	-0.5
nitrile	C ₈ H ₅ NO	44.5	71.7	85.5	100.2	116.6	127.0	141.0	161.3	185.0	208.0	33.5
Benzyl acetate	C ₉ H ₁₀ O ₂	45.0	73.4	87.6	102.3	119.6	129.8	144.0	165.5	189.0	213.5	-51.5
alcohol	C ₇ H ₈ O	58.0	80.8	92.6	105.8	119.8	129.3	141.7	160.0	183.0	204.7	-15.3

*Compiled from the extended tables published by D. R. Stull in *Ind. Eng. Chem.*, **39**, 517 (1947). For information on fuels see Hibbard, N.A.C.A. Research Mem. E56121, 1956. For methane see Johnson (ed.), WADD-TR-60-56, 1960.

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm (Continued)

Compound		Pressure, mm Hg									Melting point, °C	
		1	5	10	20	40	60	100	200	400		760
Name	Formula	Temperature, °C										
Benzylamine	C ₇ H ₉ N	29.0	54.8	67.7	81.8	97.3	107.3	120.0	140.0	161.3	184.5	
Benzyl bromide (α -bromotoluene)	C ₇ H ₇ Br	32.2	59.6	73.4	88.3	104.8	115.6	129.8	150.8	175.2	198.5	-4
chloride (α -chlorotoluene)	C ₇ H ₇ Cl	22.0	47.8	60.8	75.0	90.7	100.5	114.2	134.0	155.8	179.4	-39
cinnamate	C ₁₀ H ₁₀ O ₂	173.8	206.3	221.5	239.3	255.8	267.0	281.5	303.8	326.7	350.0	39
Benzylidichlorosilane	C ₇ H ₈ Cl ₂ Si	45.3	70.2	83.2	96.7	111.8	121.3	133.5	152.0	173.0	194.3	
Benzyl ethyl ether	C ₉ H ₁₂ O	26.0	52.0	65.0	79.6	95.4	105.5	118.9	139.6	161.5	185.0	
phenyl ether	C ₁₃ H ₁₂ O	95.4	127.7	144.0	160.7	180.1	192.6	209.2	233.2	259.8	287.0	
isothiocyanate	C ₈ H ₇ NS	79.5	107.8	121.8	137.0	153.0	163.8	177.7	198.0	220.4	243.0	
Biphenyl	C ₁₂ H ₁₀	70.6	101.8	117.0	134.2	152.5	165.2	180.7	204.2	229.4	254.9	69.5
1-Biphenyloxy-2,3-epoxypropane	C ₁₅ H ₁₄ O ₂	135.3	169.9	187.2	205.8	226.3	239.7	255.0	280.4	309.8	340.0	
<i>d</i> -Bornyl acetate	C ₁₂ H ₂₀ O ₂	46.9	75.7	90.2	106.0	123.7	135.7	149.8	172.0	197.5	223.0	29
Bornyl <i>n</i> -butyrate	C ₁₄ H ₂₄ O ₂	74.0	103.4	118.0	133.8	150.7	161.8	176.4	198.0	222.2	247.0	
formate	C ₁₁ H ₁₈ O ₂	47.0	74.8	89.3	104.0	121.2	131.7	145.8	166.4	190.2	214.0	
isobutyrate	C ₁₄ H ₂₄ O ₂	70.0	99.8	114.0	130.0	147.2	157.6	172.2	194.2	218.2	243.0	
propionate	C ₁₃ H ₂₂ O ₂	64.6	93.7	108.0	123.7	140.4	151.2	165.7	187.5	211.2	235.0	
Brassidic acid	C ₂₂ H ₃₂ O ₂	209.6	241.7	256.0	272.9	290.0	301.5	316.2	336.8	359.6	382.5	61.5
Bromoacetic acid	C ₂ H ₃ BrO ₂	54.7	81.6	94.1	108.2	124.0	133.8	146.3	165.8	186.7	208.0	49.5
4-Bromoanisole	C ₇ H ₇ BrO	48.8	77.8	91.9	107.8	125.0	136.0	150.1	172.7	197.5	223.0	12.5
Bromobenzene	C ₆ H ₅ Br	+2.9	27.8	40.0	53.8	68.6	78.1	90.8	110.1	132.3	156.2	-30.7
4-Bromobiphenyl	C ₁₂ H ₉ Br	98.0	133.7	150.6	169.8	190.8	204.5	221.8	248.2	277.7	310.0	90.5
1-Bromo-2-butanol	C ₄ H ₉ BrO	23.7	45.4	55.8	67.2	79.5	87.0	97.6	112.1	128.3	145.0	
1-Bromo-2-butanol	C ₄ H ₇ BrO	+6.2	30.0	41.8	54.2	68.2	77.3	89.2	107.0	126.3	147.0	
<i>cis</i> -1-Bromo-1-butene	C ₄ H ₇ Br	-44.0	-23.2	-12.8	-1.4	+11.5	19.8	30.8	47.8	66.8	86.2	
<i>trans</i> -1-Bromo-1-butene	C ₄ H ₇ Br	-38.4	-17.0	-6.4	+5.4	18.4	27.2	38.1	55.7	75.0	94.7	-100.3
2-Bromo-1-butene	C ₄ H ₇ Br	-47.3	-27.0	-16.8	-5.3	+7.2	15.4	25.4	42.8	61.9	81.0	-133.4
<i>cis</i> -2-Bromo-2-butene	C ₄ H ₇ Br	-39.0	-17.9	-7.2	+4.6	17.7	26.2	37.5	54.5	74.0	93.9	-111.2
<i>trans</i> -2-Bromo-2-butene	C ₄ H ₇ Br	-45.0	-24.1	-13.8	-2.4	+10.5	18.7	29.9	46.5	66.0	85.5	-114.6
1,4-Dibromochlorobenzene	C ₆ H ₃ BrCl	32.0	59.5	72.7	87.8	103.8	114.8	128.0	149.5	172.6	196.9	
1-Bromo-1-chloroethane	C ₂ H ₄ BrCl	-36.0	-18.0	-9.4	0.0	+10.4	17.0	28.0	44.7	63.4	82.7	16.6
1-Bromo-2-chloroethane	C ₂ H ₄ BrCl	-28.8	-7.0	+4.1	16.0	29.7	38.0	49.5	66.8	86.0	106.7	-16.6
2-Bromo-4,6-dichlorophenol	C ₆ H ₃ BrCl ₂ O	84.0	115.6	130.8	147.7	165.8	177.6	193.2	216.5	242.0	268.0	68
1-Bromo-4-ethyl benzene	C ₈ H ₉ Br	30.4	42.5	74.0	90.2	108.5	121.0	135.5	156.5	182.0	206.0	-45.0
(2-Bromoethyl)-benzene	C ₈ H ₉ Br	48.0	76.2	90.5	105.8	123.2	133.8	148.2	169.8	194.0	219.0	
2-Bromoethyl 2-chloroethyl ether	C ₈ H ₉ BrClO	36.5	63.2	76.3	90.8	106.6	116.4	129.8	150.0	172.3	195.8	
(2-Bromoethyl)-cyclohexane	C ₈ H ₁₅ Br	38.7	66.6	80.5	95.8	113.0	123.7	138.0	160.0	186.2	213.0	
1-Bromoethylene	C ₂ H ₃ Br	-95.4	-77.8	-68.8	-58.8	-48.1	-41.2	-31.9	-17.2	-1.1	+15.8	-138
Bromoform (tribromomethane)	CHBr ₃	22.0	34.0	48.0	63.6	73.4	85.9	106.1	127.9	150.5	185.0	8.5
1-Bromonaphthalene	C ₁₀ H ₇ Br	84.2	117.5	133.6	150.2	170.2	183.5	198.8	224.2	252.0	281.1	5.5
2-Bromo-4-phenylphenol	C ₁₂ H ₉ BrO	100.0	135.4	152.3	171.8	193.8	207.0	224.5	251.0	280.2	311.0	95
3-Bromopyridine	C ₅ H ₄ BrN	16.8	42.0	55.2	69.1	84.1	94.1	107.8	127.7	150.0	173.4	
2-Bromotoluene	C ₇ H ₇ Br	24.4	49.7	62.3	76.0	91.0	100.0	112.0	133.6	157.3	181.8	-28
3-Bromotoluene	C ₇ H ₇ Br	14.8	50.8	64.0	78.1	93.9	104.1	117.8	138.0	160.0	183.7	39.8
4-Bromotoluene	C ₇ H ₇ Br	10.3	47.5	61.1	75.2	91.8	102.3	116.4	137.4	160.2	184.5	28.5
3-Bromo-2,4,6-trichlorophenol	C ₆ H ₃ BrCl ₃ O	112.4	146.2	163.2	181.8	200.5	213.0	229.3	253.0	278.0	305.8	
2-Bromo-1,4-xylene	C ₈ H ₉ Br	37.5	65.0	78.8	94.0	110.6	121.6	135.7	156.4	181.0	206.7	+9.5
1,2-Butadiene (methyl allene)	C ₄ H ₆	-89.0	-72.7	-64.2	-54.9	-44.3	-37.5	-28.3	-14.2	+1.8	18.5	
1,3-Butadiene	C ₄ H ₆	-102.8	-87.6	-79.7	-71.0	-61.3	-55.1	-46.8	-33.9	-19.3	-4.5	-108.9
<i>n</i> -Butane	C ₄ H ₁₀	-101.5	-85.7	-77.8	-68.9	-59.1	-52.8	-44.2	-31.2	-16.3	-0.5	-135
iso-Butane (2-methylpropane)	C ₄ H ₁₀	-109.2	-94.1	-86.4	-77.9	-68.4	-62.4	-54.1	-41.5	-27.1	-11.7	-145
1,3-Butanediol	C ₄ H ₁₀ O ₂	22.2	67.5	85.3	100.0	117.4	127.5	141.2	161.0	183.8	206.5	77
1,2,3-Butanetriol	C ₄ H ₁₀ O ₃	102.0	132.0	146.0	161.0	178.0	188.0	202.5	222.0	243.5	264.0	
1-Butene	C ₄ H ₈	-104.8	-89.4	-81.6	-73.0	-63.4	-57.2	-48.9	-36.2	-21.7	-6.3	-130
<i>cis</i> -2-Butene	C ₄ H ₈	-96.4	-81.1	-73.4	-64.6	-54.7	-48.4	-39.8	-26.8	-12.0	+3.7	-138.9
<i>trans</i> -2-Butene	C ₄ H ₈	-99.4	-84.0	-76.3	-67.5	-57.6	-51.3	-42.7	-29.7	-14.8	+0.9	-105.4
3-Butenenitrile	C ₄ H ₅ N	-19.6	+2.9	14.1	26.6	40.0	48.8	60.2	78.0	98.0	119.0	
iso-Butyl acetate	C ₆ H ₁₂ O ₂	-21.2	+1.4	12.8	25.5	39.2	48.0	59.7	77.6	97.5	118.0	-98.9
<i>n</i> -Butyl acrylate	C ₇ H ₁₂ O ₂	-0.5	+23.5	35.5	48.6	63.4	72.6	85.1	104.0	125.2	147.4	-64.6
alcohol	C ₄ H ₁₀ O	-1.2	+20.0	30.2	41.5	53.4	60.3	70.1	84.3	100.8	117.5	-79.9
iso-Butyl alcohol	C ₄ H ₁₀ O	-9.0	+11.6	21.7	32.4	44.1	51.7	61.5	75.9	91.4	108.0	-108
<i>sec</i> -Butyl alcohol	C ₄ H ₁₀ O	-12.2	+7.2	16.9	27.3	38.1	45.2	54.1	67.9	83.9	99.5	-114.7
<i>tert</i> -Butyl alcohol	C ₄ H ₁₀ O	-20.4	-3.0	+5.5	14.3	24.5	31.0	39.8	52.7	68.0	82.9	25.3
iso-Butyl amine	C ₄ H ₁₁ N	-50.0	-31.0	-21.0	-10.3	+1.3	8.8	18.8	32.0	50.7	68.6	-85.0
<i>n</i> -Butylbenzene	C ₁₀ H ₁₄	22.7	48.8	62.0	76.3	92.4	102.6	116.2	136.9	159.2	183.1	-88.0
iso-Butylbenzene	C ₁₀ H ₁₄	14.1	40.5	53.7	67.8	83.3	93.3	107.0	127.2	149.6	172.8	-51.5
<i>sec</i> -Butylbenzene	C ₁₀ H ₁₄	18.6	44.2	57.0	70.6	86.2	96.0	109.5	128.8	150.3	173.5	-75.5
<i>tert</i> -Butylbenzene	C ₁₀ H ₁₄	13.0	39.0	51.7	65.6	80.8	90.6	103.8	123.7	145.8	168.5	-58
iso-Butyl benzoate	C ₁₁ H ₁₄ O ₂	64.0	93.6	108.6	124.2	141.8	152.0	166.4	188.2	212.8	237.0	
<i>n</i> -Butyl bromide (1-bromobutane)	C ₄ H ₉ Br	-33.0	-11.2	-0.3	+11.6	24.8	33.4	44.7	62.0	81.7	101.6	-112.4
iso-Butyl <i>n</i> -butyrate	C ₈ H ₁₆ O ₂	+4.6	30.0	42.2	56.1	71.7	81.3	94.0	113.9	135.7	156.9	
carbamate	C ₅ H ₁₁ NO ₂		83.7	96.4	110.1	125.3	134.6	147.2	165.7	186.0	206.5	65
Butyl carbitol (diethylene glycol butyl ether)	C ₈ H ₁₈ O ₃	70.0	95.7	107.8	120.5	135.5	146.0	159.8	181.2	205.0	231.2	
<i>n</i> -Butyl chloride (1-chlorobutane)	C ₄ H ₉ Cl	-49.0	-28.9	-18.6	-7.4	+5.0	13.0	24.0	40.0	58.8	77.8	-123.1
iso-Butyl chloride	C ₄ H ₉ Cl	-53.8	-34.3	-24.5	-13.8	-1.9	+9.9	16.0	32.0	50.0	68.9	-131.2

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm (Continued)

Compound		Pressure, mm Hg									Melting point, °C	
		1	5	10	20	40	60	100	200	400		760
Name	Formula	Temperature, °C										
<i>sec</i> -Butyl chloride (2-Chlorobutane)	C ₄ H ₉ Cl	-60.2	-39.8	-29.2	-17.7	-5.0	+3.4	14.2	31.5	50.0	68.0	-131.3
<i>tert</i> -Butyl chloride	C ₄ H ₉ Cl					-19.0	-11.4	-1.0	+14.6	32.6	51.0	-26.5
<i>sec</i> -Butyl chloroacetate	C ₆ H ₁₁ ClO ₂	17.0	41.8	54.6	68.2	83.6	93.0	105.5	124.1	146.0	167.8	
2- <i>tert</i> -Butyl-4-cresol	C ₁₁ H ₁₆ O	70.0	98.0	112.0	127.2	143.9	153.7	167.0	187.8	210.0	232.6	
4- <i>tert</i> -Butyl-2-cresol	C ₁₁ H ₁₆ O	74.3	103.7	118.0	134.0	150.8	161.7	176.2	197.8	221.8	247.0	
iso-Butyl dichloroacetate	C ₆ H ₁₀ Cl ₂ O ₂	28.6	54.3	67.5	81.4	96.7	106.6	119.8	139.2	160.0	183.0	
2,3-Butylene glycol (2,3-butanediol)	C ₄ H ₁₀ O ₂	44.0	68.4	80.3	93.4	107.8	116.3	127.8	145.6	164.0	182.0	22.5
2-Butyl-2-ethylbutane-1,3-diol	C ₁₀ H ₂₂ O ₂	94.1	122.6	136.8	151.2	167.8	178.0	191.9	212.0	233.5	255.0	
2- <i>tert</i> -Butyl-4-ethylphenol	C ₁₂ H ₁₈ O	76.3	106.2	121.0	137.0	154.0	165.4	179.0	200.3	223.8	247.8	
<i>n</i> -Butyl formate	C ₅ H ₁₀ O ₂	-26.4	-4.7	+6.1	18.0	31.6	39.8	51.0	67.9	86.2	106.0	
iso-Butyl formate	C ₅ H ₁₀ O ₂			-11.4	-0.8	+11.0	24.1	32.4	43.4	60.0	79.0	-95.3
<i>sec</i> -Butyl formate	C ₅ H ₁₀ O ₂	-34.4	-13.3	-3.1	+8.4	21.3	29.6	40.2	56.8	75.2	93.6	
<i>sec</i> -Butyl glycolate	C ₆ H ₁₂ O ₃	28.3	53.6	66.0	79.8	94.2	104.0	116.4	135.5	155.6	177.5	
iso-Butyl iodide (1-iodo-2-methylpropane)	C ₄ H ₉ I	-17.0	+5.8	17.0	29.8	42.8	51.8	63.5	81.0	100.3	120.4	-90.7
isobutyrate	C ₅ H ₁₀ O ₂	+4.1	28.0	39.9	52.4	67.2	75.9	88.0	106.3	126.3	147.5	-80.7
isovalerate	C ₆ H ₁₂ O ₂	16.0	41.2	53.8	67.7	82.7	92.4	105.2	124.8	146.4	168.9	
levulinat	C ₆ H ₁₀ O ₃	65.0	92.1	105.9	120.2	136.2	147.0	160.2	181.8	205.5	229.7	
naphthylketone (1-isovaleronaphthone)	C ₁₅ H ₁₆ O	136.0	167.9	184.0	201.6	219.7	231.5	246.7	269.7	294.0	320.0	
2- <i>sec</i> -Butylphenol	C ₁₀ H ₁₄ O	57.4	86.0	100.8	116.1	133.4	143.9	157.3	179.7	203.8	228.0	
2- <i>tert</i> -Butylphenol	C ₁₀ H ₁₄ O	56.6	84.2	98.1	113.0	129.2	140.0	153.5	173.8	196.3	219.5	
4-iso-Butylphenol	C ₁₀ H ₁₄ O	72.1	100.9	115.5	130.3	147.2	157.0	171.2	192.1	214.7	237.0	
4- <i>sec</i> -Butylphenol	C ₁₀ H ₁₄ O	71.4	100.5	114.8	130.3	147.8	157.9	172.4	194.3	217.6	242.1	
4- <i>tert</i> -Butylphenol	C ₁₀ H ₁₄ O	70.0	99.2	114.0	129.5	146.0	156.0	170.2	191.5	214.0	238.0	99
2-(4- <i>tert</i> -Butylphenoxy)ethyl acetate	C ₁₄ H ₂₀ O ₃	118.0	150.0	165.8	183.3	201.5	212.8	228.0	250.3	277.6	304.4	
4- <i>tert</i> -Butylphenyl dichlorophosphate	C ₁₀ H ₁₃ Cl ₂ O ₂ P	96.0	129.6	146.0	164.0	184.3	197.2	214.3	240.0	268.2	299.0	
<i>tert</i> -Butyl phenyl ketone (pivalophenone)	C ₁₁ H ₁₄ O	57.8	85.7	99.0	114.3	130.4	140.8	154.0	175.0	197.7	220.0	
iso-Butyl propionate	C ₇ H ₁₄ O ₂	-2.3	+20.9	32.3	44.8	58.5	67.6	79.5	97.0	116.4	136.8	-71
4- <i>tert</i> -Butyl-2,5-xyleneol	C ₁₂ H ₁₈ O	88.2	119.8	135.0	151.0	169.8	180.3	195.0	217.5	241.3	265.3	
4- <i>tert</i> -Butyl-2,6-xyleneol	C ₁₂ H ₁₈ O	74.0	103.9	119.0	135.0	152.2	163.6	176.0	196.0	217.8	239.8	
6- <i>tert</i> -Butyl-2,4-xyleneol	C ₁₂ H ₁₈ O	70.3	100.2	115.0	131.0	148.5	158.2	172.0	192.3	214.2	236.5	
6- <i>tert</i> -Butyl-3,4-xyleneol	C ₁₂ H ₁₈ O	83.9	113.6	127.0	143.0	159.7	170.0	184.0	204.5	226.7	249.5	
Butyric acid	C ₄ H ₈ O ₂	25.5	49.8	61.5	74.0	88.0	96.5	108.0	125.5	144.5	163.5	-74
iso-Butyric acid	C ₄ H ₈ O ₂	14.7	39.3	51.2	64.0	77.8	86.3	98.0	115.8	134.5	154.5	-47
Butyronitrile	C ₄ H ₇ N	-20.0	+2.1	13.4	25.7	38.4	47.3	59.0	76.7	96.8	117.5	
iso-Valerophenone	C ₁₁ H ₁₄ O	58.3	87.0	101.4	116.8	133.8	144.6	158.0	180.1	204.2	228.0	
Camphene	C ₁₀ H ₁₆			47.2	60.4	75.7	85.0	97.9	117.5	138.7	160.5	50
Campholenic acid	C ₁₀ H ₁₆ O ₂	97.6	125.7	139.8	153.9	170.0	180.0	193.7	212.7	234.0	256.0	
<i>d</i> -Camphor	C ₁₀ H ₁₆ O	41.5	68.6	82.3	97.5	114.0	124.0	138.0	157.9	182.0	209.2	178.5
Camphylamine	C ₁₀ H ₁₉ N	45.3	74.0	83.7	97.6	112.5	122.0	134.6	153.0	173.8	195.0	
Capraldehyde	C ₁₀ H ₂₀ O	51.9	78.8	92.0	106.3	122.2	132.0	145.3	164.8	186.3	208.5	
Capric acid	C ₁₀ H ₂₀ O ₂	125.0	142.0	152.2	165.0	179.9	189.8	200.0	217.1	240.3	268.4	31.5
<i>n</i> -Caproic acid	C ₆ H ₁₂ O ₂	71.4	89.5	99.5	111.8	125.0	133.3	144.0	160.8	181.0	202.0	-1.5
iso-Caproic acid	C ₆ H ₁₂ O ₂	66.2	83.0	94.0	107.0	120.4	129.6	141.4	158.3	181.0	207.7	-35
iso-Caprolactone	C ₆ H ₁₀ O ₂	38.3	66.4	80.3	95.7	112.3	123.2	137.2	157.8	182.1	207.0	
Capronitrile	C ₆ H ₁₁ N	9.2	34.6	47.5	61.7	76.9	86.8	99.8	119.7	141.0	163.7	
Capryl alcohol (2-octanol)	C ₈ H ₁₈ O	32.8	57.6	70.0	83.3	98.0	107.4	119.8	138.0	157.5	178.5	-38.6
Caprylaldehyde	C ₈ H ₁₆ O	73.4	92.0	101.2	110.2	120.0	126.0	133.9	145.4	156.5	168.5	
Caprylic acid (octanoic acid)	C ₈ H ₁₆ O ₂	92.3	114.1	124.0	136.4	150.6	160.0	172.2	190.3	213.9	237.5	16
Caprylonitrile	C ₈ H ₁₅ N	43.0	67.6	80.4	94.6	110.6	121.2	134.8	155.2	179.5	204.5	
Carbazole	C ₁₂ H ₉ N					248.2	265.0	292.5	323.0	354.8	244.8	
Carbon dioxide	CO ₂	-134.3	-124.4	-119.5	-114.4	-108.6	-104.8	-100.2	-93.0	-85.7	-78.2	-57.5
disulfide	CS ₂	-73.8	-54.3	-44.7	-34.3	-22.5	-15.3	-5.1	+10.4	28.0	46.5	-110.8
monoxide	CO	-222.0	-217.2	-215.0	-212.8	-210.0	-208.1	-205.7	-201.3	-196.3	-191.3	-205.0
oxyselenide (carbonyl selenide)	COSe	-117.1	-102.3	-95.0	-86.3	-76.4	-70.2	-61.7	-49.8	-35.6	-21.9	
oxysulfide (carbonyl sulfide)	COS	-132.4	-119.8	-113.3	-106.0	-98.3	-93.0	-85.9	-75.0	-62.7	-49.9	-138.8
tetrabromide	CBBr ₄					96.3	106.3	119.7	139.7	163.5	189.5	90.1
tetrachloride	CCl ₄	-50.0	-30.0	-19.6	-8.2	+4.3	12.3	23.0	38.3	57.8	76.7	-22.6
tetrafluoride	CF ₄	-184.6	-174.1	-169.3	-164.3	-158.8	-155.4	-150.7	-143.6	-135.5	-127.7	-183.7
Carvacrol	C ₁₀ H ₁₄ O	70.0	98.4	113.2	127.9	145.2	155.3	169.7	191.2	213.8	237.0	+0.5
Carvone	C ₁₀ H ₁₄ O	57.4	86.1	100.4	116.1	133.0	143.8	157.3	179.6	203.5	227.5	
Chavibetol	C ₁₀ H ₁₂ O ₂	83.6	113.3	127.0	143.2	159.8	170.7	185.5	206.8	229.8	254.0	
Chloral (trichloroacetaldehyde)	C ₂ HCl ₃ O	-37.8	-16.0	-5.0	+7.2	20.2	29.1	40.2	57.8	77.5	97.7	-57
hydrate (trichloroacetaldehyde hydrate)	C ₂ H ₃ Cl ₃ O ₂	-9.8	+10.0	19.5	29.2	39.7	46.2	55.0	68.0	82.1	96.2	51.7
Chloranil	C ₆ Cl ₄ O	70.7	89.3	97.8	106.4	116.1	122.0	129.5	140.3	151.3	162.6	290
Chloroacetic acid	C ₂ H ₃ ClO ₂	43.0	68.3	81.0	94.2	109.2	118.3	130.7	149.0	169.0	189.5	61.2
anhydride	C ₂ H ₂ Cl ₂ O ₃	67.2	94.1	108.0	122.4	138.2	148.0	159.8	177.8	197.0	217.0	46
2-Chloroaniline	C ₆ H ₆ ClN	46.3	72.3	84.8	99.2	115.6	125.7	139.5	160.0	183.7	208.8	0
3-Chloroaniline	C ₆ H ₆ ClN	63.5	89.8	102.0	116.7	133.6	144.1	158.0	179.5	203.5	228.5	-10.4
4-Chloroaniline	C ₆ H ₆ ClN	59.3	87.9	102.1	117.8	135.0	145.8	159.9	182.3	206.6	230.5	70.5
Chlorobenzene	C ₆ H ₅ Cl	-13.0	+10.6	22.2	35.3	49.7	58.3	70.7	89.4	110.0	132.2	-45.2
2-Chlorobenzotrchloride												
(2- α,α,α -tetrachlorotoluene)	C ₇ H ₇ Cl ₄	69.0	101.8	117.9	135.8	155.0	167.8	185.0	208.0	233.0	262.1	28.7

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm (Continued)

Compound		Pressure, mm Hg										Melting point, °C	
		1	5	10	20	40	60	100	200	400	760		
Name	Formula	Temperature, °C											
2-Chlorobenzotrifluoride													
(2-chloro- α,α,α -trifluorotoluene)	$C_7H_4ClF_3$	0.0	24.7	37.1	50.6	65.9	75.4	88.3	108.3	130.0	152.2		-6.0
2-Chlorobiphenyl	$C_{12}H_9Cl$	89.3	109.8	134.7	151.2	169.9	182.1	197.0	219.6	243.8	267.5		34
4-Chlorobiphenyl	$C_{12}H_9Cl$	96.4	129.8	146.0	164.0	183.8	196.0	212.5	237.8	264.5	292.9		75.5
α -Chlorocrotonic acid	$C_4H_5ClO_2$	70.0	95.6	108.0	121.2	135.6	144.4	155.9	173.8	193.2	212.0		
Chlorodifluoromethane	$CHClF_2$	-122.8	-110.2	-103.7	-96.5	-88.6	-83.4	-76.4	-65.8	-53.6	-40.8		-160
Chlorodimethylphenylsilane	$C_8H_{11}ClSi$	29.8	56.7	70.0	84.7	101.2	111.5	124.7	145.5	168.6	193.5		
1-Chloro-2-ethoxybenzene	C_8H_9ClO	45.8	72.8	86.5	101.5	117.8	127.8	141.8	162.0	185.5	208.0		
2-(2-Chloroethoxy) ethanol	$C_4H_9ClO_2$	53.0	78.3	90.7	104.1	118.4	127.5	139.5	157.2	176.5	196.0		
bis-2-Chloroethyl acetacetal	$C_8H_{12}Cl_2O_2$	56.2	83.7	97.6	112.2	127.8	138.0	150.7	169.8	190.5	212.6		
1-Chloro-2-ethylbenzene	C_8H_9Cl	17.2	43.0	56.1	70.3	86.2	96.4	110.0	130.2	152.2	177.6		-80.2
1-Chloro-3-ethylbenzene	C_8H_9Cl	18.6	45.2	58.1	73.0	89.2	99.6	113.6	133.8	156.7	181.1		-53.3
1-Chloro-4-ethylbenzene	C_8H_9Cl	19.2	46.4	60.0	75.5	91.8	102.0	116.0	137.0	159.8	184.3		-62.6
2-Chloroethyl chloroacetate	$C_4H_6Cl_2O_2$	46.0	72.1	86.0	100.0	116.0	126.2	140.0	159.8	182.2	205.0		
2-Chloroethyl 2-chloroisopropyl ether	$C_6H_{10}Cl_2O$	24.7	50.1	63.0	77.2	92.4	102.2	115.8	135.7	156.5	180.0		
2-Chloroethyl 2-chloropropyl ether	$C_7H_{10}Cl_2O$	29.8	56.5	70.0	84.8	101.5	111.8	125.6	146.3	169.8	194.1		
2-Chloroethyl α -methylbenzyl ether	$C_{10}H_{13}ClO$	62.3	91.4	106.0	121.8	139.6	150.0	164.8	186.3	210.8	235.0		
Chloroform (trichloromethane)	$CHCl_3$	-58.0	-39.1	-29.7	-19.0	-7.1	+0.5	10.4	25.9	42.7	61.3		-63.5
1-Chloronaphthalene	$C_{10}H_7Cl$	80.6	104.8	118.6	134.4	153.2	165.6	180.4	204.2	230.8	259.3		-20
4-Chlorophenethyl alcohol	C_8H_9ClO	84.0	114.3	129.0	145.0	162.0	173.5	188.1	210.0	234.5	259.3		
2-Chlorophenol	C_6H_5ClO	12.1	38.2	51.2	65.9	82.0	92.0	106.0	126.4	149.8	174.5		7
3-Chlorophenol	C_6H_5ClO	44.2	72.0	86.1	101.7	118.0	129.4	143.0	164.8	188.7	214.0		32.5
4-Chlorophenol	C_6H_5ClO	49.8	78.2	92.2	108.1	125.0	136.1	150.0	172.0	196.0	220.0		42
2-Chloro-3-phenylphenol	$C_{12}H_9ClO$	118.0	152.2	169.7	186.7	207.4	219.6	237.0	261.3	289.4	317.5		+6
2-Chloro-6-phenylphenol	$C_{12}H_9ClO$	119.8	153.7	170.7	189.8	208.2	220.0	237.1	261.6	289.5	317.0		
Chloropropicrin (trichloronitromethane)	CCl_3NO_2	-25.5	-3.3	+7.8	20.0	33.8	42.3	53.8	71.8	91.8	111.9		-64
1-Chloropropene	C_3H_5Cl	-81.3	-63.4	-54.1	-44.0	-32.7	-25.1	-15.1	+1.3	18.0	37.0		-99.0
2-Chloropyridine	C_5H_4ClN	13.3	38.8	51.7	65.8	81.7	91.6	104.6	125.0	147.7	170.2		
3-Chlorostyrene	C_8H_7Cl	25.3	51.3	65.2	80.0	96.5	107.2	121.2	142.2	165.7	190.0		
4-Chlorostyrene	C_8H_7Cl	28.0	54.5	67.5	82.0	98.0	108.5	122.0	143.5	166.0	191.0		-15.0
1-Chlorotetradecane	$C_{14}H_{29}Cl$	98.5	131.8	148.2	166.2	187.0	199.8	215.5	240.3	267.5	296.0		+0.9
2-Chlorotoluene	C_7H_7Cl	+5.4	30.6	43.2	56.9	72.0	81.8	94.7	115.0	137.1	159.3		
3-Chlorotoluene	C_7H_7Cl	+4.8	30.3	43.2	57.4	73.0	83.2	96.3	116.6	139.7	162.3		
4-Chlorotoluene	C_7H_7Cl	+5.5	31.0	43.8	57.8	73.5	83.3	96.6	117.1	139.8	162.3		+7.3
Chlorotriethylsilane	$C_6H_{15}ClSi$	-4.9	+19.8	32.0	45.5	60.2	69.5	82.3	101.6	123.6	146.3		
1-Chloro-1,2,2-trifluoroethylene	C_2ClF_3	-116.0	-102.5	-95.9	-88.2	-79.7	-74.1	-66.7	-55.0	-41.7	-27.9		-157.5
Chlorotrifluoromethane	$CClF_3$	-149.5	-139.2	-134.1	-128.5	-121.9	-117.3	-111.7	-102.5	-92.7	-81.2		
Chlorotrimesitylsilane	C_9H_9ClSi	-62.8	-43.6	-34.0	-23.2	-11.4	-4.0	+6.0	21.9	39.4	57.9		
<i>trans</i> -Cinnamic acid	$C_9H_8O_2$	127.5	157.8	173.0	189.5	207.1	217.8	232.4	253.3	276.7	300.0		133
Cinnamyl alcohol	$C_9H_{10}O$	72.6	102.5	117.8	133.7	151.0	162.0	177.8	199.8	224.6	250.0		33
Cinnamylaldehyde	C_9H_8O	76.1	105.8	120.0	135.7	152.2	163.7	177.7	199.3	222.4	246.0		-7.5
Citraconic anhydride	$C_8H_8O_3$	47.1	74.8	88.9	103.8	120.3	131.3	145.4	165.8	189.8	213.5		
<i>cis</i> - α -Citral	$C_{10}H_{16}O$	61.7	90.0	103.9	119.4	135.9	146.3	160.0	181.8	205.0	228.0		
<i>d</i> -Citronellal	$C_{10}H_{18}O$	44.0	71.4	84.8	99.8	116.1	126.2	140.1	160.0	183.8	206.5		
Citronellic acid	$C_{10}H_{18}O_2$	99.5	127.3	141.4	155.6	171.9	182.1	195.4	214.5	236.6	257.0		
Citronellol	$C_{10}H_{20}O$	66.4	93.6	107.0	121.5	137.2	147.2	159.8	179.8	201.0	221.5		
Citronellyl acetate	$C_{12}H_{22}O_2$	74.7	100.2	113.0	126.0	140.5	149.7	161.0	178.8	197.8	217.0		
Coumarin	$C_9H_6O_2$	106.0	137.8	153.4	170.0	189.0	200.5	216.5	240.0	264.7	291.0		70
<i>o</i> -Cresol (2-cresol; 2-methylphenol)	C_7H_8O	38.2	64.0	76.7	90.5	105.8	115.5	127.4	146.7	168.4	190.8		30.8
<i>m</i> -Cresol (3-cresol; 3-methylphenol)	C_7H_8O	52.0	76.0	87.8	101.4	116.0	125.8	138.0	157.3	179.0	202.8		10.9
<i>p</i> -Cresol (4-cresol; 4-methylphenol)	C_7H_8O	53.0	76.5	88.6	102.3	117.7	127.0	140.0	157.3	179.4	201.8		35.5
<i>cis</i> -Crotonic acid	$C_4H_6O_2$	33.5	57.4	69.0	82.0	96.0	104.5	116.3	133.9	152.2	171.9		15.5
<i>trans</i> -Crotonic acid	$C_4H_6O_2$			80.0	93.0	107.8	116.7	128.0	146.0	165.5	185.0		72
<i>cis</i> -Crotononitrile	C_4H_5N	-29.0	-7.1	+4.0	16.4	30.0	38.5	50.1	68.0	88.0	108.0		
<i>trans</i> -Crotononitrile	C_4H_5N	-19.5	+3.5	15.0	27.8	41.8	50.9	62.8	81.1	101.5	122.8		
Cumene	C_9H_{12}	+2.9	26.8	38.3	51.5	66.1	75.4	88.1	107.3	129.2	152.4		-96.0
4-Cumidene	$C_9H_{13}N$	60.0	88.2	102.2	117.8	134.2	145.0	158.0	180.0	203.2	227.0		
Cuminal	$C_{10}H_{12}O$	58.0	87.3	102.0	117.9	135.2	146.0	160.0	182.8	206.7	232.0		
Cuminy alcohol	$C_{10}H_{14}O$	74.2	103.7	118.0	133.8	150.3	161.7	176.2	199.9	221.7	246.6		
2-Cyano-2- <i>n</i> -butyl acetate	$C_7H_{11}NO_2$	42.0	68.7	82.0	96.2	111.8	121.5	133.8	152.2	173.4	195.2		
Cyanogen	C_2N_2	-95.8	-83.2	-76.8	-70.1	-62.7	-57.9	-51.8	-42.6	-33.0	-21.0		-34.4
bromide	$CBrN$	-35.7	-18.3	-10.0	-1.0	+8.6	14.7	22.6	33.8	46.0	61.5		58
chloride	$CClN$	-76.7	-61.4	-53.8	-46.1	-37.5	-32.1	-24.9	-14.1	-2.3	+13.1		-6.5
iodide	CIN	25.2	47.2	57.7	68.6	80.3	88.0	97.6	111.5	126.1	141.1		
Cyclobutane	C_4H_8	-92.0	-76.0	-67.9	-58.7	-48.4	-41.8	-32.8	-18.9	-3.4	+12.9		-50
Cyclobutene	C_4H_6	-99.1	-83.4	-75.4	-66.6	-56.4	-50.0	-41.2	-27.8	-12.2	+2.4		
Cyclohexane	C_6H_{12}	-45.3	-25.4	-15.9	-5.0	+6.7	14.7	25.5	42.0	60.8	80.7		+6.6
Cyclohexaneethanol	$C_8H_{16}O$	50.4	77.2	90.0	104.0	119.8	129.8	142.7	161.7	183.5	205.4		
Cyclohexanol	$C_6H_{12}O$	21.0	44.0	56.0	68.8	83.0	91.8	103.7	121.7	141.4	161.0		23.9
Cyclohexanone	$C_6H_{10}O$	+1.4	26.4	38.7	52.5	67.8	77.5	90.4	110.3	132.5	155.6		-45.0
2-Cyclohexyl-4,6-dinitrophenol	$C_{12}H_{11}N_2O_5$	132.8	161.8	175.9	191.2	206.7	216.0	229.0	248.7	269.8	291.5		
Cyclopentane	C_5H_{10}	-68.0	-49.6	-40.4	-30.1	-18.6	-11.3	-1.3	+13.8	31.0	49.3		-93.7
Cyclopropane	C_3H_6	-116.8	-104.2	-97.5	-90.3	-82.3	-77.0	-70.0	-59.1	-46.9	-33.5		-126.6
Cymene	$C_{10}H_{14}$	17.3	43.9	57.0	71.1	87.0	97.2	110.8	131.4	153.5	177.2		-68.2

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm (Continued)

Compound		Pressure, mm Hg									Melting point, °C	
		1	5	10	20	40	60	100	200	400		760
Name	Formula	Temperature, °C										
<i>cis</i> -Decalin	C ₁₀ H ₁₈	22.5	50.1	64.2	79.8	97.2	108.0	123.2	145.4	169.9	194.6	-43.3
<i>trans</i> -Decalin	C ₁₀ H ₁₈	-0.8	+30.6	47.2	65.3	85.7	98.4	114.6	136.2	160.1	186.7	-30.7
Decane	C ₁₀ H ₂₂	16.5	42.3	55.7	69.8	85.5	95.5	108.6	128.4	150.6	174.1	-29.7
Decan-2-one	C ₁₀ H ₂₀ O	44.2	71.9	85.8	100.7	117.1	127.8	142.0	163.2	186.7	211.0	+3.5
1-Decene	C ₁₀ H ₂₀	14.7	40.3	53.7	67.8	83.3	93.5	106.5	126.7	149.2	172.0	
Decyl alcohol	C ₁₀ H ₂₂ O	69.5	97.3	111.3	125.8	142.1	152.0	165.8	186.2	208.8	231.0	+7
Decyltrimethylsilane	C ₁₃ H ₃₀ Si	67.4	96.4	111.0	126.5	144.0	154.3	169.5	191.0	215.5	240.0	
Dehydroacetic acid	C ₈ H ₆ O ₄	91.7	122.0	137.3	153.0	171.0	181.5	197.5	219.5	244.5	269.0	
Desoxybenzoin	C ₁₄ H ₁₂ O	123.3	156.2	173.5	192.0	212.0	224.5	241.3	265.2	293.0	321.0	60
Diacetamide	C ₄ H ₇ NO ₂	70.0	95.0	108.0	122.6	138.2	148.0	160.6	180.8	202.0	223.0	78.5
Diacetylene (1,3-butadiyne)	C ₄ H ₂	-82.5	-68.0	-61.2	-53.8	-45.9	-41.0	-34.0	-20.9	-6.1	+9.7	-34.9
Diallyldichlorosilane	C ₆ H ₁₀ Cl ₂ Si	+9.5	34.8	47.4	61.3	76.4	86.3	99.7	119.4	142.0	165.3	
Diallyl sulfide	C ₆ H ₁₀ S	-9.5	+14.4	26.6	39.7	54.2	63.7	75.8	94.8	116.1	138.6	-83
Diisooamyl ether	C ₁₀ H ₂₂ O	18.6	44.3	57.0	70.7	86.3	96.0	109.6	129.0	150.3	173.4	
oxalate	C ₁₂ H ₂₂ O ₄	85.4	116.0	131.4	147.7	165.7	177.0	192.2	215.0	240.0	265.0	
sulfide	C ₁₀ H ₂₂ S	43.0	73.0	87.6	102.7	120.0	130.6	145.3	166.4	191.0	216.0	
Dibenzylamine	C ₁₄ H ₁₅ N	118.3	149.8	165.6	182.2	200.2	212.2	227.3	249.8	274.3	300.0	-26
Dibenzyl ketone (1,3-diphenyl-2-propanone)	C ₁₅ H ₁₄ O	125.5	159.8	177.6	195.7	216.6	229.4	246.6	272.3	301.7	330.5	34.5
1,4-Dibromobenzene	C ₆ H ₄ Br ₂	61.0	79.3	87.7	103.6	120.8	131.6	146.5	168.5	192.5	218.6	87.5
1,2-Dibromobutane	C ₄ H ₈ Br ₂	7.5	33.2	46.1	60.0	76.0	86.0	99.8	120.2	143.5	166.3	-64.5
<i>dl</i> -2,3-Dibromobutane	C ₄ H ₈ Br ₂	+5.0	30.0	41.6	56.4	72.0	82.0	95.3	115.7	138.0	160.5	
<i>meso</i> -2,3-Dibromobutane	C ₄ H ₈ Br ₂	+1.5	26.6	39.3	53.2	68.0	78.0	91.7	111.8	134.2	157.3	-34.5
1,2-Dibromodecane	C ₁₀ H ₂₀ Br ₂	95.7	123.6	137.3	151.0	167.4	177.5	190.2	209.6	229.8	250.4	
Di(2-bromoethyl) ether	C ₄ H ₈ Br ₂ O	47.7	75.3	88.5	103.6	119.8	130.0	144.0	165.0	188.0	212.5	
α,β -Dibromomaleic anhydride	C ₄ H ₂ Br ₂ O ₃	50.0	78.0	92.0	106.7	123.5	133.8	147.7	168.0	192.0	215.0	
1,2-Dibromo-2-methylpropane	C ₄ H ₈ Br ₂	-28.8	-3.0	+10.5	25.7	42.3	53.7	68.8	92.1	119.8	149.0	-70.3
1,3-Dibromo-2-methylpropane	C ₄ H ₈ Br ₂	14.0	40.0	53.0	67.5	83.5	93.7	107.4	117.8	150.6	174.6	
1,2-Dibromopentane	C ₅ H ₁₀ Br ₂	19.8	45.4	58.0	72.0	87.4	97.4	110.1	130.2	151.8	175.0	
1,2-Dibromopropane	C ₃ H ₆ Br ₂	-7.0	+17.3	29.4	42.3	57.2	66.4	78.7	97.8	118.5	141.6	-55.5
1,3-Dibromopropane	C ₃ H ₆ Br ₂	+9.7	35.4	48.0	62.1	77.8	87.8	101.3	121.7	144.1	167.5	-34.4
2,3-Dibromopropene	C ₃ H ₄ Br ₂	-6.0	+17.9	30.0	43.2	57.8	67.0	79.5	98.0	119.5	141.2	
2,3-Dibromo-1-propanol	C ₃ H ₆ Br ₂ O	57.0	84.5	98.2	113.5	129.8	140.0	153.0	173.8	196.0	219.0	
Diisobutylamine	C ₈ H ₁₉ N	-5.1	+18.4	30.6	43.7	57.8	67.0	79.2	97.6	118.0	139.5	-70
2,6-Ditert-butyl-4-cresol	C ₁₅ H ₂₄ O	85.8	116.2	131.0	147.0	164.1	175.2	190.0	212.8	237.6	262.5	
4,6-Ditert-butyl-2-cresol	C ₁₅ H ₂₄ O	86.2	117.3	132.4	149.0	167.4	179.0	194.0	217.5	243.4	269.3	
4,6-Ditert-butyl-3-cresol	C ₁₅ H ₂₄ O	103.7	135.2	150.0	167.0	185.3	196.1	211.0	233.0	257.1	282.0	
2,6-Ditert-butyl-4-ethylphenol	C ₁₆ H ₂₆ O	89.1	121.4	137.0	154.0	172.1	183.9	198.0	220.0	244.0	268.6	
4,6-Ditert-butyl-3-ethylphenol	C ₁₆ H ₂₆ O	111.5	142.6	157.4	174.0	192.3	204.4	218.0	241.7	264.6	290.0	
Diisobutyl oxalate	C ₁₀ H ₁₈ O ₄	63.2	91.2	105.3	120.3	137.5	147.8	161.8	183.5	205.8	229.5	
2,4-Ditert-butylphenol	C ₁₄ H ₂₂ O	84.5	115.4	130.0	146.0	164.3	175.8	190.0	212.5	237.0	260.8	
Dibutyl phthalate	C ₁₆ H ₂₂ O ₄	148.2	182.1	198.2	216.2	235.8	247.8	263.7	287.0	313.5	340.0	
sulfide	C ₈ H ₁₈ S	+21.7	51.8	66.4	80.5	96.0	105.8	118.6	138.0	159.0	182.0	-79.7
Diisobutyl <i>d</i> -tartrate	C ₁₂ H ₂₂ O ₆	117.8	151.8	169.0	188.0	208.5	221.6	239.5	264.7	294.0	324.0	73.5
Dicarvacryl-mono-(6-chloro-2-xenyl) phosphate	C ₂₃ H ₃₄ ClO ₄ P	204.2	234.5	249.3	264.5	280.5	290.7	304.9	323.8	342.0	361.0	
Dicarvacryl-2-tolyl phosphate	C ₂₇ H ₃₃ O ₄ P	180.2	209.3	221.8	237.0	251.5	260.3	272.5	290.0	309.8	330.0	
Dichloroacetic acid	C ₂ H ₂ Cl ₂ O ₂	44.0	69.8	82.6	96.3	111.8	121.5	134.0	152.3	173.7	194.4	9.7
1,2-Dichlorobenzene	C ₆ H ₄ Cl ₂	20.0	46.0	59.1	73.4	89.4	99.5	112.9	133.4	155.8	179.0	-17.6
1,3-Dichlorobenzene	C ₆ H ₄ Cl ₂	12.1	39.0	52.0	66.2	82.0	92.2	105.0	125.9	149.0	173.0	-24.2
1,4-Dichlorobenzene	C ₆ H ₄ Cl ₂			54.8	69.2	84.8	95.2	108.4	128.3	150.2	173.9	53.0
1,2-Dichlorobutane	C ₄ H ₈ Cl ₂	-23.6	-0.3	+11.5	24.5	37.7	47.8	60.2	79.7	100.8	123.5	
2,3-Dichlorobutane	C ₄ H ₈ Cl ₂	-25.2	-3.0	+8.5	21.2	35.0	43.9	56.0	74.0	94.2	116.0	-80.4
1,2-Dichloro-1,2-difluoroethylene	C ₂ Cl ₂ F ₂	-82.0	-65.6	-57.3	-48.3	-38.2	-31.8	-23.0	-10.0	+5.0	20.9	-112
Dichlorodifluoromethane	CCl ₂ F ₂	-118.5	-104.6	-97.8	-90.1	-81.6	-76.1	-68.6	-57.0	-43.9	-29.8	
Dichlorodiphenyl silane	C ₁₂ H ₁₀ Cl ₂ Si	109.6	142.4	158.0	176.0	195.5	207.5	223.8	248.0	275.5	304.0	
Dichlorodisopropyl ether	C ₆ H ₁₂ Cl ₂ O	29.6	55.2	68.2	82.2	97.3	106.9	119.7	139.0	159.8	182.7	
Di(2-chloroethoxy) methane	C ₆ H ₁₀ Cl ₂ O ₂	53.0	80.4	94.0	109.5	125.5	135.8	149.6	170.0	192.0	215.0	
Dichloroethoxymethylsilane	C ₃ H ₈ Cl ₂ O ₂ Si	-33.8	-12.1	-1.3	+11.3	24.4	32.6	44.1	61.0	80.3	100.6	
1,2-Dichloro-3-ethylbenzene	C ₈ H ₈ Cl ₂	46.0	75.0	90.0	105.9	123.8	135.0	149.8	172.0	197.0	222.1	-40.8
1,2-Dichloro-4-ethylbenzene	C ₈ H ₈ Cl ₂	47.0	77.2	92.3	109.6	127.5	139.0	153.3	176.0	201.7	226.6	-76.4
1,4-Dichloro-2-ethylbenzene	C ₈ H ₈ Cl ₂	38.5	68.0	83.2	99.8	118.0	129.0	144.0	166.2	191.5	216.3	-61.2
<i>cis</i> -1,2-Dichloroethylene	C ₂ H ₂ Cl ₂	-58.4	-39.2	-29.9	-19.4	-7.9	-0.5	+9.5	24.6	41.0	59.0	-80.5
<i>trans</i> -1,2-Dichloroethylene	C ₂ H ₂ Cl ₂	-65.4	-47.2	-38.0	-28.0	-17.0	-10.0	-0.2	+14.3	30.8	47.8	-50.0
Di(2-chloroethyl) ether	C ₄ H ₈ Cl ₂ O	23.5	49.3	62.0	76.0	91.5	101.5	114.5	134.0	155.4	178.5	
Dichlorodifluoromethane	CHCl ₂ F	-91.3	-75.5	-67.5	-58.6	-48.8	-42.6	-33.9	-20.9	-6.2	+8.9	-135
1,5-Dichlorohexamethyltrisiloxane	C ₆ H ₁₈ Cl ₂ O ₂ Si ₃	26.0	52.0	65.1	79.0	94.8	105.0	118.2	138.3	160.2	184.0	-53.0
Dichloromethylphenylsilane	C ₇ H ₉ Cl ₂ Si	35.7	63.5	77.4	92.4	109.5	120.0	134.2	155.5	180.2	205.5	
1,1-Dichloro-2-methylpropane	C ₄ H ₈ Cl ₂	-31.0	-8.4	+2.6	14.6	28.2	37.0	48.2	65.8	85.4	106.0	
1,2-Dichloro-2-methylpropane	C ₄ H ₈ Cl ₂	-25.8	-4.2	+6.7	18.7	32.0	40.2	51.7	68.9	87.8	108.0	
1,3-Dichloro-2-methylpropane	C ₄ H ₈ Cl ₂	-3.0	+20.6	32.0	44.8	58.6	67.5	78.8	96.1	115.4	135.0	
2,4-Dichlorophenol	C ₆ H ₄ Cl ₂ O	53.0	80.0	92.8	107.7	123.4	133.5	146.0	165.2	187.5	210.0	45.0
2,6-Dichlorophenol	C ₆ H ₄ Cl ₂ O	59.5	87.6	101.0	115.5	131.6	141.8	154.6	175.5	197.7	220.0	

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm (Continued)

Compound		Pressure, mm Hg									Melting point, °C	
		1	5	10	20	40	60	100	200	400		760
Name	Formula	Temperature, °C										
α,α -Dichlorophenylacetonitrile	C ₈ H ₅ Cl ₂ N	56.0	84.0	98.1	113.8	130.0	141.0	154.5	176.2	199.5		223.5
Dichlorophenylarsine	C ₆ H ₅ AsCl ₂	61.8	100.0	116.0	133.1	151.0	163.2	178.9	202.8	228.8	256.5	
1,2-Dichloropropane	C ₃ H ₆ Cl ₂	-38.5	-17.0	-6.1	+6.0	19.4	28.0	39.4	57.0	76.0	96.8	
2,3-Dichlorostyrene	C ₈ H ₆ Cl ₂	61.0	90.1	104.6	120.5	137.8	149.0	163.5	185.7	210.0	235.0	
2,4-Dichlorostyrene	C ₈ H ₆ Cl ₂	53.5	82.2	97.4	111.8	129.2	140.0	153.8	176.0	200.0	225.0	
2,5-Dichlorostyrene	C ₈ H ₆ Cl ₂	55.5	83.9	98.2	114.0	131.0	142.0	155.8	178.0	202.5	227.0	
2,6-Dichlorostyrene	C ₈ H ₆ Cl ₂	47.8	75.7	90.0	105.5	122.4	133.3	147.6	169.0	193.5	217.0	
3,4-Dichlorostyrene	C ₈ H ₆ Cl ₂	57.2	86.0	100.4	116.2	133.7	144.6	158.2	181.5	205.7	230.0	
3,5-Dichlorostyrene	C ₈ H ₆ Cl ₂	53.5	82.2	97.4	111.8	129.2	140.0	153.8	176.0	200.0	225.0	
1,2-Dichlorotetraethylbenzene	C ₁₄ H ₂₀ Cl ₂	105.6	138.7	155.0	172.5	192.2	204.8	220.7	245.6	272.8	302.0	
1,4-Dichlorotetraethylbenzene	C ₁₄ H ₂₀ Cl ₂	91.7	126.1	143.8	162.0	183.2	195.8	212.0	238.5	265.8	296.5	
1,2-Dichloro-1,1,2,2-tetrafluoroethane	C ₂ Cl ₂ F ₄	-95.4	-80.0	-72.3	-63.5	-53.7	-47.5	-39.1	-26.3	-12.0	+3.5	-94
Dichloro-4-tolylsilane	C ₉ H ₈ Cl ₂ Si	46.2	71.7	84.2	97.8	113.2	122.6	135.5	153.5	175.2	196.3	
3,4-Dichloro- α,α,α -trifluorotoluene	C ₇ H ₃ Cl ₂ F ₃	11.0	38.3	52.2	67.3	84.0	95.0	109.2	129.0	150.5	172.8	-12.1
Dicyclopentadiene	C ₁₀ H ₈		34.1	47.6	62.0	77.9	88.0	101.7	121.8	144.2	166.6	32.9
Diethoxydimethylsilane	C ₈ H ₁₆ O ₂ Si	-19.1	+2.4	13.3	25.3	38.0	46.3	57.6	74.2	93.2	113.5	
Diethoxydiphenylsilane	C ₁₆ H ₂₀ O ₂ Si	111.5	142.8	157.6	174.3	193.2	205.0	220.0	243.8	259.7	296.0	
Diethyl adipate	C ₁₀ H ₁₈ O ₄	74.0	106.6	123.0	138.3	154.6	165.8	179.0	198.2	219.1	240.0	-21
Diethylamine	C ₄ H ₁₁ N			-33.0	-22.6	-11.3	-4.0	+6.0	21.0	38.0	55.5	-38.9
N-Diethylamine	C ₁₀ H ₁₉ N	49.7	78.0	91.9	107.2	123.6	133.8	147.3	168.2	192.4	215.0	-34.4
Diethyl arsaniolate	C ₁₀ H ₁₆ As											
	NO ₃	38.0	62.6	74.8	88.0	102.6	111.8	123.8	141.9	161.0	181.0	
1,2-Diethylbenzene	C ₁₀ H ₁₄	22.3	48.7	62.0	76.4	92.5	102.6	116.2	136.7	159.0	183.5	-31.4
1,3-Diethylbenzene	C ₁₀ H ₁₄	20.7	46.8	59.9	74.5	90.4	100.7	114.4	134.8	156.9	181.1	-83.9
1,4-Diethylbenzene	C ₁₀ H ₁₄	20.7	47.1	60.3	74.7	91.1	101.3	115.3	136.1	159.0	183.8	-43.2
Diethyl carbonate	C ₈ H ₁₀ O ₃	-10.1	+12.3	23.8	36.0	49.5	57.9	69.7	86.5	105.8	125.8	-43
cis-Diethyl citraconate	C ₉ H ₁₄ O ₄	59.8	88.3	103.0	118.2	135.7	146.2	160.0	182.3	206.5	230.3	
Diethyl dioxosuccinate	C ₈ H ₁₀ O ₄	70.0	98.0	112.0	126.8	143.8	153.7	167.7	188.0	210.8	233.5	
Diethylene glycol	C ₄ H ₁₀ O ₃	91.8	120.0	133.8	148.0	164.3	174.0	187.5	207.0	226.5	244.8	
Diethyleneglycol-bis-chloroacetate	C ₈ H ₁₂ Cl ₂ O ₅	148.3	180.0	195.8	212.0	229.0	239.5	252.0	271.5	291.8	313.0	
Diethylene glycol dimethyl ether												
Di(2-methoxyethyl) ether	C ₆ H ₁₄ O ₃	13.0	37.6	50.0	63.0	77.5	86.8	99.5	118.0	138.5	159.8	
glycol ethyl ether	C ₆ H ₁₄ O ₃	45.3	72.0	85.8	100.3	116.7	126.8	140.3	159.0	180.3	201.9	
Diethyl ether	C ₄ H ₁₀ O	-74.3	-56.9	-48.1	-38.5	-27.7	-21.8	-11.5	+2.2	17.9	34.6	-116.3
ethylmalonate	C ₉ H ₁₆ O ₄	50.8	77.8	91.6	106.0	122.4	132.4	146.0	166.0	188.7	211.5	
fumarate	C ₈ H ₁₂ O ₄	53.2	81.2	95.3	110.2	126.7	137.7	151.1	172.2	195.8	218.5	+0.6
glutarate	C ₉ H ₁₆ O ₄	65.6	94.7	109.7	125.4	142.8	153.2	167.8	189.5	212.8	237.0	
Diethylhexadecylamine	C ₂₀ H ₄₂ N	139.8	175.8	194.0	213.5	235.0	248.5	265.5	292.8	324.6	355.0	
Diethyl itaconate	C ₉ H ₁₄ O ₄	51.3	80.2	95.2	111.0	128.2	139.9	154.3	177.5	203.1	227.9	
ketone (3-pentanone)	C ₅ H ₁₀ O	-12.7	+7.5	17.2	27.9	39.4	46.7	56.2	70.6	86.3	102.7	
malate	C ₈ H ₁₄ O ₅	80.7	110.4	125.3	141.2	157.8	169.0	183.9	205.3	229.5	253.4	
maleate	C ₈ H ₁₂ O ₄	57.3	85.6	100.0	115.3	131.8	142.4	156.0	177.8	201.7	225.0	
malonate	C ₇ H ₁₂ O ₄	40.0	67.5	81.3	95.9	113.3	123.0	136.2	155.5	176.8	198.9	-49.8
mesaconate	C ₉ H ₁₄ O ₄	62.8	91.0	105.3	120.3	137.3	147.9	161.6	183.2	205.8	229.0	
oxalate	C ₆ H ₁₀ O ₄	47.4	71.8	83.8	96.8	110.6	119.7	130.8	147.9	166.2	185.7	-40.6
phthalate	C ₁₂ H ₁₄ O ₄	108.8	140.7	156.0	173.6	192.1	204.1	219.5	243.0	267.5	294.0	
sebacate	C ₁₄ H ₂₆ O ₄	125.3	156.2	172.1	189.8	207.5	218.4	234.4	255.8	280.3	305.5	1.3
2,5-Diethylstyrene	C ₁₂ H ₁₆	49.7	78.4	92.6	108.5	125.8	136.8	151.0	173.2	198.0	223.0	
Diethyl succinate	C ₈ H ₁₄ O ₄	54.6	83.0	96.6	111.7	127.8	138.2	151.1	171.7	193.8	216.5	-20.8
isosuccinate	C ₈ H ₁₄ O ₄	39.8	66.7	80.0	94.7	111.0	121.4	134.8	155.1	177.7	201.3	
sulfate	C ₄ H ₁₀ O ₄ S	47.0	74.0	87.7	102.1	118.0	128.6	142.5	162.5	185.5	209.5	-25.0
sulfide	C ₄ H ₁₀ S	-39.6	-18.6	-8.0	+3.5	16.1	24.2	35.0	51.3	69.7	88.0	-99.5
sulfite	C ₄ H ₁₀ O ₃ S	10.0	34.2	46.4	59.7	74.2	83.8	96.3	115.8	137.0	159.0	
d-Diethyl tartrate	C ₈ H ₁₄ O ₆	102.0	133.0	148.0	164.2	182.3	194.0	208.5	230.4	254.8	280.0	17
dl-Diethyl tartrate	C ₈ H ₁₄ O ₆	100.0	131.7	147.2	163.8	181.7	193.2	208.0	230.0	254.3	280.0	
3,5-Diethyltoluene	C ₁₁ H ₁₆	34.0	61.5	75.3	90.2	107.0	117.7	131.7	152.4	176.5	200.7	
Diethylzinc	C ₄ H ₁₀ Zn	-22.4	0.0	+11.7	24.2	38.0	47.2	59.1	77.0	97.3	118.0	-28
1-Dihydrocarbone	C ₁₀ H ₁₆ O	46.6	75.5	90.0	106.0	123.7	134.7	149.7	171.8	197.0	223.0	
Dihydrocitronellol	C ₁₀ H ₁₈ O	68.0	91.7	103.0	115.0	127.6	136.7	145.9	160.2	176.8	193.5	
1,4-Dihydroxyanthraquinone	C ₁₄ H ₈ O ₄	196.7	239.8	259.8	282.0	307.4	323.3	344.5	377.8	413.0	450.0	194
Dimethylacetylene (2-butyne)	C ₄ H ₆	-73.0	-57.9	-50.5	-42.5	-33.9	-27.8	-18.8	-5.0	+10.6	27.2	-32.5
Dimethylamine	C ₂ H ₇ N	-87.7	-72.2	-64.6	-56.0	-46.7	-40.7	-32.6	-20.4	-7.1	+7.4	-96
N,N-Dimethylaniline	C ₈ H ₁₁ N	29.5	56.3	70.0	84.8	101.6	111.9	125.8	146.5	169.2	193.1	+2.5
Dimethyl arsaniolate	C ₈ H ₁₂ AsNO ₃	15.0	39.6	51.8	65.0	79.7	88.6	101.0	119.8	140.3	160.5	
Di(α -methylbenzyl) ether	C ₁₆ H ₁₈ O	96.7	128.3	144.0	160.3	179.6	191.5	206.8	229.7	254.8	281.0	
2,2-Dimethylbutane	C ₆ H ₁₄	-69.3	-50.7	-41.5	-31.1	-19.5	-12.1	-2.0	+13.4	31.0	49.7	-99.8
2,3-Dimethylbutane	C ₆ H ₁₄	-63.6	-44.5	-34.9	-24.1	-12.4	-4.9	+5.4	21.1	39.0	58.0	-128.2
Dimethyl citraconate	C ₉ H ₁₀ O ₄	50.8	78.2	91.8	106.5	122.6	132.7	145.8	165.8	188.0	210.5	
1,1-Dimethylcyclohexane	C ₈ H ₁₆	-24.4	-1.4	+10.3	23.0	37.3	45.7	57.9	76.2	97.2	119.5	-34
cis-1,2-Dimethylcyclohexane	C ₈ H ₁₆	-15.9	+7.3	18.4	31.1	45.3	54.4	66.8	85.6	107.0	129.7	-50.0
trans-1,2-Dimethylcyclohexane	C ₈ H ₁₆	-21.1	+1.7	13.0	25.6	39.7	48.7	61.0	79.6	100.9	123.4	-88.0
trans-1,3-Dimethylcyclohexane	C ₈ H ₁₆	-19.4	+3.4	14.9	27.4	41.4	50.4	62.5	81.0	102.1	124.4	-92.0
cis-1,3-Dimethylcyclohexane	C ₈ H ₁₆	-22.7	0.0	+11.2	23.6	37.5	46.4	58.5	76.9	97.8	120.1	-76.2
cis-1,4-Dimethylcyclohexane	C ₈ H ₁₆	-20.0	+3.2	14.5	27.1	41.1	50.1	62.3	80.8	101.9	124.3	-87.4
trans-1,4-Dimethylcyclohexane	C ₈ H ₁₆	-24.3	-1.7	+10.1	22.6	36.5	45.4	57.6	76.0	97.0	119.3	-36.9

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm (Continued)

Compound		Pressure, mm Hg									Melting point, °C	
		1	5	10	20	40	60	100	200	400		760
Name	Formula	Temperature, °C										
Dimethyl ether	C ₂ H ₆ O	-115.7	-101.1	-93.3	-85.2	-76.2	-70.4	-62.7	-50.9	-37.8	-23.7	-138.5
2,2-Dimethylhexane	C ₈ H ₁₈	-29.7	-7.9	+3.1	15.0	28.2	36.7	48.2	65.7	85.6	106.8	
2,3-Dimethylhexane	C ₈ H ₁₈	-23.0	-1.1	+9.9	22.1	35.6	44.2	56.0	73.8	94.1	115.6	
2,4-Dimethylhexane	C ₈ H ₁₈	-26.9	-5.3	+5.2	17.2	30.5	39.0	50.6	68.1	88.2	109.4	
2,5-Dimethylhexane	C ₈ H ₁₈	-26.7	-5.5	+5.3	17.2	30.4	38.9	50.5	68.0	87.9	109.1	-90.7
3,3-Dimethylhexane	C ₈ H ₁₈	-25.8	-4.4	+6.1	18.2	31.7	40.4	52.5	70.0	90.4	112.0	
3,4-Dimethylhexane	C ₈ H ₁₈	-22.1	+0.2	11.3	23.5	37.1	45.8	57.7	75.6	96.0	117.7	
Dimethyl itaconate	C ₇ H ₁₀ O ₄	69.3	94.0	106.6	119.7	133.7	142.6	153.7	171.0	189.8	208.0	38
1-Dimethyl malate	C ₆ H ₁₀ O ₅	75.4	104.0	118.3	133.8	150.1	160.4	175.1	196.3	219.5	242.6	
Dimethyl maleate	C ₆ H ₈ O ₄	45.7	73.0	86.4	101.3	117.2	127.1	140.4	160.0	182.2	205.0	
malonate	C ₅ H ₈ O ₄	35.0	59.8	72.0	85.0	100.0	109.7	121.9	140.0	159.8	180.7	-62
<i>trans</i> -Dimethyl mesaconate	C ₇ H ₁₀ O ₄	46.8	74.0	87.8	102.1	118.0	127.8	141.5	161.0	183.5	206.0	
2,7-Dimethyloctane	C ₁₀ H ₂₂	+6.3	30.5	42.3	55.8	71.2	80.8	93.9	114.0	136.0	159.7	-52.8
Dimethyl oxalate	C ₄ H ₆ O ₄	20.0	44.0	56.0	69.4	83.6	92.8	104.8	123.3	143.3	163.3	
2,2-Dimethylpentane	C ₇ H ₁₆	-49.0	-28.7	-18.7	-7.5	+5.0	13.0	23.9	40.3	59.2	79.2	-123.7
2,3-Dimethylpentane	C ₇ H ₁₆	-42.0	-20.8	-10.3	+1.1	13.9	22.1	33.3	50.1	69.4	89.8	-135
2,4-Dimethylpentane	C ₇ H ₁₆	-48.0	-27.4	-17.1	-5.9	+6.5	14.5	25.4	41.8	60.6	80.5	-119.5
3,3-Dimethylpentane	C ₇ H ₁₆	-45.9	-25.0	-14.4	-2.9	+9.9	18.1	29.3	46.2	65.5	86.1	-135.0
2,3-Dimethylphenol (2,3-xylene)	C ₈ H ₁₀ O	56.0	83.8	97.6	112.0	129.2	139.5	152.2	173.0	196.0	218.0	75
2,4-Dimethylphenol (2,4-xylene)	C ₈ H ₁₀ O	51.8	78.0	91.3	105.0	121.5	131.0	143.0	161.5	184.2	211.5	25.5
2,5-Dimethylphenol (2,5-xylene)	C ₈ H ₁₀ O	51.8	78.0	91.3	105.0	121.5	131.0	143.0	161.5	184.2	211.5	74.5
3,4-Dimethylphenol (3,4-xylene)	C ₈ H ₁₀ O	66.2	93.8	107.7	122.0	138.0	148.0	161.0	181.5	203.6	225.2	62.5
3,5-Dimethylphenol (3,5-xylene)	C ₈ H ₁₀ O	62.0	89.2	102.4	117.0	133.3	143.5	156.0	176.2	197.8	219.5	68
Dimethylphenylsilane	C ₈ H ₁₂ Si	+5.3	30.3	42.6	56.2	71.4	81.3	94.2	114.2	136.4	159.3	
Dimethyl phthalate	C ₁₀ H ₁₀ O ₄	100.3	131.8	147.6	164.0	182.8	194.0	210.0	232.7	257.8	283.7	
3,5-Dimethyl-1,2-pyrone	C ₇ H ₈ O ₂	78.6	107.6	122.0	136.4	152.7	163.8	177.5	198.0	221.0	245.0	51.5
4,6-Dimethylresorcinol	C ₈ H ₁₀ O ₂	49.0	76.8	90.7	105.8	122.5	133.2	147.3	167.8	192.0	215.0	
Dimethyl sebacate	C ₁₂ H ₂₂ O ₄	104.0	139.8	156.2	175.8	196.0	208.0	222.6	245.0	269.6	293.5	38
2,4-Dimethylstyrene	C ₁₀ H ₁₂	34.2	61.9	75.8	90.8	107.7	118.0	132.3	153.2	177.5	202.0	
2,5-Dimethylstyrene	C ₁₀ H ₁₂	-29.0	55.9	69.0	84.0	100.2	110.7	124.7	145.6	168.7	193.0	
α,α-Dimethylsuccinic anhydride	C ₆ H ₈ O ₃	61.4	88.1	102.0	116.3	132.3	142.4	155.3	175.8	197.5	219.5	
Dimethyl sulfide	C ₂ H ₆ S	-75.6	-58.0	-49.2	-39.4	-28.4	-21.4	-12.0	+2.6	18.7	36.0	-83.2
<i>d</i> -Dimethyl tartrate	C ₈ H ₁₆ O ₆	102.1	133.2	148.2	164.3	182.4	193.8	208.8	230.5	255.0	280.0	61.5
<i>dl</i> -Dimethyl tartrate	C ₈ H ₁₆ O ₆	100.4	131.8	147.5	164.0	182.4	193.8	209.5	232.3	257.4	282.0	89
<i>N,N</i> -Dimethyl-2-toluidine	C ₉ H ₁₃ N	28.8	54.1	66.2	80.2	95.0	105.2	118.3	138.3	161.5	184.8	-61
<i>N,N</i> -Dimethyl-4-toluidine	C ₉ H ₁₃ N	50.1	74.3	86.7	100.0	116.3	126.4	140.3	161.6	185.4	209.5	
Di(mitosromethyl) amine	C ₂ H ₅ N ₃ O ₂	+3.2	27.8	40.0	53.7	68.2	77.7	90.3	110.0	131.3	153.0	
Diosphenol	C ₁₀ H ₁₆ O ₂	66.7	95.4	109.0	124.0	141.2	151.3	165.6	186.2	209.5	232.0	
1,4-Dioxane	C ₄ H ₈ O ₂	-35.8	-12.8	-1.2	+12.0	25.2	33.8	45.1	62.3	81.8	101.1	10
Dipentene	C ₁₀ H ₁₆	14.0	40.4	53.8	68.2	84.3	94.6	108.3	128.2	150.5	174.6	
Diphenylamine	C ₁₂ H ₁₁ N	108.3	141.7	157.0	175.2	194.3	206.9	222.8	247.5	274.1	302.0	52.9
Diphenyl carbinol (benzhydrol)	C ₁₃ H ₁₂ O	110.0	145.0	162.0	180.9	200.0	212.0	227.5	250.0	275.6	301.0	68.5
chlorophosphate	C ₁₂ H ₁₀ ClPO ₃	121.5	160.5	182.0	203.8	227.9	244.2	265.0	299.5	337.2	378.0	
disulfide	C ₁₂ H ₁₀ S ₂	131.6	164.0	180.0	197.0	214.8	226.2	241.3	262.6	285.8	310.0	61
1,2-Diphenylethane (dibenzyl)	C ₁₄ H ₁₄	86.8	119.8	136.0	153.7	173.7	186.0	202.8	227.8	255.0	284.0	51.5
Diphenyl ether	C ₁₂ H ₁₀ O	66.1	97.8	114.0	130.8	150.0	162.0	178.8	203.3	230.7	258.5	27
1,1-Diphenylethylene	C ₁₄ H ₁₂	87.4	119.6	135.0	151.8	170.8	183.4	198.6	222.8	249.8	277.0	
<i>trans</i> -Diphenylethylene	C ₁₄ H ₁₂	113.2	145.8	161.0	179.8	199.0	211.5	227.4	251.7	278.3	306.5	124
1,1-Diphenylhydrazine	C ₁₂ H ₁₂ N ₂	126.0	159.3	176.1	194.0	213.5	225.9	242.5	267.2	294.0	322.2	44
Diphenylmethane	C ₁₃ H ₁₂	76.0	107.4	122.8	139.8	157.8	170.2	186.3	210.7	237.5	264.5	26.5
Diphenyl sulfide	C ₁₂ H ₁₀ S	96.1	129.0	145.0	162.0	182.8	194.8	211.8	236.8	263.9	292.5	
Diphenyl-2-tolyl thiophosphate	C ₁₈ H ₁₇ O ₃ PS	159.7	179.8	201.6	215.5	230.6	240.4	252.5	270.3	290.0	310.0	
1,2-Dipropoxyethane	C ₈ H ₁₈ O ₂	-38.8	-10.3	+5.0	22.3	42.3	55.8	74.2	103.8	140.0	180.0	
1,2-Diisopropylbenzene	C ₁₂ H ₁₈	40.0	67.8	81.8	96.8	114.0	124.3	138.7	159.8	184.3	209.0	
1,3-Diisopropylbenzene	C ₁₂ H ₁₈	34.7	62.3	76.0	91.2	107.9	118.2	132.3	153.7	177.6	202.0	-105
Dipropylene glycol	C ₆ H ₁₄ O ₃	73.8	102.1	116.2	131.3	147.4	156.5	169.9	189.9	210.5	231.8	
Dipropylene glycol monobutyl ether	C ₁₀ H ₂₂ O ₃	64.7	92.0	106.0	120.4	136.3	146.3	159.8	180.0	203.8	227.0	
isopropyl ether	C ₆ H ₁₄ O ₂	46.0	72.8	86.2	100.8	117.0	126.8	140.3	160.0	183.1	205.6	
Di- <i>n</i> -propyl ether	C ₆ H ₁₄ O	-43.3	-22.3	-11.8	0.0	+13.2	21.6	33.0	50.3	69.5	89.5	-122
Diisopropyl ether	C ₆ H ₁₄ O	-57.0	-37.4	-27.4	-16.7	-4.5	+3.4	13.7	30.0	48.2	67.5	-60
Di- <i>n</i> -propyl ketone (4-heptanone)	C ₇ H ₁₄ O	23.0	44.4	55.0	66.2	78.1	85.8	96.0	111.2	127.3	143.7	-32.6
Di- <i>n</i> -propyl oxalate	C ₈ H ₁₄ O ₄	53.4	80.2	93.9	108.6	124.6	134.8	148.1	168.0	190.3	213.5	
Diisopropyl oxalate	C ₈ H ₁₄ O ₄	43.2	69.0	81.9	95.6	110.5	120.0	132.6	151.2	171.8	193.5	
Di- <i>n</i> -propyl succinate	C ₁₀ H ₁₈ O ₄	77.5	107.6	122.2	138.0	154.8	166.0	180.3	202.5	226.5	250.8	
Di- <i>n</i> -propyl <i>d</i> -tartrate	C ₁₀ H ₁₈ O ₆	115.6	147.7	163.5	180.4	199.7	211.7	227.0	250.1	275.6	303.0	
Diisopropyl <i>d</i> -tartrate	C ₁₀ H ₁₈ O ₆	103.7	133.7	148.2	164.0	181.9	192.6	207.3	228.2	251.8	275.0	
Divinyl acetylene (1,5-hexadiene-3-yne)	C ₆ H ₆	-45.1	-24.4	-14.0	-2.8	+10.0	18.1	29.5	46.0	64.4	84.0	
1,3-Divinylbenzene	C ₁₀ H ₁₀	32.7	60.0	73.8	88.7	105.5	116.0	130.0	151.4	175.2	199.5	-66.9
Docosane	C ₂₂ H ₄₆	157.8	195.4	213.0	233.5	254.5	268.3	286.0	314.2	343.5	376.0	44.5
<i>n</i> -Dodecane	C ₁₂ H ₂₆	47.8	75.8	90.0	104.6	121.7	132.1	146.2	167.2	191.0	216.2	-9.6
1-Dodecene	C ₁₂ H ₂₄	47.2	74.0	87.8	102.4	118.6	128.5	142.3	162.2	185.5	208.0	-31.5
<i>n</i> -Dodecyl alcohol	C ₁₂ H ₂₆ O	91.0	120.2	134.7	150.0	167.2	177.8	192.0	213.0	235.7	259.0	24
Dodecylamine	C ₁₂ H ₂₇ N	82.8	111.8	127.8	141.6	157.4	168.0	182.1	203.0	225.0	248.0	
Dodecyltrimethylsilane	C ₁₅ H ₃₄ Si	91.2	122.1	137.7	153.8	172.1	184.2	199.5	222.0	248.0	273.0	
Elaidic acid	C ₁₈ H ₃₄ O ₂	171.3	206.7	223.5	242.3	260.8	273.0	288.0	312.4	337.0	362.0	51.5

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm (Continued)

Compound		Pressure, mm Hg										Melting point, °C
		1	5	10	20	40	60	100	200	400	760	
Name	Formula	Temperature, °C										
Epichlorohydrin	C ₃ H ₅ ClO	-16.5	+5.6	16.6	29.0	42.0	50.6	62.0	79.3	98.0	117.9	-25.6
1,2-Epoxy-2-methylpropane	C ₄ H ₈ O	-69.0	-50.0	-40.3	-29.5	-17.3	-9.7	+1.2	17.5	36.0	55.5	
Erucic acid	C ₂₂ H ₄₂ O ₂	206.7	239.7	254.5	270.6	289.1	300.2	314.4	336.5	358.8	381.5	33.5
Estragole (<i>p</i> -methoxy allyl benzene)	C ₁₀ H ₁₂ O	52.6	80.0	93.7	108.4	124.6	135.2	148.5	168.7	192.0	215.0	
Ethane	C ₂ H ₆	-159.5	-148.5	-142.9	-136.7	-129.8	-125.4	-119.3	-110.2	-99.7	-88.6	-183.2
Ethoxydimethylphenylsilane	C ₁₀ H ₁₆ OSi	36.3	63.1	76.2	91.0	107.2	127.5	131.4	151.5	175.0	199.5	
Ethoxytrimethylsilane	C ₅ H ₁₄ OSi	-50.9	-31.0	-20.7	-9.8	+3.7	11.5	22.1	38.1	56.3	75.7	
Ethoxytriphenylsilane	C ₂₀ H ₃₀ OSi	167.0	198.2	213.5	230.0	247.0	258.3	273.5	295.0	319.5	344.0	
Ethyl acetate	C ₄ H ₈ O ₂	-43.4	-23.5	-13.5	-3.0	+9.1	16.6	27.0	42.0	59.3	77.1	-82.4
acetate	C ₆ H ₁₀ O ₃	28.5	54.0	67.3	81.1	96.2	106.0	118.5	138.0	158.2	180.8	-45
Ethylacetylene (1-butyne)	C ₄ H ₆	-92.5	-76.7	-68.7	-59.9	-50.0	-43.4	-34.9	-21.6	-6.9	+8.7	-130
Ethyl acrylate	C ₅ H ₈ O ₂	-29.5	-8.7	+2.0	13.0	26.0	33.5	44.5	61.5	80.0	99.5	-71.2
α-Ethylacrylic acid	C ₅ H ₈ O ₂	47.0	70.7	82.0	94.4	108.1	116.7	127.5	144.0	160.7	179.2	
α-Ethylacrylonitrile	C ₃ H ₇ N	-29.0	-6.4	+5.0	17.7	31.8	40.6	53.0	71.6	92.2	114.0	
Ethyl alcohol (ethanol)	C ₂ H ₆ O	-31.3	-12.0	-2.3	+8.0	19.0	26.0	34.9	48.4	63.5	78.4	-112
Ethylamine	C ₂ H ₇ N	-82.3	-66.4	-58.3	-48.6	-39.8	-33.4	-25.1	-12.3	+2.0	16.6	-80.6
4-Ethylaniline	C ₈ H ₁₁ N	52.0	80.0	93.8	109.0	125.7	136.0	149.8	170.6	194.2	217.4	-4
N-Ethylaniline	C ₈ H ₁₁ N	38.5	66.4	80.6	96.0	113.2	123.6	137.3	156.9	180.8	204.0	-63.5
2-Ethylanisole	C ₉ H ₁₂ O	29.7	55.9	69.0	83.1	98.8	109.0	122.3	142.1	164.2	187.1	
3-Ethylanisole	C ₉ H ₁₂ O	33.7	60.3	73.9	88.5	104.8	115.5	129.2	149.7	172.8	196.5	
4-Ethylanisole	C ₉ H ₁₂ O	33.5	60.2	73.9	88.5	104.7	115.4	128.4	149.2	172.3	196.5	
Ethylbenzene	C ₈ H ₁₀	-9.8	+13.9	25.9	38.6	52.8	61.8	74.1	92.7	113.8	136.2	-94.9
Ethyl benzoate	C ₉ H ₁₀ O ₂	44.0	72.0	86.0	101.4	118.2	129.0	143.2	164.8	188.4	213.4	-34.6
benzoacetate	C ₁₁ H ₁₂ O ₃	107.6	136.4	150.3	166.8	181.8	191.9	205.0	223.8	244.7	265.0	
bromide	C ₈ H ₇ Br	-74.3	-56.4	-47.5	-37.8	-26.7	-19.5	-10.0	+4.5	21.0	38.4	-117.8
α-bromoisobutyrate	C ₆ H ₁₁ BrO ₂	10.6	35.8	48.0	61.8	77.0	86.7	99.8	119.7	141.2	163.6	
<i>n</i> -butyrate	C ₆ H ₁₂ O ₂	-18.4	+4.0	15.3	27.8	41.5	50.1	62.0	79.8	100.0	121.0	-93.3
isobutyrate	C ₆ H ₁₂ O ₂	-24.3	-2.4	+8.4	20.6	33.8	42.3	53.5	71.0	90.0	110.0	-88.2
Ethylcamphoronic anhydride	C ₁₁ H ₁₆ O ₅	118.2	149.8	165.0	181.8	199.8	211.5	226.6	248.5	272.8	298.0	
Ethyl isocaproate	C ₈ H ₁₆ O ₂	11.0	35.8	48.0	61.7	76.3	85.8	98.4	117.8	139.2	160.4	
carbamate	C ₃ H ₇ NO ₂		65.8	77.8	91.0	105.6	114.8	126.2	144.2	164.0	184.0	49
carbanilate	C ₉ H ₁₁ NO ₂	107.8	131.8	143.7	155.5	168.8	177.3	187.9	203.8	220.0	237.0	52.5
Ethylcetylamine	C ₁₈ H ₃₉ N	133.2	168.2	186.0	205.2	226.5	239.8	256.8	283.3	313.0	342.0	
Ethyl chloride	C ₂ H ₅ Cl	-89.8	-73.9	-65.8	-56.8	-47.0	-40.6	-32.0	-18.6	-3.9	+12.3	-139
chloroacetate	C ₄ H ₇ ClO ₂	+1.0	25.4	37.5	50.4	65.2	74.0	86.0	103.8	123.8	144.2	-26
chloroglyoxylate	C ₄ H ₅ ClO ₃	-5.1	+18.0	29.9	42.0	56.0	65.2	76.6	94.5	114.7	135.0	
α-chloropropionate	C ₃ H ₅ ClO ₂	+6.6	30.2	41.9	54.3	68.2	77.3	89.3	107.2	126.2	146.5	
<i>trans</i> -cinnamate	C ₁₁ H ₁₂ O ₂	87.6	108.5	134.0	150.3	169.2	181.2	196.0	219.3	245.0	271.0	12
3-Ethylcumene	C ₁₁ H ₁₆	28.3	55.5	68.8	83.6	99.9	110.2	124.3	145.4	168.2	193.0	
4-Ethylcumene	C ₁₁ H ₁₆	31.5	58.4	72.0	86.7	103.3	113.8	127.2	148.3	171.8	195.8	
Ethyl cyanoacetate	C ₃ H ₇ NO ₂	67.8	93.5	106.0	119.8	133.8	142.1	152.8	169.8	187.8	206.0	
Ethylcyclohexane	C ₈ H ₁₆	-14.5	+9.2	20.6	33.4	47.6	56.7	69.0	87.8	109.1	131.8	-111.3
Ethylcyclopentane	C ₇ H ₁₄	-32.2	-10.8	-0.1	+11.7	25.0	33.4	45.0	62.4	82.3	103.4	-138.6
Ethyl dichloroacetate	C ₄ H ₆ Cl ₂ O ₂	9.6	34.0	46.3	59.5	74.0	83.6	96.1	115.2	135.9	156.5	
<i>N,N</i> -diethyloxamate	C ₈ H ₁₅ NO ₃	76.0	106.3	121.7	137.7	154.4	166.0	180.3	202.8	226.5	252.0	
<i>N</i> -Ethylidiphenylamine	C ₁₄ H ₁₅ N	98.3	130.2	146.0	162.8	182.0	193.7	209.8	233.0	258.8	286.0	
Ethylene	C ₂ H ₄	-168.3	-158.3	-153.2	-147.6	-141.3	-137.3	-131.8	-123.4	-113.9	-103.7	-169
Ethylene-bis-(chloroacetate)	C ₆ H ₈ Cl ₂ O ₄	112.0	142.4	158.0	173.5	191.0	201.8	215.0	237.3	259.5	283.5	
Ethylene chlorohydrin (2-chloroethanol)	C ₂ H ₅ ClO	-4.0	+19.0	30.3	42.5	56.0	64.1	75.0	91.8	110.0	128.8	-69
diamine (1,2-ethanediamine)	C ₂ H ₈ N ₂	-11.0	+10.5	21.5	33.0	45.8	53.8	62.5	81.0	99.0	117.2	8.5
dibromide (1,2-dibromethane)	C ₂ H ₄ Br ₂	-27.0	+4.7	18.6	32.7	48.0	57.9	70.4	89.8	110.1	131.5	10
dichloride (1,2-dichloroethane)	C ₂ H ₄ Cl ₂	-44.5	-24.0	-13.6	-2.4	+10.0	18.1	29.4	45.7	64.0	82.4	-35.3
glycol (1,2-ethanediol)	C ₂ H ₆ O ₂	53.0	79.7	92.1	105.8	120.0	129.5	141.8	158.5	178.5	197.3	-15.6
glycol diethyl ether (1,2-diethoxyethane)	C ₆ H ₁₄ O ₂	-33.5	-10.2	+1.6	14.7	29.7	39.0	51.8	71.8	94.1	119.5	
glycol dimethyl ether (1,2-dimethoxyethane)	C ₄ H ₁₀ O ₂	-48.0	-26.2	-15.3	-3.0	+10.7	19.7	31.8	50.0	70.8	93.0	
glycol monomethyl ether (2-methoxyethanol)	C ₃ H ₈ O ₂	-13.5	+10.2	22.0	34.3	47.8	56.4	68.0	85.3	104.3	124.4	
oxide	C ₂ H ₄ O	-89.7	-73.8	-65.7	-56.6	-46.9	-40.7	-32.1	-19.5	-4.9	+10.7	-111.3
Ethyl α-ethylacetate	C ₈ H ₁₄ O ₃	40.5	67.3	80.2	94.6	110.3	120.6	133.8	153.2	175.6	198.0	
fluoride	C ₂ H ₅ F	-117.0	-103.8	-97.7	-90.0	-81.8	-76.4	-69.3	-58.0	-45.5	-32.0	
formate	C ₃ H ₆ O ₂	-60.5	-42.2	-33.0	-22.7	-11.5	-4.3	-5.4	20.0	37.1	54.3	-79
2-furoate	C ₃ H ₆ O ₃	37.6	63.8	77.1	91.5	107.5	117.5	130.4	150.1	172.5	195.0	34
glycolate	C ₄ H ₈ O ₃	14.3	38.8	50.5	63.9	78.1	87.6	99.8	117.8	138.0	158.2	
3-Ethylhexane	C ₈ H ₁₈	-20.0	+2.1	12.8	25.0	38.5	47.1	58.9	76.7	97.0	118.5	
2-Ethylhexyl acrylate	C ₁₁ H ₂₀ O ₂	50.0	77.7	91.8	106.3	123.7	134.0	147.9	168.2	192.2	216.0	
Ethylidene chloride (1,1-dichloroethane)	C ₂ H ₄ Cl ₂	-60.7	-41.9	-32.3	-21.9	-10.2	-2.9	+7.2	22.4	39.8	57.4	-96.7
fluoride (1,1-difluoroethane)	C ₂ H ₄ F ₂	-112.5	-98.4	-91.7	-84.1	-75.8	-70.4	-63.2	-52.0	-39.5	-26.5	-117
Ethyl iodide	C ₂ H ₅ I	-54.4	-34.3	-24.3	-13.1	-0.9	+7.2	18.0	34.1	52.3	72.4	-105
Ethyl <i>l</i> -leucinate	C ₈ H ₁₇ NO ₂	27.8	57.3	72.1	88.0	106.0	117.8	131.8	149.8	183.3	184.0	
Ethyl levulinate	C ₇ H ₁₂ O ₃	47.3	74.0	87.3	101.8	117.7	127.6	141.3	160.2	183.0	206.2	
Ethyl mercaptan (ethanethiol)	C ₂ H ₆ S	-76.7	-59.1	-50.2	-40.7	-29.8	-22.4	-13.0	+1.5	17.7	35.0	-121
Ethyl methylcarbamate	C ₄ H ₉ NO ₂	26.5	51.0	63.2	76.1	91.0	100.0	112.0	130.0	149.8	170.0	
Ethyl methyl ether	C ₃ H ₈ O	-91.0	-75.6	-67.8	-59.1	-49.4	-43.3	-34.8	-22.0	-7.8	+7.5	

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm (Continued)

Compound	Formula	Pressure, mm Hg										Melting point, °C
		1	5	10	20	40	60	100	200	400	760	
		Temperature, °C										
1-Ethyl-naphthalene	C ₁₂ H ₁₂	70.0	101.4	116.8	133.8	152.0	164.1	180.0	204.6	230.8	258.1	-27
Ethyl α -naphthyl ketone (1-propionaphthone)	C ₁₃ H ₁₂ O	124.0	155.5	171.0	188.1	206.9	218.2	233.5	255.5	280.2	306.0	
Ethyl 3-nitrobenzoate	C ₉ H ₉ NO ₄	108.1	140.2	155.0	173.6	192.6	205.0	220.3	244.6	270.6	298.0	47
3-Ethylpentane	C ₇ H ₁₆	-37.8	-17.0	-6.8	+4.7	17.5	25.7	36.9	53.8	73.0	93.5	-118.6
4-Ethylphenetole	C ₁₀ H ₁₄ O	48.5	75.7	89.5	103.8	119.8	129.8	143.5	163.2	185.7	208.0	
2-Ethylphenol	C ₈ H ₁₀ O	46.2	73.4	87.0	101.5	117.9	127.9	141.8	161.6	184.5	207.5	-45
3-Ethylphenol	C ₈ H ₁₀ O	60.0	86.8	100.2	114.5	130.0	139.8	152.0	171.8	193.3	214.0	-4
4-Ethylphenol	C ₈ H ₁₀ O	59.3	86.5	100.2	115.0	131.3	141.7	154.2	175.0	197.4	219.0	46.5
Ethyl phenyl ether (phenetole)	C ₈ H ₁₀ O	18.1	43.7	56.4	70.3	86.6	95.4	108.4	127.9	149.8	172.0	-30.2
Ethyl propionate	C ₅ H ₁₀ O ₂	-28.0	-7.2	+3.4	14.3	27.2	35.1	45.2	61.7	79.8	99.1	-72.6
Ethyl propyl ether	C ₅ H ₁₂ O	-64.3	-45.0	-35.0	-24.0	-12.0	-4.0	+6.8	23.3	41.6	61.7	
Ethyl salicylate	C ₉ H ₁₀ O ₃	61.2	90.0	104.2	119.3	136.7	147.6	161.5	183.7	207.0	231.5	1.3
3-Ethylstyrene	C ₁₀ H ₁₂	28.3	55.0	68.3	82.8	99.2	109.6	123.2	144.0	167.2	191.5	
4-Ethylstyrene	C ₁₀ H ₁₂	26.0	52.7	66.3	80.8	97.3	107.6	121.5	142.0	165.0	189.0	
Ethylisothiocyanate	C ₃ H ₃ NS	13.2	+10.6	22.8	36.1	50.8	59.8	71.9	90.0	110.1	131.0	-5.9
2-Ethyltoluene	C ₉ H ₁₂	9.4	34.8	47.6	61.2	76.4	86.0	99.0	119.0	141.4	165.1	
3-Ethyltoluene	C ₉ H ₁₂	7.2	32.3	44.7	58.2	73.3	82.9	95.9	115.5	137.8	161.3	-95.5
4-Ethyltoluene	C ₉ H ₁₂	7.6	32.7	44.9	58.5	73.6	83.2	96.3	116.1	136.4	162.0	
Ethyl trichloroacetate	C ₄ H ₅ Cl ₃ O ₂	20.7	45.5	57.7	70.6	85.5	94.4	107.4	125.8	146.0	167.0	
Ethyltrimethylsilane	C ₅ H ₁₄ Si	-60.6	-41.4	-31.8	-21.0	-9.0	-1.2	+9.2	25.0	42.8	62.0	
Ethyltrimethyltin	C ₅ H ₁₄ Sn	-30.0	-7.6	+3.8	16.1	30.0	38.4	50.0	67.3	87.6	108.8	
Ethyl isovalerate	C ₇ H ₁₄ O ₂	-6.1	+17.0	28.7	41.3	55.2	64.0	75.9	93.8	114.0	134.3	-99.3
2-Ethyl-1,4-xylene	C ₁₀ H ₁₄	25.7	52.0	65.6	79.8	96.0	106.2	120.0	140.2	163.1	186.9	
4-Ethyl-1,3-xylene	C ₁₀ H ₁₄	26.3	53.0	66.4	80.6	97.2	107.4	121.2	141.8	164.4	188.4	
5-Ethyl-1,3-xylene	C ₁₀ H ₁₄	22.1	48.8	62.1	76.5	92.6	103.0	116.5	137.4	159.6	183.7	
Eugenol	C ₁₀ H ₁₂ O ₂	78.4	108.1	123.0	138.7	155.8	167.3	182.2	204.7	228.3	253.5	
iso-Eugenol	C ₁₀ H ₁₂ O ₂	86.3	117.0	132.4	149.0	167.0	178.2	194.0	217.2	242.3	267.5	-10
Eugenyl acetate	C ₁₂ H ₁₄ O ₃	101.6	132.3	148.0	164.2	183.0	194.0	209.7	232.5	257.4	282.0	295
Fencholic acid	C ₁₀ H ₁₆ O ₂	101.7	128.7	142.3	155.8	171.8	181.5	194.0	215.0	237.8	264.1	19
d-Fenchone	C ₁₀ H ₁₆ O	28.0	54.7	68.3	83.0	99.5	109.8	123.6	144.0	166.8	191.0	5
dl-Fenchyl alcohol	C ₁₀ H ₁₈ O	45.8	70.3	82.1	95.6	110.8	120.2	132.3	150.0	173.2	201.0	35
Fluorene	C ₁₃ H ₁₀	129.3	129.3	146.0	164.2	185.2	197.8	214.7	240.3	268.6	295.0	113
Fluorobenzene	C ₆ H ₅ F	-43.4	-22.8	-12.4	-1.2	+11.5	19.6	30.4	47.2	65.7	84.7	-42.1
2-Fluorotoluene	C ₇ H ₇ F	-24.2	-2.2	+8.9	21.4	34.7	43.7	55.3	73.0	92.8	114.0	-80
3-Fluorotoluene	C ₇ H ₇ F	-22.4	-0.3	+11.0	23.4	37.0	45.8	57.5	75.4	95.4	116.0	-110.8
4-Fluorotoluene	C ₇ H ₇ F	-21.8	+0.3	11.8	24.0	37.8	46.5	58.1	76.0	96.1	117.0	
Formaldehyde	CH ₂ O			-88.0	-79.6	-70.6	-65.0	-57.3	-46.0	-33.0	-19.5	-92
Formamide	CH ₃ NO	70.5	96.3	109.5	122.5	137.5	147.0	157.5	175.5	193.5	210.5	
Formic acid	CH ₂ O ₂	-20.0	-5.0	+2.1	10.3	24.0	32.4	43.8	61.4	80.3	100.6	8.2
trans-Fumaryl chloride	C ₄ H ₂ Cl ₂ O ₂	+15.0	38.5	51.8	65.0	79.5	89.0	101.0	120.0	140.0	160.0	
Furfural (2-furaldehyde)	C ₅ H ₄ O ₂	18.5	42.6	54.8	67.8	82.1	91.5	103.4	121.8	141.8	161.8	
Furfuryl alcohol	C ₅ H ₆ O ₂	31.8	56.0	68.0	81.0	95.7	104.0	115.9	133.1	151.8	170.0	
Geraniol	C ₁₀ H ₁₈ O	69.2	96.8	110.0	125.6	141.8	151.5	165.3	185.6	207.8	230.0	
Geranyl acetate	C ₁₂ H ₂₀ O ₂	73.5	102.7	117.9	133.0	150.0	160.3	175.2	196.3	219.8	243.3	
Geranyl n-butylate	C ₁₄ H ₂₄ O ₂	96.8	125.2	139.0	153.8	170.1	180.2	193.8	214.0	235.0	257.4	
Geranyl isobutylate	C ₁₄ H ₂₄ O ₂	90.9	119.6	133.0	147.9	164.0	174.0	187.7	207.6	228.5	251.0	
Geranyl formate	C ₁₁ H ₁₈ O ₂	61.8	90.3	104.3	119.8	136.2	147.2	160.7	182.6	205.8	230.0	
Glutaric acid	C ₅ H ₈ O ₄	155.5	183.8	196.0	210.5	226.3	235.5	247.0	265.0	283.5	303.0	97.5
Glutaric anhydride	C ₅ H ₆ O ₃	100.8	133.3	149.5	166.0	185.5	196.2	212.5	236.5	261.0	287.0	
Glutaronitrile	C ₇ H ₆ N ₂	91.3	123.7	140.0	156.5	176.4	189.5	205.5	230.0	257.3	286.2	
Glutaryl chloride	C ₅ H ₆ Cl ₂ O ₂	56.1	84.0	97.8	112.3	128.3	139.1	151.8	172.4	195.3	217.0	
Glycerol	C ₃ H ₈ O ₃	125.5	153.8	167.2	182.2	198.0	208.0	220.1	240.0	263.0	290.0	17.9
Glycerol dichlorohydrin (1,3-dichloro-2-propanol)	C ₃ H ₆ Cl ₂ O	28.0	52.2	64.7	78.0	93.0	102.0	114.8	133.3	153.5	174.3	
Glycol diacetate	C ₆ H ₁₀ O ₄	38.3	64.1	77.1	90.8	106.1	115.8	128.0	147.8	168.3	190.5	-31
Glycolide (1,4-dioxane-2,6-dione)	C ₄ H ₄ O ₄	103.0	116.6	132.0	148.6	168.2	183.2	199.0	217.0	237.0	259.0	97
Guaicol (2-methoxyphenol)	C ₇ H ₈ O ₂	52.4	79.1	92.0	106.0	121.6	131.0	144.0	162.7	184.1	205.0	28.3
Heneicosane	C ₂₇ H ₅₄	152.6	188.0	205.4	223.2	243.4	255.3	272.0	296.5	323.8	350.5	40.4
Heptacosane	C ₂₇ H ₅₆	211.7	248.6	266.8	284.6	305.7	318.3	333.5	359.4	385.0	410.6	59.5
Heptadecane	C ₁₇ H ₃₆	115.0	145.2	160.0	177.7	195.8	207.3	223.0	247.8	274.5	303.0	22.5
Heptaldehyde (enanthaldehyde)	C ₇ H ₁₄ O	12.0	32.7	43.0	54.0	66.3	74.0	84.0	102.0	125.5	155.0	-42
n-Heptane	C ₇ H ₁₆	-34.0	-12.7	-2.1	+9.5	22.3	30.6	41.8	58.7	78.0	98.4	-90.6
Heptanoic acid (enanthic acid)	C ₇ H ₁₄ O ₂	78.0	101.3	113.2	125.6	139.5	148.5	160.0	179.5	199.6	221.5	-10
1-Heptanol	C ₇ H ₁₆ O	42.4	64.3	74.7	85.8	99.8	108.0	119.5	136.6	155.6	175.8	34.6
Heptanoyl chloride (enanthyl chloride)	C ₇ H ₁₃ ClO	34.2	54.6	64.6	75.0	86.4	93.5	102.7	116.3	130.7	145.0	
2-Heptene	C ₇ H ₁₄	-35.8	-14.1	-3.5	+8.3	21.5	30.0	41.3	58.6	78.1	98.5	
Heptylbenzene	C ₁₃ H ₂₀	64.0	94.6	110.0	126.0	144.0	154.8	170.2	193.3	217.8	244.0	
Heptyl cyanide (enanthonitrile)	C ₇ H ₁₃ N	21.0	47.8	61.6	76.3	92.6	103.0	116.8	137.7	160.0	184.6	
Hexachlorobenzene	C ₆ Cl ₆	114.4	149.3	166.4	185.7	206.0	219.0	235.5	258.5	283.5	309.4	230
Hexachloroethane	C ₂ Cl ₆	32.7	49.8	73.5	87.6	102.3	112.0	124.2	143.1	163.8	185.6	186.6
Hexadecane	C ₁₆ H ₃₄	204.0	240.0	257.4	275.8	295.2	307.8	323.2	348.4	374.6	399.8	56.6
Hexadecene	C ₁₆ H ₃₂	105.3	135.2	149.8	164.7	181.3	193.2	208.5	231.7	258.3	287.5	18.5
1-Hexadecene	C ₁₆ H ₃₂	101.6	131.7	146.2	162.0	178.8	190.8	205.3	226.8	250.0	274.0	4
n-Hexadecyl alcohol (cetyl alcohol)	C ₁₆ H ₃₄ O	122.7	158.3	177.8	197.8	219.8	234.3	251.7	280.2	312.7	344.0	49.3

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm (Continued)

Compound		Pressure, mm Hg									Melting point, °C	
		1	5	10	20	40	60	100	200	400		760
Name	Formula	Temperature, °C										
<i>n</i> -Hexadecylamine (cetylamine)	C ₁₆ H ₃₅ N	123.6	157.8	176.0	195.7	215.7	228.8	245.8	272.2	300.4	330.0	
Hexaethylbenzene	C ₁₈ H ₃₀		134.3	150.3	168.0	187.7	199.7	216.0	241.7	268.5	298.3	130
<i>n</i> -Hexane	C ₆ H ₁₄	-53.9	-34.5	-25.0	-14.1	-2.3	+5.4	15.8	31.6	49.6	68.7	-95.3
1-Hexanol	C ₆ H ₁₄ O	24.4	47.2	58.2	70.3	83.7	92.0	102.8	119.6	138.0	157.0	-51.6
2-Hexanol	C ₆ H ₁₄ O	14.6	34.8	45.0	55.9	67.9	76.0	87.3	103.7	121.8	139.9	
3-Hexanol	C ₆ H ₁₄ O	+2.5	25.7	36.7	49.0	62.2	70.7	81.8	98.3	117.0	135.5	
1-Hexene	C ₆ H ₁₂	-57.5	-38.0	-28.1	-17.2	-5.0	+2.8	13.0	29.0	46.8	66.0	-98.5
<i>n</i> -Hexyl levulinate	C ₁₁ H ₂₀ O ₃	90.0	120.0	134.7	150.2	167.8	179.0	193.6	215.7	241.0	266.8	
<i>n</i> -Hexyl phenyl ketone (enanthophenone)	C ₁₃ H ₁₆ O	100.0	130.3	145.5	161.0	178.9	189.8	204.2	225.0	248.3	271.3	
Hydrocinamic acid	C ₉ H ₁₀ O ₂	102.2	133.5	148.7	165.0	183.3	194.0	209.0	230.8	255.0	279.8	48.5
Hydrogen cyanide (hydrocyanic acid)	CHN	-71.0	-55.3	-47.7	-39.7	-30.9	-25.1	-17.8	-5.3	+10.2	25.9	-13.2
Hydroquinone	C ₆ H ₆ O ₂	132.4	153.3	163.5	174.6	192.0	203.0	216.5	238.0	262.5	286.2	170.3
4-Hydroxybenzaldehyde	C ₇ H ₆ O ₂	121.2	153.2	169.7	186.8	206.0	217.5	233.5	256.8	282.6	310.0	115.5
α -Hydroxyisobutyric acid	C ₄ H ₈ O ₃	73.5	98.5	110.5	123.8	138.0	146.4	157.7	175.2	193.8	212.0	79
α -Hydroxybutyronitrile	C ₅ H ₉ NO	41.0	65.8	77.8	90.7	104.8	113.9	125.0	142.0	159.8	178.8	
4-Hydroxy-3-methyl-2-butanone	C ₆ H ₁₀ O ₂	44.6	69.3	81.0	94.0	108.2	117.4	129.0	146.5	165.5	185.0	
4-Hydroxy-4-methyl-2-pentanone	C ₇ H ₁₂ O ₂	22.0	46.7	58.8	72.0	86.7	96.0	108.2	126.8	147.5	167.9	-47
3-Hydroxypropionitrile	C ₃ H ₅ NO	58.7	87.8	102.0	117.9	134.1	144.7	157.7	178.0	200.0	221.0	
Indene	C ₉ H ₈	16.4	44.3	58.5	73.9	90.7	100.8	114.7	135.6	157.8	181.6	-2
Iodobenzene	C ₆ H ₅ I	24.1	50.6	64.0	78.3	94.4	105.0	118.3	139.8	163.9	188.6	-28.5
Iodononane	C ₉ H ₁₉ I	70.0	96.2	109.0	123.0	138.1	147.7	159.8	179.0	199.3	219.5	
2-Iodotoluene	C ₇ H ₇ I	37.2	65.9	79.8	95.6	112.4	123.8	138.1	160.0	185.7	211.0	
α -Ionone	C ₁₃ H ₂₀ O	79.5	108.8	123.0	139.0	155.6	166.3	181.2	202.5	225.2	250.0	
Isoprene	C ₅ H ₈	-79.8	-62.3	-53.3	-43.5	-32.6	-25.4	-16.0	-1.2	+15.4	32.6	-146.7
Lauraldehyde	C ₁₂ H ₂₄ O	77.7	108.4	123.7	140.2	157.8	168.7	184.5	207.8	231.8	257.0	44.5
Lauric acid	C ₁₂ H ₂₄ O ₂	121.0	150.6	166.0	183.6	201.4	212.7	227.5	249.8	273.8	299.2	48
Levulinoldehyde	C ₅ H ₈ O ₂	28.1	54.9	68.0	82.7	98.3	108.4	121.8	142.0	164.0	187.0	
Levulinic acid	C ₅ H ₈ O ₃	102.0	128.1	141.8	154.1	169.5	178.0	190.2	208.3	227.4	245.8	33.5
<i>l</i> -Limonene	C ₁₀ H ₁₆	14.0	40.4	53.8	68.2	84.3	94.6	108.3	128.5	151.4	175.0	-96.9
Linyl acetate	C ₁₂ H ₂₀ O ₂	55.4	82.5	96.0	111.4	127.7	138.1	151.8	173.3	196.2	220.0	
Maleic anhydride	C ₄ H ₂ O ₃	44.0	63.4	78.7	95.0	111.8	122.0	135.8	155.9	179.5	202.0	58
Menthane	C ₁₀ H ₂₀	+9.7	35.7	48.3	62.7	78.3	88.6	102.1	122.7	146.0	169.5	
1-Menthol	C ₁₀ H ₂₀ O	56.0	83.2	96.0	110.3	126.1	136.1	149.4	168.3	190.2	212.0	42.5
Menthyl acetate	C ₁₂ H ₂₂ O ₂	57.4	85.8	100.0	115.4	132.1	143.2	156.7	178.8	202.8	227.0	
benzoate	C ₁₇ H ₂₄ O ₂	123.2	154.2	170.0	186.3	204.3	215.8	230.4	253.2	277.1	301.0	54.5
formate	C ₁₁ H ₂₀ O ₂	47.3	75.8	90.0	105.8	123.0	133.8	148.0	169.8	194.2	219.0	
Mesityl oxide	C ₆ H ₆ O	-8.7	+14.1	26.0	37.9	51.7	60.4	72.1	90.0	109.8	130.0	-59
Methacrylic acid	C ₄ H ₆ O ₂	25.5	48.5	60.0	72.7	86.4	95.3	106.6	123.9	142.5	161.0	15
Methacrylonitrile	C ₄ H ₅ N	-44.5	-23.3	-12.5	-0.6	+12.8	21.5	32.8	50.0	70.3	90.3	
Methane	CH ₄	-205.9	-199.0	-195.5	-191.8	-187.7	-185.1	-181.4	-175.5	-168.8	-161.5	-182.5
Methanethiol	CH ₃ S	-90.7	-75.3	-67.5	-58.8	-49.2	-43.1	-34.8	-22.1	-7.9	+6.8	-121
Methoxyacetic acid	C ₃ H ₆ O ₃	52.5	79.3	92.0	106.5	122.0	131.8	144.5	163.5	184.2	204.0	
<i>N</i> -Methylacetanilide	C ₉ H ₁₁ NO	103.8	118.6	135.1	152.2	164.2	179.8	202.3	227.4	253.0	283.0	102
Methyl acetate	C ₃ H ₆ O ₂	-57.2	-38.6	-29.3	-19.1	-7.9	-0.5	+9.4	24.0	40.0	57.8	-98.7
acetylene (propyne)	C ₃ H ₄	-111.0	-97.5	-90.5	-82.9	-74.3	-68.8	-61.3	-49.8	-37.2	-23.3	-102.7
acrylate	C ₄ H ₆ O ₂	-43.7	-23.6	-13.5	-2.7	+9.2	17.3	28.0	43.9	61.8	80.2	
alcohol (methanol)	CH ₃ O	-44.0	-25.3	-16.2	-6.0	+5.0	12.1	21.2	34.8	49.9	64.7	-97.8
Methylamine	CH ₅ N	-95.8	-81.3	-73.8	-65.9	-56.9	-51.3	-43.7	-32.4	-19.7	-6.3	-93.5
<i>N</i> -Methylaniline	C ₇ H ₉ N	36.0	62.8	76.2	90.5	106.0	115.8	129.8	149.3	172.0	195.5	-57
Methyl anthranilate	C ₈ H ₉ NO ₂	77.6	109.0	124.2	141.5	159.7	172.0	187.8	212.4	238.5	266.5	24
benzoate	C ₈ H ₇ O ₂	39.0	64.4	77.3	91.8	107.8	117.4	130.8	151.4	174.7	199.5	-12.5
2-Methylbenzothiazole	C ₈ H ₇ NS	70.0	97.5	111.2	125.5	141.2	150.4	163.9	183.2	204.5	225.5	15.4
α -Methylbenzyl alcohol	C ₈ H ₁₀ O	49.0	75.2	88.0	102.1	117.8	127.4	140.3	159.0	180.7	204.0	
Methyl bromide	CH ₃ Br	-96.3	-80.6	-72.8	-64.0	-54.2	-48.0	-39.4	-26.5	-11.9	+3.6	-93
2-Methyl-1-butene	C ₅ H ₁₀	-89.1	-72.8	-64.3	-54.8	-44.1	-37.3	-28.0	-13.8	+2.5	20.2	-135
2-Methyl-2-butene	C ₅ H ₁₀	-75.4	-57.0	-47.9	-37.9	-26.7	-19.4	-9.9	+4.9	21.6	38.5	-133
Methyl isobutyl carbinol (2-methyl-4-pentanol)	C ₆ H ₁₄ O	-0.3	+22.1	33.3	45.4	58.2	67.0	78.0	94.9	113.5	131.7	
<i>n</i> -butyl ketone (2-hexanone)	C ₆ H ₁₂ O	+7.7	28.8	38.8	50.0	62.0	69.8	79.8	94.3	111.0	127.5	-56.9
isobutyl ketone (4-methyl-2-pentanone)	C ₆ H ₁₂ O	-1.4	+19.7	30.0	40.8	52.8	60.4	70.4	85.6	102.0	119.0	-84.7
<i>n</i> -butyrate	C ₈ H ₁₆ O ₂	-26.8	-5.5	+5.0	16.7	29.6	37.4	48.0	64.3	83.1	102.3	
isobutyrate	C ₇ H ₁₄ O ₂	-34.1	-13.0	-2.9	+8.4	21.0	28.9	39.6	55.7	73.6	92.6	-84.7
caprate	C ₁₁ H ₂₂ O ₂	63.7	93.5	108.0	123.0	139.0	148.6	161.5	181.6	202.9	224.0	-18
caproate	C ₇ H ₁₄ O ₂	+5.0	30.0	42.0	55.4	70.0	79.7	91.4	109.8	129.8	150.0	
caprylate	C ₉ H ₁₈ O ₂	34.2	61.7	74.9	89.0	105.3	115.3	128.0	148.1	170.0	193.0	-40
chloride	CH ₃ Cl	-99.5	-92.4	-84.8	-76.0	-70.4	-63.0	-51.2	-38.0	-24.0	-9.7	-97.7
chloroacetate	C ₃ H ₅ ClO ₂	-2.9	19.0	30.0	41.5	54.5	63.0	73.5	90.5	109.5	130.3	-31.9
cinnamate	C ₁₀ H ₁₀ O ₂	77.4	108.1	123.0	140.0	157.9	170.0	185.8	209.6	235.0	263.0	33.4
α -Methyleinnamic acid	C ₁₀ H ₁₀ O ₂	125.7	155.0	169.8	185.2	201.8	212.0	224.8	245.0	266.8	288.0	
Methylcyclohexane	C ₇ H ₁₄	-35.9	-14.0	-3.2	+8.7	22.0	30.5	42.1	59.6	79.6	100.9	-126.4
Methylcyclopentane	C ₆ H ₁₂	-53.7	-33.8	-23.7	-12.8	-0.6	+7.2	17.9	34.0	52.3	71.8	-142.4
Methylcyclopropane	C ₃ H ₆	-96.0	-80.6	-72.8	-64.0	-54.2	-48.0	-39.3	-26.0	-11.3	+4.5	
Methyl <i>n</i> -decyl ketone (<i>n</i> -dodecan-2-one)	C ₁₂ H ₂₄ O	77.1	106.0	120.4	136.0	152.4	163.8	177.5	199.0	222.5	246.5	
dichloroacetate	C ₃ H ₄ Cl ₂ O ₂	3.2	26.7	38.1	50.7	64.7	73.6	85.4	103.2	122.6	143.0	
<i>N</i> -Methyldiphenylamine	C ₁₃ H ₁₃ N	103.5	134.0	149.7	165.8	184.0	195.4	210.1	232.8	257.0	282.0	-7.6

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm* (Continued)

Compound	Formula	Pressure, mm Hg									Melting point, °C	
		1	5	10	20	40	60	100	200	400		760
Name	Formula	Temperature, °C										
Methyl <i>n</i> -dodecyl ketone (2-tetradecanone)	C ₁₄ H ₂₈ O	99.3	130.0	145.5	161.3	179.8	191.4	206.0	228.2	253.3	278.0	
Methylene bromide (dibromomethane)	CH ₂ Br ₂	-35.1	-13.2	-2.4	+9.7	23.3	31.6	42.3	58.5	79.0	98.6	-52.8
chloride (dichloromethane)	CH ₂ Cl ₂	-70.0	-52.1	-43.3	-33.4	-22.3	-15.7	-6.3	+8.0	24.1	40.7	-96.7
Methyl ethyl ketone (2-butanone)	C ₄ H ₈ O	-48.3	-28.0	-17.7	-6.5	+6.0	14.0	25.0	41.6	60.0	79.6	-85.9
2-Methyl-3-ethylpentane	C ₈ H ₁₈	-24.0	-1.8	+9.5	21.7	35.2	43.9	55.7	73.6	94.0	115.6	-114.5
3-Methyl-3-ethylpentane	C ₈ H ₁₈	-23.9	-1.4	+9.9	22.3	36.2	45.0	57.1	75.3	96.2	118.3	-90
Methyl fluoride	CH ₃ F	-147.3	-137.0	-131.6	-125.9	-119.1	-115.0	-109.0	-99.9	-89.5	-78.2	-99.8
formate	C ₂ H ₄ O ₂	-74.2	-57.0	-48.6	-39.2	-28.7	-21.9	-12.9	+0.8	16.0	32.0	-99.8
α-Methylglutaric anhydride	C ₆ H ₈ O ₃	93.8	125.4	141.8	157.7	177.5	189.9	205.0	229.1	255.5	282.5	
Methyl glycolate	C ₃ H ₆ O ₃	+9.6	33.7	45.3	58.1	72.3	81.8	93.7	111.8	131.7	151.5	
2-Methylheptadecane	C ₁₅ H ₃₂	119.8	152.0	168.7	186.0	204.8	216.3	231.5	254.5	279.8	306.5	
2-Methylheptane	C ₈ H ₁₈	-21.0	+1.3	12.3	24.4	37.9	46.6	58.3	76.0	96.2	117.6	-109.5
3-Methylheptane	C ₈ H ₁₈	-19.8	+2.6	13.3	25.4	38.9	47.6	59.4	77.1	97.4	118.9	-120.8
4-Methylheptane	C ₈ H ₁₈	-20.4	+1.5	12.4	24.5	38.0	46.6	58.3	76.1	96.3	117.7	-121.1
2-Methyl-2-heptene	C ₈ H ₁₆	-16.1	+6.7	17.8	30.4	44.0	52.8	64.6	82.3	102.2	122.5	
6-Methyl-3-hepten-2-ol	C ₈ H ₁₆ O	41.6	65.0	76.7	89.3	102.7	111.5	122.6	139.5	156.6	175.5	
6-Methyl-5-hepten-2-ol	C ₈ H ₁₆ O	41.9	66.0	77.8	90.4	104.0	112.8	123.8	140.0	156.6	174.3	
2-Methylhexane	C ₇ H ₁₆	-40.4	-19.5	-9.1	+2.3	14.9	23.0	34.1	50.8	69.8	90.0	-118.2
3-Methylhexane	C ₇ H ₁₆	-39.0	-18.1	-7.8	+3.6	16.4	24.5	35.6	52.4	71.6	91.9	
Methyl iodide	CH ₃ I	-55.0	-45.8	-35.6	-24.2	-16.9	-7.0	+8.0	25.3	42.4	61.4	-64.4
laurate	C ₁₃ H ₂₆ O ₂	87.8	117.9	133.2	149.0	166.0	176.8	190.8				5
levulinate	C ₆ H ₁₀ O ₃	39.8	66.4	79.7	93.7	109.5	119.3	133.0	153.4	175.8	197.7	
methacrylate	C ₅ H ₈ O ₂	-30.5	-10.0	+1.0	11.0	25.5	34.5	47.0	63.0	82.0	101.0	
myristate	C ₁₅ H ₃₀ O ₂	115.0	145.7	160.8	177.8	195.8	207.5	222.6	245.3	269.8	295.8	18.5
α-naphthyl ketone (1-acetonaphthone)	C ₁₂ H ₁₀ O	115.6	146.3	161.5	178.4	196.8	208.6	223.8	246.7	270.5	295.5	
β-naphthyl ketone (2-acetonaphthone)	C ₁₂ H ₁₀ O	120.2	152.3	168.5	185.7	203.8	214.7	229.8	251.6	275.8	301.0	55.5
<i>n</i> -nonyl ketone (undecan-2-one)	C ₁₁ H ₂₂ O	68.2	95.5	108.9	123.1	139.0	148.6	161.0	181.2	202.3	224.0	15
palmitate	C ₁₇ H ₃₄ O ₂	134.3	166.8	184.3	202.0							30
<i>n</i> -pentadecyl ketone (2-heptadecanone)	C ₁₇ H ₃₄ O	129.6	161.6	178.0	196.4	214.3	226.7	242.0	265.8	291.7	319.5	
2-Methylpentane	C ₆ H ₁₄	-60.9	-41.7	-32.1	-21.4	-9.7	-1.9	+8.1	24.1	41.6	60.3	-154
3-Methylpentane	C ₆ H ₁₄	-59.0	-39.8	-30.1	-19.4	-7.3	+0.1	10.5	26.5	44.2	63.3	-118
2-Methyl-1-pentanol	C ₆ H ₁₄ O	15.4	38.0	49.6	61.6	74.7	83.4	94.2	111.3	129.8	147.9	
2-Methyl-2-pentanol	C ₆ H ₁₄ O	-4.5	+16.8	27.6	38.8	51.3	58.8	69.2	85.0	102.6	121.2	-103
Methyl <i>n</i> -pentyl ketone (2-heptanone)	C ₇ H ₁₄ O	19.3	43.6	55.5	67.7	81.2	89.8	100.0	116.1	133.2	150.2	
phenyl ether (anisole)	C ₇ H ₈ O	+5.4	30.0	42.2	55.8	70.7	80.1	93.0	112.3	133.8	155.5	-37.3
2-Methylpropene	C ₄ H ₈	-105.1	-96.5	-81.9	-73.4	-63.8	-57.7	-49.3	-36.7	-22.2	-6.9	-140.3
Methyl propionate	C ₄ H ₈ O ₂	-42.0	-21.5	-11.8	-1.0	+11.0	18.7	29.0	44.2	61.8	79.8	-87.5
4-Methylpropiophenone	C ₁₀ H ₁₂ O	59.6	89.3	103.8	120.2	138.0	149.3	164.2	187.4	212.7	238.5	
2-Methylpropionyl bromide	C ₄ H ₇ BrO	13.5	38.4	50.6	64.1	79.4	88.8	101.6	120.5	141.7	163.0	
Methyl propyl ether	C ₄ H ₁₀ O	-72.2	-54.3	-45.4	-35.4	-24.3	-17.4	-8.1	+6.0	22.5	39.1	
<i>n</i> -propyl ketone (2-pentanone)	C ₅ H ₁₀ O	-12.0	+8.0	17.9	28.5	39.8	47.3	56.8	71.0	86.8	103.3	-77.8
isopropyl ketone (3-Methyl-2-butanone)	C ₅ H ₁₀ O	-19.9	-1.0	+8.3	18.3	29.6	36.2	45.5	59.0	73.8	88.9	-92
2-Methylquinoline	C ₁₀ H ₉ N	75.3	104.0	119.0	134.0	150.8	161.7	176.2	197.8	211.7	246.5	-1
Methyl salicylate	C ₈ H ₈ O ₃	54.0	81.6	95.3	110.0	126.2	136.7	150.0	172.6	197.5	223.2	-8.3
α-Methyl styrene	C ₉ H ₁₀	7.4	34.0	47.1	61.8	77.8	88.3	102.2	121.8	143.0	165.4	-23.2
4-Methyl styrene	C ₉ H ₁₀	16.0	42.0	55.1	69.2	85.0	95.0	108.6	128.7	151.2	175.0	
Methyl <i>n</i> -tetradecyl ketone (2-hexadecanone)	C ₁₆ H ₃₂ O	109.8	151.5	167.3	184.6	203.7	215.0	230.5	254.4	279.8	307.0	
thiocyanate	C ₂ H ₃ NS	-14.0	+9.8	21.6	34.5	49.0	58.1	70.4	89.8	110.8	132.9	-51
isothiocyanate	C ₂ H ₃ NS	-34.7	-8.3	+5.4	20.4	38.2	47.5	59.3	77.5	97.8	119.0	35.5
undecyl ketone (2-tridecanone)	C ₁₃ H ₂₆ O	86.8	117.0	131.8	147.8	165.7	176.6	191.5	214.0	238.3	262.5	28.5
isovalerate	C ₆ H ₁₂ O ₂	-19.2	+2.9	14.0	26.4	39.8	48.2	59.8	77.3	96.7	116.7	
Monoethylacetylene (butenyne)	C ₄ H ₄	-93.2	-77.7	-70.0	-61.3	-51.7	-45.3	-37.1	-24.1	-10.1	+5.3	
Myrcene	C ₁₀ H ₁₆	14.5	40.0	53.2	67.0	82.6	92.6	106.0	126.0	148.3	171.5	
Myristaldehyde	C ₁₄ H ₂₆ O	99.0	132.0	148.3	166.2	186.0	198.3	214.5	240.4	267.9	297.8	23.5
Myristic acid (tetradecanoic acid)	C ₁₄ H ₂₈ O ₂	142.0	174.1	190.8	207.6	223.5	237.2	250.5	272.3	294.6	318.0	57.5
Naphthalene	C ₁₀ H ₈	52.6	74.2	85.8	101.7	119.3	130.2	145.5	167.7	193.2	217.9	80.2
1-Naphthoic acid	C ₁₁ H ₈ O ₂	156.0	184.0	196.8	211.2	225.0	234.5	245.8	263.5	281.4	300.0	160.5
2-Naphthoic acid	C ₁₁ H ₈ O ₂	160.8	189.7	202.8	216.9	231.5	241.3	252.7	270.3	289.5	308.5	184
1-Naphthol	C ₁₀ H ₈ O	94.0	125.5	142.0	158.0	177.8	190.0	206.0	229.6	255.8	282.5	96
2-Naphthol	C ₁₀ H ₈ O		128.6	145.5	161.8	181.7	193.7	209.8	234.0	260.6	288.0	122.5
1-Naphthylamine	C ₁₀ H ₉ N	104.3	137.7	153.8	171.6	191.5	203.8	220.0	244.9	272.2	300.8	50
2-Naphthylamine	C ₁₀ H ₉ N	108.0	141.6	157.6	175.8	195.7	208.1	224.3	249.7	277.4	306.1	111.5
Nicotine	C ₁₀ H ₁₄ N ₂	61.8	91.8	107.2	123.7	142.1	154.7	169.5	193.8	219.8	247.3	
2-Nitroaniline	C ₆ H ₆ N ₂ O ₂	104.0	135.7	150.4	167.7	186.0	197.8	213.0	236.3	260.0	284.5	71.5
3-Nitroaniline	C ₆ H ₆ N ₂ O ₂	119.3	151.5	167.8	185.5	204.2	216.5	232.1	255.3	280.2	305.7	114
4-Nitroaniline	C ₆ H ₆ N ₂ O ₂	142.4	177.6	194.4	213.2	234.2	245.9	261.8	284.5	310.2	336.0	146.5
2-Nitrobenzaldehyde	C ₇ H ₅ NO ₃	85.8	117.7	133.4	150.0	168.8	180.7	196.2	220.0	246.8	273.5	40.9
3-Nitrobenzaldehyde	C ₇ H ₅ NO ₃	96.2	127.4	142.8	159.0	177.7	189.5	204.3	227.4	252.1	278.3	58
Nitrobenzene	C ₆ H ₅ NO ₂	44.4	71.6	84.9	99.3	115.4	125.8	139.9	161.2	185.8	210.6	+57.7
Nitroethane	C ₂ H ₅ NO ₂	-21.0	+1.5	12.5	24.8	38.0	46.5	57.8	74.8	94.0	114.0	-90
Nitroglycerin	C ₃ H ₅ N ₃ O ₉	127	167	188	210	235	251					11
Nitromethane	CH ₃ NO ₂	-29.0	-7.9	+2.8	14.1	27.5	35.5	46.6	63.5	82.0	101.2	-29
2-Nitrophenol	C ₆ H ₅ NO ₃	49.3	76.8	90.4	105.8	122.1	132.6	146.4	167.6	191.0	214.5	45
2-Nitrophenyl acetate	C ₈ H ₇ NO ₄	100.0	128.0	142.0	155.8	172.8	181.7	194.1	213.0	233.5	253.0	

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm (Continued)

Compound		Pressure, mm Hg									Melting point, °C	
		1	5	10	20	40	60	100	200	400		760
Name	Formula	Temperature, °C										
1-Nitropropane	C ₃ H ₇ NO ₂	-9.6	+13.5	25.3	37.9	51.8	60.5	72.3	90.2	110.6	131.6	-108
2-Nitropropane	C ₃ H ₇ NO ₂	-18.8	+4.1	15.8	28.2	41.8	50.3	62.0	80.0	99.8	120.3	-93
2-Nitrotoluene	C ₇ H ₇ NO ₂	50.0	79.1	93.8	109.6	126.3	137.6	151.5	173.7	197.7	222.3	-4.1
3-Nitrotoluene	C ₇ H ₇ NO ₂	50.2	81.0	96.0	112.8	130.7	142.5	156.9	180.3	206.8	231.9	15.5
4-Nitrotoluene	C ₇ H ₇ NO ₂	53.7	85.0	100.5	117.7	136.0	147.9	163.0	186.7	212.5	238.3	51.9
4-Nitro-1,3-xylene (4-nitro- <i>m</i> -xylene)	C ₈ H ₉ NO ₂	65.6	95.0	109.8	125.8	143.3	153.8	168.5	191.7	217.5	244.0	+2
Nonacosane	C ₂₉ H ₆₀	234.2	269.8	286.4	303.6	323.2	334.8	350.0	373.2	397.2	421.8	63.8
Nonadecane	C ₁₉ H ₄₀	133.2	166.3	183.5	200.8	220.0	232.8	248.0	271.8	299.8	330.0	32
<i>n</i> -Nonane	C ₉ H ₂₀	+1.4	25.8	38.0	51.2	66.0	75.5	88.1	107.5	128.2	150.8	-53.7
1-Nonanol	C ₉ H ₂₀ O	59.5	86.1	99.7	113.8	129.0	139.0	151.3	170.5	192.1	213.5	-5
2-Nonanone	C ₉ H ₁₈ O	32.1	59.0	72.3	87.2	103.4	113.8	127.4	148.2	171.2	195.0	-19
Octacosane	C ₂₈ H ₅₈	226.5	260.3	277.4	295.4	314.2	326.8	341.8	364.8	388.9	412.5	61.6
Octadecane	C ₁₈ H ₃₈	119.6	152.1	169.6	187.5	207.4	219.7	236.0	260.6	288.0	317.0	28
<i>n</i> -Octane	C ₈ H ₁₈	-14.0	+8.3	19.2	31.5	45.1	53.8	65.7	83.6	104.0	125.6	-56.8
<i>n</i> -Octanol (1-octanol)	C ₈ H ₁₈ O	54.0	76.5	88.3	101.0	115.2	123.8	135.2	152.0	173.8	195.2	-15.4
2-Octanone	C ₈ H ₁₆ O	23.6	48.4	60.9	74.3	89.8	99.0	111.7	130.4	151.0	172.9	-16
<i>n</i> -Octyl acrylate	C ₁₁ H ₂₀ O ₂	58.5	87.7	102.0	117.8	135.6	145.6	159.1	180.2	204.0	227.0	
iodide (1-Iodooctane)	C ₈ H ₁₇ I	45.8	74.8	90.0	105.9	123.8	135.4	150.0	173.3	199.3	225.5	-45.9
Oleic acid	C ₁₈ H ₃₄ O ₂	176.5	208.5	223.0	240.0	257.2	269.8	286.0	309.8	334.7	360.0	14
Palmitaldehyde	C ₁₆ H ₃₂ O	121.6	154.6	171.8	190.0	210.0	222.6	239.5	264.1	292.3	321.0	34
Palmitic acid	C ₁₆ H ₃₂ O ₂	153.6	188.1	205.8	223.8	244.4	256.0	271.5	298.7	326.0	353.8	64.0
Palmitonitrile	C ₁₆ H ₃₁ N	134.3	168.3	185.8	204.2	223.8	236.6	251.5	277.1	304.5	332.0	31
Pelargonic acid	C ₉ H ₁₈ O ₂	108.2	126.0	137.4	149.8	163.7	172.3	184.4	203.1	227.5	253.5	12.5
Pentachlorobenzene	C ₅ HCl ₅	98.6	129.7	144.3	160.0	178.5	190.1	205.5	227.0	251.6	276.0	85.5
Pentachloroethane	C ₂ HCl ₅	+1.0	27.2	39.8	53.9	69.9	80.0	93.5	114.0	137.2	160.5	-22
Pentachloroethylbenzene	C ₈ H ₅ Cl ₅	96.2	130.0	148.0	166.0	186.2	199.0	216.0	241.8	269.3	299.0	
Pentachlorophenol	C ₆ HCl ₅ O				192.2	211.2	223.4	239.6	261.8	285.0	309.3	188.5
Pentacosane	C ₂₅ H ₅₂	194.2	230.0	248.2	266.1	285.6	298.4	314.0	339.0	365.4	390.3	53.3
Pentadecane	C ₁₅ H ₃₂	91.6	121.0	135.4	150.2	167.7	178.4	194.0	216.1	242.8	270.5	10
1,3-Pentadiene	C ₅ H ₈	-71.8	-53.8	-45.0	-34.8	-23.4	-16.5	-6.7	+8.0	24.7	42.1	
1,4-Pentadiene	C ₅ H ₈	-83.5	-66.2	-57.1	-47.7	-37.0	-30.0	-20.6	-6.7	+8.3	26.1	
Pentaethylbenzene	C ₁₆ H ₂₆	86.0	120.0	135.8	152.4	171.9	184.2	200.0	224.1	250.2	277.0	
Pentaethylchlorobenzene	C ₁₆ H ₂₅ Cl	90.0	123.8	140.7	158.1	178.2	191.0	208.0	230.3	257.2	285.0	
<i>n</i> -Pentane	C ₅ H ₁₂	-76.6	-62.5	-50.1	-40.2	-29.2	-22.2	-12.6	+1.9	18.5	36.1	-129.7
iso-Pentane (2-methylbutane)	C ₅ H ₁₂	-82.9	-65.8	-57.0	-47.3	-36.5	-29.6	-20.2	-5.9	+10.5	27.8	-159.7
neo-Pentane (2,2-dimethylpropane)	C ₅ H ₁₂	-102.0	-85.4	-76.7	-67.2	-56.1	-49.0	-39.1	-23.7	-7.1	+9.5	-16.6
2,3,4-Pentanetriol	C ₅ H ₁₂ O ₃	155.0	189.3	204.5	220.5	239.6	249.8	263.5	284.5	307.0	327.2	
1-Pentene	C ₅ H ₁₀	-80.4	-63.3	-54.5	-46.0	-34.1	-27.1	-17.7	-3.4	+12.8	30.1	
α-Phellandrene	C ₁₀ H ₁₆	20.0	45.7	58.0	72.1	87.8	97.6	110.6	130.6	152.0	175.0	
Phenanthrene	C ₁₄ H ₁₀	118.2	154.3	173.0	193.7	215.8	229.9	249.0	277.1	308.0	340.2	99.5
Phenethyl alcohol (phenyl cellosolve)	C ₈ H ₁₀ O ₂	58.2	85.9	100.0	114.8	130.5	141.2	154.0	175.0	197.5	219.5	
2-Phenetidine	C ₈ H ₁₁ NO	67.0	94.7	108.6	123.7	139.9	149.8	163.5	184.0	207.0	228.0	
Phenol	C ₆ H ₆ O	40.1	62.5	73.8	86.0	100.1	108.4	121.4	139.0	160.0	181.9	40.6
2-Phenoxyethanol	C ₈ H ₁₀ O ₂	78.0	106.6	121.2	136.0	152.2	163.2	176.5	197.6	221.0	245.3	11.6
2-Phenoxyethyl acetate	C ₁₀ H ₁₂ O ₃	82.6	113.5	128.0	144.5	162.3	174.0	189.2	211.3	235.0	259.7	-6.7
Phenyl acetate	C ₈ H ₈ O ₂	38.2	64.8	78.0	92.3	108.1	118.1	131.6	151.2	173.5	195.9	
Phenylacetic acid	C ₈ H ₈ O ₂	97.0	127.0	141.3	156.0	173.6	184.5	198.2	219.5	243.0	265.5	76.5
Phenylacetonitrile	C ₈ H ₇ N	60.0	89.0	103.5	119.4	136.3	147.7	161.8	184.2	208.5	233.5	-23.8
Phenylacetyl chloride	C ₈ H ₇ ClO	48.0	75.3	89.0	103.6	119.8	129.8	143.5	163.8	186.0	210.0	
Phenyl benzoate	C ₁₃ H ₁₀ O ₂	106.8	141.5	157.8	177.0	197.6	210.8	227.8	254.0	283.5	314.0	70.5
4-Phenyl-3-buten-2-one	C ₁₀ H ₁₀ O	81.7	112.2	127.4	143.8	161.3	172.6	187.8	211.0	235.4	261.0	41.5
Phenyl isocyanate	C ₇ H ₅ NO	10.6	36.0	48.5	62.5	77.7	87.7	100.6	120.8	142.7	165.6	
isocyanide	C ₇ H ₅ N	12.0	37.0	49.7	63.4	78.3	88.0	101.0	120.8	142.3	165.0	
Phenylcyclohexane	C ₁₂ H ₁₆	67.5	96.5	111.3	126.4	144.0	154.2	169.3	191.3	214.6	240.0	+7.5
Phenyl dichlorophosphate	C ₆ H ₅ Cl ₂ O ₂ P	66.7	95.9	110.0	125.9	143.4	153.6	168.0	189.8	213.0	239.5	
<i>m</i> -Phenylene diamine												
(1,3-phenylenediamine)	C ₆ H ₈ N ₂	99.8	131.2	147.0	163.8	182.5	194.0	209.9	233.0	259.0	285.5	62.8
Phenylglyoxal	C ₈ H ₆ O ₃		75.0	87.8	100.7	115.5	124.2	136.2	153.8	173.5	193.5	73
Phenylhydrazine	C ₆ H ₈ N ₂	71.8	101.6	115.8	131.5	148.2	158.7	173.5	195.4	218.2	243.5	19.5
<i>N</i> -Phenyliminodiethanol	C ₁₀ H ₁₅ NO ₂	145.0	179.2	195.8	213.4	233.0	245.3	260.6	284.5	311.3	337.8	
1-Phenyl-1,3-pentanedione	C ₁₁ H ₁₂ O ₂	98.0	128.5	144.0	159.9	178.0	189.8	204.5	226.7	251.2	276.5	
2-Phenylphenol	C ₁₂ H ₁₀ O	100.0	131.6	146.2	163.3	180.3	192.2	205.9	227.9	251.8	275.0	56.5
4-Phenylphenol	C ₁₂ H ₁₀ O			176.2	193.8	213.0	225.3	240.9	263.2	285.5	308.0	164.5
3-Phenyl-1-propanol	C ₈ H ₁₂ O	74.7	102.4	116.0	131.2	147.4	156.8	170.3	191.2	212.8	235.0	
Phenyl isothiocyanate	C ₇ H ₅ NS	47.2	75.6	89.8	115.5	122.5	133.3	147.7	169.6	194.0	218.5	-21.0
Phorone	C ₉ H ₁₄ O	42.0	68.3	81.5	95.6	111.3	121.4	134.0	153.5	175.3	197.2	28
iso-Phorone	C ₉ H ₁₄ O	38.0	66.7	81.2	96.8	114.5	125.6	140.6	163.3	188.7	215.2	
Phosgene (carbonyl chloride)	CCl ₂ O	-92.9	-77.0	-69.3	-60.3	-50.3	-44.0	-35.6	-22.3	-7.6	+8.3	-104
Phthalic anhydride	C ₈ H ₄ O ₃	96.5	121.3	134.0	151.7	172.0	185.3	202.3	228.0	256.8	284.5	130.8
Phthalide	C ₈ H ₆ O ₂	95.5	127.7	144.0	161.3	181.0	193.5	210.0	234.5	261.8	290.0	73
Phthaloyl chloride	C ₈ H ₄ Cl ₂ O ₂	86.3	118.3	134.2	151.0	170.0	182.2	197.8	222.0	248.3	275.8	88.5
2-Picoline	C ₈ H ₇ N	-11.1	+12.6	24.4	37.4	51.2	59.9	71.4	89.0	108.4	128.8	-70
Pimelic acid	C ₇ H ₁₂ O ₄	163.4	196.2	212.0	229.3	247.0	258.2	272.0	294.5	318.5	342.1	103
α-Pinene	C ₁₀ H ₁₆	-1.0	+24.6	37.3	51.4	66.8	76.8	90.1	110.2	132.3	155.0	-55
β-Pinene	C ₁₀ H ₁₆	+4.2	30.0	42.3	58.1	71.5	81.2	94.0	114.1	136.1	158.3	

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm (Continued)

Compound		Pressure, mm Hg									Melting point, °C	
		1	5	10	20	40	60	100	200	400		760
Name	Formula	Temperature, °C										
Piperidine	C ₅ H ₁₁ N		-7.0	+3.9	15.8	29.2	37.7	49.0	66.2	85.7	106.0	-9
Piperonal	C ₈ H ₆ O ₃	87.0	117.4	132.0	148.0	165.7	177.0	191.7	214.3	238.5	263.0	37
Propane	C ₃ H ₈	-128.9	-115.4	-108.5	-100.9	-92.4	-87.0	-79.6	-68.4	-55.6	-42.1	-187.1
Propenylbenzene	C ₉ H ₁₀	17.5	43.8	57.0	71.5	87.7	97.8	111.7	132.0	154.7	179.0	-30.1
Propionamide	C ₃ H ₇ NO	65.0	91.0	105.0	119.0	134.8	144.3	156.0	174.2	194.0	213.0	79
Propionic acid	C ₃ H ₆ O ₂	4.6	28.0	39.7	52.0	65.8	74.1	85.8	102.5	122.0	141.1	-22
anhydride	C ₆ H ₁₀ O ₃	20.6	45.3	57.7	70.4	85.6	94.5	107.2	127.8	146.0	167.0	-45
Propionitrile	C ₃ H ₅ N	-35.0	-13.6	-3.0	+8.8	22.0	30.1	41.4	58.2	77.7	97.1	-91.9
Propiophenone	C ₉ H ₁₀ O	50.0	77.9	92.2	107.6	124.3	135.0	149.3	170.2	194.2	218.0	21
<i>n</i> -Propyl acetate	C ₅ H ₁₀ O ₂	-26.7	-5.4	+5.0	16.0	28.8	37.0	47.8	64.0	82.0	101.8	-92.5
iso-Propyl acetate	C ₅ H ₁₀ O ₂	-38.3	-17.4	-7.2	+4.2	17.0	25.1	35.7	51.7	69.8	89.0	
<i>n</i> -Propyl alcohol (1-propanol)	C ₃ H ₈ O	-15.0	+5.0	14.7	25.3	36.4	43.5	52.8	66.8	82.0	97.8	-127
iso-Propyl alcohol (2-propanol)	C ₃ H ₈ O	-26.1	-7.0	+2.4	12.7	23.8	30.5	39.5	53.0	67.8	82.5	-85.8
<i>n</i> -Propylamine	C ₃ H ₉ N	-64.4	-46.3	-37.2	-27.1	-16.0	-9.0	+0.5	15.0	31.5	48.5	-83
Propylbenzene	C ₉ H ₁₂	6.3	31.3	43.4	56.8	71.6	81.1	94.0	113.5	135.7	159.2	-99.5
Propyl benzoate	C ₁₀ H ₁₂ O ₂	54.6	83.8	98.0	114.3	131.8	143.3	157.4	180.1	205.2	231.0	-51.6
<i>n</i> -Propyl bromide (1-bromopropane)	C ₃ H ₇ Br	-53.0	-33.4	-23.3	-12.4	-0.3	+7.5	18.0	34.0	52.0	71.0	-109.9
iso-Propyl bromide (2-bromopropane)	C ₃ H ₇ Br	-61.8	-42.5	-32.8	-22.0	-10.1	-2.5	+8.0	23.8	41.5	60.0	-89.0
<i>n</i> -Propyl <i>n</i> -butyrate	C ₇ H ₁₄ O ₂	-1.6	+22.1	34.0	47.0	61.5	70.3	82.6	101.0	121.7	142.7	-95.2
isobutyrate	C ₇ H ₁₄ O ₂	-6.2	+16.8	28.3	40.6	54.3	63.0	73.9	91.8	112.0	133.9	
iso-Propyl isobutyrate	C ₇ H ₁₄ O ₂	-16.3	+5.8	17.0	29.0	42.4	51.4	62.3	80.2	100.0	120.5	
Propyl carbamate	C ₄ H ₉ NO ₂	52.4	77.6	90.0	103.2	117.7	126.5	138.3	155.8	175.8	195.0	
<i>n</i> -Propyl chloride (1-chloropropane)	C ₃ H ₇ Cl	-68.3	-50.0	-41.0	-31.0	-19.5	-12.1	-2.5	+12.2	29.4	46.4	-122.8
iso-Propyl chloride (2-chloropropane)	C ₃ H ₇ Cl	-78.8	-61.1	-52.0	-42.0	-31.0	-23.5	-13.7	+1.3	18.1	36.5	-117
iso-Propyl chloroacetate	C ₅ H ₉ ClO ₂	+3.8	28.1	40.2	53.9	68.7	78.0	90.3	108.8	128.0	148.6	
Propyl chloroglyoxylate	C ₅ H ₇ ClO ₃	9.7	32.3	43.5	55.6	68.8	77.2	88.0	104.7	123.0	150.0	
Propylene	C ₃ H ₆	-131.9	-120.7	-112.1	-104.7	-96.5	-91.3	-84.1	-73.3	-60.9	-47.7	-185
Propylene glycol (1,2-Propanediol)	C ₃ H ₈ O ₂	45.5	70.8	83.2	96.4	111.2	119.9	132.0	149.7	168.1	188.2	
Propylene oxide	C ₃ H ₆ O	-75.0	-57.8	-49.0	-39.3	-28.4	-21.3	-12.0	+2.1	17.8	34.5	-112.1
<i>n</i> -Propyl formate	C ₄ H ₈ O ₂	-43.0	-22.7	-12.6	-1.7	+10.8	18.8	29.5	45.3	62.6	81.3	-92.9
iso-Propyl formate	C ₄ H ₈ O ₂	-52.0	-32.7	-22.7	-12.1	-0.2	+7.5	17.8	33.6	50.5	68.3	
4,4'-iso-Propylidenebisphenol	C ₁₅ H ₁₆ O ₂	193.0	224.2	240.8	255.5	273.0	282.9	297.0	317.5	339.0	360.5	
<i>n</i> -Propyl iodide (1-iodopropane)	C ₃ H ₇ I	-36.0	-13.5	-2.4	+10.0	23.6	32.1	43.8	61.8	81.8	102.5	-98.8
iso-Propyl iodide (2-iodopropane)	C ₃ H ₇ I	-43.3	-22.1	-11.7	0.0	+13.2	21.6	32.8	50.0	69.5	89.5	-90
<i>n</i> -Propyl levulinate	C ₈ H ₁₄ O ₃	59.7	86.3	99.9	114.0	130.1	140.6	154.0	175.6	198.0	221.2	
iso-Propyl levulinate	C ₈ H ₁₄ O ₃	48.0	74.5	88.0	102.4	118.1	127.8	141.8	161.6	185.2	208.2	
Propyl mercaptan (1-propanethiol)	C ₃ H ₆ S	-56.0	-36.3	-26.3	-15.4	-3.2	+4.6	15.3	31.5	49.2	67.4	-112
2-iso-Propyl-naphthalene	C ₁₃ H ₁₄	76.0	107.9	123.4	140.3	159.0	171.4	187.6	211.8	238.5	266.0	
iso-Propyl β-naphthyl ketone (2-isobutyronaphthone)	C ₁₄ H ₁₄ O	133.2	165.4	181.0	197.7	215.6	227.0	242.3	264.0	288.2	313.0	
2-iso-Propylphenol	C ₉ H ₁₂ O	56.6	83.8	97.0	111.7	127.5	137.7	150.3	170.1	192.6	214.5	15.5
3-iso-Propylphenol	C ₉ H ₁₂ O	62.0	90.3	104.1	119.8	136.2	146.6	160.2	182.0	205.0	228.0	26
4-iso-Propylphenol	C ₉ H ₁₂ O	67.0	94.7	108.0	123.4	139.8	149.7	163.3	184.0	206.1	228.2	61
Propyl propionate	C ₆ H ₁₂ O ₂	-14.2	+8.0	19.4	31.6	45.0	53.8	65.2	82.7	102.0	122.4	-76
4-iso-Propylstyrene	C ₁₁ H ₁₄	34.7	62.3	76.0	91.2	108.0	118.4	132.8	153.9	178.0	202.5	
Propyl isovalerate	C ₈ H ₁₆ O ₂	+8.0	32.8	45.1	58.0	72.8	82.3	95.0	113.9	135.0	155.9	
Pulegone	C ₁₀ H ₁₆ O	58.3	82.5	94.0	106.8	121.7	130.2	143.1	162.5	189.8	221.0	
Pyridine	C ₅ H ₅ N	-18.9	+2.5	13.2	24.8	38.0	46.8	57.8	75.0	95.6	115.4	-42
Pyrocatechol	C ₆ H ₆ O ₂		104.0	118.3	134.0	150.6	161.7	176.0	197.7	221.5	245.5	105
Pyrocatechol diacetate (1,2-phenylene diacetate)	C ₁₀ H ₁₀ O ₄	98.0	129.8	145.7	161.8	179.8	191.6	206.5	228.7	253.3	278.0	
Pyrogallol	C ₆ H ₆ O ₃		151.7	167.7	185.3	204.2	216.3	232.0	255.3	281.5	309.0	133
Pyrotartaric anhydride	C ₅ H ₆ O ₃	69.7	99.7	114.2	130.0	147.8	158.6	173.8	196.1	221.0	247.4	
Pyruvic acid	C ₃ H ₄ O ₃	21.4	45.8	57.9	70.8	85.3	94.1	106.5	124.7	144.7	165.0	13.6
Quinoline	C ₉ H ₇ N	59.7	89.6	103.8	119.8	136.7	148.1	163.2	186.2	212.3	237.7	-15
iso-Quinoline	C ₉ H ₇ N	63.5	92.7	107.8	123.7	141.6	152.0	167.6	190.0	214.5	240.5	24.6
Resorcinol	C ₆ H ₆ O ₂	108.4	138.0	152.1	168.0	185.3	195.8	209.8	230.8	253.4	276.5	110.7
Saffrole	C ₁₀ H ₁₀ O ₂	63.8	93.0	107.6	123.0	140.1	150.3	165.1	186.2	210.0	233.0	11.2
Salicylaldehyde	C ₇ H ₆ O ₂	33.0	60.1	73.8	88.7	105.2	115.7	129.4	150.0	173.7	196.5	-7
Salicylic acid	C ₇ H ₆ O ₃	113.7	136.0	146.2	156.8	172.2	182.0	193.4	210.0	230.5	256.0	159
Sebacic acid	C ₁₀ H ₁₈ O ₄	183.0	215.7	232.0	250.0	268.2	279.8	294.5	313.2	332.8	352.3	134.5
Selenophene	C ₄ H ₄ Se	-39.0	-16.0	-4.0	+9.1	24.1	33.8	47.0	66.7	89.8	114.3	
Skatole	C ₉ H ₈ N	95.0	124.2	139.6	154.3	171.9	183.6	197.4	218.8	242.5	266.2	95
Stearaldehyde	C ₁₈ H ₃₆ O	140.0	174.6	192.1	210.6	230.8	244.2	260.0	285.0	313.8	342.5	63.5
Stearic acid	C ₁₈ H ₃₆ O ₂	173.7	209.0	225.0	243.4	263.3	275.5	291.0	316.5	343.0	370.0	69.3
Stearyl alcohol (1-octadecanol)	C ₁₈ H ₃₆ O	150.3	185.6	202.0	220.0	240.4	252.7	269.4	293.5	320.3	349.5	58.5
Styrene	C ₈ H ₈	-7.0	+18.0	30.8	44.6	59.8	69.5	82.0	101.3	122.5	145.2	-30.6
Styrene dibromide [(1,2-dibromoethyl) benzene]	C ₈ H ₈ Br ₂	86.0	115.6	129.8	145.2	161.8	172.2	186.3	207.8	230.0	254.0	
Suberic acid	C ₈ H ₁₄ O ₄	172.8	205.5	219.5	238.2	254.6	265.4	279.8	300.5	322.8	345.5	142
Succinic anhydride	C ₄ H ₄ O ₃	92.0	115.0	128.2	145.3	163.0	174.0	189.0	212.0	237.0	261.0	119.6
Succinimide	C ₄ H ₅ NO ₂	115.0	143.2	157.0	174.0	192.0	203.0	217.4	240.0	263.5	287.5	125.5
Succinyl chloride	C ₄ H ₄ Cl ₂ O ₂	39.0	65.0	78.0	91.8	107.5	117.2	130.0	149.3	170.0	192.5	17
α-Terpineol	C ₁₀ H ₁₈ O	52.8	80.4	94.3	109.8	126.0	136.3	150.1	171.2	194.3	217.5	35
Terpenoline	C ₁₀ H ₁₆	32.3	58.0	70.6	84.8	100.0	109.8	122.7	142.0	163.5	185.0	

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm (Continued)

Compound		Pressure, mm Hg										Melting point, °C
		1	5	10	20	40	60	100	200	400	760	
Name	Formula	Temperature, °C										
1,1,1,2-Tetrabromoethane	C ₂ H ₂ Br ₄	58.0	83.3	95.7	108.5	123.2	132.0	144.0	161.5	181.0	200.0	
1,1,2,2-Tetrabromoethane	C ₂ H ₂ Br ₄	65.0	95.5	110.0	126.0	144.0	155.1	170.0	192.5	217.5	243.5	
Tetraisobutylene	C ₁₆ H ₃₂	63.8	93.7	108.5	124.5	142.2	152.6	167.5	190.0	214.6	240.0	
Tetracosane	C ₂₄ H ₅₀	183.8	219.6	237.6	255.3	276.3	288.4	305.2	330.5	358.0	386.4	51.1
1,2,3,4-Tetrachlorobenzene	C ₆ H ₂ Cl ₄	68.5	99.6	114.7	131.2	149.2	160.0	175.7	198.0	225.5	254.0	46.5
1,2,3,5-Tetrachlorobenzene	C ₆ H ₂ Cl ₄	58.2	89.0	104.1	121.6	140.0	152.0	168.0	193.7	220.0	246.0	54.5
1,2,4,5-Tetrachlorobenzene	C ₆ H ₂ Cl ₄					146.0	157.7	173.5	196.0	220.5	245.0	139
1,1,2,2-Tetrachloro-1,2-difluoroethane	C ₂ Cl ₂ F ₂	-37.5	-16.0	-5.0	+6.7	19.8	28.1	38.6	55.0	73.1	92.0	26.5
1,1,1,2-Tetrachloroethane	C ₂ H ₂ Cl ₄	-16.3	+7.4	19.3	32.1	46.7	56.0	68.0	87.2	108.2	130.5	-68.7
1,1,2,2-Tetrachloroethane	C ₂ H ₂ Cl ₄	-3.8	+20.7	33.0	46.2	60.8	70.0	83.2	102.2	124.0	145.9	-36
1,2,3,5-Tetrachloro-4-ethylbenzene	C ₈ H ₆ Cl ₄	77.0	110.0	126.0	143.7	162.1	175.0	191.6	215.3	243.0	270.0	
Tetrachloroethylene	C ₂ Cl ₄	-20.6	+2.4	13.8	26.3	40.1	49.2	61.3	79.8	100.0	120.8	-19.0
2,3,4,6-Tetrachlorophenol	C ₆ H ₂ Cl ₄ O	100.0	130.3	145.3	161.0	179.1	190.0	205.2	227.2	250.4	275.0	69.5
3,4,5,6-Tetrachloro-1,2-xylene	C ₈ H ₆ Cl ₄	94.4	125.0	140.3	156.0	174.2	185.8	200.5	223.0	248.3	273.5	
Tetradecane	C ₁₄ H ₃₀	76.4	106.0	120.7	135.6	152.7	164.0	178.5	201.8	226.8	252.5	5.5
Tetradecylamine	C ₁₄ H ₃₁ N	102.6	135.8	152.0	170.0	189.0	200.2	215.7	239.8	264.6	291.2	
Tetradecyltrimethylsilane	C ₁₇ H ₃₆ Si	120.0	150.7	166.2	183.5	201.5	213.3	227.8	250.0	275.0	300.0	
Tetraethoxysilane	C ₈ H ₂₀ O ₄ Si	16.0	40.3	52.6	65.8	81.1	90.7	103.6	123.5	146.2	168.5	
1,2,3,4-Tetraethylbenzene	C ₁₄ H ₂₂	65.7	96.2	111.6	127.7	145.8	156.7	172.4	196.0	221.4	248.0	11.6
Tetraethylene glycol	C ₈ H ₁₈ O ₅	153.9	183.7	197.1	212.3	228.0	237.8	250.0	268.4	288.0	307.8	
Tetraethylene glycol chlorohydrin	C ₈ H ₁₇ ClO ₄	110.1	141.8	156.1	172.6	190.0	200.5	214.7	236.5	258.2	281.5	
Tetraethyllead	C ₈ H ₂₀ Pb	38.4	63.6	74.8	88.0	102.4	111.7	123.8	142.0	161.8	183.0	-136
Tetraethylsilane	C ₈ H ₂₀ Si	-1.0	+23.9	36.3	50.0	65.3	74.8	88.0	108.0	130.2	153.0	
Tetralin	C ₁₀ H ₁₂	38.0	65.3	79.0	93.8	110.4	121.3	135.3	157.2	181.8	207.2	-31.0
1,2,3,4-Tetramethylbenzene	C ₁₀ H ₁₄	42.6	68.7	81.8	95.8	111.5	121.8	135.7	155.7	180.0	204.4	-6.2
1,2,3,5-Tetramethylbenzene	C ₁₀ H ₁₄	40.6	65.8	77.8	91.0	105.8	115.4	128.3	149.9	173.7	197.9	-24.0
1,2,4,5-Tetramethylbenzene	C ₁₀ H ₁₄	45.0	65.0	74.6	88.0	104.2	114.8	128.1	149.5	172.1	195.9	79.5
2,2,3,3-Tetramethylbutane	C ₈ H ₁₈	-17.4	+3.2	13.5	24.6	36.8	44.5	54.8	70.2	87.4	106.3	-102.2
Tetramethylene dibromide (1,4-dibromobutane)	C ₄ H ₈ Br ₂	32.0	58.8	72.4	87.6	104.0	115.1	128.7	149.8	173.8	197.5	-20
Tetramethyllead	C ₄ H ₁₂ Pb	-29.0	-6.8	+4.4	16.6	30.3	39.2	50.8	68.8	89.0	110.0	-27.5
Tetramethyltin	C ₄ H ₁₂ Sn	-51.3	-31.0	-20.6	-9.3	+3.5	11.7	22.8	39.8	58.5	78.0	
Tetrapropylene glycol monoisopropyl ether	C ₁₅ H ₃₂ O ₅	116.6	147.8	163.0	179.8	197.7	209.0	223.3	245.0	268.3	292.7	
Thioacetic acid (mercaptoacetic acid)	C ₂ H ₄ O ₂ S	60.0	87.7	101.5	115.8	131.8	142.0	154.0				-16.5
Thiodiglycol (2,2'-thiodiethanol)	C ₄ H ₁₀ O ₂ S	42.0	96.0	128.0	165.0	210.0	240.5	285				
Thiophene	C ₄ H ₄ S	-40.7	-20.8	-10.9	0.0	+12.5	20.1	30.5	46.5	64.7	84.4	-38.3
Thiophenol (benzenethiol)	C ₆ H ₆ S	18.6	43.7	56.0	69.7	84.2	93.9	106.6	125.8	146.7	168.0	
α-Thujone	C ₁₀ H ₁₆ O	38.3	65.7	79.3	93.7	110.0	120.2	134.0	154.2	177.8	201.0	
Thymol	C ₁₀ H ₁₄ O	64.3	92.8	107.4	122.6	139.8	149.8	164.1	185.5	209.2	231.8	51.5
Tiglaldehyde	C ₅ H ₈ O	-25.0	-1.6	+10.0	23.2	37.0	45.8	57.7	75.4	95.5	116.4	
Tiglic acid	C ₅ H ₈ O ₂	52.0	77.8	90.2	103.8	119.0	127.8	140.5	158.0	179.2	198.5	64.5
Tiglonitrile	C ₅ H ₇ N	-25.5	-2.4	+9.2	22.1	36.7	46.0	58.2	77.8	99.7	122.0	
Toluene	C ₇ H ₈	-26.7	-4.4	+6.4	18.4	31.8	40.3	51.9	69.5	89.5	110.6	-95.0
Toluene-2,4-diamine	C ₇ H ₁₀ N ₂	106.5	137.2	151.7	167.9	185.7	196.2	211.5	232.8	256.0	280.0	99
2-Toluic nitrile (2-tolunitrile)	C ₈ H ₇ N	36.7	64.0	77.9	93.0	110.0	120.8	135.0	156.0	180.0	205.2	-13
4-Toluic nitrile (4-tolunitrile)	C ₈ H ₇ N	42.5	71.3	85.8	101.7	109.5	130.0	145.2	167.3	193.0	217.6	29.5
2-Toluidine	C ₇ H ₉ N	44.0	69.3	81.4	95.1	110.0	119.8	133.0	153.0	176.2	199.7	-16.3
3-Toluidine	C ₇ H ₉ N	41.0	68.0	82.0	96.7	113.5	123.8	136.7	157.6	180.6	203.3	-31.5
4-Toluidine	C ₇ H ₉ N	42.0	68.2	81.8	95.8	111.5	121.5	133.7	154.0	176.9	200.4	44.5
2-Tolyl isocyanide	C ₈ H ₇ N	25.2	51.0	64.0	78.2	94.0	104.0	117.7	137.8	159.9	183.5	
4-Tolylhydrazine	C ₈ H ₁₀ N ₂	82.4	110.0	123.8	138.6	154.1	165.0	178.0	198.0	219.5	242.0	65.5
Tribromoacetaldehyde	C ₂ HBr ₃ O	18.5	45.0	58.0	72.1	87.8	97.5	110.2	130.0	151.6	174.0	
1,1,2-Tribromobutane	C ₄ H ₇ Br ₃	45.0	73.5	87.8	103.2	120.2	131.6	146.0	167.8	192.0	216.2	
1,2,2-Tribromobutane	C ₄ H ₇ Br ₃	41.0	69.0	83.2	98.6	116.0	127.0	141.8	163.5	188.0	213.8	
2,2,3-Tribromobutane	C ₄ H ₇ Br ₃	38.2	66.0	79.8	94.6	111.8	122.2	136.3	157.8	182.2	206.5	
1,1,2-Tribromoethane	C ₂ H ₃ Br ₃	32.6	58.0	70.6	84.2	100.0	110.0	123.5	143.5	165.4	188.4	-26
1,2,3-Tribromopropane	C ₃ H ₅ Br ₃	47.5	75.8	90.0	105.8	122.8	134.0	148.0	170.0	195.0	220.0	16.5
Triisobutylamine	C ₁₂ H ₂₇ N	32.3	57.4	69.8	83.0	97.8	107.3	119.7	138.0	157.8	179.0	-22
Triisobutylene	C ₁₂ H ₂₄	18.0	44.0	56.5	70.0	86.7	96.7	110.0	130.2	153.0	179.0	
2,4,6-Tritertbutylphenol	C ₁₈ H ₃₀ O	95.2	126.1	142.0	158.0	177.4	188.0	203.0	226.2	250.6	276.3	
Trichloroacetic acid	C ₂ HCl ₃ O ₂	51.0	76.0	88.2	101.8	116.3	125.9	137.8	155.4	175.2	195.6	
Trichloroacetic anhydride	C ₄ Cl ₆ O ₃	56.2	85.3	99.6	114.3	131.2	141.8	155.2	176.2	199.8	223.0	
Trichloroacetyl bromide	C ₂ BrCl ₂ O	-7.4	+16.7	29.3	42.1	57.2	66.7	79.5	98.4	120.2	143.0	
2,4,6-Trichloroaniline	C ₆ H ₃ Cl ₃ N	134.0	157.8	170.0	182.6	195.8	204.5	214.6	229.8	246.4	262.0	78
1,2,3-Trichlorobenzene	C ₆ H ₃ Cl ₃	40.0	70.0	85.6	101.8	119.8	131.5	146.0	168.2	193.5	218.5	52.5
1,2,4-Trichlorobenzene	C ₆ H ₃ Cl ₃	38.4	67.3	81.7	97.2	114.8	125.7	140.0	162.0	187.7	213.0	17
1,3,5-Trichlorobenzene	C ₆ H ₃ Cl ₃		63.8	78.0	93.7	110.8	121.8	136.0	157.7	183.0	208.4	63.5
1,2,3-Trichlorobutane	C ₄ H ₇ Cl ₃	+0.5	27.2	40.0	55.0	71.5	82.0	96.2	118.0	143.0	169.0	
1,1,1-Trichloroethane	C ₂ H ₃ Cl ₃	-52.0	-32.0	-21.9	-10.8	+1.6	9.5	20.0	36.2	54.6	74.1	-30.6
1,1,2-Trichloroethane	C ₂ H ₃ Cl ₃	-24.0	-2.0	+8.3	21.6	35.2	44.0	55.7	73.3	93.0	113.9	-36.7
Trichloroethylene	C ₂ HCl ₃	-43.8	-22.8	-12.4	-1.0	+11.9	20.0	31.4	48.0	67.0	86.7	-73
Trichlorofluoromethane	CCl ₂ F	-84.3	-67.6	-59.0	-49.7	-39.0	-32.3	-23.0	-9.1	+6.8	23.7	
2,4,5-Trichlorophenol	C ₆ H ₃ Cl ₃ O	72.0	102.1	117.3	134.0	151.5	162.5	178.0	201.5	226.5	251.8	62
2,4,6-Trichlorophenol	C ₆ H ₃ Cl ₃ O	76.5	105.9	120.2	135.8	152.2	163.5	177.8	199.0	222.5	246.0	68.5

TABLE 2-8 Vapor Pressures of Organic Compounds, up to 1 atm (Concluded)

Compound		Pressure, mm Hg									Melting point, °C	
		1	5	10	20	40	60	100	200	400		760
Name	Formula	Temperature, °C										
Tri-2-chlorophenylthiophosphate	C ₁₈ H ₁₂ Cl ₃ O ₃ PS	188.2	217.2	231.2	246.7	261.7	271.5	283.8	302.8	322.0	341.3	
1,1,1-Trichloropropane	C ₃ H ₅ Cl ₃	-28.8	-7.0	+4.2	16.2	29.9	38.3	50.0	67.7	87.5	108.2	-77.7
1,2,3-Trichloropropane	C ₃ H ₅ Cl ₃	+9.0	33.7	46.0	59.3	74.0	83.6	96.1	115.6	137.0	158.0	-14.7
1,1,2-Trichloro-1,2,2-trifluoroethane	C ₂ Cl ₃ F ₃	-68.0	-49.4	-40.3	-30.0	-18.5	-11.2	-1.7	+13.5	30.2	47.6	-35
Tricosane	C ₂₃ H ₄₈	170.0	206.3	223.0	242.0	261.3	273.8	289.8	313.5	339.8	366.5	47.7
Tridecane	C ₁₃ H ₂₈	59.4	98.3	104.0	120.2	137.7	148.2	162.5	185.0	209.4	234.0	-6.2
Tridecanoic acid	C ₁₃ H ₂₆ O ₂	137.8	166.3	181.0	195.8	212.4	222.0	236.0	255.2	276.5	299.0	41
Triethoxymethylsilane	C ₇ H ₁₆ O ₃ Si	-1.5	+22.8	34.6	47.2	61.7	70.4	82.7	101.0	121.8	143.5	
Triethoxyphenylsilane	C ₁₂ H ₂₀ O ₃ Si	71.0	98.8	112.6	127.2	143.5	153.2	167.5	188.0	210.5	233.5	
1,2,4-Triethylbenzene	C ₁₂ H ₁₈	46.0	74.2	88.5	104.0	121.7	132.2	146.8	168.3	193.7	218.0	
1,3,4-Triethylbenzene	C ₁₂ H ₁₈	47.9	76.0	90.2	105.8	122.6	133.4	147.7	168.3	193.2	217.5	
Triethylborine	C ₆ H ₁₅ B			-148.0	-140.6	-131.4	-125.2	-116.0	-101.0	-81.0	-56.2	
Triethyl camphoronate citrate	C ₁₅ H ₂₆ O ₆ C ₁₂ H ₂₀ O ₇		150.2	166.0	183.6	201.8	213.5	228.6	250.8	276.0	301.0	135
Triethyleneglycol	C ₆ H ₁₄ O ₄	114.0	144.0	158.1	174.0	191.3	201.5	214.6	235.2	256.6	278.3	
Triethylheptylsilane	C ₁₃ H ₃₀ Si	70.0	99.8	114.6	130.3	148.0	158.2	174.0	196.0	221.0	247.0	
Triethyloctylsilane	C ₁₄ H ₃₂ Si	73.7	104.8	120.6	137.7	155.7	168.0	184.3	208.0	235.0	262.0	
Triethyl orthoformate phosphate	C ₇ H ₁₆ O ₃ C ₆ H ₁₅ O ₄ P	+5.5 39.6	29.2 67.8	40.5 82.1	53.4 97.8	67.5 115.7	76.0 126.3	88.0 141.6	106.0 163.7	125.7 187.0	146.0 211.0	
Triethylthallium	C ₆ H ₁₅ Tl	+9.3	37.6	51.7	67.7	85.4	95.7	112.1	136.0	163.5	192.1	-63.0
Trifluorophenylsilane	C ₆ H ₅ F ₃ Si	-31.0	-9.7	+0.8	12.3	25.4	33.2	44.2	60.1	78.7	98.3	
Trimethyl phosphate	C ₃ H ₉ PO ₄	93.7	131.0	149.8	169.8	192.0	207.0	225.7	255.0	288.5	324.0	
2,3,5-Trimethylacetophenone	C ₁₁ H ₁₄ O	79.0	108.0	122.3	137.5	154.2	165.7	179.7	201.3	224.3	247.5	
Trimethylamine	C ₃ H ₉ N	-97.1	-81.7	-73.8	-65.0	-55.2	-48.8	-40.3	-27.0	-12.5	+2.9	-117.1
2,4,5-Trimethylaniline	C ₉ H ₁₃ N	68.4	95.9	109.0	123.7	139.8	149.5	162.0	182.3	203.7	234.5	67
1,2,3-Trimethylbenzene	C ₉ H ₁₂	16.8	42.9	55.9	69.9	85.4	95.3	108.8	129.0	152.0	176.1	-25.5
1,2,4-Trimethylbenzene	C ₉ H ₁₂	13.6	38.3	50.7	64.5	79.8	89.5	102.8	122.7	145.4	169.2	-44.1
1,3,5-Trimethylbenzene	C ₉ H ₁₂	9.6	34.7	47.4	61.0	76.1	85.8	98.9	118.6	141.0	164.7	-44.8
2,2,3-Trimethylbutane	C ₇ H ₁₆			-18.8	-7.5	+5.2	13.3	24.4	41.2	60.4	80.9	-25.0
Trimethyl citrate	C ₉ H ₁₄ O ₇	106.2	146.2	160.4	177.2	194.2	205.5	219.6	241.3	264.2	287.0	78.5
Trimethyleneglycol (1,3-propanediol)	C ₃ H ₈ O ₂	59.4	87.2	100.6	115.5	131.0	141.1	153.4	172.8	193.8	214.2	
1,2,4-Trimethyl-5-ethylbenzene	C ₁₁ H ₁₆	43.7	71.2	84.6	99.7	106.0	126.3	140.3	160.3	184.5	208.1	
1,3,5-Trimethyl-2-ethylbenzene	C ₁₁ H ₁₆	38.8	67.0	80.5	96.0	113.2	123.8	137.9	158.4	183.5	208.0	
2,2,3-Trimethylpentane	C ₈ H ₁₈	-29.0	-7.1	+3.9	16.0	29.5	38.1	49.9	67.8	88.2	109.8	-112.3
2,2,4-Trimethylpentane	C ₈ H ₁₈	-36.5	-15.0	-4.3	+7.5	20.7	29.1	40.7	58.1	78.0	99.2	-107.3
2,3,3-Trimethylpentane	C ₈ H ₁₈	-25.8	-3.9	+6.9	19.2	33.0	41.8	53.8	72.0	92.7	114.8	-101.5
2,3,4-Trimethylpentane	C ₈ H ₁₈	-26.3	-4.1	+7.1	19.3	32.9	41.6	53.4	71.3	91.8	113.5	-109.2
2,2,4-Trimethyl-3-pentanone	C ₈ H ₁₆ O	14.7	36.0	46.4	57.6	69.8	77.3	87.6	102.2	118.4	135.0	
Trimethyl phosphate	C ₃ H ₉ O ₄ P	26.0	53.7	67.8	83.0	100.0	110.0	124.0	145.0	167.8	192.7	
2,4,5-Trimethylstyrene	C ₁₁ H ₁₄	48.1	77.0	91.6	107.1	124.2	135.5	149.8	171.8	196.1	221.2	
2,4,6-Trimethylstyrene	C ₁₁ H ₁₄	37.5	65.7	79.7	94.8	111.8	122.3	136.8	157.8	182.3	207.0	
Trimethylsuccinic anhydride	C ₇ H ₁₀ O ₃	53.5	82.6	97.4	113.8	131.0	142.2	156.5	179.8	205.5	231.0	
Triphenylmethane	C ₁₉ H ₁₆	169.7	188.4	197.0	206.8	215.5	221.2	228.4	239.7	249.8	259.2	93.4
Triphenylphosphate	C ₁₈ H ₁₅ O ₄ P	193.5	230.4	249.8	269.7	290.3	305.2	322.5	349.8	379.2	413.5	49.4
Tripropyleneglycol	C ₉ H ₂₀ O ₄	96.0	125.7	140.5	155.8	173.7	184.6	199.0	220.2	244.3	267.2	
Tripropyleneglycol monobutyl ether	C ₁₃ H ₂₈ O ₄	101.5	131.6	147.0	161.8	179.8	190.2	204.4	224.4	247.0	269.5	
Tripropyleneglycol monoisopropyl ether	C ₁₂ H ₂₆ O ₄	82.4	112.4	127.3	143.7	161.4	173.2	187.8	209.7	232.8	256.6	
Tritolyl phosphate	C ₂₁ H ₂₁ O ₄ P	154.6	184.2	198.0	213.2	229.7	239.8	252.2	271.8	292.7	313.0	
Undecane	C ₁₁ H ₂₄	32.7	59.7	73.9	85.6	104.4	115.2	128.1	149.3	171.9	195.8	-25.6
Undecanoic acid	C ₁₁ H ₂₂ O ₂	101.4	133.1	149.0	166.0	185.6	197.2	212.5	237.8	262.8	290.0	29.5
10-Undecenoic acid	C ₁₁ H ₂₀ O ₂	114.0	142.8	156.3	172.0	188.7	199.5	213.5	232.8	254.0	275.0	24.5
Undecan-2-ol	C ₁₁ H ₂₄ O	71.1	99.0	112.8	127.5	143.7	153.7	167.2	187.7	209.8	232.0	
n-Valeric acid	C ₅ H ₁₀ O ₂	42.2	67.7	79.8	93.1	107.8	116.6	128.3	146.0	165.0	184.4	-34.5
iso-Valeric acid	C ₅ H ₁₀ O ₂	34.5	59.6	71.3	84.0	98.0	107.3	118.9	136.2	155.2	175.1	-37.6
γ-Valerolactone	C ₅ H ₈ O ₂	37.5	65.8	79.8	95.2	101.9	122.4	136.5	157.7	182.3	207.5	
Valeronitrile	C ₅ H ₉ N	-6.0	+18.1	30.0	43.3	57.8	66.9	78.6	97.7	118.7	140.8	
Vanillin	C ₈ H ₈ O ₃	107.0	138.4	154.0	170.5	188.7	199.8	214.5	237.3	260.0	285.0	81.5
Vinyl acetate	C ₄ H ₆ O ₂	-48.0	-28.0	-18.0	-7.0	+5.3	13.0	23.3	38.4	55.5	72.5	
2-Vinylanisole	C ₉ H ₁₀ O	41.9	68.0	81.0	94.7	110.0	119.8	132.3	151.0	172.1	194.0	
3-Vinylanisole	C ₉ H ₁₀ O	43.4	69.9	83.0	97.2	112.5	122.3	135.3	154.0	175.9	197.5	
4-Vinylanisole	C ₉ H ₁₀ O	45.2	72.0	85.7	100.0	116.0	126.1	139.7	159.0	182.0	204.5	
Vinyl chloride (1-chloroethylene)	C ₂ H ₃ Cl	-105.6	-90.8	-83.7	-75.7	-66.8	-61.1	-53.2	-41.3	-28.0	-13.8	-153.7
cyanide (acrylonitrile)	C ₃ H ₃ N	-51.0	-30.7	-20.3	-9.0	+3.8	11.8	22.8	38.7	58.3	78.5	-82
fluoride (1-fluoroethylene)	C ₂ H ₃ F	-149.3	-138.0	-132.2	-125.4	-118.0	-113.0	-106.2	-95.4	-84.0	-72.2	-160.5
Vinylidene chloride (1,1-dichloroethylene)	C ₂ H ₂ Cl ₂	-77.2	-60.0	-51.2	-41.7	-31.1	-24.0	-15.0	-1.0	+14.8	31.7	-122.5
4-Vinylphenetole	C ₁₀ H ₁₂ O	64.0	91.7	105.6	120.3	136.3	146.4	159.8	180.0	202.8	225.0	
2-Xenyl dichlorophosphate	C ₁₂ H ₆ Cl ₂ PO	138.2	171.1	187.0	205.0	223.8	236.0	251.5	275.3	301.5	328.5	
2,4-Xyaldehyde	C ₉ H ₁₀ O	59.0	85.9	99.0	114.0	129.7	139.8	152.2	172.3	194.1	215.5	75
2-Xylene (2-xylene)	C ₈ H ₁₀	-3.8	+20.2	32.1	45.1	59.5	68.8	81.3	100.2	121.7	144.4	-25.2
3-Xylene (3-xylene)	C ₈ H ₁₀	-6.9	+16.8	28.3	41.1	55.3	64.4	76.8	95.5	116.7	139.1	-47.9
4-Xylene (4-xylene)	C ₈ H ₁₀	-8.1	+15.5	27.3	40.1	54.4	63.5	75.9	94.6	115.9	138.3	+13.3
2,4-Xylidine	C ₈ H ₁₁ N	52.6	79.8	93.0	107.6	123.8	133.7	146.8	166.4	188.3	211.5	
2,6-Xylidine	C ₈ H ₁₁ N	44.0	72.6	87.0	102.7	120.2	131.5	146.0	168.0	193.7	217.9	

VAPOR PRESSURES OF SOLUTIONS

UNITS CONVERSIONS

For this subsection, the following units conversions are applicable:

$$^{\circ}\text{F} = \%^{\circ}\text{C} + 32.$$

To convert millimeters of mercury to pounds-force per square inch, multiply by 0.01934.

To convert cubic feet to cubic meters, multiply by 0.02832.
 To convert bars to pounds-force per square inch, multiply by 14.504.
 To convert bars to kilopascals, multiply by 1×10^2 .

TABLE 2-9 Partial Pressures of Water over Aqueous Solutions of HCl*

$\log_{10} p_{\text{mm}} = A - B/T$, (T in K), which, however, agrees only approximately with the table. The table is more nearly correct. Partial pressure of H₂O, mmHg, °C

% HCl	A	B	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	60°	70°	80°	90°	100°	110°
6	8.99156	2282	4.18	6.04	8.45	11.7	15.9	21.8	29.1	39.4	50.6	66.2	86.0	139	220	333	492	715	
10	8.99864	2295	3.84	5.52	7.70	10.7	14.6	20.0	26.8	35.5	47.0	61.5	80.0	130	204	310	463	677	960
14	8.97075	2300	3.39	4.91	6.95	9.65	13.1	18.0	24.1	31.9	42.1	55.3	72.0	116	185	273	425	625	892
18	8.98014	2323	2.87	4.21	5.92	8.26	11.3	15.4	20.6	27.5	36.4	47.9	62.5	102	162	248	374	550	783
20	8.97877	2334	2.62	3.83	5.40	7.50	10.3	14.1	19.0	25.1	33.3	43.6	57.0	93.5	150	230	345	510	729
22	9.02708	2363	2.33	3.40	4.82	6.75	9.30	12.6	17.1	22.8	30.2	39.8	52.0	85.6	138	211	317	467	670
24	8.96022	2356	2.05	3.04	4.31	6.03	8.30	11.4	15.4	20.4	27.1	35.7	46.7	77.0	124	194	290	426	611
26	9.01511	2390	1.76	2.60	3.71	5.21	7.21	9.95	13.5	18.0	24.0	31.7	41.5	69.0	112	173	261	387	555
28	8.97611	2395	1.50	2.24	3.21	4.54	6.32	8.75	11.8	15.8	21.1	27.9	36.5	60.7	99.0	154	234	349	499
30	9.00117	2422	1.26	1.90	2.73	3.88	5.41	7.52	10.2	13.7	18.4	24.3	32.0	53.5	87.5	136	207	310	444
32	9.03317	2453	1.04	1.57	2.27	3.25	4.55	6.37	8.70	11.7	15.7	21.0	27.7	46.5	76.5	120	184	275	396
34	9.07143	2487	0.85	1.29	1.87	2.70	3.81	5.35	7.32	9.95	13.5	18.1	24.0	40.5	66.5	104	161	243	355
36	9.11815	2526	0.68	1.03	1.50	2.19	3.10	4.41	6.08	8.33	11.4	15.4	20.4	34.8	57.0	90.0	140	212	311
38	9.20783	2579	0.53	0.81	1.20	1.75	2.51	3.60	5.03	6.92	9.52	13.0	17.4	29.6	49.1	77.5	120	182	266
40	9.33923	2647	0.41	0.63	0.94	1.37	2.00	2.88	4.09	5.68	7.85	10.7	14.5	25.0	42.1	67.3	105	158	230
42	9.44953	2709	0.31	0.48	0.72	1.06	1.56	2.30	3.28	4.60	6.45	8.90	12.1	21.2	35.8	57.2	89.2	135	195

*Accuracy, ca. 2 percent for solutions of 15 to 30 percent HCl between 0 and 100°; for solutions of > 30 percent HCl the accuracy is ca. 5 percent at the lower temperatures and ca. 15 percent at the higher temperatures. Below 15 percent HCl, the accuracy is ca. 5 percent at the lower temperatures and higher strengths to ca. 15 to 20 percent at the lower strengths and perhaps 15 to 20 percent at the higher temperatures and lower strengths.

TABLE 2-10 Partial Pressures of HCl over Aqueous Solutions of HCl*

$\log_{10} p_{\text{mm}} = A - B/T$, (T in K), which, however, agrees only approximately with the table. The table is more nearly correct. mmHg, °C

% HCl	A	B	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	60°	70°	80°	90°	100°	110°
2	11.8037	4736			0.0000117	0.000023	0.000044	0.000084	0.000151	0.000275	0.00047	0.00083	0.00140	0.00380	0.0100	0.0245	0.058	0.132	0.280
4	11.6400	4471	0.000018	0.000036	.000069	.000131	.00024	.00044	.00077	.00134	.0023	.00385	.0064	.0165	.0405	.095	.21	.46	.93
6	11.2144	4202	.000066	.000125	.000234	.000425	.00076	.00131	.00225	.0038	.0062	.0102	.0163	.040	.094	.206	.44	.92	1.78
8	11.0406	4042	.000118	.000323	.000583	.00104	.00178	.0031	.00515	.0085	.0136	.022	.0344	.081	.183	.39	.82	1.64	3.10
10	10.9311	3908	.00042	.00075	.00134	.00232	.00395	.0067	.0111	.0178	.0282	.045	.069	.157	.35	.73	1.48	2.9	5.4
12	10.7900	3765	.00099	.00175	.00305	.0052	.0088	.0145	.0234	.037	.058	.091	.136	.305	.66	1.34	2.65	5.1	9.3
14	10.6954	3636	.0024	.00415	.0071	.0118	.0196	.0316	.050	.078	.121	.185	.275	.60	1.25	2.50	4.8	9.0	16.0
16	10.6261	3516	.0056	.0095	.016	.0265	.0428	.0685	.106	.163	.247	.375	.55	1.17	2.40	4.66	8.8	16.1	28
18	10.4957	3376	.0135	.0225	.037	.060	.095	.148	.228	.345	.515	.77	1.11	2.3	4.55	8.6	15.7	28	48
20	10.3833	3245	.0316	.052	.084	.132	.205	.32	.48	.72	1.06	1.55	2.21	4.4	8.5	15.6	28.1	49	83
22	10.3172	3125	.0734	.119	.187	.294	.45	.68	1.02	1.50	2.18	3.14	4.42	8.6	16.3	29.3	52	90	146
24	10.2185	2995	.175	.277	.43	.66	1.00	1.49	2.17	3.14	4.5	6.4	8.9	16.9	31.0	54.5	94	157	253
26	10.1303	2870	.41	.64	.98	1.47	2.17	3.20	4.56	6.50	9.2	12.7	17.5	32.5	58.5	100	169	276	436
28	10.0115	2732	1.0	1.52	2.27	3.36	4.90	7.05	9.90	13.8	19.1	26.4	35.7	64	112	188	309	493	760
30	9.8763	2593	2.4	3.57	5.23	7.60	10.6	15.1	21.0	28.6	39.4	53	71	124	208	340	542	845	
32	9.7523	2457	5.7	8.3	11.8	16.8	23.5	32.5	44.5	60.0	81	107	141	238	390	623	970		
34	9.6061	2316	13.1	18.8	26.4	36.8	50.5	68.5	92	122	161	211	273	450	720				
36	9.5262	2229	29.0	41.0	56.4	78	105.5	142	188	246	322	416	535	860					
38	9.4670	2094	63.0	87.0	117	158	210	277	360	465	598	758	955						
40	9.2156	1939	130	176	233	307	399	515	627	830									
42	8.9925	1800	253	332	430	560	709	900											
44	8.8621	1681	510	655	840														
46		940																	

*Accuracy, ca. 2 percent for solutions of 15 to 30 percent HCl between 0 and 100°; for solutions of > 30 percent HCl the accuracy is ca. 5 percent at the lower temperatures and ca. 15 percent at the higher temperatures. Below 15 percent HCl, the accuracy is ca. 5 percent at the lower temperatures and higher strengths to ca. 15 to 20 percent at the lower strengths and perhaps 15 to 20 percent at the higher temperatures and lower strengths.

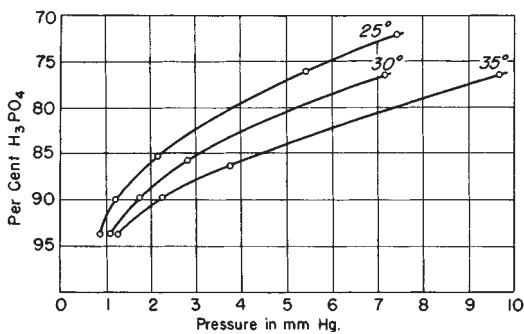


FIG. 2-1 Vapor pressures of H₃PO₄ aqueous: partial pressure of H₂O vapor. (Courtesy of Victor Chemical Works, Stauffer Chemical Company; measurements by W. H. Woodstock.)

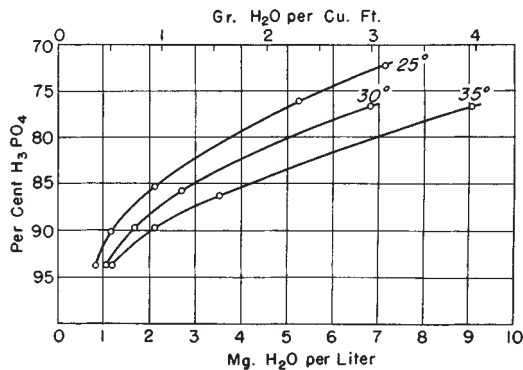


FIG. 2-2 Vapor pressures of H₃PO₄ aqueous: weight of H₂O in saturated air. (Courtesy of Victor Chemical Works, Stauffer Chemical Company; measurements by W. H. Woodstock.)

TABLE 2-11 Partial Pressures of H₂O and SO₂ over Aqueous Solutions of Sulfur Dioxide*

Partial pressures of H₂O and SO₂, mmHg, °C

g SO ₂ / 100 g H ₂ O	Temperature, °C								
	0	10	20	30	40	50	60	90	120
0.01	0.02	0.04	0.07	0.12	0.19	0.29	0.43	1.21	2.82
0.05	0.38	0.66	1.07	1.68	2.53	3.69	5.24	12.9	27.0
0.10	1.15	1.91	3.03	4.62	6.80	9.71	13.5	31.7	63.9
0.15	2.10	3.44	5.37	8.07	11.7	16.5	22.7	52.2	104
0.20	3.17	5.13	7.93	11.8	17.0	23.8	32.6	73.7	145
0.25	4.34	6.93	10.6	15.7	22.5	31.4	42.8	95.8	186
0.30	5.57	8.84	13.5	19.8	28.2	39.2	53.3	118	229
0.40	8.17	12.8	19.4	28.3	40.1	55.3	74.7	164	316
0.50	10.9	17.0	25.6	37.1	52.3	72.0	96.8	211	404
1.00	25.8	39.5	58.4	83.7	117	159	212	454	856
2.00	58.6	88.5	129	183	253	342	453	955	
3.00	93.2	139	202	285	393	530	700		
4.00	129	192	277	389	535	720			
5.00	165	245	353	496	679				
6.00	202	299	430	602	824				
8.00	275	407	585	818					
10.00	351	517	741						
15.00	542	796							
20.00	735								

*Extracted with permission from *J. Chem Eng. Data* 8, 1963: 333-336. Copyright 1963 American Chemical Society.

TABLE 2-12 Water Partial Pressure, bar, over Aqueous Sulfuric Acid Solutions*
 Weight percent, H₂SO₄

°C	10.0	20.0	30.0	40.0	50.0	60.0	70.0	75.0	80.0	85.0
0	.582E-02	.534E-02	.448E-02	.326E-02	.193E-02	.836E-03	.207E-03	.747E-04	.197E-04	.343E-05
10	.117E-01	.107E-01	.909E-02	.670E-02	.405E-02	.180E-02	.467E-03	.175E-03	.490E-04	.952E-05
20	.223E-01	.205E-01	.174E-01	.130E-01	.802E-02	.367E-02	.995E-03	.388E-03	.115E-04	.245E-04
30	.404E-01	.373E-01	.319E-01	.241E-01	.151E-01	.710E-02	.201E-02	.811E-03	.253E-03	.589E-04
40	.703E-01	.649E-01	.558E-01	.427E-01	.272E-01	.131E-01	.387E-02	.162E-02	.531E-03	.133E-03
50	.117	.109	.939E-01	.725E-01	.470E-01	.232E-01	.715E-02	.309E-02	.106E-02	.286E-03
60	.189	.175	.152	.119	.782E-01	.395E-01	.127E-01	.565E-02	.204E-02	.584E-03
70	.296	.275	.239	.188	.126	.651E-01	.217E-01	.997E-02	.376E-02	.114E-02
80	.449	.417	.365	.290	.196	.104	.360E-01	.170E-01	.668E-02	.213E-02
90	.664	.617	.542	.434	.298	.161	.578E-01	.281E-01	.115E-01	.383E-02
100	.957	.891	.786	.634	.441	.244	.905E-01	.452E-01	.192E-01	.666E-02
110	1.349	1.258	1.113	.904	.638	.360	.138	.708E-01	.312E-01	.112E-01
120	1.863	1.740	1.544	1.264	.903	.519	.206	.108	.493E-01	.183E-01
130	2.524	2.361	2.101	1.732	1.253	.734	.301	.162	.760E-01	.291E-01
140	3.361	3.149	2.810	2.333	1.708	1.020	.481	.236	.115	.451E-01
150	4.404	4.132	3.697	3.090	2.289	1.392	.605	.339	.170	.682E-01
160	5.685	5.342	4.793	4.031	3.021	1.870	.837	.478	.246	.101
170	7.236	6.810	6.127	5.185	3.930	2.475	1.138	.662	.350	.147
180	9.093	8.571	7.731	6.584	5.045	3.233	1.525	.902	.489	.208
190	11.289	10.658	9.640	8.259	6.397	4.169	2.017	1.212	.673	.291
200	13.861	13.107	11.887	10.245	8.020	5.312	2.632	1.606	.913	.401
210	16.841	15.951	14.505	12.576	9.948	6.696	3.395	2.101	1.220	.542
220	20.264	19.225	17.529	15.287	12.217	8.354	4.331	2.714	1.609	.724
230	24.160	22.960	20.992	18.414	14.864	10.322	5.466	3.467	2.096	.952
240	28.561	27.188	24.927	21.992	17.929	12.641	6.831	4.381	2.699	1.237
250	33.494	31.939	29.364	26.056	21.452	15.351	8.458	5.480	3.435	1.587
260	38.984	37.240	34.334	30.642	25.472	18.496	10.382	6.788	4.326	2.012
270	45.055	43.116	39.865	35.784	30.030	22.121	12.640	8.333	5.395	2.525
280	51.726	49.590	45.984	41.514	35.168	26.274	15.269	10.142	6.663	3.136
290	59.015	56.681	52.715	47.865	40.926	31.003	18.311	12.242	8.155	3.857
300	66.934	64.407	60.081	54.868	47.346	36.360	21.808	14.665	9.897	4.701
310	75.495	72.781	68.100	62.553	54.470	42.395	25.804	17.438	11.912	5.680
320	84.705	81.816	76.792	70.947	62.337	49.164	30.343	20.591	14.227	6.806
330	94.567	91.518	86.172	80.077	70.988	56.721	35.473	24.153	16.867	8.093
340	105.083	101.894	96.252	89.969	80.463	65.123	41.240	28.154	19.855	9.551
350	116.251	112.946	107.043	100.646	90.802	74.426	47.692	32.622	23.217	11.193

*Vermeulen, Dong, Robinson, Nguyen, and Gmitro, AIChE meeting, Anaheim, Calif., 1982; and private communication from Prof. Theodore Vermeulen, Chemical Engineering Dept., University of California, Berkeley.

TABLE 2-12 Water Partial Pressure, bar, over Aqueous Sulfuric Acid Solutions (Concluded)
 Weight percent, H₂SO₄

°C	90.0	92.0	94.0	96.0	97.0	98.0	98.5	99.0	99.5	100.0
0	.518E-06	.242E-06	.107E-06	.401E-07	.218E-07	.980E-08	.569E-08	.268E-08	.775E-09	.196E-09
10	.159E-05	.762E-06	.344E-06	.130E-06	.713E-07	.323E-07	.188E-07	.888E-08	.258E-08	.655E-09
20	.448E-05	.220E-05	.101E-05	.390E-06	.215E-06	.978E-07	.572E-07	.271E-07	.789E-08	.201E-08
30	.117E-04	.587E-05	.275E-05	.108E-05	.598E-06	.275E-06	.161E-06	.766E-07	.224E-07	.575E-08
40	.285E-04	.146E-04	.696E-05	.278E-05	.155E-05	.720E-06	.424E-06	.202E-06	.595E-07	.153E-07
50	.652E-04	.341E-04	.166E-04	.672E-05	.379E-05	.177E-05	.105E-05	.503E-06	.149E-06	.384E-07
60	.141E-03	.754E-04	.372E-04	.154E-04	.875E-05	.413E-05	.245E-05	.118E-05	.350E-06	.910E-07
70	.290E-03	.158E-03	.795E-04	.334E-04	.192E-04	.912E-05	.544E-05	.263E-05	.784E-06	.205E-06
80	.569E-03	.316E-03	.162E-03	.691E-04	.400E-04	.192E-04	.115E-04	.559E-05	.168E-05	.439E-06
90	.107E-02	.606E-03	.315E-03	.137E-03	.801E-04	.388E-04	.234E-04	.114E-04	.343E-05	.903E-06
100	.194E-02	.112E-02	.590E-03	.261E-03	.154E-03	.752E-04	.455E-04	.223E-04	.674E-05	.178E-05
110	.338E-02	.198E-02	.107E-02	.479E-03	.285E-03	.141E-03	.855E-04	.420E-04	.128E-04	.339E-05
120	.571E-02	.341E-02	.186E-02	.851E-03	.511E-03	.254E-03	.155E-03	.766E-04	.233E-04	.623E-05
130	.938E-02	.569E-02	.315E-02	.146E-02	.886E-03	.445E-03	.278E-03	.135E-03	.414E-04	.111E-04
140	.150E-01	.923E-02	.519E-02	.245E-02	.149E-02	.757E-03	.467E-03	.232E-03	.711E-04	.191E-04
150	.233E-01	.146E-01	.832E-02	.399E-02	.245E-02	.125E-02	.776E-03	.387E-03	.119E-03	.321E-04
160	.354E-01	.225E-01	.130E-01	.633E-02	.393E-02	.202E-02	.126E-02	.629E-03	.194E-03	.526E-04
170	.526E-01	.340E-01	.199E-01	.983E-02	.614E-02	.319E-02	.199E-02	.999E-03	.309E-03	.840E-04
180	.766E-01	.502E-01	.298E-01	.149E-01	.941E-02	.492E-02	.309E-02	.155E-02	.482E-03	.131E-03
190	.110	.729E-01	.438E-01	.222E-01	.141E-01	.744E-02	.469E-02	.236E-02	.735E-03	.201E-03
200	.154	.104	.631E-01	.325E-01	.208E-01	.110E-01	.698E-02	.352E-02	.110E-02	.300E-03
210	.213	.146	.894E-01	.467E-01	.300E-01	.161E-01	.102E-01	.516E-02	.161E-02	.442E-03
220	.290	.201	.125	.660E-01	.427E-01	.230E-01	.147E-01	.743E-02	.232E-02	.638E-03
230	.389	.273	.171	.918E-01	.598E-01	.325E-01	.208E-01	.105E-01	.329E-02	.906E-03
240	.514	.366	.232	.126	.825E-01	.451E-01	.290E-01	.147E-01	.460E-02	.127E-02
250	.673	.485	.310	.170	.112	.618E-01	.398E-01	.202E-01	.633E-02	.174E-02
260	.870	.635	.409	.227	.151	.835E-01	.540E-01	.274E-01	.858E-02	.237E-02
270	1.112	.822	.534	.300	.200	.111	.723E-01	.366E-01	.115E-01	.317E-02
280	1.407	1.052	.689	.391	.263	.147	.957E-01	.485E-01	.152E-01	.420E-02
290	1.763	1.335	.880	.505	.341	.192	.125	.634E-01	.199E-01	.548E-02
300	2.190	1.676	1.112	.646	.437	.248	.162	.820E-01	.257E-01	.708E-02
310	2.696	2.088	1.394	.817	.556	.316	.208	.105	.328E-01	.905E-02
320	3.292	2.578	1.732	1.025	.701	.400	.264	.133	.415E-01	.114E-01
330	3.990	3.159	2.133	1.274	.875	.502	.331	.167	.520E-01	.143E-01
340	4.801	3.843	2.608	1.571	1.083	.624	.413	.208	.646E-01	.178E-01
350	5.738	4.641	3.164	1.922	1.331	.770	.511	.256	.795E-01	.218E-01

TABLE 2-13 Sulfur Trioxide Partial Pressure, bar, over Aqueous Sulfuric Acid Solutions*
 Weight percent, H₂SO₄

°C	10.0	20.0	30.0	40.0	50.0	60.0	70.0	75.0	80.0	85.0
0	.644E-29	.103E-27	.205E-26	.688E-25	.368E-23	.341E-21	.784E-19	.174E-17	.531E-16	.229E-14
10	.149E-27	.223E-26	.395E-25	.113E-23	.522E-22	.415E-20	.796E-18	.158E-16	.417E-15	.141E-13
20	.278E-26	.394E-25	.626E-24	.156E-22	.621E-21	.426E-19	.685E-17	.121E-15	.280E-14	.767E-13
30	.426E-25	.577E-24	.832E-23	.181E-21	.630E-20	.376E-18	.509E-16	.808E-15	.164E-13	.371E-12
40	.549E-24	.714E-23	.941E-22	.181E-20	.555E-19	.288E-17	.331E-15	.473E-14	.851E-13	.162E-11
50	.602E-23	.757E-22	.921E-21	.158E-19	.429E-18	.195E-16	.191E-14	.246E-13	.395E-12	.643E-11
60	.573E-22	.699E-21	.789E-20	.122E-18	.294E-17	.118E-15	.985E-14	.116E-12	.165E-11	.234E-10
70	.477E-21	.567E-20	.599E-19	.843E-18	.181E-16	.643E-15	.461E-13	.492E-12	.634E-11	.791E-10
80	.352E-20	.410E-19	.408E-18	.524E-17	.101E-15	.319E-14	.197E-12	.192E-11	.223E-10	.249E-09
90	.233E-19	.266E-18	.250E-17	.296E-16	.516E-15	.145E-13	.775E-12	.693E-11	.731E-10	.734E-09
100	.139E-18	.157E-17	.140E-16	.153E-15	.242E-14	.606E-13	.283E-11	.232E-10	.223E-09	.204E-08
110	.756E-18	.844E-17	.719E-16	.730E-15	.105E-13	.236E-12	.961E-11	.729E-10	.641E-09	.538E-08
120	.377E-17	.418E-16	.340E-15	.323E-14	.424E-13	.858E-12	.307E-10	.215E-09	.174E-08	.135E-07
130	.174E-16	.191E-15	.150E-14	.133E-13	.160E-12	.293E-11	.922E-10	.601E-09	.446E-08	.324E-07
140	.743E-16	.815E-15	.615E-14	.517E-13	.569E-12	.943E-11	.262E-09	.159E-08	.109E-07	.745E-07
150	.297E-15	.325E-14	.237E-13	.188E-12	.191E-11	.287E-10	.710E-09	.403E-08	.256E-07	.165E-06
160	.111E-14	.122E-13	.862E-13	.649E-12	.608E-11	.833E-10	.183E-08	.974E-08	.575E-07	.351E-06
170	.393E-14	.430E-13	.296E-12	.212E-11	.184E-10	.231E-09	.453E-08	.226E-07	.125E-06	.725E-06
180	.131E-13	.144E-12	.967E-12	.622E-11	.532E-10	.610E-09	.107E-07	.505E-07	.260E-06	.145E-05
190	.415E-13	.458E-12	.301E-11	.197E-10	.147E-09	.155E-08	.246E-07	.109E-06	.527E-06	.282E-05
200	.125E-12	.139E-11	.893E-11	.561E-10	.391E-09	.379E-08	.542E-07	.228E-06	.103E-05	.534E-05
210	.362E-12	.404E-11	.254E-10	.154E-09	.100E-08	.894E-08	.116E-06	.462E-06	.198E-05	.986E-05
220	.100E-11	.112E-10	.695E-10	.405E-09	.246E-08	.204E-07	.240E-06	.911E-06	.368E-05	.178E-04
230	.265E-11	.301E-10	.183E-09	.103E-08	.587E-08	.450E-07	.482E-06	.175E-05	.668E-05	.314E-04
240	.678E-11	.777E-10	.465E-09	.253E-08	.135E-07	.965E-07	.944E-06	.328E-05	.119E-04	.543E-04
250	.167E-10	.193E-09	.114E-08	.602E-08	.303E-07	.201E-06	.180E-05	.600E-05	.206E-04	.923E-04
260	.399E-10	.466E-09	.272E-08	.139E-07	.660E-07	.408E-06	.336E-05	.108E-04	.352E-04	.154E-03
270	.920E-10	.109E-08	.628E-08	.312E-07	.140E-06	.807E-06	.612E-05	.189E-04	.590E-04	.253E-03
280	.206E-09	.247E-08	.141E-07	.683E-07	.288E-06	.156E-05	.109E-04	.326E-04	.973E-04	.408E-03
290	.449E-09	.545E-08	.308E-07	.145E-06	.580E-06	.295E-05	.191E-04	.553E-04	.158E-03	.649E-03
300	.953E-09	.117E-07	.657E-07	.302E-06	.114E-05	.546E-05	.329E-04	.921E-04	.253E-03	.102E-02
310	.197E-08	.245E-07	.136E-06	.614E-06	.220E-05	.990E-05	.556E-04	.151E-03	.398E-03	.158E-02
320	.397E-08	.502E-07	.277E-06	.122E-05	.414E-05	.176E-04	.923E-04	.245E-03	.621E-03	.242E-02
330	.782E-08	.100E-06	.551E-06	.237E-05	.766E-05	.308E-04	.151E-03	.391E-03	.956E-03	.367E-02
340	.151E-07	.196E-06	.107E-05	.452E-05	.139E-04	.529E-04	.243E-03	.617E-03	.145E-02	.550E-02
350	.285E-07	.376E-06	.204E-05	.846E-05	.246E-04	.893E-04	.387E-03	.963E-03	.219E-02	.815E-02

*Vermeulen, Dong, Robinson, Nguyen, and Gmitro, AIChE meeting, Anaheim, Calif., 1982; and private communication from Prof. Theodore Vermeulen, Chemical Engineering Dept., University of California, Berkeley.

TABLE 2-13 Sulfur Trioxide Partial Pressure, bar, over Aqueous Sulfuric Acid Solutions (Concluded)
 Weight percent, H₂SO₄

°C	90.0	92.0	94.0	96.0	97.0	98.0	98.5	99.0	99.5	100.0
0	.671E-13	.216E-12	.677E-12	.240E-11	.500E-11	.124E-10	.224E-10	.502E-10	.182E-09	.755E-09
10	.345E-12	.107E-11	.326E-11	.114E-10	.234E-10	.578E-10	.104E-09	.232E-09	.839E-09	.347E-08
20	.159E-11	.475E-11	.141E-10	.482E-10	.986E-10	.241E-09	.433E-09	.961E-09	.346E-08	.142E-07
30	.664E-11	.192E-10	.557E-10	.186E-09	.376E-09	.911E-09	.163E-08	.360E-08	.129E-07	.528E-07
40	.254E-10	.709E-10	.201E-09	.655E-09	.131E-08	.315E-08	.562E-08	.123E-07	.440E-07	.179E-06
50	.897E-10	.242E-09	.669E-09	.214E-08	.424E-08	.101E-07	.179E-07	.391E-07	.139E-06	.560E-06
60	.294E-09	.771E-09	.207E-08	.647E-08	.127E-07	.299E-07	.528E-07	.115E-06	.405E-06	.163E-05
70	.904E-09	.230E-08	.602E-08	.184E-07	.357E-07	.833E-07	.146E-06	.316E-06	.111E-05	.444E-05
80	.261E-08	.643E-08	.165E-07	.492E-07	.946E-07	.218E-06	.381E-06	.820E-06	.286E-05	.114E-04
90	.712E-08	.171E-07	.426E-07	.124E-06	.237E-06	.541E-06	.940E-06	.201E-05	.698E-05	.276E-04
100	.184E-07	.430E-07	.105E-06	.300E-06	.565E-06	.127E-05	.220E-05	.470E-05	.162E-04	.638E-04
110	.456E-07	.103E-06	.247E-06	.689E-06	.128E-05	.287E-05	.494E-05	.105E-04	.359E-04	.141E-03
120	.108E-06	.238E-06	.555E-06	.152E-05	.280E-05	.619E-05	.106E-04	.224E-04	.764E-04	.298E-03
130	.244E-06	.526E-06	.120E-05	.321E-05	.586E-05	.128E-04	.219E-04	.459E-04	.156E-03	.606E-03
140	.533E-06	.112E-05	.250E-05	.656E-05	.118E-04	.257E-04	.435E-04	.910E-04	.308E-03	.119E-02
150	.112E-05	.230E-05	.504E-05	.129E-04	.231E-04	.497E-04	.837E-04	.174E-03	.588E-03	.226E-02
160	.229E-05	.459E-05	.983E-05	.247E-04	.438E-04	.932E-04	.156E-03	.324E-03	.109E-02	.416E-02
170	.453E-05	.886E-05	.186E-04	.459E-04	.806E-04	.170E-03	.283E-03	.586E-03	.196E-02	.746E-02
180	.870E-05	.166E-04	.343E-04	.829E-04	.144E-03	.301E-03	.499E-03	.103E-02	.343E-02	.130E-01
190	.163E-04	.304E-04	.615E-04	.146E-03	.252E-03	.520E-03	.859E-03	.177E-02	.587E-02	.222E-01
200	.297E-04	.543E-04	.108E-03	.251E-03	.429E-03	.878E-03	.144E-02	.296E-02	.981E-02	.370E-01
210	.528E-04	.946E-04	.185E-03	.422E-03	.714E-03	.145E-02	.237E-02	.486E-02	.161E-01	.603E-01
220	.919E-04	.161E-03	.309E-03	.694E-03	.117E-02	.235E-02	.383E-02	.781E-02	.258E-01	.965E-01
230	.157E-03	.269E-03	.508E-03	.112E-02	.187E-02	.373E-02	.605E-02	.123E-01	.405E-01	.152
240	.261E-03	.441E-03	.819E-03	.178E-02	.293E-02	.582E-02	.939E-02	.191E-01	.627E-01	.234
250	.428E-03	.708E-03	.130E-02	.276E-02	.453E-02	.891E-02	.143E-01	.291E-01	.955E-01	.356
260	.690E-03	.112E-02	.202E-02	.423E-02	.688E-02	.134E-01	.215E-01	.437E-01	.143	.532
270	.109E-02	.174E-02	.309E-02	.638E-02	.103E-01	.200E-01	.319E-01	.646E-01	.212	.786
280	.170E-02	.266E-02	.466E-02	.948E-02	.152E-01	.293E-01	.465E-01	.943E-01	.309	1.144
290	.261E-02	.401E-02	.694E-02	.139E-01	.221E-01	.423E-01	.670E-01	.136	.444	1.646
300	.395E-02	.595E-02	.102E-01	.201E-01	.318E-01	.604E-01	.953E-01	.193	.632	2.339
310	.589E-02	.873E-02	.148E-01	.287E-01	.451E-01	.852E-01	.134	.272	.889	3.289
320	.868E-02	.126E-01	.211E-01	.405E-01	.632E-01	.119	.186	.378	1.236	4.575
330	.126E-01	.181E-01	.299E-01	.565E-01	.877E-01	.164	.256	.520	1.703	6.303
340	.181E-01	.255E-01	.418E-01	.780E-01	.120	.224	.348	.708	2.323	8.603
350	.258E-01	.357E-01	.578E-01	.107	.164	.303	.470	.956	3.142	11.640

TABLE 2-14 Sulfuric Acid Partial Pressure, bar, over Aqueous Sulfuric Acid*

°C	Weight Percent, H ₂ SO ₄									
	10.0	20.0	30.0	40.0	50.0	60.0	70.0	75.0	80.0	85.0
0	.576E-21	.843E-20	.141E-18	.344E-17	.109E-15	.438E-14	.249E-12	.200E-11	.161E-10	.121E-09
10	.634E-20	.874E-19	.131E-17	.276E-16	.769E-15	.273E-13	.135E-11	.101E-10	.743E-10	.490E-09
20	.588E-19	.769E-18	.104E-16	.193E-15	.474E-14	.149E-12	.649E-11	.447E-10	.305E-09	.179E-08
30	.468E-18	.584E-17	.721E-16	.119E-14	.259E-13	.725E-12	.278E-10	.178E-09	.113E-08	.594E-08
40	.324E-17	.389E-16	.441E-15	.649E-14	.127E-12	.317E-11	.108E-09	.643E-09	.379E-08	.181E-07
50	.197E-16	.229E-15	.241E-14	.320E-13	.562E-12	.126E-10	.380E-09	.212E-08	.117E-07	.513E-07
60	.107E-15	.121E-14	.119E-13	.144E-12	.228E-11	.462E-10	.124E-08	.646E-08	.334E-07	.135E-06
70	.526E-15	.581E-14	.535E-13	.592E-12	.851E-11	.156E-09	.373E-08	.183E-07	.888E-07	.336E-06
80	.235E-14	.254E-13	.221E-12	.225E-11	.295E-10	.492E-09	.105E-07	.485E-07	.222E-06	.786E-06
90	.960E-14	.102E-12	.844E-12	.798E-11	.956E-10	.145E-08	.279E-07	.121E-06	.522E-06	.175E-05
100	.353E-13	.381E-12	.300E-11	.264E-10	.291E-09	.402E-08	.698E-07	.287E-06	.117E-05	.371E-05
110	.127E-12	.132E-11	.997E-11	.824E-10	.835E-09	.106E-07	.166E-06	.644E-06	.249E-05	.752E-05
120	.418E-12	.432E-11	.312E-10	.243E-09	.227E-08	.264E-07	.375E-06	.138E-05	.508E-05	.147E-04
130	.129E-11	.132E-10	.924E-10	.678E-09	.589E-08	.631E-07	.814E-06	.285E-05	.995E-05	.277E-04
140	.375E-11	.385E-10	.259E-09	.181E-08	.146E-07	.144E-06	.169E-05	.565E-05	.188E-04	.503E-04
150	.103E-10	.106E-09	.694E-09	.460E-08	.346E-07	.316E-06	.340E-05	.108E-04	.343E-04	.889E-04
160	.272E-10	.279E-09	.178E-08	.112E-07	.789E-07	.670E-06	.659E-05	.200E-04	.608E-04	.152E-03
170	.682E-10	.702E-09	.436E-08	.264E-07	.174E-06	.137E-05	.124E-04	.359E-04	.104E-03	.255E-03
180	.164E-09	.170E-08	.103E-07	.599E-07	.369E-06	.271E-05	.225E-04	.627E-04	.175E-03	.416E-03
190	.378E-09	.394E-08	.234E-07	.131E-06	.760E-06	.521E-05	.400E-04	.107E-03	.286E-03	.663E-03
200	.842E-09	.883E-08	.514E-07	.278E-06	.152E-05	.975E-05	.691E-04	.177E-03	.457E-03	.104E-02
210	.181E-08	.191E-07	.109E-06	.573E-06	.295E-05	.178E-04	.117E-03	.288E-03	.715E-03	.159E-02
220	.376E-08	.401E-07	.226E-06	.115E-05	.559E-05	.316E-04	.193E-03	.459E-03	.110E-02	.239E-02
230	.758E-08	.817E-07	.455E-06	.224E-05	.103E-04	.549E-04	.311E-03	.717E-03	.166E-02	.354E-02
240	.148E-07	.162E-06	.889E-06	.427E-05	.186E-04	.935E-04	.494E-03	.110E-02	.245E-02	.515E-02
250	.283E-07	.312E-06	.170E-05	.793E-05	.329E-04	.156E-03	.770E-03	.166E-02	.358E-02	.740E-02
260	.526E-07	.588E-06	.317E-05	.144E-04	.569E-04	.255E-03	.118E-02	.247E-02	.516E-02	.105E-01
270	.954E-07	.108E-05	.566E-05	.257E-04	.965E-04	.411E-03	.178E-02	.362E-02	.733E-02	.147E-01
280	.169E-06	.194E-05	.103E-04	.450E-04	.161E-03	.650E-03	.265E-02	.524E-02	.103E-01	.203E-01
290	.294E-06	.342E-05	.180E-04	.771E-04	.263E-03	.101E-02	.389E-02	.750E-02	.143E-01	.278E-01
300	.500E-06	.591E-05	.309E-04	.130E-03	.424E-03	.156E-02	.563E-02	.106E-01	.196E-01	.376E-01
310	.834E-06	.100E-04	.522E-04	.215E-03	.672E-03	.236E-02	.805E-02	.148E-01	.266E-01	.504E-01
320	.137E-05	.167E-04	.865E-04	.352E-03	.105E-02	.352E-02	.114E-01	.205E-01	.359E-01	.670E-01
330	.220E-05	.273E-04	.141E-03	.565E-03	.162E-02	.519E-02	.159E-01	.281E-01	.480E-01	.883E-01
340	.349E-05	.440E-04	.227E-03	.895E-03	.246E-02	.757E-02	.221E-01	.382E-01	.636E-01	.116
350	.544E-05	.698E-04	.360E-03	.140E-02	.369E-02	.109E-01	.303E-01	.516E-01	.836E-01	.150
°C	Weight percent, H ₂ SO ₄									
	90.0	92.0	94.0	96.0	97.0	98.0	98.5	99.0	99.5	100.0
0	.534E-09	.803E-09	.112E-08	.148E-08	.167E-08	.187E-08	.196E-08	.206E-08	.217E-08	.228E-08
10	.200E-08	.296E-08	.409E-08	.540E-08	.609E-08	.679E-08	.714E-08	.750E-08	.788E-08	.827E-08
20	.677E-08	.993E-08	.136E-07	.179E-07	.201E-07	.224E-07	.236E-07	.247E-07	.260E-07	.273E-07
30	.211E-07	.306E-07	.415E-07	.543E-07	.611E-07	.680E-07	.714E-07	.749E-07	.786E-07	.824E-07
40	.607E-07	.870E-07	.117E-06	.153E-06	.171E-06	.191E-06	.200E-06	.210E-06	.220E-06	.230E-06
50	.163E-06	.231E-06	.309E-06	.400E-06	.449E-06	.498E-06	.523E-06	.548E-06	.574E-06	.600E-06
60	.411E-06	.575E-06	.765E-06	.985E-06	.110E-05	.122E-05	.128E-05	.134E-05	.140E-05	.147E-05
70	.976E-06	.135E-05	.179E-05	.229E-05	.256E-05	.283E-05	.297E-05	.310E-05	.325E-05	.339E-05
80	.220E-05	.302E-05	.396E-05	.504E-05	.562E-05	.622E-05	.652E-05	.681E-05	.712E-05	.743E-05
90	.473E-05	.642E-05	.835E-05	.106E-04	.118E-04	.130E-04	.136E-04	.143E-04	.149E-04	.155E-04
100	.973E-05	.131E-04	.169E-04	.213E-04	.237E-04	.261E-04	.274E-04	.285E-04	.298E-04	.310E-04
110	.192E-04	.256E-04	.328E-04	.412E-04	.457E-04	.503E-04	.527E-04	.549E-04	.572E-04	.595E-04
120	.366E-04	.482E-04	.614E-04	.767E-04	.849E-04	.935E-04	.977E-04	.102E-03	.106E-03	.110E-03
130	.672E-04	.879E-04	.111E-03	.138E-03	.153E-03	.168E-03	.175E-03	.182E-03	.190E-03	.197E-03
140	.120E-03	.155E-03	.195E-03	.241E-03	.266E-03	.292E-03	.304E-03	.316E-03	.329E-03	.341E-03
150	.207E-03	.266E-03	.332E-03	.408E-03	.449E-03	.493E-03	.514E-03	.534E-03	.554E-03	.574E-03
160	.348E-03	.444E-03	.550E-03	.673E-03	.740E-03	.810E-03	.844E-03	.876E-03	.909E-03	.941E-03
170	.572E-03	.723E-03	.889E-03	.108E-02	.119E-02	.130E-02	.135E-02	.140E-02	.145E-02	.150E-02
180	.917E-03	.115E-02	.140E-02	.170E-02	.186E-02	.204E-02	.212E-02	.220E-02	.227E-02	.235E-02
190	.144E-02	.179E-02	.217E-02	.262E-02	.286E-02	.312E-02	.325E-02	.336E-02	.348E-02	.359E-02
200	.221E-02	.273E-02	.329E-02	.395E-02	.431E-02	.470E-02	.488E-02	.505E-02	.522E-02	.538E-02
210	.333E-02	.408E-02	.490E-02	.585E-02	.637E-02	.693E-02	.720E-02	.744E-02	.768E-02	.791E-02
220	.494E-02	.601E-02	.715E-02	.850E-02	.924E-02	.100E-01	.104E-01	.108E-01	.111E-01	.114E-01
230	.719E-02	.869E-02	.103E-01	.122E-01	.132E-01	.143E-01	.149E-01	.153E-01	.158E-01	.162E-01
240	.103E-01	.124E-01	.146E-01	.171E-01	.186E-01	.201E-01	.209E-01	.215E-01	.221E-01	.227E-01
250	.146E-01	.174E-01	.203E-01	.238E-01	.257E-01	.278E-01	.289E-01	.297E-01	.305E-01	.314E-01
260	.203E-01	.240E-01	.279E-01	.326E-01	.352E-01	.380E-01	.394E-01	.405E-01	.416E-01	.427E-01
270	.279E-01	.329E-01	.380E-01	.441E-01	.475E-01	.513E-01	.531E-01	.545E-01	.560E-01	.574E-01
280	.380E-01	.444E-01	.510E-01	.589E-01	.633E-01	.683E-01	.706E-01	.725E-01	.744E-01	.762E-01
290	.510E-01	.592E-01	.676E-01	.778E-01	.835E-01	.900E-01	.930E-01	.954E-01	.978E-01	.100
300	.678E-01	.782E-01	.888E-01	.102	.109	.117	.121	.124	.127	.130
310	.892E-01	.102	.115	.132	.141	.151	.156	.160	.164	.167
320	.116	.132	.149	.169	.180	.193	.199	.204	.209	.213
330	.150	.170	.190	.214	.228	.245	.252	.258	.263	.269
340	.192	.216	.240	.270	.287	.307	.317	.328	.330	.386
350	.243	.272	.301	.337	.358	.383	.394	.402	.410	.417

*Vermeulen, Dong, Robinson, Nguyen, and Gmitro, AIChE meeting, Anaheim, CA, 1982; and private communication from Prof. Theodore Vermeulen, Chemical Engineering Dept., University of California, Berkeley.

TABLE 2-15 Total Pressure, bar, of Aqueous Sulfuric Acid Solutions*

°C	Weight percent, H ₂ SO ₄									
	10.0	20.0	30.0	40.0	50.0	60.0	70.0	75.0	80.0	85.0
0	.582E-02	.534E-02	.448E-02	.326E-02	.193E-02	.836E-03	.207E-03	.747E-04	.197E-04	.343E-05
10	.117E-01	.107E-01	.909E-02	.670E-02	.405E-02	.180E-02	.467E-03	.175E-03	.490E-04	.952E-05
20	.223E-01	.205E-01	.174E-01	.130E-01	.802E-02	.367E-02	.995E-03	.388E-03	.115E-03	.245E-04
30	.404E-01	.373E-01	.319E-01	.241E-01	.151E-01	.710E-02	.201E-02	.811E-03	.253E-03	.589E-04
40	.703E-01	.649E-01	.558E-01	.427E-01	.272E-01	.131E-01	.387E-02	.162E-02	.531E-03	.134E-03
50	.117	.109	.939E-01	.725E-01	.470E-01	.232E-01	.715E-02	.309E-02	.106E-02	.286E-03
60	.189	.175	.152	.119	.782E-01	.395E-01	.127E-01	.565E-02	.204E-02	.584E-03
70	.296	.275	.239	.188	.126	.651E-01	.217E-01	.997E-01	.376E-02	.114E-02
80	.449	.417	.365	.290	.196	.104	.360E-01	.170E-01	.668E-02	.213E-02
90	.664	.617	.542	.434	.298	.161	.578E-01	.281E-01	.115E-01	.383E-02
100	.957	.891	.786	.634	.441	.244	.905E-01	.452E-01	.192E-01	.666E-02
110	1.349	1.258	1.113	.904	.638	.360	.138	.708E-01	.312E-01	.112E-01
120	1.863	1.740	1.544	1.264	.903	.519	.206	.108	.493E-01	.183E-01
130	2.524	2.361	2.101	1.732	1.253	.734	.301	.162	.760E-01	.291E-01
140	3.361	3.149	2.810	2.333	1.708	1.020	.431	.236	.115	.451E-01
150	4.404	4.132	3.697	3.090	2.289	1.392	.605	.339	.170	.683E-01
160	5.685	5.342	4.793	4.031	3.021	1.870	.837	.478	.246	.101
170	7.236	6.810	6.127	5.185	3.930	2.475	1.138	.662	.350	.147
180	9.093	8.571	7.731	6.584	5.045	3.233	1.525	.902	.489	.209
190	11.289	10.658	9.640	8.259	6.397	4.169	2.017	1.212	.673	.292
200	13.861	13.107	11.887	10.245	8.020	5.312	2.633	1.606	.913	.402
210	16.841	15.951	14.505	12.576	9.948	6.696	3.396	2.101	1.221	.544
220	20.264	19.225	17.529	15.287	12.217	8.354	4.331	2.715	1.610	.726
230	24.160	22.960	20.992	18.414	14.864	10.322	5.466	3.468	2.098	.956
240	28.561	27.188	24.927	21.992	17.929	12.641	6.832	4.382	2.701	1.242
250	33.494	31.939	29.364	26.056	21.452	15.351	8.459	5.481	3.439	1.594
260	38.984	37.240	34.334	30.642	25.472	18.496	10.384	6.791	4.332	2.023
270	45.055	43.116	39.865	35.784	30.030	22.122	12.642	8.337	5.402	2.540
280	51.726	49.590	45.984	41.514	35.168	26.275	15.272	10.147	6.673	3.157
290	59.015	56.681	52.715	47.866	40.926	31.004	18.315	12.250	8.170	3.886
300	66.934	64.407	60.081	54.869	47.347	36.361	21.814	14.675	9.916	4.740
310	75.495	72.781	68.101	62.553	54.470	42.398	25.812	17.453	11.939	5.732
320	84.705	81.816	76.792	70.947	62.338	49.168	30.355	20.611	14.264	6.876
330	94.567	91.518	86.172	80.078	70.990	56.727	35.489	24.182	16.916	8.185
340	105.083	101.894	96.252	89.970	80.466	65.130	41.262	28.193	19.920	9.672
350	116.251	112.947	107.043	100.647	90.806	74.437	47.723	32.674	23.303	11.351
°C	Weight percent, H ₂ SO ₄									
	90.0	92.0	94.0	96.0	97.0	98.0	98.5	99.0	99.5	100.0
0	.518E-06	.243E-06	.109E-06	.416E-07	.235E-07	.117E-07	.768E-08	.479E-08	.313E-08	.323E-08
10	.159E-05	.765E-06	.348E-06	.136E-06	.774E-07	.391E-07	.261E-07	.166E-07	.113E-07	.124E-07
20	.449E-05	.221E-05	.102E-05	.407E-06	.235E-06	.121E-06	.812E-07	.528E-07	.373E-07	.435E-07
30	.117E-04	.590E-05	.279E-05	.113E-05	.659E-06	.344E-06	.234E-06	.155E-06	.114E-06	.141E-06
40	.385E-04	.147E-04	.708E-05	.293E-05	.173E-05	.914E-06	.630E-06	.425E-06	.323E-06	.425E-06
50	.653E-04	.344E-04	.169E-04	.712E-05	.425E-05	.228E-05	.159E-05	.109E-05	.861E-06	.120E-05
60	.141E-03	.759E-04	.380E-04	.164E-04	.987E-05	.538E-05	.379E-05	.264E-05	.216E-05	.319E-05
70	.291E-03	.159E-03	.813E-04	.357E-04	.218E-04	.120E-04	.856E-05	.605E-05	.514E-05	.804E-05
80	.571E-03	.319E-03	.166E-03	.742E-04	.458E-04	.257E-04	.184E-04	.132E-04	.117E-04	.193E-04
90	.107E-02	.612E-03	.324E-03	.148E-03	.921E-04	.524E-04	.390E-04	.277E-04	.253E-04	.441E-04
100	.195E-02	.113E-02	.607E-03	.283E-03	.178E-03	.103E-03	.751E-04	.555E-04	.527E-04	.966E-04
110	.340E-02	.201E-02	.110E-02	.521E-03	.332E-03	.194E-03	.143E-03	.107E-03	.106E-03	.204E-03
120	.575E-02	.346E-02	.192E-02	.929E-03	.598E-03	.354E-03	.263E-03	.201E-03	.206E-03	.414E-03
130	.944E-02	.578E-02	.327E-02	.161E-02	.104E-02	.626E-03	.470E-03	.363E-03	.387E-03	.314E-03
140	.151E-01	.939E-02	.539E-02	.270E-02	.177E-02	.107E-02	.815E-03	.639E-03	.708E-03	.155E-02
150	.235E-01	.149E-01	.866E-02	.441E-02	.293E-02	.180E-02	.137E-02	.109E-02	.126E-02	.287E-02
160	.357E-01	.230E-01	.136E-01	.703E-02	.471E-02	.293E-02	.226E-02	.183E-02	.219E-02	.516E-02
170	.532E-01	.347E-01	.208E-01	.110E-01	.741E-02	.466E-02	.363E-02	.299E-02	.372E-02	.905E-02
180	.775E-01	.514E-01	.312E-01	.167E-01	.114E-01	.726E-02	.571E-02	.478E-02	.619E-02	.155E-01
190	.111	.747E-01	.460E-01	.250E-01	.172E-01	.111E-01	.880E-02	.749E-02	.101E-01	.260E-01
200	.156	.107	.665E-01	.367E-01	.255E-01	.166E-01	.133E-01	.115E-01	.161E-01	.427E-01
210	.216	.150	.944E-01	.530E-01	.371E-01	.245E-01	.198E-01	.175E-01	.253E-01	.687E-01
220	.295	.207	.132	.752E-01	.531E-01	.354E-01	.289E-01	.260E-01	.392E-01	.109
230	.396	.282	.182	.105	.749E-01	.505E-01	.417E-01	.382E-01	.596E-01	.169
240	.525	.379	.247	.145	.104	.710E-01	.592E-01	.553E-01	.895E-01	.258
250	.688	.503	.331	.197	.143	.985E-01	.830E-01	.790E-01	.132	.389
260	.881	.660	.439	.264	.193	.135	.115	.112	.193	.577
270	1.141	.856	.575	.351	.258	.153	.157	.156	.279	.846
280	1.447	1.099	.744	.460	.341	.245	.213	.215	.398	1.225
290	1.817	1.398	.954	.597	.446	.324	.285	.295	.562	1.751
300	2.261	1.761	1.211	.767	.578	.425	.379	.399	.785	2.476
310	2.791	2.199	1.524	.977	.742	.553	.498	.536	1.085	3.465
320	3.417	2.723	1.901	1.234	.944	.713	.649	.714	1.486	4.800
330	4.153	3.347	2.353	1.545	1.191	.911	.840	.944	2.018	6.586
340	5.011	4.084	2.889	1.919	1.491	1.156	1.078	1.239	2.718	8.957
350	6.006	4.949	3.523	2.366	1.852	1.456	1.374	1.614	3.631	12.079

*Vermeulen, Dong, Robinson, Nguyen, and Gmitro, AIChE meeting, Anaheim, Calif., 1982; and private communication from Prof. Theodore Vermeulen, Chemical Engineering Dept., University of California, Berkeley.

TABLE 2-16 Partial Pressures of HNO₃ and H₂O over Aqueous Solutions of HNO₃

°C	20%		25%		30%		35%		40%		45%		50%	
	HNO ₃	H ₂ O	HNO ₃	H ₂ O	HNO ₃	H ₂ O	HNO ₃	H ₂ O	HNO ₃	H ₂ O	HNO ₃	H ₂ O	HNO ₃	H ₂ O
0		4.1		3.8		3.6		3.3		3.0		2.6		2.1
5		5.7		5.4		5.0		4.6		4.2		3.6		3.0
10		8.0		7.6		7.1		6.5		5.8		5.0	0.12	4.2
15		10.9		10.3		9.7		8.9		8.0	0.10	6.9	.18	5.8
20		15.2		14.2		13.2		12.0		10.8	.15	9.4	.27	7.9
25		20.6		19.2		17.8		16.2	0.12	14.6	.23	12.7	.39	10.7
30		27.6		25.7		23.8	0.09	21.7	.17	19.5	.33	16.9	.56	14.4
35		36.5		33.8		31.1	.13	28.3	.25	25.5	.48	22.3	.80	19.0
40		47.5		44	0.11	41	.20	37.7	.36	33.5	.68	29.3	1.13	25.0
45		62	0.09	57.5	.17	53	.28	48	.52	43	.96	38.0	1.57	32.5
50		80	.13	75	.25	69	.42	63	.75	56	1.35	49.5	2.18	42.5
55	0.09	100	.18	94	.35	87	.59	79	1.04	71	1.83	62.5	2.95	54
60	.13	128	.28	121	.51	113	.85	102	1.48	90	2.54	80	4.05	70
65	.19	162	.40	151	.71	140	1.18	127	2.05	114	3.47	100	5.46	88
70	.27	200	.54	187	1.00	174	1.63	159	2.80	143	4.65	126	7.25	110
75	.38	250	.77	234	1.38	217	2.26	198	3.80	178	6.20	158	9.6	138
80	.53	307	1.05	287	1.87	267	3.07	243	5.10	218	8.15	195	12.5	170
85	.74	378	1.44	352	2.53	325	4.15	297	6.83	268	10.7	240	16.3	211
90	1.01	458	1.95	426	3.38	393	5.50	359	9.0	325	13.7	292	20.9	258
95	1.37	555	2.62	517	4.53	478	7.32	436	11.7	394	17.8	355	26.8	315
100	1.87	675	3.50	628	6.05	580	9.7	530	15.5	480	23.0	430	34.2	383
105	2.50	800	4.65	745	7.90	690	12.7	631	20.0	573	29.2	520	43.0	463
110							16.5	755	25.7	688	37.0	625	54.5	560
115									32.5	810	46	740	67	665
120													84	785

°C	55%		60%		65%		70%		80%		90%		100%
	HNO ₃	H ₂ O	HNO ₃	H ₂ O	HNO ₃	H ₂ O	HNO ₃	H ₂ O	HNO ₃	H ₂ O	HNO ₃	H ₂ O	HNO ₃
0		1.8	0.19	1.5	0.41	1.3	0.79	1.1	2		5.5		11
5	0.14	2.5	.28	2.1	.60	1.8	1.12	1.6	3		8		15
10	.21	3.5	.41	3.0	.86	2.6	1.58	2.2	4	1.2	11		22
15	.31	4.9	.59	4.1	1.21	3.5	2.18	3.0	6	1.7	15		30
20	.45	6.7	.84	5.6	1.68	4.9	3.00	4.1	8	2.4	20		42
25	.66	9.1	1.21	7.7	2.32	6.6	4.10	5.5	10.5	3.2	27	1	57
30	.93	12.2	1.66	10.3	3.17	8.8	5.50	7.4	14	4	36	1.3	77
35	1.30	16.1	2.28	13.6	4.26	11.6	7.30	9.8	18.5	5.5	47	1.8	102
40	1.82	21.3	3.10	18.1	5.70	15.5	9.65	12.8	24.5	7	62	2.4	133
45	2.50	28.0	4.20	23.7	7.55	20.0	12.6	16.7	32	9.5	80	3	170
50	3.41	36.3	5.68	31	10.0	26.0	16.5	21.8	41	12	103	4	215
55	4.54	46	7.45	39	12.8	33.0	21.0	27.3	52	15	127	5	262
60	6.15	60	9.9	51	16.8	43.0	27.1	35.3	67	20	157	6.5	320
65	8.18	76	13.0	64	21.7	54.5	34.5	44.5	85	25	192	8	385
70	10.7	95	16.8	81	27.5	68	43.3	56	106	31	232	10	460
75	13.9	120	21.8	102	35.0	86	54.5	70	130	38	282	13	540
80	18.0	148	27.5	126	43.5	106	67.5	86	158	48	338	16	625
85	23.0	182	34.8	156	54.5	131	83	107	192	60	405	20	720
90	29.4	223	43.7	192	67.5	160	103	130	230	73	480	24	820
95	37.3	272	55.0	233	83.5	195	125	158	278	89	570	29	
100	47	331	69.5	285	103	238	152	192	330	108	675	35	
105	58.5	400	84.5	345	124	288	183	231	392	129	790	42	
110	73	485	103	417	152	345	221	278	465	155			
115	90	575	126	495	181	410	262	330	545	185			
120	110	685	156	590	218	490	312	393	640	219			
125			187	700	260	580	372	469					

TABLE 2-17 Partial Pressures of H₂O and HBr over Aqueous Solutions of HBr at 20 to 55°C

		mmHg							
% HBr	20°C		25°C		50°C		55°C		
	HBr	H ₂ O	HBr	H ₂ O	HBr	H ₂ O	HBr	H ₂ O	
32			0.0016						
34			.0022						
36			.0033						
38			.0061						
40			.011						
42			.023						
44			.048						
46			.10						
48	0.09	6.2	.13	8.2	1.3	30.2	2.0	38	
50	.23	4.5	.37	6.1	3.2	24.3	4.6	31	
52	.71	3.3	1.1	4.5	7.2	19.3	10.2	25	
54	2.2	2.4	3.2	3.3	17	16.0	23.0	21	
56	6.8	1.7	9.3	2.4	40	13.3	51	18	
58	21	1.3	27	1.9	91	10.4	115	14	
60							260	11.4	

TABLE 2-18 Partial Pressures of HI over Aqueous Solutions of HI at 25°C

		mmHg					
% HI	4	46	48	50	52	54	56
p_{HI}	0.00064	0.0010	0.0022	0.0050	0.013	0.035	0.10

TABLE 2-19 Vapor Pressures of the System: Water-Sulfuric Acid-Nitric Acid

For these data reference must be made to the graphs of *International Critical Tables*, vol. 3, pp. 306-308.

TABLE 2-21 Partial Pressures of H₂O over Aqueous Solutions of NH₃*

Pressures are in pounds per square inch absolute

t_f °F	Molal concentration of ammonia in the solutions in percentages (Weight concentration of ammonia in the solution in percentages)																			
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
	(0)	(4.74)	(9.50)	(14.29)	(19.10)	(23.94)	(28.81)	(33.71)	(38.64)	(43.59)	(48.57)	(53.58)	(58.62)	(63.69)	(68.79)	(73.91)	(79.07)	(84.26)	(89.47)	(94.72)
32	0.09	0.084	0.079	0.074	0.070	0.065	0.060	0.056	0.051	0.047	0.042	0.038	0.034	0.030	0.025	0.021	0.017	0.013	0.008	0.004
40	.12	.115	.108	.101	.095	.089	.083	.076	.070	.064	.058	.052	.046	.040	.035	.029	.023	.015	.012	.006
50	.18	.17	.16	.15	.14	.13	.12	.11	.10	.094	.085	.076	.068	.059	.051	.042	.034	.025	.017	.008
60	.26	.24	.23	.21	.20	.19	.17	.16	.15	.13	.12	.11	.097	.085	.073	.061	.049	.037	.024	.012
70	.36	.34	.32	.30	.28	.26	.25	.23	.21	.19	.17	.15	.14	.12	.10	.086	.069	.052	.034	.017
80	.51	.48	.45	.42	.40	.37	.34	.32	.29	.27	.24	.22	.19	.17	.14	.12	.096	.072	.048	.024
90	.70	.66	.63	.58	.55	.51	.47	.44	.40	.37	.33	.30	.26	.23	.20	.16	.13	.10	.066	.033
100	.95	.90	.85	.79	.74	.69	.64	.59	.55	.50	.45	.41	.36	.31	.27	.22	.18	.13	.090	.045
110	1.27	1.20	1.14	1.07	1.00	.93	.86	.80	.73	.67	.60	.54	.48	.42	.36	.30	.24	.18	.120	.061
120	1.69	1.60	1.51	1.42	1.33	1.24	1.15	1.06	.97	.89	.80	.72	.64	.56	.48	.40	.32	.24	.160	.081
130	2.22	2.10	1.98	1.86	1.74	1.62	1.51	1.39	1.28	1.17	1.05	.95	.84	.74	.63	.53	.42	.32	.210	.100
140	2.89	2.73	2.57	2.42	2.26	2.11	1.96	1.81	1.66	1.52	1.37	1.23	1.10	.96	.82	.69	.55	.41	.270	.140
150	3.72	3.51	3.31	3.11	2.91	2.72	2.52	2.33	2.14	1.95	1.76	1.59	1.41	1.24	1.06	.88	.71	.53	.350	.180
160	4.74	4.48	4.22	3.97	3.71	3.46	3.22	2.97	2.73	2.49	2.25	2.02	1.80	1.58	1.35	1.12	.90	.67	.450	.220
170	5.99	5.66	5.34	5.02	4.70	4.38	4.07	3.75	3.45	3.15	2.84	2.56	2.28	1.99	1.71	1.42	1.13	1.85	.570	.300
180	7.51	7.10	6.69	6.30	5.89	5.49	5.10	4.71	4.33	3.94	3.57	3.21	2.85	2.50	2.14	1.77	1.42	1.06		
190	9.34	8.83	8.32	7.82	7.32	6.83	6.34	5.86	5.38	4.91	4.44	3.99	3.55	3.10	2.65					
200	11.53	10.90	10.27	9.65	9.04	8.43	7.83	7.23	6.64	6.06	5.48	4.93	4.38	3.81						
210	14.12	13.35	12.58	11.82	11.07	10.32	9.59	8.86	8.13	7.42	6.71	6.04	5.34							
220	17.19	16.25	15.32	14.39	13.48	12.57	11.67	10.78	9.90	9.03	8.17	7.31								
230	20.78	19.64	18.51	17.40	16.29	15.19	14.11	13.03	11.97	10.91	9.87									
240	24.97	23.60	22.25	20.91	19.58	18.26	16.95	15.66	14.38	13.12	11.86									
250	29.83	28.20	26.58	25.00	23.39	21.82	20.25	18.71	17.18	15.67										

*Wilson, *Univ. Ill., Eng. Expt. Sta. Bull.* 146.

TABLE 2-20 Total Vapor Pressures of Aqueous Solutions of CH₃COOH

		Percentages of weight % acetic acid in the solution		
		mmHg		
°C		25%	50%	75%
20		16.3	15.7	15.3
25		22.1	21.4	20.8
30		29.6	28.8	27.8
35		39.4	38.3	36.6
40		51.7	50.2	48.1
45		67.0	65.0	62.0
50		87.2	85.0	80.1
55		110	107	102
60		141	138	130
65		178	172	162
70		223	216	203
75		277	269	251
80		342	331	310
85		419	407	376
90		510	497	458
95		618	602	550
100		743	725	666

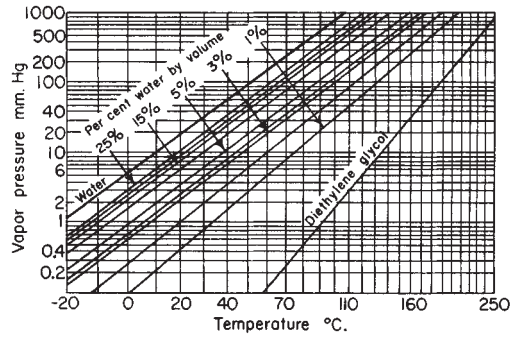


FIG. 2-3 Vapor pressure of aqueous diethylene glycol solutions. (Courtesy of Carbide and Carbon Chemicals Corp.)

TABLE 2-22 Mole Percentages of H₂O over Aqueous Solutions of NH₃*

<i>t</i> , °F	Molal concentration of ammonia in the solutions in percentages (Weight concentration of ammonia in the solutions in percentages)																				
	0 (0)	5 (4.74)	10 (9.50)	15 (14.29)	20 (19.10)	25 (23.94)	30 (28.81)	35 (33.71)	40 (38.64)	45 (43.59)	50 (48.57)	55 (53.58)	60 (58.62)	65 (63.69)	70 (68.79)	75 (73.91)	80 (79.07)	85 (84.26)	90 (89.47)	95 (94.72)	100 (100.00)
32	100	24.3	13.2	7.63	4.43	2.50	1.43	0.856	0.514	0.335	0.216	0.151	0.109	0.0816	0.0585	0.0457	0.0345	0.0249	0.0146	0.00689	0.00
40	100	25.3	14.1	8.15	4.73	2.74	1.59	.943	.581	.372	.248	.172	.124	.0914	.0706	.0533	.0395	.0243	.0185	.00879	
50	100	26.6	15.2	9.09	5.24	3.03	1.78	1.060	.652	.434	.290	.202	.148	.1095	.0838	.0630	.0477	.0332	.0215	.00959	
60	100	27.9	16.2	9.50	5.69	3.42	1.97	1.210	.777	.481	.331	.238	.172	.1290	.0986	.0754	.0566	.0406	.0251	.01125	
70	100	29.1	17.4	10.30	6.14	3.65	2.27	1.390	.873	.569	.383	.266	.205	.1510	.112	.0882	.0656	.0474	.0296	.0135	
80	100	31.6	18.5	11.20	6.89	4.08	2.45	1.550	.978	.659	.444	.323	.230	.1750	.130	.103	.0772	.0528	.0351	.0167	
90	100	32.7	20.0	12.00	7.40	4.47	2.73	1.730	1.100	.742	.505	.366	.267	.2020	.157	.115	.0884	.0647	.0408	.0194	
100	100	34.4	21.0	12.90	7.92	4.85	3.00	1.890	1.250	.834	.574	.420	.307	.2290	.179	.135	.104	.0714	.0473	.0226	
110	100	35.9	22.2	13.80	8.59	5.29	3.30	2.110	1.370	.932	.644	.466	.347	.2640	.208	.157	.118	.0846	.0540	.0262	
120	100	37.5	23.4	14.70	9.22	5.75	3.63	2.320	1.520	1.044	.714	.529	.395	.3020	.233	.180	.135	.0970	.0619	.0300	
130	100	39.0	24.5	15.60	9.85	6.18	3.95	2.550	1.690	1.160	.811	.596	.444	.3430	.263	.205	.154	.1117	.0703	.0339	
140	100	40.7	25.8	16.50	10.50	6.69	4.28	2.790	1.860	1.286	.906	.663	.501	.3840	.297	.232	.175	.124	.0786	.0385	
150	100	42.3	27.1	17.50	11.20	7.19	4.63	3.080	2.040	1.410	1.004	.741	.558	.4320	.334	.257	.197	.140	.0892	.0439	
160	100	44.1	28.3	18.40	11.90	7.69	5.01	3.300	2.230	1.550	1.110	.818	.617	.4800	.372	.287	.218	.154	.1005	.0499	
170	100	45.6	29.6	19.40	12.70	8.22	5.38	3.580	2.430	1.700	1.220	.904	.689	.5300	.414	.320	.242	.174	.112	.0567	
180	100	47.3	30.9	20.40	13.40	8.76	5.78	3.870	2.640	1.850	1.340	.994	.756	.5860	.456	.352	.268	.192			
190	100	48.7	32.2	21.40	14.10	9.31	6.18	4.160	2.860	2.020	1.460	1.087	.830	.6420	.501						
200	100	50.4	33.4	22.30	14.90	9.88	6.59	4.470	3.080	2.190	1.580	1.187	.907	.7010							
210	100	52.1	34.7	23.40	15.70	10.45	7.03	4.780	3.310	2.360	1.720	1.272	.983								
220	100	53.7	36.1	24.40	16.40	11.05	7.48	5.100	3.560	2.540	1.860	1.390									
230	100	55.2	37.3	25.40	17.30	11.63	7.91	5.440	3.810	2.730	2.000										
240	100	56.8	38.6	26.50	18.00	12.24	8.36	5.780	4.060	2.920	2.150										
250	100	58.4	39.8	27.50	18.80	12.88	8.82	6.120	4.340	3.120											

*Wilson, *Univ. Ill., Eng. Expt. Sta. Bull.* 146.

TABLE 2-23 Partial Pressures of NH₃ over Aqueous Solutions of NH₃*

Pressures are in pounds per square inch absolute

t, °F	Molal concentration of ammonia in the solutions in percentages (Weight concentration of ammonia in the solutions in percentages)																		
	5 (4.74)	10 (9.50)	15 (14.29)	20 (19.10)	25 (23.94)	30 (28.81)	35 (33.71)	40 (38.64)	45 (43.59)	50 (48.57)	55 (53.58)	60 (58.62)	65 (63.69)	70 (68.79)	75 (73.91)	80 (79.07)	85 (84.26)	90 (89.47)	95 (94.72)
32	0.26	0.52	0.90	1.51	2.67	4.27	6.54	8.93	14.13	19.36	25.12	31.13	36.74	42.69	45.92	49.26	52.13	54.89	58.01
40	.33	.66	1.14	1.92	3.16	5.13	7.98	11.98	17.14	23.33	30.15	37.15	43.69	49.56	54.40	58.31	61.62	64.77	68.31
50	.47	.89	1.50	2.53	4.16	6.63	10.24	15.24	21.56	29.17	37.46	45.86	53.79	60.82	66.63	71.26	75.22	79.05	83.40
60	.62	1.19	2.00	3.21	5.36	8.48	13.06	19.15	26.92	36.14	46.12	56.22	65.81	73.99	80.90	86.44	91.04	95.67	100.65
70	.83	1.52	2.60	4.28	6.87	10.76	16.33	23.84	33.20	44.25	56.29	68.32	79.42	89.26	97.42	104.01	109.55	114.83	120.61
80	1.04	1.98	3.34	5.45	8.69	13.52	20.29	29.40	40.69	53.84	67.97	82.36	95.52	107.06	116.42	124.20	130.57	136.35	143.70
90	1.36	2.52	4.25	6.88	10.89	16.76	25.04	35.94	49.45	64.99	81.61	98.35	113.79	127.22	138.18	147.02	154.46	161.74	169.73
100	1.72	3.20	5.34	8.60	13.53	20.68	30.57	43.57	59.49	77.85	97.27	116.81	134.70	150.23	162.94	173.22	181.97	190.13	199.17
110	2.14	4.00	6.65	10.64	16.65	25.21	37.01	52.43	71.20	92.59	115.16	137.62	158.42	176.18	190.85	203.02	212.71	222.22	232.79
120	2.67	4.95	8.21	13.09	20.30	30.54	44.56	62.62	84.44	109.40	135.48	161.44	185.14	205.81	222.28	236.05	247.14	258.24	270.02
130	3.28	6.09	10.05	15.93	24.58	36.74	53.16	74.27	99.69	128.45	158.45	188.16	215.14	238.70	257.87	272.88	286.08	298.46	311.80
140	3.97	7.41	12.21	19.23	29.43	43.77	62.97	87.53	116.72	149.93	184.17	218.18	248.70	275.33	297.12	314.45	328.99	342.93	358.46
150	4.78	8.92	14.70	23.09	35.09	51.91	74.28	102.51	136.15	173.64	212.91	251.24	286.00	316.24	340.82	360.39	376.57	392.45	409.62
160	5.68	10.70	17.57	27.45	41.56	61.03	86.91	119.37	157.71	200.45	244.98	288.38	327.82	361.75	389.08	411.30	429.73	447.35	466.38
170	6.75	12.67	20.85	32.41	48.89	71.48	101.09	138.30	181.95	230.36	280.54	329.42	373.61	411.59	442.28	466.67	487.85	507.63	528.50
180	7.90	14.96	24.56	38.13	57.19	83.07	116.97	159.37	208.66	263.43	319.89	374.25	424.10	466.26	500.63	528.08	551.24		
190	9.23	17.55	28.78	44.49	66.49	96.22	134.89	182.72	238.39	299.86	363.11	424.15	479.40	526.15					
200	10.70	20.45	33.49	51.58	76.90	110.85	154.58	208.56	270.94	340.02	410.17	478.62	539.79						
210	12.26	23.68	38.76	59.65	88.48	126.83	176.24	236.97	307.08	383.99	462.36	537.56							
220	14.02	27.15	44.61	68.43	101.24	144.74	200.46	268.30	346.07	431.43	518.19								
230	15.95	31.09	51.06	78.14	115.45	164.17	226.67	302.53	389.29	483.53									
240	17.92	35.40	58.00	89.02	130.94	185.79	255.26	339.72	435.78	540.44									
250	20.12	40.09	65.74	100.69	147.66	209.37	286.89	380.42	486.73										

*Wilson, *Univ. Ill., Eng. Expt. Sta. Bull.* 146.

TABLE 2-24 Total Vapor Pressures of Aqueous Solutions of NH₃*

Pressures are in pounds per square inch absolute

<i>t</i> , °F	Molal concentration of ammonia in the solutions in percentages (Weight concentration of ammonia in the solutions in percentages)																				
	0 (0)	5 (4.74)	10 (9.50)	15 (14.29)	20 (19.10)	25 (23.94)	30 (28.81)	35 (33.71)	40 (38.64)	45 (43.59)	50 (48.57)	55 (53.58)	60 (58.62)	65 (63.69)	70 (68.79)	75 (73.91)	80 (79.07)	85 (84.26)	90 (89.47)	95 (94.72)	100 (100.00)
32	0.09	0.34	0.60	0.97	1.58	2.60	4.20	6.54	9.93	14.18	19.40	25.16	31.16	36.77	42.72	45.94	49.28	52.14	54.90	58.01	62.29
40	.12	.45	.77	1.24	2.01	3.25	5.21	8.06	12.05	17.20	23.39	30.20	37.20	43.73	49.60	54.43	58.33	61.64	64.78	68.32	73.32
50	.18	.64	1.05	1.65	2.67	4.29	6.75	10.35	15.34	21.65	29.26	37.54	45.93	53.85	60.87	66.67	71.29	75.25	79.07	83.41	89.19
60	.26	.86	1.42	2.21	3.51	5.55	8.65	13.22	19.30	27.05	36.26	46.23	56.32	65.90	74.06	80.96	86.49	91.08	95.69	100.66	107.6
70	.36	1.17	1.84	2.90	4.56	7.13	11.01	16.56	24.05	33.39	44.42	56.44	68.46	79.54	89.36	97.51	104.08	109.60	114.86	120.63	128.8
80	.51	1.52	2.43	3.76	5.85	9.06	13.86	20.61	29.69	40.96	54.08	68.19	82.55	95.69	107.20	116.54	124.30	130.64	136.40	143.72	153.0
90	.70	2.02	3.15	4.83	7.43	11.40	17.23	25.48	36.34	49.82	65.32	81.91	98.61	114.02	127.42	138.34	147.15	154.56	161.81	169.76	180.6
100	.95	2.62	4.05	6.13	9.34	14.22	21.32	31.16	44.12	59.99	78.30	97.68	117.17	135.01	150.50	163.16	173.40	182.10	190.22	199.22	211.9
110	1.27	3.34	5.14	7.72	11.64	17.58	26.07	37.81	53.16	71.87	93.19	115.7	138.10	158.84	176.54	191.15	203.26	212.89	222.34	232.85	247.0
120	1.69	4.27	6.46	9.63	14.42	21.54	31.69	45.62	63.59	85.33	110.2	136.2	162.08	185.70	206.29	222.68	236.37	247.38	258.40	270.1	286.4
130	2.22	5.38	8.07	11.91	17.67	26.20	38.25	54.55	75.55	100.86	129.5	159.0	189.00	215.88	239.33	258.40	273.3	286.4	298.67	311.9	330.3
140	2.89	6.70	9.98	14.63	21.49	31.54	45.73	64.78	89.19	118.24	151.3	185.4	219.28	249.66	276.15	297.81	315.0	329.4	343.2	358.6	379.1
150	3.72	8.29	12.23	17.81	26.00	37.81	54.43	76.61	104.65	138.1	175.4	214.5	252.65	287.24	317.3	341.7	361.1	377.1	392.8	409.8	432.2
160	4.74	10.16	14.92	21.54	31.16	45.02	64.25	89.88	122.10	160.2	202.7	247.0	290.18	329.4	363.1	390.2	412.2	430.4	447.8	466.6	492.8
170	5.99	12.41	18.01	25.87	37.11	53.27	75.55	104.84	141.75	185.1	233.2	283.1	331.7	375.6	413.3	443.7	467.8	488.7	508.2	528.8	558.4
180	7.51	15.00	21.65	30.86	44.02	62.68	88.17	121.68	163.7	212.6	267.0	323.1	377.1	426.6	468.4	502.4	529.5	552.3			
190	9.34	18.06	25.87	36.60	51.81	73.32	102.56	140.75	188.1	243.3	304.3	367.1	427.7	482.5	528.8						
200	11.53	21.60	30.72	43.14	60.62	85.33	118.68	161.81	215.2	277.0	345.5	415.1	483.0	543.6							
210	14.12	25.61	36.26	50.58	70.72	98.80	136.42	185.10	245.1	314.5	390.7	468.4	542.9								
220	17.19	30.27	42.47	59.00	81.91	113.81	156.41	211.24	278.2	355.1	439.6	525.5									
230	20.78	35.59	49.60	68.46	94.43	130.64	178.28	239.70	314.5	400.2	493.4										
240	24.97	41.52	57.65	78.91	108.60	149.20	202.74	270.92	354.1	448.9	552.3										
250	29.83	48.32	66.67	90.74	124.08	169.48	229.62	305.60	397.6	502.4											

*Wilson, Univ. Ill., Eng. Expt. Sta. Bull. 146.

WATER-VAPOR CONTENT OF GASES

CHART FOR GASES AT HIGH PRESSURES

The accompanying figure is useful in determining the water-vapor content of air at high pressure in contact with liquid water.

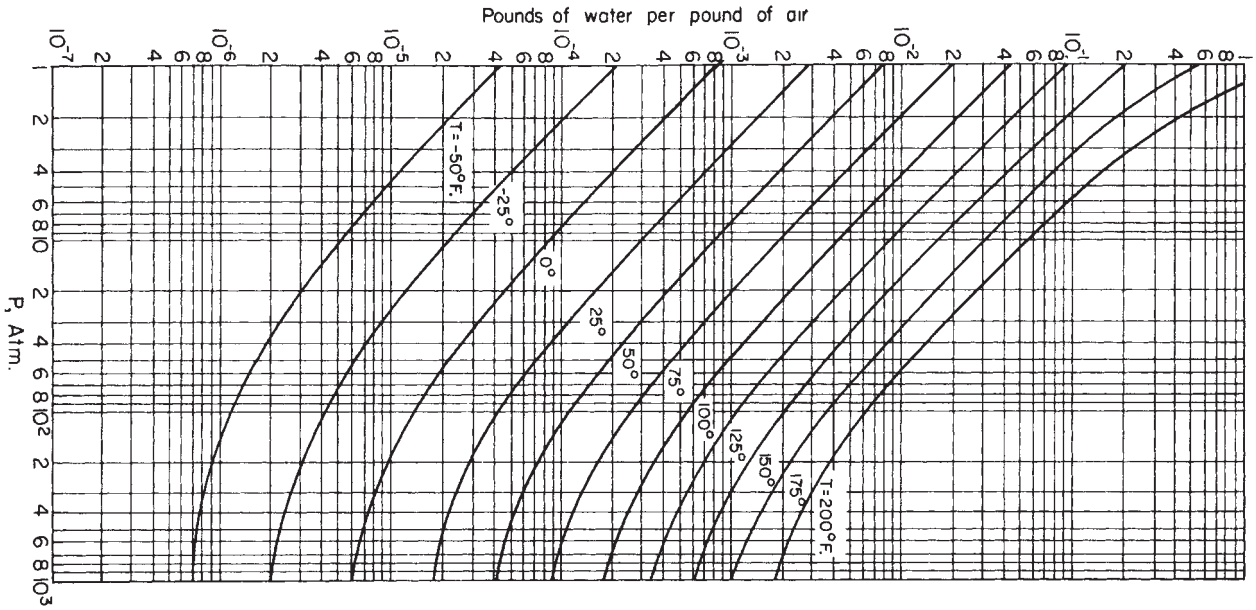


FIG. 2-4 Water content of air, $^\circ\text{C} = (^\circ\text{F} - 32) \times \%$. (Landsbaum, Dadds, and Stutzman. Reprinted from vol. 47, January 1955 issue of *Ind. Eng. Chem.* [p. 192]. Copyright 1955 by the American Chemical Society and reproduced by permission of the copyright owner.)

DENSITIES OF PURE SUBSTANCES

UNITS CONVERSIONS

For this subsection, the following units conversions are applicable:

$$^{\circ}\text{F} = \% \text{ } ^{\circ}\text{C} + 32.$$

To convert kilograms per cubic meter to pounds per cubic foot, multiply by 0.06243.

TABLE 2-28 Density (kg/m³) of Water from 0 to 100°C*

t, °C	ρ, kg/m ³									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	999.839	999.846	999.852	999.859	999.865	999.871	999.877	999.882	999.888	999.893
1	999.898	999.903	999.908	999.913	999.917	999.921	999.925	999.929	999.933	999.936
2	999.940	999.943	999.946	999.949	999.952	999.954	999.956	999.959	999.961	999.962
3	999.964	999.966	999.967	999.968	999.969	999.970	999.971	999.971	999.972	999.972
4	999.972	999.972	999.972	999.971	999.971	999.970	999.970	999.969	999.968	999.967
5	999.964	999.962	999.960	999.958	999.956	999.954	999.951	999.949	999.946	999.943
6	999.940	999.937	999.934	999.930	999.926	999.923	999.919	999.915	999.910	999.906
7	999.901	999.897	999.892	999.887	999.882	999.877	999.871	999.866	999.860	999.854
8	999.848	999.842	999.836	999.829	999.823	999.816	999.809	999.802	999.795	999.788
9	999.781	999.773	999.765	999.758	999.750	999.742	999.734	999.725	999.717	999.708
10	999.699	999.691	999.682	999.672	999.663	999.654	999.644	999.635	999.625	999.615
11	999.605	999.595	999.584	999.574	999.563	999.553	999.542	999.531	999.520	999.509
12	999.497	999.486	999.474	999.462	999.451	999.439	999.426	999.414	999.402	999.389
13	999.377	999.364	999.351	999.338	999.325	999.312	999.299	999.285	999.272	999.258
14	999.244	999.230	999.216	999.202	999.188	999.173	999.159	999.144	999.129	999.114
15	999.099	999.084	999.069	999.054	999.038	999.022	999.007	998.991	998.975	998.958
16	998.943	998.926	998.910	998.894	998.877	998.860	998.843	998.826	998.809	998.792
17	998.775	998.757	998.740	998.722	998.704	998.686	998.668	998.650	998.632	998.614
18	998.595	998.577	998.558	998.539	998.520	998.502	998.482	998.463	998.444	998.425
19	998.405	998.385	998.366	998.346	998.326	998.306	998.286	998.265	998.245	998.224
20	998.204	998.183	998.162	998.141	998.120	998.099	998.078	998.057	998.035	998.014
21	997.992	997.971	997.949	997.927	997.905	997.883	997.860	997.838	997.816	997.793
22	997.770	997.747	997.725	997.702	997.679	997.656	997.632	997.609	997.585	997.562
23	997.538	997.515	997.491	997.467	997.443	997.419	997.394	997.370	997.345	997.321
24	997.296	997.272	997.247	997.222	997.197	997.172	997.146	997.121	997.096	997.070
25	997.045	997.019	996.993	996.967	996.941	996.915	996.889	996.863	996.836	996.810
26	996.783	996.757	996.730	996.703	996.676	996.649	996.622	996.595	996.568	996.540
27	996.513	996.485	996.458	996.430	996.402	996.374	996.346	996.318	996.290	996.262
28	996.233	996.205	996.176	996.148	996.119	996.090	996.061	996.032	996.003	995.974
29	995.945	995.915	995.886	995.856	995.827	995.797	995.767	995.737	995.707	995.677
30	995.647	995.617	995.586	995.556	995.526	995.495	995.464	995.433	995.403	995.372
31	995.341	995.310	995.278	995.247	995.216	995.184	995.153	995.121	995.090	995.058
32	995.026	994.997	994.962	994.930	994.898	994.865	994.833	994.801	994.768	994.735
33	994.703	994.670	994.637	994.604	994.571	994.538	994.505	994.472	994.438	994.405
34	994.371	994.338	994.304	994.270	994.236	994.202	994.168	994.134	994.100	994.066
35	994.032	993.997	993.963	993.928	993.893	993.859	993.824	993.789	993.754	993.719
36	993.684	993.648	993.613	993.578	993.543	993.507	993.471	993.436	993.400	993.364
37	993.328	993.292	993.256	993.220	993.184	993.148	993.111	993.075	993.038	993.002
38	992.965	992.928	992.891	992.855	992.818	992.780	992.743	992.706	992.669	992.631
39	992.594	992.557	992.519	992.481	992.444	992.406	992.368	992.330	992.292	992.254
40	992.215	992.177	992.139	992.100	992.062	992.023	991.985	991.946	991.907	992.868
41	991.830	991.791	991.751	991.712	992.673	991.634	991.594	991.555	991.515	991.476
42	991.436	991.396	991.357	991.317	991.277	991.237	991.197	991.157	991.116	991.076
43	991.036	990.995	990.955	990.914	990.873	990.833	990.792	990.751	990.710	990.669
44	990.628	990.587	990.546	990.504	990.463	990.421	990.380	990.338	990.297	990.255
45	990.213	990.171	990.129	990.087	990.045	990.003	989.961	989.919	989.876	989.834
46	989.792	989.749	989.706	989.664	989.621	989.578	989.535	989.492	989.449	989.406
47	989.363	989.320	989.276	989.233	989.190	989.146	989.103	989.059	989.015	988.971
48	988.928	988.884	988.840	988.796	988.752	988.707	988.663	988.619	988.574	988.530
49	988.485	988.441	988.396	988.352	988.307	988.262	988.217	988.172	988.127	988.082

*From "Water: Density at Atmospheric Pressure and Temperatures from 0 to 100°C," *Tables of Standard Handbook Data*, Standartov, Moscow, 1978. To conserve space, only a few tables of density values are given. The reader is reminded that density values may be found as the reciprocal of the specific volume values tabulated in the "Thermodynamic Properties: Tables" subsection.

TABLE 2-29 Density (kg/m³) of Mercury from 0 to 350°C*

<i>t</i> , °C	Density, kg/m ³									
	0	1	2	3	4	5	6	7	8	9
0	13595.08	13592.61	13590.14	13587.68	13585.21	13582.75	13580.29	13577.82	13575.36	13572.90
10	13570.44	13567.98	13565.52	13563.06	13560.60	13558.14	13555.69	13553.23	13550.78	13548.32
20	13545.87	13543.41	13540.96	13538.51	13536.06	13533.61	13531.16	13528.71	13526.26	13523.81
30	13521.36	13518.91	13516.47	13514.02	13511.58	13509.13	13506.69	13504.25	13501.80	13499.36
40	13496.92	13494.48	13492.04	13489.60	13487.16	13484.72	13482.29	13479.85	13477.41	13474.98
50	13472.54	13470.11	13467.67	13465.24	13462.81	13460.38	13457.94	13455.51	13453.08	13450.65
60	13448.22	13445.80	13443.37	13440.94	13438.51	13436.09	13433.66	13431.23	13428.81	13426.39
70	13423.96	13421.54	13419.12	13416.69	13414.27	13411.85	13409.43	13407.01	13404.59	13402.17
80	13399.75	13397.34	13394.92	13392.50	13390.08	13387.67	13385.25	13382.84	13380.42	13378.01
90	13375.59	13373.18	13370.77	13368.36	13365.94	13363.53	13361.12	13358.71	13356.30	13353.89
100	13351.5	13349.1	13346.7	13344.3	13341.9	13339.4	13337.0	13334.6	13332.2	13329.8
110	13327.4	13325.0	13322.6	13320.2	13317.8	13315.4	13313.0	13310.6	13308.2	13305.8
120	13303.4	13301.0	13298.6	13296.2	13293.8	13291.4	13288.9	13286.6	13284.2	13281.8
130	13279.4	13277.0	13274.6	13272.2	13269.8	13267.4	13265.0	13262.6	13260.2	13257.8
140	13255.4	13253.0	13250.6	13248.2	13245.8	13243.4	13241.0	13238.7	13236.3	13233.9
150	13231.5	13229.1	13226.7	13224.3	13221.9	13219.5	13217.1	13214.7	13212.4	13210.0
160	13207.6	13205.2	13202.8	13200.4	13198.0	13195.6	13193.2	13190.8	13188.5	13186.1
170	13183.7	13181.3	13178.9	13176.5	13174.1	13171.7	13169.4	13167.0	13164.6	13162.2
180	13159.8	13157.4	13155.0	13152.6	13150.3	13147.9	13145.5	13143.1	13140.7	13138.3
190	13136.0	13133.6	13131.2	13128.8	13126.4	13124.0	13121.7	13119.3	13116.9	13114.5
200	13112.1	13109.7	13107.4	13105.0	13102.6	13100.2	13097.8	13095.4	13093.1	13090.7
210	13088.3	13085.9	13083.5	13081.1	13078.8	13076.4	13074.0	13071.6	13069.2	13066.8
220	13064.5	13062.1	13059.7	13057.3	13054.9	13052.6	13050.2	13047.8	13045.4	13043.0
230	13040.6	13038.3	13035.9	13033.5	13031.1	13028.7	13026.4	13024.0	13021.6	13019.2
240	13016.8	13014.5	13012.1	13009.7	13007.3	13004.9	13002.5	13000.2	12997.8	12995.4
250	12993.0	12990.6	12988.3	12985.9	12983.5	12981.1	12978.7	12976.3	12974.0	12971.6
260	12969.2	12966.8	12964.4	12962.0	12959.7	12957.3	12954.9	12952.5	12950.1	12947.7
270	12945.4	12943.0	12940.6	12938.2	12935.8	12933.4	12931.1	12928.7	12926.3	12923.9
280	12921.5	12919.1	12916.7	12914.4	12912.0	12909.6	12907.2	12904.8	12902.4	12900.0
290	12897.7	12895.3	12892.9	12890.5	12888.1	12885.7	12883.3	12880.9	12878.5	12876.2
300	12873.8	12871.4	12869.0	12866.6	12864.2	12861.8	12859.4	12857.0	12854.6	12852.2
310	12849.9	12847.5	12845.1	12842.7	12840.3	12837.9	12835.5	12833.1	12830.7	12828.3
320	12825.9	12823.5	12821.1	12818.7	12816.3	12813.9	12811.5	12809.1	12806.7	12804.3
330	12801.9	12799.5	12797.1	12794.7	12792.3	12789.9	12787.5	12785.1	12782.7	12780.2
340	12777.8	12775.4	12773.0	12770.6	12768.2	12765.8	12763.4	12761.0	12758.6	12756.1
350	12753.7									

*From "Mercury—Density and Thermal Expansion at Atmospheric Pressure and Temperatures from 0 to 350°C." *Tables of Standard Handbook Data*, Standartov, Moscow, 1978. The density values obtainable from those cited for the specific volume of the saturated liquid in the "Thermodynamic Properties" subsection show minor differences. No attempt was made to adjust either set.

TABLE 2-30 Densities of Inorganic and Organic Liquids

Cmpd. no.	Name	Formula	CAS no.	Mol. wt.	C1	C2	C3	C4	T_{\min} , K	Density at T_{\min}	T_{\max} , K	Density at T_{\max}
1	Methane	CH ₄	74828	16.043	2.9214	0.28976	190.56	0.28881	90.69	28.18	190.56	10.082
2	Ethane	C ₂ H ₆	74840	30.070	1.9122	0.27937	305.32	0.29187	90.35	21.64	305.32	6.845
3	Propane	C ₃ H ₈	74986	44.097	1.3757	0.27453	369.83	0.29359	85.47	16.583	369.83	5.011
4	<i>n</i> -Butane	C ₄ H ₁₀	106978	58.123	1.0677	0.27188	425.12	0.28688	134.86	12.62	425.12	3.927
5	<i>n</i> -Pentane	C ₅ H ₁₂	109660	72.150	0.84947	0.26726	469.7	0.27789	143.42	10.474	469.7	3.178
6	<i>n</i> -Hexane	C ₆ H ₁₄	110543	86.177	0.70824	0.26411	507.6	0.27537	177.83	8.747	507.6	2.682
7	<i>n</i> -Heptane	C ₇ H ₁₆	142825	100.204	0.61259	0.26211	540.2	0.28141	182.57	7.6998	540.2	2.337
8	<i>n</i> -Octane	C ₈ H ₁₈	111659	114.231	0.53731	0.26115	568.7	0.28034	216.38	6.6558	568.7	2.058
9	<i>n</i> -Nonane	C ₉ H ₂₀	111842	128.258	0.48387	0.26147	594.6	0.28281	219.66	6.007	594.6	1.851
10	<i>n</i> -Decane	C ₁₀ H ₂₂	124185	142.285	0.42831	0.25745	617.7	0.28912	243.51	5.3811	617.7	1.664
11	<i>n</i> -Undecane	C ₁₁ H ₂₄	1120214	156.312	0.39	0.25678	639	0.2913	247.57	4.9362	639	1.519
12	<i>n</i> -Dodecane	C ₁₂ H ₂₆	112403	170.338	0.35541	0.25511	658	0.29368	263.57	4.5132	658	1.393
13	<i>n</i> -Tridecane	C ₁₃ H ₂₈	629505	184.365	0.3216	0.2504	675	0.3071	267.76	4.2035	675	1.284
14	<i>n</i> -Tetradecane	C ₁₄ H ₃₀	629594	198.392	0.30545	0.2535	693	0.30538	279.01	3.8924	693	1.205
15	<i>n</i> -Pentadecane	C ₁₅ H ₃₂	629629	212.419	0.28445	0.25269	708	0.30786	283.07	3.6471	708	1.126
16	<i>n</i> -Hexadecane	C ₁₆ H ₃₄	544763	226.446	0.26807	0.25287	723	0.31143	291.31	3.4187	723	1.060
17	<i>n</i> -Heptadecane	C ₁₇ H ₃₆	629787	240.473	0.2545	0.254	736	0.31072	295.13	3.2241	736	1.002
18	<i>n</i> -Octadecane	C ₁₈ H ₃₈	593453	254.500	0.23864	0.25272	747	0.31104	301.31	3.0466	747	0.944
19	<i>n</i> -Nonadecane	C ₁₉ H ₄₀	629925	268.527	0.22451	0.25133	758	0.3133	305.04	2.8933	758	0.893
20	<i>n</i> -Eicosane	C ₂₀ H ₄₂	112958	282.553	0.21624	0.25287	768	0.31613	309.58	2.7496	768	0.855
21	2-Methylpropane	C ₄ H ₁₀	75285	58.123	1.0463	0.27294	408.14	0.27301	113.54	12.575	408.14	3.833
22	2-Methylbutane	C ₅ H ₁₂	78784	72.150	0.9079	0.2761	460.43	0.28673	113.25	10.776	460.43	3.288
23	2,3-Dimethylbutane	C ₆ H ₁₄	79298	86.177	0.76929	0.27524	499.98	0.27691	145.19	9.0343	499.98	2.795
24	2-Methylpentane	C ₆ H ₁₄	107835	86.177	0.73335	0.2687	497.5	0.28361	119.55	9.2041	497.5	2.729
25	2,3-Dimethylpentane	C ₇ H ₁₆	565593	100.204	0.7229	0.28614	537.35	0.2713	160.00	7.8746	537.35	2.526
26	2,3,3-Trimethylpentane	C ₈ H ₁₈	560214	114.231	0.6028	0.27446	573.5	0.2741	172.22	7.0934	573.5	2.196
27	2,2,4-Trimethylpentane	C ₈ H ₁₈	540841	114.231	0.5886	0.27373	543.96	0.2846	165.78	6.9163	543.96	2.150
28	Ethylene	C ₂ H ₄	74851	28.054	2.0961	0.27657	282.34	0.29147	104.00	23.326	282.34	7.579
29	Propylene	C ₃ H ₆	115071	42.081	1.4094	0.26465	365.57	0.295	87.89	18.143	365.57	5.326
30	1-Butene	C ₄ H ₈	106989	56.108	1.0972	0.2649	419.95	0.29043	87.80	14.326	419.95	4.142
31	<i>cis</i> -2-Butene	C ₄ H ₈	590181	56.108	1.1609	0.27104	435.58	0.2816	134.26	13.895	435.58	4.283
32	<i>trans</i> -2-Butene	C ₄ H ₈	624646	56.108	1.1426	0.27095	428.63	0.2854	167.62	13.1	428.63	4.217
33	1-Pentene	C ₅ H ₁₀	109671	70.134	0.9038	0.26648	464.78	0.2905	107.93	11.543	464.78	3.392
34	1-Hexene	C ₆ H ₁₂	592416	84.161	0.7389	0.26147	504.03	0.2902	133.39	9.6388	504.03	2.826
35	1-Heptene	C ₇ H ₁₄	592767	98.188	0.63734	0.26319	537.29	0.27375	154.27	8.1759	537.29	2.422
36	1-Octene	C ₈ H ₁₆	111660	112.215	0.5871	0.27005	566.65	0.27187	171.45	7.1247	566.65	2.174
37	1-Nonene	C ₉ H ₁₈	124118	126.242	0.4945	0.26108	593.25	0.27319	191.78	6.333	593.25	1.894
38	1-Decene	C ₁₀ H ₂₀	872059	140.269	0.44244	0.25838	616.4	0.28411	206.89	5.7131	616.4	1.712
39	2-Methylpropene	C ₄ H ₈	115117	56.108	1.1454	0.2725	417.9	0.28186	132.81	13.506	417.9	4.203
40	2-Methyl-1-butene	C ₅ H ₁₀	563462	70.134	0.91619	0.26752	465	0.28164	135.58	11.332	465	3.425
41	2-Methyl-2-butene	C ₅ H ₁₀	513359	70.134	0.93322	0.27251	471	0.26031	139.39	11.218	471	3.425
42	1,2-Butadiene	C ₄ H ₆	590192	54.092	1.187	0.26114	452	0.3065	136.95	15.123	452	4.546
43	1,3-Butadiene	C ₄ H ₆	106990	54.092	1.2384	0.2725	425.17	0.28813	164.25	14.061	425.17	4.545
44	2-Methyl-1,3-butadiene ¹	C ₅ H ₈	78795	68.119	0.95673	0.26488	484	0.28571	127.27	12.205	484	3.612
45	Acetylene	C ₂ H ₂	74862	26.038	2.4091	0.27223	308.32	0.28477	192.40	23.692	308.32	8.850
46	Methylacetylene	C ₃ H ₄	74997	40.065	1.6086	0.26448	402.39	0.279	170.45	19.027	402.39	6.082
47	Dimethylacetylene	C ₄ H ₆	503173	54.092	1.1717	0.25895	473.2	0.27289	240.91	13.767	473.2	4.525
48	3-Methyl-1-butyne	C ₅ H ₈	598232	68.119	0.94575	0.26008	463.2	0.30807	183.45	11.519	463.2	3.636
49	1-Pentyne	C ₅ H ₈	627190	68.119	0.8491	0.2352	481.2	0.353	167.45	12.532	481.2	3.610
50	2-Pentyne	C ₅ H ₈	627214	68.119	0.92099	0.25419	519	0.31077	163.83	12.24	519	3.623
51	1-Hexyne	C ₆ H ₁₀	693027	82.145	0.84427	0.27185	516.2	0.2771	141.25	10.23	516.2	3.106
52	2-Hexyne	C ₆ H ₁₀	764352	82.145	0.76277	0.25248	549	0.31611	183.65	10.133	549	3.021
53	3-Hexyne ¹	C ₆ H ₁₀	928494	82.145	0.78045	0.26065	544	0.28571	170.05	10.021	544	2.994

54	1-Heptyne	C ₇ H ₁₂	628717	96.172	0.67366	0.26003	559	0.29804	192.22	8.4987	559	2.591
55	1-Octyne	C ₈ H ₁₄	629050	110.199	0.59229	0.26118	585	0.29357	193.55	7.478	585	2.268
56	Vinylacetylene ²	C ₄ H ₄	689974	52.076	1.2703	0.26041	454	0.297	173.15	15.664	454	4.878
57	Cyclopentane	C ₅ H ₁₀	287923	70.134	1.124	0.28859	511.76	0.2506	179.28	11.883	511.76	3.895
58	Methylcyclopentane	C ₆ H ₁₂	96377	84.161	0.84798	0.27042	532.79	0.28276	130.73	10.492	532.79	3.136
59	Ethylcyclopentane	C ₇ H ₁₄	1640897	98.188	0.7193	0.26936	569.52	0.2777	134.71	9.018	569.52	2.670
60	Cyclohexane	C ₆ H ₁₂	110827	84.161	0.8908	0.27396	553.58	0.2851	279.69	9.3797	553.58	3.252
61	Methylcyclohexane	C ₇ H ₁₄	108872	98.188	0.735	0.27041	572.19	0.2927	146.58	9.018	572.19	2.718
62	1,1-Dimethylcyclohexane	C ₈ H ₁₆	590669	112.215	0.55873	0.25143	591.15	0.27758	239.66	7.3417	591.15	2.222
63	Ethylcyclohexane	C ₈ H ₁₆	1678917	112.215	0.61587	0.26477	609.15	0.28054	161.84	7.8679	609.15	2.326
64	Cyclopentene	C ₅ H ₈	142290	68.119	1.1035	0.27035	507	0.28699	138.13	13.47	507	4.082
65	1-Methylcyclopentene	C ₆ H ₁₀	693890	82.145	0.88824	0.26914	542	0.27874	146.62	10.98	542	3.300
66	Cyclohexene	C ₆ H ₁₀	110838	82.145	0.92997	0.27056	560.4	0.28943	169.67	11.16	560.4	3.437
67	Benzene	C ₆ H ₆	71432	78.114	1.0162	0.2655	562.16	0.28212	278.68	11.421	562.16	3.828
68	Toluene	C ₇ H ₈	108883	92.141	0.8488	0.26655	591.8	0.2878	178.18	10.495	591.8	3.184
69	<i>o</i> -Xylene	C ₈ H ₁₀	95476	106.167	0.69883	0.26113	630.33	0.27429	247.98	8.6285	630.33	2.676
70	<i>m</i> -Xylene	C ₈ H ₁₀	108383	106.167	0.69555	0.26204	617.05	0.27602	225.30	8.6505	617.05	2.654
71	<i>p</i> -Xylene	C ₈ H ₁₀	106423	106.167	0.6816	0.25963	616.23	0.2768	286.41	8.1616	616.23	2.625
72	Ethylbenzene	C ₈ H ₁₀	100414	106.167	0.6952	0.26037	617.2	0.2844	178.15	9.0568	617.2	2.670
73	Propylbenzene	C ₉ H ₁₂	103651	120.194	0.57695	0.25395	638.32	0.283	183.15	7.8942	638.32	2.272
74	1,2,4-Trimethylbenzene	C ₉ H ₁₂	95636	120.194	0.60394	0.25955	649.13	0.27716	229.33	7.6895	649.13	2.327
75	Isopropylbenzene	C ₉ H ₁₂	98828	120.194	0.604	0.25912	631.1	0.2914	177.14	7.9496	631.1	2.331
76	1,3,5-Trimethylbenzene	C ₉ H ₁₂	108678	120.194	0.59879	0.25916	637.36	0.27968	228.42	7.6154	637.36	2.311
77	<i>p</i> -Isopropyltoluene	C ₁₀ H ₁₄	99876	134.221	0.51036	0.25383	653.15	0.28816	205.25	6.8779	653.15	2.011
78	Naphthalene ⁶	C ₁₀ H ₈	91203	128.174	0.61674	0.25473	748.35	0.27355	333.15	7.7543	748.35	2.421
79	Biphenyl	C ₁₂ H ₁₀	92524	154.211	0.5039	0.25273	789.26	0.281	342.20	6.4395	789.26	1.994
80	Styrene	C ₈ H ₈	100425	104.152	0.7397	0.2603	636	0.3009	242.54	9.1088	636	2.842
81	<i>m</i> -Terphenyl	C ₁₈ H ₁₄	92068	230.309	0.30826	0.23669	924.85	0.29678	360.00	4.5223	924.85	1.302
82	Methanol	CH ₄ O	67561	32.042	2.288	0.2685	512.64	0.2453	175.47	27.912	512.64	8.521
83	Ethanol	C ₂ H ₆ O	64175	46.069	1.648	0.27627	513.92	0.2331	159.05	19.413	513.92	5.965
84	1-Propanol	C ₃ H ₈ O	71238	60.096	1.235	0.27136	536.78	0.24	146.95	15.231	536.78	4.551
85	1-Butanol	C ₄ H ₁₀ O	71363	74.123	0.965	0.2666	563.05	0.24419	184.51	12.016	563.05	3.620
86	2-Butanol	C ₄ H ₁₀ O	78922	74.123	0.966	0.26064	536.05	0.2746	158.45	12.57	536.05	3.706
87	2-Propanol	C ₃ H ₈ O	67630	60.096	1.24	0.27342	508.3	0.2353	185.28	14.547	508.3	4.535
88	2-Methyl-2-propanol	C ₄ H ₁₀ O	75650	74.123	0.9212	0.2544	506.21	0.276	298.97	10.555	506.21	3.621
89	1-Pentanol	C ₅ H ₁₂ O	71410	88.150	0.8164	0.2673	586.15	0.2506	195.56	10.057	586.15	3.054
90	2-Methyl-1-butanol	C ₅ H ₁₂ O	137326	88.150	0.82046	0.26829	565	0.2322	203.00	10.017	565	3.058
91	3-Methyl-1-butanol	C ₅ H ₁₂ O	123513	88.150	0.837	0.27375	577.2	0.22951	155.95	10.204	577.2	3.058
92	1-Hexanol	C ₆ H ₁₄ O	111273	102.177	0.70617	0.26901	611.35	0.2479	228.55	8.4506	611.35	2.625
93	1-Heptanol	C ₇ H ₁₆ O	111706	116.203	0.60481	0.2632	631.9	0.273	239.15	7.421	631.9	2.298
94	Cyclohexanol	C ₆ H ₁₂ O	108930	100.161	0.8243	0.26546	650	0.2848	296.60	9.4693	650	3.105
95	Ethylene glycol	C ₂ H ₆ O ₂	107211	62.068	1.3151	0.25125	719.7	0.2187	260.15	18.31	719.7	5.234
96	1,2-Propylene glycol	C ₃ H ₈ O ₂	57556	76.095	1.0923	0.26106	626	0.20459	213.15	14.363	626	4.184
97	Phenol	C ₆ H ₆ O	108952	94.113	1.3798	0.31598	694.25	0.32768	314.06	11.244	694.25	4.367
98	<i>o</i> -Cresol	C ₇ H ₈ O	95487	108.140	1.0861	0.30624	697.55	0.30587	304.19	9.5751	697.55	3.547
99	<i>m</i> -Cresol	C ₇ H ₈ O	108394	108.140	0.9061	0.28268	705.85	0.2707	285.39	9.6115	705.85	3.205
100	<i>p</i> -Cresol	C ₇ H ₈ O	106445	108.140	1.1503	0.31861	704.65	0.30104	307.93	9.4494	704.65	3.610
101	Dimethyl ether	C ₂ H ₆ O	115106	46.069	1.5693	0.2679	400.1	0.2882	131.65	18.95	400.1	5.858
102	Methyl ethyl ether	C ₃ H ₈ O	540670	60.096	1.2635	0.27878	437.8	0.2744	160.00	13.995	437.8	4.532
103	Methyl- <i>n</i> -propyl ether	C ₄ H ₁₀ O	557175	74.123	1.0124	0.27942	476.3	0.2555	133.97	11.696	476.3	3.623
104	Methyl isopropyl ether	C ₄ H ₁₀ O	598538	74.123	1.0318	0.28478	464.5	0.2444	127.93	11.568	464.5	3.623
105	Methyl- <i>n</i> -butyl ether	C ₅ H ₁₂ O	628284	88.150	0.8281	0.27245	510	0.2827	157.48	9.8068	510	3.040
106	Methyl isobutyl ether ¹	C ₅ H ₁₂ O	625445	88.150	0.8252	0.27282	497	0.2857	150.00	9.7673	497	3.025
107	Methyl tert-butyl ether	C ₅ H ₁₂ O	1634044	88.150	0.82157	0.27032	497.1	0.2829	164.55	9.7682	497.1	3.039
108	Diethyl ether	C ₄ H ₁₀ O	60297	74.123	0.9554	0.26847	466.7	0.2814	156.85	11.487	466.7	3.559

TABLE 2-30 Densities of Inorganic and Organic Liquids (Continued)

Cmpd. no.	Name	Formula	CAS no.	Mol. wt.	C1	C2	C3	C4	T_{\min} , K	Density at T_{\min}	T_{\max} , K	Density at T_{\max}
109	Ethyl propyl ether	C ₈ H ₁₈ O	628320	88.150	0.7908	0.2666	500.23	0.292	145.65	9.8474	500.23	2.973
110	Ethyl isopropyl ether	C ₉ H ₁₈ O	625547	88.150	0.82049	0.26994	489	0.30381	140.00	9.9117	489	3.040
111	Methyl phenyl ether	C ₇ H ₈ O	100663	108.140	0.77488	0.26114	645.6	0.28234	235.65	9.6675	645.6	2.967
112	Diphenyl ether	C ₁₂ H ₁₀ O	101848	170.211	0.52133	0.26218	766.8	0.31033	300.03	6.2648	766.8	1.988
113	Formaldehyde ³	CH ₂ O	50000	30.026	1.9415	0.22309	408	0.28571	181.15	30.945	408	8.703
114	Acetaldehyde	C ₂ H ₄ O	75070	44.053	1.6994	0.26167	466	0.2913	150.15	21.499	466	6.494
115	1-Propanal	C ₃ H ₆ O	123386	58.080	1.296	0.26439	504.4	0.29471	170.00	15.929	504.4	4.902
116	1-Butanal	C ₄ H ₈ O	123728	72.107	1.0361	0.26731	537.2	0.28397	176.75	12.589	537.2	3.876
117	1-Pentanal	C ₅ H ₁₀ O	110623	86.134	0.83871	0.26252	566.1	0.29444	182.00	10.534	566.1	3.195
118	1-Hexanal	C ₆ H ₁₂ O	66251	100.161	0.71899	0.26531	591	0.27628	217.15	8.7243	591	2.710
119	1-Heptanal	C ₇ H ₁₄ O	111717	114.188	0.62649	0.26376	617	0.29221	229.80	7.6002	617	2.375
120	1-Octanal	C ₈ H ₁₆ O	124130	128.214	0.56833	0.26939	638.1	0.26975	246.00	6.6637	638.1	2.110
121	1-Nonanal	C ₉ H ₁₈ O	124196	142.241	0.49587	0.26135	658	0.30736	255.15	6.0165	658	1.897
122	1-Decanal	C ₁₀ H ₂₀ O	112312	156.268	0.46802	0.27146	674.2	0.26869	267.15	5.3834	674.2	1.724
123	Acetone	C ₃ H ₆ O	67641	58.080	1.2332	0.25886	508.2	0.2913	178.45	15.683	508.2	4.764
124	Methyl ethyl ketone	C ₄ H ₈ O	78933	72.107	0.93767	0.25035	535.5	0.29964	186.48	12.663	535.5	3.745
125	2-Pentanone	C ₅ H ₁₀ O	107879	86.134	0.90411	0.27207	561.08	0.30669	196.29	10.398	561.08	3.323
126	Methyl isopropyl ketone ¹	C ₅ H ₁₀ O	563804	86.134	0.8374	0.26204	553	0.2857	181.15	10.565	553	3.196
127	2-Hexanone	C ₆ H ₁₂ O	591786	100.161	0.70659	0.26073	587.05	0.2963	217.35	8.7505	587.05	2.710
128	Methyl isobutyl ketone	C ₆ H ₁₂ O	108101	100.161	0.71791	0.26491	571.4	0.28544	189.15	8.8579	571.4	2.710
129	3-Methyl-2-pentanone ¹	C ₆ H ₁₂ O	565617	100.161	0.6969	0.2587	573	0.2857	167.15	9.1722	573	2.694
130	3-Pentanone	C ₅ H ₁₀ O	96220	86.134	0.71811	0.24129	560.95	0.27996	234.18	10.102	560.95	2.976
131	Ethyl isopropyl ketone	C ₆ H ₁₂ O	565695	100.161	0.66469	0.24527	567	0.34305	200.00	9.0933	567	2.710
132	Diisopropyl ketone	C ₇ H ₁₄ O	565800	114.188	0.56213	0.23385	576	0.2618	204.81	8.7779	576	2.404
133	Cyclohexanone	C ₆ H ₁₀ O	108941	98.145	0.8663	0.26941	653	0.2977	242.00	10.081	653	3.216
134	Methyl phenyl ketone	C ₈ H ₈ O	98862	120.151	0.64417	0.24863	709.5	0.28661	292.81	8.5581	709.5	2.591
135	Formic acid	CH ₂ O ₂	64186	46.026	1.938	0.24225	588	0.24435	281.45	26.806	588	8.000
136	Acetic acid	C ₂ H ₄ O ₂	64197	60.053	1.4486	0.25892	591.95	0.2529	289.81	17.492	591.95	5.595
137	Propionic acid	C ₃ H ₆ O ₂	79094	74.079	1.1041	0.25659	600.81	0.26874	252.45	13.933	600.81	4.303
138	<i>n</i> -Butyric acid	C ₄ H ₈ O ₂	107926	88.106	0.89213	0.25938	615.7	0.24909	267.95	11.087	615.7	3.440
139	Isobutyric acid	C ₄ H ₈ O ₂	79312	88.106	0.88575	0.25736	605	0.26265	227.15	11.42	605	3.442
140	Benzoic acid ¹	C ₇ H ₆ O ₂	65850	122.123	0.71587	0.24812	751	0.2857	395.45	8.8935	751	2.885
141	Acetic anhydride	C ₄ H ₆ O ₃	108247	102.090	0.86852	0.25187	606	0.31172	200.15	11.643	606	3.448
142	Methyl formate	C ₂ H ₄ O ₂	107313	60.053	1.525	0.2634	487.2	0.2806	174.15	18.811	487.2	5.790
143	Methyl acetate	C ₃ H ₆ O ₂	79209	74.079	1.13	0.2593	506.55	0.2764	175.15	14.475	506.55	4.358
144	Methyl propionate	C ₄ H ₈ O ₂	554121	88.106	0.9147	0.2594	530.6	0.2774	185.65	11.678	530.6	3.526
145	Methyl <i>n</i> -butyrate	C ₅ H ₁₀ O ₂	623427	102.133	0.76983	0.26173	554.5	0.26879	187.35	9.7638	554.5	2.941
146	Ethyl formate	C ₃ H ₆ O ₂	109944	74.079	1.1343	0.26168	508.4	0.2791	193.55	14.006	508.4	4.335
147	Ethyl acetate	C ₄ H ₈ O ₂	141786	88.106	0.8996	0.25856	523.3	0.278	189.60	11.478	523.3	3.479
148	Ethyl propionate	C ₅ H ₁₀ O ₂	105373	102.133	0.7405	0.25563	546	0.2795	199.25	9.6317	546	2.897
149	Ethyl <i>n</i> -butyrate	C ₆ H ₁₂ O ₂	105544	116.160	0.63566	0.25613	571	0.27829	175.15	8.4912	571	2.482
150	<i>n</i> -Propyl formate	C ₄ H ₈ O ₂	110747	88.106	0.915	0.26134	538	0.28	180.25	11.59	538	3.501
151	<i>n</i> -Propyl acetate	C ₅ H ₁₀ O ₂	109604	102.133	0.73041	0.25456	549.73	0.27666	178.15	9.7941	549.73	2.869
152	<i>n</i> -Butyl acetate	C ₆ H ₁₂ O ₂	123864	116.160	0.669	0.26028	579.15	0.309	199.65	8.3747	579.15	2.570
153	Methyl benzoate	C ₈ H ₈ O ₂	93583	136.150	0.53944	0.23519	693	0.2676	260.75	8.2133	693	2.294
154	Ethyl benzoate	C ₉ H ₁₀ O ₂	93890	150.177	0.4883	0.23878	698	0.28487	238.45	7.2924	698	2.045
155	Vinyl acetate	C ₄ H ₆ O ₂	108054	86.090	0.9591	0.2593	519.13	0.27448	180.35	12.287	519.13	3.699
156	Methylamine	CH ₃ N	74895	31.057	1.39	0.21405	430.05	0.2275	179.69	25.378	430.05	6.494
157	Dimethylamine	C ₂ H ₇ N	124403	45.084	1.5436	0.27784	437.2	0.2572	180.96	16.964	437.2	5.556
158	Trimethylamine	C ₃ H ₉ N	75503	59.111	1.0116	0.25683	433.25	0.2696	156.08	13.144	433.25	3.939
159	Ethylamine	C ₂ H ₇ N	75047	45.084	1.1477	0.23182	456.15	0.26053	192.15	17.588	456.15	4.951
160	Diethylamine	C ₄ H ₁₁ N	109897	73.138	0.85379	0.25675	496.6	0.27027	223.35	10.575	496.6	3.325

161	Triethylamine	C ₆ H ₁₅ N	121448	101.192	0.7035	0.27386	535.15	0.2872	158.45	8.2843	535.15	2.569
162	<i>n</i> -Propylamine	C ₃ H ₉ N	107108	59.111	0.9195	0.23878	496.95	0.2461	188.36	13.764	496.95	3.851
163	di- <i>n</i> -Propylamine	C ₆ H ₁₅ N	142847	101.192	0.659	0.26428	550	0.2766	210.15	7.9929	550	2.494
164	Isopropylamine	C ₃ H ₉ N	75310	59.111	1.2801	0.2828	471.85	0.2972	177.95	13.561	471.85	4.527
165	Diisopropylamine	C ₆ H ₁₅ N	108189	101.192	0.6181	0.25786	523.1	0.271	176.85	8.0541	523.1	2.397
166	Aniline	C ₆ H ₇ N	62533	93.128	1.0405	0.2807	699	0.29236	267.13	11.176	699	3.707
167	<i>N</i> -Methylaniline	C ₇ H ₉ N	100618	107.155	0.6527	0.24324	701.55	0.25374	216.15	9.7244	701.55	2.683
168	<i>N,N</i> -Dimethylaniline	C ₈ H ₁₁ N	121697	121.182	0.4923	0.22868	687.15	0.2335	275.60	7.9705	687.15	2.153
169	Ethylene oxide	C ₂ H ₄ O	75218	44.053	1.836	0.26024	469.15	0.2696	160.65	23.477	469.15	7.055
170	Furan	C ₄ H ₄ O	110009	68.075	1.1339	0.24741	490.15	0.2612	187.55	15.702	490.15	4.583
171	Thiophene	C ₄ H ₄ S	110021	84.142	1.2875	0.28195	579.35	0.3077	234.94	13.431	579.35	4.566
172	Pyridine	C ₅ H ₅ N	110861	79.101	0.9815	0.24957	619.95	0.29295	231.51	13.193	619.95	3.933
173	Formamide ⁵	CH ₃ NO	75127	45.041	1.2486	0.20352	771	0.25178	275.60	25.488	771	6.135
174	<i>N,N</i> -Dimethyl- formamide	C ₃ H ₇ NO	68122	73.095	0.89615	0.23478	649.6	0.28091	212.72	13.954	649.6	3.817
175	Acetamide	C ₂ H ₅ NO	60355	59.068	1.016	0.21845	761	0.26116	353.33	16.936	761	4.651
176	<i>N</i> -Methylacetamide	C ₃ H ₇ NO	79163	73.095	0.88268	0.23568	718	0.27379	301.15	13.012	718	3.745
177	Acetonitrile	C ₂ H ₃ N	75058	41.053	1.3064	0.22597	545.5	0.28678	229.32	20.628	545.5	5.781
178	Propionitrile	C ₃ H ₅ N	107120	55.079	1.0224	0.23452	564.4	0.2804	180.26	16.027	564.4	4.360
179	<i>n</i> -Butyronitrile	C ₄ H ₇ N	109740	69.106	0.87533	0.24331	582.25	0.28586	161.25	13.047	582.25	3.598
180	Benzonitrile	C ₇ H ₅ N	100470	103.123	0.73136	0.24793	699.35	0.2841	260.40	10.009	699.35	2.950
181	Methyl mercaptan	CH ₃ S	74931	48.109	1.9323	0.28018	469.95	0.28523	150.18	21.564	469.95	6.897
182	Ethyl mercaptan	C ₂ H ₆ S	75081	62.136	1.3047	0.2694	499.15	0.27866	125.26	16.242	499.15	4.843
183	<i>n</i> -Propyl mercaptan	C ₃ H ₈ S	107039	76.163	1.0714	0.27214	536.6	0.29481	159.95	12.716	536.6	3.937
184	<i>n</i> -Butyl mercaptan	C ₄ H ₁₀ S	109795	90.189	0.89458	0.27463	570.1	0.28512	157.46	10.585	570.1	3.257
185	Isobutyl mercaptan	C ₄ H ₁₀ S	513440	90.189	0.88801	0.27262	559	0.29522	128.31	10.851	559	3.257
186	<i>sec</i> -Butyl mercaptan	C ₄ H ₁₀ S	513531	90.189	0.89137	0.27365	554	0.2953	133.02	10.761	554	3.257
187	Dimethyl sulfide	C ₂ H ₆ S	75183	62.136	1.4029	0.27991	503.04	0.2741	174.88	15.556	503.04	5.012
188	Methyl ethyl sulfide	C ₃ H ₈ S	624895	76.163	1.067	0.27101	533	0.29363	167.23	12.672	533	3.937
189	Diethyl sulfide	C ₄ H ₁₀ S	352932	90.189	0.82413	0.26333	557.15	0.27445	169.20	10.476	557.15	3.130
190	Fluoromethane	CH ₃ F	593533	34.033	2.1854	0.24725	317.42	0.27558	131.35	29.526	317.42	8.839
191	Chloromethane	CH ₃ Cl	74873	50.488	1.817	0.25877	416.25	0.2833	175.43	22.347	416.25	7.022
192	Trichloromethane	CHCl ₃	67663	119.377	1.0841	0.2581	536.4	0.2741	209.63	13.702	536.4	4.200
193	Tetrachloromethane	CCl ₄	56235	153.822	0.99835	0.274	556.35	0.287	250.33	10.843	556.35	3.644
194	Bromomethane	CH ₃ Br	74839	94.939	1.6762	0.26141	467	0.28402	179.47	20.64	467	6.412
195	Fluoroethane	C ₂ H ₅ F	353366	48.060	1.6525	0.27099	375.31	0.2442	129.95	19.785	375.31	6.098
196	Chloroethane	C ₂ H ₅ Cl	75003	64.514	2.176	0.3377	460.35	0.3361	134.80	16.934	460.35	6.444
197	Bromoethane	C ₂ H ₅ Br	74964	108.966	1.1908	0.25595	503.8	0.29152	154.55	15.833	503.8	4.653
198	1-Chloropropane	C ₃ H ₇ Cl	540545	78.541	1.087	0.26832	503.15	0.28055	150.35	13.328	503.15	4.051
199	2-Chloropropane	C ₃ H ₇ Cl	75296	78.541	1.1202	0.27669	489	0.27646	155.97	12.855	489	4.049
200	1,1-Dichloropropane ¹	C ₃ H ₆ Cl ₂	78999	112.986	0.91064	0.26561	560	0.28571	200.00	11.03	560	3.429
201	1,2-Dichloropropane	C ₃ H ₆ Cl ₂	78875	112.986	0.89833	0.26142	572	0.2868	172.71	11.526	572	3.436
202	Vinyl chloride	C ₂ H ₃ Cl	75014	62.499	1.5115	0.2707	432	0.2716	119.36	18.481	432	5.584
203	Fluorobenzene	C ₆ H ₅ F	462066	96.104	1.0146	0.27277	560.09	0.28291	230.94	11.374	560.09	3.720
204	Chlorobenzene	C ₆ H ₅ Cl	108907	112.558	0.8711	0.26805	632.35	0.2799	227.95	10.385	632.35	3.250
205	Bromobenzene	C ₆ H ₅ Br	108861	157.010	0.8226	0.26632	670.15	0.2821	242.43	9.9087	670.15	3.089
206	Air		132259100	28.951	2.8963	0.26733	132.45	0.27341	59.15	33.279	132.45	10.834
207	Hydrogen	H ₂	1333740	2.016	5.414	0.34893	33.19	0.2706	13.95	38.487	33.19	15.516
208	Helium-4 ¹	He	7440597	4.003	7.2475	0.41865	5.2	0.24096	2.20	37.115	5.2	17.312
209	Neon	Ne	7440019	20.180	7.3718	0.3067	44.4	0.2786	24.56	61.796	44.4	24.036
210	Argon	Ar	7440371	39.948	3.8469	0.2881	150.86	0.29783	83.78	35.491	150.86	13.353
211	Fluorine	F ₂	7782414	37.997	4.2895	0.28587	144.12	0.28776	53.48	44.888	144.12	15.005
212	Chlorine	Cl ₂	7782505	70.905	2.23	0.27645	417.15	0.2926	172.12	24.242	417.15	8.067
213	Bromine	Br ₂	7726956	159.808	2.1872	0.29527	584.15	0.3295	265.85	20.109	584.15	7.408
214	Oxygen	O ₂	7782447	31.999	3.9143	0.28772	154.58	0.2924	54.35	40.77	154.58	13.605
215	Nitrogen	N ₂	7727379	28.014	3.2091	0.2861	126.2	0.2966	63.15	31.063	126.2	11.217
216	Ammonia	NH ₃	7664417	17.031	3.5383	0.25443	405.65	0.2888	195.41	43.141	405.65	13.907
217	Hydrazine	N ₂ H ₄	302012	32.045	1.0516	0.16613	653.15	0.1898	274.69	31.934	653.15	6.330

TABLE 2-30 Densities of Inorganic and Organic Liquids (Concluded)

Cmpd. no.	Name	Formula	CAS no.	Mol. wt.	C1	C2	C3	C4	T_{\min} , K	Density at T_{\min}	T_{\max} , K	Density at T_{\max}
218	Nitrous oxide	N ₂ O	10024972	44.013	2.781	0.27244	309.57	0.2882	182.30	27.928	309.57	10.208
219	Nitric oxide	NO	10102439	30.006	5.246	0.3044	180.15	0.242	109.50	44.487	180.15	17.234
220	Cyanogen	C ₂ N ₂	460195	52.036	1.0761	0.20984	400.15	0.20635	245.25	18.513	400.15	5.128
221	Carbon monoxide	CO	630080	28.010	2.897	0.27532	132.92	0.2813	68.15	30.18	132.92	10.522
222	Carbon dioxide	CO ₂	124389	44.010	2.768	0.26212	304.21	0.2908	216.58	26.828	304.21	10.560
223	Carbon disulfide	CS ₂	75150	76.143	1.7968	0.28749	552	0.3226	161.11	19.064	552	6.250
224	Hydrogen fluoride	HF	7664393	20.006	2.5635	0.1766	461.15	0.3733	189.79	60.203	461.15	14.516
225	Hydrogen chloride	HCl	7647010	36.461	3.342	0.2729	324.65	0.3217	158.97	34.854	324.65	12.246
226	Hydrogen bromide ¹	HBr	10035106	80.912	2.832	0.2832	363.15	0.28571	185.15	27.985	363.15	10.000
227	Hydrogen cyanide	HCN	74908	27.026	1.3413	0.18589	456.65	0.28206	259.83	27.202	456.65	7.216
228	Hydrogen sulfide	H ₂ S	7783064	34.082	2.7672	0.27369	373.53	0.29015	187.68	29.13	373.53	10.111
229	Sulfur dioxide	SO ₂	7446095	64.065	2.106	0.25842	430.75	0.2895	197.67	25.298	430.75	8.150
230	Sulfur trioxide	SO ₃	7446119	80.064	1.4969	0.19013	490.85	0.4359	289.95	24.241	490.85	7.873
231	Water ⁷	H ₂ O	7732185	18.015	5.459	0.30542	647.13	0.081	273.16	55.583	333.15	54.703

All substances are listed in alphabetical order in Table 2-6a. Compiled from Daubert, T. E., R. P. Danner, H. M. Sibul, and C. C. Stebbins, DIPPR Data Compilation of Pure Compound Properties, Project 801 Sponsor Release, July, 1993, Design Institute for Physical Property Data, AIChE, New York, NY; and from Thermodynamics Research Center, "Selected Values of Properties of Hydrocarbons and Related Compounds," Thermodynamics Research Center Hydrocarbon Project, Texas A&M University, College Station, Texas (extant 1994).

Temperatures are in kelvins. Liquid densities are in kmol/m³. Density formulas: kmol/m³ × (mol. wt./1E+03) = g/cm³; kmol/m³ × (mol. wt./1.601846E+01) = lb/ft³.

The liquid density equation is $C1/C2^{1+(1-T/C_2)^{C4}}$ unless otherwise noted.

¹ The modified Rackett equation, density = $(P_c/RT_c)/ZRA^{1+(1-(T/T_c))^{2/7}}$, was used. See Spencer, C. F., and R. P. Danner, "Improved Equation for Prediction of Saturated Liquid Density," *J. Chem. Eng. Data* **17**, 236 (1972).

² Decomposes violently on heating. Forms explosive peroxides with air or oxygen. Polymerizes under pressure and heat.

³ For the hypothetical pure liquid.

⁴ Exhibits superfluid properties below 2.2 K.

⁵ Coefficients are hypothetical above the decomposition temperature.

⁶ Lower limit is for the undercooled liquid.

⁷ For the temperature range 333.15 to 403.15 K, use the coefficients: $C_1 = 4.9669E+00$, $C_2 = 2.7788E-01$, $C_3 = 6.4713E+02$, $C_4 = 1.8740E-01$. For the temperature range 403.15 to 647.13 K, use $C_1 = 4.3910E+00$, $C_2 = 2.4870E-01$, $C_3 = 6.4713E+02$, $C_4 = 2.5340E-01$.

DENSITIES OF AQUEOUS INORGANIC SOLUTIONS

UNITS AND UNITS CONVERSIONS

Densities are given in grams per cubic centimeter. To convert to pounds per cubic foot, multiply by 62.43. °F = % °C + 32.

ADDITIONAL REFERENCES

For more detailed data on densities see *International Critical Tables*: tabular index, vol. 3, p. 1; abrasives, vol. 2, p. 87; air, moist, vol. 1, p. 71; building stones, vol. 2, p. 52; clays, vol. 2, p. 56; coals, vol. 2, p. 135; compounds, vol. 1, pp. 106, 176, 313, 341; elements, vol. 1, pp. 102, 340; fibers, vol. 2, p. 237; gases and vapors, vol. 3, pp. 3, 345; glass, vol. 2, p. 93; liquids and vitreous solids, vol. 3, p. 22; vol. 1, pp. 102, 340; vol. 2, pp. 456, 463; vol. 3, pp. 20, 35; liquid coolants and saturated

vapors are available from WADC-TR-59-598, 1959; plastics are collected in the *Handbook of Chemistry and Physics*, Chemical Rubber Publishing Co.; solid helium, neon, argon, fluorine, and methane data are given by Johnson (ed.), WADD-TR-60-56, 1960; temperatures of maximum solubility, vol. 3, p. 107; metals, vol. 2, p. 463; oils, fats, and waxes, vol. 2, p. 201; orthobaric, vol. 3, pp. 202, 228, 237, 244; petroleum, vol. 2, pp. 137, 144; plastics, vol. 2, p. 296; porcelains, vol. 2, pp. 68, 75; refrigerating brines, vol. 2, p. 327; rubber, vol. 2, pp. 255, 259; soaps, vol. 5, p. 447; metallic solid solutions, vol. 2, p. 358; solids, vol. 3, pp. 43, 45; vol. 2, p. 456; vol. 3, p. 21; solutions and mixtures, vol. 3, pp. 17, 51, 104, 107, 111, 125, 130; woods, vol. 2, p. 1. Also see the *Handbook of Chemistry and Physics*, Chemical Rubber Publishing Co., 40th ed., etc.

TABLE 2-31 Aluminum Sulfate [Al₂(SO₄)₃]

%	d ₄ ¹⁵	%	d ₄ ¹⁵
1	1.0093	16	1.1770
2	1.0195	20	1.2272
4	1.0404	24	1.2803
8	1.0837	26	1.3079
12	1.1293		

TABLE 2-32 Ammonia (NH₃)

%	-15°C	-10°C	-5°C	0°C	5°C	10°C	20°C	25°C	%	d ₄ ¹⁵
1		0.9943	0.9954	0.9959	0.9958	0.9955	0.9939	0.993	32	0.889
2		.9906	.9915	.9919	.9917	.9913	.9895	.988	36	.877
4		.9834	.9840	.9842	.9837	.9832	.9811	.980	40	.865
8	0.970	.9701	.9701	.9695	.9686	.9677	.9651	.964	45	.849
12	.958	.9576	.9571	.9561	.9548	.9534	.9501	.948	50	.832
16	.947	.9461	.9450	.9435	.9420	.9402	.9362	.934	60	.796
20		.9353	.9335	.9316	.9296	.9275	.9229		70	.755
24		.9249	.9226	.9202	.9179	.9155	.9101		80	.711
28		.9150	.9122	.9094	.9067	.9040	.8980		90	.665
30		.9101	.9070	.9040	.9012	.8983	.8920		100	.618

TABLE 2-33 Ammonium Acetate* (CH₃COONH₄)

%	d ₄ ²⁵
1	0.9992
2	1.0013
4	1.0055
8	1.0136
12	1.0216
16	1.0294
20	1.0368
24	1.0439
28	1.0507
30	1.0540
35	1.0618
40	1.0691
45	1.0760

*For data at 16°C for 3(1/52) percent see *Atack Handbook of Chemical Data*, p. 33, Reinhold, New York, 1957.

TABLE 2-34 Ammonium Bichromate [(NH₄)₂Cr₂O₇]

%	d ₄ ¹²
1	1.0051
2	1.0108
4	1.0223
8	1.0463
12	1.0715
16	1.0981
20	1.1263

TABLE 2-35 Ammonium Chloride (NH₄Cl)

%	0°C	10°C	20°C	30°C	50°C	80°C	100°C
1	1.0033	1.0029	1.0013	0.9987	0.9910	0.9749	0.9617
2	1.0067	1.0062	1.0045	1.0018	.9940	.9780	.9651
4	1.0135	1.0126	1.0107	1.0077	.9999	.9842	.9718
8	1.0266	1.0251	1.0227	1.0195	1.0116	.9963	.9849
12	1.0391	1.0370	1.0344	1.0310	1.0231	1.0081	.9975
16	1.0510	1.0485	1.0457	1.0422	1.0343	1.0198	1.0096
20	1.0625	1.0596	1.0567	1.0532	1.0454	1.0312	1.0213
24	1.0736	1.0705	1.0674	1.0641	1.0564	1.0426	1.0327

TABLE 2-36 Ammonium Chromate [(NH₄)₂CrO₄]

%	°C	d ₄ ¹⁵
3.80	20	1.0219
10.52	13	1.0627
19.75	13.7	1.1189
28.04	19.6	1.1707

TABLE 2-37 Ammonium Nitrate (NH₄NO₃)

%	0°C	10°C	25°C	40°C	60°C	80°C
1.0	1.0043	1.0039	1.0011	0.9961	0.9870	0.9755
2.0	1.0088	1.0082	1.0051	1.0000	.9908	.9793
4.0	1.0178	1.0168	1.0132	1.0079	.9985	.9869
8.0	1.0358	1.0340	1.0297	1.0238	1.0142	1.0024
12.0	1.0539	1.0515	1.0464	1.0400	1.0301	1.0181
16.0	1.0721	1.0691	1.0633	1.0565	1.0462	1.0342
20.0	1.0905	1.0870	1.0806	1.0734	1.0627	1.0506
24.0	1.1090	1.1051	1.0982	1.0907	1.0796	1.0673
28.0	1.1277	1.1234	1.1161	1.1082	1.0968	1.0844
30.0	1.1371	1.1327	1.1252	1.1171	1.1055	1.0931
40.0	1.1862	1.1810	1.1727	1.1640	1.1515	1.1385
50.0	1.2380	1.2320	1.2229	1.2136	1.2006	1.1868

TABLE 2-38 Ammonium Sulfate [(NH₄)₂SO₄]

%	0°C	20°C	40°C	80°C	100°C
1	1.0061	1.0041	0.9980	0.9777	0.9644
2	1.0124	1.0101	1.0039	.9836	.9705
4	1.0248	1.0220	1.0155	.9953	.9826
8	1.0495	1.0456	1.0387	1.0187	1.0066
12	1.0740	1.0691	1.0619	1.0421	1.0303
16	1.0980	1.0924	1.0849	1.0653	1.0539
20	1.1215	1.1154	1.1077	1.0883	1.0772
24	1.1448	1.1383	1.1304	1.1111	1.1003
28	1.1677	1.1609	1.1529	1.1338	1.1232
35	1.2072	1.2000	1.1919	1.1731	1.1629
40	1.2350	1.2277	1.2196	1.2011	1.1910
50	1.2899	1.2825	1.2745	1.2568	1.2466

TABLE 2-39 Arsenic Acid (H₃A₃O₄)

%	d ₄ ¹⁵	%	d ₄ ¹⁵
1	1.0057	20	1.1447
2	1.0124	30	1.2331
6	1.0398	40	1.3370
10	1.0681	50	1.4602
16	1.1128	60	1.6070
		70	1.7811

TABLE 2-40 Barium Chloride (BaCl₂)

%	0°C	20°C	40°C	60°C	80°C	100°C
2	1.0181	1.0159	1.0096	1.0004	0.9890	0.9755
4	1.0368	1.0341	1.0275	1.0181	1.0066	.9931
8	1.0760	1.0721	1.0648	1.0551	1.0434	1.0299
12	1.1178	1.1128	1.1047	1.0948	1.0827	1.0692
16	1.1627	1.1564	1.1478	1.1373	1.1249	1.1113
20	1.2105	1.2031	1.1938	1.1828	1.1702	1.1563
24		1.2531	1.2430	1.2316	1.2186	1.2045
26		1.2793	1.2688	1.2571	1.2440	1.2298

TABLE 2-41 Cadmium Nitrate [Cd(NO₃)₂]

%	d_4^{18}	%	d_4^{18}
2	1.0154	20	1.1904
4	1.0326	25	1.2488
8	1.0683	30	1.3124
12	1.1061	40	1.4590
16	1.1468	50	1.6356

TABLE 2-42 Calcium Chloride (CaCl₂)

%	-5°C	0°C	20°C	30°C	40°C	60°C	80°C	100°C	120°C*	140°C
2		1.0171	1.0148	1.0120	1.0084	0.9994	0.9881	0.9748	0.9596	0.9428
4		1.0346	1.0316	1.0286	1.0249	1.0158	1.0046	.9915	.9765	.9601
8	1.0708	1.0703	1.0659	1.0626	1.0586	1.0492	1.0382	1.0257	1.0111	.9954
12	1.1083	1.1072	1.1015	1.0978	1.0937	1.0840	1.0730	1.0610	1.0466	1.0317
16	1.1471	1.1454	1.1386	1.1345	1.1301	1.1202	1.1092	1.0973	1.0835	1.0691
20	1.1874	1.1853	1.1775	1.1730	1.1684	1.1581	1.1471	1.1352	1.1219	1.1080
25		1.2376	1.2284	1.2236	1.2186	1.2079	1.1965	1.1846		
30		1.2922	1.2816	1.2764	1.2709	1.2597	1.2478	1.2359		
35			1.3373	1.3316	1.3255	1.3137	1.3013	1.2893		
40			1.3957	1.3895	1.3826	1.3700	1.3571	1.3450		

*Corrected to atmospheric pressure.

TABLE 2-43 Calcium Hydroxide [Ca(OH)₂]

%	d_4^{15}	d_4^{25}
0.05	0.99979	0.99773
.10	1.00044	.99838
.15	1.00110	.99904

TABLE 2-44 Calcium Hypochlorite* (CaOCl₂)

% total salt	d_4^{15}
2	1.0169
4	1.0345
6	1.0520
8	1.0697
10	1.0876
12	1.1060

*CaOCl₂ = 89.15%
 CaCl₂ = 7.31%
 Ca(ClO₃)₂ = 0.26%
 Ca(OH)₂ = 2.92%.

TABLE 2-45 Calcium Nitrate [Ca(NO₃)₂]

%	6°C	18°C	25°C	30°C
2°	1.0157	1.0137	1.0120	1.0105
4	1.0316	1.0291	1.0272	1.0256
8	1.0641	1.0608	1.0585	1.0565
12	1.0979	1.0937	1.0911	1.0887
16	1.1330	1.1279	1.1250	1.1224
20	1.1694	1.1636	1.1602	1.1575
25	1.2168	1.2106	1.2065	1.2032
30		1.260		
35		1.311		
40		1.365		
45		1.422		
68°		1.747	1.741	1.736

*Supercooled tetrahydrate (m.p. 41.4°C).

TABLE 2-46 Chromic Acid (CrO₃)

%	d_4^{15}	%	d_4^{15}
1	1.006	20	1.163
2	1.014	26	1.220
6	1.045	30	1.260
10	1.076	40	1.371
16	1.127	50	1.505
		60	1.663

TABLE 2-47 Chromium Chloride (CrCl₃)

%	d_4^{18}		
	Violet	Green	Equilibrium mixture of violet and green
1	1.0076	1.0071	1.0075
2	1.0166	1.0157	1.0165
4	1.0349	1.0332	1.0347
8	1.0724	1.0691	1.0722
12	1.1114	1.1065	1.1111
14	1.1316		

TABLE 2-48 Copper Nitrate [Cu(NO₃)₂]

%	d_4^{20}	%	d_4^{20}
1	1.007	12	1.107
2	1.015	16	1.147
4	1.032	20	1.189
8	1.069	25	1.248

TABLE 2-49 Copper Sulfate (CuSO₄)

%	0°C	20°C	40°C
1	1.0104	1.0086	1.0024
4	1.0429	1.0401	1.0332
8	1.0887	1.084	1.0764
12	1.1379	1.1308	1.1222
16		1.180	
18		1.206	

TABLE 2-50 Cuprous Chloride (Cu₂Cl₂)

%	0°C	20°C	40°C
1	1.0095	1.0072	1.002
4	1.0387	1.036	1.0305
8	1.0788	1.0754	1.0682
12	1.1208	1.1165	1.107
16	1.1653	1.1595	1.151
20	1.2121	1.2052	1.1953

TABLE 2-51 Ferric Chloride (FeCl₃)

%	0°C	10°C	20°C	30°C
1	1.0086	1.0084	1.0068	1.0040
2	1.0174	1.0168	1.0152	1.0122
4	1.0347	1.0341	1.0324	1.0292
8	1.0703	1.0692	1.0669	1.0636
12	1.1088	1.1071	1.1040	1.1006
16	1.1475	1.1449	1.1418	1.1386
20	1.1870	1.1847	1.1820	1.1786
25	1.2400	1.2380	1.2340	1.2290
30	1.2970	1.2950	1.2910	1.2850
35	1.3605	1.3580	1.3530	1.3475
40	1.4280	1.4235	1.4175	1.4115
45		1.4920	1.4850	
50		1.5610	1.5510	

TABLE 2-52 Ferric Sulfate
[Fe₂(SO₄)₃]

%	<i>d</i> ₄ ^{17.5}
1	1.0072
2	1.0157
4	1.0327
8	1.0670
12	1.1028
16	1.1409
20	1.1811
30	1.3073
40	1.4487
50	1.6127
60	1.7983

TABLE 2-53 Ferric Nitrate
[Fe(NO₃)₃]

%	<i>d</i> ₄ ¹⁸
1	1.0065
2	1.0144
4	1.0304
8	1.0636
12	1.0989
16	1.1359
20	1.1748
25	1.2281

TABLE 2-58 Hydrogen Fluoride (HF)

%	<i>d</i> ₄ ²⁰	<i>d</i> ₄ ⁰
5	1.020	1.017
10	1.040	1.035
20	1.080	1.070
30	1.119	1.101
40	1.159	1.130
50	1.198	1.155
60	1.235	
70	1.258	
80	1.259	
90	1.178	
95	1.089	
100	1.0005	

TABLE 2-59 Hydrogen Peroxide (H₂O₂)

%	<i>d</i> ₄ ¹⁸	%	<i>d</i> ₄ ¹⁸
1	1.0022	26	1.0959
2	1.0058	28	1.1040
4	1.0131	30	1.1122
6	1.0204	35	1.1327
8	1.0277	40	1.1536
10	1.0351	45	1.1749
12	1.0425	50	1.1966
14	1.0499	55	1.2188
16	1.0574	60	1.2416
18	1.0649	70	1.2897
20	1.0725	80	1.3406
22	1.0802	90	1.3931
24	1.0880	100	1.4465

TABLE 2-54 Ferrous Sulfate (FeSO₄)

%	15°C	18°C	20°C
0.2		1.00068	1.0002
0.4		1.00275	1.0022
0.8		1.00645	1.0062
1.0	1.0090	1.0085	1.0082
4.0	1.0380	1.0375	
8.0	1.0790	1.0785	
12.0	1.1235	1.1220	
16.0	1.1690	1.1675	
20.0	1.2150	1.2135	

TABLE 2-55 Hydrogen Bromide (HBr)

%	<i>d</i> ₄ ⁴	<i>d</i> ₄ ¹⁰	<i>d</i> ₄ ²⁵
1.0	1.0073	1.0068	1.0041
2.0	1.0146	1.0139	1.0111
4.0	1.0295	1.0285	1.0255
6.0	1.0448	1.0435	1.0402
8.0	1.0604	1.0589	1.0552
10.0	1.0764	1.0747	1.0707
12.0	1.0928	1.0910	1.0867
14.0	1.1097	1.1078	1.1032
16.0	1.1272	1.1251	1.1202
18.0	1.1453	1.1430	1.1377
20.0	1.1640	1.1615	1.1557
22.0	1.1832	1.1806	1.1743
24.0	1.2030	1.2003	1.1935
26.0	1.2235	1.2206	1.2134
28.0	1.2446	1.2415	1.2340
30.0	1.2663	1.2630	1.2552
40.0	1.3877	1.3838	1.3736
50.0	1.5305	1.5257	1.5127
60.0	1.6950	1.6892	1.6731
65.0	1.7854	1.7792	1.7613

TABLE 2-56 Hydrogen Cyanide (HCN)

%	<i>d</i> ₄ ¹⁵
1	.998
2	.996
4	.993
8	.984
12	.971
16	.956
82	.752
90	.724
100	.691

TABLE 2-60 Hydrofluosilic Acid (H₂SiF₆)

%	<i>d</i> ₄ ^{17.5}	%	<i>d</i> ₄ ^{17.5}
1	1.0080	16	1.1373
2	1.0161	20	1.1748
4	1.0324	25	1.2235
8	1.0661	30	1.2742
12	1.1011	34	1.3162

TABLE 2-61 Magnesium Chloride (MgCl₂)

%	0°C	20°C	40°C	60°C	80°C	100°C
2	1.0168	1.0146	1.0084	0.9995	0.9883	0.9753
4	1.0338	1.0311	1.0248	1.0159	1.0050	.9923
8	1.0683	1.0646	1.0580	1.0493	1.0388	1.0269
12	1.1035	1.0989	1.0921	1.0836	1.0735	1.0622
16	1.1395	1.1342	1.1272	1.1188	1.1092	1.0984
20	1.1764	1.1706	1.1635	1.1552	1.1460	1.1359
25	1.2246	1.2184	1.2111	1.2031	1.1942	1.1847
30	1.2754	1.2688	1.2614	1.2535	1.2451	1.2360

TABLE 2-62 Magnesium Sulfate (MgSO₄)

%	0°C	20°C	30°C	40°C	50°C	60°C	80°C
2	1.0210	1.0186	1.0158	1.0123	1.0081	1.0032	0.9916
4	1.0423	1.0392	1.0362	1.0326	1.0283	1.0234	1.0118
8	1.0858	1.0816	1.0782	1.0743	1.0700	1.0650	1.0534
12	1.1309	1.1256	1.1220	1.1179	1.1135	1.1083	1.0968
16	1.1777	1.1717	1.1679	1.1637	1.1592		
20	1.2264	1.2198	1.2159	1.2117	1.2072		
26	1.3032	1.2961	1.2922	1.2879	1.2836		

TABLE 2-57 Hydrogen Chloride (HCl)

%	-5°C	0°C	10°C	20°C	40°C	60°C	80°C	100°C
1	1.0048	1.0052	1.0048	1.0032	0.9970	0.9881	0.9768	0.9636
2	1.0104	1.0106	1.0100	1.0082	1.0019	.9930	0.9819	.9688
4	1.0213	1.0213	1.0202	1.0181	1.0116	1.0026	0.9919	.9791
6	1.0321	1.0319	1.0303	1.0279	1.0211	1.0121	1.0016	.9892
8	1.0428	1.0423	1.0403	1.0376	1.0305	1.0215	1.0111	.9992
10	1.0536	1.0528	1.0504	1.0474	1.0400	1.0310	1.0206	1.0090
12	1.0645	1.0634	1.0607	1.0574	1.0497	1.0406	1.0302	1.0188
14	1.0754	1.0741	1.0711	1.0675	1.0594	1.0502	1.0398	1.0286
16	1.0864	1.0849	1.0815	1.0776	1.0692	1.0598	1.0494	1.0383
18	1.0975	1.0958	1.0920	1.0878	1.0790	1.0694	1.0590	1.0479
20	1.1087	1.1067	1.1025	1.0980	1.0888	1.0790	1.0685	1.0574
22	1.1200	1.1177	1.1131	1.1083	1.0986	1.0886	1.0780	1.0668
24	1.1314	1.1287	1.1238	1.1187	1.1085	1.0982	1.0874	1.0761
26	1.1426	1.1396	1.1344	1.1290	1.1183	1.1076	1.0967	1.0853
28	1.1537	1.1505	1.1449	1.1392	1.1280	1.1169	1.1058	1.0942
30	1.1648	1.1613	1.1553	1.1493	1.1376	1.1260	1.1149	1.1030
32				1.1593				
34				1.1691				
36				1.1789				
38				1.1885				
40				1.1980				

TABLE 2-63 Nickel Chloride (NiCl₂)

%	<i>d</i> ₄ ¹⁸
1	1.0082
2	1.0179
4	1.0375
8	1.0785
12	1.1217
16	1.1674
20	1.2163
30	1.353

TABLE 2-64 Nickel Nitrate [Ni(NO₃)₂]

%	<i>d</i> ₄ ²⁰
1	1.0065
2	1.0150
4	1.0325
8	1.0688
12	1.1070
16	1.1480
20	1.191
30	1.311
35	1.377

TABLE 2-65 Nickel Sulfate (NiSO₄)

%	<i>d</i> ₄ ¹⁸
1	1.0091
2	1.0198
4	1.0415
8	1.0852
12	1.1325
16	1.1825
18	1.2090

TABLE 2-66 Nitric Acid (HNO₃)

%	0°C	5°C	10°C	15°C	20°C	25°C	30°C	40°C	50°C	60°C	80°C	100°C
1	1.0058	1.00572	1.00534	1.00464	1.00364	1.00241	1.0009	0.9973	0.9931	0.9882	0.9767	0.9632
2	1.0117	1.01149	1.01099	1.01018	1.00909	1.00778	1.0061	1.0025	.9982	.9932	.9816	.9681
3	1.0176	1.01730	1.01668	1.01576	1.01457	1.01318	1.0114	1.0077	1.0033	.9982	.9865	.9730
4	1.0236	1.02315	1.02240	1.02137	1.02008	1.01861	1.0168	1.0129	1.0084	1.0033	.9915	.9779
5	1.0296	1.02904	1.02816	1.02702	1.02563	1.02408	1.0222	1.0182	1.0136	1.0084	.9965	.9829
6	1.0357	1.03497	1.03397	1.03272	1.03122	1.02958	1.0277	1.0235	1.0188	1.0136	1.0015	.9879
7	1.0418	1.0410	1.0399	1.0385	1.0369	1.0352	1.0333	1.0289	1.0241	1.0188	1.0066	.9929
8	1.0480	1.0471	1.0458	1.0443	1.0427	1.0409	1.0389	1.0344	1.0295	1.0241	1.0117	.9980
9	1.0543	1.0532	1.0518	1.0502	1.0485	1.0466	1.0446	1.0399	1.0349	1.0294	1.0169	1.0032
10	1.0606	1.0594	1.0578	1.0561	1.0543	1.0523	1.0503	1.0455	1.0403	1.0347	1.0221	1.0083
11	1.0669	1.0656	1.0639	1.0621	1.0602	1.0581	1.0560	1.0511	1.0458	1.0401	1.0273	1.0134
12	1.0733	1.0718	1.0700	1.0681	1.0661	1.0640	1.0618	1.0567	1.0513	1.0455	1.0326	1.0186
13	1.0797	1.0781	1.0762	1.0742	1.0721	1.0699	1.0676	1.0624	1.0568	1.0509	1.0379	1.0238
14	1.0862	1.0845	1.0824	1.0803	1.0781	1.0758	1.0735	1.0681	1.0624	1.0564	1.0432	1.0289
15	1.0927	1.0909	1.0887	1.0865	1.0842	1.0818	1.0794	1.0739	1.0680	1.0619	1.0485	1.0341
16	1.0992	1.0973	1.0950	1.0927	1.0903	1.0879	1.0854	1.0797	1.0737	1.0675	1.0538	1.0393
17	1.1057	1.1038	1.1014	1.0989	1.0964	1.0940	1.0914	1.0855	1.0794	1.0731	1.0592	1.0444
18	1.1123	1.1103	1.1078	1.1052	1.1026	1.1001	1.0974	1.0913	1.0851	1.0787	1.0646	1.0496
19	1.1189	1.1168	1.1142	1.1115	1.1088	1.1062	1.1034	1.0972	1.0908	1.0843	1.0700	1.0547
20	1.1255	1.1234	1.1206	1.1178	1.1150	1.1123	1.1094	1.1031	1.0966	1.0899	1.0754	1.0598
21	1.1322	1.1300	1.1271	1.1242	1.1213	1.1185	1.1155	1.1090	1.1024	1.0956	1.0808	1.0650
22	1.1389	1.1366	1.1336	1.1306	1.1276	1.1247	1.1217	1.1150	1.1083	1.1013	1.0862	1.0701
23	1.1457	1.1433	1.1402	1.1371	1.1340	1.1310	1.1280	1.1210	1.1142	1.1070	1.0917	1.0753
24	1.1525	1.1501	1.1469	1.1437	1.1404	1.1374	1.1343	1.1271	1.1201	1.1127	1.0972	1.0805
25	1.1594	1.1569	1.1536	1.1503	1.1469	1.1438	1.1406	1.1332	1.1260	1.1185	1.1027	1.0857
26	1.1663	1.1638	1.1603	1.1569	1.1534	1.1502	1.1469	1.1394	1.1320	1.1244	1.1083	1.0910
27	1.1733	1.1707	1.1670	1.1635	1.1600	1.1566	1.1533	1.1456	1.1381	1.1303	1.1139	1.0963
28	1.1803	1.1777	1.1738	1.1702	1.1666	1.1631	1.1597	1.1519	1.1442	1.1362	1.1195	1.1016
29	1.1874	1.1847	1.1807	1.1770	1.1733	1.1697	1.1662	1.1582	1.1503	1.1422	1.1251	1.1069
30	1.1945	1.1917	1.1876	1.1838	1.1800	1.1763	1.1727	1.1645	1.1564	1.1482	1.1307	1.1122
31	1.2016	1.1988	1.1945	1.1906	1.1867	1.1829	1.1792	1.1708	1.1625	1.1542	1.1363	1.1175
32	1.2088	1.2059	1.2014	1.1974	1.1934	1.1896	1.1857	1.1772	1.1687	1.1602	1.1419	1.1228
33	1.2160	1.2131	1.2084	1.2043	1.2002	1.1963	1.1922	1.1836	1.1749	1.1662	1.1476	1.1281
34	1.2233	1.2203	1.2155	1.2113	1.2071	1.2030	1.1988	1.1901	1.1812	1.1723	1.1533	1.1335
35	1.2306	1.2275	1.2227	1.2183	1.2140	1.2098	1.2055	1.1966	1.1876	1.1784	1.1591	1.1390
36	1.2375	1.2344	1.2294	1.2249	1.2205	1.2163	1.2119	1.2028	1.1936	1.1842	1.1645	1.1440
37	1.2444	1.2412	1.2361	1.2315	1.2270	1.2227	1.2182	1.2089	1.1995	1.1899	1.1699	1.1490
38	1.2513	1.2479	1.2428	1.2381	1.2335	1.2291	1.2245	1.2150	1.2054	1.1956	1.1752	1.1540
39	1.2581	1.2546	1.2494	1.2446	1.2399	1.2354	1.2308	1.2210	1.2112	1.2013	1.1805	1.1589
40	1.2649	1.2613	1.2560	1.2511	1.2463	1.2417	1.2370	1.2270	1.2170	1.2069	1.1858	1.1638
41	1.2717	1.2680	1.2626	1.2576	1.2527	1.2480	1.2432	1.2330	1.2229	1.2126	1.1911	1.1687
42	1.2786	1.2747	1.2692	1.2641	1.2591	1.2543	1.2494	1.2390	1.2287	1.2182	1.1963	1.1735
43	1.2854	1.2814	1.2758	1.2706	1.2655	1.2606	1.2556	1.2450	1.2345	1.2238	1.2015	1.1783
44	1.2922	1.2880	1.2824	1.2771	1.2719	1.2669	1.2618	1.2510	1.2403	1.2294	1.2067	1.1831
45	1.2990	1.2947	1.2890	1.2836	1.2783	1.2732	1.2680	1.2570	1.2461	1.2350	1.2119	1.1879
46	1.3058	1.3014	1.2955	1.2901	1.2847	1.2795	1.2742	1.2630	1.2519	1.2406	1.2171	1.1927
47	1.3126	1.3080	1.3021	1.2966	1.2911	1.2858	1.2804	1.2690	1.2577	1.2462	1.2223	1.1976
48	1.3194	1.3147	1.3087	1.3031	1.2975	1.2921	1.2867	1.2750	1.2635	1.2518	1.2275	1.2024
49	1.3263	1.3214	1.3153	1.3096	1.3040	1.2984	1.2929	1.2811	1.2693	1.2575	1.2328	1.2073
50	1.3327	1.3277	1.3215	1.3157	1.3100	1.3043	1.2987	1.2867	1.2748	1.2628	1.2377	1.2118
51	1.3391	1.3339	1.3277	1.3218	1.3160	1.3102	1.3045	1.2923	1.2802	1.2680	1.2425	1.2163
52	1.3454	1.3401	1.3338	1.3278	1.3219	1.3160	1.3102	1.2978	1.2856	1.2731	1.2473	1.2208
53	1.3517	1.3462	1.3399	1.3338	1.3278	1.3218	1.3159	1.3033	1.2909	1.2782	1.2521	1.2252
54	1.3579	1.3523	1.3459	1.3397	1.3336	1.3275	1.3215	1.3087	1.2961	1.2833	1.2568	1.2296
55	1.3640	1.3583	1.3518	1.3455	1.3393	1.3331	1.3270	1.3141	1.3013	1.2883	1.2615	1.2339
56	1.3700	1.3642	1.3576	1.3512	1.3449	1.3386	1.3324	1.3194	1.3064	1.2932	1.2661	1.2382
57	1.3759	1.3700	1.3634	1.3569	1.3505	1.3441	1.3377	1.3246	1.3114	1.2981	1.2706	1.2424
58	1.3818	1.3757	1.3691	1.3625	1.3560	1.3495	1.3430	1.3298	1.3164	1.3029	1.2751	1.2466
59	1.3875	1.3813	1.3747	1.3680	1.3614	1.3548	1.3482	1.3348	1.3213	1.3077	1.2795	1.2507
60	1.3931	1.3868	1.3801	1.3734	1.3667	1.3600	1.3533	1.3398	1.3261	1.3124	1.2839	1.2547
61	1.3986	1.3922	1.3855	1.3787	1.3719	1.3651	1.3583	1.3447	1.3308	1.3169	1.2881	1.2587
62	1.4039	1.3975	1.3907	1.3838	1.3769	1.3700	1.3632	1.3494	1.3354	1.3213	1.2922	1.2625
63	1.4091	1.4027	1.3958	1.3888	1.3818	1.3748	1.3679	1.3540	1.3398	1.3255	1.2962	1.2661
64		1.4078	1.4007	1.3936	1.3866	1.3795	1.3725					

TABLE 2-66 Nitric Acid (HNO₃) (Concluded)

%	0°C	5°C	10°C	15°C	20°C	25°C	30°C	40°C	50°C	60°C	80°C	100°C
65		1.4128	1.4055	1.3984	1.3913	1.3841	1.3770					
66		1.4177	1.4103	1.4031	1.3959	1.3887	1.3814					
67		1.4224	1.4150	1.4077	1.4004	1.3932	1.3857					
68		1.4271	1.4196	1.4122	1.4048	1.3976	1.3900					
69		1.4317	1.4241	1.4166	1.4091	1.4019	1.3942					
70		1.4362	1.4285	1.4210	1.4134	1.4061	1.3983					
71		1.4406	1.4328	1.4252	1.4176	1.4102	1.4023					
72		1.4449	1.4371	1.4294	1.4218	1.4142	1.4063					
73		1.4491	1.4413	1.4335	1.4258	1.4182	1.4103					
74		1.4532	1.4454	1.4376	1.4298	1.4221	1.4142					
75		1.4573	1.4494	1.4415	1.4337	1.4259	1.4180					
76		1.4613	1.4533	1.4454	1.4375	1.4296	1.4217					
77		1.4652	1.4572	1.4492	1.4413	1.4333	1.4253					
78		1.4690	1.4610	1.4529	1.4450	1.4369	1.4288					
79		1.4727	1.4647	1.4565	1.4486	1.4404	1.4323					
80		1.4764	1.4683	1.4601	1.4521	1.4439	1.4357					
81		1.4800	1.4718	1.4636	1.4555	1.4473	1.4391					
82		1.4835	1.4753	1.4670	1.4589	1.4507	1.4424					
83		1.4869	1.4787	1.4704	1.4622	1.4540	1.4456					
84		1.4903	1.4820	1.4737	1.4655	1.4572	1.4487					
85		1.4936	1.4852	1.4769	1.4686	1.4603	1.4518					
86		1.4968	1.4883	1.4799	1.4716	1.4633	1.4548					
87		1.4999	1.4913	1.4829	1.4745	1.4662	1.4577					
88		1.5029	1.4942	1.4858	1.4773	1.4690	1.4605					
89		1.5058	1.4970	1.4885	1.4800	1.4716	1.4631					
90		1.5085	1.4997	1.4911	1.4826	1.4741	1.4656					
91		1.5111	1.5023	1.4936	1.4850	1.4766	1.4681					
92		1.5136	1.5048	1.4960	1.4873	1.4789	1.4704					
93		1.5156	1.5068	1.4979	1.4892	1.4807	1.4722					
94		1.5177	1.5088	1.4999	1.4912	1.4826	1.4741					
95		1.5198	1.5109	1.5019	1.4932	1.4846	1.4761					
96		1.5220	1.5130	1.5040	1.4952	1.4867	1.4781					
97		1.5244	1.5152	1.5062	1.4974	1.4889	1.4802					
98		1.5278	1.5187	1.5096	1.5008	1.4922	1.4835					
99		1.5327	1.5235	1.5144	1.5056	1.4969	1.4881					
100		1.5402	1.5310	1.5217	1.5129	1.5040	1.4952					

TABLE 2-67 Perchloric Acid (HClO₄)

%	d_4^{15}	d_4^{20}	d_4^{25}	d_4^{50}	%	d_4^{15}	d_4^{20}	d_4^{50}
1	1.0050		1.0020	0.9933	28	1.1900	1.1851	1.1645
2	1.0109		1.0070	0.9986	30	1.2067	1.2013	1.1800
4	1.0228		1.0169	0.9906	32	1.2239	1.2183	1.1960
6	1.0348		1.0270	1.0205	34	1.2418	1.2359	1.2130
8	1.0471		1.0372	1.0320	36	1.2603	1.2542	1.2310
10	1.0597		1.0475	1.0440	38	1.2794	1.2732	1.2490
12	1.0726			1.0560	40	1.2991	1.2927	1.2680
14	1.0589			1.0680	45	1.3521	1.3450	1.3180
16	1.0995			1.0810	50	1.4103	1.4018	1.3730
18	1.1135			1.0940	55	1.4733	1.4636	1.4320
20	1.1279			1.1070	60	1.5389	1.5298	1.4950
22	1.1428			1.1205	65	1.6059	1.5986	1.5620
24	1.1581			1.1345	70	1.6736	1.6680	1.6290
26	1.1738	1.1697		1.1490				

TABLE 2-68 Phosphoric Acid (H₃PO₄)

°C	2%	6%	14%	20%	26%	35%	50%	75%	100%
0	1.0113	1.0339	1.0811	1.1192					
10	1.0109	1.0330	1.0792	1.1167	1.1567	1.221	1.341		
20	1.0092	1.0309	1.0764	1.1134	1.1529	1.216	1.335	1.579	1.870
30	1.0065	1.0279	1.0728	1.1094	1.1484	1.211	1.329	1.572	1.862
40	1.0029	1.0241	1.0685	1.1048					

TABLE 2-69 Potassium Bicarbonate (KHCO₃)

°C	1%	2%	4%	6%	8%	10%
0	1.0066	1.0134	1.0270			
10	1.0064	1.0132	1.0268			
15	1.0058	1.0125	1.0260	1.0396	1.0534	1.0674
20	1.0049	1.0117	1.0252			
30	1.0024	1.0092	1.0228			
40	0.9990	1.0058	1.0195			
50	.9949	1.0017	1.0154			
60	.9901	0.9969	1.0106			
80	.9786	.9855	0.9993			
100	.9653	.9722	.9860			

TABLE 2-70 Potassium Bromide (KBr)

%	d_4^{20}
1	1.0054
2	1.0127
6	1.0426
12	1.0903
20	1.1601
30	1.2593
40	1.3746

TABLE 2-71 Potassium Carbonate (K₂CO₃)

%	0°C	10°C	20°C	40°C	60°C	80°C	100°C
1	1.0094	1.0089	1.0072	1.0010	0.9919	0.9803	0.9670
2	1.0189	1.0182	1.0163	1.0098	1.0005	.9889	.9756
4	1.0381	1.0369	1.0345	1.0276	1.0180	1.0063	.9951
8	1.0768	1.0746	1.0715	1.0640	1.0538	1.0418	1.0291
12	1.1160	1.1131	1.1096	1.1013	1.0906	1.0786	1.0663
16	1.1562	1.1530	1.1490	1.1399	1.1290	1.1170	1.1049
20	1.1977	1.1941	1.1898	1.1801	1.1690	1.1570	1.1451
24	1.2405	1.2366	1.2320	1.2219	1.2106	1.1986	1.1869
28	1.2846	1.2804	1.2756	1.2652	1.2538	1.2418	1.2301
30	1.3071	1.3028	1.2979	1.2873	1.2759	1.2640	1.2522
35	1.3646	1.3600	1.3548	1.3440	1.3324	1.3206	1.3089
40	1.4244	1.4195	1.4141	1.4029	1.3913	1.3795	1.3678
45	1.4867	1.4815	1.4759	1.4644	1.4528	1.4408	1.4290
50	1.5517	1.5462	1.5404	1.5285	1.5169	1.5048	1.4928

TABLE 2-72 Potassium Chromate (K₂CrO₄)

%	d ₄ ¹⁵	d ₄ ¹⁸
1	1.0073	1.0066
2	1.0155	1.0147
4	1.0321	1.0311
8	1.0659	1.0647
12	1.1009	1.0999
16		1.1366
20		1.1748
24		1.2147
28		1.2566
30		1.2784

TABLE 2-73 Potassium Chlorate (KClO₃)

°C	1%	2%	3%	4%
0	1.0061	1.0124	1.0189	1.0256
10	1.0059	1.0122	1.0187	1.0254
20	1.0045	1.0109	1.0174	1.0241
30	1.0020	1.0085	1.0151	1.0218
40	0.9986	1.0051	1.0116	1.0183
60	.9895	0.9959	1.0024	1.0091
80	.9781	.9845	0.9910	0.9977
100	.9646	.9709	.9774	.9840

TABLE 2-74 Potassium Chloride (KCl)

%	0°C	20°C	25°C	40°C	60°C	80°C	100°C
1.0	1.00661	1.00462	1.00342	0.99847	0.9894	0.9780	0.9646
2.0	1.01335	1.01103	1.00977	1.00471	.9956	.9842	.9708
4.0	1.02690	1.02391	1.02255	1.01727	1.0080	.9966	.9634
8.0	1.05431	1.05003	1.04847	1.04278	1.0333	1.0219	1.0888
12.0	1.08222	1.07679	1.07506	1.06897	1.0592	1.0478	1.0350
16.0	1.11068	1.10434	1.10245	1.09600	1.0861	1.0746	1.0619
20.0	1.13973	1.13280	1.13072	1.12399	1.1138	1.1024	1.0897
24.0		1.16226	1.15995	1.15299	1.1425	1.1311	1.1185
28.0				1.18304	1.1723	1.1609	1.1483
%	110°C	120°C	130°C	140°C			
3.79	0.9733	0.9663	0.9583	0.9502			
7.45	.9978	.9899	.9827	.9745			
13.62	1.0388	1.0313	1.0238	1.0159			

TABLE 2-75 Potassium Chrome Alum [K₂Cr₂(SO₄)₄]

%	d ₄ ¹⁵
1	1.007
2	1.016
6	1.052
10	1.089
14	1.129
20	1.193
30	1.315
40	1.456
50	1.615

TABLE 2-76 Potassium Hydroxide (KOH)

%	d ₄ ¹⁵
1.0	1.0083
2.0	1.0175
4.0	1.0359
6.0	1.0544
8.0	1.0730
10.0	1.0918
15.0	1.1396
20.0	1.1884
25.0	1.2387
30.0	1.2905
35.0	1.3440
40.0	1.3991
45.0	1.4558
50.0	1.5143
51.7	1.5355 (sat'd. soln.)

TABLE 2-77 Potassium Nitrate (KNO₃)

%	0°C	10°C	20°C	40°C	60°C	80°C	100°C
1	1.00654	1.00615	1.00447	0.99825	0.9890	0.9776	0.9641
2	1.01326	1.01262	1.01075	1.00430	.9949	.9834	.9699
4	1.02677	1.02566	1.02344	1.01652	1.0068	.9951	.9816
8	1.05419	1.05226	1.04940	1.04152	1.0313	1.0192	1.0056
12	1.08221	1.07963	1.07620	1.06740	1.0567	1.0442	1.0304
16			1.10392	1.09432	1.0831	1.0703	1.0562
20			1.13261	1.12240	1.1106	1.0974	1.0831
24			1.16233	1.15175	1.1391	1.1256	1.1110

TABLE 2-78 Potassium Dichromate (K₂Cr₂O₇)

%	d ₄ ²⁰
1	1.0052
2	1.0122
4	1.0264
6	1.0408
8	1.0554
10	1.0703

TABLE 2-79 Potassium Sulfate (K₂SO₄)

%	d ₄ ²⁰
1	1.0063
2	1.0145
4	1.0310
6	1.0477
8	1.0646
10	1.0817

TABLE 2-80 Potassium Sulfite (K₂SO₃)

%	d ₄ ¹⁵
1	1.0073
2	1.0155
4	1.0322
8	1.0667
12	1.1026
16	1.1402
20	1.1793
24	1.2197
26	1.2404

TABLE 2-81 Sodium Acetate (NaC₂H₃O₂)

%	d ₄ ²⁰
1	1.0033
2	1.0084
4	1.0186
8	1.0392
12	1.0598
18	1.0807
20	1.1021
26	1.1351
28	1.1462

TABLE 2-82 Sodium Arsenate (Na₃AsO₄)

%	d ₄ ¹⁷
1	1.0097
2	1.0207
4	1.0431
8	1.0892
10	1.1130
12	1.1373

TABLE 2-83 Sodium Bichromate (Na₂Cr₂O₇)

%	d ₄ ¹⁵
1	1.006
2	1.013
4	1.027
8	1.056
12	1.084
16	1.112
20	1.140
24	1.166
28	1.193
30	1.207
35	1.244
40	1.279
45	1.312
50	1.342

TABLE 2-84 Sodium Bromide (NaBr)

%	d ₄ ¹⁷
1	1.0060
2	1.0139
4	1.0298
8	1.0631
10	1.0803
12	1.0981
20	1.1745
30	1.2841
40	1.4138

TABLE 2-85 Sodium Formate (HCOONa)

%	d ₄ ²⁵
1	1.003
2	1.009
4	1.022
8	1.048
12	1.074
16	1.100
20	1.127
24	1.155
28	1.184
30	1.199
35	1.236
40	1.274

TABLE 2-86 Sodium Carbonate (Na₂CO₃)

%	0°C	10°C	20°C	30°C	40°C	60°C	80°C	100°C
1	1.0109	1.0103	1.0086	1.0058	1.0022	0.9929	0.9814	0.9683
2	1.0219	1.0210	1.0190	1.0159	1.0122	1.0027	.9910	.9782
4	1.0439	1.0423	1.0398	1.0363	1.0323	1.0223	1.0105	.9980
8	1.0878	1.0850	1.0816	1.0775	1.0732	1.0625	1.0503	1.0380
12	1.1319	1.1284	1.1244	1.1200	1.1150	1.1039	1.0914	1.0787
14	1.1543	1.1506	1.1463	1.1417	1.1365	1.1251	1.1125	1.0996
16				1.1636				
18				1.1859				
20				1.2086				
24				1.2552				
28				1.3031				
30				1.3274				

TABLE 2-87 Sodium Chlorate (NaClO₃)

%	d_4^{18}	%	d_4^{18}
1	1.0053	18	1.1288
2	1.0121	20	1.1449
4	1.0258	22	1.1614
6	1.0397	24	1.1782
8	1.0538	26	1.1953
10	1.0681	28	1.2128
12	1.0827	30	1.2307
14	1.0977	32	1.2491
16	1.1131	34	1.2680

TABLE 2-88 Sodium Chloride (NaCl)

%	0°C	10°C	25°C	40°C	60°C	80°C	100°C
1	1.00747	1.00707	1.00409	0.99908	0.9900	0.9785	0.9651
2	1.01509	1.01442	1.01112	1.00593	.9967	.9852	.9719
4	1.03038	1.02920	1.02530	1.01977	1.0103	.9988	.9855
8	1.06121	1.05907	1.05412	1.04798	1.0381	1.0264	1.0134
12	1.09244	1.08946	1.08365	1.07699	1.0667	1.0549	1.0420
16	1.12419	1.12056	1.11401	1.10688	1.0962	1.0842	1.0713
20	1.15663	1.15254	1.14533	1.13774	1.1268	1.1146	1.1017
24	1.18999	1.18557	1.17776	1.16971	1.1584	1.1463	1.1331
26	1.20709	1.20254	1.19443	1.18614	1.1747	1.1626	1.1492

TABLE 2-89 Sodium Chromate (Na₂CrO₄)

%	d_4^{18}
1	1.0074
2	1.0164
4	1.0344
8	1.0718
12	1.1110
16	1.1518
20	1.1942
24	1.2383
26	1.2611

TABLE 2-90 Sodium Hydroxide (NaOH)

%	0°C	15°C	20°C	40°C	60°C	80°C	100°C
1	1.0124	1.01065	1.0095	1.0033	0.9941	0.9824	0.9693
2	1.0244	1.02198	1.0207	1.0139	1.0045	.9929	.9797
4	1.0482	1.04441	1.0428	1.0352	1.0254	1.0139	1.0009
8	1.0943	1.08887	1.0869	1.0780	1.0676	1.0560	1.0432
12	1.1399	1.13327	1.1309	1.1210	1.1101	1.0983	1.0855
16	1.1849	1.17761	1.1751	1.1645	1.1531	1.1408	1.1277
20	1.2296	1.22183	1.2191	1.2079	1.1960	1.1833	1.1700
24	1.2741	1.26582	1.2629	1.2512	1.2388	1.2259	1.2124
28	1.3182	1.3094	1.3064	1.2942	1.2814	1.2682	1.2546
32	1.3614	1.3520	1.3490	1.3362	1.3232	1.3097	1.2960
36	1.4030	1.3933	1.3900	1.3768	1.3634	1.3498	1.3360
40	1.4435	1.4334	1.4300	1.4164	1.4027	1.3889	1.3750
44	1.4825	1.4720	1.4685	1.4545	1.4405	1.4266	1.4127
48	1.5210	1.5102	1.5065	1.4922	1.4781	1.4641	1.4503
50	1.5400	1.5290	1.5253	1.5109	1.4967	1.4827	1.4690

TABLE 2-91 Sodium Nitrate (NaNO₃)

%	0°C	20°C	40°C	60°C	80°C	100°C
1	1.0071	1.0049	0.9986	0.9894	0.9779	0.9644
2	1.0144	1.0117	1.0050	.9956	.9840	.9704
4	1.0290	1.0254	1.0180	1.0082	.9964	.9826
8	1.0587	1.0532	1.0447	1.0340	1.0218	1.0078
12	1.0891	1.0819	1.0724	1.0609	1.0481	1.0340
16	1.1203	1.1118	1.1013	1.0892	1.0757	1.0614
20	1.1526	1.1429	1.1314	1.1187	1.1048	1.0901
24	1.1860	1.1752	1.1629	1.1496	1.1351	1.1200
28	1.2204	1.2085	1.1955	1.1816	1.1667	1.1513
30	1.2380	1.2256	1.2122	1.1980	1.1830	1.1674
35	1.2834	1.2701	1.2560	1.2413	1.2258	1.2100
40	1.3316	1.3175	1.3027	1.2875	1.2715	1.2555
45		1.3683	1.3528	1.3371	1.3206	1.3044

TABLE 2-92 Sodium Nitrite (NaNO₂)

%	d_4^{15}
1	1.0058
2	1.0125
4	1.0260
8	1.0535
12	1.0816
16	1.1103
20	1.1394

TABLE 2-93 Sodium Silicates

Formula	Concentration, %													
	1	2	4	8	10	14	20	24	30	36	40	45	50	
	d_4^{20}													
Na ₂ O/3.9SiO ₂	1.006	1.014	1.030	1.063	1.080	1.116	1.172	1.211	1.275					
Na ₂ O/3.36SiO ₂	1.006	1.014	1.030	1.065	1.083	1.120	1.179	1.222	1.290	1.365				
Na ₂ O/2.40SiO ₂	1.007	1.016	1.034	1.071	1.090	1.130								
Na ₂ O/2.44SiO ₂									1.309	1.387	1.445			
Na ₂ O/2.06SiO ₂	1.007	1.016	1.035	1.073	1.093	1.134	1.200	1.247	1.321	1.397	1.450	1.520	1.594	
Na ₂ O/1.69SiO ₂	1.007	1.017	1.036	1.077	1.098	1.141	1.210	1.259	1.337	1.424				

TABLE 2-94 Sodium Sulfate (Na₂SO₄)

%	0°C	20°C	30°C	40°C	60°C	80°C	100°C
1	1.0094	1.0073	1.0046	1.0010	0.9919	0.9805	0.9671
2	1.0189	1.0164	1.0135	1.0098	1.0007	.9892	.9758
4	1.0381	1.0348	1.0315	1.0276	1.0184	1.0068	.9934
8	1.0773	1.0724	1.0682	1.0639	1.0544	1.0426	1.0292
12	1.1174	1.1109	1.1062	1.1015	1.0915	1.0795	1.0661
16	1.1585	1.1586	1.1456	1.1406	1.1299	1.1176	1.1042
20	1.2008	1.1915	1.1865	1.1813	1.1696	1.1569	
24	1.2443	1.2336	1.2292	1.2237			

TABLE 2-95 Sodium Sulfide (Na₂S)

%	d_4^{18}
1	1.0098
2	1.0211
4	1.0440
8	1.0907
12	1.1388
16	1.1885
18	1.2140

TABLE 2-96 Sodium Sulfite (Na₂SO₃)

%	d_4^{19}
1	1.0078
2	1.0172
4	1.0363
8	1.0751
12	1.1146
16	1.1549
18	1.1755

TABLE 2-97 Sodium Thiosulfate (Na₂S₂O₃)

%	d_4^{20}
1	1.0065
2	1.0148
4	1.0315
8	1.0654
12	1.1003
16	1.1365
20	1.1740
24	1.2128
28	1.2532
30	1.2739
35	1.3273
40	1.3827

TABLE 2-98 Sodium Thiosulfate Pentahydrate (Na₂S₂O₃·5H₂O)

%	d_4^{19}
1	1.0052
2	1.0105
4	1.0211
8	1.0423
12	1.0639
16	1.0863
20	1.1087
24	1.1322
28	1.1558
30	1.1676
40	1.2297
50	1.2954

TABLE 2-99 Stannic Chloride (SnCl₄)

%	d_4^{15}
1	1.007
2	1.015
4	1.031
8	1.064
12	1.099
16	1.135
20	1.173
24	1.212
28	1.255
30	1.278
35	1.337
40	1.403
45	1.475
50	1.555
55	1.644
60	1.742
65	1.851
70	1.971

TABLE 2-100 Stannous Chloride (SnCl₂)

%	d_4^{15}
1	1.0068
2	1.0146
4	1.0306
8	1.0638
12	1.0986
16	1.1353
20	1.1743
24	1.2159
28	1.2603
30	1.2837
35	1.3461
40	1.4145
45	1.4897
50	1.5729
55	1.6656
60	1.7695
65	1.8865

TABLE 2-101 Sulfuric Acid (H₂SO₄)

%	0°C	10°C	15°C	20°C	25°C	30°C	40°C	50°C	60°C	80°C	100°C
1	1.0074	1.0068	1.0060	1.0051	1.0038	1.0022	0.9986	0.9944	0.9895	0.9779	0.9645
2	1.0147	1.0138	1.0129	1.0118	1.0104	1.0087	1.0050	1.0006	.9956	.9839	.9705
3	1.0219	1.0206	1.0197	1.0184	1.0169	1.0152	1.0113	1.0067	1.0017	.9900	.9766
4	1.0291	1.0275	1.0264	1.0250	1.0234	1.0216	1.0176	1.0129	1.0078	.9961	.9827
5	1.0364	1.0344	1.0332	1.0317	1.0300	1.0281	1.0240	1.0192	1.0140	1.0022	.9888
6	1.0437	1.0414	1.0400	1.0385	1.0367	1.0347	1.0305	1.0256	1.0203	1.0084	.9950
7	1.0511	1.0485	1.0469	1.0453	1.0434	1.0414	1.0371	1.0321	1.0266	1.0146	1.0013
8	1.0585	1.0556	1.0539	1.0522	1.0502	1.0481	1.0437	1.0386	1.0330	1.0209	1.0076
9	1.0660	1.0628	1.0610	1.0591	1.0571	1.0549	1.0503	1.0451	1.0395	1.0273	1.0140
10	1.0735	1.0700	1.0681	1.0661	1.0640	1.0617	1.0570	1.0517	1.0460	1.0338	1.0204
11	1.0810	1.0773	1.0753	1.0731	1.0710	1.0686	1.0637	1.0584	1.0526	1.0403	1.0269
12	1.0886	1.0846	1.0825	1.0802	1.0780	1.0756	1.0705	1.0651	1.0593	1.0469	1.0335
13	1.0962	1.0920	1.0898	1.0874	1.0851	1.0826	1.0774	1.0719	1.0661	1.0536	1.0402
14	1.1039	1.0994	1.0971	1.0947	1.0922	1.0897	1.0844	1.0788	1.0729	1.0603	1.0469
15	1.1116	1.1069	1.1045	1.1020	1.0994	1.0968	1.0914	1.0857	1.0798	1.0671	1.0537
16	1.1194	1.1145	1.1120	1.1094	1.1067	1.1040	1.0985	1.0927	1.0868	1.0740	1.0605
17	1.1272	1.1221	1.1195	1.1168	1.1141	1.1113	1.1057	1.0998	1.0938	1.0809	1.0674
18	1.1351	1.1298	1.1271	1.1243	1.1215	1.1187	1.1129	1.1070	1.1009	1.0879	1.0744
19	1.1430	1.1375	1.1347	1.1318	1.1290	1.1261	1.1202	1.1142	1.1081	1.0950	1.0814
20	1.1510	1.1453	1.1424	1.1394	1.1365	1.1335	1.1275	1.1215	1.1153	1.1021	1.0885
21	1.1590	1.1531	1.1501	1.1471	1.1441	1.1410	1.1349	1.1288	1.1226	1.1093	1.0957
22	1.1670	1.1609	1.1579	1.1548	1.1517	1.1486	1.1424	1.1362	1.1299	1.1166	1.1029
23	1.1751	1.1688	1.1657	1.1626	1.1594	1.1563	1.1500	1.1437	1.1373	1.1239	1.1102
24	1.1832	1.1768	1.1736	1.1704	1.1672	1.1640	1.1576	1.1512	1.1448	1.1313	1.1176
25	1.1914	1.1848	1.1816	1.1783	1.1750	1.1718	1.1653	1.1588	1.1523	1.1388	1.1250
26	1.1996	1.1929	1.1896	1.1862	1.1829	1.1796	1.1730	1.1665	1.1599	1.1463	1.1325
27	1.2078	1.2010	1.1976	1.1942	1.1909	1.1875	1.1808	1.1742	1.1676	1.1539	1.1400
28	1.2160	1.2091	1.2057	1.2023	1.1989	1.1955	1.1887	1.1820	1.1753	1.1616	1.1476
29	1.2243	1.2173	1.2138	1.2104	1.2069	1.2035	1.1966	1.1898	1.1831	1.1693	1.1553
30	1.2326	1.2255	1.2220	1.2185	1.2150	1.2115	1.2046	1.1977	1.1909	1.1771	1.1630
31	1.2409	1.2338	1.2302	1.2267	1.2232	1.2196	1.2126	1.2057	1.1988	1.1849	1.1708
32	1.2493	1.2421	1.2385	1.2349	1.2314	1.2278	1.2207	1.2137	1.2068	1.1928	1.1787
33	1.2577	1.2504	1.2468	1.2432	1.2396	1.2360	1.2289	1.2218	1.2148	1.2008	1.1866
34	1.2661	1.2588	1.2552	1.2515	1.2479	1.2443	1.2371	1.2300	1.2229	1.2088	1.1946
35	1.2746	1.2672	1.2636	1.2599	1.2563	1.2526	1.2454	1.2383	1.2311	1.2169	1.2027
36	1.2831	1.2757	1.2720	1.2684	1.2647	1.2610	1.2538	1.2466	1.2394	1.2251	1.2109
37	1.2917	1.2843	1.2805	1.2769	1.2732	1.2695	1.2622	1.2550	1.2477	1.2334	1.2192
38	1.3004	1.2929	1.2891	1.2855	1.2818	1.2780	1.2707	1.2635	1.2561	1.2418	1.2276
39	1.3091	1.3016	1.2978	1.2941	1.2904	1.2866	1.2793	1.2720	1.2646	1.2503	1.2361
40	1.3179	1.3103	1.3065	1.3028	1.2991	1.2953	1.2880	1.2806	1.2732	1.2589	1.2446
41	1.3268	1.3191	1.3153	1.3116	1.3079	1.3041	1.2967	1.2893	1.2819	1.2675	1.2532
42	1.3357	1.3280	1.3242	1.3205	1.3167	1.3129	1.3055	1.2981	1.2907	1.2762	1.2619
43	1.3447	1.3370	1.3332	1.3294	1.3256	1.3218	1.3144	1.3070	1.2996	1.2850	1.2707
44	1.3538	1.3461	1.3423	1.3384	1.3346	1.3308	1.3234	1.3160	1.3086	1.2939	1.2796
45	1.3630	1.3553	1.3515	1.3476	1.3437	1.3399	1.3325	1.3251	1.3177	1.3029	1.2886
46	1.3724	1.3646	1.3608	1.3569	1.3530	1.3492	1.3417	1.3343	1.3269	1.3120	1.2976
47	1.3819	1.3740	1.3702	1.3663	1.3624	1.3586	1.3510	1.3435	1.3362	1.3212	1.3067
48	1.3915	1.3835	1.3797	1.3758	1.3719	1.3680	1.3604	1.3528	1.3455	1.3305	1.3159
49	1.4012	1.3931	1.3893	1.3854	1.3814	1.3775	1.3699	1.3623	1.3549	1.3399	1.3253
50	1.4110	1.4029	1.3990	1.3951	1.3911	1.3872	1.3795	1.3719	1.3644	1.3494	1.3348
51	1.4209	1.4128	1.4088	1.4049	1.4009	1.3970	1.3893	1.3816	1.3740	1.3590	1.3444
52	1.4310	1.4228	1.4188	1.4148	1.4109	1.4069	1.3991	1.3914	1.3837	1.3687	1.3540
53	1.4412	1.4329	1.4289	1.4248	1.4209	1.4169	1.4091	1.4013	1.3936	1.3785	1.3637
54	1.4515	1.4431	1.4391	1.4350	1.4310	1.4270	1.4191	1.4113	1.4036	1.3884	1.3735
55	1.4619	1.4535	1.4494	1.4453	1.4412	1.4372	1.4293	1.4214	1.4137	1.3984	1.3834
56	1.4724	1.4640	1.4598	1.4557	1.4516	1.4475	1.4396	1.4317	1.4239	1.4085	1.3934
57	1.4830	1.4746	1.4703	1.4662	1.4621	1.4580	1.4500	1.4420	1.4342	1.4187	1.4035
58	1.4937	1.4852	1.4809	1.4768	1.4726	1.4685	1.4604	1.4524	1.4446	1.4290	1.4137
59	1.5045	1.4959	1.4916	1.4875	1.4832	1.4791	1.4709	1.4629	1.4551	1.4393	1.4240
60	1.5154	1.5067	1.5024	1.4983	1.4940	1.4898	1.4816	1.4735	1.4656	1.4497	1.4344
61	1.5264	1.5177	1.5133	1.5091	1.5048	1.5006	1.4923	1.4842	1.4762	1.4602	1.4449
62	1.5375	1.5287	1.5243	1.5200	1.5157	1.5115	1.5031	1.4950	1.4869	1.4708	1.4554
63	1.5487	1.5398	1.5354	1.5310	1.5267	1.5225	1.5140	1.5058	1.4977	1.4815	1.4660
64	1.5600	1.5510	1.5465	1.5421	1.5378	1.5335	1.5250	1.5167	1.5086	1.4923	1.4766

TABLE 2-101 Sulfuric Acid (H₂SO₄) (Concluded)

%	0°C	10°C	15°C	20°C	25°C	30°C	40°C	50°C	60°C	80°C	100°C
65	1.5714	1.5623	1.5578	1.5533	1.5490	1.5446	1.5361	1.5277	1.5195	1.5031	1.4873
66	1.5828	1.5736	1.5691	1.5646	1.5602	1.5558	1.5472	1.5388	1.5305	1.5140	1.4981
67	1.5943	1.5850	1.5805	1.5760	1.5715	1.5671	1.5584	1.5499	1.5416	1.5249	1.5089
68	1.6059	1.5965	1.5920	1.5874	1.5829	1.5785	1.5697	1.5611	1.5528	1.5359	1.5198
69	1.6176	1.6081	1.6035	1.5989	1.5944	1.5899	1.5811	1.5724	1.5640	1.5470	1.5307
70	1.6293	1.6198	1.6151	1.6105	1.6059	1.6014	1.5925	1.5838	1.5753	1.5582	1.5417
71	1.6411	1.6315	1.6268	1.6221	1.6175	1.6130	1.6040	1.5952	1.5867	1.5694	1.5527
72	1.6529	1.6433	1.6385	1.6338	1.6292	1.6246	1.6155	1.6067	1.5981	1.5806	1.5637
73	1.6648	1.6551	1.6503	1.6456	1.6409	1.6363	1.6271	1.6182	1.6095	1.5919	1.5747
74	1.6768	1.6670	1.6622	1.6574	1.6526	1.6480	1.6387	1.6297	1.6209	1.6031	1.5857
75	1.6888	1.6789	1.6740	1.6692	1.6644	1.6597	1.6503	1.6412	1.6322	1.6142	1.5966
76	1.7008	1.6908	1.6858	1.6810	1.6761	1.6713	1.6619	1.6526	1.6435	1.6252	1.6074
77	1.7128	1.7026	1.6976	1.6927	1.6878	1.6829	1.6734	1.6640	1.6547	1.6361	1.6181
78	1.7247	1.7144	1.7093	1.7043	1.6994	1.6944	1.6847	1.6751	1.6657	1.6469	1.6286
79	1.7365	1.7261	1.7209	1.7158	1.7108	1.7058	1.6959	1.6862	1.6766	1.6575	1.6390
80	1.7482	1.7376	1.7323	1.7272	1.7221	1.7170	1.7069	1.6971	1.6873	1.6680	1.6493
81	1.7597	1.7489	1.7435	1.7383	1.7331	1.7279	1.7177	1.7077	1.6978	1.6782	1.6594
82	1.7709	1.7599	1.7544	1.7491	1.7437	1.7385	1.7281	1.7180	1.7080	1.6882	1.6692
83	1.7815	1.7704	1.7649	1.7594	1.7540	1.7487	1.7382	1.7279	1.7179	1.6979	1.6787
84	1.7916	1.7804	1.7748	1.7693	1.7639	1.7585	1.7479	1.7375	1.7274	1.7072	1.6878
85	1.8009	1.7897	1.7841	1.7786	1.7732	1.7678	1.7571	1.7466	1.7364	1.7161	1.6966
86	1.8095	1.7983	1.7927	1.7872	1.7818	1.7763	1.7657	1.7552	1.7449	1.7245	1.7050
87	1.8173	1.8061	1.8006	1.7951	1.7897	1.7842	1.7736	1.7632	1.7529	1.7324	1.7129
88	1.8243	1.8132	1.8077	1.8022	1.7968	1.7914	1.7809	1.7705	1.7602	1.7397	1.7202
89	1.8306	1.8195	1.8141	1.8087	1.8033	1.7979	1.7874	1.7770	1.7669	1.7464	1.7269
90	1.8361	1.8252	1.8198	1.8144	1.8091	1.8038	1.7933	1.7829	1.7729	1.7525	1.7331
91	1.8410	1.8302	1.8248	1.8195	1.8142	1.8090	1.7986	1.7883	1.7783	1.7581	1.7388
92	1.8453	1.8346	1.8293	1.8240	1.8188	1.8136	1.8033	1.7932	1.7832	1.7633	1.7439
93	1.8490	1.8384	1.8331	1.8279	1.8227	1.8176	1.8074	1.7974	1.7876	1.7681	1.7485
94	1.8520	1.8415	1.8363	1.8312	1.8260	1.8210	1.8109	1.8011	1.7914		
95	1.8544	1.8439	1.8388	1.8337	1.8286	1.8236	1.8137	1.8040	1.7944		
96	1.8560	1.8457	1.8406	1.8355	1.8305	1.8255	1.8157	1.8060	1.7965		
97	1.8569	1.8466	1.8414	1.8364	1.8314	1.8264	1.8166	1.8071	1.7977		
98	1.8567	1.8463	1.8411	1.8361	1.8310	1.8261	1.8163	1.8068	1.7976		
99	1.8551	1.8445	1.8393	1.8342	1.8292	1.8242	1.8145	1.8050	1.7958		
100	1.8517	1.8409	1.8357	1.8305	1.8255	1.8205	1.8107	1.8013	1.7922		

%	$d_4^{15.96}$	%	$d_4^{13.00}$	$d_4^{18.00}$
0.005	1.000 0140	0.05	0.999 810	0.999 028
.01	1.000 0576	.1	1.000 185	.999 400
.02	1.000 1434	.2	1.000 912	1.000 119
.03	1.000 2276	.3	1.001 623	1.000 820
.04	1.000 3104	.4	1.002 326	1.001 512
.05	1.000 3920	.5	1.003 023	1.002 197
.06	1.000 4726	.6	1.003 716	1.002 877
.07	1.000 5523	.8	1.005 090	1.004 227
.08	1.000 6313	1.0	1.006 452	1.005 570
.09	1.000 7098	1.2	1.007 807	1.006 909
.10	1.000 7880	1.4	1.009 159	1.008 247
.15	1.001 1732	1.6	1.010 510	1.009 583
.20	1.001 5514	1.8	1.011 860	1.010 918
.25	1.001 9254	2.0	1.013 209	1.012 252
.30	1.002 2961	2.2	1.014 557	1.013 586
.35	1.002 6639	2.4	1.015 904	1.014 919
.40	1.003 0292			
.45	1.003 3923			
.50	1.003 7534			

TABLE 2-102 Zinc Bromide (ZnBr₂)

%	0°C	20°C	40°C	60°C	80°C	100°C
2	1.0188	1.0167	1.0102	1.0008	0.9890	0.9751
4	1.0381	1.0354	1.0285	1.0187	1.0065	0.9921
8	1.0777	1.0738	1.0660	1.0554	1.0422	1.0270
12	1.1186	1.1135	1.1046	1.0932	1.0789	1.0629
16	1.1609	1.1544	1.1445	1.1320	1.1169	1.1000
20	1.2043	1.1965	1.1855	1.1720	1.1560	1.1382
30	1.3288	1.3170	1.3030	1.2868	1.2688	1.2489
40	1.477	1.462	1.445	1.427	1.406	1.385
50	1.661	1.643	1.623	1.602	1.579	1.555
60	1.891	1.869	1.845	1.822	1.797	1.771
65	2.026	2.002	1.976	1.951	1.924	1.898

TABLE 2-103 Zinc Chloride (ZnCl₂)

%	0°C	20°C	40°C	60°C	80°C	100°C
2	1.0192	1.0167	1.0099	1.0003	0.9882	0.9739
4	1.0384	1.0350	1.0274	1.0172	1.0044	.9894
8	1.0769	1.0715	1.0624	1.0508	1.0369	1.0211
12	1.1159	1.1085	1.0980	1.0853	1.0704	1.0541
16	1.1558	1.1468	1.1350	1.1212	1.1055	1.0888
20	1.1970	1.1866	1.1736	1.1590	1.1428	1.1255
30	1.3062	1.2928	1.2778	1.2614	1.2438	1.2252
40	1.4329	1.4173	1.4003	1.3824	1.3637	1.3441
50	1.5860	1.5681	1.5495	1.5300	1.5097	1.4892
60		1.749				
70		1.962				

TABLE 2-104 Zinc Nitrate [Zn(NO₃)₂]

%	18°C	%	18°C
2	1.0154	18	1.1652
4	1.0322	20	1.1865
6	1.0496	25	1.2427
8	1.0675	30	1.3029
10	1.0859	35	1.3678
12	1.1048	40	1.4378
14	1.1244	45	1.5134
16	1.1445	50	1.5944

TABLE 2-105 Zinc Sulfate (ZnSO₄)

%	20°C
2	1.019
4	1.0403
6	1.0620
8	1.0842
10	1.1071
12	1.1308
14	1.1553
16	1.1806

DENSITIES OF AQUEOUS ORGANIC SOLUTIONS*

UNITS AND UNITS CONVERSIONS

Unless otherwise noted, densities are given in grams per cubic centimeter. To convert to pounds per cubic foot, multiply by 62.43.

$\rho^{\circ}F = \% \text{ }^{\circ}C + 32$

From *International Critical Tables*, vol. 3, pp. 115–129. All compositions are in weight percent in vacuo. All density values are $d_4^t = g/mL$ in vacuo.

*For gasoline and aircraft fuels see Hibbard, NACA Res. Mem. E56121 (declassified 1958).

TABLE 2-106 Formic Acid (HCOOH)

%	0°C	15°C	20°C	30°C	%	0°C	15°C	20°C	30°C	%	0°C	15°C	20°C	30°C	%	0°C	15°C	20°C	30°C
0	0.9999	0.9991	0.9982	0.9957	25	1.0706	1.0627	1.0609	1.0540	50	1.1349	1.1225	1.1207	1.1098	75	1.1953	1.1794	1.1769	1.1636
1	1.0028	1.0019	1.0019	0.9980	26	1.0733	1.0652	1.0633	1.0564	51	1.1374	1.1248	1.1223	1.1120	76	1.1976	1.1816	1.1785	1.1656
2	1.0059	1.0045	1.0044	1.0004	27	1.0760	1.0678	1.0656	1.0587	52	1.1399	1.1271	1.1244	1.1142	77	1.1999	1.1837	1.1801	1.1676
3	1.0090	1.0072	1.0070	1.0028	28	1.0787	1.0702	1.0681	1.0611	53	1.1424	1.1294	1.1269	1.1164	78	1.2021	1.1859	1.1818	1.1697
4	1.0120	1.0100	1.0093	1.0053	29	1.0813	1.0726	1.0705	1.0632	54	1.1448	1.1318	1.1295	1.1186	79	1.2043	1.1881	1.1837	1.1717
5	1.0150	1.0124	1.0115	1.0075	30	1.0839	1.0750	1.0729	1.0654	55	1.1472	1.1341	1.1320	1.1208	80	1.2065	1.1902	1.1806	1.1737
6	1.0179	1.0151	1.0141	1.0101	31	1.0866	1.0774	1.0753	1.0676	56	1.1497	1.1365	1.1342	1.1230	81	1.2088	1.1924	1.1876	1.1758
7	1.0207	1.0177	1.0170	1.0125	32	1.0891	1.0798	1.0777	1.0699	57	1.1523	1.1388	1.1361	1.1253	82	1.2110	1.1944	1.1896	1.1778
8	1.0237	1.0204	1.0196	1.0149	33	1.0916	1.0821	1.0800	1.0721	58	1.1548	1.1411	1.1381	1.1274	83	1.2132	1.1965	1.1914	1.1798
9	1.0266	1.0230	1.0221	1.0173	34	1.0941	1.0844	1.0823	1.0743	59	1.1573	1.1434	1.1401	1.1295	84	1.2154	1.1985	1.1929	1.1817
10	1.0295	1.0256	1.0246	1.0197	35	1.0966	1.0867	1.0847	1.0766	60	1.1597	1.1458	1.1424	1.1317	85	1.2176	1.2005	1.1953	1.1837
11	1.0324	1.0281	1.0271	1.0221	36	1.0993	1.0892	1.0871	1.0788	61	1.1621	1.1481	1.1448	1.1338	86	1.2196	1.2025	1.1976	1.1856
12	1.0351	1.0306	1.0296	1.0244	37	1.1018	1.0916	1.0895	1.0810	62	1.1645	1.1504	1.1473	1.1360	87	1.2217	1.2045	1.1994	1.1875
13	1.0379	1.0330	1.0321	1.0267	38	1.1043	1.0940	1.0919	1.0832	63	1.1669	1.1526	1.1493	1.1382	88	1.2237	1.2064	1.2012	1.1893
14	1.0407	1.0355	1.0345	1.0290	39	1.1069	1.0964	1.0940	1.0854	64	1.1694	1.1549	1.1517	1.1403	89	1.2258	1.2084	1.2028	1.1910
15	1.0435	1.0380	1.0370	1.0313	40	1.1095	1.0988	1.0963	1.0876	65	1.1718	1.1572	1.1543	1.1425	90	1.2278	1.2102	1.2044	1.1927
16	1.0463	1.0405	1.0393	1.0336	41	1.1122	1.1012	1.0990	1.0898	66	1.1742	1.1595	1.1565	1.1446	91	1.2297	1.2121	1.2059	1.1945
17	1.0491	1.0430	1.0417	1.0358	42	1.1148	1.1036	1.1015	1.0920	67	1.1766	1.1618	1.1584	1.1467	92	1.2316	1.2139	1.2078	1.1961
18	1.0518	1.0455	1.0441	1.0381	43	1.1174	1.1060	1.1038	1.0943	68	1.1790	1.1640	1.1604	1.1489	93	1.2335	1.2157	1.2099	1.1978
19	1.0545	1.0480	1.0464	1.0404	44	1.1199	1.1084	1.1062	1.0965	69	1.1813	1.1663	1.1628	1.1510	94	1.2354	1.2174	1.2117	1.1994
20	1.0571	1.0505	1.0488	1.0427	45	1.1224	1.1109	1.1085	1.0987	70	1.1835	1.1685	1.1655	1.1531	95	1.2372	1.2191	1.2140	1.2008
21	1.0598	1.0532	1.0512	1.0451	46	1.1249	1.1133	1.1108	1.1009	71	1.1858	1.1707	1.1677	1.1552	96	1.2390	1.2208	1.2158	1.2022
22	1.0625	1.0556	1.0537	1.0473	47	1.1274	1.1156	1.1130	1.1031	72	1.1882	1.1729	1.1702	1.1573	97	1.2408	1.2224	1.2170	1.2036
23	1.0652	1.0580	1.0561	1.0496	48	1.1299	1.1179	1.1157	1.1053	73	1.1906	1.1751	1.1728	1.1595	98	1.2425	1.2240	1.2183	1.2048
24	1.0679	1.0604	1.0585	1.0518	49	1.1324	1.1202	1.1185	1.1076	74	1.1929	1.1773	1.1752	1.1615	99	1.2441	1.2257	1.2202	1.2061
															100	1.2456	1.2273	1.2212	1.2073

TABLE 2-107 Acetic Acid (CH₃COOH)

%	0°C	10°C	15°C	20°C	25°C	30°C	40°C	%	0°C	10°C	15°C	20°C	25°C	30°C	40°C
0	0.9999	0.9997	0.9991	0.9982	0.9971	0.9957	0.9922	50	1.0729	1.0654	1.0613	1.0575	1.0534	1.0492	1.0408
1	1.0016	1.0013	1.0006	.9996	.9987	.9971	.9934	51	1.0738	1.0663	1.0622	1.0582	1.0542	1.0499	1.0414
2	1.0033	1.0029	1.0021	1.0012	1.0000	.9984	.9946	52	1.0748	1.0671	1.0629	1.0590	1.0549	1.0506	1.0421
3	1.0051	1.0044	1.0036	1.0025	1.0013	.9997	.9958	53	1.0757	1.0679	1.0637	1.0597	1.0555	1.0512	1.0427
4	1.0070	1.0060	1.0051	1.0040	1.0027	1.0011	.9970	54	1.0765	1.0687	1.0644	1.0604	1.0562	1.0518	1.0432
5	1.0088	1.0076	1.0066	1.0055	1.0041	1.0024	.9982	55	1.0774	1.0694	1.0651	1.0611	1.0568	1.0525	1.0438
6	1.0106	1.0092	1.0081	1.0069	1.0055	1.0037	.9994	56	1.0782	1.0701	1.0658	1.0618	1.0574	1.0531	1.0443
7	1.0124	1.0108	1.0096	1.0083	1.0068	1.0050	1.0006	57	1.0790	1.0708	1.0665	1.0624	1.0580	1.0536	1.0448
8	1.0142	1.0124	1.0111	1.0097	1.0081	1.0063	1.0018	58	1.0798	1.0715	1.0672	1.0631	1.0586	1.0542	1.0453
9	1.0159	1.0140	1.0126	1.0111	1.0094	1.0076	1.0030	59	1.0805	1.0722	1.0678	1.0637	1.0592	1.0547	1.0458
10	1.0177	1.0156	1.0141	1.0125	1.0107	1.0089	1.0042	60	1.0813	1.0728	1.0684	1.0642	1.0597	1.0552	1.0462
11	1.0194	1.0171	1.0155	1.0139	1.0120	1.0102	1.0054	61	1.0820	1.0734	1.0690	1.0648	1.0602	1.0557	1.0466
12	1.0211	1.0187	1.0170	1.0154	1.0133	1.0115	1.0065	62	1.0826	1.0740	1.0696	1.0653	1.0607	1.0562	1.0470
13	1.0228	1.0202	1.0184	1.0168	1.0146	1.0127	1.0077	63	1.0833	1.0746	1.0701	1.0658	1.0612	1.0566	1.0473
14	1.0245	1.0217	1.0199	1.0182	1.0159	1.0139	1.0088	64	1.0838	1.0752	1.0706	1.0662	1.0616	1.0571	1.0477
15	1.0262	1.0232	1.0213	1.0195	1.0172	1.0151	1.0099	65	1.0844	1.0757	1.0711	1.0666	1.0621	1.0575	1.0480
16	1.0278	1.0247	1.0227	1.0209	1.0185	1.0163	1.0110	66	1.0850	1.0762	1.0716	1.0671	1.0624	1.0578	1.0483
17	1.0295	1.0262	1.0241	1.0223	1.0198	1.0175	1.0121	67	1.0856	1.0767	1.0720	1.0675	1.0628	1.0582	1.0486
18	1.0311	1.0276	1.0255	1.0236	1.0210	1.0187	1.0132	68	1.0860	1.0771	1.0725	1.0678	1.0631	1.0585	1.0489
19	1.0327	1.0291	1.0269	1.0250	1.0223	1.0198	1.0142	69	1.0865	1.0775	1.0729	1.0682	1.0634	1.0588	1.0491
20	1.0343	1.0305	1.0283	1.0263	1.0235	1.0210	1.0153	70	1.0869	1.0779	1.0732	1.0685	1.0637	1.0590	1.0493
21	1.0358	1.0319	1.0297	1.0276	1.0248	1.0222	1.0164	71	1.0874	1.0783	1.0736	1.0687	1.0640	1.0592	1.0495
22	1.0374	1.0333	1.0310	1.0288	1.0260	1.0233	1.0174	72	1.0877	1.0786	1.0738	1.0690	1.0642	1.0594	1.0496
23	1.0389	1.0347	1.0323	1.0301	1.0272	1.0244	1.0185	73	1.0881	1.0789	1.0741	1.0693	1.0644	1.0595	1.0497
24	1.0404	1.0361	1.0336	1.0313	1.0283	1.0256	1.0195	74	1.0884	1.0792	1.0743	1.0694	1.0645	1.0596	1.0498
25	1.0419	1.0375	1.0349	1.0326	1.0295	1.0267	1.0205	75	1.0887	1.0794	1.0745	1.0696	1.0647	1.0597	1.0499
26	1.0434	1.0388	1.0362	1.0338	1.0307	1.0278	1.0215	76	1.0889	1.0796	1.0746	1.0698	1.0648	1.0598	1.0499
27	1.0449	1.0401	1.0374	1.0349	1.0318	1.0289	1.0225	77	1.0891	1.0797	1.0747	1.0699	1.0648	1.0598	1.0499
28	1.0463	1.0414	1.0386	1.0361	1.0329	1.0299	1.0234	78	1.0893	1.0798	1.0747	1.0700	1.0648	1.0598	1.0498
29	1.0477	1.0427	1.0399	1.0372	1.0340	1.0310	1.0244	79	1.0894	1.0798	1.0747	1.0700	1.0648	1.0597	1.0497
30	1.0491	1.0440	1.0411	1.0384	1.0350	1.0320	1.0253	80	1.0895	1.0798	1.0747	1.0700	1.0647	1.0596	1.0495
31	1.0505	1.0453	1.0423	1.0395	1.0361	1.0330	1.0262	81	1.0895	1.0797	1.0745	1.0699	1.0646	1.0594	1.0493
32	1.0519	1.0465	1.0435	1.0406	1.0372	1.0341	1.0272	82	1.0895	1.0796	1.0743	1.0698	1.0644	1.0592	1.0490
33	1.0532	1.0477	1.0446	1.0417	1.0382	1.0351	1.0281	83	1.0895	1.0795	1.0741	1.0696	1.0642	1.0589	1.0487
34	1.0545	1.0489	1.0458	1.0428	1.0392	1.0361	1.0289	84	1.0893	1.0793	1.0738	1.0693	1.0638	1.0585	1.0483
35	1.0558	1.0501	1.0469	1.0438	1.0402	1.0371	1.0298	85	1.0891	1.0790	1.0735	1.0689	1.0635	1.0582	1.0479
36	1.0571	1.0513	1.0480	1.0449	1.0412	1.0380	1.0306	86	1.0887	1.0787	1.0731	1.0685	1.0630	1.0576	1.0473
37	1.0584	1.0524	1.0491	1.0459	1.0422	1.0390	1.0314	87	1.0883	1.0783	1.0726	1.0680	1.0626	1.0571	1.0467
38	1.0596	1.0535	1.0501	1.0469	1.0432	1.0399	1.0322	88	1.0877	1.0778	1.0721	1.0675	1.0620	1.0564	1.0460
39	1.0608	1.0546	1.0512	1.0479	1.0441	1.0408	1.0330	89	1.0872	1.0773	1.0715	1.0668	1.0613	1.0557	1.0453
40	1.0621	1.0557	1.0522	1.0488	1.0450	1.0416	1.0338	90	1.0865	1.0766	1.0708	1.0661	1.0605	1.0549	1.0445
41	1.0633	1.0568	1.0532	1.0498	1.0460	1.0425	1.0346	91	1.0857	1.0758	1.0700	1.0652	1.0597	1.0541	1.0436
42	1.0644	1.0578	1.0542	1.0507	1.0469	1.0433	1.0353	92	1.0848	1.0749	1.0690	1.0643	1.0587	1.0530	1.0426
43	1.0656	1.0588	1.0551	1.0516	1.0477	1.0441	1.0361	93	1.0838	1.0739	1.0680	1.0632	1.0577	1.0518	1.0414
44	1.0667	1.0598	1.0561	1.0525	1.0486	1.0449	1.0368	94	1.0826	1.0727	1.0667	1.0619	1.0564	1.0506	1.0401
45	1.0679	1.0608	1.0570	1.0534	1.0495	1.0456	1.0375	95	1.0813	1.0714	1.0652	1.0605	1.0551	1.0491	1.0386
46	1.0689	1.0618	1.0579	1.0542	1.0503	1.0464	1.0382	96	1.0798	1.0698	1.0632	1.0585	1.0535	1.0473	1.0368
47	1.0699	1.0627	1.0588	1.0551	1.0511	1.0471	1.0389	97	1.0780	1.0680	1.0611	1.0561	1.0516	1.0454	1.0348
48	1.0709	1.0636	1.0597	1.0559	1.0518	1.0479	1.0395	98	1.0759	1.0659	1.0590	1.0549	1.0495	1.0431	1.0325
49	1.0720	1.0645	1.0605	1.0567	1.0526	1.0486	1.0402	99	1.0730	1.0630	1.0567	1.0524	1.0468	1.0407	1.0299
								100	1.0697		1.0545	1.0498	1.0440	1.0380	1.0271

TABLE 2-108 Oxalic Acid (H₂C₂O₄)

%	$d_4^{17.5}$	%	$d_4^{17.5}$
1	1.0035	8	1.0280
2	1.0070	10	1.0350
4	1.0140	12	1.0420

 TABLE 2-109 Methyl Alcohol (CH₃OH)*

%	0°C	10°C	15.56°C	20°C	15°C	%	0°C	10°C	15.56°C	20°C	15°C	%	0°C	10°C	15.56°C	20°C	15°C
0	.9999	.9997	.9990	.9982	.99913	35	.9534	.9484	.9456	.9433	.94570	70	.8869	.8794	.8748	.8715	.87507
1	.9981	.9980	.9973	.9965	.99727	36	.9520	.9469	.9440	.9416	.94404	71	.8847	.8770	.8726	.8690	.87271
2	.9963	.9962	.9955	.9948	.99543	37	.9505	.9453	.9422	.9398	.94237	72	.8824	.8747	.8702	.8665	.87033
3	.9946	.9945	.9938	.9931	.99370	38	.9490	.9437	.9405	.9381	.94067	73	.8801	.8724	.8678	.8641	.86792
4	.9930	.9929	.9921	.9914	.99198	39	.9475	.9420	.9387	.9363	.93894	74	.8778	.8699	.8653	.8616	.86546
5	.9914	.9912	.9904	.9896	.99029	40	.9459	.9403	.9369	.9345	.93720	75	.8754	.8676	.8629	.8592	.86300
6	.9899	.9896	.9889	.9880	.98864	41	.9443	.9387	.9351	.9327	.93543	76	.8729	.8651	.8604	.8567	.86051
7	.9884	.9881	.9872	.9863	.98701	42	.9427	.9370	.9333	.9309	.93365	77	.8705	.8626	.8579	.8542	.85801
8	.9870	.9865	.9857	.9847	.98547	43	.9411	.9352	.9315	.9290	.93185	78	.8680	.8602	.8554	.8518	.85551
9	.9856	.9849	.9841	.9831	.98394	44	.9395	.9334	.9297	.9272	.93001	79	.8657	.8577	.8529	.8494	.85300
10	.9842	.9834	.9826	.9815	.98241	45	.9377	.9316	.9279	.9252	.92815	80	.8634	.8551	.8503	.8469	.85048
11	.9829	.9820	.9811	.9799	.98093	46	.9360	.9298	.9261	.9234	.92627	81	.8610	.8527	.8478	.8446	.84794
12	.9816	.9805	.9796	.9784	.97945	47	.9342	.9279	.9242	.9214	.92436	82	.8585	.8501	.8452	.8420	.84536
13	.9804	.9791	.9781	.9768	.97802	48	.9324	.9260	.9223	.9196	.92242	83	.8560	.8475	.8426	.8394	.84274
14	.9792	.9778	.9766	.9754	.97660	49	.9306	.9240	.9204	.9176	.92048	84	.8535	.8449	.8400	.8366	.84009
15	.9780	.9764	.9752	.9740	.97518	50	.9287	.9221	.9185	.9156	.91852	85	.8510	.8422	.8374	.8340	.83742
16	.9769	.9751	.9738	.9725	.97377	51	.9269	.9202	.9166	.9135	.91653	86	.8483	.8394	.8347	.8314	.83475
17	.9758	.9739	.9723	.9710	.97237	52	.9250	.9182	.9146	.9114	.91451	87	.8456	.8367	.8320	.8286	.83207
18	.9747	.9726	.9709	.9696	.97096	53	.9230	.9162	.9126	.9094	.91248	88	.8428	.8340	.8294	.8258	.82937
19	.9736	.9713	.9695	.9681	.96955	54	.9211	.9142	.9106	.9073	.91044	89	.8400	.8314	.8267	.8230	.82667
20	.9725	.9700	.9680	.9666	.96814	55	.9191	.9122	.9086	.9052	.90839	90	.8374	.8287	.8239	.8202	.82396
21	.9714	.9687	.9666	.9651	.96673	56	.9172	.9101	.9065	.9032	.90631	91	.8347	.8261	.8212	.8174	.82124
22	.9702	.9673	.9652	.9636	.96533	57	.9151	.9080	.9045	.9010	.90421	92	.8320	.8234	.8185	.8146	.81849
23	.9690	.9660	.9638	.9622	.96392	58	.9131	.9060	.9024	.8988	.90210	93	.8293	.8208	.8157	.8118	.81568
24	.9678	.9646	.9624	.9607	.96251	59	.9111	.9039	.9002	.8968	.89996	94	.8266	.8180	.8129	.8090	.81285
25	.9666	.9632	.9609	.9592	.96108	60	.9090	.9018	.8980	.8946	.89781	95	.8240	.8152	.8101	.8062	.80999
26	.9654	.9618	.9595	.9576	.95963	61	.9068	.8998	.8958	.8924	.89563	96	.8212	.8124	.8073	.8034	.80713
27	.9642	.9604	.9580	.9562	.95817	62	.9046	.8977	.8936	.8902	.89341	97	.8186	.8096	.8045	.8005	.80428
28	.9629	.9590	.9565	.9546	.95668	63	.9024	.8955	.8913	.8879	.89117	98	.8158	.8068	.8016	.7976	.80143
29	.9616	.9575	.9550	.9531	.95518	64	.9002	.8933	.8890	.8856	.88890	99	.8130	.8040	.7987	.7948	.79859
30	.9604	.9560	.9535	.9515	.95366	65	.8980	.8911	.8867	.8834	.88662	100	.8102	.8009	.7959	.7917	.79577
31	.9590	.9546	.9521	.9499	.95213	66	.8958	.8888	.8844	.8811	.88433						
32	.9576	.9531	.9505	.9483	.95056	67	.8935	.8865	.8820	.8787	.88203						
33	.9563	.9516	.9489	.9466	.94896	68	.8913	.8842	.8797	.8763	.87971						
34	.9549	.9500	.9473	.9450	.94734	69	.8891	.8818	.8771	.8738	.87739						

*It should be noted that the values for 100 percent do not agree with some data available elsewhere, e.g., *American Institute of Physics Handbook*, McGraw-Hill, New York, 1957. Also, see *Atack, Handbook of Chemical Data*, Reinhold, New York, 1957.

TABLE 2-110 Ethyl Alcohol (C₂H₅OH)*

%	10°C	15°C	20°C	25°C	30°C	35°C	40°C	%	10°C	15°C	20°C	25°C	30°C	35°C	40°C
0	0.99973	0.99913	0.99823	0.99708	0.99568	0.99406	0.99225	50	0.92126	0.91776	0.91384	0.90985	0.90580	0.90168	0.89750
1	785	725	636	520	379	217	034	51	.91943	555	160	760	353	.89940	519
2	602	542	453	336	194	031	.98846	52	723	333	.90936	534	125	710	288
3	426	365	275	157	014	.98849	663	53	502	110	711	307	.89896	479	056
4	258	195	103	.98984	.98839	672	485	54	279	.90885	485	079	667	248	.88823
5	098	032	.98938	817	670	501	311	55	055	659	258	.89850	437	016	589
6	.98946	.98877	780	656	507	335	142	56	.90831	433	031	621	206	.88784	356
7	801	729	627	500	347	172	.97975	57	607	207	.89803	392	.88975	552	122
8	660	584	478	346	189	009	808	58	381	.89980	574	162	744	319	.87888
9	524	442	331	193	031	.97846	641	59	154	752	344	.88931	512	085	653
10	393	304	187	043	.97875	685	475	60	.89927	523	113	699	278	.87851	417
11	267	171	047	.97897	723	527	312	61	698	293	.88882	446	044	615	180
12	145	041	.97910	753	573	371	150	62	468	062	650	233	.87809	379	.86943
13	026	.97914	775	611	424	216	.96989	63	237	.88830	417	.87998	574	142	705
14	.97911	790	643	472	278	063	829	64	006	597	183	763	337	.86905	466
15	800	669	514	334	133	.96911	670	65	.88774	364	.87948	527	100	667	227
16	692	552	387	199	.96990	760	512	66	541	130	713	291	.86863	429	.85987
17	583	433	259	062	844	607	352	67	308	.87895	477	054	625	190	747
18	473	313	129	.96923	697	452	189	68	074	660	241	.86817	387	.85950	407
19	363	191	.96997	782	547	294	023	69	.87839	424	004	579	148	710	266
20	252	068	864	639	395	134	.95856	70	602	187	.86766	340	.85908	470	025
21	139	.96944	729	495	242	.95973	687	71	365	.86949	527	100	667	228	.84783
22	024	818	592	348	087	809	516	72	127	710	287	.85859	426	.84986	540
23	.96907	689	453	199	.95929	643	343	73	.86888	470	047	618	184	743	297
24	787	558	312	048	769	476	168	74	648	229	.85806	376	.84941	500	053
25	665	424	168	.95895	607	306	.94991	75	408	.85988	564	134	698	257	.83809
26	539	287	020	738	442	133	810	76	168	747	322	.84891	455	013	564
27	406	144	.95867	576	272	.94955	625	77	.85927	505	079	647	211	.83768	319
28	268	.95996	710	410	098	774	438	78	685	262	.84835	403	.83966	523	074
29	125	844	548	241	.94922	590	248	79	442	018	590	158	720	277	.82827
30	.95977	686	382	067	741	403	055	80	197	.84772	344	.83911	473	029	578
31	823	524	212	.94890	557	214	.93860	81	.84950	525	096	664	224	.82780	329
32	665	357	038	709	370	021	662	82	702	277	.83848	415	.82974	530	079
33	502	186	.94860	525	180	.93825	461	83	453	028	599	164	724	279	.81828
34	334	011	679	337	.93986	626	257	84	203	.83777	348	.82913	473	027	576
35	162	.94832	494	146	790	425	051	85	.83951	525	095	660	220	.81774	322
36	.94986	650	306	.93952	591	221	.92843	86	697	271	.82840	405	.81965	519	067
37	805	464	114	756	390	016	634	87	441	014	583	148	708	262	.80811
38	620	273	.93919	556	186	.92808	422	88	181	.82754	323	.81888	448	003	552
39	431	079	720	353	.92979	597	208	89	.82919	492	062	626	186	.80742	291
40	238	.93882	518	148	770	385	.91992	90	654	227	.81797	362	.80922	478	028
41	042	682	314	.92940	558	170	774	91	386	.81959	529	094	655	211	.79761
42	.93842	478	107	729	344	.91952	554	92	114	688	257	.80823	384	.79941	491
43	639	271	.92897	516	128	733	332	93	.81839	413	.80983	549	111	669	220
44	433	062	685	301	.91910	513	108	94	561	134	705	272	.79835	393	.78947
45	226	.92852	472	085	692	291	.90884	95	278	.80852	424	.79991	555	114	670
46	017	640	257	.91868	472	069	660	96	.80991	566	138	706	271	.78831	388
47	.92806	426	041	649	250	.90845	434	97	698	274	.79846	415	.78981	542	100
48	593	211	.91823	429	028	621	207	98	399	.79975	547	117	684	247	.77806
49	379	.91995	604	208	.90805	396	.89979	99	094	670	243	.78814	382	.77946	507
								100	.79784	360	.78934	506	075	641	203

*For data from -78° to 78°C, see p. 2-142, Table 2N-5, *American Institute of Physics Handbook*, McGraw-Hill, New York, 1957.

TABLE 2-115 Glycerol*

Glycerol, %	Density					Glycerol, %	Density					Glycerol, %	Density				
	15°C	15.5°C	20°C	25°C	30°C		15°C	15.5°C	20°C	25°C	30°C		15°C	15.5°C	20°C	25°C	30°C
100	1.26415	1.26381	1.26108	1.15802	1.25495	65	1.17030	1.17000	1.16750	1.16475	1.16195	30	1.07455	1.07435	1.07270	1.07070	1.06855
99	1.26160	1.26125	1.25850	1.25545	1.25235	64	1.16755	1.16725	1.16475	1.16200	1.15925	29	1.07195	1.07175	1.07010	1.06815	1.06605
98	1.25900	1.25865	1.25590	1.25290	1.24975	63	1.16480	1.16445	1.16205	1.15925	1.15650	28	1.06935	1.06915	1.06755	1.06560	1.06355
97	1.25645	1.25610	1.25335	1.25030	1.24710	62	1.16200	1.16170	1.15930	1.15655	1.15375	27	1.06670	1.06655	1.06495	1.06305	1.06105
96	1.25385	1.25350	1.25080	1.24770	1.24450	61	1.15925	1.15895	1.15655	1.15380	1.15100	26	1.06410	1.06390	1.06240	1.06055	1.05855
95	1.25130	1.25095	1.24825	1.24515	1.24190	60	1.15650	1.15615	1.15380	1.15105	1.14830	25	1.06150	1.06130	1.05980	1.05800	1.05605
94	1.24865	1.24830	1.24560	1.24250	1.23930	59	1.15370	1.15340	1.15105	1.14835	1.14555	24	1.05885	1.05870	1.05720	1.05545	1.05350
93	1.24600	1.24565	1.24300	1.23985	1.23670	58	1.15095	1.15065	1.14830	1.14560	1.14285	23	1.05625	1.05610	1.05465	1.05290	1.05100
92	1.24340	1.24305	1.24035	1.23725	1.23410	57	1.14815	1.14785	1.14555	1.14285	1.14010	22	1.05365	1.05350	1.05205	1.05035	1.04850
91	1.24075	1.24040	1.23770	1.23460	1.23150	56	1.14535	1.14510	1.14280	1.14015	1.13740	21	1.05100	1.05090	1.04950	1.04780	1.04600
90	1.23810	1.23775	1.23510	1.23200	1.22890	55	1.14260	1.14230	1.14005	1.13740	1.13470	20	1.04840	1.04825	1.04690	1.04525	1.04350
89	1.23545	1.23510	1.23245	1.22935	1.22625	54	1.13980	1.13955	1.13730	1.13465	1.13195	19	1.04590	1.04575	1.04440	1.04280	1.04105
88	1.23280	1.23245	1.22975	1.22665	1.22360	53	1.13705	1.13680	1.13455	1.13195	1.12925	18	1.04335	1.04325	1.04195	1.04035	1.03860
87	1.23015	1.22980	1.22710	1.22400	1.22095	52	1.13425	1.13400	1.13180	1.12920	1.12650	17	1.04085	1.04075	1.03945	1.03790	1.03615
86	1.22750	1.22710	1.22445	1.22135	1.21830	51	1.13150	1.13125	1.12905	1.12650	1.12380	16	1.03835	1.03825	1.03695	1.03545	1.03370
85	1.22485	1.22445	1.22180	1.21870	1.21565	50	1.12870	1.12845	1.12630	1.12375	1.12110	15	1.03580	1.03570	1.03450	1.03300	1.03130
84	1.22220	1.22180	1.21915	1.21605	1.21300	49	1.12600	1.12575	1.12360	1.12110	1.11845	14	1.03330	1.03320	1.03200	1.03055	1.02885
83	1.21955	1.21915	1.21650	1.21340	1.21035	48	1.12325	1.12305	1.12090	1.11840	1.11580	13	1.03080	1.03070	1.02955	1.02805	1.02640
82	1.21690	1.21650	1.21380	1.21075	1.20770	47	1.12055	1.12030	1.11820	1.11575	1.11320	12	1.02830	1.02820	1.02705	1.02560	1.02395
81	1.21425	1.21385	1.21115	1.20810	1.20505	46	1.11780	1.11760	1.11550	1.11310	1.11055	11	1.02575	1.02565	1.02455	1.02315	1.02150
80	1.21160	1.21120	1.20850	1.20545	1.20240	45	1.11510	1.11490	1.11280	1.11040	1.10795	10	1.02325	1.02315	1.02210	1.02070	1.01905
79	1.20885	1.20845	1.20575	1.20275	1.19970	44	1.11235	1.11215	1.11010	1.10775	1.10530	9	1.02085	1.02075	1.01970	1.01835	1.01670
78	1.20610	1.20570	1.20305	1.20005	1.19705	43	1.10960	1.10945	1.10740	1.10510	1.10265	8	1.01840	1.01835	1.01730	1.01600	1.01440
77	1.20335	1.20300	1.20030	1.19735	1.19435	42	1.10690	1.10670	1.10470	1.10240	1.10005	7	1.01600	1.01590	1.01495	1.01360	1.01205
76	1.20060	1.20025	1.19760	1.19465	1.19170	41	1.10415	1.10400	1.10200	1.09975	1.09740	6	1.01360	1.01350	1.01255	1.01125	1.00970
75	1.19785	1.19750	1.19485	1.19195	1.18900	40	1.10145	1.10130	1.09930	1.09710	1.09475	5	1.01120	1.01110	1.01015	1.00890	1.00735
74	1.19510	1.19480	1.19215	1.18925	1.18635	39	1.09875	1.09860	1.09665	1.09445	1.09215	4	1.00875	1.00870	1.00780	1.00655	1.00505
73	1.19235	1.19205	1.18940	1.18650	1.18365	38	1.09605	1.09590	1.09400	1.09180	1.08955	3	1.00635	1.00630	1.00540	1.00415	1.00270
72	1.18965	1.18930	1.18670	1.18380	1.18100	37	1.09340	1.09320	1.09135	1.08915	1.08690	2	1.00395	1.00385	1.00300	1.00180	1.00035
71	1.18690	1.18655	1.18395	1.18110	1.17830	36	1.09070	1.09050	1.08865	1.08655	1.08430	1	1.00155	1.00145	1.00060	0.99945	0.99800
70	1.18415	1.18385	1.18125	1.17840	1.17565	35	1.08800	1.08780	1.08600	1.08390	1.08165	0	0.99913	0.99905	0.99823	0.99708	0.99568
69	1.18135	1.18105	1.17850	1.17565	1.17290	34	1.08530	1.08515	1.08335	1.08125	1.07905						
68	1.17860	1.17830	1.17575	1.17295	1.17020	33	1.08265	1.08245	1.08070	1.07860	1.07645						
67	1.17585	1.17555	1.17300	1.17020	1.16745	32	1.07995	1.07975	1.07800	1.07600	1.07380						
66	1.17305	1.17275	1.17025	1.16745	1.16470	31	1.07725	1.07705	1.07535	1.07335	1.07120						

*Bosart and Snoddy, *Ind. Eng. Chem.*, **20**, (1928): 1378.TABLE 2-116 Hydrazine (N₂H₄)

%	d_4^{15}	%	d_4^{15}
1	1.0002	30	1.0305
2	1.0013	40	1.038
4	1.0034	50	1.044
8	1.0077	60	1.047
12	1.0121	70	1.046
16	1.0164	80	1.040
20	1.0207	90	1.030
24	1.0248	100	1.011
28	1.0286		

TABLE 2-117 Densities of Aqueous Solutions of Miscellaneous Organic Compounds*

d (resp., d_w , d_s) = density of the solution (resp., water; resp., the pure liquid solute) in g/mL; p_s (resp., p_w) = wt % of solute (resp., water) in the solution; range = range of applicability of the equation.

Section A $d = d_w + Ap_s + Bp_s^2 + Cp_s^3$						
Name	Formula	t , °C	Range, p_s	A	B	C
Acetaldehyde	C ₂ H ₄ O	18	0– 30	+0.0 ₃ 255	–0.0 ₅ 16	
Acetamide	C ₂ H ₅ NO	15	0– 6	+0.0 ₃ 639	+0.0 ₄ 171	
Acetone	C ₃ H ₆ O	0	0–100	–0.0 ₃ 856	–0.0 ₃ 449	–0.0 ₅ 588
		4	0–100	–0.0 ₂ 7648	–0.0 ₄ 1193	+0.0 ₂ 272
		15	0–100	–0.0 ₃ 1009	–0.0 ₃ 9682	–0.0 ₂ 624
		20	0–100	–0.0 ₃ 1233	–0.0 ₃ 3529	–0.0 ₅ 327
Acetonitrile	C ₂ H ₃ N	25	0–100	–0.0 ₃ 1171	–0.0 ₃ 904	–0.0 ₅ 56
		15	0– 16	–0.0 ₃ 1175	–0.0 ₂ 2024	
Allyl alcohol	C ₃ H ₆ O	0	0– 89	–0.0 ₃ 3729	–0.0 ₄ 1232	+0.0 ₇ 2984
Benzenepentacarboxylic acid	C ₁₁ H ₆ O ₁₀	25	0– 0.6	+0.0 ₂ 5615	–0.0 ₂ 117	
Butyl alcohol (<i>n</i> -)	C ₄ H ₁₀ O	20	0– 7.9	–0.0 ₃ 1651	+0.0 ₂ 285	
Butyric acid (<i>n</i> -)	C ₄ H ₈ O ₂	18	0– 10	+0.0 ₃ 414	+0.0 ₄ 131	
		25	0– 62	+0.0 ₃ 5135	–0.0 ₄ 166	+0.0 ₆ 11
		0	0– 70	+0.0 ₃ 4489	+0.0 ₂ 2802	–0.0 ₇ 1291
Chloral hydrate	C ₂ H ₃ Cl ₃ O ₂	15	0– 78	+0.0 ₃ 4455	+0.0 ₂ 2198	+0.0 ₄ 366
		30	0– 90	+0.0 ₃ 4401	+0.0 ₄ 1887	+0.0 ₆ 6549
Chloroacetic acid	C ₂ H ₃ ClO ₂	20	0– 32	+0.0 ₂ 3648	+0.0 ₃ 302	
		25	0– 86	+0.0 ₂ 3602	+0.0 ₃ 552	+0.0 ₂ 22
Citric acid (hydrate)	C ₆ H ₈ O ₇ + H ₂ O	18	0– 50	+0.0 ₃ 3824	+0.0 ₄ 1141	+0.0 ₇ 17
Dichloroacetic acid	C ₂ H ₂ Cl ₂ O ₂	20	0– 30	+0.0 ₃ 4427	+0.0 ₃ 537	+0.0 ₇ 534
		25	0– 97	+0.0 ₂ 4427	+0.0 ₃ 537	+0.0 ₇ 534
Diethylamine hydrochloride	C ₄ H ₁₂ ClN	21	0– 36	+0.0 ₃ 34	+0.0 ₆ 76	
Ethylamine hydrochloride	C ₂ H ₅ ClN	21	0– 65	+0.0 ₃ 1193	–0.0 ₃ 307	–0.0 ₇ 47
Ethylene glycol	C ₂ H ₆ O ₂	0	0–100	+0.0 ₃ 1483	+0.0 ₂ 2992	–0.0 ₅ 5248
		15	0– 6	+0.0 ₃ 133	–0.0 ₅ 108	
Ethyl ether	C ₄ H ₁₀ O	20	0– 5	–0.0 ₂ 221	+0.0 ₄ 48	
		25	0– 4.5	–0.0 ₃ 221	+0.0 ₃ 35	
tartrate	C ₈ H ₁₄ O ₆	15	0– 95	+0.0 ₂ 2367	+0.0 ₃ 358	–0.0 ₆ 6005
Formaldehyde	CH ₂ O	15	0– 40	+0.0 ₂ 518	–0.0 ₃ 658	+0.0 ₇ 542
Formamide	CH ₃ NO	25	22– 96	+0.0 ₂ 1217	+0.0 ₃ 3199	–0.0 ₇ 2529
Furfural	C ₅ H ₄ O ₂	20	0– 8	+0.0 ₃ 1827	+0.0 ₃ 366	
		25	0– 8	+0.0 ₃ 1664	+0.0 ₂ 21	
Isoamyl alcohol	C ₅ H ₁₂ O	20	0– 2.5	+0.0 ₃ 155	+0.0 ₃ 3	
Isobutyl alcohol	C ₄ H ₁₀ O	15	0– 8	–0.0 ₂ 146	+0.0 ₃ 6	
		20	0– 8	–0.0 ₃ 169	+0.0 ₃ 38	
Isobutyric acid	C ₄ H ₈ O ₂	15	0– 9	+0.0 ₃ 52		
		18	0– 9	+0.0 ₃ 45		
		25	0– 12	+0.0 ₃ 37		
Isovaleric acid	C ₅ H ₁₀ O ₂	5	0– 5	+0.0 ₃ 253	–0.0 ₄ 282	
Lactic acid	C ₃ H ₆ O ₃	25	0– 9	+0.0 ₃ 231	+0.0 ₃ 186	
Maleic acid	C ₄ H ₄ O ₄	25	0– 40	+0.0 ₃ 34	+0.0 ₇ 75	
Malic acid	C ₄ H ₆ O ₅	20	0– 40	+0.0 ₂ 3933	+0.0 ₃ 957	
		25	0– 40	+0.0 ₂ 3736	+0.0 ₄ 175	
Malonic acid	C ₃ H ₄ O ₄	20	0– 40	+0.0 ₃ 389	+0.0 ₄ 1066	
Methyl acetate	C ₃ H ₆ O ₂	20	0– 20	+0.0 ₃ 40	–0.0 ₅ 74	
		0	26– 51	+0.0 ₃ 3336	+0.0 ₃ 996	+0.01544
		30	26– 51	+0.0 ₂ 3151	+0.0 ₃ 975	+0.0 ₃ 978
Nicotine	C ₁₀ H ₁₄ N ₂	20	0– 60	+0.0 ₃ 642	+0.0 ₃ 454	–0.0 ₆ 687
Nitrophenol (<i>p</i> -)	C ₆ H ₅ NO ₃	15	0– 1.5	+0.0 ₃ 3216	–0.0 ₅ 55	
		0	0– 4	+0.0 ₃ 5898	–0.0 ₃ 3185	+0.0 ₄ 41
		15	0– 4	+0.0 ₂ 494	–0.0 ₅ 8	
Oxalic acid	C ₂ H ₂ O ₄	17.5	0– 9	+0.0 ₂ 494	–0.0 ₅ 8	
		20	0– 4	+0.0 ₃ 5264	–0.0 ₃ 1996	+0.0 ₄ 254
		25	0– 4	+0.0 ₃ 5108	–0.0 ₃ 1607	+0.0 ₄ 208
		15	0– 5	+0.0 ₂ 111	–0.0 ₂ 283	
Phenol	C ₆ H ₆ O	80	0– 65	+0.0 ₃ 462	–0.0 ₆ 86	
Phenylglycolic acid	C ₈ H ₈ O ₃	25	0– 11	+0.0 ₃ 207	+0.0 ₂ 23	
Picoline (α -)	C ₆ H ₇ N	25	0– 70	–0.0 ₃ 386	–0.0 ₁ 1405	–0.0 ₄ 167
		25	0– 60	–0.0 ₄ 683	–0.0 ₅ 13	
Propionic acid	C ₃ H ₆ O ₂	18	0– 10	+0.0 ₃ 95	–0.0 ₄ 172	
		25	0– 40	+0.0 ₃ 9245	–0.0 ₃ 99	+0.0 ₇ 361
Pyridine	C ₅ H ₅ N	25	0– 60	+0.0 ₃ 229	–0.0 ₂ 204	–0.0 ₆ 28
Resorcinol	C ₆ H ₆ O ₂	18	0– 52	+0.0 ₃ 201	+0.0 ₃ 519	–0.0 ₈ 19
Succinic acid	C ₄ H ₆ O ₄	25	0– 5.5	+0.0 ₂ 304		
		15	0– 15	+0.0 ₃ 4482	+0.0 ₄ 185	
		17.5	0– 50	+0.0 ₂ 4455	+0.0 ₄ 185	
		20	0– 50	+0.0 ₃ 4432	+0.0 ₄ 1837	
		30	0– 50	+0.0 ₂ 4335	+0.0 ₄ 185	
		40	0– 50	+0.0 ₃ 4265	+0.0 ₄ 185	
		50	0– 50	+0.0 ₃ 4205	+0.0 ₄ 185	
Tartaric acid (<i>d</i> , <i>l</i> , or <i>dl</i>)	C ₄ H ₆ O ₆	60	0– 50	+0.0 ₂ 4155	+0.0 ₄ 185	

*From "International Critical Tables," vol. 3, pp. 111–114.

TABLE 2-117 Densities of Aqueous Solutions of Miscellaneous Organic Compounds (Concluded)

Section A $d = d_w + Ap_s + Bp_s^2 + Cp_s^3$ (Cont.)							
Name	Formula	$t, ^\circ\text{C}$	Range, p_s	A	B	C	
Tetraethyl ammonium chloride	$\text{C}_8\text{H}_{20}\text{ClN}$	21	0- 63	+0.0 ₃ 1884	+0.0 ₆	+0.0 ₁ 122	
		15	0- 7	+0.0 ₂ 2995	+0.0 ₅ 374		
Thiourea	$\text{CH}_4\text{N}_2\text{S}$	12.5	0- 61	+0.0 ₂ 499	+0.0 ₁ 153		
		20	10- 30	+0.0 ₂ 5053	+0.0 ₁ 1387		
		25	0- 94	+0.0 ₂ 5051	+0.0 ₆ 119	+0.0 ₆ 1038	
Triethylamine hydrochloride	$\text{C}_6\text{H}_{16}\text{ClN}$	21	0- 54	+0.0 ₆	+0.0 ₅ 558	-0.0 ₆ 69	
Trimethyl carbinol	$\text{C}_4\text{H}_{10}\text{O}$	20	0-100	-0.0 ₂ 117	-0.0 ₁ 1908	+0.0 ₂ 957	
		25	0-100	-0.0 ₁ 286	-0.0 ₁ 176	+0.0 ₂ 887	
		14.8	0- 12	+0.0 ₂ 3213	-0.0 ₁ 4802	+0.0 ₅ 1216	
Urea	$\text{CH}_4\text{N}_2\text{O}$	18	0- 51	+0.0 ₂ 2718	+0.0 ₅ 1552	+0.0 ₂ 2573	
		20	0- 35	+0.0 ₂ 2702	+0.0 ₅ 3712	-0.0 ₂ 2285	
		25	0- 10	+0.0 ₂ 2728	-0.0 ₁ 1817	+0.0 ₅ 1379	
		20	0- 56	+0.0 ₁ 278	-0.0 ₂ 245	-0.0 ₇ 3437	
Urethane	$\text{C}_5\text{H}_7\text{NO}_2$	20	0- 3	+0.0 ₅ 34	-0.0 ₁ 27		
Valeric acid (<i>n</i> -)	$\text{C}_5\text{H}_{10}\text{O}_2$	25					
Section B $d = d_s + Ap_w + Bp_w^2 + Cp_w^3$							
Name	Formula	d_s	$t, ^\circ\text{C}$	Range, p_w	A	B	C
Butyl alcohol (<i>n</i> -)	$\text{C}_4\text{H}_{10}\text{O}$	0.8097	20	0-20	+0.0 ₂ 2103	-0.0 ₁ 113	
Butyric acid (<i>n</i> -)	$\text{C}_4\text{H}_8\text{O}_2$	0.9534	25	0-38	+0.0 ₂ 1854	-0.0 ₂ 2314	
Ethyl ether	$\text{C}_4\text{H}_{10}\text{O}$	0.7077	25	0- 1.1	+0.0 ₂ 34	+0.0 ₃ 36	
		0.8170	0	0-14	+0.0 ₂ 2437	-0.0 ₂ 285	
Isobutyl alcohol	$\text{C}_4\text{H}_{10}\text{O}$	0.8055	15	0-16	+0.0 ₂ 224	-0.0 ₁ 129	
		0.9425	26	0-80	+0.0 ₂ 1808	-0.0 ₂ 2358	+0.0 ₆ 1253
Isobutyric acid	$\text{C}_4\text{H}_8\text{O}_2$	0.9425	26	0-80	+0.0 ₂ 199	-0.0 ₂ 331	+0.0 ₇ 315
Nicotine	$\text{C}_{10}\text{H}_{14}\text{N}_2$	1.0093	20	0-40	+0.0 ₂ 199	-0.0 ₂ 331	
Picoline (α -)	$\text{C}_6\text{H}_7\text{N}$	0.9404	25	0-30	+0.0 ₂ 2715	-0.0 ₂ 393	
		0.9515	25	0-40	+0.0 ₂ 1925	-0.0 ₂ 352	+0.0 ₂ 25
Pyridine (β -)	$\text{C}_5\text{H}_5\text{N}$	0.9776	25	0-40	+0.0 ₂ 1157	-0.0 ₂ 536	-0.0 ₆ 2
		0.7856	20	0-20	+0.0 ₂ 2287	+0.0 ₂ 275	
Trimethyl carbinol	$\text{C}_4\text{H}_{10}\text{O}$	0.7856	20	0-20			
Section C $d_t = d_o + At + Bt^2$							
Name	Formula	p_s	d_o	Range, $^\circ\text{C}$	A	B	
Allyl alcohol	$\text{C}_3\text{H}_6\text{O}$	76.60	0.9122	0-45	-0.0 ₂ 8	-0.0 ₂ 27	
Butyl alcohol (<i>n</i> -)	$\text{C}_4\text{H}_{10}\text{O}$	80.95	0.8614	0-43	-0.0 ₅ 7292	-0.0 ₆ 75	
		2.00	1.0094	7-80	-0.0 ₂ 2597	-0.0 ₂ 4313	
Chloral hydrate	$\text{C}_2\text{H}_3\text{Cl}_3\text{O}_2$	10.00	1.0476	7-80	-0.0 ₄ 7955	-0.0 ₂ 4253	
		5.00	1.0150	15-80	-0.0 ₂ 2103	-0.0 ₂ 2544	
		10.00	1.0270	15-80	-0.0 ₂ 2116	-0.0 ₂ 2929	
Ethyl tartrate	$\text{C}_7\text{H}_{14}\text{O}_6$	25.00	1.0665	15-80	-0.0 ₃ 401	-0.0 ₂ 23	
		4.62	1.0125	22-74	-0.0 ₂ 232	-0.0 ₂ 254	
		5.69	1.0140	22-74	-0.0 ₂ 221	-0.0 ₂ 268	
Furfural	$\text{C}_5\text{H}_4\text{O}_2$	6.56	1.0155	22-74	-0.0 ₂ 211	-0.0 ₂ 290	
		9.34	1.0055	11-73	-0.0 ₃ 171	-0.0 ₂ 3615	
		21.20	1.0115	14-73	-0.0 ₃ 378	-0.0 ₂ 248	
Pyridine	$\text{C}_5\text{H}_5\text{N}$	29.50	1.0145	12-72	-0.0 ₃ 463	-0.0 ₂ 235	
		40.40	1.0182	9-74	-0.0 ₂ 605	-0.0 ₂ 167	

DENSITIES OF MISCELLANEOUS MATERIALS

TABLE 2-118 Approximate Specific Gravities and Densities of Miscellaneous Solids and Liquids*

Water at 4°C and normal atmospheric pressure taken as unity. For more detailed data on any material, see the section dealing with the properties of that material.

Substance	Sp. gr.	Aver. weight lb/ft ³	Substance	Sp. gr.	Aver. weight lb/ft ³	Substance	Sp. gr.	Aver. weight lb/ft ³
Metals, Alloys, Ores			Timber, Air-dry			Dry Rubble Masonry		
Aluminum, cast-hammered bronze	2.55-2.80	165	Apple	0.66-0.74	44	Granite, syenite, gneiss	1.9-2.3	130
Brass, cast-rolled	7.7	481	Ash, black	0.55	34	Limestone, marble	1.9-2.1	125
Bronze, 7.9 to 14% Sn phosphor	8.4-8.7	534	white	0.64-0.71	42	Sandstone, bluestone	1.8-1.9	110
Copper, cast-rolled ore, pyrites	7.4-8.9	509	Birch, sweet, yellow	0.71-0.72	44	Brick Masonry		
German silver	8.88	554	Cedar, white, red	0.35	22	Hard brick	1.8-2.3	128
Gold, cast-hammered coin (U.S.)	8.8-8.95	556	Cherry, wild red	0.43	27	Medium brick	1.6-2.0	112
Iridium	4.1-4.3	262	Chestnut	0.48	30	Soft brick	1.4-1.9	103
Iron, gray cast	7.2	450	Cypress	0.45-0.48	29	Sand-lime brick	1.4-2.2	112
cast, pig wrought	7.6-7.9	485	Elm, white	0.56	35	Concrete Masonry		
spiegeleisen	7.5	468	Fir, Douglas	0.48-0.55	32	Cement, stone, sand slag, etc.	2.2-2.4	144
ferro-silicon ore, hematite	6.7-7.3	437	balsam	0.40	25	slag, etc.	1.9-2.3	130
ore, limonite	5.2	325	Hemlock	0.45-0.50	29	cinder, etc.	1.5-1.7	100
ore, magnetite	3.6-4.0	237	Hickory	0.74-0.80	48	Various Building Materials		
slag	4.9-5.2	315	Locust	0.67-0.77	45	Ashes, cinders	0.64-0.72	40-45
Lead	2.5-3.0	172	Mahogany	0.56-0.85	44	Cement, Portland, loose	1.5	94
ore, galena	11.34	710	Maple, sugar white	0.68	43	Lime, gypsum, loose	0.85-1.00	53-64
Manganese ore, pyrolusite	7.3-7.6	465	Oak, chestnut live	0.53	33	Mortar, lime, set	1.4-1.9	103
Mercury	7.42	475	red, black	0.74	46	Portland cement	2.08-2.25	94-135
Monel metal, rolled	3.7-4.6	259	white	0.87	54	Portland cement	3.1-3.2	196
Nickel	13.6	849	Pine, Norway	0.64-0.71	42	Slags, bank slag	1.1-1.2	67-72
Platinum, cast-hammered	19.25-19.35	1205	Oregon	0.77	48	bank screenings	1.5-1.9	98-117
Silver, cast-hammered	17.18-17.2	1073	red	0.55	34	machine slag	1.5	96
Steel, cold-drawn machine tool	7.03-7.13	442	Southern white	0.48	30	slag sand	0.8-0.9	49-55
Tin, cast-hammered cassiterite	7.2	450	white	0.61-0.67	38-42	Earth, etc., Excavated		
Tungsten	7.6-7.9	485	Poplar	0.43	27	Clay, dry	1.0	63
Zinc, cast-rolled blende	6.9-7.2	440	Redwood, California	0.43	27	damp plastic and gravel, dry	1.76	110
Various Solids			Spruce, white, red	0.42	26	Earth, dry, loose	1.6	100
Cereals, oats, bulk	0.51	26	Teak, African	0.45	28	dry, packed	1.2	76
barley, bulk	0.62	39	Indian	0.99	62	moist, loose	1.5	95
corn, rye, bulk	0.73	45	Walnut, black	0.66-0.88	48	moist, packed	1.3	78
wheat, bulk	0.77	48	Willow	0.59	37	mud, flowing	1.6	96
Cork	0.22-0.26	15	Various Liquids			mud, packed	1.7	108
Cotton, flax, hemp	1.47-1.50	93	Alcohol, ethyl (100%)	0.789	49	Riprap, limestone	1.8	115
Fats	0.90-0.97	58	methyl (100%)	0.796	50	Riprap, sandstone	1.3-1.4	80-85
Flour, loose	0.40-0.50	28	Acid, muriatic, 40%	1.20	75	Riprap, shale	1.4	90
pressed	0.70-0.80	47	nitric, 91%	1.50	94	Sand, gravel, dry, loose	1.7	105
Glass, common	2.40-2.80	162	sulfuric, 87%	1.80	112	gravel, dry, packed	1.4-1.7	90-105
plate or crown crystal	2.45-2.72	161	Chloroform	1.500	95	gravel, wet	1.6-1.9	100-120
dint	2.90-3.00	184	Ether	0.736	46	Excavations in Water	1.89-2.16	126
Hay and straw, bales	3.2-4.7	247	Lye, soda, 66%	1.70	106	Clay	1.28	80
Leather	0.32	20	Oils, vegetable mineral, lubricants	0.91-0.94	58	River mud	1.44	90
Paper	0.86-1.02	59	Turpentine	0.88-0.94	57	Sand or gravel and clay	0.96	60
Potatoes, piled	0.70-1.15	58	Water, 4°C max. density	0.861-0.867	54	Soil	1.00	65
Rubber, caoutchouc goods	0.67	44	100°C	1.0	62,428	Stone riprap	1.12	70
Salt, granulated, piled	0.92-0.96	59	ice	0.9584	59,830		1.00	65
Saltpeter	1.0-2.0	94	snow, fresh fallen	0.88-0.92	56	Minerals		
Starch	1.32	82	sea water	1.025	8	Asbestos	2.1-2.8	153
Sulfur	1.93-2.07	125	Ashlar Masonry			Barytes	4.50	281
Wool	1.32	82	Bluestone	2.3-2.6	153	Basalt	2.7-3.2	184
			Granite, syenite, gneiss	2.4-2.7	159	Bauxite	2.55	159
			Limestone	2.1-2.8	153	Bluestone	2.5-2.6	159
			Marble	2.4-2.8	162	Borax	1.7-1.8	109
			Sandstone	2.0-2.6	143	Chalk	1.8-2.8	143
			Rubble Masonry			Clay, marl	1.8-2.6	137
			Bluestone	2.2-2.5	147	Dolomite	2.9	181
			Granite, syenite, gneiss	2.3-2.6	153	Feldspar, orthoclase	2.5-2.7	162
			Limestone	2.0-2.7	147	Gneiss	2.7-2.9	175
			Marble	2.3-2.7	156	Granite	2.6-2.7	165
			Sandstone	1.9-2.5	137	Greenstone, trap	2.8-3.2	187
						Gypsum, alabaster	2.3-2.8	159
						Hornblende	3.0	187
						Limestone	2.1-2.86	155
						Marble	2.6-2.86	170
						Magnesite	3.0	187
						Phosphate rock, apatite	3.2	200
						Porphyry	2.6-2.9	172

*From Marks, *Mechanical Engineers' Handbook*, McGraw-Hill.

TABLE 2-118 Approximate Specific Gravities and Densities of Miscellaneous Solids and Liquids (Concluded)

Water at 4°C and normal atmospheric pressure taken as unity. For more detailed data on any material, see the section dealing with the properties of that material.

Substance	Sp. gr.	Aver. weight lb/ft ³	Substance	Sp. gr.	Aver. weight lb/ft ³	Substance	Sp. gr.	Aver. weight lb/ft ³
Minerals (Cont.)			Bituminous Substances			Bituminous Substances (Cont.)		
Pumice, natural	0.37-0.90	40	Asphaltum	1.1-1.5	81	Petroleum	0.87	54
Quartz, flint	2.5-2.8	165	Coal, anthracite	1.4-1.8	97	refined (kerosene)	0.78-0.82	50
Sandstone	2.0-2.6	143	bituminous	1.2-1.5	84	benzine	0.73-0.75	46
Serpentine	2.7-2.8	171	lignite	1.1-1.4	78	gasoline	0.70-0.75	45
Shale, slate	2.6-2.9	172	peat, turf, dry	0.65-0.85	47	Pitch	1.07-1.15	69
Soapstone, talc	2.6-2.8	169	charcoal, pine	0.28-0.44	23	Tar, bituminous	1.20	75
Syenite	2.6-2.7	165	charcoal, oak	0.47-0.57	33	Coal and Coke, Piled		
Stone, Quarried, Piled			coke	1.0-1.4	75	Coal, anthracite	0.75-0.93	47-58
Basalt, granite, gneiss	1.5	96	Graphite	1.64-2.7	135	bituminous, lignite	0.64-0.87	40-54
Greenstone, hornblende	1.7	107	Paraffin	0.87-0.91	56	peat, turf	0.32-0.42	20-26
Limestone, marble, quartz	1.5	95				charcoal	0.16-0.23	10-14
Sandstone	1.3	82				coke	0.37-0.51	23-32
Shale	1.5	92						

NOTE: To convert pounds per cubic foot to kilograms per cubic meter, multiply by 16.02. °F = 5/9 °C + 32.

TABLE 2-119 Density (kg/m³) of Selected Elements as a Function of Temperature

Temperature, K°	Element symbol												
	Al	Be†	Cr	Cu	Au	Ir	Fe	Pb	Mo	Ni	Pt	Ag	Zn†
50	2736	3650	7160	9019	19,490	22,600	7910	11,570	10,260	8960	21,570	10,620	7280
100	2732	3640	7155	9009	19,460	22,580	7900	11,520	10,260	8950	21,550	10,600	7260
150	2726	3630	7150	8992	19,420	22,560	7890	11,470	10,250	8940	21,530	10,575	7230
200	2719	3620	7145	8973	19,380	22,540	7880	11,430	10,250	8930	21,500	10,550	7200
250	2710	3610	7140	8951	19,340	22,520	7870	11,380	10,250	8910	21,470	10,520	7170
300	2701	3600	7135	8930	19,300	22,500	7860	11,330	10,240	8900	21,450	10,490	7135
400	2681	3580	7120	8885	19,210	22,450	7830	11,230	10,220	8860	21,380	10,430	7070
500	2661	3555	7110	8837	19,130	22,410	7800	11,130	10,210	8820	21,330	10,360	7000
600	2639	3530	7080	8787	19,040	22,360	7760	11,010	10,190	8780	21,270	10,300	6935
800	2591		7040	8686	18,860	22,250	7690	10,430	10,160	8690	21,140	10,160	6430
1000	2365		7000	8568	18,660	22,140	7650	10,190	10,120	8610	21,010	10,010	6260
1200	2305		6945	8458	18,440	22,030	7620	9,940	10,080	8510	20,870	9,850	
1400	2255		6890	7920	17,230	21,920	7520		10,040	8410	20,720	9,170	
1600			6760	7750	16,950	21,790	7420		10,000	8320	20,570	8,980	
1800			6700	7600		21,660	7320		9,950	7690	20,400		
2000				7460		21,510	7030		9,900	7450	20,220		

NOTE: Above the horizontal line the condensed phase is solid; below the line, it is liquid.

°R = 5/9 K.

†Polycrystalline form tabulated. Similar tables for an additional 45 elements appear in the *Handbook of Heat Transfer*; 2d ed., McGraw-Hill, New York, 1984.

SOLUBILITIES

UNITS CONVERSIONS

For this subsection, the following units conversions are applicable:

$$°F = 5/9 °C + 32.$$

To convert cubic centimeters to cubic feet, multiply by 3.532×10^{-5} .

To convert millimeters of mercury to pounds-force per square inch, multiply by 0.01934.

To convert grams per liter to pounds per cubic foot, multiply by 6.243×10^{-2} .

TABLE 2-120 Solubilities of Inorganic Compounds in Water at Various Temperatures*

This table shows the amount of anhydrous substance that is soluble in 100 g of water at the temperature in degrees Celsius as indicated; when the name is followed by †, the value is expressed in grams of substance in 100 cm³ of saturated solution. Solid phase gives the hydrated form in equilibrium with the saturated solution.

	Substance	Formula	Solid phase	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C	100°C	
1	Aluminum chloride	AlCl ₃	6H ₂ O			69.86 ¹⁵⁰									1
2	sulfate	Al ₂ (SO ₄) ₃	18H ₂ O	31.2	33.5	36.4	40.4	46.1	52.2	59.2	66.1	73.0	80.8	89.0	2
3	Ammonium aluminum sulfate	(NH ₄) ₂ Al ₂ (SO ₄) ₄	24H ₂ O	2.1	4.99	7.74	10.94	14.88	20.10	26.70				109.7 ⁹⁶⁰	3
4	bicarbonate	NH ₄ HCO ₃		11.9	15.8	21	27								4
5	bromide	NH ₄ Br		60.6	68	75.5	83.2	91.1	99.2	107.8	116.8	126	135.6	145.6	5
6	chloride	NH ₄ Cl		29.4	33.3	37.2	41.4	45.8	50.4	55.2	60.2	65.6	71.3	77.3	6
7	chloroplatinate	(NH ₄) ₂ PtCl ₆			0.7										7
8	chromate	(NH ₄) ₂ CrO ₄					40.4								8
9	chromium sulfate	(NH ₄) ₂ Cr ₂ (SO ₄) ₄	24H ₂ O			10.78 ²⁵⁰									9
10	dichromate	(NH ₄) ₂ Cr ₂ O ₇					47.17								10
11	dihydrogen phosphite	NH ₄ H ₂ PO ₃		171		190 ¹⁴⁵⁰	260 ³¹⁰								11
12	hydrogen phosphate	(NH ₄) ₂ HPO ₄				131 ¹⁵									12
13	iodide	NH ₄ I		154.2	163.2	172.3	181.4	190.5	199.6	208.9	218.7	228.8		250.3	13
14	magnesium phosphate	NH ₄ MgPO ₄	6H ₂ O	0.023		0.052		0.036	0.030	0.040	0.016	0.019			14
15	manganese phosphate	NH ₄ MnPO ₄	7H ₂ O			0		0		0	0.005	0.007			15
16	nitrate	NH ₄ NO ₃		118.3		192	241.8	297.0	344.0	421.0	499.0	580.0	740.0	871.0	16
17	oxalate	(NH ₄) ₂ C ₂ O ₄	1H ₂ O	2.2	3.1	4.4	5.9	8.0	10.3						17
18	perchlorate†	NH ₄ ClO ₄ †		11.56		20.85		30.58		39.05		48.19		57.01	18
19	persulfate	(NH ₄) ₂ S ₂ O ₈		58.2											19
20	sulfate	(NH ₄) ₂ SO ₄		70.6	73.0	75.4	78.0	81.0		88.0		95.3		103.3	20
21	thiocyanate	NH ₄ CNS		119.8	144	170	207.7								21
22	vanadate (meta)	NH ₄ VO ₃				0.48	0.84	1.32	1.78		3.05				22
23	Antimonious fluoride	SbF ₃		384.7		444.7	563.6								23
24	sulfide	Sb ₂ S ₃				0.000175 ¹⁸⁰									24
25	Arsenic oxide	As ₂ O ₃		59.5	62.1	65.8	69.5	71.2		73.0		75.1		76.7	25
26	Arsenious sulfide	As ₂ S ₃		5.17×10 ⁻⁵ at 18°											26
27	Barium acetate	Ba(C ₂ H ₃ O ₂) ₂	3H ₂ O	59	63	71									27
28	acetate	Ba(C ₂ H ₃ O ₂) ₂	1H ₂ O					75	79	77	74	74		75	28
29	carbonate	BaCO ₃			0.0016 ⁸⁰	0.0022 ¹⁸⁰	0.0024 at 24.2°								29
30	chlorate	Ba(ClO ₃) ₂	1H ₂ O	20.34	26.95	33.80	41.70	49.61		66.81		84.84		104.9	30
31	chloride	BaCl ₂	2H ₂ O	31.6	33.3	35.7	38.2	40.7	43.6	46.4	49.4	52.4		58.8	31
32	chromate	BaCrO ₄		0.0002	0.00028	0.00037	0.00046								32
33	hydroxide	Ba(OH) ₂	8H ₂ O	1.67	2.48	3.89	5.59	8.22	13.12	20.94		101.4			33
34	iodide	BaI ₂	6H ₂ O	170.2	185.7	203.1	219.6								34
35	iodide	BaI ₂	2H ₂ O					231.9		247.3		261.0		271.7	35
36	nitrate	Ba(NO ₃) ₂		5.0	7.0	9.2	11.6	14.2	17.1	20.3		27.0		34.2	36
37	nitrite	Ba(NO ₂) ₂	1H ₂ O			67.5						205.8		300	37
38	oxalate	BaC ₂ O ₄			0.0016 ⁸⁰	0.0022 ¹⁸⁰	0.0024 at 24.2°								38
39	perchlorate	Ba(ClO ₄) ₂	3H ₂ O	205.8		289.1		358.7	426.3		495.2		562.3		39
40	sulfate	BaSO ₄		1.15 × 10 ⁻⁴	2.0 × 10 ⁻⁴	2.4 × 10 ⁻⁴	2.85 × 10 ⁻⁴								40
41	Beryllium sulfate	BeSO ₄	6H ₂ O				52		60.67						41
42	sulfate	BeSO ₄	4H ₂ O				43.78	46.74			62				42
43	sulfate	BeSO ₄	2H ₂ O									84.76	98	100	43
44	Boric acid	H ₃ BO ₃		2.66	3.57	5.04	6.60	8.72	11.54	14.81	16.73	23.75	30.38	40.25	44
45	Boron oxide	B ₂ O ₃		1.1	1.5	2.2	3.2	4.0		6.2	9.5		15.7		45
46	Bromine	Br ₂		4.22	3.4	3.20									46
47	Cadmium chloride	CdCl ₂	4H ₂ O	97.59	125.1										47
48	chloride	CdCl ₂	2½H ₂ O	90.01			132.1								48
49	chloride	CdCl ₂	1H ₂ O		135.1	134.5		135.3		136.5		140.4		147.0	49
50	cyanide	Cd(CN) ₂				1.7 ¹⁵⁰									50
51	hydroxide	Cd(OH) ₂						2.6 × 10 ⁻⁴ at 25°							51
52	sulfate	CdSO ₄		76.48	76.00	76.60		78.54		83.68			63.13	60.77	52
53	Calcium acetate	Ca(C ₂ H ₃ O ₂) ₂	2H ₂ O	37.4	36.0	34.7	33.8	33.2		32.7		33.5			53
54	acetate	Ca(C ₂ H ₃ O ₂) ₂	1H ₂ O										31.1	29.7	54

*By N. A. Lange. Abridged from "Table of Solubilities of Inorganic Compounds in Water at Various Temperatures" in Lange, *Handbook of Chemistry*, 10th ed., McGraw-Hill, New York, 1961. For tables of the solubility of gases in water at various temperatures, Atack (*Handbook of Chemical Data*, Reinhold, New York, 1957) gives values at closer temperature intervals, usually 1 or 5°C, than are tabulated here. For materials marked by †, additional data are given in tables subsequent to this one. For the solubility of various hydrocarbons in water at high pressures see *J. Chem. Eng. Data*, **4**, 212 (1959).

TABLE 2-120 Solubilities of Inorganic Compounds in Water at Various Temperatures (Continued)

	Substance	Formula	Solid phase	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C	100°C	
1	Calcium bicarbonate	Ca(HCO ₃) ₂		16.15		16.60		17.05		17.50		17.95		18.40	1
2	chloride	CaCl ₂	6H ₂ O	59.5	65.0	74.5	102								2
3	chloride	CaCl ₂	2H ₂ O							136.8	141.7	147.0	152.7	159	3
4	fluoride	CaF ₂				0.0016 ¹⁸⁰	0.0017 ²⁶⁰								4
5	hydroxide	Ca(OH) ₂		0.185	0.176	0.165	0.153	0.141	0.128	0.116	0.106	0.094	0.085	0.077	5
6	nitrate	Ca(NO ₃) ₂	4H ₂ O	102.0	115.3	129.3	152.6	195.9							6
7	nitrate	Ca(NO ₃) ₂	3H ₂ O					237.5	281.5						7
8	nitrate	Ca(NO ₃) ₂										358.7			8
9	nitrite	Ca(NO ₂) ₂	4H ₂ O	62.07		76.68									9
10	nitrite	Ca(NO ₂) ₂	2H ₂ O							132.6	151.9		244.8		10
11	oxalate	CaC ₂ O ₄			6.7 × 10 ⁻⁴	6.8 × 10 ⁻⁴	9.5 × 10 ⁻⁴	14 × 10 ⁻⁴							11
12	sulfate	CaSO ₄	2H ₂ O	0.1759	0.1928	0.2090	0.2097			0.2047	0.1966			0.1619	12
13	Carbon dioxide, 760 mm †	CO ₂		0.3346	0.2318	0.1688	0.1257	0.0973	0.0761	0.0576				0	13
14	monoxide, 760 mm †	CO		0.0044	0.0035	0.0028	0.0024	0.0021	0.0018	0.0015	0.0013	0.0010	0.0006	0	14
15	Cesium chloride	CsCl		161.4	174.7	186.5	197.3	208.0	218.5	229.7	239.5	250.0	260.1	270.5	15
16	nitrate	CsNO ₃		9.33	14.9	23.0	33.9	47.2	64.4	83.8	107.0	134.0	163.0	197.0	16
17	sulfate	Cs ₂ SO ₄		167.1	173.1	178.7	184.1	189.9	194.9	199.9	205.0	210.3	214.9	220.3	17
18	Chlorine, 760 mm †	Cl ₂		1.46	0.980	0.716	0.562	0.451	0.386	0.324	0.274	0.219	0.125	0	18
19	Chromic anhydride	CrO ₃		164.9				174.0	182.1				217.5	206.8	19
20	Cuprio chloride	CuCl ₂	2H ₂ O	70.7	73.76	77.0	80.34	83.8	87.44	91.2		99.2		107.9	20
21	nitrate	Cu(NO ₃) ₂	6H ₂ O	81.8	95.28	125.1									21
22	nitrate	Cu(NO ₃) ₂	3H ₂ O					159.8		178.8		207.8			22
23	sulfate	CuSO ₄	5H ₂ O	14.3	17.4	20.7	25	28.5	33.3	40		55		75.4	23
24	sulfide	CuS				3.3 × 10 ⁻⁵									24
25	Cuprous chloride	CuCl				at 18°									25
26	Ferric chloride	FeCl ₃		74.4	81.9	91.8				315.1		525.8		535.7	26
27	Ferrous chloride	FeCl ₂	4H ₂ O		64.5		73.0	77.3	82.5	88.7		100			27
28	chloride	FeCl ₃											105.3	105.8	28
29	nitrate	Fe(NO ₃) ₂	6H ₂ O	71.02		83.8				165.6					29
30	sulfate	FeSO ₄	7H ₂ O	15.65	20.51	26.5	32.9	40.2	48.6						30
31	sulfate	FeSO ₄	1H ₂ O								50.9	43.6	37.3		31
32	Hydrobromic acid, 760 mm	HBr		221.2	210.3	198			171.5					130	32
33	Hydrochloric acid, 760 mm	HCl		82.3			67.3	63.3	59.6	56.1					33
34	Iodine	I ₂				0.029	0.04	0.056	0.078						34
35	Lead acetate	Pb(C ₂ H ₃ O ₂) ₂	3H ₂ O				55.04 ²³⁰								35
36	bromide	PbBr ₂		0.4554		0.85	1.15	1.53	1.94	2.36		3.34		4.75	36
37	carbonate	PbCO ₃				0.00011									37
38	chloride	PbCl ₂		0.6728		0.99	1.20	1.45	1.70	1.98		2.62		3.34	38
39	chromate	PbCrO ₄				7 × 10 ⁻⁶									39
40	fluoride	PbF ₂			0.060	0.064	0.068								40
41	nitrate	Pb(NO ₃) ₂		38.8	48.3	56.5	66	75	85	95		115		38.8	41
42	sulfate	PbSO ₄		0.0028	0.0035	0.0041	0.0049	0.0056							42
43	Magnesium bromide	MgBr ₂	6H ₂ O	91.0	94.5	96.5	99.2	101.6	104.1	107.5		113.7		120.2	43
44	chloride	MgCl ₂	6H ₂ O	52.8	53.5	54.5		57.5		61.0		66.0		73.0	44
45	hydroxide	Mg(OH) ₂				0.0009 ¹⁸⁰									45
46	nitrate	Mg(NO ₃) ₂	6H ₂ O	66.55				84.74					137.0		46
47	sulfate	MgSO ₄	7H ₂ O		30.9	35.5	40.8	45.6							47
48	sulfate	MgSO ₄	6H ₂ O	40.8	42.2	44.5	45.3		50.4	53.5	59.5	64.2	69.0	74.0	48
49	sulfate	MgSO ₄	1H ₂ O									62.9		68.3	49
50	Manganous sulfate	MnSO ₄	7H ₂ O	53.23	60.01										50
51	sulfate	MnSO ₄	5H ₂ O		59.5	62.9	67.76								51
52	sulfate	MnSO ₄	4H ₂ O			64.5	66.44	68.8	72.6						52
53	sulfate	MnSO ₄	1H ₂ O						58.17	55.0	52.0	48.0	42.5	34.0	53
54	Mercurous chloride	HgCl		0.00014		0.0002		0.0007							54
55	Molybdic oxide	MoO ₃	2H ₂ O			0.138	0.264	0.476	0.687	1.206	2.055	2.106			55
56	Nickel chloride	NiCl ₂	6H ₂ O	53.9	59.5	64.2	68.9	73.3	78.3	82.2	85.2			87.6	56
57	nitrate	Ni(NO ₃) ₂	6H ₂ O	79.58		96.31		122.2							57
58	nitrate	Ni(NO ₃) ₂	3H ₂ O								163.1	169.1		235.1	58
59	sulfate	NiSO ₄	7H ₂ O	27.22	32		42.46								59
60	sulfate	NiSO ₄	6H ₂ O												60
61	Nitric oxide, 760 mm	NO		0.00984	0.00757	0.00618	0.00517	0.00440	50.15	54.80	59.44	63.17	0.00199	76.7	61
62	Nitrous oxide	N ₂ O			0.1705	0.1211			0.00376	0.00324	0.00267		0.00114	0	62

TABLE 2-120 Solubilities of Inorganic Compounds in Water at Various Temperatures (Concluded)

	Substance	Formula	Solid phase	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C	100°C	
1	Sodium vanadate (meta)	NaVO ₃				21.10 ²⁵⁰		26.23		32.97	36.9	38.8 ⁷⁵⁰			1
2	Stannous chloride	SnCl ₂		83.9		269.8 ¹⁵⁰									2
3	sulfate	SnSO ₄				19								18	3
4	Strontium acetate	Sr(C ₂ H ₃ O ₂) ₂	4H ₂ O	36.9	43.61										4
5	acetate	Sr(C ₂ H ₃ O ₂) ₂	½H ₂ O		42.95	41.6	39.5		37.35		36.24	36.10		36.4	5
6	chloride	SrCl ₂	6H ₂ O	43.5	47.7	52.9	58.7	65.3	72.4	81.8					6
7	chloride	SrCl ₂	2H ₂ O								85.9	90.5		100.8	7
8	nitrate	Sr(NO ₃) ₂	1H ₂ O	52.7		64.0			83.8	97.2			130.4	139	8
9	nitrate	Sr(NO ₃) ₂	4H ₂ O	40.1		70.5									9
10	nitrate	Sr(NO ₃) ₂					88.6	90.1		93.8	96	98	100		10
11	sulfate	SrSO ₄		0.0113		0.0114	0.0114								11
12	Sulfur dioxide, 760 mm †	SO ₂		22.83	16.21	11.29	7.81	5.41	4.5						12
13	Thallium sulfate	Tl ₂ SO ₄		2.70	3.70	4.87	6.16		9.21	10.92	12.74	14.61	16.53	18.45	13
14	Thorium sulfate	Th(SO ₄) ₂	9H ₂ O	0.74	0.98	1.38	1.995	2.998	5.22						14
15	sulfate	Th(SO ₄) ₂	8H ₂ O	1.0	1.25	1.62									15
16	sulfate	Th(SO ₄) ₂	6H ₂ O	1.50		1.90	2.45			6.64					16
17	sulfate	Th(SO ₄) ₂	4H ₂ O					4.04	2.54	1.63	1.09				17
18	Zinc chlorate	ZnClO ₃	6H ₂ O	145.0	152.5										18
19	chlorate	ZnClO ₃	4H ₂ O			200.3	209.2	223.2	273.1						19
20	nitrate	Zn(NO ₃) ₂	6H ₂ O	94.78		118.3									20
21	nitrate	Zn(NO ₃) ₂	3H ₂ O					206.9							21
22	sulfate	ZnSO ₄	7H ₂ O	41.9	47	54.4									22
23	sulfate	ZnSO ₄	6H ₂ O					70.1	76.8						23
24	sulfate	ZnSO ₄	1H ₂ O									86.6	83.7	80.8	24

The *H* in solubility tables (2-121 to 2-144) is the proportionality constant for the expression of Henry's law, $p = Hx$, where x = mole fraction of the solute in the liquid phase; p = partial pressure of the solute in the gas phase, expressed in atmospheres; and H = a proportionality constant expressed in units of atmospheres of solute pressure in the gas phase per unit concentration of the solute in the liquid phase. (The unit of concentration of the solute in the liquid phase is moles solute per mole solution.)

TABLE 2-121 Acetylene (C₂H₂)

<i>t</i> , °C	0	5	10	15	20	25	30
$10^{-3} \times H^\circ$	0.72	0.84	0.96	1.08	1.21	1.33	1.46

International Critical Tables, vol. 3, p. 260, McGraw-Hill, 1928.
[°]*H*. See footnote for Table 2-122.

TABLE 2-122 Air

<i>t</i> , °C	0	5	10	15	20	25	30	35
$10^{-4} \times H^\circ$	4.32	4.88	5.49	6.07	6.64	7.20	7.71	8.23

<i>t</i> , °C	40	45	50	60	70	80	90	100
$10^{-4} \times H^\circ$	8.70	9.11	9.46	10.1	10.5	10.7	10.8	10.7

International Critical Tables, vol. 3, p. 257.
[°]*H* is calculated from the absorption coefficients of O₂ and N₂, taking into consideration the correction for constant argon content.

TABLE 2-123 Ammonia (NH₃)

Weight NH ₃ per 100 weights H ₂ O	Partial pressure of NH ₃ , mm. Hg								
	0°C	10°C	20°C	25°C	30°C	40°C	50°C	60°C	
100	947								
90	785								
80	636	987	1450			3300			
70	500	780	1170			2760			
60	380	600	945			2130			
50	275	439	686			1520			
40	190	301	470		719	1065			
30	119	190	298		454	692			
25	89.5	144	227		352	534	825		
20	64	103.5	166		260	395	596	834	
15	42.7	70.1	114		179	273	405	583	
10	25.1	41.8	69.6		110	167	247	361	
7.5	17.7	29.9	50.0		79.7	120	179	261	
5	11.2	19.1	31.7		51.0	76.5	115	165	
4		16.1	24.9		40.1	60.8	91.1	129.2	
3		11.3	18.2	23.5	29.6	45	67.1	94.3	
2.5			15.0	19.4	24.4	(37.6) [°]	(55.7)	77.0	
2			12.0	15.3	19.3	(30.0)	(44.5)	61.0	
1.6				12.0	15.3	(24.1)	(35.5)	48.7	
1.2					9.1	11.5	(18.3)	(26.7)	36.3
1.0					7.4		(15.4)	(22.2)	30.2
0.5					3.4				

[°]Extrapolated values.

TABLE 2-124 Ammonia (NH₃)—Low Pressures

Weight NH ₃ per 100 weights H ₂ O	0.105	0.244	0.32	0.38	0.576	0.751	1.02
Partial pressure NH ₃ , mm. Hg, at 25°C	0.791	1.83	2.41	2.89	4.41	5.80	7.96
Weight NH ₃ per 100 weights H ₂ O	1.31	1.53	1.71	1.98	2.11	2.58	2.75
Partial pressure NH ₃ , mm. Hg, at 25°C	10.31	11.91	13.46	15.75	16.94	20.86	22.38

"Landolt-Börnstein Physikalisches-chemische Tabellen," Eg. I, p. 303, 1927. Phase-equilibrium data for the binary system NH₃-H₂O are given by Clifford and Hunter, *J. Phys. Chem.*, **37**, 101 (1933).

TABLE 2-125 Carbon Dioxide (CO₂)

Total pressure, atm	Weight of CO ₂ per 100 weights of H ₂ O [°]								
	12°C	18°C	25°C	31.04°C	35°C	40°C	50°C	75°C	100°C
25	3.86			2.80	2.56	2.30	1.92	1.35	1.06
50	7.03	6.33	5.38	4.77	4.39	4.02	3.41	2.49	2.01
75	7.18	6.69	6.17	5.80	5.51	5.10	4.45	3.37	2.82
100	7.27	6.72	6.28	5.97	5.76	5.50	5.07	4.07	3.49
150	7.59	7.07		6.25	6.03	5.81	5.47	4.86	4.49
200				6.48	6.29	6.28	5.76	5.27	5.08
300	7.86	7.35					6.20	5.83	5.84
400	8.12	7.77	7.54	7.27	7.06	6.89	6.58	6.30	6.40
500				7.65	7.51	7.26			
700							7.58	7.43	7.61

[°]In the original, concentration is expressed in cubic centimeters of CO₂ (reduced to 0°C and 1 atm) dissolved in 1 g of water.

TABLE 2-126 Carbon Monoxide (CO)

Partial pressure of CO, mm Hg	$10^{-4} \times H$	
	17.7°C	19.0°C
900	4.77	4.88
2000	4.77	4.91
3000	4.77	4.93
4000	4.78	4.95
5000	4.80	4.97
6000	4.82	4.98
7000	4.86	5.02
8000	4.88	5.08

International Critical Tables, vol. 3, p. 260.

TABLE 2-127 Carbonyl Sulfide (COS)

<i>t</i> °C	0	5	10	15	20	25	30
$10^{-3} \times H$	0.92	1.17	1.48	1.82	2.19	2.59	3.04

International Critical Tables, vol. 3, p. 261.

TABLE 2-128 Chlorine (Cl₂)

Partial pressure of Cl ₂ , mm Hg	Solubility, g of Cl ₂ per liter					
	0°C	10°C	20°C	30°C	40°C	50°C
	5	0.488	0.451	0.438	0.424	0.412
10	.679	.603	.575	.553	.532	.512
30	1.221	1.024	.937	.873	.821	.781
50	1.717	1.354	1.210	1.106	1.025	.962
100	2.79	2.08	1.773	1.573	1.424	1.313
150	3.81	2.73	2.27	1.966	1.754	1.599
200	4.78	3.35	2.74	2.34	2.05	1.856
250	5.71	3.95	3.19	2.69	2.34	2.09
300		4.54	3.63	3.03	2.61	2.31
350		5.13	4.06	3.35	2.86	2.53
400		5.71	4.48	3.69	3.11	2.74
450		6.26	4.88	3.98	3.36	2.94
500		6.85	5.29	4.30	3.61	3.14
550		7.39	5.71	4.60	3.84	3.33
600		7.97	6.12	4.91	4.08	3.52
650		8.52	6.52	5.21	4.32	3.71
700		9.09	6.90	5.50	4.54	3.89
750		9.65	7.29	5.80	4.77	4.07
800		10.21	7.69	6.08	4.99	4.27
900			8.46	6.68	5.44	4.62
1000			9.27	7.27	5.89	4.97
1200			10.84	8.42	6.81	5.67
1500			13.23	10.14	8.05	6.70
2000			17.07	13.02	10.22	8.38
2500			21.0	15.84	12.32	10.03
3000				18.73	14.47	11.70
3500				21.7	16.62	13.38
4000				24.7	18.84	15.04
4500				27.7	20.7	16.75
5000				30.8	23.3	18.46

Partial pressure of Cl ₂ , mm Hg	Solubility, g of Cl ₂ per liter					
	60°C	70°C	80°C	90°C	100°C	110°C
	5	0.383	0.369	0.351	0.339	0.326
10	.492	.470	.447	.431	.415	.402
30	.743	.704	.671	.642	.627	.598
50	.912	.863	.815	.781	.747	.722
100	1.228	1.149	1.085	1.034	.987	.950
150	1.482	1.382	1.294	1.227	1.174	1.137
200	1.706	1.580	1.479	1.396	1.333	1.276
250	1.914	1.764	1.642	1.553	1.480	1.413
300	2.10	1.932	1.793	1.700	1.610	1.542
350	2.28	2.10	1.940	1.831	1.736	1.661
400	2.47	2.25	2.08	1.965	1.854	1.773
450	2.64	2.41	2.22	2.09	1.972	1.880
500	2.80	2.55	2.35	2.21	2.08	1.986
550	2.97	2.69	2.47	2.32	2.19	2.09
600	3.13	2.83	2.59	2.43	2.29	2.19
650	3.29	2.97	2.72	2.55	2.41	2.28
700	3.44	3.10	2.84	2.66	2.50	2.37
750	3.59	3.23	2.96	2.76	2.60	2.47
800	3.75	3.37	3.08	2.87	2.69	2.56
900	4.04	3.63	3.30	3.08	2.89	2.74
1000	4.36	3.88	3.53	3.28	3.07	2.91
1200	4.92	4.37	3.95	3.67	3.43	3.25
1500	5.76	5.09	4.58	4.23	3.95	3.74
2000	7.14	6.26	5.63	5.17	4.78	4.49
2500	8.48	7.40	6.61	6.05	5.59	5.25
3000	9.83	8.52	7.54	6.92	6.38	5.97
3500	11.22	9.65	8.53	7.79	7.16	6.72
4000	12.54	10.76	9.52	8.65	7.94	7.42
4500	13.88	11.91	10.46	9.49	8.72	8.13
5000	15.26	13.01	11.42	10.35	9.48	8.84

TABLE 2-129 Chlorine Dioxide (ClO₂)

Vol % of ClO ₂ in gas phase	Weight of ClO ₂ , grams per liter of solution						
	0°C	5°C	10°C	15°C	20°C	30°C	40°C
1	2.00	1.50	1.25	1.00	0.90	0.60	0.46
3	6.00	4.7	3.85	3.20	2.70	1.95	1.30
5	10.0	7.8	6.30	5.25	4.30	3.20	2.25
7	14.0	10.9	8.95	7.35	6.15	4.40	3.20
10	20.0	15.5	12.8	10.5	8.80	6.30	4.50
11		17.0	14.0	11.7	9.70	7.00	5.00
12		18.6	15.3	12.8	10.55	7.50	5.45
13		20.3	16.6	13.8	11.5	8.20	5.85
14			18.0	14.9	12.3	8.80	6.35
15			19.2	16.0	13.2	9.50	6.80
16			20.3	17.0	14.2	10.1	7.20

Ishi, *Chem. Eng. (Japan)*, **22**, 153 (1958).TABLE 2-130 Ethane (C₂H₆)

t, °C	0	5	10	15	20	25	30	35
10 ⁻⁴ × H	1.26	1.55	1.89	2.26	2.63	3.02	3.42	3.83
t, °C	40	45	50	60	70	80	90	100
10 ⁻⁴ × H	4.23	4.63	5.00	5.65	6.23	6.61	6.87	6.92

International Critical Tables, vol. 3, p. 261.TABLE 2-131 Ethylene (C₂H₄)

t, °C	0	5	10	15	20	25	30
10 ⁻³ × H	5.52	6.53	7.68	8.95	10.2	11.4	12.7

International Critical Tables, vol. 3, p. 260.

TABLE 2-132 Helium (He)

t, °C	0	10	20	30	40	50
10 ⁻⁴ × H	12.9	12.6	12.5	12.4	12.1	11.5

See also Pray, Schweickert, and Minnich, *Ind. Eng. Chem.*, **44**, 1146 (1952).TABLE 2-133 Hydrogen (H₂)—Temperature

t, °C	0	5	10	15	20	25	30	35
10 ⁻⁴ × H	5.79	6.08	6.36	6.61	6.83	7.07	7.29	7.42
t, °C	40	45	50	60	70	80	90	100
10 ⁻⁴ × H	7.51	7.60	7.65	7.65	7.61	7.55	7.51	7.45

International Critical Tables, vol. 3, p. 256.See also Pray, Schweickert, and Minnich, *Ind. Eng. Chem.*, **44**, 1146 (1952).

TABLE 2-134 Hydrogen (H₂)—Pressure

Partial pressure H ₂ , mm Hg	10 ⁻⁴ × H	
	19.5°C	23°C
900	7.42	
1100		7.75
2000	7.42	7.76
3000	7.43	7.77
4000	7.47	7.81
5000	7.56	7.89
6000	7.70	8.00
7000	7.87	8.16
8200		8.41
8250	8.17	

International Critical Tables, vol. 3, p. 256.

TABLE 2-135 Hydrogen Chloride (HCl)

Weights of HCl per 100 weights of H ₂ O	Partial pressure of HCl, mm Hg			
	0°C	10°C	20°C	30°C
78.6	510	840		
66.7	130	233	399	627
56.3	29.0	56.4	105.5	188
47.0	5.7	11.8	23.5	44.5
38.9	1.0	2.27	4.90	9.90
31.6	0.175	0.43	1.00	2.17
25.0	.0316	.084	0.205	0.48
19.05	.0056	.016	.0428	.106
13.64	.00099	.00305	.0088	.0234
8.70	.000118	.000583	.00178	.00515
4.17	.000018	.000069	.00024	.00077
2.04		.0000117	.000044	.000151

Weights of HCl per 100 weights of H ₂ O	Partial pressure of HCl, mm Hg		
	50°C	80°C	110°C
78.6			
66.7			
56.3	535		
47.0	141	623	
38.9	35.7	188	760
31.6	8.9	54.5	253
25.0	2.21	15.6	83
19.05	0.55	4.66	28
13.64	.136	1.34	9.3
8.70	.0344	0.39	3.10
4.17	.0064	.095	0.93
2.04	.00140	.0245	.280

Enthalpy and phase-equilibrium data for the binary system HCl-H₂O are given by Van Nuys, *Trans. Am. Inst. Chem. Engrs.*, **39**, 663 (1943).

TABLE 2-136 Hydrogen Sulfide (H₂S)

t, °C	0	5	10	15	20	25	30	35
10 ⁻² × H	2.68	3.15	3.67	4.23	4.83	5.45	6.09	6.76
t, °C	40	45	50	60	70	80	90	100
10 ⁻² × H	7.45	8.14	8.84	10.3	11.9	13.5	14.4	14.8

International Critical Tables, vol. 3, p. 259.

TABLE 2-137 Methane (CH₄)

t, °C	0	5	10	15	20	25	30	35
10 ⁻⁴ × H	2.24	2.59	2.97	3.37	3.76	4.13	4.49	4.86
t, °C	40	45	50	60	70	80	90	100
10 ⁻⁴ × H	5.20	5.51	5.77	6.26	6.66	6.82	6.92	7.01

International Critical Tables, vol. 3, p. 260.

TABLE 2-138 Nitrogen (N₂)—Temperature*

t, °C	0	5	10	15	20	25	30	35
10 ⁻⁴ × H	5.29	5.97	6.68	7.38	8.04	8.65	9.24	9.85
t, °C	40	45	50	60	70	80	90	100
10 ⁻⁴ × H	10.4	10.9	11.3	12.0	12.5	12.6	12.6	12.6

International Critical Tables*, vol. 3, p. 256. See also Pray, Schweickert, and Minnich, *Ind. Eng. Chem.*, **44, 1146 (1952).

*Atmospheric nitrogen = 98.815 vol. % N₂ + 1.185 vol. % A.

TABLE 2-139 Nitrogen (N₂)—Pressure

Partial pressure of N ₂ , mm Hg	10 ⁻⁴ × H	
	19.4°C	24.9°C
900	8.24	9.08
2000	8.32	9.15
3000	8.41	9.25
4000	8.49	9.38
5000	8.59	9.49
6000	8.74	9.62
7000	8.86	9.75
8100	9.04	
8200		9.91

See also Goodman and Krase [*Ind. Eng. Chem.*, **23**, 401 (1931)] for values up to 169°C and 300 atm.

TABLE 2-140 Oxygen (O₂)—Temperature

t, °C	0	5	10	15	20	25	30	35
10 ⁻⁴ × H	2.55	2.91	3.27	3.64	4.01	4.38	4.75	5.07
t, °C	40	45	50	60	70	80	90	100
10 ⁻⁴ × H	5.35	5.63	5.88	6.29	6.63	6.87	6.99	7.01

International Critical Tables, vol. 3, p. 257. Pray, Schweickert, and Minnich [*Ind. Eng. Chem.*, **44**, 1146 (1952)] give H = 4.46 × 10⁻⁴ at 25°C and other values up to 343°C.

TABLE 2-141 Oxygen (O₂)—Pressure

Partial pressure of O ₂ , mm Hg	10 ⁻⁴ × H	
	23°C	25.9°C
800		4.79
900	4.58	
2000	4.59	4.80
3000	4.60	4.83
4000	4.68	4.88
5000	4.73	4.92
6000	4.80	4.98
7000	4.88	5.05
8150	4.98	
8200		5.16

International Critical Tables, vol. 3, p. 257. See also *Trans. Am. Soc. Mech. Engrs.*, **76**, 69 (1954) for solubility of O₂ for 100°F < T < 650°F, 300 < P < 2000 lb/in².

TABLE 2-142 Ozone (O₃)

<i>t</i> , °C	0	5	10	15	20	25	30	35	40	50
$10^{-3} \times H$	1.94	2.18	2.48	2.88	3.76	4.57	5.98	8.18	12.0	27.4

International Critical Tables, vol. 3, p. 257.

TABLE 2-143 Propylene (C₃H₆)

<i>t</i> , °C	2	6	10	14	18
$10^{-3} \times H$	3.04	3.84	4.46	5.06	5.69

International Critical Tables, vol. 3, p. 260.

TABLE 2-144 Partial Vapor Pressure of Sulfur Dioxide over Water, mm Hg

g SO ₂ / 100 g H ₂ O	Temperature, °C								
	0	10	20	30	40	50	60	90	120
0.01	0.02	0.04	0.07	0.12	0.19	0.29	0.43	1.21	2.82
0.05	0.38	0.66	1.07	1.68	2.53	3.69	5.24	12.9	27.0
0.10	1.15	1.91	3.03	4.62	6.80	9.71	13.5	31.7	63.9
0.15	2.10	3.44	5.37	8.07	11.7	16.5	22.7	52.2	104
0.20	3.17	5.13	7.93	11.8	17.0	23.8	32.6	73.7	145
0.25	4.34	6.93	10.6	15.7	22.5	31.4	42.8	95.8	186
0.30	5.57	8.84	13.5	19.8	28.2	39.2	53.3	118	229
0.40	8.17	12.8	19.4	28.3	40.1	55.3	74.7	164	316
0.50	10.9	17.0	25.6	37.1	52.3	72.0	96.8	211	404
1.00	25.8	39.5	58.4	83.7	117	159	212	454	856
2.00	58.6	88.5	129	183	253	342	453	955	
3.00	93.2	139	202	285	393	530	700		
4.00	129	192	277	389	535	720			
5.00	165	245	353	496	679				
6.00	202	299	430	602	824				
8.00	275	407	585	818					
10.00	351	517	741						
15.00	542	796							
20.00	735								

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THERMAL EXPANSION

UNITS CONVERSIONS

For this subsection, the following units conversion is applicable:

$$^{\circ}\text{F} = \% ^{\circ}\text{C} + 32.$$

ADDITIONAL REFERENCES

The tables given under this subject are reprinted by permission from the *Smithsonian Tables*. For more detailed data on thermal expansion, see *International Critical Tables*: tabular index, vol. 3, p. 1; abrasives, vol. 2, p. 87; alloys, vol. 2, p. 463; building stones, vol. 2, p. 54; carbons, vol. 2, p. 303; elements, vol. 1, p. 102; enamels, vol. 2, p. 115; glass, vol.

2, p. 93; metals, vol. 2, p. 459; petroleums, vol. 2, p. 145; porcelains, vol. 2, pp. 70, 78; refractory materials, vol. 2, p. 83; solid insulators, vol. 2, p. 310.

THERMAL EXPANSION OF GASES

No tables of the coefficients of thermal expansion of gases are given in this edition. The coefficient at constant pressure, $1/\alpha(\partial v/\partial T)_p$, for an ideal gas is merely the reciprocal of the absolute temperature. For a real gas or liquid, both it and the coefficient at constant volume, $1/p(\partial p/\partial T)_v$, should be calculated either from the equation of state or from tabulated *PVT* data.

TABLE 2-145 Linear Expansion of the Solid Elements*

C is the true expansion coefficient at the given temperature; *M* is the mean coefficient between given temperatures; where one temperature is given, the true coefficient at that temperature is indicated; α and β are coefficients in formula $l_t = l_0(1 + \alpha t + \beta t^2)$; l_0 is length at 0°C (unless otherwise indicated, when, if *x* is the reference temperature, $l_t = l_x[1 + \alpha(t - t_x) + \beta(t - t_x)^2]$; l_t is length at *t*°C).

Element	Temp. °C	<i>C</i> × 10 ⁴	Temp. range, °C	<i>M</i> × 10 ⁴	Temp. range, °C	α × 10 ⁴	β × 10 ⁶
Aluminum	20	0.224	100	0.235	0, 500	0.22	0.009
Aluminum	300	0.284	500	0.311			
Antimony	20	0.136	20	0.080⊥			
Arsenic	20	0.05					
Bismuth	20	0.014	20	0.103⊥			
Cadmium	0	0.54	-180, -140	0.59	20, 100	0.526	
Cadmium	0	0.20⊥	-180, -140	0.117⊥	20, 100	0.214⊥	
Carbon, diamond	50	0.012					
graphite	50	0.06					
Chromium			20, 100	0.068	20, 500	0.086	
Cobalt	20	0.123			6, 121	0.121	0.0064
Copper	20	0.162	100	0.166	0, 625	0.161	0.0040
Copper	200	0.170	300	0.175			
Gold	20	0.140	17, 100	0.143	0, 520	0.142	0.0022
Gold			-191, 17	0.132			
Indium	40	0.417					
Iodine			-190, 17	0.837			
Iridium	20	0.065			0, 80	0.0636	0.0032
Iridium					1070, 1720	0.0679	0.0011
Iron, soft	40	0.1210	0, 100	0.11			
cast	20	0.118			0, 750	0.1158	0.0053
wrought	20	0.119			0, 750	0.1170	0.0053
steel	20	0.114			0, 750	0.1118	0.0053
Lead (99.9)			20, 100	0.291	100, 240	0.269	0.011
	100	0.291	20, 200	0.300			
	280	0.343					
Magnesium	20	0.254	-100, +20	0.240	+20, 500	0.2480	0.0096
			20, 100	0.260			
Manganese	20	0.233	0, 100	0.228			
			-190, 0	0.159	20, 300	0.216	0.0121
Molybdenum†	20	0.053	0, 100	0.052	-142, 19	0.0515	0.0057
			25, 100	0.049	19, +305	0.0501	0.0014
			25, 500	0.055			
Nickel	20	0.126	0, 100	0.130	-190, +20	0.1308	0.0166
					+20, +300	0.1236	0.0066
					500, 1000	0.1346	0.0033
Osmium	40	0.066					
Palladium	20	0.1173			-190, +100	0.1152	0.00517
					0, 1000	0.1167	0.0022
Platinum	20	0.0887			-190, -100	0.0875	0.00314
	20	0.0893			0, +80	0.0890	0.00121
					0, 1000	0.0887	0.00132
Potassium			0, 50	0.83			
Rhodium	40	0.0850	6, 21	0.0876	-75, -112	0.0746	
Ruthenium	40	0.0963					
Selenium	0	0.439	0, 100	0.660			
Silicon	40	0.0763	-3, +18	0.0249	-75, -67	0.0182	
Silver	20	0.1846	0, 100	0.197	0, 875	0.1827	0.00479
	20	0.195			20, 500	0.1939	0.00295
			-190, -17	0.622	0, 50	0.72	
Sodium			20, 260	0.031	260, 500	0.144	
Steel, 36.4Ni			20, 340	0.055	340, 500	0.136	
Tantalum†	20	0.065	-78, 0	0.059	20, 400	0.0646	0.0009
			0, 100	0.0655			
Tellurium	20	0.016	20	0.272⊥			
Thallium	40	0.302					
Tin	20	0.214			8, 95	0.2033	0.0263
	20	0.305	20	0.154⊥			
Tungsten†	27	0.0444	0, 100	0.045	-105, +502	0.0428	0.00058
Zinc	20‡	0.643	-140, -100	0.656	+0, 400	0.354	0.010
	20‡	0.125⊥	+20, 100	0.639			
	20	0.358	+20, 100	0.141⊥			

**Smithsonian Tables*. For more complete tabulations see Table 142, *Smithsonian Physical Tables*, 9th ed., 1954; *Handbook of Chemistry and Physics*, 40th ed., pp. 2239–2245. American Rubber Publishing Co.; Goldsmith, and Waterman, WADC-TR-58-476, 1959; Johnson (ed.), WADD-TR-60-56, 1960, etc.

†Molybdenum, 300° to 2500°C; $l_t = l_{300}[1 + 5.00 \times 10^{-6}(t - 300) + 10.5 \times 10^{-10}(t - 300)^2]$

Tantalum, 300° to 2800°C; $l_t = l_{300}[1 + 6.60 \times 10^{-6}(t - 300) + 5.2 \times 10^{-10}(t - 300)^2]$

Tungsten, 300° to 2700°C; $l_t = l_{300}[1 + 4.44 \times 10^{-6}(t - 300) + 4.5 \times 10^{-10}(t - 300)^2]$

Beryllium, 20° to 100°C; 12.3×10^{-6} per °C.

Columbium, 0° to 100°C; 7.2×10^{-6} per °C.

Tantalum, 20° to 100°C; 6.6×10^{-6} per °C.

‡Two errors in the data of zinc have been corrected. These values were taken from Grüneisen and Goens, *Z. Physik.*, **29**, 141 (1924).

TABLE 2-146 Linear Expansion of Miscellaneous Substances*

The coefficient of cubical expansion may be taken as three times the linear coefficient. In the following table, t is the temperature or range of temperature, and C , the coefficient of expansion.

Substance	$t^{\circ}\text{C}$	$C \times 10^4$	Substance	$t^{\circ}\text{C}$	$C \times 10^4$	Substance	$t^{\circ}\text{C}$	$C \times 10^4$
Amber	0-30	0.50	Jena thermometer 59 ^{III}	0-100	0.058	Topas:		
	0-09	0.61	Jena thermometer 59 ^{III}	-191 to +16	0.424	Parallel to lesser hori-		
Bakelite, bleached	20-60	0.22	Gutta percha	20	1.983	zontal axis	0-100	0.0832
Brass:			Ice	-20 to -1	0.51	Parallel to greater hori-		
Cast	0-100	0.1875	Iceland spar:			zontal axis	0-100	0.0836
Wire	0-100	0.1930	Parallel to axis	0-80	0.2631	Parallel to vertical axis	0-100	0.0472
Wire	0-100	0.1783 to 0.1933	Perpendicular to axis	0-80	0.0544	Tourmaline:		
71.5 Cu + 27.7 Zn +			Lead tin (solder) 2 Pb			Parallel to longitudinal		
0.3 Sn + 0.5 Pb	40	0.1859	+ 1 Sn	0-100	0.2508	axis	0-100	0.0937
71 Cu + 29 Zn	0-100	0.1906	Limestone	25-100	0.09	Parallel to horizontal		
Bronze:			Magnalium	12-39	0.238	axis	0-100	0.0773
3 Cu + 1 Sn	16.6-100	0.1844	Manganin		0.181	Type metal	16.6-254	0.1952
3 Cu + 1 Sn	16.6-350	0.2116	Marble	15-100	0.117	Vulcanite	0-18	0.6360
3 Cu + 1 Sn	16.6-957	0.1737	Monel metal	25-100	0.14	Wedgwood ware	0-100	0.0890
86.3 Cu + 9.7 Sn + 4 Zn	40	0.1782		25-600	0.16	Wood:		
97.6 Cu + hard	0-80	0.1713	Paraffin	0-16	1.0662	Parallel to fiber:		
2.2 Sn + soft	0-80	0.1708	Paraffin	16-38	1.3030	Ash	0-100	0.0951
0.2 P			Paraffin	38-49	4.7707	Beech	2.34	0.0257
Caoutchouc		0.657 to 0.686	Platinum-iridium, 10 Pt			Chestnut	2.34	0.0649
Caoutchouc	16.7-25.3	0.770	+ 1 Ir	40	0.0884	Elm	2.34	0.0565
Celluloid	20-70	1.00	Platinum-silver, 1 Pt +			Mahogany	2.34	0.0361
Constantan	4-29	0.1523	2 Ag	0-100	0.1523	Maple	2.34	0.0638
Duralumin, 94Al	20-100	0.23	Porcelain	20-790	0.0413	Oak	2.34	0.0492
	20-300	0.25	Porcelain Bayeux	1000-1400	0.0553	Pine	2.34	0.0541
Ebonite	25.3-35.4	0.842	Quartz:			Walnut	2.34	0.0658
Fluorspar, CaF ₂	0-100	0.1950	Parallel to axis	0-80	0.0797	Across the fiber:		
German silver	0-100	0.1836	Parallel to axis	-190 to + 16	0.0521	Beech	2.34	0.614
Gold-platinum, 2 Au + 1 Pt	0-100	0.1523	Perpend. to axis	0-80	0.1337	Chestnut	2.34	0.325
Gold-copper, 2 Au + 1 Cu	0-100	0.1552	Quartz glass	-190 to + 16	-0.0026	Elm	2.34	0.443
Glass:			Quartz glass	16 to 500	0.0057	Mahogany	2.34	0.404
Tube	0-100	0.0833	Quartz glass	16 to 1000	0.0058	Maple	2.34	0.484
Tube	0-100	0.0828	Rock salt	40	0.4040	Oak	2.34	0.544
Plate	0-100	0.0891	Rubber, hard	0	0.691	Pine	2.34	0.341
Crown (mean)	0-100	0.0897	Rubber, hard	-160	0.300	Walnut	2.34	0.484
Crown (mean)	50-60	0.0954	Speculum metal	0-100	0.1933	Wax white	10-26	2.300
Flint	50-60	0.0788	Steel, 0.14 C, 34.5 Ni	25-100	0.037	Wax white	26-31	3.120
Jena ther- 16 ^{III}	0-100	0.081		25-600	0.136	Wax white	31-43	4.860
meter normal						Wax white	43-57	15.227

Smithsonian Tables*. For a more complete tabulation see Tables 143, 144, *Smithsonian Physical Tables*, 9th ed., 1954, also reprinted in *American Institute of Physics Handbook*, McGraw-Hill, New York, 1957; *Handbook of Chemistry and Physics*, 40th ed., pp. 2239-2245, Chemical Rubber Publishing Co. For data on many solids prior to 1926, see Gruneisen, *Handbuch der Physik*, vol. 10, pp. 1-52, 1926, translation available as N.A.S.A. RE 2-18-59W, 1959. For eight plastic solids below 300 K, see Scott, *Cryogenic Engineering*, p. 331, Van Nostrand, Princeton, NJ, 1959. For 11 other materials to 300 K, see Scott, *loc. cit.*, p. 333. For quartz and silica, see Cook, *Brit. J. Appl. Phys.*, **7, 285 (1956).

TABLE 2-147 Cubical Expansion of Liquids*

If V_0 is the volume at 0° , then at t° the expansion formula is $V_t = V_0(1 + \alpha t + \beta t^2 + \gamma t^3)$. The table gives values of α , β , and γ , and of C , the true coefficient of cubical expansion at 20° for some liquids and solutions. The temperature range of the observation is Δt . Values for the coefficient of cubical expansion of liquids can be derived from the tables of specific volumes of the saturated liquid given as a function of temperature later in this section.

Liquid	Range	$\alpha \times 10^3$	$\beta \times 10^6$	$\gamma \times 10^8$	$C \times 10^8$ at 20°
Acetic acid	16-107	1.0630	0.12636	1.0876	1.071
Acetone	0-54	1.3240	3.8090	-0.87983	1.487
Alcohol:					
Amyl	-15-80	0.9001	0.6573	1.18458	0.902
Ethyl, 30% by volume	18-39	0.2928	10.790	-11.87	
Ethyl, 50% by volume	0-39	0.7450	1.85	0.730	
Ethyl, 99.3% by volume	27-46	1.012	2.20		1.12
Ethyl, 500 atm. pressure					
Ethyl, 3000 atm. pressure	0-40	0.866			
Methyl	0-61	1.1342	1.3635	0.8741	1.199
Benzene	11-81	1.17626	1.27776	0.80648	1.237
Bromine	0-59	1.06218	1.87714	-0.30854	1.132
Calcium chloride:					
5.8% solution	18-25	0.07878	4.2742		0.250
40.9% solution	17-24	0.42383	0.8571		0.458
Carbon disulfide	-34-60	1.13980	1.37065	1.91225	1.218
500 atm. pressure	0-50	0.940			
3000 atm. pressure	0-50	0.581			
Carbon tetrachloride	0-76	1.18384	0.89881	1.35135	1.236
Chloroform	0-63	1.10715	4.66473	-1.74328	1.273
Ether	-15-38	1.51324	2.35918	4.00512	1.656
Glycerin		0.4853	0.4895		0.505
Hydrochloric acid, 33.2% solution	0-33	0.4460	0.215		0.455
Mercury	0-100	0.18182	0.0078		0.18186
Olive oil		0.6821	1.1405	-0.539	0.721
Pentane	0-33	1.4646	3.09319	1.6084	1.608
Potassium chloride, 24.3% solution	16-25	0.2695	2.080		0.353
Phenol	36-157	0.8340	0.10732	0.4446	1.090
Petroleum, 0.8467 density	24-120	0.8994	1.396		0.955
Sodium chloride, 20.6% solution	0-29	0.3640	1.237		0.414
Sodium sulfate, 24% solution	11-40	0.3599	1.258		0.410
Sulfuric acid:					
10.9% solution	0-30	0.2835	2.580		0.387
100.0%	0-30	0.5758	-0.432		0.558
Turpentine	-9-106	0.9003	1.9595	-0.44998	0.973
Water	0-33	-0.06427	8.5053	-6.7900	0.207

Smithsonian Tables*, Table 269. For a detailed discussion of mercury data, see Cook, *Brit. J. Appl. Phys.*, **7, 285 (1956). For data on nitrogen and argon, see Johnson (ed.), WADD-TR-60-56, 1960.

Bromoform¹ 7.7 - 50°C.

$$V_t = 0.34204[1 + 0.00090411(t - 7.7) + 0.000006766(t - 7.7)^2]$$

0.34204 in the specific volume of bromoform at 7.7°C.

Glycerin² -62 to 0°C.

$$V_t = V_0(1 + 4.83 \times 10^{-4}t - 0.49 \times 10^{-6}t^2)$$

0 - 80°C.

$$V_t = V_0(1 + 4.83 \times 10^{-4}t + 0.49 \times 10^{-6}t^2)$$

Mercury³ 0 - 300°C.

$$V_t = V_0[1 + 10^{-8}(18153.8t + 0.7548t^2 + 0.001533t^3 + 0.00000536t^4)]$$

¹ Sherman and Sherman, *J. Am. Chem. Soc.*, **50**, 1119 (1928). (An obvious error in their equation has been corrected.)

² Samsoen, *Ann. phys.*, (10) **9**, 91 (1928).

³ Harlow, *Phil. Mag.*, (7) **7**, 674 (1929).

TABLE 2-148 Cubical Expansion of Solids*

If v_2 and v_1 are the volumes at t_2 and t_1 , respectively, then $v_2 = v_1(1 + C\Delta t)$, C being the coefficient of cubical expansion and Δt the temperature interval. Where only a single temperature is stated, C represents the true coefficient of cubical expansion at that temperature.

Substance	t or Δt	$C \times 10^4$
Antimony	0-100	0.3167
Beryl	0-100	0.0105
Bismuth	0-100	0.3948
Copper†	0-100	0.4998
Diamond	40	0.0354
Emerald	40	0.0168
Galena	0-100	0.558
Glass, common tube	0-100	0.276
hard	0-100	0.214
Jena, borosilicate 59 III	20-100	0.156
pure silica	0-80	0.0129
Gold	0-100	0.4411
Ice	-20 to -1	1.1250
Iron	0-100	0.3550
Lead†	0-100	0.8399
Paraffin	20	5.88
Platinum	0-100	0.265
Porcelain, Berlin	20	0.0814
chloride	0-100	1.094
nitrate	0-100	1.967
sulfate	20	1.0754
Quartz	0-100	0.3840
Rock salt	50-60	1.2120
Rubber	20	4.87
Silver	0-100	0.5831
Sodium	20	2.13
Stearic acid	33.8-45.4	8.1
Sulfur, native	13.2-50.3	2.23
Tin	0-100	0.6889
Zinc†	0-100	0.8928

**Smithsonian Tables*, Table 268.

† See additional data below.

Aluminum¹ 100 - 530°C.

$$V = V_0(1 + 2.16 \times 10^{-5}t + 0.95 \times 10^{-8}t^2)$$

Cadmium¹ 130 - 270°C.

$$V = V_0(1 + 8.04 \times 10^{-5}t + 5.9 \times 10^{-8}t^2)$$

Copper¹ 110 - 300°C.

$$V = V_0(1 + 1.62 \times 10^{-5}t + 0.20 \times 10^{-8}t^2)$$

Colophony² 0 - 34°C.

$$V = V_0(1 + 2.21 \times 10^{-4}t + 0.31 \times 10^{-6}t^2)$$

34 - 150°C.

$$V = V_{34}[1 + 7.40 \times 10^{-4}(t - 34) + 5.91 \times 10^{-6}(t - 34)^2]$$

Lead¹ 100 - 280°C.

$$V = V_0(1 + 1.60 \times 10^{-5}t + 3.2 \times 10^{-8}t^2)$$

Shellac² 0 - 46°C.

$$V = V_0(1 + 2.73 \times 10^{-4}t + 0.39 \times 10^{-6}t^2)$$

46 - 100°C.

$$V = V_{46}[1 + 13.10 \times 10^{-4}(t - 46) + 0.62 \times 10^{-6}(t - 46)^2]$$

Silica (vitreous)³ 0 - 300°C.

$$V_t = V_0[1 + 10^{-8}(93.6t + 0.7776t^2 - 0.003315t^3 + 0.000005244t^4)]$$

Sugar (cane, amorphous)³ 0 - 67°C.

$$V_t = V_0(1 + 2.34 \times 10^{-4}t + 0.14 \times 10^{-6}t^2)$$

67 - 160°C.

$$V_t = V_{67}[1 + 5.02 \times 10^{-4}(t - 67) + 0.43 \times 10^{-6}(t - 67)^2]$$

Zinc¹ 120 - 360°C.

$$V_t = V_0(1 + 8.50 \times 10^{-5}t + 3.9 \times 10^{-8}t^2)$$

¹ Uffelmann, *Phil. Mag.*, (7) **10**, 633 (1930).

² Samsoen, *Ann. phys.*, (10) **9**, 83 (1928).

³ Harlow, *Phil. Mag.*, (7) **7**, 674 (1929).

JOULE-THOMSON EFFECT

UNITS CONVERSIONS

For this subsection, the following units conversions are applicable:

To convert the Joule-Thomson coefficient, μ , in degrees Celsius per atmosphere to degrees Fahrenheit per atmosphere, multiply by 1.8.

$$^{\circ}\text{F} = \% ^{\circ}\text{C} + 32; \text{ }^{\circ}\text{R} = \% \text{K}$$

To convert bars to pounds-force per square inch, multiply by 14.504; to convert bars to kilopascals, multiply by 1×10^2 .

TABLE 2-149 Additional References Available for the Joule-Thomson Coefficient

Gas	Pressure range, atm				Temp. range, °C			Unclassified
	0-10	10-50	50-200	>200	<0	0-300	>300	
Air	12, 15, 16 19, 35	12, 15, 19 35	15, 19, 35		19, 35	12, 15, 16 19, 35		3, 4, 18
Ammonia	28					28		2, 3
Argon	39	39	39		39	39		
Benzene	31	31	31			31	31	
Butane	26	26				26		
Carbon dioxide	7, 8, 28 37	7, 8, 37	7, 8, 37		7, 8, 37	7, 8, 9, 10 37		
Carbon monoxide	17	17			17	17		
Deuterium		22, 24, 25 1°	1, ° 22, 24 25		1, ° 22, 24, 25			
Dowtherm A	46	46				46	46	
Ethane	45	45				45		
Ethylene						9, 10		
Helium	1, 38	1, 38	38		1, 38	38		48
Hydrogen	24, 30	22, 24, 25 30	24, 30		22, 24, 25 30	24		
Methane		6	6			6		
Mixtures						9, 11		
Natural gas			33	33	33	33		
Nitrogen	13, 28, 40	13, 40	13, 40	13	13, 40	9, 10, 13 28, 40	13	19
Nitrous oxide						9, 10		
Pentane	26, 34, 44	34	34			26, 34, 44		
Propane	41	43				43		
Steam	28, 29, 42	29, 42, 47	42, 47			28, 29, 42 45	29, 42, 47	29, 47

*See also 14 (generalized chart); 18 (review, to 1919); 20-22; 23 (review, to 1948); 27 (review, to 1905); 32, 36, 41, 50.

REFERENCES: 1. Baehr, *Z. Elektrochem.*, **60**, 515 (1956). 2. Beattie, *J. Math. Phys.*, **9**, 11 (1930). 3. Beattie, *Phys. Rev.*, **35**, 643 (1930). 4. Bradley and Hale, *Phys. Rev.*, **29**, 258 (1909). 5. Brown and Dean, *Bur. Stand. J. Res.*, **60**, 161 (1958). 6. Budenholzer, Sage, et al., *Ind. Eng. Chem.*, **29**, 658 (1937). 7. Burnett, *Phys. Rev.*, **22**, 590 (1923). 8. Burnett, Univ. Wisconsin Bull. **9**(6), 1926. 9. Charnley, Ph.D. thesis, University of Manchester, 1952. 10. Charnley, Isles, et al., *Proc. R. Soc. (London)*, **A217**, 133 (1953). 11. Charnley, Rowlinson, et al., *Proc. R. Soc. (London)*, **A230**, 354 (1955). 12. Dalton, *Commun. Phys. Lab. Univ. Leiden*, no. 109c, 1909. 13. Deming and Deming, *Phys. Rev.*, **48**, 448 (1935). 14. Edmister, *Pet. Refiner*, **28**, 128 (1949). 15. Eucken, Clusius, et al., *Z. Tech. Phys.*, **13**, 267 (1932). 16. Eumorfopoulos and Rai, *Phil. Mag.*, **7**, 961 (1926). 17. Huang, Lin, et al., *Z. Phys.*, **100**, 594 (1936). 18. Hoxton, *Phys. Rev.*, **13**, 438 (1919). 19. Ishkin and Kaganev, *J. Tech. Phys. U.S.S.R.*, **26**, 2323 (1956). 20. Isles, Ph.D. thesis, Leeds University. 21. Jenkin and Pye, *Phil. Trans. R. Soc. (London)*, **A213**, 67 (1914); **A215**, 353 (1915). 22. Johnston, *J. Am. Chem. Soc.*, **68**, 2362 (1946). 23. Johnston, *Trans. Am. Soc. Mech. Eng.*, **70**, 651 (1948). 24. Johnston, Bezman, et al., *J. Am. Chem. Soc.*, **68**, 2367 (1946). 25. Johnston, Swanson, et al., *J. Am. Chem. Soc.*, **68**, 2373 (1946). 26. Kennedy, Sage, et al., *Ind. Eng. Chem.*, **28**, 718 (1936). 27. Kester, *Phys. Rev.*, **21**, 260 (1905). 28. Keyes and Collins, *Proc. Nat. Acad. Sci.*, **18**, 328 (1932). 29. Kleinschmidt, *Mech. Eng.*, **45**, 165 (1923); **48**, 155 (1926). 30. Koeppe, *Kältetechnik*, **8**, 275 (1956). 31. Lindsay and Brown, *Ind. Eng. Chem.*, **27**, 817 (1935). 32. Noell, dissertation, Munich, 1914, *Forschungsdienst*, 184, p. 1, 1916. 33. Palienko, *Tr. Inst. Ispol'z. Gaza, Akad. Nauk Ukr. SSR*, no. 4, p. 87, 1956. 34. Pattee and Brown, *Ind. Eng. Chem.*, **26**, 511, (1934). 35. Roebuck, *Proc. Am. Acad. Arts Sci.*, **60**, 537 (1925); **64**, 287 (1930). 36. Roebuck, see 49 below. 37. Roebuck and Murrell, *Phys. Rev.*, **55**, 240 (1939). 38. Roebuck and Osterberg, *Phys. Rev.*, **37**, 110 (1931); **43**, 60 (1933). 39. Roebuck and Osterberg, *Phys. Rev.*, **46**, 785 (1934). 40. Roebuck and Osterberg, *Phys. Rev.*, **48**, 450 (1935). 41. Roebuck, Murrell, et al., *J. Am. Chem. Soc.*, **64**, 400 (1942). 42. Sage, unpublished data, California Institute of Technology, 1959. 43. Sage and Lacy, *Ind. Eng. Chem.*, **27**, 1484 (1934). 44. Sage, Kennedy, et al., *Ind. Eng. Chem.*, **28**, 601 (1936). 45. Sage, Webster, et al., *Ind. Eng. Chem.*, **29**, 658 (1937). 46. Ullock, Gaffert, et al., *Trans. Am. Inst. Chem. Eng.*, **32**, 73 (1936). 47. Yang, *Ind. Eng. Chem.*, **45**, 786 (1953). 48. Zelmanov, *J. Phys. U.S.S.R.*, **3**, 43 (1940). 49. Roebuck, recalculated data. 50. Michels et al., van der Waals laboratory publications. Gunn, Cheuh, and Prausnitz, *Cryogenics*, **6**, 324 (1966), review equations relating the inversion temperatures and pressures. The ability of various equations of state to relate these was also discussed by Miller, *Ind. Eng. Chem. Fundam.*, **9**, 585 (1970); and Juris and Wenzel, *Am. Inst. Chem. Eng. J.*, **18**, 684 (1972). Perhaps the most detailed review is that of Hendricks, Peller, and Baron. NASA Tech. Note D 6807, 1972.

TABLE 2-150 Approximate Inversion-Curve Locus in Reduced Coordinates ($T_r = T/T_c$; $P_r = P/P_c$)^a

P_r	0	0.5	1	1.5	2	2.5	3	4
T_{rL}	0.782	0.800	0.818	0.838	0.859	0.880	0.903	0.953
T_{rU}	4.984	4.916	4.847	4.777	4.706	4.633	4.550	4.401
P_r	5	6	7	8	9	10	11	11.79
T_{rL}	1.01	1.08	1.16	1.25	1.35	1.50	1.73	2.24
T_{rU}	4.23	4.06	3.88	3.68	3.45	3.18	2.86	2.24

^aCalculated from the best three-constant equation recommended by Miller, *Ind. Eng. Chem. Fundam.*, **9**, 585 (1970). T_{rL} refers to the lower curve, and T_{rU} to the upper curve.

TABLE 2-151 Joule-Thomson Data for Air^{*}

P , atm	t , °C												
	-150	-100	-75	-50	-25	0	25	50	75	100	150	200	250
1		0.5895	0.4795	0.3910	0.3225	0.2745	0.2320	0.1956	0.1614	0.1355	0.0961	0.0645	0.0409
20		.5700	.4555	.3690	.3010	.2580	.2173	.1830	.1508	.1258	.0883	.0580	.0356
60	0.0450	.4820	.3835	.3195	.2610	.2200	.1852	.1571	.1293	.1062	.0732	.0453	.0254
100	.0185	.2775	.2880	.2505	.2130	.1820	.1550	.1310	.1087	.0884	.0600	.0343	.0165
140	-.0070	.1360	.1855	.1825	.1650	.1450	.1249	.1070	.0889	.0726	.0482	.0250	.0092
180	-.0255	.0655	.1136	.1270	.1240	.1100	.0959	.0829	.0707	.0580	.0376	.0174	.0027
200	-.0330	.0440	.0855	.1065	.1090	.0950							

^{*}Free of water and CO₂. Extracted from Table 261, *Smithsonian Physical Tables*, 9th rev. ed., Washington, DC, 1954. These data are corrected from earlier publications. μ in °C/atm.

TABLE 2-152 Approximate Inversion-Curve Locus for Air

P , bar	0	25	50	75	100	125	150	175	200	225
T_{L} , K	(112) ^o	114	117	120	124	128	132	137	143	149
T_{U} , K	653	641	629	617	606	594	582	568	555	541
P , bar	250	275	300	325	350	375	400	425	432	
T_{L} , K	156	164	173	184	197	212	230	265	300	
T_{U} , K	526	509	491	470	445	417	386	345	300	

^oHypothetical low-pressure limit.

TABLE 2-153 Joule-Thomson Data for Argon^{*}

t , °C	Pressure, atm						
	1	20	60	100	140	180	200
-150	1.812		-0.0025	-0.0277	-0.0403	-0.0595	-0.0640
-125	1.112	1.102	.1250	.0415	.0090	-0.1100	-.0165
-100	0.8605	0.8485	.6900	.2820	.1137	.0560	.0395
-75	.7100	.6895	.5910	.4225	.2480	.1537	.1215
-50	.5960	.5720	.4963	.3970	.2840	.2037	.1860
-25	.5045	.4805	.4210	.3460	.2763	.2140	.1950
0	.4307	.4080	.3600	.3010	.2505	.2050	.1883
25	.3720	.3490	.3077	.2628	.2213	.1890	.1745
50	.3220	.3015	.2650	.2297	.1947	.1700	.1580
75	.2695	.2557	.2285	.1993	.1710	.1505	.1415
100	.2413	.2277	.1975	.1715	.1490	.1320	.1255
125	.2105	.1980	.1707	.1480	.1300	.1153	.1100
150	.1845	.1720	.1485	.1285	.1123	.0998	.0945
200	.1377	.1280	.1102	.0950	.0823	.0715	.0675
250	.0980	.0910	.0785	.0665	.0555	.0485	.0468
300	.0643	.0607	.0530	.0445	.0370	.0370	.0276

^{*}Extracted from Table 263, *Smithsonian Physical Tables*, 9th rev. ed., Washington, DC, 1954. These data are corrected from an earlier publication. μ in °C/atm.

TABLE 2-154 Approximate Inversion-Curve Locus for Argon

P , bar	0	25	50	75	100	125	150	175	200	225
T_L , K	94	97	101	105	109	113	118	123	128	134
T_U , K	765	755	744	736	726	716	705	694	683	671
P , bar	250	275	300	325	350	375	400	425	450	475
T_L , K	141	148	158	170	183	201	222	248	288	375
T_U , K	657	643	627	610	591	569	544	515	478	375

TABLE 2-155 Joule-Thomson Data for Carbon Dioxide*

t , °C	Pressure, atm							
	1	20	60	73	100	140	180	200
-75		-0.0200	-0.0200	-0.0232	-0.0228	-0.0240	-0.0250	-0.0290
-50	2.4130	-.0140	-.0150	-.0165	-.0160	-.0183	-.0228	-.0248
0	1.2900	1.4020	.0370	.0310	.0215	.0115	.0085	.0045
50	0.8950	.8950	.8800	.8225	.5570	.1720	.1025	.0930
100	.6490	.6375	.6080	.5920	.5405	.4320	.3000	.2555
125	.5600	.5450	.5160	.5068	.4750	.4130	.3230	.2915
150	.4890	.4695	.4430	.4380	.4155	.3760	.3102	.2910
200	.3770	.3575	.3400	.3325	.3150	.2890	.2600	.2455
250	.3075	.2885	.2625	.2565	.2420	.2235	.2045	.1975
300	.2650	.2425	.2080	.2002	.1872	.1700	.1540	.1505

*Extracted from Table 266, *Smithsonian Physical Tables*, 9th rev. ed., Washington, DC, 1954. These data are corrected from an earlier publication. μ in °C/atm.

TABLE 2-156 Approximate Inversion-Curve Locus for Carbon Dioxide*

P , bar	50	100	150	200	250	300	350	400	450
T_L , K	243	251	258	266	272	283	293	302	312
T_U , K	1290	1261	1233	1205	1175	1146	1111	1076	1045
P , bar	500	550	600	650	700	750	800	850	884
T_L , K	325	338	351	365	383	403	441	496	608
T_U , K	1015	983	950	914	878	840	796	739	608

*Interpolated from Vukalovich and Altunin's interpolation of data of Price, *Ind. Eng. Chem.*, **47**, 1691 (1955). T_L = lower inversion temperature, and T_U = upper inversion temperature.

TABLE 2-157 Approximate Inversion-Curve Locus for Deuterium

P , bar	0	25	50	75	100	125	150	175	194
T_L , K	(31)*	34	38	43	49	56	65	77	108
T_U , K	216	202	189	178	168	157	146	131	108

*Hypothetical low-pressure limit.

TABLE 2-158 Approximate Inversion-Curve Locus for Ethane

P , bar	0	25	50	75	100	125	150	175	200	225
T_L , K		249	255	262	269	275	282	290	297	306
P , bar	250	275	300	325	350	375	400	425	450	475
T_L , K	315	325	335	345	357	370	383	398	415	432
P , bar	500	525	550	575	600					
T_L , K	453	477	505	545	626					

TABLE 2-159 Joule-Thomson Data for Helium*

<i>T</i> , K	160	180	200	220	240	260	280	300
μ	-0.0574	-0.0587	-0.0594	-0.0601	-0.0608	-0.0614	-0.0619	-0.0625
<i>T</i> , K	320	340	360	380	400	420	440	460
μ	-0.0629	-0.0634	-0.0637	-0.0640	-0.0643	-0.0645	-0.0645	-0.0643
<i>T</i> , K	480	500	520	540	560	580	600	
μ	-0.0640	-0.0636	-0.0630	-0.0622	-0.0611	-0.0587	-0.0540	

*Interpolated and converted from data in Table 262, *Smithsonian Physical Tables*, 9th rev. ed., Washington, DC, 1954. These data are corrected from those in an earlier publication. μ is in °C/atm. Below about 200 atm, little change in the coefficient with pressure occurs.

TABLE 2-160 Approximate Inversion-Curve Locus for Normal Hydrogen

<i>P</i> , bar	0	25	50	75	100	125	150	164
<i>T_L</i> , K	(28) ^o	32	38	44	52	61	73	92
<i>T_U</i> , K	202	193	183	171	157	141	119	92

^oHypothetical low-pressure limit.

TABLE 2-161 Approximate Inversion-Curve Locus for Methane

<i>P</i> , bar	25	50	75	100	125	150	175	200	225	250	275	300
<i>T_L</i> , K		161	166	172	176	182	189	195	202	209	217	225
<i>P</i> , bar	325	350	375	400	425	450	475	500	525	534		
<i>T_L</i> , K	234	243	254	265	277	292	309	331	365	400		
<i>T_U</i> , K							505	474	437	400		

TABLE 2-162 Joule-Thomson Data for Nitrogen*

<i>t</i> , °C	Pressure, atm							
	1	20	33.5	60	100	140	180	200
-150	1.2659	1.1246	0.1704	0.0601	0.0202	-0.0056	-0.0211	-0.0284
-125	0.8557	0.7948	.7025	.4940	.1314	.0498	.0167	.0032
-100	.6490	.5958	.5494	.4506	.2754	.1373	.0765	.0587
-75	.5033	.4671	.4318	.3712	.2682	.1735	.1026	.0800
-50	.3968	.3734	.3467	.3059	.2332	.1676	.1120	.0906
-25	.3224	.3013	.2854	.2528	.2001	.1506	.1101	.0932
0	.2656	.2494	.2377	.2088	.1679	.1316	.1015	.0891
25	.2217	.2060	.1961	.1729	.1400	.1105	.0874	.0779
50	.1855	.1709	.1621	.1449	.1164	.0915	.0732	.0666
75	.1555	.1421	.1336	.1191	.0941	.0740	.0583	.0543
100	.1292	.1173	.1100	.0975	.0768	.0582	.0462	.0419
125	.1070	.0973	.0904	.0786	.0621	.0459	.0347	.0326
150	.0868	.0776	.0734	.0628	.0482	.0348	.0248	.0228
200	.0558	.0472	.0430	.0372	.0262	.0168	.0094	.0070
250	.0331	.0256	.0230	.0160	.0071	.0009	-.0037	-.0058
300	.0140	.0096	.0050	-.0013	-.0075	-.0129	-.0160	-.0171

*Extracted from Table 264, *Smithsonian Physical Tables*, 9th rev. ed., Washington, DC, 1954. These data are corrected from an earlier publication. μ in °C/atm.

TABLE 2-163 Approximate Inversion-Curve Locus for Propane

<i>P</i> , bar	0	25	50	75	100	125	150	175	200	225	250	275
<i>T_L</i> , K	(296) ^o	303	311	318	327	336	345	355	365	374	389	403
<i>P</i> , bar	300	325	350	375	400	425	450	475	500	525	541	
<i>T_L</i> , K	418	435	452	473	495	521	551	586	628	686	780	

^oHypothetical low-pressure limit.

CRITICAL CONSTANTS

ADDITIONAL REFERENCES

Other data and estimation techniques for the elements are contained in Gates and Thodos, *Am. Inst. Chem. Eng. J.*, **6** (1960):50-54; and Ohse and von Tippelskirch, *High Temperatures—High Pressures*, **9**

(1977):367-385. For inorganic substances see Mathews, *Chem. Rev.*, **72** (1972):71-100; for organics see Kudchaker, Alani, and Zwolinski, *Chem. Rev.*, **68** (1968):659-735; and for fluorocarbons see *Advances in Fluorine Chemistry*, App. B, Butterworth, Washington, 1963, pp. 173-175.

TABLE 2-164 Critical Constants and Acentric Factors of Inorganic and Organic Compounds

Cmpd. no.	Name	Formula	CAS no.	Mol. wt.	T_c , K	$P_c \times 1E-06$ Pa	V_c , $m^3/Kmol$	Z_c	Acentric factor
1	Methane	CH ₄	74828	16.043	190.564	4.59	0.099	0.286	0.011
2	Ethane	C ₂ H ₆	74840	30.070	305.32	4.85	0.146	0.279	0.098
3	Propane	C ₃ H ₈	74986	44.097	369.83	4.21	0.200	0.273	0.149
4	<i>n</i> -Butane	C ₄ H ₁₀	106978	58.123	425.12	3.77	0.255	0.272	0.197
5	<i>n</i> -Pentane	C ₅ H ₁₂	109660	72.150	469.7	3.36	0.315	0.271	0.251
6	<i>n</i> -Hexane	C ₆ H ₁₄	110543	86.177	507.6	3.04	0.373	0.269	0.304
7	<i>n</i> -Heptane	C ₇ H ₁₆	142825	100.204	540.2	2.72	0.428	0.259	0.346
8	<i>n</i> -Octane	C ₈ H ₁₈	111659	114.231	568.7	2.47	0.486	0.254	0.396
9	<i>n</i> -Nonane	C ₉ H ₂₀	111842	128.258	594.6	2.31	0.540	0.252	0.446
10	<i>n</i> -Decane	C ₁₀ H ₂₂	124185	142.285	617.7	2.09	0.601	0.245	0.488
11	<i>n</i> -Undecane	C ₁₁ H ₂₄	1120214	156.312	639	1.95	0.658	0.242	0.530
12	<i>n</i> -Dodecane	C ₁₂ H ₂₆	112403	170.338	658	1.82	0.718	0.239	0.577
13	<i>n</i> -Tridecane	C ₁₃ H ₂₈	629505	184.365	675	1.68	0.779	0.233	0.617
14	<i>n</i> -Tetradecane	C ₁₄ H ₃₀	629594	198.392	693	1.57	0.830	0.226	0.643
15	<i>n</i> -Pentadecane	C ₁₅ H ₃₂	629629	212.419	708	1.47	0.888	0.222	0.685
16	<i>n</i> -Hexadecane	C ₁₆ H ₃₄	544763	226.446	723	1.41	0.943	0.221	0.721
17	<i>n</i> -Heptadecane	C ₁₇ H ₃₆	629787	240.473	736	1.34	0.998	0.219	0.771
18	<i>n</i> -Octadecane	C ₁₈ H ₃₈	593453	254.500	747	1.26	1.059	0.214	0.806
19	<i>n</i> -Nonadecane	C ₁₉ H ₄₀	629925	268.527	758	1.21	1.119	0.215	0.851
20	<i>n</i> -Eicosane	C ₂₀ H ₄₂	112958	282.553	768	1.17	1.169	0.215	0.912
21	2-Methylpropane	C ₄ H ₁₀	75285	58.123	408.14	3.62	0.261	0.278	0.177
22	2-Methylbutane	C ₅ H ₁₂	78784	72.150	460.43	3.37	0.304	0.268	0.226
23	2,3-Dimethylbutane	C ₆ H ₁₄	79298	86.177	499.98	3.13	0.358	0.269	0.246
24	2-Methylpentane	C ₆ H ₁₄	107835	86.177	497.5	3.02	0.366	0.267	0.279
25	2,3-Dimethylpentane	C ₇ H ₁₆	565593	100.204	537.35	2.88	0.396	0.255	0.292
26	2,3,3-Trimethylpentane	C ₈ H ₁₈	560214	114.231	573.5	2.81	0.455	0.268	0.289
27	2,2,4-Trimethylpentane	C ₈ H ₁₈	540841	114.231	543.96	2.56	0.465	0.264	0.301
28	Ethylene	C ₂ H ₄	74851	28.054	282.34	5.03	0.132	0.283	0.086
29	Propylene	C ₃ H ₆	115071	42.081	365.57	4.63	0.188	0.286	0.137
30	1-Butene	C ₄ H ₈	106989	56.108	419.95	4.04	0.241	0.279	0.190
31	<i>cis</i> -2-Butene	C ₄ H ₈	590181	56.108	435.58	4.24	0.233	0.273	0.204
32	<i>trans</i> -2-Butene	C ₄ H ₈	624646	56.108	428.63	4.08	0.237	0.272	0.216
33	1-Pentene	C ₅ H ₁₀	109671	70.134	464.78	3.56	0.295	0.271	0.236
34	1-Hexene	C ₆ H ₁₂	592416	84.161	504.03	3.14	0.354	0.265	0.280
35	1-Heptene	C ₇ H ₁₄	592767	98.188	537.29	2.82	0.413	0.261	0.330
36	1-Octene	C ₈ H ₁₆	111660	112.215	566.65	2.57	0.460	0.251	0.377
37	1-Nonene	C ₉ H ₁₈	124118	126.242	593.25	2.33	0.528	0.249	0.417
38	1-Decene	C ₁₀ H ₂₀	872059	140.269	616.4	2.21	0.584	0.252	0.478
39	2-Methylpropene	C ₄ H ₈	115117	56.108	417.9	3.98	0.238	0.272	0.192
40	2-Methyl-1-butene	C ₅ H ₁₀	563462	70.134	465	3.45	0.292	0.261	0.237
41	2-Methyl-2-butene	C ₅ H ₁₀	513359	70.134	471	3.38	0.292	0.252	0.272
42	1,2-Butadiene	C ₄ H ₆	590192	54.092	452	4.36	0.220	0.255	0.166
43	1,3-Butadiene	C ₄ H ₆	106990	54.092	425.17	4.30	0.220	0.268	0.192
44	2-Methyl-1,3-butadiene	C ₅ H ₈	78795	68.119	484	3.85	0.277	0.265	0.158
45	Acetylene	C ₂ H ₂	74862	26.038	308.32	6.15	0.113	0.271	0.188
46	Methylacetylene	C ₃ H ₄	74997	40.065	402.39	5.62	0.164	0.276	0.216
47	Dimethylacetylene	C ₄ H ₆	503173	54.092	473.2	4.87	0.221	0.274	0.239
48	3-Methyl-1-butyne	C ₅ H ₈	598232	68.119	463.2	4.20	0.275	0.300	0.308
49	1-Pentyne	C ₅ H ₈	627190	68.119	481.2	4.17	0.277	0.289	0.290
50	2-Pentyne	C ₅ H ₈	627214	68.119	519	4.02	0.276	0.257	0.174
51	1-Hexyne	C ₆ H ₁₀	693027	82.145	516.2	3.64	0.322	0.273	0.335
52	2-Hexyne	C ₆ H ₁₀	764352	82.145	549	3.53	0.331	0.256	0.221
53	3-Hexyne	C ₆ H ₁₀	928494	82.145	544	3.54	0.334	0.261	0.219
54	1-Heptyne	C ₇ H ₁₂	628717	96.172	559	3.13	0.386	0.260	0.272
55	1-Octyne	C ₈ H ₁₄	629050	110.199	585	2.82	0.441	0.256	0.323
56	Vinylacetylene	C ₄ H ₄	689974	52.076	454	4.89	0.205	0.265	0.109

TABLE 2-164 Critical Constants and Acentric Factors of Inorganic and Organic Compounds (Concluded)

Cmpd. no.	Name	Formula	CAS no.	Mol. wt.	T_c , K	$P_c \times 1E-06$ Pa	V_c , $m^3/kmol$	Z_c	Acentric factor
190	Fluoromethane	CH ₃ F	593533	34.033	317.42	5.88	0.113	0.252	0.198
191	Chloromethane	CH ₃ Cl	74873	50.488	416.25	6.69	0.142	0.275	0.154
192	Trichloromethane	CHCl ₃	67663	119.377	536.4	5.55	0.238	0.296	0.228
193	Tetrachloromethane	CCl ₄	56235	153.822	556.35	4.54	0.274	0.270	0.191
194	Bromomethane	CH ₃ Br	74839	94.939	467	8.00	0.156	0.321	0.192
195	Fluoroethane	C ₂ H ₅ F	353366	48.060	375.31	5.01	0.164	0.263	0.218
196	Chloroethane	C ₂ H ₅ Cl	75003	64.514	460.35	5.46	0.155	0.221	0.206
197	Bromoethane	C ₂ H ₅ Br	74964	108.966	503.8	6.29	0.215	0.323	0.259
198	1-Chloropropane	C ₃ H ₇ Cl	540545	78.541	503.15	4.58	0.247	0.270	0.228
199	2-Chloropropane	C ₃ H ₇ Cl	75296	78.541	489	4.51	0.247	0.274	0.196
200	1,1-Dichloropropane	C ₃ H ₆ Cl ₂	78999	112.986	560	4.24	0.292	0.266	0.253
201	1,2-Dichloropropane	C ₃ H ₆ Cl ₂	78875	112.986	572	4.23	0.291	0.259	0.256
202	Vinyl chloride	C ₂ H ₃ Cl	75014	62.499	432	5.75	0.179	0.287	0.106
203	Fluorobenzene	C ₆ H ₅ F	462066	96.104	560.09	4.54	0.269	0.262	0.247
204	Chlorobenzene	C ₆ H ₅ Cl	108907	112.558	632.35	4.53	0.308	0.265	0.251
205	Bromobenzene	C ₆ H ₅ Br	108861	157.010	670.15	4.52	0.324	0.263	0.251
206	Air		132259100	28.951	132.45	3.79	0.092	0.318	0.000
207	Hydrogen	H ₂	1333740	2.016	33.19	1.32	0.064	0.307	-0.215
208	Helium-4	He	7440597	4.003	5.2	0.23	0.058	0.305	-0.388
209	Neon	Ne	7440019	20.180	44.4	2.67	0.042	0.300	-0.038
210	Argon	Ar	7440371	39.948	150.86	4.90	0.075	0.292	0.000
211	Fluorine	F ₂	7782414	37.997	144.12	5.17	0.067	0.287	0.053
212	Chlorine	Cl ₂	7782505	70.905	417.15	7.79	0.124	0.279	0.073
213	Bromine	Br ₂	7726956	159.808	584.15	10.28	0.135	0.286	0.128
214	Oxygen	O ₂	7782447	31.999	154.58	5.02	0.074	0.287	0.020
215	Nitrogen	N ₂	7727379	28.014	126.2	3.39	0.089	0.288	0.037
216	Ammonia	NH ₃	7664417	17.031	405.65	11.30	0.072	0.241	0.253
217	Hydrazine	N ₂ H ₄	302012	32.045	653.15	14.73	0.158	0.429	0.315
218	Nitrous oxide	N ₂ O	10024972	44.013	309.57	7.28	0.098	0.277	0.143
219	Nitric oxide	NO	10102439	30.006	180.15	6.52	0.058	0.252	0.585
220	Cyanogen	C ₂ N ₂	460195	52.036	400.15	5.94	0.195	0.348	0.276
221	Carbon monoxide	CO	630080	28.010	132.92	3.49	0.095	0.300	0.048
222	Carbon dioxide	CO ₂	124389	44.010	304.21	7.39	0.095	0.277	0.224
223	Carbon disulfide	CS ₂	75150	76.143	552	8.04	0.160	0.280	0.118
224	Hydrogen fluoride	HF	7664393	20.006	461.15	6.49	0.069	0.117	0.383
225	Hydrogen chloride	HCl	7647010	36.461	324.65	8.36	0.082	0.253	0.134
226	Hydrogen bromide	HBr	10035106	80.912	363.15	8.46	0.100	0.280	0.069
227	Hydrogen cyanide	HCN	74908	27.026	456.65	5.35	0.139	0.195	0.407
228	Hydrogen sulfide	H ₂ S	7783064	34.082	373.53	9.00	0.099	0.287	0.096
229	Sulfur dioxide	SO ₂	7446095	64.065	430.75	7.86	0.123	0.269	0.244
230	Sulfur trioxide	SO ₃	7446119	80.064	490.85	8.19	0.127	0.255	0.423
231	Water	H ₂ O	7732185	18.015	647.13	21.94	0.056	0.228	0.343

All substances are listed in alphabetical order in Table 2-6a.

Compiled from Daubert, T. E., R. P. Danner, H. M. Sibul, and C. C. Stebbins, DIPPR Data Compilation of Pure Compound Properties, Project 801 Sponsor Release, July, 1993, Design Institute for Physical Property Data, AIChE, New York, NY; and from Ambrose, D. "Vapour-Liquid Critical Properties", Report Chem 107, National Physical Laboratory, Teddington, UK, October, 1979.

In order to ensure thermodynamic consistency, in almost all cases these properties are calculated from T_c and the vapor pressure and liquid density correlation coefficients listed in those tables. This means that there will be slight differences between the values listed here and those in the DIPPR tables. Most of the differences are less than 1%, and almost all the rest are less than the estimated accuracy of the quantity in question.

The atomic weights used, taken from *J. Phys. Chem. Ref. Data* 22(6), 1993, are C = 12.011, H = 1.00794, O = 15.9994, N = 14.00674, S = 32.066, F = 18.9984, Cl = 35.4527, Br = 79.904, and I = 126.90447.

The value of the gas constant, R , used here is 8314.51 J/(kmol·K), as given by E. R. Cohen and B. N. Taylor in *J. Phys. Chem. Ref. Data* 17, 1988. $K - 273.15 = ^\circ C$; $1.8 \times K - 459.67 = ^\circ F$; $Pa \times 9.869233E-06 = atm$; $Pa \times 1.450377E-04 = psia$; $m^3/kmol \times (1E + 03/mol. wt.) = cm^3/g$; $m^3/kmol \times (1.601846E + 01/mol. wt.) = ft^3/lb$.

COMPRESSIBILITIES

INTRODUCTION

The increasing ranges of pressure and temperature of interest to technology for an ever-increasing number of substances would necessitate additional tables in this subsection as well as in the subsection "Thermodynamic Properties." Space restrictions preclude this. Hence, in the present revision, an attempt was made to update the fluid-compressibility tables for selected fluids and to omit tables for other fluids. The reader is thus referred to the fourth edition for tables on miscellaneous gases at 0°C, acetylene, ammonia, ethane, ethylene, hydrogen-nitrogen mixtures, and methyl chloride. The reader is also

reminded that compressibilities can be calculated from the pressure—volume (or density)—temperature tables of the subsection "Thermodynamic Properties."

UNITS CONVERSIONS

For this subsection, the following units conversions are applicable:

$$^{\circ}\text{R} = \% \text{ K.}$$

To convert bars to pounds-force per cubic inch, multiply by 14.504.
To convert bars to kilopascals, multiply by 1×10^2 .

TABLE 2-165 Compressibility Factors for Air*

Temp., K	Pressure, bar													
	1	5	10	20	40	60	80	100	150	200	250	300	400	500
75	0.0052	0.0260	0.0519	0.1036	0.2063	0.3082	0.4094	0.5099	0.7581	1.0025				
80		0.0250	0.0499	0.0995	0.1981	0.2958	0.3927	0.4887	0.7258	0.9588	1.1931	1.4139		
90	0.9764	0.0236	0.0471	0.0940	0.1866	0.2781	0.3686	0.4581	0.6779	0.8929	1.1098	1.3110	1.7161	2.1105
100	0.9797	0.8872	0.0453	0.0900	0.1782	0.2635	0.3498	0.4337	0.6386	0.8377	1.0395	1.2227	1.5937	1.9536
120	0.9880	0.9373	0.8660	0.6730	0.1778	0.2557	0.3371	0.4132	0.5964	0.7720	0.9530	1.1076	1.5091	1.7366
140	0.9927	0.9614	0.9205	0.8297	0.5856	0.3313	0.3737	0.4340	0.5909	0.7699	0.9114	1.0393	1.3202	1.5903
160	0.9951	0.9748	0.9489	0.8954	0.7803	0.6603	0.5696	0.5489	0.6340	0.7564	0.8840	1.0105	1.2585	1.4970
180	0.9967	0.9832	0.9660	0.9314	0.8625	0.7977	0.7432	0.7084	0.7180	0.7986	0.9000	1.0068	1.2232	1.4361
200	0.9978	0.9886	0.9767	0.9539	0.9100	0.8701	0.8374	0.8142	0.8061	0.8549	0.9311	1.0185	1.2054	1.3944
250	0.9992	0.9957	0.9911	0.9822	0.9671	0.9549	0.9463	0.9411	0.9450	0.9713	1.0152	1.0702	1.1990	1.3392
300	0.9999	0.9987	0.9974	0.9950	0.9917	0.9901	0.9903	0.9930	1.0074	1.0326	1.0669	1.1089	1.2073	1.3163
350	1.0000	1.0002	1.0004	1.0014	1.0038	1.0075	1.0121	1.0183	1.0377	1.0635	1.0947	1.1303	1.2116	1.3015
400	1.0002	1.0012	1.0025	1.0046	1.0100	1.0159	1.0229	1.0312	1.0533	1.0795	1.1087	1.1411	1.2117	1.2890
450	1.0003	1.0016	1.0034	1.0063	1.0133	1.0210	1.0287	1.0374	1.0614	1.0913	1.1183	1.1463	1.2090	1.2778
500	1.0003	1.0020	1.0034	1.0074	1.0151	1.0234	1.0323	1.0410	1.0650	1.0913	1.1183	1.1463	1.2051	1.2667
600	1.0004	1.0022	1.0039	1.0081	1.0164	1.0253	1.0340	1.0434	1.0678	1.0920	1.1172	1.1427	1.1947	1.2475
800	1.0004	1.0020	1.0038	1.0077	1.0157	1.0240	1.0321	1.0408	1.0621	1.0844	1.1061	1.1283	1.1720	1.2150
1000	1.0004	1.0018	1.0037	1.0068	1.0142	1.0215	1.0290	1.0365	1.0556	1.0744	1.0948	1.1131	1.1515	1.1889

*Calculated from values of pressure, volume (or density), and temperature in Vasserman, Kazavchinskii, and Rabinovich, *Thermophysical Properties of Air and Air Components*, Moscow, Nauka, 1966, and NBS-NSF Trans. TT 70-50095, 1971; and Vasserman and Rabinovich, *Thermophysical Properties of Liquid Air and Its Components*, Moscow, 1968, and NBS-NSF Trans. 69-55092, 1970.

TABLE 2-166 Compressibility Factors for Argon*

Temp., K	Pressure, bar													
	1	5	10	20	40	60	80	100	200	300	400	500		
100	0.9773	0.0183	0.0366	0.0729	0.1449	0.2162	0.2867	0.3567	0.6975	1.0267	1.3470	1.6932		
150	0.9932	0.9647	0.9273	0.8447	0.6101	0.2249	0.2781	0.3324	0.5934	0.8387	1.0732	1.2995		
200	0.9972	0.9857	0.9713	0.9419	0.8810	0.8208	0.7624	0.7121	0.6870	0.8360	1.0051	1.1982		
250	0.9988	0.9935	0.9869	0.9741	0.9494	0.9263	0.9056	0.8877	0.8590	0.9207	1.0262	1.1479		
300	0.9995	0.9969	0.9941	0.9884	0.9777	0.9686	0.9611	0.9552	0.9533	0.9950	1.0673	1.1786		
400	1.0001	0.9997	0.9998	0.9999	1.0004	1.0018	1.0031	1.0056	1.0280	1.0656	1.1157	1.1976		
500	1.0002	1.0007	1.0012	1.0034	1.0071	1.0113	1.0154	1.0205	1.0501	1.0874	1.1301	1.1997		
600	1.0003	1.0012	1.0025	1.0046	1.0094	1.0143	1.0198	1.0250	1.0553	1.0904	1.1291	1.1933		
800	1.0003	1.0012	1.0023	1.0050	1.0102	1.0151	1.0205	1.0258	1.0532	1.0830	1.1147	1.1707		
1000	1.0002	1.0013	1.0022	1.0050	1.0096	1.0142	1.0193	1.0239	1.0484	1.0736	1.0999	1.1497		

*Calculated from PVT values tabulated in Rabinovich (ed.), *Thermophysical Properties of Neon, Argon, Krypton and Xenon*, Standard Press, Moscow, 1976. This book was published in English translation by Hemisphere, New York, 1988 (604 pp.).

TABLE 2-167 Compressibility Factors for Carbon Dioxide*

Temp., °C	Pressure, bar											
	1	5	10	20	40	60	80	100	200	300	400	500
0	0.9933	0.9658	0.9294	0.8496								
50	0.9964	0.9805	0.9607	0.9195	0.8300	0.7264	0.5981	0.4239				
100	0.9977	0.9883	0.9764	0.9524	0.9034	0.8533	0.8022	0.7514	0.5891	0.6420		
150	0.9985	0.9927	0.9853	0.9705	0.9416	0.9131	0.8854	0.8590	0.7651	0.7623	0.8235	0.9098
200	0.9991	0.9953	0.9908	0.9818	0.9640	0.9473	0.9313	0.9170	0.8649	0.8619	0.8995	0.9621
250	0.9994	0.9971	0.9943	0.9886	0.9783	0.9684	0.9593	0.9511	0.9253	0.9294	0.9508	1.0096
300	0.9996	0.9982	0.9967	0.9936	0.9875	0.9822	0.9773	0.9733	0.9640	0.9746	1.0030	1.0464
350	0.9998	0.9991	0.9983	0.9964	0.9938	0.9914	0.9896	0.9882	0.9895	1.0053	1.0340	1.0734
400	0.9999	0.9997	0.9994	0.9989	0.9982	0.9979	0.9979	0.9984	1.0073	1.0266	1.0559	1.0928
450	1.0000	1.0000	1.0003	1.0005	1.0013	1.0023	1.0038	1.0056	1.0070	1.0412	1.0709	1.1067
500	1.0000	1.0004	1.0008	1.0015	1.0035	1.0056	1.0079	1.0107	1.0282	1.0522	1.0820	1.1165
600	1.0000	1.0007	1.0013	1.0030	1.0062	1.0093	1.0129	1.0168	1.0386	1.0648	1.0948	1.1277
700	1.0003	1.0010	1.0017	1.0036	1.0073	1.0161	1.0155	1.0198	1.0436	1.0707	1.1000	1.1318
800	1.0002	1.0009	1.0019	1.0040	1.0082	1.0122	1.0168	1.0212	1.0458	1.0731	1.1016	1.1324
900	1.0002	1.0009	1.0020	1.0041	1.0083	1.0128	1.0171	1.0221	1.0463	1.0726	1.1012	1.1303
1000	1.0002	1.0009	1.0021	1.0042	1.0084	1.0128	1.0172	1.0218	1.0460	1.0725	1.0725	1.1274

*Calculated from density-pressure-temperature data in Vukalovitch and Altunin, *Thermophysical Properties of Carbon Dioxide*, Atomizdat, Moscow, 1965, and Collet's, London, 1968, translation.

TABLE 2-168 Compressibility Factors for Carbon Monoxide*

Temp., K	Pressure, atm						
	1	4	7	10	40	70	100
200	0.9973	0.9893	0.9813	0.9734			
250	0.9989	0.9957	0.9926	0.9896	0.9632		
300	0.9997	0.9987	0.9977	0.9968	0.9907	0.9896	0.9935
350	1.0000	1.0002	1.0003	1.0005	1.0042	1.0112	1.0216
400	1.0002	1.0010	1.0017	1.0025	1.0042	1.0112	1.0216
450	1.0003	1.0014	1.0025	1.0035	1.0152	1.0285	1.0433
500	1.0004	1.0016	1.0029	1.0041	1.0172	1.0314	1.0469
600	1.0005	1.0018	1.0032	1.0045	1.0186	1.0332	1.0485
700	1.0005	1.0018	1.0032	1.0045	1.0183	1.0325	1.0470
800	1.0004	1.0017	1.0030	1.0044	1.0175	1.0309	1.0445
900	1.0004	1.0017	1.0029	1.0041	1.0166	1.0291	1.0418
1000	1.0004	1.0016	1.0027	1.0039	1.0156	1.0273	1.0391
1500	1.0003	1.0012	1.0021	1.0029	1.0115	1.0200	1.0286
2000	1.0002	1.0009	1.0016	1.0022	1.0088	1.0155	1.0221
2500	1.0002	1.0007	1.0013	1.0018	1.0071	1.0124	1.0178
3000	1.0002	1.0006	1.0010	1.0015	1.0059	1.0104	1.0148

*From Hilsenrath *et al.*, *N.B.S. Circ.* 564, 1955. Some of the above values have been rounded to four decimal places. Values at 10-K increments below 1000 K and at 50 K increments for higher temperatures appear in the original, also for pressures below atmospheric.

TABLE 2-169 Compressibility Factors for Ethanol

Temp., K	Pressure, bar								
	0.1	0.5	1.013	10	20	50	100	250	500
300	0.0022	0.0023	0.0024	0.0229	0.0458	0.114	0.228	0.565	1.11
350				0.0215	0.0411	0.107	0.208	0.509	1.03
400	0.999	0.993	0.986	0.0204	0.0408	0.101	0.201	0.490	0.95
450	1.000	0.997	0.991	0.908		0.101	0.198	0.472	0.898
500	1.000	0.997	0.994	0.941	0.874	0.122	0.214	0.473	0.868
600	1.000	0.998	0.997	0.972	0.943		0.672	0.470	0.868
700	1.000	0.999	0.999	0.985	0.971	0.948	0.902	0.760	0.921
800	1.000	1.000	0.999	0.992	0.984	0.973	0.953	0.890	0.988
900	1.000	1.000	1.000	0.996	0.992	0.988	0.981	0.962	1.04
1000	1.000	1.000	1.000	0.998	0.997	0.993	0.990	1.002	1.08

Rounded and interpolated from Thermodynamics Research Center tables, Texas A&M University.

TABLE 2-170 Compressibility Factors for Ethylene

Pressure, bar	Temperature, K								
	110	150	200	250	300	350	400	450	500
1	0.0047	0.0038	0.9808	0.9902	0.9944	0.9966	0.9979	0.9986	0.9991
5	0.0237	0.0189	0.0162	0.9495	0.9717	0.9828	0.9894	0.9935	0.9959
10	0.0472	0.0378	0.0323	0.8946	0.9425	0.9659	0.9785	0.9867	0.9919
15	0.0710	0.0566	0.0484	0.8320	0.9121	0.9479	0.9679	0.9749	0.9876
20	0.0946	0.0754	0.0644	0.7578	0.8804	0.9299	0.9574	0.9734	0.9833
30	0.1418	0.1129	0.0963	0.0950	0.8122	0.8936	0.9357	0.9603	0.9754
40	0.1889	0.1504	0.1280	0.1251	0.7342	0.8560	0.9144	0.9477	0.9677
60	0.2831	0.2251	0.1910	0.1838	0.5235	0.7791	0.8730	0.9231	0.9541
80	0.3767	0.2994	0.2533	0.2410	0.3302	0.7023	0.9056	0.9009	0.9428
100	0.4702	0.3734	0.3150	0.2968	0.3480	0.6359	0.9220	0.8825	0.9321
150	0.7030	0.5567	0.4671	0.4324	0.4528	0.5842	0.7483	0.8523	0.9167
200	0.9337	0.7382	0.6161	0.5630	0.5641	0.6347	0.7499	0.8494	0.9184
250	1.1636	0.9179	0.7630	0.6904	0.6740	0.7110	0.7895	0.8710	0.9343
300	1.3917	1.0960	0.9075	0.8148	0.7816	0.7969	0.8479	0.9095	0.9631
400	1.8441	1.4475	1.1910	1.0565	0.9909	0.9726	0.9849	1.0142	1.0450
500	solid	1.7934	1.4679	1.2908	1.1932	1.1468	1.1304	1.1341	1.1436

Calculated from Jacobsen, R.T., M. Jahangiri, et al., *Ethylene*, Blackwell Sci. Publ., Oxford, 1988 (299 pp.).

TABLE 2-171 Compressibility Factors for Normal Hydrogen*

Temp., K	Pressure, bar												
	1	10	20	40	60	80	100	200	400	600	800	1000	
20	0.0169	0.1680	0.3302	0.6430	0.9434	1.2346	1.5166	2.844					
40	0.9848	0.8340	0.6311	0.5240	0.6627	0.8118	0.9590	1.650	2.878	3.993	5.034	6.019	
60	0.9955	0.9562	0.9169	0.8608	0.8498	0.8832	0.9432	1.347	2.158	2.902	3.598	4.263	
80	0.9986	0.9776	0.9763	0.9655	0.9676	0.9842	1.0138	1.257	1.834	2.389	2.907	3.404	
100	0.9998	0.9979	0.9976	1.0022	1.0133	1.0280	1.0528	1.225	1.659	2.095	2.512	2.902	
200	1.0007	1.0066	1.0134	1.0275	1.0422	1.0575	1.0734	1.163	1.355	1.555	1.753	1.936	
300	1.0005	1.0059	1.0117	1.0236	1.0357	1.0479	1.0603	1.124	1.253	1.383	1.510	1.636	
400	1.0004	1.0048	1.0096	1.0192	1.0289	1.0386	1.0484	1.098	1.196	1.293	1.388	1.481	
500	1.0004	1.0040	1.0080	1.0160	1.0240	1.0320	1.0400	1.080	1.159	1.236	1.311	1.385	
600	1.0003	1.0034	1.0068	1.0136	1.0204	1.0272	1.0340	1.068	1.133	1.197	1.259	1.320	
800	1.0002	1.0026	1.0052	1.0104	1.0156	1.0208	1.0259	1.051	1.100	1.147	1.193	1.237	
1000	1.0002	1.0021	1.0042	1.0084	1.0126	1.0168	1.0209	1.041	1.080	1.117	1.153	1.187	
2000	1.0009	1.0013	1.0023	1.0044	1.0065	1.0086	1.0107	1.021	1.040	1.057	1.073	1.088	

*Calculated from PVT tables of McCarty, Hord, and Roder, NBS Monogr. 168, 1981.

TABLE 2-172 Compressibility Factors for KLEA 60

Temp., K	Pressure, bar								Z_{sat}	P_{sat}
	1	5	10	15	20	25	30			
250	0.9687								0.9494	2.08
260	0.9780								0.9315	3.11
270	0.9803								0.9098	4.49
280	0.9824	0.9099							0.8839	6.30
290	0.9848	0.9199							0.8538	8.62
300	0.9867	0.9284	0.8459						0.8175	11.55
310	0.9872	0.9359	0.8637	0.7800					0.7756	15.19
320	0.9884	0.9425	0.8790	0.8066					0.7261	19.66
330	0.9894	0.9484	0.8908	0.8299	0.7577	0.6700			0.6666	25.10
340	0.9905	0.9537	0.9026	0.8488	0.7888	0.7184	0.6305			
350	0.9920	0.9582	0.9139	0.8663	0.8145	0.7570	0.6908			
Z_{sat}	0.9712	0.9022	0.8361	0.7777	0.7224	0.6677	0.6118			
T_{sat}	234.0	273.1	295.0	309.5	320.7	329.8	337.6			

Converted and interpolated from "Thermodynamic Properties of KLEA 60," British units, © ICI Chemicals and Polymers, 1993 (20 pp.). Reproduced by permission. KLEA 60 is R32/125/134a (20/40/40 wt %).

TABLE 2-173 Compressibility Factors for KLEA 61

Temp., K	Pressure, bar								Z_{sat}	P_{sat}
	1	5	10	15	20	25	30			
250	0.9746								0.9381	2.46
260	0.9773								0.9172	3.63
270	0.9798								0.8920	5.18
280	0.9787	0.9067							0.8622	7.19
290	0.9838	0.9185							0.8272	9.75
300	0.9854	0.9270	0.8431						0.7868	12.21
310	0.9868	0.9348	0.8615	0.7755					0.7377	16.88
320	0.9881	0.9416	0.8772	0.8042	0.7148				0.6801	21.68
330	0.9892	0.9481	0.8909	0.8280	0.7518	0.6659			0.6087	27.50
340	0.9903	0.9529	0.9027	0.8484	0.7934	0.7174	0.6312			
350	0.9917	0.9577	0.9131	0.8653	0.8134	0.7565	0.6916			
Z_{sat}	0.9686	0.8944	0.8237	0.7602	0.7003	0.6399	0.5780			
T_{sat}	230.0	269.0	290.9	305.5	316.7	325.9	333.7			

Converted and interpolated from "Thermodynamic Properties of KLEA 61," British units, © ICI Chemicals and Polymers, 1993 (23 pp.). Reproduced by permission. KLEA 61 is R32/125/134a (10/70/20 wt %).

TABLE 2-174 Compressibility Factors for KLEA 66

Temp., K	Pressure, bar								Z_{sat}	P_{sat}
	1	5	10	15	20	25	30			
250	0.974								0.9541	1.89
260	0.9772								0.9374	2.84
270	0.9796								0.9172	4.12
280	0.9838	0.9089							0.8931	5.81
290	0.9858	0.9209							0.8645	7.98
300	0.9872	0.9287	0.8461						0.8328	10.73
310	0.9883	0.9359	0.8663						0.7920	14.15
320	0.9896	0.9431	0.8786	0.8056					0.7462	18.37
330	0.9907	0.9490	0.8910	0.8292	0.7551				0.6918	23.50
340	0.9917	0.9540	0.9035	0.8492	0.7878	0.7147			0.6255	29.73
350	0.9926	0.9588	0.9137	0.8659	0.8127	0.7542	0.6843			
Z_{sat}	0.9719	0.9044	0.8397	0.7827	0.7289	0.6759	0.6220			
T_{sat}	236.1	275.5	297.6	312.1	323.5	332.6	340.4			

Converted and interpolated from "Thermodynamic properties of KLEA 66," British units, © ICI Chemicals and Polymers, 1993 (20 pp.). Reproduced by permission. KLEA 66 is R32/125/134a (23/25/52 wt %).

TABLE 2-175 Compressibility Factors for Krypton*

Temp., K	Pressure, bar											
	1	5	10	20	40	60	80	100	200	300	400	500
150	0.9837	0.9155	0.0310	0.0618	0.1227	0.1829	0.2423	0.3012	0.5875	0.8636	1.1315	1.3932
200	0.9933	0.9648	0.9278	0.8459	0.6039	0.1870	0.2393	0.2903	0.5313	0.7568	0.9730	1.1820
250	0.9966	0.9841	0.9635	0.9265	0.8468	0.7605	0.6680	0.5810	0.5785	0.7461	0.9197	1.0891
300	0.9982	0.9899	0.9800	0.9595	0.9197	0.8807	0.8437	0.8097	0.7337	0.7954	0.9302	1.0627
350	0.9989	0.9949	0.9897	0.9793	0.9522	0.9415	0.9250	0.9110	0.8774	0.8992	0.9799	1.0664
400	0.9993	0.9967	0.9933	0.9867	0.9746	0.9635	0.9539	0.9459	0.9323	0.9570	1.0150	1.0910
450	0.9998	0.9985	0.9969	0.9939	0.9886	0.9838	0.9800	0.9774	0.9663	1.0011	1.0543	1.1142
500	0.9998	0.9992	0.9984	0.9970	0.9942	0.9921	0.9910	0.9906	1.0019	1.0311	1.0732	1.1258
600	1.0000	1.0003	1.0005	1.0012	1.0025	1.0043	1.0064	1.0091	1.0301	1.0618	1.1000	1.1431
800	1.0002	1.0010	1.0020	1.0041	1.0079	1.0122	1.0170	1.0214	1.0475	1.0779	1.1112	1.1147
1000	1.0002	1.0013	1.0023	1.0045	1.0091	1.0135	1.0184	1.0230	1.0486	1.0767	1.1063	1.1369

*Calculated from PVT values tabulated in Rabinovich (ed.), *Thermophysical Properties of Neon, Argon, Krypton and Xenon*, Standards Press, Moscow, 1976. This book was published in English translation by Hemisphere, New York, 1988 (604 pp.).

TABLE 2-176 Compressibility Factors for Methane (R50)*

Temp., K	Pressure, bar											
	1	5	10	20	40	60	80	100	200	300	400	500
150	0.9854	0.9225	0.8275	0.0714	0.1411	0.2093	0.2763	0.3423	0.6599	0.9623	1.2537	1.5363
200	0.9936	0.9676	0.9339	0.8599	0.6784	0.3559	0.3172	0.3618	0.6141	0.8568	1.0887	1.3122
250	0.9965	0.9838	0.9680	0.9352	0.8682	0.8020	0.7386	0.6854	0.6899	0.8554	1.0359	1.2155
300	0.9983	0.9915	0.9830	0.9667	0.9343	0.9047	0.8783	0.8556	0.8280	0.9154	1.0432	1.1829
350	0.9991	0.9954	0.9911	0.9825	0.9662	0.9520	0.9401	0.9306	0.9227	0.9800	1.0723	1.1804
400	0.9995	0.9977	0.9953	0.9912	0.9835	0.9772	0.9726	0.9696	0.9779	1.0245	1.0986	1.1859
450	0.9997	0.9989	0.9979	0.9963	0.9935	0.9917	0.9911	0.9916	1.0098	1.0528	1.1152	1.1899
500	0.9999	0.9997	0.9995	0.9995	0.9996	1.0005	1.0022	1.0048	1.0285	1.0699	1.1248	1.1899
600	1.0000	1.0009	1.0020	1.0039	1.0081	1.0125	1.0171	1.0217	1.0540	1.0969	1.1470	1.2019
800	1.0003	1.0017	1.0034	1.0068	1.0130	1.0197	1.0263	1.0330	1.0678	1.1068	1.1496	1.1951
1000	1.0004	1.0014	1.0035	1.0071	1.0141	1.0207	1.0274	1.0342	1.0678	1.1033	1.1400	1.1790

*Calculated from PVT values tabulated in Goodwin, NBS Tech. Note 653, 1974, for temperatures up to 500 K, and from PVT values tabulated in Zhuravlev, *Thermophysical Properties of Gaseous and Liquid Methane*, Standartov, Moscow, 1969, and NBS-NSF transl. TT 70-50097, 1970.

TABLE 2-177 Compressibility Factors for Methanol

Temp., K	Pressure, bar												
	0.1	0.5	1.0133	10	20	50	100	150	200	250	300	400	500
200	0.0002	0.0011	0.0022	0.0219	0.0438	0.1091	0.2174	0.3250	0.4319	0.5381	0.6437	0.8531	1.6030
250	0.0002	0.0009	0.0019	0.0185	0.0370	0.0923	0.1837	0.2743	0.3643	0.4535	0.5422	0.7176	0.8909
300	0.9792	0.0008	0.0017	0.0164	0.0327	0.0813	0.1617	0.2413	0.3201	0.3981	0.4755	0.6284	0.7791
350	0.9844	0.9713	0.9551	0.0150	0.0298	0.0742	0.1473	0.2193	0.2904	0.3606	0.4301	0.5671	0.7016
400	0.9872	0.9795	0.9722	0.0142	0.0283	0.0702	0.1386	0.2056	0.2714	0.3362	0.4000	0.5253	0.6478
450	0.9890	0.9835	0.9792	0.9145	0.7989	0.0701	0.1366	0.2007	0.2629	0.3238	0.3834	0.4997	0.6128
500	0.9903	0.9859	0.9828	0.9525	0.9081	0.6799	0.1505	0.2110	0.2699	0.3271	0.3829	0.4912	0.5959
600	0.9922	0.9889	0.9867	0.9756	0.9643	0.9042	0.7629	0.6275	0.5255	0.4921	0.5010	0.5606	0.6358
700	0.9934	0.9907	0.9889	0.9816	0.9778	0.9541	0.8932	0.8392	0.8027	0.7797	0.7675	0.7713	0.7993
800	0.9964	0.9920	0.9904	0.9838	0.9818	0.9711	0.9411	0.9156	0.9025	0.8994	0.9026	0.9205	0.9485

Goodwin, R.D., *J. Phys. Chem. Ref. Data*, **16** (4), 799, 1987.

TABLE 2-178 Compressibility Factors for Neon*

Temp., K	Pressure, bar											
	1	5	10	20	40	60	80	100	200	300	400	500
50	0.9913	0.9472	0.9083	0.8013	0.3810	0.4398	0.4984	0.5850	0.9864	1.3659	1.7289	2.0794
100	0.9993	0.9970	0.9949	0.9913	0.9854	0.9245	0.9864	0.9930	1.0796	1.2197	1.3796	1.5473
150	1.0002	1.0017	1.0036	1.0078	1.0162	1.0262	1.0375	1.0497	1.1236	1.2131	1.3113	1.4150
200	1.0003	1.0023	1.0049	1.0100	1.0204	1.0318	1.0427	1.0551	1.1191	1.1909	1.2655	1.3422
250	1.0001	1.0022	1.0045	1.0097	1.0198	1.0295	1.0403	1.0502	1.1057	1.1633	1.2223	1.2822
300	1.0000	1.0020	1.0041	1.0091	1.0181	1.0277	1.0369	1.0469	1.0961	1.1476	1.1997	1.2520
400	1.0000	1.0017	1.0036	1.0074	1.0151	1.0216	1.0301	1.0376	1.0771	1.1172	1.1575	1.1981
500	1.0000	1.0014	1.0029	1.0058	1.0124	1.0188	1.0252	1.0316	1.0641	1.0963	1.1291	1.1621
600	1.0000	1.0012	1.0024	1.0049	1.0107	1.0160	1.0214	1.0267	1.0542	1.0814	1.1091	1.1369
800	1.0000	1.0009	1.0018	1.0043	1.0081	1.0123	1.0163	1.0206	1.0413	1.0622	1.0829	1.1039
1000	1.0000	1.0007	1.0014	1.0034	1.0068	1.0098	1.0132	1.0165	1.0330	1.0500	1.0670	1.0836

*Calculated from PVT values tabulated in Rabinovich (ed.), *Thermophysical Properties of Neon, Argon, Krypton and Xenon*, Standards Press, Moscow, 1976. This book was published in English translation by Hemisphere, New York, 1988 (604 pp.).

TABLE 2-179 Compressibility Factors for Nitrogen*

Temp., K	Pressure, bar											
	1	5	10	20	40	60	80	100	200	300	400	500
70	0.0057	0.0287	0.0573	0.1143	0.2277	0.3400	0.4516	0.5623	1.1044	1.6308	Solid	Solid
80	0.9593	0.0264	0.0528	0.1053	0.2093	0.3122	0.4140	0.5148	1.0061	1.4797	1.9396	2.3879
90	0.9722	0.0251	0.0500	0.0996	0.1975	0.2938	0.3888	0.4826	0.9362	1.3700	1.7890	2.1962
100	0.9798	0.8910	0.0487	0.0966	0.1905	0.2823	0.3720	0.4605	0.8840	1.2852	1.6707	2.0441
120	0.9883	0.9397	0.8732	0.7059	0.1975	0.2822	0.3641	0.4438	0.8188	1.1684	1.5015	1.8223
140	0.9927	0.9635	0.9253	0.8433	0.6376	0.4251	0.4278	0.4799	0.7942	1.0996	1.3920	1.6726
160	0.9952	0.9766	0.9529	0.9042	0.8031	0.7017	0.6304	0.6134	0.8107	1.0708	1.3275	1.5762
180	0.9967	0.9846	0.9690	0.9381	0.8782	0.8125	0.7784	0.7530	0.8550	1.0669	1.2893	1.5105
200	0.9978	0.9897	0.9791	0.9592	0.9212	0.8882	0.8621	0.8455	0.9067	1.0760	1.2683	1.4631
250	0.9992	0.9960	0.9924	0.9857	0.9741	0.9655	0.9604	0.9589	1.0048	1.1143	1.2501	1.3962
300	0.9998	0.9990	0.9983	0.9971	0.9964	0.9973	1.0000	1.0052	1.0559	1.1422	1.2480	1.3629
350	1.0001	1.0007	1.0011	1.0029	1.0069	1.0125	1.0189	1.0271	1.0810	1.1560	1.2445	1.3405
400	1.0002	1.0011	1.0024	1.0057	1.0125	1.0199	1.0283	1.0377	1.0926	1.1609	1.2382	1.3216
450	1.0003	1.0018	1.0033	1.0073	1.0153	1.0238	1.0332	1.0430	1.0973	1.1606	1.2303	1.3043
500	1.0004	1.0020	1.0040	1.0081	1.0167	1.0257	1.0350	1.0451	1.0984	1.1575	1.2213	1.2881
600	1.0004	1.0021	1.0040	1.0084	1.0173	1.0263	1.0355	1.0450	1.0951	1.1540	1.2028	1.2657
800	1.0004	1.0017	1.0036	1.0074	1.0157	1.0237	1.0320	1.0402	1.0832	1.1264	1.1701	1.2140
1000	1.0003	1.0015	1.0034	1.0067	1.0136	1.0205	1.0275	1.0347	1.0714	1.1078	1.1449	1.1814

*Computed from pressure-volume-temperature tables in the Vasserman monographs referenced under Table 2-165.

TABLE 2-180 Compressibility Factors for Oxygen*

Temp., K	Pressure, bar											
	1	5	10	20	40	60	80	100	200	300	400	500
75	0.0043	0.0213	0.0425	0.0849	0.1693	0.2533	0.3368	0.4200	0.8301	1.2322	1.6278	2.0175
80	0.0041	0.0203	0.0406	0.0811	0.1616	0.2418	0.3214	0.4007	0.7912	1.1738	1.5495	1.9196
90	0.0038	0.0188	0.0376	0.0750	0.1494	0.2233	0.2966	0.3696	0.7281	1.0780	1.4211	1.7580
100	0.9757	0.0177	0.0354	0.0705	0.1404	0.2096	0.2783	0.3464	0.6798	1.0040	1.3206	1.6309
120	0.9855	0.9246	0.8367	0.0660	0.1302	0.1935	0.2558	0.3173	0.6148	0.8999	1.1762	1.4456
140	0.9911	0.9535	0.9034	0.7852	0.1334	0.1940	0.2527	0.3099	0.5815	0.8374	1.0832	1.3214
160	0.9939	0.9697	0.9379	0.8689	0.6991	0.3725	0.2969	0.3378	0.5766	0.8058	1.0249	1.2364
180	0.9960	0.9793	0.9579	0.9134	0.8167	0.7696	0.5954	0.5106	0.6043	0.8025	0.9990	1.1888
200	0.9970	0.9853	0.9705	0.9399	0.8768	0.8140	0.7534	0.6997	0.6720	0.8204	0.9907	1.1623
250	0.9987	0.9938	0.9870	0.9736	0.9477	0.9237	0.9030	0.8858	0.8563	0.9172	1.0222	1.1431
300	0.9994	0.9968	0.9941	0.9884	0.9771	0.9676	0.9597	0.9542	0.9560	0.9972	1.0689	1.1572
350	0.9998	0.9990	0.9979	0.9961	0.9919	0.9890	0.9870	0.9870	1.0049	1.0451	1.1023	1.1722
400	1.0000	1.0000	1.0000	1.0000	1.0003	1.0011	1.0022	1.0045	1.0305	1.0718	1.1227	1.1816
450	1.0002	1.0007	1.0015	1.0024	1.0048	1.0074	1.0106	1.0152	1.0445	1.0859	1.1334	1.1859
500	1.0002	1.0011	1.0022	1.0038	1.0075	1.0115	1.0161	1.0207	1.0523	1.0927	1.1380	1.1866
600	1.0003	1.0014	1.0024	1.0052	1.0102	1.0153	1.0207	1.0266	1.0582	1.0961	1.1374	1.1803
800	1.0003	1.0014	1.0026	1.0055	1.0109	1.0164	1.0219	1.0271	1.0565	1.0888	1.1231	1.1582
1000	1.0003	1.0013	1.0026	1.0053	1.0101	1.0149	1.0198	1.0253	1.0507	1.0783	1.1072	1.1369

*Calculated from pressure-volume-temperature tables in the Vasserman monographs listed under Table 2-165.

TABLE 2-181 Compressibility Factors for Refrigerant 32*

Temp., K	Pressure, bar										Z_{sat}	P_{sat}
	1	5	10	15	20	25	30	40	50			
230	0.9656										0.9453	1.54
240	0.9711										0.9278	2.40
250	0.9755										0.9062	3.60
260	0.9791	0.8865									0.8811	5.22
270	0.9819	0.9036									0.8522	7.34
280	0.9844	0.9180	0.8210								0.8194	10.07
290	0.9864	0.9285	0.8476								0.7822	13.51
300	0.9880	0.9376	0.8686	0.7899							0.7401	17.76
310	0.9894	0.9453	0.8358	0.8197	0.7439						0.6922	22.95
320	0.9904	0.9518	0.8998	0.8436	0.7812	0.7089					0.6370	29.21
330	0.9914	0.9573	0.9118	0.8628	0.8102	0.7518	0.6851				0.5719	36.72
340	0.9923	0.9619	0.9203	0.8790	0.8338	0.7846	0.7316	0.6021			0.4905	45.66
350	0.9932	0.9655	0.9296	0.8932	0.8534	0.8115	0.7671	0.6675	0.5312		0.3702	56.35
Z_{sat}	0.9595	0.8843	0.8202	0.7670	0.7191	0.6722	0.6303	0.5427	0.4467			
T_{sat}	221.2	258.8	279.8	293.8	304.6	313.5	321.1	333.9	344.3			

*Converted and interpolated from British units shown in *Thermodynamic properties of KLEA 32*, ICI Chemicals and Polymers, 1993. Reproduced by permission.

TABLE 2-182 Compressibility Factors for Refrigerant 123

Temp., °C	Pressure, bar											Z _{sat}	Psat
	1	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25		
40	0.9639											0.9427	1.54
50	0.9682											0.9294	2.13
60	0.9717	0.9248										0.9134	2.96
70	0.9745	0.9327										0.8950	3.78
80	0.9766	0.9401										0.8727	4.90
100	0.9804	0.9501	0.9197	0.8355								0.8262	7.87
120	0.9839	0.9591	0.9146	0.8667	0.8140							0.7640	12.01
140	0.9861	0.9650	0.9282	0.8915	0.8503	0.8023	0.7479	0.6916				0.6890	17.59
160	0.9886	0.9714	0.9406	0.9077	0.8747	0.8398	0.8026	0.7600	0.7134	0.6553		0.5820	24.92
180	0.9908	0.9762	0.9518	0.9254	0.8970	0.8709	0.8402	0.8072	0.7712	0.7346	0.6841	0.3926	34.54
200	0.9924	0.9806	0.9602	0.9388	0.9174	0.8931	0.8688	0.8422	0.8163	0.7882	0.7539	—	—
225	0.9938	0.9846	0.9692	0.9526	0.9378	0.9170	0.8972	0.8800	0.8566	0.8401	0.8157	—	—
250	0.9954	0.9885	0.9	0.9651	0.9528	0.9382	0.9229	0.9101	0.8930	0.8771	0.8581	—	—
Z _{sat}	0.9575	0.9210	0.9730	0.8292	0.7947	0.7654	0.7229	0.7110	0.6564	0.6206	0.5821	—	—
T	27.5	55.4	80.8	97.9	111.1	122.0	131.4	139.7	147.2	154.0	160.2	—	—

Dashes indicate inaccessible states; blanks indicate no available data.

TABLE 2-183 Compressibility Factors for Refrigerant 124

Temp., °C	Pressure, bar											Z _{sat}	Psat
	1	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25		
-20												0.9562	0.72
-10												0.9431	1.10
0	0.9573											0.9284	1.63
10	0.9641											0.9243	2.34
20	0.9693											0.8920	3.27
30	0.9736	0.9313										0.8828	4.45
40	0.9675	0.9396	0.8728									0.8427	5.93
50	0.9798	0.9473	0.8889	0.8229								0.8151	7.75
60	0.9820	0.9534	0.9017	0.8462								0.7803	9.96
80	0.9854	0.9633	0.9226	0.8820	0.8366		0.7251					0.7024	15.74
100	0.9880	0.9700	0.9370	0.9040	0.8710	0.8314	0.7918	0.7463	0.6950	0.6380		0.5955	23.75
120	0.9899	0.9749	0.9478	0.9206	0.8935	0.8634	0.8329	0.8022	0.7682	0.7285	0.6878	0.3912	34.70
140	0.9917	0.9794	0.9575	0.9357	0.9138	0.8884	0.8641	0.8391	0.8105	0.7896	0.7647		
160		0.9825	0.9645	0.9464	0.9247	0.9061	0.8868	0.8644	0.8489	0.8285	0.7868		
180			0.9690	0.9536	0.9382	0.9213	0.9056	0.8857	0.8634	0.8574	0.8379		
200				0.9601	0.9471	0.9338	0.9211	0.9042	0.8951	0.8783	0.8647		
225					0.9589	0.9488	0.9391	0.9223	0.9160	0.9040	0.8947		
250					0.9650	0.9573	0.9443	0.9412	0.9333	0.9252	0.9174		
Z _{sat}	0.9468	0.9071	0.8605	0.8185	0.7830	0.7488	0.7157	0.6825	0.6484	0.6279	0.5788		
T	-12.4	11.9	34.0	48.7	60.2	69.6	77.8	85.0	91.4	96.3	102.6		

Dashes indicate inaccessible states; blanks indicate no available data.

TABLE 2-184 Compressibility Factors for Refrigerant 134a

Temp., °C	Pressure, bar										Z _{sat}	Psat
	1	5	10	15	20	25	30	40	50			
-10	0.9622										0.9316	2.005
0	0.9710										0.9119	2.926
10	0.9752										0.8888	4.144
20	0.9778	0.8819									0.8621	5.716
30	0.9817	0.8973									0.8314	7.701
40	0.9839	0.9098	0.8005								0.7963	10.17
50	0.9857	0.9206	0.8280								0.7560	13.18
60	0.9872	0.9296	0.8449	0.7361							0.7098	16.82
70	0.9886	0.9376	0.8678	0.7917	0.6853						0.6562	21.17
80	0.9897	0.9442	0.8828	0.8137	0.7327	0.6290					0.5911	26.38
90	0.9908	0.9495	0.8954	0.8390	0.7682	0.6860	0.5832				0.5054	32.45
100	0.9916	0.9543	0.9062	0.8555	0.7965	0.7335	0.6557				0.3462	39.72
110	0.9920	0.9592	0.9151	0.8630	0.8144	0.7630	0.7046	0.5732	0.4530		—	—
120	0.9924	0.9638	0.9235	0.8802	0.8386	0.7915	0.7418	0.6249	0.4885		—	—
130	0.9927	0.9673	0.9308	0.8949	0.8553	0.8165	0.7716	0.6771	0.5645		—	—
140	0.9929	0.9691	0.9370	0.9040	0.8694	0.8350	0.7964	0.7169	0.6303		—	—
150	0.9931	0.9727	0.9428	0.8877	0.8817	0.8495	0.8173	0.7489	0.6783		—	—
satn.	0.9567	0.8741	0.7989	0.7017	0.6704	0.6094	0.5415	0.4442	—		—	—
sat. T	-26.37	15.74	39.39	55.23	67.49	77.57	86.20	100.35	—		—	—

Dashes indicate inaccessible states; blanks indicate no available data.

TABLE 2-185 Compressibility Factors for Water Substance (fps units)*

Pressure, lb/in ² abs.	Temp., °F																		
	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000
10	0.9965	0.9989	0.9992	0.9995	0.9999	0.9999	0.9999	1.0000	1.0000	1.0000	1.0001	1.0006	1.0012	1.0024	1.0053	1.0084	1.0145	1.0211	1.0332
15	0.9943	0.9972	0.9986	0.9993	0.9997	0.9998	0.9999	0.9999	1.0000	1.0000	1.0001	1.0004	1.0012	1.0022	1.0042	1.0072	1.0124	1.0188	1.0295
20	0.9930	0.9970	0.9981	0.9991	0.9995	0.9996	0.9998	0.9999	1.0000	1.0000	1.0001	1.0003	1.0011	1.0020	1.0036	1.0065	1.0112	1.0173	1.0269
40	0.9861	0.9940	0.9967	0.9981	0.9990	0.9994	0.9996	0.9998	0.9999	0.9999	1.0001	1.0003	1.0010	1.0018	1.0028	1.0054	1.0090	1.0139	1.0214
60	0.9788	0.9910	0.9951	0.9973	0.9984	0.9991	0.9994	0.9997	0.9999	0.9999	1.0001	1.0003	1.0009	1.0018	1.0024	1.0048	1.0080	1.0120	1.0186
80	0.9714	0.9878	0.9935	0.9963	0.9979	0.9987	0.9992	0.9996	0.9998	0.9999	1.0001	1.0003	1.0008	1.0016	1.0023	1.0044	1.0073	1.0108	1.0170
100	0.9469	0.9848	0.9919	0.9954	0.9974	0.9985	0.9990	0.9995	0.9998	0.9999	1.0001	1.0004	1.0007	1.0015	1.0022	1.0042	1.0067	1.0099	1.0157
150	0.9435	0.9770	0.9879	0.9931	0.9960	0.9976	0.9985	0.9993	0.9997	0.9998	1.0001	1.0004	1.0006	1.0014	1.0021	1.0039	1.0059	1.0087	1.0137
200	0.9216	0.9690	0.9839	0.9908	0.9947	0.9968	0.9980	0.9991	0.9996	0.9998	1.0001	1.0005	1.0007	1.0015	1.0021	1.0037	1.0055	1.0080	1.0126
400		0.9356	0.9675	0.9817	0.9893	0.9935	0.9960	0.9982	0.9992	0.9998	1.0002	1.0007	1.0011	1.0017	1.0023	1.0033	1.0049	1.0070	1.0105
600		0.8989	0.9509	0.9725	0.9839	0.9904	0.9942	0.9973	0.9988	0.9997	1.0002	1.0008	1.0014	1.0019	1.0026	1.0034	1.0048	1.0066	1.0097
800		0.8586	0.9336	0.9633	0.9790	0.9872	0.9925	0.9964	0.9985	0.9996	1.0003	1.0010	1.0016	1.0022	1.0029	1.0036	1.0049	1.0065	1.0094
1,000		0.8138	0.9162	0.9540	0.9733	0.9841	0.9905	0.9955	0.9981	0.9994	1.0004	1.0012	1.0019	1.0025	1.0032	1.0039	1.0052	1.0066	1.0092
1,500		0.6702	0.8695	0.9305	0.9600	0.9764	0.9859	0.9932	0.9971	0.9992	1.0007	1.0017	1.0026	1.0033	1.0040	1.0048	1.0059	1.0072	1.0096
2,000			0.8188	0.9067	0.9468	0.9687	0.9813	0.9900	0.9958	0.9990	1.0010	1.0023	1.0034	1.0042	1.0049	1.0058	1.0068	1.0082	1.0104
4,000			0.5608	0.8060	0.8942	0.9392	0.9647	0.9836	0.9930	0.9989	1.0024	1.0050	1.0069	1.0082	1.0093	1.0106	1.0118	1.0132	1.0149
6,000				0.7042	0.8442	0.9121	0.9497	0.9771	0.9907	0.9991	1.0048	1.0081	1.0110	1.0128	1.0139	1.0152	1.0165	1.0179	1.0195
8,000				0.6185	0.8003	0.8883	0.9371	0.9714	0.9895	1.0004	1.0075	1.0118	1.0152	1.0172	1.0188	1.0204	1.0216	1.0229	1.0242
10,000				0.5699	0.7657	0.8693	0.9274	0.9668	0.9890	1.0025	1.0105	1.0158	1.0196	1.0220	1.0240	1.0258	1.0271	1.0284	1.0298

* Calculated by P. E. Liley from various steam tables for the lower temperatures and from Paper B-11 by P. H. Kesselman and Yu. I. Blank, 7th. Int. Conf. Properties of Steam, Tokyo, 1968, for the higher temperatures.

TABLE 2-186 Compressibility Factors of Water Substance (SI units)*

Temperature, K	Pressure, bar																				
	1	5	10	15	20	25	30	40	50	60	80	100	150	200	250	300	400	500	600	800	1000
400	0.990	0.003	0.006	0.009	0.012	0.014	0.017	0.023	0.029	0.035	0.046	0.058	0.086	0.114	0.143	0.171	0.227	0.282	0.336	0.445	0.552
450	0.993	0.003	0.006	0.009	0.012	0.014	0.016	0.022	0.027	0.033	0.043	0.054	0.080	0.107	0.134	0.159	0.206	0.255	0.304	0.402	0.498
500	0.996	0.980	0.958	0.930	0.901	0.878	0.016	0.021	0.026	0.031	0.042	0.052	0.077	0.102	0.127	0.152	0.201	0.249	0.297	0.390	0.482
550	0.997	0.985	0.969	0.956	0.939	0.922	0.904	0.865	0.822	0.773	0.042	0.052	0.077	0.102	0.126	0.150	0.181	0.198	0.289	0.378	0.464
600	0.998	0.990	0.979	0.970	0.961	0.948	0.935	0.910	0.885	0.858	0.798	0.726	0.082	0.107	0.131	0.155	0.201	0.246	0.290	0.375	0.457
650	0.999	0.992	0.984	0.977	0.968	0.959	0.958	0.937	0.919	0.902	0.864	0.824	0.702	0.514	0.177	0.183	0.221	0.260	0.303	0.383	0.460
700	1.000	0.994	0.988	0.984	0.976	0.967	0.966	0.952	0.941	0.929	0.900	0.876	0.800	0.716	0.618	0.503	0.326	0.316	0.340	0.406	0.476
750	1.000	0.996	0.991	0.988	0.981	0.975	0.971	0.961	0.955	0.945	0.927	0.907	0.856	0.801	0.743	0.682	0.557	0.465	0.435	0.456	0.509
800	1.000	0.997	0.993	0.991	0.985	0.982	0.976	0.970	0.966	0.957	0.945	0.929	0.892	0.853	0.813	0.773	0.693	0.620	0.568	0.538	0.561
850	1.000	0.997	0.995	0.992	0.989	0.984	0.981	0.977	0.973	0.967	0.957	0.946	0.917	0.889	0.860	0.831	0.775	0.715	0.679	0.631	0.629
900	1.000	0.998	0.997	0.993	0.992	0.989	0.986	0.982	0.979	0.974	0.965	0.958	0.936	0.915	0.893	0.872	0.830	0.792	0.760	0.714	0.700
950	1.000	0.998	0.997	0.994	0.994	0.993	0.991	0.985	0.983	0.980	0.973	0.967	0.950	0.933	0.916	0.901	0.867	0.839	0.816	0.780	0.761
1000	1.000	0.999	0.998	0.995	0.995	0.994	0.993	0.990	0.987	0.985	0.978	0.973	0.960	0.948	0.935	0.923	0.900	0.878	0.859	0.831	0.816
1200	1.000	1.000	0.999	0.998	0.998	0.997	0.997	0.995	0.994	0.994	0.992	0.990	0.986	0.982	0.975	0.968	0.961	0.957	0.949	0.942	0.937
1400	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999	0.998	0.998	0.998	0.997	0.996	0.995	0.995	0.994	0.993	0.992	0.994	0.996	0.998
1600	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.001	1.002	1.002	1.004	1.006	1.009	1.012	1.015	1.020
1800	1.001	1.001	1.001	1.000	1.000	1.000	1.000	1.000	1.000	1.001	1.002	1.003	1.003	1.004	1.005	1.008	1.011	1.014	1.017	1.021	1.031
2000	1.003	1.002	1.002	1.002	1.002	1.002	1.002	1.002	1.002	1.003	1.003	1.004	1.004	1.006	1.008	1.011	1.014	1.018	1.021	1.032	1.043

* Calculated by P. E. Liley from various steam tables for the lower temperatures and from Pap. B-11 by P. H. Kesselman and Yu. I. Blank, 7th Internal Conference on the Properties of Steam, Tokyo, 1968, for the higher temperatures.

TABLE 2-187 Compressibility Factors for Xenon*

Temperature, K	Pressure, bar											
	1	5	10	20	40	60	80	100	200	300	400	500
200	0.9831	0.9088	0.0293	0.0584	0.1162	0.1733	0.2300	0.2861	0.5601	0.8253	1.0833	1.3356
250	0.9911	0.9545	0.9052	0.7887	0.1114	0.1642	0.2158	0.2663	0.5074	0.7355	0.9546	1.1670
300	0.9949	0.9736	0.9465	0.8885	0.7517	0.5492	0.2794	0.3016	0.5021	0.6997	0.8886	1.0707
350	0.9967	0.9834	0.9669	0.9322	0.8473	0.7840	0.7039	0.6249	0.5645	0.7124	0.8706	1.0269
400	0.9977	0.9892	0.9183	0.9562	0.9128	0.8696	0.8278	0.7888	0.6916	0.7642	0.8850	1.0148
450	0.9989	0.9928	0.9856	0.9714	0.9429	0.9163	0.8911	0.8679	0.7335	0.8331	0.9187	1.0224
500	0.9982	0.9951	0.9902	0.9810	0.9623	0.9452	0.9293	0.9156	0.8774	0.8953	0.9572	1.0412
600	0.9996	0.9979	0.9957	0.9917	0.9841	0.9772	0.9715	0.9667	0.9596	0.9791	1.0211	1.0799
800	1.0000	0.9998	1.0002	1.0004	1.0012	1.0020	1.0034	1.0054	1.0213	1.0476	1.0818	1.1222
1000	1.0000	1.0004	1.0015	1.0031	1.0144	1.0101	1.0133	1.0172	1.0394	1.0669	1.0979	1.1331

* Calculated from PVT values tabulated in Rabinovich (ed.), *Thermophysical Properties of Neon, Argon, Krypton and Xenon*, Standards Press, Moscow, 1976. This book was published in English translation by Hemisphere, New York, 1988 (604 pp.).

TABLE 2-188 Compressibilities of Liquids*

At the constant temperature T , the compressibility $\beta = (1/\bar{V}_0)(dV/dP)$. In general as P increases, β decreases rapidly at first and then slowly; the change of β with T is large at low pressures but very small at pressures above 1000 to 2000 megabars. 1 megabar = 0.987 atm. = 10^6 dynes/cm² based upon the older usage, 1 bar = 1 dyne/cm². The use of the bar as a pressure unit is not encouraged.

Substance	Temp., °C	Pressure, megabars	Compressibility per megabar $\beta \times 10^6$	Substance	Temp., °C	Pressure, megabars	Compressibility per megabar $\beta \times 10^6$	Substance	Temp., °C	Pressure, megabars	Compressibility per megabar $\beta \times 10^6$
Acetone	14	23	111	Ethyl acetate	20	400	75	Methyl alcohol	15	23	103
Acetone	20	500	61	alcohol	14	23	100	alcohol	20	200	95
Acetone	20	1,000	52	alcohol	20	500	63	alcohol	20	400	80
Acetone	40	12,000	9	alcohol	20	1,000	54	alcohol	20	500	65
Amyl alcohol	14	23	88	alcohol	20	12,000	8	alcohol	20	1,000	54
alcohol, iso.	20	200	84	bromide	20	200	100	alcohol	20	12,000	8
alcohol, iso.	20	400	70	bromide	20	400	82	Nitric acid	0	17	32
alcohol, n	20	500	61	bromide	20	500	70	Oils:			
alcohol, n	20	1,000	46	bromide	20	1,000	54	Almond	15	5	53
alcohol, n	20	12,000	8	bromide	20	12,000	8	Castor	15	5	46
alcohol, n	40	12,000	8	chloride	15	23	151	Linseed	15	5	51
Benzene	17	5	89	chloride	20	500	102	Olive	15	5	55
Benzene	20	200	77	chloride	20	1,000	66	Rapeseed	20		59
Benzene	20	400	67	chloride	20	12,000	8	Phosphorus trichloride	10	250	71
Bromine	20	200	56	ether	25	23	188	trichloride	20	500	63
Bromine	20	400	51	ether	20	500	84	trichloride	20	1,000	47
Butyl alcohol, iso	18	8	97	ether	20	1,000	61	trichloride	20	12,000	8
alcohol, iso	20	200	81	ether	20	12,000	10	Propyl alcohol (n)	20	200	77
alcohol, iso	20	400	64	iodide	20	200	81	alcohol (n)	20	400	67
alcohol, iso	20	500	56	iodide	20	400	69	alcohol (n?)	20	500	65
alcohol, iso	20	1,000	46	iodide	20	500	64	alcohol (n?)	20	1,000	47
alcohol, iso	20	12,000	8	iodide	20	1,000	50	alcohol (n?)	20	12,000	7
Carbon bisulfide	16	21	86	iodide	20	12,000	8	Toluene	20	200	74
bisulfide	20	500	57	Gallium	30	300	3.97	Toluene	20	400	64
bisulfide	20	1,000	48	Glycerol	15	5	22	Turpentine	20		74
bisulfide	20	12,000	6	Hexane	20	200	117	Water	20	13	49
tetrachloride	20	200	86	Hexane	20	400	91	Water	20	200	43
tetrachloride	20	400	73	Kerosene	20	500	55	Water	20	400	41
Chloroform	20	200	83	Kerosene	20	1,000	45	Water	20	500	39
Chloroform	20	400	70	Kerosene	20	12,000	8	Water	40	500	38
Dichloroethylsulfide	32	1,000	34	Mercury	20	300	3.95	Water	40	1,000	33
Dichloroethylsulfide	32	2,000	24	Mercury	22	500	3.97	Water	40	12,000	9
Ethyl acetate	13	23	103	Mercury	22	1,000	3.91	Xylene, meta	20	200	69
acetate	20	200	90	Mercury	22	12,000	2.37	meta	20	400	60

* *Smithsonian Tables*, Table 106.

Scott (*Cryogenic Engineering*, Van Nostrand, Princeton, NJ, 1959) gives data for liquid nitrogen (p. 283), oxygen (p. 276), and hydrogen (p. 303). For a convenient index to the high-pressure work of Bridgman, see *American Institute of Physics Handbook*, p. 2-163, McGraw-Hill, New York, 1957.

TABLE 2-189 Compressibilities of Solids

Many data on the compressibility of solids obtained prior to 1926 are contained in Gruneisen, *Handbuch der Physik*, vol. 10, Springer, Berlin, 1926, pp. 1–52; also available as translation, NASA RE 2-18-59W, 1959. See also Tables 271, 273, 276, 278, and other material in *Smithsonian Physical Tables*, 9th ed., 1954. For a review of high-pressure work to 1946, see Bridgman, *Rev. Mod. Phys.*, **18**, 1 (1946).

LATENT HEATS

UNITS CONVERSIONS

For this subsection, the following units conversions are applicable:

$$^{\circ}\text{F} = \frac{9}{5}^{\circ}\text{C} + 32.$$

To convert calories per gram-mole to British thermal units per

pound-mole, multiply by 1.799; to convert calories per gram to British thermal units per pound, multiply by 1.799.

To convert millimeters of mercury to pounds-force per square inch, multiply by 1.934×10^{-2} .

TABLE 2-190 Heats of Fusion and Vaporization of the Elements and Inorganic Compounds (Concluded)

Substance	mp, °C	Heat of fusion, ^{a,b} cal/mole	bp at 1 atm, °C	Heat of vaporization, ^{a,b} cal/mole	Substance	mp, °C	Heat of fusion, ^{a,b} cal/mole	bp at 1 atm, °C	Heat of vaporization, ^{a,b} cal/mole
Sodium (Cont.)					Thallium				
NaBr	747	6,140	1392	37,950	Tl	302.5	1,030	1457	38,810
NaCl	800	7,220	1465	40,810	TlBr	460	5,990	819	23,800
NaClO ₃	255	5,290			TlCl	427	4,260	807	24,420
NaCN	562	(4,400)	1500	37,280	Tl ₂ CO ₃	273	4,400		
NaCNS	323	4,450			TlI	440	3,125	823	25,030
Na ₂ CO ₃	854	7,000			TlNO ₃	207	2,290		
NaF	992	7,000	1704	53,260	Tl ₂ S	449	3,000		
NaI	662	5,240			Tl ₂ SO ₄	632	5,500		
Na ₂ MoO ₄	687	3,600			Tin				
NaNO ₃	310	3,760			Sn ₄	231.8	1,720	2270	68,000
NaOH	322	2,000	1378		SnBr ₂	232	(1,700)		
½Na ₂ O·½Al ₂ O ₃ ·3SiO ₂	1107	13,150			SnBr ₄	30	3,000		
NaPO ₃	988	(5,000)			SnCl ₂	247	3,050	623	20,740
Na ₄ P ₂ O ₇	970	(13,700)			SnCl ₄	-33.2	2,190	113	8,330
Na ₂ S	920	(1,200)			Sn(CH ₃) ₄			78.3	7,320
Na ₂ SiO ₃	1087	10,300			SnH ₄	-149.8		-52.3	4,420
Na ₂ Si ₂ O ₅	884	8,460			SnI ₄	143.5	(4,300)		
Na ₂ SO ₄	884	5,830			Titanium				
Na ₂ WO ₄	702	5,800			TiBr ₄	38.2	(2,060)		
Strontium					TiCl ₄	-23	2,240	136	8,350
Sr	757	2,190	1384	33,610	TiO ₂	1825	(11,400)		
SrBr ₂	643	4,780			Tungsten				
SrCl ₂	872	4,100			W	3390	(8,400)	(5900)	(176,000)
SrF ₂	1400	4,260			WF ₆	-0.4	1,800	17.3	6,350
Sr ₂ (PO ₄) ₂	1770	18,500			Uranium				
Sulfur					UF ₆			55.1 ^c	9,990 ^c
S (rhombic)	112.8		444.6	2,200	Xenon				
S (monoclinic)	119.2				Xe	-111.5	740	-108.0	3,110
S ₂ Cl ₂			138	8,720	Zinc				
SF ₆			-63.5 ^e	5,600 ^e	Zn	419.5	1,595	907	27,430
SO ₂	-75.5	1,769 ^g	-5.0	5,960 ^g	ZnCl ₂	283	(5,500)	732	28,710
SO ₃ (α)	17	2,060	44.8	10,190	Zn(C ₂ H ₅) ₂			118	8,960
SO ₃ (β)	32.4	2,890			ZnO	1975	4,470		
SO ₃ (γ)	62.2	6,310			ZnS	1645	(9,000)		
SOBr ₂			139.5	9,920	Zirconium				
SOCl ₂			75.4	7,600	ZrBr ₄			357 ^e	25,800 ^e
SO ₂ Cl ₂			69.2	7,760	ZrCl ₄			311 ^e	25,290 ^e
Tellurium					ZrI ₄			431 ^e	29,030 ^e
Te	453	3,230	1090		ZrO ₂	2715	20,800		
TeCl ₄			392	16,830					
TeF ₆			-38.6 ^f	6,700 ^f					

^a Values in parentheses are uncertain.
^b For the freezing point or the normal boiling point unless otherwise stated.
^c Sublimation.
^d Decomposes at about 75°C; value obtained by extrapolation.
^e Bichowsky and Rossini, "Thermochemistry of the Chemical Substances," Reinhold, New York (1936).
^f Decomposes before the normal boiling point is reached.
^g Decomposes at about 40°C; value obtained by extrapolation.
^h See also pp. 2-304 through 2-307 on steam table.
ⁱ Giauque and Ruehrwein, *J. Am. Chem. Soc.*, **61** (1939): 2626.
^j Giauque and Egan, *J. Chem. Phys.*, **5** (1937): 45.

^k Kemp and Giauque, *J. Am. Chem. Soc.*, **59** (1937): 79.
^l Brown and Manov, *J. Am. Chem. Soc.*, **59** (1937): 500.
^m Giauque and Powell, *J. Am. Chem. Soc.*, **61** (1939): 1970.
ⁿ Overstreet and Giauque, *J. Am. Chem. Soc.*, **59** (1937): 254.
^o Stephenson and Giauque, *J. Chem. Phys.*, **5** (1937): 149.
^p Giauque and Stephenson, *J. Am. Chem. Soc.*, **60** (1938): 1389.
^q Osborne, Stimson, and Ginnings, *Bur. Standards J. Research*, **23**, 197 (1939): 261.
^r Miles and Menzies, *J. Am. Chem. Soc.*, **58** (1936): 1067.
^s Long and Kemp, *J. Am. Chem. Soc.*, **58** (1936): 1829.
^t Giauque and Blue, *J. Am. Chem. Soc.*, **58** (1936): 831.
^u Ruehrwein and Giauque, *J. Am. Chem. Soc.*, **61** (1939): 2940.

TABLE 2-191 Heats of Fusion of Miscellaneous Materials

Material	mp, °C	Heat of fusion, cal/g
Alloys		
30.5 Pb + 69.5 Sn	183	17
36.9 Pb + 63.1 Sn	179	15.5
63.7 Pb + 36.3 Sn	177.5	11.6
77.8 Pb + 22.2 Sn	176.5	9.54
1 Pb + 9 Sn	236	28
24 Pb + 27.3 Sn + 48.7 Bi	98.8	6.85
25.8 Pb + 14.7 Sn + 52.4 Bi + 7 Cd	75.5	8.4
Silicates		
Anorthite (CaAl ₂ Si ₂ O ₈)		100
Orthoclase (KAlSi ₃ O ₈)		100
Microcline (KAlSi ₃ O ₈)		83
Wollastonite (CaSiO ₃)		100
Malacolite (Ca ₈ MgSi ₄ O ₁₂)		94
Diopside (CaMgSi ₂ O ₆)		100
Olivine (Mg ₂ SiO ₄)		130
Fayalite (Fe ₂ SiO ₄)		85
Spermaceti	43.9	37.0
Wax (bees')	61.8	42.3

TABLE 2-192 Heats of Fusion of Organic Compounds (Concluded)

Nonhydrocarbon compounds	Formula	mp, °C	Heat of fusion, cal/g	Nonhydrocarbon compounds	Formula	mp, °C	Heat of fusion, cal/g
Dibromobenzene (<i>o</i> -)	C ₆ H ₄ Br ₂	1.8	12.78	Naphthol (α -)	C ₁₀ H ₈ O	95.0	38.94
(<i>m</i> -)	C ₆ H ₄ Br ₂	-6.9	13.38	(β -)	C ₁₀ H ₈ O	120.6	31.30
(<i>p</i> -)	C ₆ H ₄ Br ₂	86	20.55	Naphthylamine (α -)	C ₇ H ₇ N	50	22.34
Dibromophenol (2, 4-)	C ₆ H ₃ Br ₂ O	12	13.97	Nitroaniline (<i>o</i> -)	C ₆ H ₅ N ₂ O ₂	71.2	27.88
Dichloroacetic acid	C ₂ H ₃ Cl ₂ O ₂	-4(?)	14.21	(<i>m</i> -)	C ₆ H ₄ N ₂ O ₂	114.0	40.97
Dichlorobenzene (<i>o</i> -)	C ₆ H ₄ Cl ₂	-16.7	21.02	(<i>p</i> -)	C ₆ H ₄ N ₂ O ₂	147.3	36.46
(<i>m</i> -)	C ₆ H ₄ Cl ₂	-24.8	20.55	Nitrobenzene	C ₆ H ₅ NO ₂	5.85	22.52
(<i>p</i> -)	C ₆ H ₄ Cl ₂	53.13	29.67	Nitrobenzoic acid (<i>o</i> -)	C ₇ H ₅ NO ₄	145.8	40.06
Dihydroxybenzene (<i>o</i> -)	C ₆ H ₆ O ₂	104.3	49.40	(<i>m</i> -)	C ₇ H ₅ NO ₄	141.1	27.59
(<i>m</i> -)	C ₆ H ₆ O ₂	109.65	46.20	(<i>p</i> -)	C ₇ H ₅ NO ₄	239.2	52.80
(<i>p</i> -)	C ₆ H ₆ O ₂	172.3	58.77	Nitronaphthalene	C ₁₀ H ₇ NO ₂	56.7	25.44
Di-iodobenzene (<i>o</i> -)	C ₆ H ₄ I ₂	23.4	10.15	Nitrophenol (<i>o</i> -)	C ₆ H ₅ NO ₂	45.13	26.76
(<i>m</i> -)	C ₆ H ₄ I ₂	34.2	11.54	Palmitic acid	C ₁₆ H ₃₂ O ₂	61.82	39.18
(<i>p</i> -)	C ₆ H ₄ I ₂	129	16.20	Paraldehyde	C ₆ H ₁₂ O ₃	10.5	25.02
Dimethyl tartrate (<i>dl</i> -)	C ₈ H ₁₀ O ₆	87	35.12	Pelargic acid (<i>n</i> -) (β -)	C ₉ H ₁₈ O ₂		39.04
Diphenyl amine	C ₆ H ₁₀ N	49	21.50	Pelargonic acid (<i>n</i> -) (α -)	C ₉ H ₁₈ O ₂	12.35	30.63
pyrone	C ₆ H ₄ O ₂	132	56.14	Phenol	C ₆ H ₆ O	40.92	29.03
Dinitrobenzene (<i>o</i> -)	C ₆ H ₄ N ₂ O ₄	116.93	32.25	Phenylacetic acid	C ₈ H ₈ O ₂	76.7	25.44
(<i>m</i> -)	C ₆ H ₄ N ₂ O ₄	89.7	24.70	Phenyldiazine	C ₆ H ₈ N ₂	19.6	36.31
(<i>p</i> -)	C ₆ H ₄ N ₂ O ₄	173.5	39.99	Propyl ether (<i>n</i>)	C ₆ H ₁₄ O	-126.1	20.66
Dinitrotoluene (2, 4-)	C ₇ H ₆ N ₂ O ₄	70.14	26.40	Quinone	C ₆ H ₄ O ₂	115.7	40.85
Dioxane	C ₄ H ₈ O ₂	11.0	34.85	Stearic acid	C ₁₈ H ₃₆ O ₂	68.82	47.54
Diphenyl amine	C ₁₂ H ₁₁ N	52.98	25.23	Succinic anhydride	C ₆ H ₈ O ₃	119	48.74
Elaidic acid	C ₁₈ H ₃₄ O ₂	44.4	52.08	Succinonitrile	C ₄ H ₄ N ₂	54.5	11.71
Ethyl acetate	C ₄ H ₈ O ₂	83.8	28.43	Tetrachloroethylene (<i>o</i> -)	C ₂ Cl ₄	86	21.02
alcohol	C ₂ H ₆ O	-114.4	25.76	(<i>p</i> -)	C ₂ H ₂ Cl ₄	95	22.10
Ethylene dibromide	C ₂ H ₄ Br ₂	10.012	13.52	Thiophene	C ₄ H ₄ S	-39.4	14.11
Ethyl ether	C ₄ H ₁₀ O	-116.3	23.54	Thiosinamine	C ₇ H ₈ N ₂ S	77	33.45
Formic acid	CH ₂ O ₂	8.40	58.89	Thymol	C ₁₀ H ₁₄ O	51.5	27.47
Glutaric acid	C ₆ H ₈ O ₄	97.5	37.39	Toluic acid (<i>o</i> -)	C ₈ H ₈ O ₂	103.7	35.40
Glycerol	C ₃ H ₈ O ₃	18.07	47.49	(<i>m</i> -)	C ₈ H ₈ O ₂	108.75	27.59
Glycol, ethylene	C ₂ H ₆ O ₂	-11.5	43.26	(<i>p</i> -)	C ₈ H ₈ O ₂	179.6	39.90
Hydrazo benzene	C ₁₂ H ₁₂ N ₂	134	22.89	Toluidine (<i>p</i> -)	C ₇ H ₉ N	43.3	39.90
Hydrocinmamic acid	C ₉ H ₁₀ O ₂	48	28.14	Tribromophenol (2, 4, 6-)	C ₆ H ₃ Br ₃ O	93	13.38
Hydroxyacetanilide	C ₈ H ₉ NO ₂	91.3	33.59	Trichloroacetic acid	C ₂ HCl ₃ O ₂	57.5	8.60
Iodotoluene (<i>p</i> -)	C ₇ H ₇ I	34	18.75	Trinitroglycerol	C ₃ H ₅ N ₃ O ₉	12.3	23.02
Isopropyl alcohol	C ₃ H ₈ O	-88.5	21.08	Trinitrotoluene (2, 4, 6-)	C ₇ H ₅ N ₃ O ₆	80.83	22.34
ether	C ₆ H ₁₄ O	-86.8	25.79	Tristearin	C ₅₇ H ₁₁₀ O ₆	70.8, 54.5	45.63
Lauric acid (<i>n</i> -)	C ₁₂ H ₂₄ O ₂	43.22	43.72	Undecylic acid (α -) (<i>n</i> -)	C ₁₁ H ₂₂ O ₂	28.25	32.20
Levulinic acid	C ₅ H ₈ O ₃	33	18.97	(β -) (<i>n</i> -)	C ₁₁ H ₂₂ O ₃		42.91
Menthol (<i>l</i> -) (α)	C ₁₀ H ₂₀ O	43.5	18.63	Urethane	C ₃ H ₇ NO ₂	48.7	40.85
Methyl alcohol	CH ₃ O	-97.8	23.7	Veratrol	C ₈ H ₁₀ O ₂	22.5	27.45
Myristic acid	C ₁₄ H ₂₈ O ₂	53.86	47.49	Xylene dibromide (<i>o</i> -)	C ₈ H ₈ Br ₂	95	24.25
Methyl cinnamate	C ₁₀ H ₁₀ O ₂	36	26.53	(<i>m</i> -)	C ₈ H ₈ Br ₂	77	21.45
fumarate	C ₆ H ₆ O ₄	102	57.93	dichloride (<i>o</i> -)	C ₈ H ₆ Cl ₂	55	29.03
oxalate	C ₄ H ₄ O ₄	54.35	42.64	(<i>m</i> -)	C ₈ H ₆ Cl ₂	34	26.64
phenylpropiolate	C ₁₀ H ₈ O ₂	18	22.86	(<i>p</i> -)	C ₈ H ₆ Cl ₂	100	32.73
succinate	C ₆ H ₁₀ O ₄	19.5	35.72				

TABLE 2-193 Heats of Vaporization of Inorganic and Organic Compounds

Cmpd. no.	Name	Formula	CAS no.	Mol wt	C1 × 1E-07	C2	C3	C4	T_{\min} , K	ΔH_v at $T_{\min} \times 1E-07$	T_{\max} , K	ΔH_v at T_{\max}
1	Methane	CH ₄	74828	16.043	1.0194	0.26087	-0.14694	0.22154	90.69	0.8724	190.56	0
2	Ethane	C ₂ H ₆	74840	30.070	2.1091	0.60646	-0.55492	0.32799	90.35	1.7879	305.32	0
3	Propane	C ₃ H ₈	74986	44.097	2.9209	0.78237	-0.77319	0.39246	85.47	2.4787	369.83	0
4	<i>n</i> -Butane	C ₄ H ₁₀	106978	58.123	3.6238	0.8337	-0.82274	0.39613	134.86	2.8684	425.12	0
5	<i>n</i> -Pentane	C ₅ H ₁₂	109660	72.150	3.9109	0.38681	0	0	143.42	3.3968	469.7	0
6	<i>n</i> -Hexane	C ₆ H ₁₄	110543	86.177	4.4544	0.39002	0	0	177.83	3.7647	507.6	0
7	<i>n</i> -Heptane	C ₇ H ₁₆	142825	100.204	5.0014	0.38795	0	0	182.57	4.2619	540.2	0
8	<i>n</i> -Octane	C ₈ H ₁₈	111659	114.231	5.5180	0.38467	0	0	216.38	4.5898	568.7	0
9	<i>n</i> -Nonane	C ₉ H ₂₀	111842	128.258	6.0370	0.38522	0	0	219.66	5.0545	594.6	0
10	<i>n</i> -Decane	C ₁₀ H ₂₂	124185	142.285	6.6126	0.39797	0	0	243.51	5.4168	617.7	0
11	<i>n</i> -Undecane	C ₁₁ H ₂₄	1120214	156.312	7.2284	0.40607	0	0	247.57	5.9240	639	0
12	<i>n</i> -Dodecane	C ₁₂ H ₂₆	112403	170.338	7.7337	0.40681	0	0	263.57	6.2802	658	0
13	<i>n</i> -Tridecane	C ₁₃ H ₂₈	629505	184.365	8.4339	0.4257	0	0	267.76	6.8015	675	0
14	<i>n</i> -Tetradecane	C ₁₄ H ₃₀	629594	198.392	9.0539	0.44467	0	0	279.01	7.2002	693	0
15	<i>n</i> -Pentadecane	C ₁₅ H ₃₂	629629	212.419	9.6741	0.45399	0	0	283.07	7.6728	708	0
16	<i>n</i> -Hexadecane	C ₁₆ H ₃₄	544763	226.446	10.1560	0.45726	0	0	291.31	8.0225	723	0
17	<i>n</i> -Heptadecane	C ₁₇ H ₃₆	629787	240.473	10.4730	0.4374	0	0	295.13	8.3699	736	0
18	<i>n</i> -Octadecane	C ₁₈ H ₃₈	593453	254.500	10.9690	0.44327	0	0	301.31	8.7246	747	0
19	<i>n</i> -Nonadecane	C ₁₉ H ₄₀	629925	268.527	11.6740	0.45865	0	0	305.04	9.2185	758	0
20	<i>n</i> -Eicosane	C ₂₀ H ₄₂	112958	282.553	12.8600	0.50351	0.32986	-0.42184	309.58	9.5933	768	0
21	2-Methylpropane	C ₄ H ₁₀	75285	58.123	3.1667	0.3855	0	0	113.54	2.7927	408.14	0
22	2-Methylbutane	C ₅ H ₁₂	78784	72.150	3.7700	0.3952	0	0	113.25	3.3720	460.43	0
23	2,3-Dimethylbutane	C ₆ H ₁₄	79298	86.177	4.1404	0.38124	0	0	145.19	3.6328	499.98	0
24	2-Methylpentane	C ₆ H ₁₄	107835	86.177	4.2780	0.384	0	0	119.55	3.8495	497.5	0
25	2,3-Dimethylpentane	C ₇ H ₁₆	565593	100.204	4.6536	0.37579	0	0	160	4.0747	537.35	0
26	2,3,3-Trimethylpentane	C ₈ H ₁₈	560214	114.231	4.9910	0.383	0	0	172.22	4.3530	573.5	0
27	2,2,4-Trimethylpentane	C ₈ H ₁₈	540841	114.231	4.7721	0.37992	0	0	165.78	4.1565	543.96	0
28	Ethylene	C ₂ H ₄	74851	28.054		0.3746	0	0	104	1.6025	282.34	0
29	Propylene	C ₃ H ₆	115071	42.081	2.8694	0.8375	-0.9216	0.5012	87.89	2.4031	365.57	0
30	1-Butene	C ₄ H ₈	106989	56.108	3.2300	0.3747	0	0	87.8	2.9582	419.95	0
31	<i>cis</i> -2-Butene	C ₄ H ₈	590181	56.108	3.4190	0.3754	0	0	134.26	2.9773	435.58	0
32	<i>trans</i> -2-Butene	C ₄ H ₈	624646	56.108	3.3320	0.3736	0	0	167.62	2.7684	428.63	0
33	1-Pentene	C ₅ H ₁₀	109671	70.134	3.7740	0.37647	0	0	107.93	3.4166	464.78	0
34	1-Hexene	C ₆ H ₁₂	592416	84.161	4.3236	0.3788	0	0	133.39	3.8483	504.03	0
35	1-Heptene	C ₇ H ₁₄	592767	98.188	4.8120	0.3685	0	0	154.27	4.2478	537.29	0
36	1-Octene	C ₈ H ₁₆	111660	112.215	5.3980	0.3835	0	0	171.45	4.7013	566.65	0
37	1-Nonene	C ₉ H ₁₈	124118	126.242	5.9940	0.3953	0	0	191.78	5.1366	593.25	0
38	1-Decene	C ₁₀ H ₂₀	872059	140.269	6.4898	0.39187	0	0	206.89	5.5289	616.4	0
39	2-Methylpropene	C ₄ H ₈	115117	56.108	3.2720	0.383	0	0	132.81	2.8262	417.9	0
40	2-Methyl-1-butene	C ₅ H ₁₀	563462	70.134	3.9091	0.39866	0	0	135.58	3.4072	465	0
41	2-Methyl-2-butene	C ₅ H ₁₀	513359	70.134	3.9121	0.3634	0	0	139.39	3.4437	471	0
42	1,2-Butadiene	C ₄ H ₆	590192	54.092	3.5220	0.395	0	0	136.95	3.0540	452	0
43	1,3-Butadiene	C ₄ H ₆	106990	54.092	3.2580	0.373	0	0	164.25	2.7155	425.17	0
44	2-Methyl-1,3-butadiene	C ₅ H ₈	78795	68.119	3.9310	0.425	0	0	127.27	3.4529	484	0
45	Acetylene	C ₂ H ₂	74862	26.038	2.3795	0.375	0	0	192.4	1.6488	308.32	0
46	Methylacetylene	C ₃ H ₄	74997	40.065	3.2775	0.3997	0	0	170.45	2.6297	402.39	0
47	Dimethylacetylene	C ₄ H ₆	503173	54.092	3.8560	0.3737	0	0	240.91	2.9557	473.2	0
48	3-Methyl-1-butyne	C ₅ H ₈	598232	68.119	3.7920	0.3565	0	0	183.45	3.1681	463.2	0
49	1-Pentyne	C ₅ H ₈	627190	68.119	3.9540	0.3512	0	0	167.45	3.4025	481.2	0
50	2-Pentyne	C ₅ H ₈	627214	68.119	4.4158	0.44347	0	0	163.83	3.7321	519	0
51	1-Hexyne	C ₆ H ₁₀	693027	82.145	4.5740	0.3698	0	0	141.25	4.0640	516.2	0
52	2-Hexyne	C ₆ H ₁₀	764352	82.145	4.9110	0.4392	0	0	183.65	4.1067	549	0

53	3-Hexyne	C ₆ H ₁₀	928494	82.145	4.8080	0.436	0	0	170.05	4.0831	544	0
54	1-Heptyne	C ₇ H ₁₂	628717	96.172	5.0514	0.41163	0	0	192.22	4.2470	559	0
55	1-Octyne	C ₈ H ₁₄	629050	110.199	5.6306	0.4148	0	0	193.55	4.7663	585	0
56	Vinylacetylene ¹	C ₄ H ₄	689974	52.076	3.6490	0.4	0.043	0	173.15	2.9876	454	0
57	Cyclopentane	C ₅ H ₁₀	287923	70.134	3.8900	0.361	0	0	179.28	3.3292	511.76	0
58	Methylcyclopentane	C ₆ H ₁₂	96377	84.161	4.3600	0.38531	0	0	130.73	3.9118	532.79	0
59	Ethylcyclopentane	C ₇ H ₁₄	1640897	98.188	4.8288	0.37809	0	0	134.71	4.3604	569.52	0
60	Cyclohexane	C ₆ H ₁₂	110827	84.161	4.4940	0.3974	0	0	279.69	3.3977	553.58	0
61	Methylcyclohexane	C ₇ H ₁₄	108872	98.188	4.7534	0.39461	0	0	146.58	4.2295	572.19	0
62	1,1-Dimethylcyclohexane	C ₈ H ₁₆	590669	112.215	5.0402	0.4036	0	0	239.66	4.0862	591.15	0
63	Ethylcyclohexane	C ₈ H ₁₆	1678917	112.215	5.3832	0.41763	0	0	161.84	4.7318	609.15	0
64	Cyclopentene	C ₅ H ₈	142290	68.119	3.8107	0.3543	0	0	138.13	3.4046	507	0
65	1-Methylcyclopentene	C ₆ H ₁₀	693890	82.145	4.3541	0.36805	0	0	146.62	3.8769	542	0
66	Cyclohexene	C ₆ H ₁₀	110838	82.145	4.4405	0.37479	0	0	169.67	3.8791	560.4	0
67	Benzene	C ₆ H ₆	71432	78.114	4.7500	0.45238	0.0534	-0.1181	278.68	3.4909	562.16	0
68	Toluene	C ₇ H ₈	108883	92.141	5.0144	0.3859	0	0	178.18	4.3670	591.8	0
69	<i>o</i> -Xylene	C ₈ H ₁₀	95476	106.167	5.5330	0.377	0	0	247.98	4.5826	630.33	0
70	<i>m</i> -Xylene	C ₈ H ₁₀	108383	106.167	5.4600	0.3726	0	0	225.3	4.6097	617.05	0
71	<i>p</i> -Xylene	C ₈ H ₁₀	106423	106.167	5.3740	0.3656	0	0	286.41	4.2761	616.23	0
72	Ethylbenzene	C ₈ H ₁₀	100414	106.167	5.4640	0.392	0	0	178.15	4.7811	617.2	0
73	Propylbenzene	C ₉ H ₁₂	103651	120.194	5.7663	0.3956	-8.9129E-03	0	215.03	5.0574	574.54	2.4695E+07
74	1,2,4-Trimethylbenzene	C ₉ H ₁₂	95636	120.194	5.9126	0.35632	0	0	229.33	5.0621	649.13	0
75	Isopropylbenzene	C ₉ H ₁₂	98828	120.194	5.7950	0.3956	0	0	177.14	5.0869	631.1	0
76	1,3,5-Trimethylbenzene	C ₉ H ₁₂	108678	120.194	6.0380	0.37999	0	0	228.42	5.1010	637.36	0
77	<i>p</i> -Isopropyltoluene	C ₁₀ H ₁₄	99876	134.221	6.3314	0.40289	0	0	205.25	5.4387	653.15	0
78	Naphthalene	C ₁₀ H ₈	91203	128.174	7.0510	0.4612	0	0	353.43	5.2508	748.35	0
79	Biphenyl	C ₁₂ H ₁₀	92524	154.211	7.5736	0.3975	0	0	342.2	6.0420	789.26	0
80	Styrene	C ₈ H ₈	100425	104.152	5.7260	0.4055	0	0	242.54	4.7128	636	0
81	<i>m</i> -Terphenyl	C ₁₈ H ₁₄	92068	230.309	10.1230	0.3767	0	0	360	8.4070	924.85	0
82	Methanol	CH ₄ O	67561	32.042	5.2390	0.3682	0	0	175.47	4.4900	512.64	0
83	Ethanol	C ₂ H ₆ O	64175	46.069	5.6900	0.3359	0	0	159.05	5.0245	513.92	0
84	1-Propanol	C ₃ H ₈ O	71238	60.096	6.3300	0.3575	0	0	146.95	5.6460	536.78	0
85	1-Butanol	C ₄ H ₁₀ O	71363	74.123	6.7390	0.173	0.2915	0	184.51	6.0575	563.05	0
86	2-Butanol	C ₄ H ₁₀ O	78922	74.123	7.2560	0.4774	0	0	158.45	6.1383	536.05	0
87	2-Propanol	C ₃ H ₈ O	67630	60.096	6.3080	0.3921	0	0	185.28	5.2807	508.3	0
88	2-Methyl-2-propanol	C ₄ H ₁₀ O	75650	74.123	7.7320	0.5645	0	0	298.97	4.6703	506.21	0
89	1-Pentanol	C ₅ H ₁₂ O	71410	88.150	8.3100	0.511	0	0	195.56	6.7533	586.15	0
90	2-Methyl-1-butanol	C ₅ H ₁₂ O	137326	88.150	7.7839	0.45313	0	0	203	6.3619	565	0
91	3-Methyl-1-butanol	C ₅ H ₁₂ O	123513	88.150	8.0815	0.50185	0	0	155.95	6.8999	577.2	0
92	1-Hexanol	C ₆ H ₁₄ O	111273	102.177	8.5980	0.513	0	0	228.55	6.7623	611.35	0
93	1-Heptanol	C ₇ H ₁₆ O	111706	116.203	9.6900	0.572	0	0	239.15	7.3822	631.9	0
94	Cyclohexanol	C ₆ H ₁₂ O	108930	100.161	9.2440	0.64825	0	0	296.6	6.2273	650	0
95	Ethylene glycol	C ₂ H ₆ O ₂	107211	62.068	8.2900	0.4266	0	0	260.15	6.8461	719.7	0
96	1,2-Propylene glycol	C ₃ H ₈ O ₂	57556	76.095	8.0700	0.295	0	0	213.15	7.1374	626	0
97	Phenol	C ₆ H ₆ O	108952	94.113	7.3060	0.4246	0	0	314.06	5.6577	694.25	0
98	<i>o</i> -Cresol	C ₇ H ₈ O	95487	108.140	7.1979	0.40317	0	0	304.19	5.7135	697.55	0
99	<i>m</i> -Cresol	C ₇ H ₈ O	108394	108.140	8.0082	0.45314	0	0	285.39	6.3326	705.85	0
100	<i>p</i> -Cresol	C ₇ H ₈ O	106445	108.140	8.4942	0.50234	0	0	307.93	6.3649	704.65	0
101	Dimethyl ether	C ₂ H ₆ O	115106	46.069	2.9940	0.3505	0	0	131.65	2.6032	400.1	0
102	Methyl ethyl ether	C ₃ H ₈ O	540670	60.096	3.5300	0.376	0	0	160	2.9751	437.8	0
103	Methyl <i>n</i> -propyl ether	C ₄ H ₁₀ O	557175	74.123	3.9795	0.3729	0	0	133.97	3.5184	476.3	0
104	Methyl isopropyl ether	C ₄ H ₁₀ O	598538	74.123	3.9305	0.3711	0	0	127.93	3.4876	464.5	0
105	Methyl- <i>n</i> -butyl ether	C ₅ H ₁₂ O	628284	88.150	4.5328	0.3824	0	0	157.48	3.9358	510	0
106	Methyl isobutyl ether	C ₅ H ₁₂ O	625445	88.150	4.2678	0.37995	0	0	150	3.7232	497	0
107	Methyl tert-butyl ether	C ₅ H ₁₂ O	1634044	88.150	4.2024	0.37826	0	0	164.55	3.6096	497.1	0

TABLE 2-193 Heats of Vaporization of Inorganic and Organic Compounds (Continued)

Cmpd. no.	Name	Formula	CAS no.	Mol wt	C1 × 1E-07	C2	C3	C4	T_{\min} , K	ΔH_v at $T_{\min} \times 1E-07$	T_{\max} , K	ΔH_v at T_{\max}
108	Diethyl ether	C ₄ H ₁₀ O	60297	74.123	4.0600	0.3868	0	0	156.85	3.4651	466.7	0
109	Ethyl propyl ether	C ₅ H ₁₂ O	628320	88.150	5.4380	0.60624	0	0	145.65	4.4140	500.23	0
110	Ethyl isopropyl ether	C ₅ H ₁₂ O	625547	88.150	4.2580	0.37221	0	0	140	3.7556	489	0
111	Methyl phenyl ether	C ₇ H ₈ O	100663	108.140	5.8662	0.37127	0	0	235.65	4.9560	645.6	0
112	Diphenyl ether	C ₁₂ H ₁₀ O	101848	170.211	6.8243	0.30877	0	0	300.03	5.8546	766.8	0
113	Formaldehyde	CH ₂ O	50000	30.026	3.0760	0.2954	0	0	181.15	2.5863	408	0
114	Acetaldehyde	C ₂ H ₄ O	75070	44.053	4.6070	0.62	0	0	150.15	3.6199	466	0
115	1-Propanal	C ₃ H ₆ O	123386	58.080	4.1492	0.36751	0	0	170	3.5675	504.4	0
116	1-Butanal	C ₄ H ₈ O	123728	72.107	4.6403	0.3849	0	0	176.75	3.9797	537.2	0
117	1-Pentanal	C ₅ H ₁₀ O	110623	86.134	5.1478	0.37541	0	0	182	4.4502	566.1	0
118	1-Hexanal	C ₆ H ₁₂ O	66251	100.161	5.6661	0.38533	0	0	217.15	4.7495	591	0
119	1-Heptanal	C ₇ H ₁₄ O	111717	114.188	6.1299	0.37999	0	0	229.8	5.1353	617	0
120	1-Octanal	C ₈ H ₁₆ O	124130	128.214	6.8347	0.41039	0	0	246	5.5966	638.1	0
121	1-Nonanal	C ₉ H ₁₈ O	124196	142.241	7.3363	0.41735	0	0	255.15	5.9779	658	0
122	1-Decanal	C ₁₀ H ₂₀ O	112312	156.268	7.9073	0.4129	0	0	267.15	6.4201	674.2	0
123	Acetone	C ₃ H ₆ O	67641	58.080	4.2150	0.3397	0	0	178.45	3.6390	508.2	0
124	Methyl ethyl ketone	C ₄ H ₈ O	78933	72.107	4.6220	0.355	0	0	186.48	3.9704	535.5	0
125	2-Pentanone	C ₅ H ₁₀ O	107879	86.134	5.1740	0.39422	0	0	196.29	4.3663	561.08	0
126	Methyl isopropyl ketone	C ₅ H ₁₀ O	563804	86.134	5.1400	0.3858	0	0	250	4.0753	553	0
127	2-Hexanone	C ₆ H ₁₂ O	591786	100.161	5.6770	0.3817	0	0	217.35	4.7584	587.05	0
128	Methyl isobutyl ketone	C ₆ H ₁₂ O	108101	100.161	5.4000	0.383	0	0	189.15	4.6294	571.4	0
129	3-Methyl-2-pentanone	C ₆ H ₁₂ O	565617	100.161	5.1130	0.3395	0	0	167.15	4.5480	573	0
130	3-Pentanone	C ₅ H ₁₀ O	96220	86.134	5.2359	0.40465	0	0	234.18	4.2075	560.95	0
131	Ethyl isopropyl ketone	C ₆ H ₁₂ O	565695	100.161	5.3880	0.40616	0	0	200	4.5154	567	0
132	Diisopropyl ketone	C ₇ H ₁₄ O	565800	114.188	5.5980	0.3774	0	0	204.81	4.7426	576	0
133	Cyclohexanone	C ₆ H ₁₀ O	108941	98.145	5.5500	0.3538	0	0	242	4.7114	653	0
134	Methyl phenyl ketone	C ₈ H ₈ O	98862	120.151	6.6104	0.37425	0	0	292.81	5.4166	709.5	0
135	Formic acid	CH ₂ O ₂	64186	46.026	2.3700	1.999	-5.1503	3.331	281.45	1.9532	588	0
136	Acetic acid	C ₂ H ₄ O ₂	64197	60.053	2.0265	0.11911	-1.3487	1.4227	289.81	2.3185	591.95	0
137	Propionic acid	C ₃ H ₆ O ₂	79094	74.079	2.7290	0.06954	-1.0423	1.1152	252.45	2.9964	600.81	0
138	<i>n</i> -Butyric acid	C ₄ H ₈ O ₂	107926	88.106	7.4996	2.333	-3.8644	2.016	267.95	4.1566	615.7	0
139	Isobutyric acid	C ₄ H ₈ O ₂	79312	88.106	4.4967	1.1615	-2.4573	1.5823	227.15	3.6179	605	0
140	Benzoic acid ²	C ₇ H ₆ O ₂	65850	122.123	10.1900	0.478	0	0	395.45	7.1277	751	0
141	Acetic anhydride	C ₄ H ₆ O ₃	108247	102.090	6.3520	0.3986	0	0	200.15	5.4139	606	0
142	Methyl formate	C ₂ H ₄ O ₂	107313	60.053	4.1030	0.3825	0	0	174.15	3.4644	487.2	0
143	Methyl acetate	C ₃ H ₆ O ₂	79209	74.079	4.4920	0.3685	0	0	175.15	3.8418	506.55	0
144	Methyl propionate	C ₄ H ₈ O ₂	554121	88.106	5.0080	0.3959	0	0	185.65	4.2231	530.6	0
145	Methyl <i>n</i> -butyrate	C ₅ H ₁₀ O ₂	623427	102.133	5.3781	0.39523	0	0	187.35	4.5694	554.5	0
146	Ethyl formate	C ₃ H ₆ O ₂	109944	74.079	4.5909	0.4123	0	0	193.55	3.7679	508.4	0
147	Ethyl acetate	C ₄ H ₈ O ₂	141786	88.106	4.9330	0.3847	0	0	189.6	4.1490	523.3	0
148	Ethyl propionate	C ₅ H ₁₀ O ₂	105373	102.133	5.3325	0.401	0	0	199.25	4.4449	546	0
149	Ethyl <i>n</i> -butyrate	C ₆ H ₁₂ O ₂	105544	116.160	5.6419	0.37985	0	0	175.15	4.9090	571	0
150	<i>n</i> -Propyl formate	C ₄ H ₈ O ₂	110747	88.106	4.9687	0.4025	0	0	180.25	4.2162	538	0
151	<i>n</i> -Propyl acetate	C ₅ H ₁₀ O ₂	109604	102.133	5.4327	0.407	0	0	178.15	4.6322	549.73	0
152	<i>n</i> -Butyl acetate	C ₆ H ₁₂ O ₂	123864	116.160	5.7800	0.3935	0	0	199.65	4.8943	579.15	0
153	Methyl benzoate	C ₈ H ₈ O ₂	93583	136.150	6.9650	0.4061	0	0	260.75	5.7500	693	0
154	Ethyl benzoate	C ₉ H ₁₀ O ₂	93890	150.177	6.3400	0.2911	0	0	238.45	5.6137	698	0
155	Vinyl acetate	C ₄ H ₆ O ₂	108054	86.090	4.7700	0.3765	0	0	180.35	4.0619	519.13	0
156	Methylamine	CH ₅ N	74895	31.057	3.8580	0.404	0	0	179.69	3.1006	430.05	0
157	Dimethylamine	C ₂ H ₇ N	124403	45.084	4.0900	0.42005	0	0	180.96	3.2678	437.2	0
158	Trimethylamine	C ₃ H ₉ N	75503	59.111	3.3050	0.354	0	0	156.08	2.8216	433.25	0

159	Ethylamine	C ₂ H ₇ N	75047	45.084	4.2750	0.5857	-0.332	0.169	192.15	3.2955	456.15	0
160	Diethylamine	C ₄ H ₁₁ N	109897	73.138	4.6133	0.42628	0	0	223.35	3.5761	496.6	0
161	Triethylamine	C ₆ H ₁₅ N	121448	101.192	4.6640	0.3663	0	0	158.45	4.1011	535.15	0
162	<i>n</i> -Propylamine	C ₃ H ₉ N	107108	59.111	4.4488	0.39494	0	0	188.36	3.6857	496.95	0
163	di- <i>n</i> -Propylamine	C ₆ H ₁₅ N	142847	101.192	5.4280	0.3665	0	0	210.15	4.5500	550	0
164	Isopropylamine	C ₃ H ₉ N	75310	59.111	4.4041	0.43325	0	0	177.95	3.5874	471.85	0
165	Diisopropylamine	C ₆ H ₁₅ N	108189	101.192	5.0070	0.4362	0	0	176.85	4.1823	523.1	0
166	Aniline	C ₆ H ₇ N	62533	93.128	7.1950	0.458	0	0	267.13	5.7710	699	0
167	<i>N</i> -Methylaniline	C ₇ H ₉ N	100618	107.155	6.3860	0.3104	0	0	216.15	5.6961	701.55	0
168	<i>N,N</i> -Dimethylaniline	C ₈ H ₁₁ N	121697	121.182	6.7900	0.4053	0	0	275.6	5.5162	687.15	0
169	Ethylene oxide	C ₂ H ₄ O	75218	44.053	3.6652	0.37878	0	0	160.65	3.1271	469.15	0
170	Furan	C ₄ H ₄ O	110009	68.075	4.0050	0.3995	0	0	196.29	3.2647	490.15	0
171	Thiophene	C ₄ H ₄ S	110021	84.142	4.5793	0.38557	0	0	234.94	3.7472	579.35	0
172	Pyridine	C ₅ H ₅ N	110861	79.101	5.1740	0.38865	0	0	231.51	4.3144	619.95	0
173	Formamide ³	CH ₃ NO	75127	45.041	7.3580	0.3564	0	0	275.7	6.2844	771	0
174	<i>N,N</i> -Dimethylformamide	C ₃ H ₇ NO	68122	73.095	5.9217	0.37996	0	0	212.72	5.0931	649.6	0
175	Acetamide	C ₂ H ₅ NO	60355	59.068	8.1070	0.42	0	0	353.15	6.2386	761	0
176	<i>N</i> -Methylacetamide	C ₃ H ₇ NO	79163	73.095	7.3402	0.38974	0	0	301.15	5.9384	718	0
177	Acetonitrile	C ₂ H ₃ N	75058	41.053	4.3511	0.34765	0	0	229.32	3.5996	545.5	0
178	Propionitrile	C ₃ H ₅ N	107120	55.079	4.9348	0.41873	0	0	180.26	4.2005	564.4	0
179	<i>n</i> -Butyronitrile	C ₄ H ₇ N	109740	69.106	5.2200	0.165	0.6692	-0.539	161.25	4.7223	582.25	0
180	Benzonitrile	C ₇ H ₅ N	100470	103.123	6.2615	0.35427	0	0	260.4	5.3091	699.35	0
181	Methyl mercaptan	CH ₃ S	74931	48.109	3.4448	0.37427	0	0	150.18	2.9825	469.95	0
182	Ethyl mercaptan	C ₂ H ₆ S	75081	62.136	3.8440	0.37534	0	0	125.26	3.4489	499.15	0
183	<i>n</i> -Propyl mercaptan	C ₃ H ₈ S	107039	76.163	4.4782	0.41073	0	0	159.95	3.8723	536.6	0
184	<i>n</i> -Butyl mercaptan	C ₄ H ₁₀ S	109795	90.189	4.9702	0.41199	0	0	157.46	4.3505	570.1	0
185	Isobutyl mercaptan	C ₄ H ₁₀ S	513440	90.189	4.7420	0.40535	0	0	128.31	4.2664	559	0
186	sec-Butyl mercaptan	C ₄ H ₁₀ S	513531	90.189	4.6432	0.399	0	0	133.02	4.1614	554	0
187	Dimethyl sulfide	C ₂ H ₆ S	75183	62.136	3.8690	0.3694	0	0	174.88	3.3042	503.04	0
188	Methyl ethyl sulfide	C ₃ H ₈ S	624895	76.163	4.4740	0.4097	0	0	167.23	3.8344	533	0
189	Diethyl sulfide	C ₄ H ₁₀ S	352932	90.189	4.7182	0.3643	0	0	169.2	4.1353	557.15	0
190	Fluoromethane	CH ₃ F	593533	34.033	2.4708	0.37014	0	0	131.35	2.0276	317.42	0
191	Chloromethane	CH ₃ Cl	74873	50.488	2.9745	0.353	0	0	175.43	2.4520	416.25	0
192	Trichloromethane	CHCl ₃	67663	119.377	4.1860	0.3584	0	0	209.63	3.5047	536.4	0
193	Tetrachloromethane	CCl ₄	56235	153.822	4.3252	0.37688	0	0	250.33	3.4528	556.35	0
194	Bromomethane	CH ₃ Br	74839	94.939	3.1690	0.3015	0	0	179.47	2.7379	467	0
195	Fluoroethane	C ₂ H ₅ F	353366	48.060	2.7617	0.32162	0	0	129.95	2.4089	375.31	0
196	Chloroethane	C ₂ H ₅ Cl	75003	64.514	3.5240	0.3652	0	0	134.8	3.1052	460.35	0
197	Bromoethane	C ₂ H ₅ Br	74964	108.966	3.9004	0.38012	0	0	154.55	3.3933	503.8	0
198	1-Chloropropane	C ₃ H ₇ Cl	540545	78.541	3.9890	0.37956	0	0	150.35	3.4862	503.15	0
199	2-Chloropropane	C ₃ H ₇ Cl	75296	78.541	3.8871	0.38043	0	0	155.97	3.3586	489	0
200	1,1-Dichloropropane	C ₃ H ₆ Cl ₂	78999	112.986	4.7740	0.39204	0	0	200	4.0147	560	0
201	1,2-Dichloropropane	C ₃ H ₆ Cl ₂	78875	112.986	4.6750	0.36529	0	0	172.71	4.0997	572	0
202	Vinyl chloride	C ₂ H ₃ Cl	75014	62.499	3.4125	0.4513	0	0	119.36	2.9491	432	0
203	Fluorobenzene	C ₆ H ₅ F	462066	96.104	4.5820	0.3717	0	0	230.94	3.7605	560.09	0
204	Chlorobenzene	C ₆ H ₅ Cl	108907	112.558	5.1480	0.36614	0	0	227.95	4.3707	632.35	0
205	Bromobenzene	C ₆ H ₅ Br	108861	157.010	5.5520	0.37694	0	0	242.43	4.6875	670.15	0
206	Air		132259100	28.951	0.8474	0.3822	0	0	59.15	0.6759	132.45	0
207	Hydrogen	H ₂	1333740	2.016	0.1013	0.698	-1.817	1.447	13.95	0.0913	33.19	0
208	Helium-4	He	7440597	4.003	0.0125	1.3038	-2.6954	1.7098	2.2	0.0097	5.2	0
209	Neon	Ne	7440019	20.180	0.2389	0.3494	0	0	24.56	0.1803	44.4	0
210	Argon	Ar	7440371	39.948	0.8731	0.3526	0	0	83.78	0.6561	150.86	0
211	Fluorine	F ₂	7782414	37.997	0.8876	0.34072	0	0	53.48	0.7578	144.12	0
212	Chlorine	Cl ₂	7782505	70.905	3.0680	0.8458	-0.9001	0.453	172.12	2.2878	417.15	0
213	Bromine	Br ₂	7726956	159.808	4.0000	0.351	0	0	265.85	3.2323	584.15	0

TABLE 2-193 Heats of Vaporization of Inorganic and Organic Compounds (Concluded)

Cmpd. no.	Name	Formula	CAS no.	Mol wt	C1 × 1E-07	C2	C3	C4	T_{\min} , K	ΔH_v at $T_{\min} \times 1E-07$	T_{\max} , K	ΔH_v at T_{\max}
214	Oxygen	O ₂	7782447	31.999	0.9008	0.4542	-0.4096	0.3183	54.36	0.7742	154.58	0
215	Nitrogen	N ₂	7727379	28.014	0.7491	0.40406	-0.317	0.27343	63.15	0.6024	126.2	0
216	Ammonia	NH ₃	7664417	17.031	3.1523	0.3914	-0.2289	0.2309	195.41	2.5298	405.65	0
217	Hydrazine	N ₂ H ₄	302012	32.045	5.9794	0.9424	-1.398	0.8862	274.69	4.5238	653.15	0
218	Nitrous oxide	N ₂ O	10024972	44.013	2.3215	0.384	0	0	182.3	1.6502	309.57	0
219	Nitric oxide	NO	10102439	30.006	2.1310	0.4056	0	0	109.5	1.4578	180.15	0
220	Cyanogen	C ₂ N ₂	460195	52.036	3.3840	0.3707	0	0	245.25	2.3803	400.15	0
221	Carbon monoxide	CO	630080	28.010	0.8585	0.4921	-0.326	0.2231	68.13	0.6517	132.5	915280
222	Carbon dioxide	CO ₂	124389	44.010	2.1730	0.382	-0.4339	0.42213	216.58	1.5202	304.21	0
223	Carbon disulfide	CS ₂	75150	76.143	3.4960	0.2986	0	0	161.11	3.1537	552	0
224	Hydrogen fluoride	HF	7664393	20.006	13.4510	13.36	-23.383	10.785	277.56	0.7104	461.15	0
225	Hydrogen chloride	HCl	7647010	36.461	2.2093	0.3466	0	0	158.97	1.7498	324.65	0
226	Hydrogen bromide	HBr	10035106	80.912	2.4850	0.39	0	0	185.15	1.8817	363.15	0
227	Hydrogen cyanide ²	HCN	74908	27.026	3.3490	0.2053	0	0	259.83	2.8176	456.65	0
228	Hydrogen sulfide	H ₂ S	7783064	34.082	2.5676	0.37358	0	0	187.68	1.9782	373.53	0
229	Sulfur dioxide	SO ₂	7446095	64.065	3.6760	0.4	0	0	197.67	2.8753	430.75	0
230	Sulfur trioxide	SO ₃	7446119	80.064	7.3370	0.5647	0	0	289.95	4.4303	490.85	0
231	Water	H ₂ O	7732185	18.015	5.2053	0.3199	-0.212	0.25795	273.16	4.4733	647.13	0

All substances are listed in alphabetical order in Table 2-6a.

Compiled from Daubert, T. E., R. P. Danner, H. M. Sibul, and C. C. Stebbins, DIPPR Data Compilation of Pure Compound Properties, Project 801 Sponsor Release, July, 1993, Design Institute for Physical Property Data, AIChE, New York, NY; and from Thermodynamics Research Center, "Selected Values of Properties of Hydrocarbons and Related Compounds," Thermodynamics Research Center Hydrocarbon Project, Texas A&M University, College Station, Texas (extant 1994).

Temperatures are expressed in kelvins; heats of vaporization, in J/kmol.

J/kmol × 2.390E-04 = cal/gmol; J/kmol × 4.302106E-04 = Btu/lbmol.

The heat of vaporization equation used is $\Delta H_v = C1 \times (1 - T_r)^{C2 + C3 \times T_r + C4 \times T_r \times T_r}$. T_r is the reduced temperature, T/T_c .

¹ Coefficients are hypothetical; compound *decomposes violently* on heating.

² For the monomer.

³ Equation coefficients are hypothetical above the decomposition temperature.

SPECIFIC HEATS OF PURE COMPOUNDS

UNITS CONVERSIONS

For this subsection, the following units conversions are applicable:

$$^{\circ}\text{F} = \frac{9}{5} ^{\circ}\text{C} + 32$$

$$^{\circ}\text{F} = 1.8 \text{ K}$$

To convert calories per gram-kelvin to British thermal units per pound-degree Rankine, multiply by 1.0; to convert calories per gram-mole-kelvin to British thermal units per pound-mole-degree Rankine, multiply by 1.0.

To convert kilojoules per kilogram-kelvin to British thermal units per pound-degree Rankine, multiply by 0.2388.

ADDITIONAL REFERENCES

Additional data are contained in the subsection "Thermodynamic Properties." Data on water are also contained in that subsection. Additional tables for water are found in Eng. Sci. Data Item 68008, 251 Regent Street, London, England, which contains about 5000 values from 1 to 1000 bar, 0 to 1500°C.

TABLE 2-194 Heat Capacities of the Elements and Inorganic Compounds*

Substance	State†	Heat capacity at constant pressure ($T = \text{K}$; $^{\circ}\text{C} = 273.1 \text{ K}$), cal/deg mol	Range of temperature, K	Uncertainty, %
Aluminum ¹				
Al	<i>c</i>	4.80 + 0.00322 <i>T</i>	273–931	1
	<i>l</i>	7.00	931–1273	5
AlBr ₃	<i>c</i>	18.74 + 0.01866 <i>T</i>	273–370	3
	<i>l</i>	29.5	370–407	5
AlCl ₃	<i>c</i>	13.25 + 0.02800 <i>T</i>	273–465	3
	<i>l</i>	31.2	465–504	3
AlCl ₃ ·6H ₂ O	<i>c</i>	76	288–327	?
AlF ₃	<i>c</i>	19.3	288–326	?
AlF ₃ ·3½H ₂ O	<i>c</i>	50.5	288–326	?
AlF ₃ ·3NaF	<i>c</i>	38.63 + 0.04760 <i>T</i> – 449200/ <i>T</i> ²	273–1273	2
	<i>l</i>	142	1273–1373	?
AlI ₃	<i>c</i>	16.88 + 0.02266 <i>T</i>	273–464	3
	<i>l</i>	28.8	464–480	5
Al ₂ O ₃	<i>c</i>	22.08 + 0.008971 <i>T</i> – 522500/ <i>T</i> ²	273–1973	3
Al ₂ O ₃ ·SiO ₂	<i>c</i> , sillimanite	40.79 + 0.004763 <i>T</i> – 992800/ <i>T</i> ²	273–1573	3
	<i>c</i> , disthene	41.81 + 0.005283 <i>T</i> – 1211000/ <i>T</i> ²	273–1673	2
	<i>c</i> , andalusite	43.96 + 0.001923 <i>T</i> – 1086000/ <i>T</i> ²	273–1573	3
3Al ₂ O ₃ ·2SiO ₂	<i>c</i> , mullite	59.65 + 0.0670 <i>T</i>	273–576	5
4Al ₂ O ₃ ·3SiO ₂	<i>c</i>	113.2 + 0.0652 <i>T</i>	273–575	3
Al ₂ (SO ₄) ₃	<i>c</i>	63.5	273–373	?
Al ₂ (SO ₄) ₃ ·18H ₂ O	<i>c</i>	235	288–325	?
Antimony				
Sb	<i>c</i>	5.51 + 0.00178 <i>T</i>	273–903	2
	<i>l</i>	7.15	903–1273	5
SbBr ₃	<i>c</i>	17.2 + 0.0293 <i>T</i>	273–370	?
SbCl ₃	<i>c</i>	10.3 + 0.0511 <i>T</i>	273–346	?
Sb ₂ O ₃	<i>c</i>	19.1 + 0.0171 <i>T</i>	273–929	?
Sb ₂ O ₄	<i>c</i>	22.6 + 0.0162 <i>T</i>	273–1198	?
Sb ₂ S ₃	<i>c</i>	24.2 + 0.0132 <i>T</i>	273–821	?
Argon ²				
A	<i>g</i>	4.97	All	0
Arsenic				
As	<i>c</i>	5.17 + 0.00234 <i>T</i>	273–1168	5
AsCl ₃	<i>l</i>	31.9	286–371	?
As ₂ O ₃	<i>c</i>	8.37 + 0.0486 <i>T</i>	273–548	?
As ₂ S ₃	<i>c</i>	25.8	293–373	?
Barium				
BaCl ₂	<i>c</i>	17.0 + 0.00334 <i>T</i>	273–1198	?
BaCl ₂ ·H ₂ O	<i>c</i>	28.2	273–307	?
BaCl ₂ ·2H ₂ O	<i>c</i>	37.3	273–307	?
Ba(ClO ₃) ₂ ·H ₂ O	<i>c</i>	51	289–320	?
BaCO ₃	<i>c</i> , α	17.26 + 0.0131 <i>T</i>	273–1083	5
	<i>c</i> , β	30.0	1083–1255	15
BaMoO ₄	<i>c</i>	34	273–297	?
Ba(NO ₃) ₂	<i>c</i>	39.8	285–371	?
BaSO ₄	<i>c</i>	21.35 + 0.0141 <i>T</i>	273–1323	5
Beryllium ^{3,4}				
Be	<i>c</i>	4.698 + 0.001555 <i>T</i> – 121000/ <i>T</i> ²	273–1173	1
BeO	<i>c</i>	8.69 + 0.00365 <i>T</i> – 313000/ <i>T</i> ²	273–1175	5
BeO·Al ₂ O ₃	<i>c</i>	25.4	273–373	?
BeSO ₄	<i>c</i>	20.8	273–373	?

*From Kelley, U.S. Bur. Mines Bull. 371, 1934. For a revision see Kelley, U.S. Bur. Mines Bull. 477, 1948. Data for many elements and compounds are given by Johnson (ed.), WADD-TR-60-56, 1960, for cryogenic temperatures. Tabulated data for gases can be obtained from many of the references cited in the "Thermodynamic Properties" subsection and other tables in this section. Thinh, Duran, et al., *Hydrocarbon Process.*, **50**, 98 (January 1971), review previous equation fits and give newer fits for 408 hydrocarbons and related compounds. Later publications include Duran, Thinh, et al., *Hydrocarbon Process.*, **55**, 153 (August 1976); Thompson, *J. Chem. Eng. Data*, **22**(4), 431 (1977); and Passut and Danner, *Ind. Eng. Chem. Process Des. Dev.*, **11**, 543 (1972); **13**, 193 (1974).

† The symbols in this column have the following meaning: *c*, crystal; *l*, liquid; *g*, gas; *gls*, glass.

TABLE 2-194 Heat Capacities of the Elements and Inorganic Compounds (Continued)

Substance	State†	Heat capacity at constant pressure ($T = K$; $0^\circ C = 273.1 K$), cal/deg mol	Range of temperature, K	Uncertainty, %
Bismuth ⁴				
Bi	<i>c</i>	5.38 + 0.00260 <i>T</i>	273–544	3
	<i>l</i>	7.60	544–1273	3
Bi ₂ O ₃	<i>c</i>	23.27 + 0.01105 <i>T</i>	273–777	2
Bi ₂ S ₃	<i>c</i>	30.4	284–372	?
Boron				
B	<i>c</i>	1.54 + 0.00440 <i>T</i>	273–1174	5
B ₂ O ₃	<i>gls</i>	5.14 + 0.0320 <i>T</i>	273–513	3
	<i>gls</i>	30.4	513–623	3
BN	<i>c</i>	1.61 + 0.00400 <i>T</i>	273–1173	5
Bromine				
Br ₂	<i>g</i>	9.00	300–2000	5
Cadmium				
Cd	<i>c</i>	5.46 + 0.002466 <i>T</i>	273–594	1
	<i>l</i>	7.13	594–973	5
CdO	<i>c</i>	9.65 + 0.00208 <i>T</i>	273–2086	?
CdS	<i>c</i>	12.9 + 0.00090 <i>T</i>	273–1273	?
CdSO ₄ ·8/3H ₂ O	<i>c</i>	51.3	293	?
Calcium				
Ca	<i>c</i>	5.31 + 0.00333 <i>T</i>	273–673	2
	<i>c</i>	6.29 + 0.00140 <i>T</i>	673–873	2
CaCl ₂	<i>c</i>	16.9 + 0.00386 <i>T</i>	273–1055	?
CaCO ₃	<i>c</i>	19.68 + 0.01189 <i>T</i> – 307600/ <i>T</i> ²	273–1033	3
CaF ₂	<i>c</i>	14.7 + 0.00380 <i>T</i>	273–1651	?
CaMg(CO ₃) ₂	<i>c</i>	40.1	299–372	?
CaMoO ₄	<i>c</i>	33	273–297	?
CaO	<i>c</i>	10.00 + 0.00484 <i>T</i> – 108000/ <i>T</i> ²	273–1173	2
Ca(OH) ₂	<i>c</i>	21.4	276–373	?
CaO·Al ₂ O ₃ ·2SiO ₂	<i>c</i> , anorthite	63.13 + 0.01500 <i>T</i> – 1537000/ <i>T</i> ²	273–1673	1
	<i>gls</i>	67.41 + 0.01048 <i>T</i> – 1874000/ <i>T</i> ²	273–973	1
CaO·MgO·2SiO ₂	<i>c</i> , diopside	54.46 + 0.005746 <i>T</i> – 1500000/ <i>T</i> ²	273–1573	1
	<i>gls</i>	51.68 + 0.009724 <i>T</i> – 1308000/ <i>T</i> ²	273–973	1
CaO·SiO ₂	<i>c</i> , wollastonite	27.95 + 0.002056 <i>T</i> – 745600/ <i>T</i> ²	273–1573	1
	<i>c</i> , pseudowollastonite	25.48 + 0.004132 <i>T</i> – 488100/ <i>T</i> ²	273–1673	1
	<i>gls</i>	23.16 + 0.009672 <i>T</i> – 487100/ <i>T</i> ²	273–973	1
CaP ₂ O ₆	<i>c</i>	39.5	287–371	?
CaSO ₄	<i>c</i>	18.52 + 0.02197 <i>T</i> – 156800/ <i>T</i> ²	273–1373	5
CaSO ₄ ·2H ₂ O	<i>c</i>	46.8	282–373	?
CaWO ₄	<i>c</i>	27.9	292–322	?
Carbon ⁵				
C	<i>c</i> , graphite	2.673 + 0.002617 <i>T</i> – 116900/ <i>T</i> ²	273–1373	2
	<i>c</i> , diamond	2.162 + 0.003059 <i>T</i> – 130300/ <i>T</i> ²	273–1313	3
CH ₄	<i>g</i>	5.34 + 0.0115 <i>T</i>	273–1200	2
CO ⁶	<i>g</i>	6.60 + 0.00120 <i>T</i>	273–2500	1½
CO ₂	<i>g</i>	10.34 + 0.00274 <i>T</i> – 195500/ <i>T</i> ²	273–1200	1½
CS ₂	<i>l</i>	18.4	293	?
Cerium				
Ce	<i>c</i>	5.88 + 0.00123 <i>T</i>	273–908	?
CeO ₂	<i>c</i>	15.1	273–373	?
Ce ₂ (MoO ₄) ₃	<i>c</i>	96	273–297	?
Ce ₂ (SO ₄) ₃	<i>c</i>	66.4	273–373	?
Ce ₂ (SO ₄) ₃ ·5H ₂ O	<i>c</i>	131.6	273–319	?
Cesium				
Cs	<i>c</i>	1.96 + 0.0182 <i>T</i>	273–301	3
	<i>l</i>	8.00	302	3
	<i>g</i>	4.97	All	0
CsBr	<i>c</i>	12.6 + 0.00259 <i>T</i>	273–909	?
CsCl	<i>c</i>	11.7 + 0.00309 <i>T</i>	273–752	?
CsF	<i>c</i>	11.3 + 0.00285 <i>T</i>	273–957	?
CsI	<i>c</i>	11.6 + 0.00268 <i>T</i>	273–894	?
Chlorine				
Cl ₂	<i>g</i>	8.28 + 0.00056 <i>T</i>	273–2000	1½
Chromium ⁴				
Cr	<i>c</i>	4.84 + 0.00295 <i>T</i>	273–1823	5
	<i>l</i>	9.70	1823–1923	10
CrCl ₃	<i>c</i>	23	286–319	?
Cr ₂ O ₃	<i>c</i>	26.0 + 0.00400 <i>T</i>	273–2263	?
CrSb	<i>c</i>	12.3 + 0.00120 <i>T</i>	273–1383	?
CrSb ₂	<i>c</i>	19.2 + 0.00184 <i>T</i>	273–949	?
Cr ₂ (SO ₄) ₃	<i>c</i>	67.4	273–373	?
Cobalt ⁴				
Co	<i>c</i>	5.12 + 0.00333 <i>T</i>	273–1763	5
	<i>l</i>	8.40	1763–1873	5
CoAs ₂ ·CoS ₂	<i>c</i>	32.9	283–373	?
CoSb	<i>c</i>	11.7 + 0.00156 <i>T</i>	273–1464	?
Co ₂ Sn	<i>c</i>	15.83 + 0.00950 <i>T</i>	273–903	2
CoS	<i>c</i>	10.6 + 0.00251 <i>T</i>	273–1373	?
CoSO ₄ ·7H ₂ O	<i>c</i>	96	286–303	?

TABLE 2-194 Heat Capacities of the Elements and Inorganic Compounds (Continued)

Substance	State†	Heat capacity at constant pressure ($T = K$; $0^\circ C = 273.1 K$), cal/deg mol	Range of temperature, K	Uncertainty, %
Copper ⁷				
Cu	<i>c</i>	$5.44 + 0.001462T$	273–1357	1
	<i>l</i>	7.50	1357–1573	3
CuAl	<i>c</i>	$9.88 + 0.00500T$	273–733	2
CuAl ₂	<i>c</i>	$16.78 + 0.00366T$	273–773	2
Cu ₃ Al	<i>c</i>	$19.61 + 0.01054T$	273–775	2
CuI	<i>c</i>	$12.1 + 0.00286T$	273–675	?
CuI ₂	<i>c</i>	20.1	274–328	?
CuO	<i>c</i>	$10.87 + 0.003576T - 150600/T^2$	273–810	2
CuO·SiO ₂ ·H ₂ O	<i>c</i>	29	293–323	?
CuS	<i>c</i>	$10.6 + 0.00264T$	273–1273	?
Cu ₂ S	<i>c</i> , α	$9.38 + 0.0312T$	273–376	3
	<i>c</i> , β	20.9	376–1173	?
CuS·FeS	<i>c</i>	24	292–321	2
Cu ₂ Sb	<i>c</i>	$13.73 + 0.01350T$	273–573	2
Cu ₂ Sb	<i>c</i>	$21.79 + 0.00900T$	273–693	2
Cu ₂ Se	<i>c</i> , α	20.85	273–383	5
	<i>c</i> , β	20.35	383–488	5
Cu ₃ Si	<i>c</i>	$20.3 + 0.00587T$	273–1135	?
CuSO ₄	<i>c</i>	24.1	282	?
CuSO ₄ ·H ₂ O	<i>c</i>	31.3	282	?
CuSO ₄ ·3H ₂ O	<i>c</i>	49.0	282	?
CuSO ₄ ·5H ₂ O	<i>c</i>	67.2	282	?
Fluorine ⁸				
F ₂	<i>g</i>	$6.50 + 0.00100T$	300–3000	5
Gallium				
Ga ₂ O ₃	<i>c</i>	$18.2 + 0.0252T$	273–923	?
Ga ₂ (SO ₄) ₃	<i>c</i>	62.4	273–373	?
Germanium ⁴				
Ge	<i>c</i>			
Gold				
Au	<i>c</i>	$5.61 + 0.00144T$	273–1336	2
	<i>l</i>	7.00	1336–1573	5
AuSb ₂	<i>c</i> , α	$17.12 + 0.00465T$	273–628	1
	<i>c</i> , $\beta\gamma$	$11.47 + 0.01756T$	628–713	?
Helium ⁹				
He	<i>g</i>	4.97	All	0
Hydrogen ¹⁰				
H	<i>g</i>	4.97	All	0
H ₂	<i>g</i> , <i>g</i>	$6.62 + 0.00081T$	273–2500	2
HBr	<i>g</i> , <i>g</i>	$6.80 + 0.00084T$	273–2000	2
HCl	<i>g</i> , <i>g</i>	$6.70 + 0.00084T$	273–2000	1½
HI	<i>g</i> , <i>g</i>	$6.93 + 0.00083T$	273–2000	2
H ₂ O	<i>l</i>	See Tables 2-355 through 2-357		
	<i>g</i>	$8.22 + 0.00015T + 0.00000134T^2$	300–2500	?
H ₂ S	<i>g</i> , <i>g</i>	$7.20 + 0.00360T$	300–600	8
H ₂ S ₂ O ₇	<i>c</i>	27	281	?
	<i>l</i>	58	308	?
Indium				
In	<i>c</i>			
Iodine				
I ₂	<i>g</i>	9.00	300–2000	5
Iridium				
Ir	<i>c</i>	$5.50 + 0.00148T$	273–1873	1
Iron ⁴				
Fe	<i>c</i> , α	$4.13 + 0.00638T$	273–1041	3
	<i>c</i> , β	$6.12 + 0.00336T$	1041–1179	3
	<i>c</i> , γ	8.40	1179–1674	5
	<i>c</i> , δ	10.0	1674–1803	5
	<i>l</i>	8.15	1803–1873	5
FeAs ₂	<i>c</i>	17.8	283–373	?
Fe ₃ C	<i>c</i>	$25.17 + 0.00223T$	273–1173	10
FeCO ₃	<i>c</i>	22.7	293–368	?
FeO	<i>c</i>	$12.62 + 0.001492T - 76200/T^2$	273–1173	2
Fe ₂ O ₃	<i>c</i>	$24.72 + 0.01604T - 423400/T^2$	273–1097	2
Fe ₃ O ₄	<i>c</i>	$41.17 + 0.01882T - 979500/T^2$	273–1065	2
Fe ₂ O ₃ ·3H ₂ O	<i>c</i>	47.8	286–373	?
FeS	<i>c</i> , α	$2.03 + 0.0390T$	273–411	5
	<i>c</i> , β	$12.05 + 0.00273T$	411–1468	3
FeS ₂	<i>c</i>	$10.7 + 0.01336T$	273–773	?
FeSi	<i>c</i>	$10.54 + 0.00458T$	273–903	2
Fe ₃ SiO ₄	<i>c</i>	$33.57 + 0.01907T - 879700/T^2$	273–1161	2
FeSO ₄	<i>c</i>	22	293–373	?
Fe ₂ (SO ₄) ₃	<i>c</i>	66.2	273–373	?
FeSO ₄ ·4H ₂ O	<i>c</i>	63.6	282	?
FeSO ₄ ·7H ₂ O	<i>c</i>	96	291–319	?
Krypton				
Kr	<i>g</i>	4.97	All	0

TABLE 2-194 Heat Capacities of the Elements and Inorganic Compounds (Continued)

Substance	State†	Heat capacity at constant pressure ($T = K$; $0^\circ\text{C} = 273.1\text{ K}$), cal/deg mol	Range of temperature, K	Uncertainty, %
Lanthanum				
La	<i>c</i>	$5.91 + 0.00100T$	273–1009	?
La ₂ O ₃	<i>c</i>	$22.6 + 0.00544T$	273–2273	?
La ₂ (MoO ₄) ₃	<i>c</i>	86	273–307	?
La ₂ (SO ₄) ₃	<i>c</i>	66.9	273–373	?
La ₂ (SO ₄) ₃ ·9H ₂ O	<i>c</i>	152	273–319	?
Lead†				
Pb	<i>c</i>	$5.77 + 0.00202T$	273–600	2
	<i>l</i>	6.8	600–1273	5
Pb ₃ (AsO ₄) ₂	<i>c</i>	65.5	286–370	?
PbB ₂ O ₄	<i>c</i>	26.5	288–371	?
PbB ₄ O ₇	<i>c</i>	41.4	289–371	?
PbBr ₂	<i>c</i>	$18.13 + 0.00310T$	273–761	2
	<i>l</i>	27.4	761–860	10
PbCl ₂	<i>c</i>	$15.88 + 0.00835T$	273–771	2
	<i>l</i>	27.2	771–851	10
2PbCl ₂ ·NH ₄ Cl	<i>c</i>	53.1	293	?
PbCO ₃	<i>c</i>	21.1	286–320	?
PbCrO ₄	<i>c</i>	29.1	292–323	?
PbF ₂	<i>c</i>	$16.5 + 0.00412T$	273–1091	?
PbI ₂	<i>c</i>	$18.66 + 0.00293T$	273–648	2
	<i>l</i>	32.3	648–776	20
PbMoO ₄	<i>c</i>	30.4	292–322	?
Pb(NO ₃) ₂	<i>c</i>	36.4	286–320	?
PbO	<i>c</i>	$10.33 + 0.00318T$	273–544	2
PbO ₂	<i>c</i>	$12.7 + 0.00780T$	273–?	?
Pb ₂ P ₂ O ₇	<i>c</i>	48.3	284–371	?
PbS	<i>c</i>	$10.63 + 0.00401T$	273–873	3
PbSO ₄	<i>c</i>	26.4	293–372	?
PbS ₂ O ₃	<i>c</i>	29	293–373	?
PbWO ₄	<i>c</i>	35	273–297	?
Lithium				
Li	<i>c</i>	$0.68 + 0.0180T$	273–459	10
	<i>g</i>	4.97	All	0
LiBr	<i>c</i>	$11.5 + 0.00302T$	273–825	?
LiBr·H ₂ O	<i>c</i>	22.6	278–318	?
LiCl	<i>c</i>	$11.0 + 0.00339T$	273–887	?
LiCl·H ₂ O	<i>c</i>	23.6	279–360	?
LiF	<i>c</i>	$8.20 + 0.00520T$	273–1117	?
LiI	<i>c</i>	$12.5 + 0.00208T$	273–723	?
LiI·H ₂ O	<i>c</i>	23.6	277–359	?
LiI·2H ₂ O	<i>c</i>	32.9	277–345	?
LiI·3H ₂ O	<i>c</i>	43.2	277–347	?
LiNO ₃	<i>c</i>	$9.17 + 0.0360T$	273–523	5
	<i>l</i>	26.8	523–575	5
Magnesium†				
Mg	<i>c</i>	$6.20 + 0.00133T - 67800/T^2$	273–923	1
	<i>l</i>	7.4	923–1048	10
MgAg	<i>c</i>	$10.58 + 0.00412T$	273–905	2
Mg ₂ Al ₃	<i>c</i>	$34.4 + 0.0198T$	273–736	?
MgAu	<i>c</i>	$11.3 + 0.00189T$	273–1433	?
Mg ₂ Au	<i>c</i>	$16.2 + 0.00451T$	273–1073	?
Mg ₃ Au	<i>c</i>	$21.2 + 0.00614T$	273–1103	?
MgCl ₂	<i>c</i>	$17.3 + 0.00377T$	273–991	?
MgCl ₂ ·6H ₂ O	<i>c</i>	77.1	292–342	?
MgCO ₃	<i>c</i>	16.9	290	?
MgCu ₂	<i>c</i>	$14.96 + 0.00776T$	273–903	3
Mg ₂ Cu	<i>c</i>	$15.5 + 0.00652T$	273–843	?
MgNi ₂	<i>c</i>	$15.87 + 0.00692T$	273–903	2
MgO	<i>c</i>	$10.86 + 0.001197T - 208700/T^2$	273–2073	2
MgO·Al ₂ O ₃	<i>c</i>	28	288–319	?
MgO·SiO ₂	<i>c</i> , amphibole	$25.60 + 0.004380T - 674200/T^2$	273–1373	1
	<i>c</i> , pyroxene	$23.35 + 0.008062T - 558800/T^2$	273–773	1
	<i>gls</i>	$23.30 + 0.007734T - 542000/T^2$	273–973	1
6MgO·MgCl ₂ ·8B ₂ O ₃	<i>c</i> , α	$58.7 + 0.408T$	273–538	5
	<i>c</i> , β	$107.2 + 0.2876T$	538–623	5
	<i>c</i>	18.2	292–323	?
Mg(OH) ₂	<i>c</i>	$28.2 + 0.00560T$	273–1234	?
Mg ₃ Sb ₂	<i>c</i>	$15.4 + 0.00415T$	273–1343	?
Mg ₂ Si	<i>c</i>	26.7	296–372	?
MgSO ₄	<i>c</i>	33	282	?
MgSO ₄ ·H ₂ O	<i>c</i>	80	282	?
MgSO ₄ ·6H ₂ O	<i>c</i>	89	291–319	?
MgSO ₄ ·7H ₂ O	<i>c</i>			?

TABLE 2-194 Heat Capacities of the Elements and Inorganic Compounds (Continued)

Substance	State†	Heat capacity at constant pressure ($T = K$; $0^\circ\text{C} = 273.1\text{ K}$), cal/deg mol	Range of temperature, K	Uncertainty, %
Manganese				
Mn	<i>c</i> , α	$3.76 + 0.00747T$	273–1108	5
	<i>c</i> , β	$5.06 + 0.00395T$	1108–1317	5
	<i>c</i> , γ	$4.80 + 0.00422T$	1317–1493	5
	<i>l</i>	11.0	1493–1673	10
MnCl ₂	<i>c</i>	$16.2 + 0.00520T$	273–923	?
MnCO ₃	<i>c</i>	$7.79 + 0.0421T + 0.0000090T^2$	273–773	?
MnO	<i>c</i>	$7.43 + 0.01038T - 0.00000362T^2$	273–1923	?
Mn ₂ O ₃	<i>c</i>	$10.33 + 0.0530T - 0.0000257T^2$	273–1173	?
Mn ₂ O ₄	<i>c</i>	$19.25 + 0.0538T - 0.0000209T^2$	273–1773	?
MnO ₂	<i>c</i>	$1.92 + 0.0471T - 0.0000297T^2$	273–773	?
Mn ₂ O ₃ ·H ₂ O	<i>c</i>	31	291–322	?
MnS	<i>c</i>	$10.21 + 0.00656T - 0.00000242T^2$	273–1883	?
MnSO ₄	<i>c</i>	27.5	293–373	?
MnSO ₄ ·5H ₂ O	<i>c</i>	78	290–319	?
Mercury ¹¹				
Hg	<i>l</i>	6.61	273–630	1
	<i>g</i>	4.97	All	0
Hg ₂	<i>g</i>	9.00	300–2000	5
HgCl	<i>c</i>	$11.05 + 0.00370T$	273–798	?
HgCl ₂	<i>c</i>	$15.3 + 0.0103T$	273–553	?
Hg(CN) ₂	<i>c</i>	25	285–319	?
HgI	<i>c</i>	$11.4 + 0.00461T$	273–563	?
HgI ₂	<i>c</i> , α	$17.4 + 0.004001T$	273–403	3
	<i>c</i> , β	20.2	403–523	3
HgO	<i>c</i>	11.5	278–371	?
HgS	<i>c</i>	$10.9 + 0.00365T$	273–853	?
Hg ₂ SO ₄	<i>c</i>	31.0	273–307	?
Molybdenum				
Mo	<i>c</i>	$5.69 + 0.00188T - 50300/T^2$	273–1773	5
MoO ₃	<i>c</i>	$15.1 + 0.0121T$	273–1068	?
MoS ₂	<i>c</i>	$19.7 + 0.00315T$	273–729	?
Neon ¹²				
Ne	<i>g</i>	4.97	All	0
Nickel ⁴				
Ni	<i>c</i> , α	$4.26 + 0.00640T$	273–626	2
	<i>c</i> , β	$6.99 + 0.000905T$	626–1725	5
	<i>l</i>	8.55	1725–1903	10
NiO	<i>c</i>	$11.3 + 0.00215T$	273–1273	?
NiS	<i>c</i>	$9.25 + 0.00640T$	273–597	3
Ni ₂ Si	<i>c</i>	$15.8 + 0.00329T$	273–1582	?
NiSi	<i>c</i>	$10.0 + 0.00312T$	273–1273	?
Ni ₃ Sn	<i>c</i>	$20.78 + 0.0102T$	273–904	2
NiSO ₄	<i>c</i>	33.4	293–373	?
NiSO ₄ ·6H ₂ O	<i>c</i>	82	291–325	?
NiTe	<i>c</i>	$11.00 + 0.00433T$	273–700	2
Nitrogen ¹³				
N ₂	<i>g</i>	$6.50 + 0.00100T$	300–3000	3
NH ₃	<i>g</i>	$6.70 + 0.00630T$	300–800	1½
NH ₄ Br	<i>c</i>	22.8	274–328	?
NH ₄ Cl	<i>c</i> , α	$9.80 + 0.0368T$	273–457	5
	<i>c</i> , β	$5.0 + 0.0340T$	457–523	5
NH ₄ I	<i>c</i>	17.8	273–328	?
NH ₄ NO ₃	<i>c</i>	31.8	273–293	?
(NH ₄) ₂ SO ₄	<i>c</i>	51.6	275–328	?
NO	<i>g</i>	$8.05 + 0.000233T - 156300/T^2$	300–5000	2
Osmium				
Os	<i>c</i>	$5.686 + 0.000875T$	273–1877	1
Oxygen ¹⁴				
O ₂	<i>g</i>	$8.27 + 0.000258T - 187700/T^2$	300–5000	1
Palladium				
Pd	<i>c</i>	$5.41 + 0.00184T$	273–1822	2
Phosphorus				
P	<i>c</i> , yellow	5.50	273–317	5
	<i>c</i> , red	$0.21 + 0.0180T$	273–472	10
	<i>l</i>	6.6	317–373	10
PCl ₃	<i>l</i>	28.7	284–371	?
P ₄ O ₁₀	<i>c</i>	$15.72 + 0.1092T$	273–631	2
	<i>g</i>	73.6	631–1371	3
Platinum ⁴				
Pt	<i>c</i>	$5.92 + 0.00116T$	273–1873	1
Potassium				
K	<i>c</i>	$5.24 + 0.00555T$	273–336	5
	<i>l</i>	7.7	336–373	5

TABLE 2-194 Heat Capacities of the Elements and Inorganic Compounds (Continued)

Substance	State†	Heat capacity at constant pressure ($T = K$; $0^\circ C = 273.1 K$), cal/deg mol	Range of temperature, K	Uncertainty, %
Potassium—(Cont.)				
K	<i>g</i>	4.97	All	0
K ₂	<i>g</i>	9.00	300–2000	5
KAsO ₃	<i>c</i>	25.3	290–372	?
KBO ₂	<i>c</i>	12.6 + 0.0126 <i>T</i>	273–1220	?
K ₂ B ₄ O ₇	<i>c</i>	51.3	290–372	?
KBr	<i>c</i>	11.49 + 0.00360 <i>T</i>	273–543	2
KCl	<i>c</i>	10.93 + 0.00376 <i>T</i>	273–1043	2
KClO ₃	<i>c</i>	25.7	289–371	?
KClO ₄	<i>c</i>	26.3	287–318	?
2KCl·CuCl ₂ ·2H ₂ O	<i>c</i>	63	292–323	?
2KCl·PtCl ₄	<i>c</i>	55	286–319	?
2KCl·SnCl ₄	<i>c</i>	54.5	292–323	?
2KCl·ZnCl ₂	<i>c</i>	43.4	279–319	?
2KCN·Zn(CN) ₂	<i>c</i>	57.4	277–319	?
K ₂ CO ₃	<i>c</i>	29.9	296–372	?
K ₂ CrO ₄	<i>c</i>	35.9	289–371	?
K ₂ Cr ₂ O ₇	<i>c</i>	42.80 + 0.0410 <i>T</i>	273–671	5
	<i>l</i>	96.9	671–757	5
KF	<i>c</i>	10.8 + 0.00284 <i>T</i>	273–1129	?
K ₄ Fe(CN) ₆	<i>c</i>	80.1	273–319	?
K ₄ Fe(CN) ₆ ·3H ₂ O	<i>c</i>	114.5	273–310	?
KH ₂ AsO ₄	<i>c</i>	32	289–319	?
KH ₂ PO ₄	<i>c</i>	28.3	290–320	?
KHSO ₄	<i>c</i>	30	292–324	?
KMnO ₄	<i>c</i>	28	287–318	?
KNO ₃	<i>c</i>	6.42 + 0.0530 <i>T</i>	273–401	10
	<i>c</i>	28.8	401–611	5
	<i>l</i>	29.5	611–683	10
K ₂ O·Al ₂ O ₃ ·3SiO ₂	<i>c</i> , orthoclase	69.26 + 0.00821 <i>T</i> – 2331000/ <i>T</i> ²	273–1373	1½
	<i>gls</i> , orthoclase	69.81 + 0.01053 – 2403000/ <i>T</i> ²	273–1373	1½
	<i>c</i> , microcline	65.65 + 0.01102 <i>T</i> – 1748000/ <i>T</i> ²	273–1373	1½
	<i>gls</i> , microcline	64.83 + 0.01438 <i>T</i> – 1641000/ <i>T</i> ²	273–1373	1½
K ₄ P ₂ O ₇	<i>c</i>	63.1	290–371	?
K ₂ SO ₄	<i>c</i>	33.1	287–371	?
K ₂ S ₂ O ₃	<i>c</i>	37	293–373	?
K ₂ SO ₄ ·Al ₂ (SO ₄) ₃ ·24H ₂ O	<i>c</i>	352	292–322	?
K ₂ SO ₄ ·Cr ₂ (SO ₄) ₃ ·24H ₂ O	<i>c</i>	324	292–324	?
K ₂ SO ₄ ·MgSO ₄ ·6H ₂ O	<i>c</i>	106	292–323	?
K ₂ SO ₄ ·NiSO ₄ ·6H ₂ O	<i>c</i>	107	289–319	?
K ₂ SO ₄ ·ZnSO ₄ ·6H ₂ O	<i>c</i>	120	293–317	?
Promethium				
Pr	<i>c</i>			
Radon				
Rn	<i>g</i>	4.97	All	0
Rhenium				
Re	<i>c</i>	6.30 + 0.00053 <i>T</i>	273–2273	?
Rhodium				
Rh	<i>c</i>	5.40 + 0.00219 <i>T</i>	273–1877	2
Rubidium				
Rb	<i>c</i>	3.27 + 0.0131 <i>T</i>	273–312	2
	<i>l</i>	7.85	312–373	5
RbBr	<i>c</i>	11.6 + 0.00255 <i>T</i>	273–954	?
RbCl	<i>c</i>	11.5 + 0.00249 <i>T</i>	273–987	?
Rb ₂ CO ₃	<i>c</i>	28.4	291–320	?
RbF	<i>c</i>	11.3 + 0.00256 <i>T</i>	273–1048	?
RbI	<i>c</i>	11.6 + 0.00263 <i>T</i>	273–913	?
Scandium				
Sc ₂ O ₃	<i>c</i>	21.1	273–373	?
Sc ₂ (SO ₄) ₃	<i>c</i>	62.0	273–373	?
Selenium				
Se	<i>c</i>	4.53 + 0.00550 <i>T</i>	273–490	2
	<i>l</i>	8.35	490–570	3
Silicon				
Si	<i>c</i>	5.74 + 0.000617 <i>T</i> – 101000/ <i>T</i> ²	273–1174	2
SiC	<i>c</i>	8.89 + 0.00291 <i>T</i> – 284000/ <i>T</i> ²	273–1629	2
SiCl ₄	<i>l</i>	32.4	293–373	?
SiO ₂	<i>c</i> , quartz, α	10.87 + 0.008712 <i>T</i> – 241200/ <i>T</i> ²	273–848	1
	<i>c</i> , quartz, β	10.95 + 0.00550 <i>T</i>	848–1873	3½
	<i>c</i> , cristobalite, α	3.65 + 0.0240 <i>T</i>	273–523	2½
	<i>c</i> , cristobalite, β	17.09 + 0.000454 <i>T</i> – 897200/ <i>T</i> ²	523–1973	2
	<i>gls</i>	12.80 + 0.00447 <i>T</i> – 302000/ <i>T</i> ²	273–1973	3½
Silver [‡]				
Ag	<i>c</i>	5.60 + 0.00150 <i>T</i>	273–1234	1
	<i>l</i>	8.2	1234–1573	3

TABLE 2-194 Heat Capacities of the Elements and Inorganic Compounds (Continued)

Substance	State†	Heat capacity at constant pressure ($T = K$; $0^\circ\text{C} = 273.1\text{ K}$), cal/deg mol	Range of temperature, K	Uncertainty, %
Silver—(Cont.)				
Ag ₃ Al	<i>c</i>	22.56 + 0.00570 <i>T</i>	273–902	2
Ag ₃ Al	<i>c</i>	16.85 + 0.00450 <i>T</i>	273–903	2
AgAl ₁₂	<i>c</i>	58.62 + 0.0575 <i>T</i>	273–768	5
AgBr	<i>c</i>	8.58 + 0.0141 <i>T</i>	273–703	6
	<i>l</i>	14.9	703–836	5
AgCl	<i>c</i>	9.60 + 0.00929 <i>T</i>	273–728	2
	<i>l</i>	14.05	728–806	5
AgCNO	<i>c</i>	18.7	273–353	?
AgI	<i>c, α</i>	8.58 + 0.0141 <i>T</i>	273–423	6
AgNO ₃	<i>c, α</i>	18.83 + 0.0160 <i>T</i>	273–433	2
	<i>c, β</i>	25.7	433–482	5
	<i>l</i>	30.2	482–541	5
Ag ₃ PO ₄	<i>c</i>	37.5	293–325	?
Ag ₃ S	<i>c, α</i>	18.8	273–448	5
	<i>c, β</i>	21.8	448–597	5
Ag ₃ Sb	<i>c</i>	19.53 + 0.0160 <i>T</i>	273–694	5
Ag ₃ Se	<i>c, α</i>	20.2	273–406	5
	<i>c, β</i>	20.4	406–460	5
Sodium ¹⁵				
Na	<i>c</i>	5.01 + 0.00536 <i>T</i>	273–371	1½
	<i>l</i>	7.50	371–451	2
	<i>g</i>	4.97	All	0
NaBO ₂	<i>c</i>	10.4 + 0.0199 <i>T</i>	273–1239	?
Na ₂ B ₄ O ₇	<i>c</i>	47.9	289–371	?
Na ₂ B ₄ O ₇ ·10H ₂ O	<i>c</i>	147	292–323	?
NaBr	<i>c</i>	11.74 + 0.00233 <i>T</i>	273–543	2
NaCl	<i>c</i>	10.79 + 0.00420 <i>T</i>	273–1074	2
	<i>l</i>	15.9	1073–1205	3
NaClO ₃	<i>c</i>	9.48 + 0.0468 <i>T</i>	273–528	3
	<i>l</i>	31.8	528–572	5
NaCNO	<i>c</i>	13.1	273–353	?
Na ₂ CO ₃	<i>c</i>	28.9	288–371	?
NaF	<i>c</i>	10.4 + 0.00289 <i>T</i>	273–1261	?
Na ₂ HPO ₄ ·7H ₂ O	<i>c</i>	86.6	275–307	?
Na ₂ HPO ₄ ·12H ₂ O	<i>c</i>	133.4	275–307	?
NaI	<i>c</i>	12.5 + 0.00162 <i>T</i>	273–936	?
NaNO ₃	<i>c</i>	4.56 + 0.0580 <i>T</i>	273–583	5
	<i>l</i>	37.2	583–703	10
Na ₂ O·Al ₂ O ₃ ·3SiO ₂	<i>c, albite</i>	63.78 + 0.01171 <i>T</i> – 1678000/ <i>T</i> ²	273–1373	1
	<i>gls</i>	61.25 + 0.01768 <i>T</i> – 1545000/ <i>T</i> ²	273–1173	1
NaPO ₃	<i>c</i>	22.1	290–319	?
Na ₄ P ₂ O ₇	<i>c</i>	60.7	290–371	?
Na ₂ SO ₄	<i>c</i>	32.8	289–371	?
Na ₂ S ₂ O ₃	<i>c</i>	34.9	273–307	?
Na ₂ S ₂ O ₃ ·5H ₂ O	<i>c</i>	86.2	273–307	?
Sodium-potassium alloys ¹⁵	<i>l</i>			
Strontium				
SrBr ₂	<i>c</i>	18.1 + 0.00311 <i>T</i>	273–923	?
SrBr ₂ ·H ₂ O	<i>c</i>	28.9	277–370	?
SrBr ₂ ·6H ₂ O	<i>c</i>	82.1	276–327	?
SrCl ₂	<i>c</i>	18.2 + 0.00244 <i>T</i>	273–1143	?
SrCl ₂ ·H ₂ O	<i>c</i>	28.7	276–365	?
SrCl ₂ ·2H ₂ O	<i>c</i>	38.3	277–366	?
SrCO ₃	<i>c</i>	21.8	281–371	?
SrI ₂	<i>c</i>	18.6 + 0.00304 <i>T</i>	273–783	?
SrI ₂ ·H ₂ O	<i>c</i>	28.5	276–363	?
SrI ₂ ·2H ₂ O	<i>c</i>	39.1	275–336	?
SrI ₂ ·6H ₂ O	<i>c</i>	84.9	275–333	?
SrMoO ₄	<i>c</i>	37	273–297	?
Sr(NO ₃) ₂	<i>c</i>	38.3	290–320	?
SrSO ₄	<i>c</i>	26.2	293–369	?
Sulfur ¹⁶				
S	<i>c, rhombic</i>	3.63 + 0.00640 <i>T</i>	273–368	3
	<i>c, monoclinic</i>	4.38 + 0.00440 <i>T</i>	368–392	3
S ₂	<i>g</i>	8.58 + 0.00030 <i>T</i>	300–2500	5
S ₂ Cl ₂	<i>l</i>	27.5	273–332	?
SO ₂	<i>g</i>	7.70 + 0.00530 <i>T</i> – 0.00000083 <i>T</i> ²	300–2500	2½
Tantalum				
Ta	<i>c</i>	5.91 + 0.00099 <i>T</i>	273–1173	2
Tellurium				
Te	<i>c</i>	5.19 + 0.00250 <i>T</i>	273–600	3
Thallium				
Tl	<i>c, α</i>	5.32 + 0.00385 <i>T</i>	273–500	1
	<i>c, β</i>	8.12	500–576	1

TABLE 2-194 Heat Capacities of the Elements and Inorganic Compounds (Concluded)

Substance	State†	Heat capacity at constant pressure ($T = K$; $0^\circ C = 273.1 K$), cal/deg mol	Range of temperature, K	Uncertainty, %
Thallium—(Cont.)				
Tl	<i>l</i>	7.12	576–773	3
TlBr	<i>c</i>	12.53 + 0.00100 <i>T</i>	273–733	10
	<i>l</i>	16.0	733–800	10
TlCl	<i>c</i>	12.56 + 0.00088 <i>T</i>	273–700	5
	<i>l</i>	14.2	700–803	10
Thorium				
Th	<i>c</i>	6.40	273–373	?
ThO ₂	<i>c</i>	14.6 + 0.00507 <i>T</i>	273–1273	?
Th(SO ₄) ₂	<i>c</i>	41.2	273–373	?
Tin ⁴				
Sn	<i>c</i>	5.05 + 0.00480 <i>T</i>	273–504	2
	<i>l</i>	6.6	504–1273	10
SnAu	<i>c</i>	11.79 + 0.00233 <i>T</i>	273–581	1
SnCl ₂	<i>c</i>	16.2 + 0.00926 <i>T</i>	273–520	?
SnCl ₄	<i>l</i>	38.4	286–371	?
SnO	<i>c</i>	9.40 + 0.00362 <i>T</i>	273–1273	?
SnO ₂	<i>c</i>	13.94 + 0.00565 <i>T</i> – 252000/ <i>T</i> ²	273–1373	?
SnPt	<i>c</i>	11.49 + 0.00190 <i>T</i>	273–1318	1
SnS	<i>c</i>	12.1 + 0.00165 <i>T</i>	273–1153	?
SnS ₂	<i>c</i>	20.5 + 0.00400 <i>T</i>	273–873	?
Titanium				
Ti	<i>c</i>	8.91 + 0.00114 <i>T</i> – 433000/ <i>T</i> ²	273–713	3
TiCl ₄	<i>l</i>	35.7	285–372	?
TiO ₂	<i>c</i>	11.81 + 0.00754 <i>T</i> – 41900/ <i>T</i> ²	273–713	3
Tungsten				
W	<i>c</i>	5.65 + 0.00866	273–2073	1
WO ₃	<i>c</i>	16.0 + 0.00774 <i>T</i>	273–1550	?
Uranium				
U	<i>c</i>	6.64	273–372	?
U ₃ O ₈	<i>c</i>	59.8	276–314	?
Vanadium				
V	<i>c</i>	5.57 + 0.00097 <i>T</i>	273–1993	?
Xenon				
Xe	<i>g</i>	4.97	All	0
Zinc ⁴				
Zn	<i>c</i>	5.25 + 0.00270 <i>T</i>	273–692	1
	<i>l</i>	7.59 + 0.00055 <i>T</i>	692–1122	3
ZnCl ₂	<i>c</i>	15.9 + 0.00800 <i>T</i>	273–638	?
ZnO	<i>c</i>	11.40 + 0.00145 <i>T</i> – 182400/ <i>T</i> ²	273–1573	1
ZnS	<i>c</i>	12.81 + 0.00095 <i>T</i> – 194600/ <i>T</i> ²	273–1173	5
ZnSb	<i>c</i>	11.5 + 0.00313 <i>T</i>	273–810	?
ZnSO ₄	<i>c</i>	28	293–373	?
ZnSO ₄ ·H ₂ O	<i>c</i>	34.7	282	?
ZnSO ₄ ·6H ₂ O	<i>c</i>	80.8	282	?
ZnSO ₄ ·7H ₂ O	<i>c</i>	100.2	273–307	?
Zirconium				
ZrO ₂	<i>c</i>	11.62 + 0.01046 <i>T</i> – 177700/ <i>T</i> ²	273–1673	5
ZrO ₂ ·SiO ₂	<i>c</i>	26.7	297–372	?

¹ See also Table 2-195. Data to 298 K are also given by Scott, *Cryogenic Engineering*, Van Nostrand, Princeton, N.J., 1959.

² For liquid and gas data, see Johnson (ed.), WADD-TR-60-56, 1960.

³ Stalder, NACA Tech. Note 4141, 1957 (Fig. 5), gives data from 400 to 2600°R.

⁴ See also Table 2-195.

⁵ For data from 400 to 5500°R see Stalder, NACA Tech. Note 4141, 1957 (Fig. 4).

⁶ For solid, liquid, and gas data, see Johnson (ed.), WADD-TR-60-56, 1960.

⁷ For data from 400 to 2350°R see Stalder, NACA Tech. Note 4141, 1957.

⁸ For solid, liquid, and gas data, see Johnson (ed.), WADD-TR-60-56, 1960.

⁹ For liquid and gas data, see Johnson (ed.), WADD-TR-60-56, 1960.

¹⁰ For solid, liquid, and gas data, see Johnson (ed.), WADD-TR-60-56, 1960.

¹¹ See also Table 2-195; Douglas, Ball, et al., *Bur. Stand. J. Res.*, **46** (1951): 334; Busey and Giaque, *J. Am. Chem. Soc.*, **75** (1953): 806; Sheldon, ASME Pap. 49-A-30, 1949.

¹² For solid, liquid, and gas data, see Johnson (ed.), WADD-TR-56-60, 1960.

¹³ For solid, liquid, and gas data, see Johnson (ed.), WADD-TR-56-60, 1960.

¹⁴ For solid, liquid, and gas data, see Johnson (ed.), WADD-TR-56-60, 1960. Ozone: For liquid see Brabets and Waterman, *J. Chem. Phys.*, **28** (1958): 1212.

¹⁵ For data on liquid Na-K alloys to 1500°F and for liquid Na to 1460°F, see Lubarsky and Kaufman, NACA Rep. 1270, 1956.

¹⁶ See also Evans and Wagman, *Bur. Stand. J. Res.* **49** (1952): 141; Gratch, OTS PB 124957, 1950; Guthrie, Scott, et al., *J. Am. Chem. Soc.*, **76** (1954): 1488.

TABLE 2-195 Specific Heat [kJ/(kg·K)] of Selected Elements

Symbol	Temperature, K														
	4	6	8	10	20	40	60	80	100	200	250	300	400	600	800
Al	0.00026	0.00050	0.00088	0.00140	0.0089	0.0775	0.214	0.357	0.481	0.797	0.859	0.902	0.949	1.042	1.134
Be	0.00008			0.00028	0.0014				0.195	1.109	1.537	1.840	2.191	2.605	2.823
Bi	0.00054	0.00220	0.00541	0.01040	0.0340	0.0729	0.092	0.102	0.109	0.120	0.121	0.122	0.123	0.142	0.136
Cr	0.00016	0.00029	0.00050	0.00081	0.0021	0.0107	0.059	0.127	0.190	0.382	0.424	0.450	0.501	0.565	0.611
Co	0.00036	0.00059	0.00085	0.00121	0.0048	0.0404	0.110	0.184	0.234	0.376	0.406	0.426	0.451	0.509	0.543
Cu	0.00011	0.00024	0.00048	0.00086	0.0076	0.059	0.137	0.203	0.254	0.357	0.377	0.386	0.396	0.431	0.448
Ge				0.00037	0.00081	0.0129	0.0619	0.108	0.153	0.192	0.286	0.305	0.323	0.343	0.364
Au	0.00018	0.00047	0.00126	0.00255	0.0163	0.0569	0.084	0.100	0.109	0.124	0.127	0.129	0.131	0.136	0.141
Ir				0.00032	0.0021				0.090	0.122	0.128	0.131	0.133	0.140	0.146
Fe	0.00038	0.00061	0.00090	0.00127	0.0039	0.0276	0.086	0.154	0.216	0.384	0.422	0.450	0.491	0.555	0.692
Pb	0.00075	0.00242	0.00747	0.01350	0.0531	0.0944	0.108	0.114	0.118	0.125	0.127	1.129	0.132	0.142	
Mg	0.00034	0.00080	0.00155	0.00172	0.0148	0.138	0.336	0.513	0.648	0.929	0.985	1.005	1.082	1.177	1.263
Hg	0.00417	0.01420	0.01820	0.02250	0.0515	0.0895	0.107	0.116	0.121	0.136	0.141	0.139	0.136	0.135	0.104
Mo	0.00011	0.00019	0.00032	0.00050	0.0029	0.0236	0.061	0.105	0.140	0.223	0.241	0.248	0.261	0.280	0.292
Ni	0.00054	0.00086	0.00121	0.00178	0.0058	0.0380	0.103	0.173	0.232	0.383	0.416	0.444	0.490	0.590	0.530
Pt	0.00019	0.00028	0.00067	0.00112	0.0077	0.0382	0.069	0.088	0.101	0.127	0.132	0.134	0.136	0.140	0.146
Ag	0.00016	0.00035	0.00093	0.00186	0.0159	0.0778	0.133	0.166	0.187	0.225	0.232	0.236	0.240	0.251	0.264
Sn	0.00024	0.00127	0.00423	0.00776	0.0400	0.108	0.149	0.173	0.189	0.214	0.220	0.222	0.245	0.257	0.257
Zn	0.00011	0.00029	0.00096	0.00250	0.0269	0.123	0.205	0.258	0.295	0.366	0.380	0.389	0.404	0.435	0.479

TABLE 2-196 Heat Capacities of Inorganic and Organic Liquids

Cmpd. no.	Name	Formula	CAS no.	Mol wt	C1	C2	C3	C4	C5	T _{min} , K	C _p at T _{min} × 1E-05	T _{max} , K	C _p at T _{max} × 1E-05
1	Methane (eqn. 2)	CH ₄	74828	16.043	6.5708E+01	3.8883E+04	-2.5795E+02	6.1407E+02	0	90.69	0.5361	190	14.9780
2	Ethane (eqn. 2)	C ₂ H ₆	74840	30.070	4.4009E+01	8.9718E+04	9.1877E+02	-1.8860E+03	0	92	0.6855	290	1.2444
3	Propane (eqn. 2)	C ₃ H ₈	74986	44.097	6.2983E+01	1.1363E+05	6.3321E+02	-8.7346E+02	0	85.47	0.8488	360	2.6079
4	n-Butane (eqn. 2)	C ₄ H ₁₀	106978	58.123	6.4730E+01	1.6184E+05	9.8341E+02	-1.4315E+03	0	134.86	1.1380	420	5.0822
5	n-Pentane	C ₅ H ₁₂	109660	72.150	1.5908E+05	-2.7050E+02	9.9537E-01	0	0	143.42	1.4076	390	2.0498
6	n-Hexane	C ₆ H ₁₄	110543	86.177	1.7212E+05	-1.8378E+02	8.8734E-01	0	0	177.83	1.6750	460	2.7534
7	n-Heptane (eqn. 2)	C ₇ H ₁₆	142825	100.204	6.1260E+01	3.1441E+05	1.8246E+03	-2.5479E+03	0	182.57	1.9989	520	4.0657
8	n-Octane	C ₈ H ₁₈	111659	114.231	2.2483E+05	-1.8663E+02	9.5891E-01	0	0	216.38	2.2934	460	3.4189
9	n-Nonane	C ₉ H ₂₀	111842	128.258	3.8308E+05	-1.1398E+03	2.7101E+00	0	0	219.66	2.6348	325	2.9890
10	n-Decane	C ₁₀ H ₂₂	124185	142.285	2.7862E+05	-1.9791E+02	1.0737E+00	0	0	243.51	2.9409	460	4.1478
11	n-Undecane	C ₁₁ H ₂₄	1120214	156.312	2.9398E+05	-1.1498E+02	9.6936E-01	0	0	247.57	3.2493	433.42	4.2624
12	n-Dodecane	C ₁₂ H ₂₆	112403	170.338	5.0821E+05	-1.3687E+03	3.1015E+00	0	0	263.57	3.6292	330	3.9429
13	n-Tridecane	C ₁₃ H ₂₈	629505	184.365	3.5018E+05	-1.0470E+02	1.0022E+00	0	0	267.76	3.9400	508.62	5.5619
14	n-Tetradecane	C ₁₄ H ₃₀	629594	198.392	3.5314E+05	2.9130E+01	8.6116E-01	0	0	279.01	4.2831	526.73	6.0741
15	n-Pentadecane	C ₁₅ H ₃₂	629629	212.419	3.4691E+05	2.1954E+02	6.5632E-01	0	0	283.07	4.6165	543.84	6.6042
16	n-Hexadecane	C ₁₆ H ₃₄	544763	226.446	3.7035E+05	2.3147E+02	6.8632E-01	0	0	291.31	4.9602	560.01	7.1521
17	n-Heptadecane	C ₁₇ H ₃₆	629787	240.473	3.7697E+05	3.4782E+02	5.7895E-01	0	0	295.13	5.3005	575.3	7.6869
18	n-Octadecane	C ₁₈ H ₃₈	593453	254.500	3.9943E+05	3.7464E+02	5.8156E-01	0	0	301.31	5.6511	589.86	8.2276
19	n-Nonadecane	C ₁₉ H ₄₀	629925	268.527	3.4257E+05	7.6208E+02	2.9481E-01	0	0	305.04	5.9409	603.05	8.7663
20	n-Eicosane	C ₂₀ H ₄₂	112958	282.553	3.5272E+05	8.0732E+02	2.1220E-01	0	0	309.58	6.2299	616.93	9.3154
21	2-Methylpropane	C ₄ H ₁₀	75285	58.123	1.7237E+05	-1.7839E+03	1.4759E+01	-4.7909E-02	5.8050E-05	113.54	0.9961	380	2.0725
22	2-Methylbutane	C ₅ H ₁₂	78784	72.150	1.0830E+05	1.4600E+02	-2.9200E-01	1.5100E-03	0	113.25	1.2328	310	1.7048
23	2,3-Dimethylbutane	C ₆ H ₁₄	79298	86.177	1.2945E+05	1.8500E+01	6.0800E-01	0	0	145.19	1.4495	331.13	2.0224
24	2-Methylpentane	C ₆ H ₁₄	107835	86.177	1.4222E+05	-4.7830E+01	7.3900E-01	0	0	119.55	1.4706	333.41	2.0842
25	2,3-Dimethylpentane ¹	C ₇ H ₁₆	565593	100.204	1.4642E+05	5.9200E+01	6.0400E-01	0	0	90	1.5664	380	2.5613
26	2,3,3-Trimethylpentane	C ₈ H ₁₈	560214	114.231	3.8862E+05	-1.4395E+03	3.2187E+00	0	0	280	3.2791	320	2.5757
27	2,2,4-Trimethylpentane	C ₈ H ₁₈	540841	114.231	9.5275E+04	6.9670E+02	-1.3765E+00	2.1734E-03	0	165.78	1.8285	520	3.9095
28	Ethylene	C ₂ H ₄	74851	28.054	2.4739E+05	-4.4280E+03	4.0936E+01	-1.6970E-01	2.6816E-04	103.97	0.7013	252.7	0.9758
29	Propylene	C ₃ H ₆	115071	42.081	1.1720E+05	-3.8632E+02	1.2348E+00	0	0	87.89	0.9279	298.15	1.1178
30	1-Butene	C ₄ H ₈	106989	56.108	1.3589E+05	-4.7739E+02	2.1835E+00	-2.2230E-03	0	87.8	1.0930	300	1.2917
31	cis-2-Butene	C ₄ H ₈	590181	56.108	1.2668E+05	-6.5470E+01	-6.4000E-01	2.9120E-03	0	134.26	1.1340	350	1.5022
32	trans-2-Butene	C ₄ H ₈	624646	56.108	1.1276E+05	-1.0470E+02	5.2140E-01	0	0	167.62	1.0986	274.03	1.2322
33	1-Pentene	C ₅ H ₁₀	109671	70.134	1.5467E+05	-4.2600E+02	1.9640E+00	-1.8038E-03	0	107.93	1.2930	310	1.5761
34	1-Hexene	C ₆ H ₁₂	592416	84.161	1.9263E+05	-5.7116E+02	2.4004E+00	-1.9758E-03	0	133.39	1.5446	336.63	1.9700
35	1-Heptene	C ₇ H ₁₄	592767	98.188	1.8997E+05	-1.5670E+02	3.4300E-01	1.5222E-03	0	154.27	1.7955	330	2.3032
36	1-Octene	C ₈ H ₁₆	111660	112.215	3.7930E+05	-2.1175E+03	8.2362E+00	-9.0093E-03	0	171.45	2.1295	315	2.4793
37	1-Nonene	C ₉ H ₁₈	124118	126.242	2.5875E+05	-3.5450E+02	1.3126E+00	0	0	191.78	2.3904	420.02	3.4142
38	1-Decene	C ₁₀ H ₂₀	872059	140.269	3.1950E+05	-5.7621E+02	1.7087E+00	0	0	206.89	2.7343	443.75	4.0027
39	2-Methylpropene	C ₄ H ₈	115117	56.108	8.7680E+04	2.1710E+02	-9.1530E-01	2.2660E-03	0	132.81	1.0568	343.15	1.4596
40	2-Methyl-1-butene ²	C ₅ H ₁₀	563462	70.134	1.4951E+05	-2.4763E+02	9.1849E-01	0	0	135.58	1.3282	304.31	1.5921
41	2-Methyl-2-butene ²	C ₅ H ₁₀	513359	70.134	1.5160E+05	-2.6672E+02	9.0847E-01	0	0	139.39	1.3207	311.71	1.5673
42	1,2-Butadiene	C ₄ H ₆	590192	54.092	1.3515E+05	-3.1114E+02	9.7007E-01	-1.5230E-04	0	136.95	1.1034	290	1.2279
43	1,3-Butadiene	C ₄ H ₆	106990	54.092	1.2886E+05	-3.2310E+02	1.0150E+00	3.2000E-05	0	165	1.0333	350	1.4148
44	2-Methyl-1,3-butadiene	C ₅ H ₈	78795	68.119	1.4148E+05	-2.8870E+02	1.0910E+00	0	0	130.32	1.2239	307.2	1.5575
45	Acetylene	C ₂ H ₂	74862	26.038	2.0011E+05	-1.1988E+03	3.0027E+00	0	0	192.4	0.8061	250	0.8808
46	Methylacetylene	C ₃ H ₄	74997	40.065	7.9791E+04	8.9490E+01	0	0	0	200	0.9769	249.94	1.0216
47	Dimethylacetylene	C ₄ H ₆	503173	54.092	8.8153E+04	1.2416E+02	0	0	0	240.91	1.1806	300.13	1.2542
48	3-Methyl-1-butyne	C ₅ H ₈	598232	68.119	1.0520E+05	1.9110E+02	0	0	0	200	1.4342	299.49	1.6243
49	1-Pentyne	C ₅ H ₈	627190	68.119	8.6200E+04	2.5660E+02	0	0	0	200	1.3752	313.33	1.6660
50	2-Pentyne	C ₅ H ₈	627214	68.119	6.8671E+04	2.4666E+02	0	0	0	200	1.1800	329.27	1.4989

51	1-Hexyne	C ₆ H ₁₀	693027	82.145	9.3000E+04	3.2600E+02	0	0	0	200	1.5820	344.48	2.0530
52	2-Hexyne	C ₆ H ₁₀	764352	82.145	9.4860E+04	2.5415E+02	0	0	0	300	1.7110	357.67	1.8576
53	3-Hexyne	C ₆ H ₁₀	928494	82.145	8.2795E+04	2.8340E+02	0	0	0	300	1.6781	354.35	1.8322
54	1-Heptyne	C ₇ H ₁₂	628717	96.172	8.5122E+04	4.0247E+02	0	0	0	192.22	1.6248	372.93	2.3522
55	1-Octyne	C ₈ H ₁₄	629050	110.199	9.1748E+04	4.7140E+02	0	0	0	193.55	1.8299	399.35	2.8000
56	Vinylacetylene ³	C ₄ H ₄	689974	52.076	6.8720E+04	1.3500E+02	0	0	0	200	0.9572	278.25	1.0628
57	Cyclopentane	C ₅ H ₁₀	287923	70.134	1.2253E+05	-4.0380E+02	1.7344E+00	-1.0975E-03	0	179.28	0.9956	322.4	1.3584
58	Methylcyclopentane	C ₆ H ₁₂	96377	84.161	1.5592E+05	-4.9000E+02	2.1383E+00	-1.5585E-03	0	130.73	1.2492	366.48	1.8682
59	Ethylcyclopentane	C ₇ H ₁₄	1640897	98.188	1.7852E+05	-5.1835E+02	2.3255E+00	-1.6818E-03	0	134.71	1.4678	301.82	1.8767
60	Cyclohexane	C ₆ H ₁₂	110827	84.161	-2.2060E+05	3.1183E+03	-9.4216E+00	1.0687E-02	0	279.69	1.4836	400	2.0323
61	Methylcyclohexane	C ₇ H ₁₄	108872	98.188	1.3134E+05	-6.3100E+01	8.1250E-01	0	0	146.58	1.3955	320	1.9435
62	1,1-Dimethylcyclohexane	C ₈ H ₁₆	590669	112.215	1.3450E+05	8.7650E+00	8.1151E-01	0	0	239.66	1.8321	392.7	2.6309
63	Ethylcyclohexane	C ₈ H ₁₆	1678917	112.215	1.3236E+05	7.2740E+01	6.4738E-01	0	0	161.84	1.6109	404.95	2.6798
64	Cyclopentene	C ₅ H ₈	142290	68.119	1.2538E+05	-3.4970E+02	1.1430E+00	0	0	138.13	0.9888	317.38	1.2953
65	1-Methylcyclopentene	C ₆ H ₁₀	693890	82.145	5.3271E+04	3.2792E+02	0	0	0	200	1.1885	348.64	1.6760
66	Cyclohexene	C ₆ H ₁₀	110838	82.145	1.0585E+05	-6.0000E+01	6.8000E-01	0	0	169.67	1.1525	356.12	1.7072
67	Benzene	C ₆ H ₆	71432	78.114	1.2944E+05	-1.6950E+02	6.4781E-01	0	0	278.68	1.3251	353.24	1.5040
68	Toluene	C ₇ H ₈	108883	92.141	1.4014E+05	-1.5230E+02	6.9500E-01	0	0	178.18	1.3507	500	2.3774
69	<i>o</i> -Xylene	C ₈ H ₁₀	95476	106.167	3.6500E+04	1.0175E+03	-2.6300E+00	3.0200E-03	0	248	1.7315	415	2.2166
70	<i>m</i> -Xylene	C ₈ H ₁₀	108383	106.167	1.7555E+05	-2.9950E+02	1.0880E+00	0	0	225.3	1.6330	360	2.0873
71	<i>p</i> -Xylene	C ₈ H ₁₀	106423	106.167	-3.5500E+04	1.2872E+03	-2.5990E+00	2.4260E-03	0	286.41	1.7697	600	3.2520
72	Ethylbenzene	C ₈ H ₁₀	100414	106.167	1.3316E+05	4.4507E+01	3.9645E-01	0	0	178.15	1.5367	409.35	2.1781
73	Propylbenzene	C ₉ H ₁₂	103651	120.194	2.3477E+05	-8.0022E+02	3.4037	-3.1739E-03	0	173.59	1.8182	370	2.4389
74	1,2,4-Trimethylbenzene	C ₉ H ₁₂	95636	120.194	1.7880E+05	-1.2847E+02	8.3741E-01	0	0	229.33	1.9338	350	2.3642
75	Isopropylbenzene	C ₉ H ₁₂	98828	120.194	1.8290E+05	-1.7400E+02	9.1200E-01	0	0	177.14	1.8069	500	3.2390
76	1,3,5-Trimethylbenzene	C ₉ H ₁₂	108678	120.194	1.4805E+05	1.9700E+01	6.2260E-01	0	0	228.42	1.8503	350	2.3121
77	<i>p</i> -Isopropyltoluene	C ₁₀ H ₁₄	99876	134.221	1.4560E+05	2.4870E+02	1.8700E-01	0	0	205.25	2.0452	450.28	2.9550
78	Naphthalene	C ₁₀ H ₈	91203	128.174	2.9800E+04	5.2750E+02	0	0	0	353.43	2.1623	491.14	2.8888
79	Biphenyl	C ₁₂ H ₁₀	92524	154.211	1.2177E+05	4.2930E+02	0	0	0	342.2	2.6868	533.37	3.5075
80	Styrene	C ₈ H ₈	100425	104.152	1.1334E+05	2.9020E+02	-6.0510E-01	1.3567E-03	0	242.54	1.6749	418.31	2.2816
81	<i>m</i> -Terphenyl	C ₁₈ H ₁₄	92068	230.309	1.9567E+05	5.9407E+02	0	0	0	360	4.0954	650	5.8182
82	Methanol	CH ₄ O	67561	32.042	1.0580E+05	-3.6223E+02	9.3790E-01	0	0	175.47	0.7112	400	1.1097
83	Ethanol	C ₂ H ₆ O	64175	46.069	1.0264E+05	-1.3963E+02	-3.0341E-02	2.0386E-03	0	159.05	0.8787	390	1.6450
84	1-Propanol	C ₃ H ₈ O	71238	60.096	1.5876E+05	-6.3500E+02	1.9690E+00	0	0	146.95	1.0797	400	2.1980
85	1-Butanol	C ₄ H ₁₀ O	71363	74.123	1.9120E+05	-7.3040E+02	2.2998E+00	0	0	184.51	1.3473	390.81	2.5701
86	2-Butanol	C ₄ H ₁₀ O	78922	74.123	2.0670E+05	-1.0204E+03	3.2900E+00	0	0	158.45	1.2762	372.7	2.8340
87	2-Propanol	C ₃ H ₈ O	67630	60.096	7.2355E+05	-8.0950E+03	3.6662E+01	-6.6395E-02	4.4064E-05	185.28	1.1189	480	2.8122
88	2-Methyl-2-propanol	C ₄ H ₁₀ O	75650	74.123	-9.2546E+05	7.8949E+03	-1.7661E+01	1.3617E-02	0	298.96	2.2016	460	2.9455
89	1-Pentanol	C ₅ H ₁₂ O	71410	88.150	2.0120E+05	-6.5130E+02	2.2750E+00	0	0	200.14	1.6198	389.15	2.9227
90	2-Methyl-1-butanol	C ₅ H ₁₂ O	137326	88.150	8.2937E+04	4.5998E+02	0.0000E+00	0	0	250	1.9793	401.85	2.6778
91	3-Methyl-1-butanol	C ₅ H ₁₂ O	123513	88.150	-5.3777E+04	8.8342E+02	0	0	0	295.52	2.0729	350	2.5542
92	1-Hexanol	C ₆ H ₁₄ O	111273	102.177	4.8466E+05	-2.7613E+03	6.5555E+00	0	0	228.55	1.9599	320	2.7233
93	1-Heptanol	C ₇ H ₁₆ O	111706	116.203	4.3790E+05	-2.0947E+03	5.2090E+00	0	0	239.15	2.3487	370	3.7597
94	Cyclohexanol	C ₆ H ₁₂ O	108930	100.161	-4.0000E+04	8.5300E+02	0	0	0	296.6	2.1300	434	3.3020
95	Ethylene glycol	C ₂ H ₄ O ₂	107211	62.068	3.5540E+04	4.3678E+02	-1.8486E-01	0	0	260.15	1.3666	493.15	2.0598
96	1,2-Propylene glycol	C ₃ H ₈ O ₂	57556	76.095	5.8080E+04	4.4520E+02	0	0	0	213.15	1.5297	460.75	2.6321
97	Phenol	C ₆ H ₆ O	108952	94.113	1.0172E+05	3.1761E+02	0	0	0	314.06	2.0147	425	2.3670
98	<i>o</i> -Cresol	C ₇ H ₈ O	95487	108.140	-1.8515E+05	3.1480E+03	-8.0367E+00	7.2540E-03	0	304.2	2.3297	400	2.5243
99	<i>m</i> -Cresol	C ₇ H ₈ O	108394	108.140	-2.4670E+05	3.2568E+03	-7.4202E+00	6.0467E-03	0	285.39	2.1895	400	2.5578
100	<i>p</i> -Cresol	C ₇ H ₈ O	106445	108.140	2.5998E+05	-1.1123E+03	4.9427E+00	-5.4367E-03	0	307.93	2.2740	400	2.5794

TABLE 2-196 Heat Capacities of Inorganic and Organic Liquids (Continued)

Cmpd. no.	Name	Formula	CAS no.	Mol wt	C1	C2	C3	C4	C5	T_{\min} , K	C_p at T_{\min} $\times 1E-05$	T_{\max} , K	C_p at T_{\max} $\times 1E-05$
101	Dimethyl ether	<chem>C2H6O</chem>	115106	46.069	1.1010E+05	-1.5747E+02	5.1853E-01	0	0	131.65	0.9836	250	1.0314
102	Methyl ethyl ether	<chem>C3H8O</chem>	540670	60.096	1.2977E+05	-3.3196E+02	1.3869E+00	0	0	218.9	1.2356	328.35	1.7030
103	Methyl- <i>n</i> -propyl ether	<chem>C4H10O</chem>	557175	74.123	1.4411E+05	-1.0209E+02	5.8113E-01	0	0	133.97	1.4086	312.2	1.6888
104	Methyl isopropyl ether	<chem>C4H10O</chem>	598538	74.123	1.4344E+05	-1.5407E+02	7.2550E-01	0	0	127.93	1.3560	310	1.6540
105	Methyl- <i>n</i> -butyl ether	<chem>C5H12O</chem>	628284	88.150	1.7785E+05	-1.7157E+02	7.4379E-01	0	0	157.48	1.6928	343.35	2.0663
106	Methyl isobutyl ether	<chem>C5H12O</chem>	625445	88.150	5.1380E+04	4.5040E+02	0	0	0	300	1.8650	370	2.1803
107	Methyl tert-butyl ether	<chem>C5H12O</chem>	1634044	88.150	1.4012E+05	-9.0000E+00	5.6300E-01	0	0	164.55	1.5388	328.35	1.9786
108	Diethyl ether	<chem>C4H10O</chem>	60297	74.123	4.4400E+04	1.3010E+03	-5.5000E+00	8.7630E-03	0	156.92	1.4698	460	3.3202
109	Ethyl propyl ether	<chem>C5H12O</chem>	628320	88.150	1.0368E+05	7.2630E+02	-2.6047E+00	4.0957E-03	0	145.65	1.6686	320	2.0358
110	Ethyl isopropyl ether	<chem>C5H12O</chem>	625547	88.150	1.0625E+05	2.9215E+02	0	0	0	298.15	1.9335	326.15	2.0153
111	Methyl phenyl ether	<chem>C7H8O</chem>	100663	108.140	1.5094E+05	9.3455E+01	2.3602E-01	0	0	298.15	1.9978	484.2	2.5153
112	Diphenyl ether	<chem>C12H10O</chem>	101848	170.211	1.3416E+05	4.4767E+02	0	0	0	300.03	2.6847	570	3.8933
113	Formaldehyde ⁴	<chem>CH2O</chem>	50000	30.026	6.1900E+04	2.8300E+01	0	0	0	204	0.6767	234	0.6852
114	Acetaldehyde	<chem>C2H4O</chem>	75070	44.053	1.1510E+05	-4.3300E+02	1.4250E+00	0	0	150.15	0.8221	294	1.1097
115	1-Propanal	<chem>C3H6O</chem>	123386	58.080	9.9306E+04	1.1573E+02	0	0	0	200	1.2245	328.75	1.3735
116	1-Butanal	<chem>C4H8O</chem>	123728	72.107	6.5682E+04	1.3291E+03	-7.1579E+00	1.2755E-02	0	176.75	1.4741	300	1.6459
117	1-Pentanal	<chem>C5H10O</chem>	110623	86.134	1.1205E+05	2.5778E+02	0	0	0	200	1.6361	376.15	2.0901
118	1-Hexanal	<chem>C6H12O</chem>	66251	100.161	1.1770E+05	3.2952E+02	0	0	0	217.15	1.8926	401.45	2.4999
119	1-Heptanal	<chem>C7H14O</chem>	111717	114.188	2.2236E+05	-1.0517E+02	6.5074E-01	0	0	229.8	2.3256	381.25	2.7685
120	1-Octanal	<chem>C8H16O</chem>	124130	128.214	1.3065E+05	4.6361E+02	0	0	0	246	2.4470	447.15	3.3795
121	1-Nomanal	<chem>C9H18O</chem>	124196	142.241	1.3682E+05	5.3129E+02	0	0	0	255.15	2.7238	468.15	3.8554
122	1-Decanal	<chem>C10H20O</chem>	112312	156.268	1.5046E+05	5.8663E+02	0	0	0	267.15	3.0718	488.15	4.3682
123	Acetone	<chem>C3H6O</chem>	67641	58.080	1.3560E+05	-1.7700E+02	2.8370E-01	6.8900E-04	0	178.45	1.1696	329.44	1.3271
124	Methyl ethyl ketone	<chem>C4H8O</chem>	78933	72.107	1.3230E+05	2.0087E+02	-9.5970E-01	1.9533E-03	0	186.48	1.4905	373.15	1.7511
125	2-Pentanone	<chem>C5H10O</chem>	107879	86.134	1.9459E+05	-2.6386E+02	7.6808E-01	0	0	196.29	1.7239	375.46	2.0380
126	Methyl isopropyl ketone	<chem>C5H10O</chem>	563804	86.134	1.8361E+05	-2.6885E+02	8.6080E-01	0	0	181.15	1.6316	367.55	2.0108
127	2-Hexanone	<chem>C6H12O</chem>	591786	100.161	2.7249E+05	-7.9070E+02	2.5834E+00	-2.0040E-03	0	220.87	2.0228	382.62	2.3590
128	Methyl isobutyl ketone	<chem>C6H12O</chem>	108101	100.161	1.2492E+05	3.0410E+02	0	0	0	298.15	2.1559	390	2.4352
129	3-Methyl-2-pentanone	<chem>C6H12O</chem>	565617	100.161	9.9815E+04	3.4672E+02	0	0	0	298.15	2.0319	390.55	2.3523
130	3-Pentanone	<chem>C5H10O</chem>	96220	86.134	1.9302E+05	-1.7643E+02	5.6690E-01	0	0	234.18	1.8279	375.14	2.0661
131	Ethyl isopropyl ketone	<chem>C6H12O</chem>	565695	100.161	8.3630E+04	3.9900E+02	0	0	0	298.15	2.0259	425	2.5320
132	Diisopropyl ketone	<chem>C7H14O</chem>	565800	114.188	1.7927E+05	2.8370E+01	5.3750E-01	0	0	204.81	2.0763	410	2.8126
133	Cyclohexanone	<chem>C6H10O</chem>	108941	98.145	1.0980E+05	2.6150E+02	0	0	0	290	1.8563	486.5	2.3702
134	Methyl phenyl ketone	<chem>C8H8O</chem>	98862	120.151	7.2692E+04	3.3783E+02	3.5572E-01	0	0	298.2	2.0506	532.12	3.5318
135	Formic acid	<chem>CH2O2</chem>	64186	46.026	7.8060E+04	7.1540E+01	0	0	0	281.45	0.9820	380	1.0525
136	Acetic acid	<chem>C2H4O2</chem>	64197	60.053	1.3964E+05	-3.2080E+02	8.9850E-01	0	0	289.81	1.2213	391.05	1.5159
137	Propionic acid	<chem>C3H6O2</chem>	79094	74.079	2.1366E+05	-7.0270E+02	1.6605E+00	0	0	252.45	1.4209	414.32	2.0756
138	<i>n</i> -Butyric acid	<chem>C4H8O2</chem>	107926	88.106	2.3770E+05	-7.4640E+02	1.8290E+00	0	0	267.95	1.6902	436.42	2.6031
139	Isobutyric acid	<chem>C4H8O2</chem>	79312	88.106	1.2754E+05	-6.5350E+01	8.2867E-01	0	0	270	1.7031	427.65	2.5114
140	Benzoic acid	<chem>C7H6O2</chem>	65850	122.123	-5.4800E+03	6.4712E+02	0	0	0	395.45	2.5042	450	2.8572
141	Acetic anhydride	<chem>C4H6O3</chem>	108247	102.090	3.6600E+04	5.1100E+02	0	0	0	250	1.6435	350	2.1545
142	Methyl formate	<chem>C2H4O2</chem>	107313	60.053	1.3020E+05	-3.9600E+02	1.2100E+00	0	0	174.15	1.2991	304.9	1.2195
143	Methyl acetate	<chem>C3H6O2</chem>	79209	74.079	6.1260E+04	2.7090E+02	0	0	0	253.4	1.2991	373.4	1.6241
144	Methyl propionate	<chem>C4H8O2</chem>	554121	88.106	7.1140E+04	3.3550E+02	0	0	0	300	1.7179	390	2.0198
145	Methyl- <i>n</i> -butyrate	<chem>C5H10O2</chem>	623427	102.133	1.0293E+05	1.2910E+02	6.2516E-01	0	0	277.25	1.8678	415.87	2.6474
146	Ethyl formate	<chem>C3H6O2</chem>	109944	74.079	8.0000E+04	2.2360E+02	0	0	0	254.2	1.3684	374.2	1.6367
147	Ethyl acetate	<chem>C4H8O2</chem>	141786	88.106	2.2623E+05	-6.2480E+02	1.4720E+00	0	0	189.6	1.6068	350.21	1.8796
148	Ethyl propionate	<chem>C5H10O2</chem>	105373	102.133	7.6330E+04	4.0010E+02	0	0	0	298.15	1.9562	410	2.4037

149	Ethyl- <i>n</i> -butyrate	C ₈ H ₁₆ O ₂	105544	116.160	8.2434E+04	4.2245E+02	2.0992E-01	0	0	285.5	2.2015	428.25	3.0185
150	<i>n</i> -Propyl formate	C ₆ H ₁₀ O ₂	110747	88.106	7.5700E+04	3.2610E+02	0	0	0	298.15	1.7293	398.15	2.0554
151	<i>n</i> -Propyl acetate	C ₆ H ₁₀ O ₂	109604	102.133	8.3400E+04	3.8410E+02	0	0	0	274.7	1.8891	404.7	2.3885
152	<i>n</i> -Butyl acetate	C ₈ H ₁₆ O ₂	123864	116.160	1.1730E+05	3.5220E+02	0	0	0	289.58	2.1929	429.58	2.6860
153	Methyl benzoate	C ₈ H ₈ O ₂	93583	136.150	1.1950E+05	2.9400E+02	0	0	0	260.75	1.9616	472.65	2.5846
154	Ethyl benzoate	C ₉ H ₁₀ O ₂	93890	150.177	1.2450E+05	3.7060E+02	0	0	0	238.45	2.1287	486.55	3.0482
155	Vinyl acetate	C ₄ H ₆ O ₂	108054	86.090	1.3630E+05	-1.0617E+02	7.5175E-01	0	0	259.56	1.5939	389.35	2.0892
156	Methylamine	CH ₃ N	74895	31.057	9.2520E+04	3.7450E+01	0	0	0	179.69	0.9925	266.82	1.0251
157	Dimethylamine	C ₂ H ₇ N	124403	45.084	-2.1487E+05	3.7872E+03	-1.3781E+01	1.6924E-02	0	180.96	1.1947	298.15	1.3779
158	Trimethylamine	C ₃ H ₉ N	75503	59.111	1.3605E+05	-2.8800E+02	9.9130E-01	0	0	156.08	1.1525	276.02	1.3208
159	Ethylamine	C ₂ H ₇ N	75047	45.084	1.2170E+05	3.8993E+01	0	0	0	192.15	1.2919	289.73	1.3300
160	Diethylamine	C ₄ H ₁₁ N	109897	73.138	1.0133E+05	2.4318E+02	0	0	0	223.35	1.5564	328.6	1.8124
161	Triethylamine	C ₆ H ₁₅ N	121448	101.192	1.1148E+05	3.6813E+02	0	0	0	200	1.8511	361.92	2.4471
162	<i>n</i> -Propylamine	C ₃ H ₉ N	107108	59.111	1.3953E+05	7.8000E+01	0	0	0	188.36	1.5422	340	1.6605
163	di- <i>n</i> -Propylamine	C ₆ H ₁₅ N	142847	101.192	4.9120E+04	5.6224E+02	0	0	0	277.9	2.0537	407.9	2.7846
164	Isopropylamine	C ₃ H ₉ N	75310	59.111	-3.2469E+04	1.9771E+03	-7.0145E+00	8.6913E-03	0	177.95	1.4621	320	1.6671
165	Diisopropylamine	C ₆ H ₁₅ N	108189	101.192	9.8434E+04	4.2904E+02	0	0	0	275	2.1642	357.05	2.5162
166	Aniline	C ₆ H ₇ N	62533	93.128	1.4150E+05	1.7120E+02	0	0	0	267.13	1.8723	457.15	2.1976
167	<i>N</i> -Methylaniline	C ₇ H ₉ N	100618	107.155	1.2850E+05	1.0020E+02	3.7400E-01	0	0	216.15	1.6763	469.02	2.5777
168	<i>N,N</i> -Dimethylaniline	C ₈ H ₁₁ N	121697	121.182	4.1860E+04	5.2750E+02	0	0	0	343.58	2.2310	513.58	3.1277
169	Ethylene oxide	C ₂ H ₄ O	75218	44.053	1.4471E+05	-7.5887E+02	2.8261E+00	-3.0640E-03	0	160.65	0.8303	283.85	0.8693
170	Furan	C ₄ H ₄ O	110009	68.075	1.1437E+05	-2.1569E+02	7.2691E-01	0	0	187.55	0.9949	304.5	1.1609
171	Thiophene	C ₄ H ₄ S	110021	84.142	8.1350E+04	1.2980E+02	-3.9000E-03	0	0	234.94	1.1163	357.31	1.2723
172	Pyridine	C ₅ H ₅ N	110861	79.101	1.0785E+05	-3.4787E+01	3.9565E-01	0	0	231.51	1.2100	388.41	1.5403
173	Formamide ⁵	CH ₃ NO	75127	45.041	6.3400E+04	1.5060E+02	0	0	0	292	1.0738	493	1.3765
174	<i>N,N</i> -Dimethylformamide	C ₃ H ₇ NO	68122	73.095	1.4790E+05	-1.0600E+02	3.8400E-01	0	0	273.82	1.4767	466.44	1.8200
175	Acetamide	C ₂ H ₅ NO	60355	59.068	1.0230E+05	1.2870E+02	0	0	0	354.15	1.4788	571	1.7579
176	<i>N</i> -Methylacetamide	C ₃ H ₇ NO	79163	73.095	6.2600E+04	2.4340E+02	0	0	0	359	1.4998	538.5	1.9367
177	Acetonitrile	C ₂ H ₃ N	75058	41.053	9.7582E+04	-1.2220E+02	3.4085E-01	0	0	229.32	0.8748	354.75	0.9713
178	Propionitrile	C ₃ H ₅ N	107120	55.079	1.1819E+05	-1.2098E+02	4.2075E-01	0	0	180.26	1.1005	370.5	1.3112
179	<i>n</i> -Butyronitrile	C ₄ H ₇ N	109740	69.106	1.0400E+05	1.7400E+02	0	0	0	161.25	1.3206	390.75	1.7199
180	Benzonitrile	C ₇ H ₅ N	100470	103.123	7.6900E+04	3.1420E+02	0	0	0	260.4	1.5872	464.15	2.2274
181	Methyl mercaptan	CH ₃ S	74931	48.109	1.1530E+05	-2.6323E+02	6.0412E-01	0	0	150.18	0.8939	298.15	0.9052
182	Ethyl mercaptan	C ₂ H ₅ S	75081	62.136	1.3467E+05	-2.3439E+02	5.9656E-01	0	0	125.26	1.1467	315.25	1.2007
183	<i>n</i> -Propyl mercaptan	C ₃ H ₇ S	107039	76.163	1.6733E+05	-3.1910E+02	8.1270E-01	0	0	159.95	1.3708	340.87	1.5299
184	<i>n</i> -Butyl mercaptan	C ₄ H ₉ S	109795	90.189	2.3219E+05	-8.0435E+02	2.7063E+00	-2.3017E-03	0	157.46	1.6365	390	1.9359
185	Isobutyl mercaptan	C ₄ H ₁₀ S	513440	90.189	1.7336E+05	-2.1732E+02	7.0933E-01	0	0	128.31	1.5715	361.64	1.8754
186	sec-Butyl mercaptan ²	C ₄ H ₁₀ S	513531	90.189	1.9789E+05	-4.9154E+02	1.7219E+00	-1.2499E-03	0	133.02	1.6003	370	1.8844
187	Dimethyl sulfide	C ₂ H ₆ S	75183	62.136	1.4695E+05	-3.8006E+02	1.2035E+00	-8.4787E-04	0	174.88	1.1276	310.48	1.1959
188	Methyl ethyl sulfide	C ₃ H ₈ S	624895	76.163	1.6124E+05	-2.8861E+02	7.8179E-01	0	0	167.23	1.3484	339.8	1.5344
189	Diethyl sulfide	C ₄ H ₁₀ S	352932	90.189	2.3852E+05	-1.0384E+03	4.0587E+00	-4.4691E-03	0	181.95	1.5703	322.08	1.7579
190	Fluoromethane ²	CH ₃ F	593533	34.033	7.4746E+04	-1.3232E+02	5.3772E-01	0	0	140	0.6676	220	0.7166
191	Chloromethane	CH ₃ Cl	74873	50.488	9.6910E+04	-2.0790E+02	3.7456E-01	4.8800E-04	0	175.43	0.7460	373.15	0.9684
192	Trichloromethane	CHCl ₃	67663	119.377	1.2485E+05	-1.6634E+02	4.3209E-01	0	0	233.15	1.0956	366.48	1.2192
193	Tetrachloromethane	CCl ₄	56235	153.822	-7.5270E+05	8.9661E+03	-3.0394E+01	3.4455E-02	0	250.33	1.2763	388.71	1.6374
194	Bromomethane	CH ₃ Br	74839	94.939	1.2973E+05	-5.9654E+02	2.1600E+00	-2.4234E-03	0	184.45	0.7798	276.71	0.7870
195	Fluoroethane	C ₂ H ₅ F	353366	48.060	8.3303E+04	6.5454E+01	0	0	0	200	0.9639	281.48	1.0173
196	Chloroethane	C ₂ H ₅ Cl	75003	64.514	1.2790E+05	-3.4515E+02	9.1500E-01	0	0	134.8	0.9800	340	1.1632
197	Bromoethane	C ₂ H ₅ Br	74964	108.966	9.4364E+04	-1.0912E+02	4.4032E-01	0	0	160	0.8818	320	1.0453

TABLE 2-196 Heat Capacities of Inorganic and Organic Liquids (Concluded)

Cmpd. no.	Name	Formula	CAS no.	Mol wt	C1	C2	C3	C4	C5	T_{\min} , K	C_p at T_{\min} × 1E-05	T_{\max} , K	C_p at T_{\max} × 1E-05
198	1-Chloropropane	C ₃ H ₇ Cl	540545	78.541	9.6344E+04	1.1752E+02	0	0	0	230	1.2337	319.67	1.3391
199	2-Chloropropane	C ₃ H ₇ Cl	75296	78.541	6.9362E+04	2.1501E+02	0	0	0	200	1.1236	308.85	1.3577
200	1,1-Dichloropropane	C ₃ H ₅ Cl ₂	78999	112.986	7.0010E+04	2.6660E+02	0	0	0	280	1.4466	420	1.8198
201	1,2-Dichloropropane	C ₃ H ₅ Cl ₂	78875	112.986	1.1094E+05	8.3496E+00	4.7218E-01	0	0	286	1.5195	429	2.0142
202	Vinyl chloride	C ₂ H ₃ Cl	75014	62.499	-1.0320E+04	3.2280E+02	0	0	0	200	0.5424	400	1.1880
203	Fluorobenzene	C ₆ H ₅ F	462066	96.104	-9.9120E+05	1.1734E+04	-4.0669E+01	4.7333E-02	0	239.99	1.3675	319.99	1.5018
204	Chlorobenzene	C ₆ H ₅ Cl	108907	112.558	-1.3075E+06	1.5338E+04	-5.3974E+01	6.3483E-02	0	227.95	1.3617	360	1.8101
205	Bromobenzene	C ₆ H ₅ Br	108861	157.010	1.2160E+05	-9.4500E+00	3.5800E-01	0	0	293.15	1.4960	495.08	2.0467
206	Air		132259100	28.951	-2.1446E+05	9.1851E+03	-1.0612E+02	4.1616E-01	0	75	0.5307	115	0.7132
207	Hydrogen (eqn. 2)	H ₂	1333740	2.016	6.6653E+01	6.7659E+03	-1.2363E+02	4.7827E+02	0	13.95	0.1262	32	1.3122
208	Helium-4 ⁶	He	7440597	4.003	3.8722E+05	-4.6557E+05	2.1180E+05	-4.2494E+04	3.2129E+03	2.2	0.1087	4.6	0.2965
209	Neon	Ne	7440019	20.180	1.0341E+06	-1.3877E+05	7.1540E+03	-1.6255E+02	1.3841E+00	24.56	0.3666	40	0.6980
210	Argon	Ar	7440371	39.948	1.3439E+05	-1.9894E+03	1.1043E+01	0	0	83.78	0.4523	135	0.6708
211	Fluorine	F ₂	7782414	37.997	-9.4585E+04	7.5299E+03	-1.3960E+02	1.1301E+00	-3.3241E-03	58	0.5541	98	0.5966
212	Chlorine	Cl ₂	7782505	70.905	6.3936E+04	4.6350E+01	-1.6230E-01	0	0	172.12	0.6711	239.12	0.6574
213	Bromine	Br ₂	7726956	159.808	3.7570E+04	3.2850E+02	-6.7000E-01	0	0	265.9	0.7755	305.37	0.7541
214	Oxygen	O ₂	7782447	31.999	1.7543E+05	-6.1523E+03	1.1392E+02	-9.2382E-01	2.7963E-03	54.36	0.5365	142	0.9066
215	Nitrogen	N ₂	7727379	28.014	2.8197E+05	-1.2281E+04	2.4800E+02	-2.2182E+00	7.4902E-03	63.15	0.5593	112	0.7960
216	Ammonia (eqn. 2)	NH ₃	7664417	17.031	6.1289E+01	8.0925E+04	7.9940E+02	-2.6510E+03	0	203.15	0.7575	401.15	4.1847
217	Hydrazine	N ₂ H ₄	302012	32.045	7.9815E+04	5.0929E+01	4.3379E-02	0	0	274.69	0.9708	653.15	1.3158
218	Nitrous oxide	N ₂ O	10024972	44.013	6.7556E+04	5.4373E+01	0	0	0	182.3	0.7747	200	0.7843
219	Nitric oxide	NO	10102439	30.006	-2.9796E+06	7.6602E+04	-6.5259E+02	1.8879E+00	0	109.5	0.6229	150	1.9909
220	Cyanogen	C ₂ N ₂	460195	52.036	3.1322E+06	-2.4320E+04	4.8844E+01	0	0	245.25	1.0557	300	2.3216
221	Carbon monoxide (eqn. 2)	CO	630080	28.010	6.5429E+01	2.8723E+04	-8.4739E+02	1.9596E+03	0	68.15	0.5912	132	6.4799
222	Carbon dioxide	CO ₂	124389	44.010	-8.3043E+06	1.0437E+05	-4.3333E+02	6.0052E-01	0	220	0.7827	290	1.6603
223	Carbon disulfide	CS ₂	75150	76.143	8.5600E+04	-1.2200E+02	5.6050E-01	-1.4520E-03	2.0080E-06	161.11	0.7577	552	1.3125
224	Hydrogen fluoride	HF	7664393	20.006	6.2520E+04	-2.2302E+02	6.2970E-01	0	0	189.79	0.4288	292.67	0.5119
225	Hydrogen chloride	HCl	7647010	36.461	4.7300E+04	9.0000E+01	0	0	0	165	0.6215	185	0.6395
226	Hydrogen bromide	HBr	10035106	80.912	5.7720E+04	9.9000E+00	0	0	0	185.15	0.5955	206.45	0.5976
227	Hydrogen cyanide	HCN	74908	27.026	9.5398E+04	-1.9752E+02	3.8830E-01	0	0	259.83	0.7029	298.85	0.7105
228	Hydrogen sulfide (eqn. 2)	H ₂ S	7783064	34.082	6.4666E+01	4.9354E+04	2.2493E+01	-1.6230E+03	0	187.68	0.6733	370	4.9183
229	Sulfur dioxide	SO ₂	7446095	64.065	8.5743E+04	5.7443E+00	0	0	0	197.67	0.8688	350	0.8775
230	Sulfur trioxide	SO ₃	7446119	80.064	2.5809E+05	0.0000E+00	0	0	0	303.15	2.5809	303.15	2.5809
231	Water	H ₂ O	7732185	18.015	2.7637E+05	-2.0901E+03	8.1250E+00	-1.4116E-02	9.3701E-06	273.16	0.7615	533.15	0.8939

All substances are listed in alphabetical order in Table 2-6a.

Compiled from Daubert, T. E., R. P. Danner, H. M. Sibul, and C. C. Stebbins, DIPPR Data Compilation of Pure Compound Properties, Project 801 Sponsor Release, July, 1993, Design Institute for Physical Property Data, AIChE, New York, NY; and from Thermodynamics Research Center, "Selected Values of Properties of Hydrocarbons and Related Compounds," Thermodynamics Research Center Hydrocarbon Project, Texas A&M University, College Station, Texas (extant 1994).

Temperatures are expressed in kelvins; liquid heat capacities are in J/(kmol·K).

J/(kmol·K) × 2.390E-04 = cal/(gmol·°C); J/(kmol·K) × 2.390059E-04 = Btu/(lbmol·°F).

Equation 1, heat capacity = C1 + C2 × T + C3 × T² + C4 × T³ + C5 × T⁴, should be used except as otherwise specified.

Equation 2 is heat capacity = C1²t + C2 - (2 × C1 × C3)t - (C1 × C4)t² - (C3^{2/3})t³ - (C3 × C4/2)t⁴ - (C4^{2/5})t⁵, t = (1 - T_r) and T_r is the reduced temperature, T/T_c.

¹ Coefficients are for the monomer and are hypothetical above 473 K.

² For the saturated heat capacity.

³ Coefficients are hypothetical; compound *decomposes violently* on heating.

⁴ Coefficients are hypothetical and are based on predicted data.

⁵ Coefficients are hypothetical.

⁶ Exhibits superfluid properties below 2.2 K.

TABLE 2-197 Specific Heats of Organic Solids

Recalculated from *International Critical Tables*, vol. 5, pp. 101-105

Compound	Formula	Temperature, °C	sp ht, cal/g °C
Acetic acid	C ₂ H ₄ O ₂	-200 to +25	0.330 + 0.00080 <i>t</i>
Acetone	C ₃ H ₆ O	-210 to -80	0.540 + 0.0156 <i>t</i>
Aminobenzoic acid (<i>o</i> -)	C ₇ H ₇ NO ₂	85 to mp	0.254 + 0.00136 <i>t</i>
(<i>m</i> -)	C ₇ H ₇ NO ₂	120 to mp	0.253 + 0.00122 <i>t</i>
(<i>p</i> -)	C ₇ H ₇ NO ₂	128 to mp	0.287 + 0.00088 <i>t</i>
Aniline	C ₆ H ₇ N		0.741
Anthracene	C ₁₄ H ₁₀	50	0.308
		100	0.350
		150	0.382
Anthraquinone	C ₁₄ H ₈ O ₂	0 to 270	0.255 + 0.00069 <i>t</i>
Apiol	C ₁₂ H ₁₄ O ₄	10	0.299
Azobenzene	C ₁₂ H ₁₀ N ₂	28	0.330
Benzene	C ₆ H ₆	-250	0.0399
		-225	0.0908
		-200	0.124
		-150	0.170
		-100	0.227
		-50	0.299
		0	0.375
Benzoic acid	C ₇ H ₆ O ₂	20 to mp	0.287 + 0.00050 <i>t</i>
Benzophenone	C ₁₃ H ₁₀ O	-150	0.115
		-100	0.172
		-50	0.220
		0	0.275
		+20	0.303
Betol	C ₁₇ H ₁₂ O ₃	-150	0.129
		-100	0.167
		0	0.248
		+50	0.308
Bromiodobenzene (<i>o</i> -)	C ₆ H ₄ BrI	-50 to 0	0.143 + 0.00025 <i>t</i>
(<i>m</i> -)	C ₆ H ₄ BrI	-75 to -15	0.143
(<i>p</i> -)	C ₆ H ₄ BrI	-40 to 50	0.116 + 0.00032 <i>t</i>
Bromonaphthalene (β-)	C ₁₀ H ₇ Br	41	0.260
Bromophenol	C ₆ H ₅ BrO	32	0.263
Camphene	C ₁₀ H ₁₆	35	0.380
Capric acid	C ₁₀ H ₂₀ O ₂	8	0.695
Caprylic acid	C ₈ H ₁₆ O ₂	-2	0.628
Carbon tetrachloride	CCl ₄	-240	0.013
		-200	0.081
		-160	0.131
		-120	0.162
		-80	0.182
		-40	0.201
		15	0.387
Cerotic acid	C ₂₇ H ₅₄ O ₂	15	0.387
Chloral alcoholate	C ₄ H ₇ Cl ₃ O ₂	78	0.509
hydrate	C ₂ H ₃ Cl ₃ O ₂	32	0.213
Chloroacetic acid	C ₂ H ₃ ClO ₂	60	0.363
Chlorobenzoic acid (<i>o</i> -)	C ₇ H ₅ ClO ₂	80 to mp	0.228 + 0.00084 <i>t</i>
(<i>m</i> -)	C ₇ H ₅ ClO ₂	94 to mp	0.232 + 0.00073 <i>t</i>
(<i>p</i> -)	C ₇ H ₅ ClO ₂	180 to mp	0.242 + 0.00055 <i>t</i>
Chlorobromobenzene (<i>o</i> -)	C ₆ H ₄ BrCl	-34	0.192
(<i>m</i> -)	C ₆ H ₄ BrCl	-52	0.150
(<i>p</i> -)	C ₆ H ₄ BrCl	-40	0.150
Crotonic acid	C ₄ H ₆ O ₂	38 to 70	0.520 + 0.00020 <i>t</i>
Cyameliide	C ₃ H ₃ N ₃ O ₃	40	0.263
Cyanamide	CH ₂ N ₂	20	0.547
Cyanuric acid	C ₃ H ₃ N ₃ O ₃	40	0.318
Dextrin	(C ₆ H ₁₀ O ₅) _x	0 to 90	0.291 + 0.00096 <i>t</i>
Dextrose	C ₆ H ₁₂ O ₆	-250	0.016
		-200	0.077
		-100	0.160
		0	0.277
		20	0.300
Dibenzyl	C ₁₄ H ₁₄	28	0.363
Dibromobenzene (<i>o</i> -)	C ₆ H ₄ Br ₂	-36	0.248
(<i>m</i> -)	C ₆ H ₄ Br ₂	-25	0.134
(<i>p</i> -)	C ₆ H ₄ Br ₂	-50 to +50	0.139 + 0.00038 <i>t</i>
Dichloroacetic acid	C ₂ H ₂ Cl ₂ O ₂		0.406
Dichlorobenzene (<i>o</i> -)	C ₆ H ₄ Cl ₂	-48.5	0.185
(<i>m</i> -)	C ₆ H ₄ Cl ₂	-52	0.186
(<i>p</i> -)	C ₆ H ₄ Cl ₂	-50 to +53	0.219 + 0.0021 <i>t</i>
Dicyandiamide	C ₂ H ₄ N ₄	0 to 204	0.456

TABLE 2-197 Specific Heats of Organic Solids (Continued)
 Recalculated from *International Critical Tables*, vol. 5, pp. 101-105

Compound	Formula	Temperature, °C	sp ht, cal/g °C	
Dihydroxybenzene (<i>o</i> -) (<i>m</i> -) (<i>p</i> -)	C ₆ H ₆ O ₂	-163 to mp	0.278 + 0.00098 <i>t</i>	
	C ₆ H ₆ O ₂	-160 to mp	0.269 + 0.00118 <i>t</i>	
	C ₆ H ₆ O ₂	-250	0.025	
		-240	0.038	
		-220	0.061	
		-200	0.081	
Di-iodobenzene (<i>o</i> -) (<i>m</i> -) (<i>p</i> -)	C ₆ H ₄ I ₂	-150 to mp	0.268 + 0.00093 <i>t</i>	
	C ₆ H ₄ I ₂	-50 to +15	0.109 + 0.00026 <i>t</i>	
	C ₆ H ₄ I ₂	-52 to -42	0.100 + 0.00026 <i>t</i>	
Dimethyl oxalate	C ₄ H ₆ O ₄	-50 to +80	0.101 + 0.00026 <i>t</i>	
Dimethylpyrene	C ₇ H ₈ O ₂	10 to 50	0.212 + 0.0044 <i>t</i>	
Dinitrobenzene (<i>o</i> -)	C ₆ H ₄ N ₂ O ₄	50	0.368	
(<i>m</i> -)	C ₆ H ₄ N ₂ O ₄	-160 to mp	0.252 + 0.00083 <i>t</i>	
(<i>p</i> -)	C ₆ H ₄ N ₂ O ₄	-160 to mp	0.248 + 0.00077 <i>t</i>	
Diphenyl	C ₁₂ H ₁₀	119 to mp	0.259 + 0.00057 <i>t</i>	
Diphenylamine	C ₁₂ H ₁₁ N	40	0.385	
Dulcitol	C ₆ H ₁₄ O ₆	26	0.337	
		20	0.282	
Erythritol	C ₄ H ₁₀ O ₄	60	0.351	
Ethyl alcohol	C ₂ H ₆ O (crystalline)	-190	0.232	
		-180	0.248	
		-160	0.282	
		-140	0.318	
		-130	0.376	
		(vitreous)	-190	0.260
		-180	0.296	
		-175	0.380	
		-170	0.399	
		-190 to -40	0.366 + 0.00110 <i>t</i>	
		Ethylene glycol	C ₂ H ₆ O ₂	
Formic acid	CH ₂ O ₂	-22	0.387	
		0	0.430	
Glutaric acid	C ₅ H ₈ O ₄	20	0.299	
Glycerol	C ₃ H ₈ O ₃	-265	0.009	
		-260	0.022	
		-250	0.047	
		-220	0.085	
		-200	0.115	
		-100	0.217	
		0	0.330	
Hexachloroethane	C ₂ Cl ₆	25	0.174	
Hexadecane	C ₁₆ H ₃₄		0.495	
Hydroxyacetanilide	C ₈ H ₉ NO ₂	41 to mp	0.249 + 0.00154 <i>t</i>	
Iodobenzene	C ₆ H ₅ I	40	0.191	
Isopropyl alcohol	C ₃ H ₈ O	-200 to -160	0.051 + 0.00165 <i>t</i>	
Lactose	C ₁₂ H ₂₂ O ₁₁	20	0.287	
		20	0.299	
Lauric acid	C ₁₂ H ₂₄ O ₂	-30 to +40	0.430 + 0.000027 <i>t</i>	
Levoglucofuranose	C ₆ H ₁₀ O ₅	40	0.607	
Levulose	C ₆ H ₁₂ O ₆	20	0.275	
Malonic acid	C ₃ H ₄ O ₄	20	0.275	
Maltose	C ₁₂ H ₂₂ O ₁₁	20	0.320	
Mannitol	C ₆ H ₁₄ O ₆	0 to 100	0.313 + 0.00025 <i>t</i>	
Melamine	C ₃ H ₆ N ₆	40	0.351	
Myristic acid	C ₁₄ H ₂₈ O ₂	0 to 35	0.381 + 0.00545 <i>t</i>	
Naphthalene	C ₁₀ H ₈	-130 to mp	0.281 + 0.00111 <i>t</i>	
Naphthol (α -)	C ₁₀ H ₈ O	50 to mp	0.240 + 0.00147 <i>t</i>	
		61 to mp	0.252 + 0.00128 <i>t</i>	
(β -)	C ₁₀ H ₈ O	0 to 50	0.270 + 0.0031 <i>t</i>	
Naphthylamine (α -)	C ₁₀ H ₉ N		0.269 + 0.000920 <i>t</i>	
Nitroaniline (<i>o</i> -)	C ₆ H ₆ N ₂ O ₂	-160 to mp	0.275 + 0.000946 <i>t</i>	
		-160 to mp	0.276 + 0.001000 <i>t</i>	
		-160 to mp	0.256 + 0.00085 <i>t</i>	
(<i>m</i> -)	C ₆ H ₆ N ₂ O ₂	-163 to mp	0.258 + 0.00091 <i>t</i>	
(<i>p</i> -)	C ₆ H ₆ N ₂ O ₂	-160 to mp	0.247 + 0.00077 <i>t</i>	
Nitrobenzoic acid (<i>o</i> -)	C ₇ H ₅ NO ₄	66 to mp	0.258 + 0.00091 <i>t</i>	
(<i>m</i> -)	C ₇ H ₅ NO ₄	-163 to mp	0.258 + 0.00091 <i>t</i>	
(<i>p</i> -)	C ₇ H ₅ NO ₄	-160 to mp	0.247 + 0.00077 <i>t</i>	
Nitronaphthalene	C ₁₀ H ₇ NO ₂	0 to 55	0.236 + 0.00215 <i>t</i>	

TABLE 2-197 Specific Heats of Organic Solids (Concluded)
 Recalculated from *International Critical Tables*, vol. 5, pp. 101-105

Compound	Formula	Temperature, °C	sp ht, cal/g °C
Oxalic acid	$C_2H_2O_4$ $C_2H_2O_4 \cdot 2H_2O$	-200 to +50	0.259 + 0.00076 <i>t</i>
		-200	0.117
		-100	0.239
		0	0.338
		+50	0.385
		100	0.416
Palmitic acid	$C_{16}H_{32}O_2$	-180	0.167
		-140	0.208
		-100	0.251
		-50	0.306
		0	0.382
		+20	0.430
Phenol	C_6H_6O	14 to 26	0.561
Phthalic acid	$C_8H_6O_4$	20	0.232
Picric acid	$C_6H_3N_3O_7$	-100	0.165
		0	0.240
		+50	0.263
		100	0.297
Propionic acid	$C_3H_6O_2$	120	0.332
		-33	0.726
		-200	0.170
		-175	0.363
Propyl alcohol (<i>n</i> -)	C_3H_8O	-150	0.471
		-130	0.497
		20	0.301
Pyrotartaric acid	$C_6H_8O_4$	20	0.301
Quinhydrone	$C_{12}H_{10}O_4$	-250	0.017
		-225	0.061
		-200	0.098
		-100	0.191
		0	0.256
Quinone	$C_6H_4O_2$	-250	0.031
		-225	0.082
		-200	0.113
		-150 to mp	0.282 + 0.00083 <i>t</i>
		32	0.289
Salol	$C_{13}H_{10}O_3$	32	0.289
Stearic acid	$C_{18}H_{36}O_2$	15	0.399
Succinic acid	$C_4H_6O_4$	0 to 160	0.248 + 0.00153 <i>t</i>
Sucrose	$C_{12}H_{22}O_{11}$	20	0.299
Sugar (cane)	$C_{12}H_{22}O_{11}$	22 to 51	0.301
Tartaric acid	$C_4H_6O_6$	36	0.287
Tartaric acid	$C_4H_6O_6 \cdot H_2O$	-150	0.112
		-100	0.170
		-50	0.231
		0	0.308
		+50	0.366
		-40 to 0	0.198 + 0.00018 <i>t</i>
		-100	0.182
Tetrachloroethylene	C_2Cl_4	-100	0.199
		-50	0.212
		0	0.236
		+100	0.236
1 Tetryl + 1 picric acid	$C_{13}H_8N_8O_{15}$	-100 to +100	0.253 + 0.00072 <i>t</i>
1 Tetryl + 2 TNT	$C_{21}H_{15}N_{11}O_{20}$	-100	0.172
		0	0.280
		+50	0.325
		0 to 49	0.315 + 0.0031 <i>t</i>
Thymol	$C_{10}H_{14}O$	0 to 49	0.315 + 0.0031 <i>t</i>
Toluic acid (<i>o</i> -)	$C_8H_8O_2$	54 to mp	0.277 + 0.00120 <i>t</i>
		54 to mp	0.239 + 0.00195 <i>t</i>
		130 to mp	0.271 + 0.00106 <i>t</i>
(<i>m</i> -)	$C_8H_8O_2$	54 to mp	0.239 + 0.00195 <i>t</i>
(<i>p</i> -)	$C_8H_8O_2$	130 to mp	0.271 + 0.00106 <i>t</i>
Toluidine (<i>p</i> -)	C_7H_9N	0	0.337
		20	0.387
		40	0.440
		solid	0.459
Trichloroacetic acid	$C_2HCl_3O_2$	solid	0.459
Trimethyl carbinol	$C_4H_{10}O$	-4	0.559
Trinitrotoluene	$C_7H_5N_3O_6$	-100	0.170
		-50	0.253
		0	0.311
		+100	0.385
Trinitroxylene	$C_8H_7N_3O_6$	-185 to +23	0.241
		20 to 50	0.423
		0 to 91	0.189 + 0.0027 <i>t</i>
Triphenylmethane	$C_{18}H_{16}$	0 to 91	0.189 + 0.0027 <i>t</i>
Urea	CH_4N_2O	20	0.320

TABLE 2-198 Heat Capacities of Inorganic and Organic Compounds in the Ideal Gas State

Cmpd. no.	Name	Formula	CAS no.	Mol wt.	C1 × 1E-05	C2 × 1E-05	C3 × 1E-03	C4 × 1E-05	C5	T_{\min} , K	C_p at T_{\min} × 1E-05	T_{\max} , K	C_p at T_{\max} × 1E-05
1	Methane	CH ₄	74828	16.043	0.3330	0.7993	2.0869	0.4160	991.96	50	0.3330	1500	0.8890
2	Ethane	C ₂ H ₆	74840	30.070	0.4033	1.3422	1.6555	0.7322	752.87	200	0.4256	1500	1.4562
3	Propane	C ₃ H ₈	74986	44.097	0.5192	1.9245	1.6265	1.1680	723.6	200	0.5632	1500	2.0556
4	<i>n</i> -Butane	C ₄ H ₁₀	106978	58.123	0.7134	2.4300	1.6300	1.5033	730.42	200	0.7673	1500	2.6602
5	<i>n</i> -Pentane	C ₅ H ₁₂	109660	72.150	0.8805	3.0110	1.6502	1.8920	747.6	200	0.9404	1500	3.2927
6	<i>n</i> -Hexane	C ₆ H ₁₄	110543	86.177	1.0440	3.5230	1.6946	2.3690	761.6	200	1.1117	1500	3.8620
7	<i>n</i> -Heptane	C ₇ H ₁₆	142825	100.204	1.2015	4.0010	1.6766	2.7400	756.4	200	1.2828	1500	4.4283
8	<i>n</i> -Octane	C ₈ H ₁₈	111659	114.231	1.3554	4.4310	1.6356	3.0540	746.4	200	1.4529	1500	4.9764
9	<i>n</i> -Nonane	C ₉ H ₂₀	111842	128.258	1.5175	4.9150	1.6448	3.4700	749.6	200	1.6257	1500	5.5407
10	<i>n</i> -Decane	C ₁₀ H ₂₂	124185	142.285	1.6720	5.3530	1.6141	3.7820	742	200	1.7967	1500	6.0932
11	<i>n</i> -Undecane	C ₁₁ H ₂₄	1120214	156.312	1.9529	6.0998	1.7087	4.1302	775.4	200	2.0594	1500	6.8342
12	<i>n</i> -Dodecane	C ₁₂ H ₂₆	112403	170.338	2.1295	6.6330	1.7155	4.5161	777.5	200	2.2442	1500	7.4325
13	<i>n</i> -Tridecane	C ₁₃ H ₂₈	629505	184.365	2.1496	7.3045	1.6695	4.9998	741.02	200	2.3156	1500	8.0251
14	<i>n</i> -Tetradecane	C ₁₄ H ₃₀	629594	198.392	2.3082	7.8678	1.6823	5.4486	743.1	200	2.4864	1500	8.6225
15	<i>n</i> -Pentadecane	C ₁₅ H ₃₂	629629	212.419	2.4679	8.4212	1.6865	5.8537	743.6	200	2.6586	1500	9.2209
16	<i>n</i> -Hexadecane	C ₁₆ H ₃₄	544763	226.446	2.6283	8.9733	1.6912	6.2640	744.41	200	2.8312	1500	9.8182
17	<i>n</i> -Heptadecane	C ₁₇ H ₃₆	629787	240.473	2.7878	9.5247	1.6935	6.6651	744.57	200	3.0034	1500	10.4160
18	<i>n</i> -Octadecane	C ₁₈ H ₃₈	593453	254.500	2.9502	10.0340	0.7711	-4.3012	916.73	200	3.1800	1500	11.0160
19	<i>n</i> -Nonadecane	C ₁₉ H ₄₀	629925	268.527	3.1062	10.5750	0.7679	-4.5661	-912.03	200	3.3533	1500	11.6130
20	<i>n</i> -Eicosane	C ₂₀ H ₄₂	112958	282.553	3.2481	11.0900	1.6360	7.4500	-726.27	200	3.5235	1500	12.2110
21	2-Methylpropane	C ₄ H ₁₀	75285	58.123	0.6549	2.4776	1.5870	1.5750	-706.99	200	0.7218	1500	2.6656
22	2-Methylbutane	C ₅ H ₁₂	78784	72.150	0.7460	3.2650	1.5450	1.9230	666.7	200	0.8546	1500	3.3792
23	2,3-Dimethylbutane	C ₆ H ₁₄	79298	86.177	0.7772	4.0320	1.5440	2.5080	-649.95	200	0.9363	1500	4.0353
24	2-Methylpentane	C ₆ H ₁₄	107835	86.177	0.9030	3.8010	1.6020	2.4530	-691.6	200	1.0192	1500	3.9617
25	2,3-Dimethylpentane	C ₇ H ₁₆	565593	100.204	0.8544	4.5772	1.5181	2.9740	641.01	200	1.0550	1500	4.5983
26	2,3,3-Trimethylpentane	C ₈ H ₁₈	560214	114.231	0.9820	5.4020	1.5310	3.4930	639.9	200	1.2194	1500	5.3754
27	2,2,4-Trimethylpentane	C ₈ H ₁₈	540841	114.231	1.1390	5.2860	1.5940	3.3510	677.94	200	1.3139	1500	5.3769
28	Ethylene	C ₂ H ₄	74851	28.054	0.3338	0.9479	1.5960	0.5510	740.8	60	0.3338	1500	1.0987
29	Propylene	C ₃ H ₆	115071	42.081	0.4339	1.5200	1.4250	0.7860	623.9	130	0.4388	1500	1.6836
30	1-Butene	C ₄ H ₈	106989	56.108	0.5998	2.0846	1.5884	1.2940	707.3	200	0.6547	1500	2.2853
31	<i>cis</i> -2-Butene	C ₄ H ₈	590181	56.108	0.5765	2.1150	1.6299	1.2872	739.1	200	0.6199	1500	2.2715
32	<i>trans</i> -2-Butene	C ₄ H ₈	624646	56.108	0.6592	2.0700	1.6733	1.2510	742.2	200	0.7004	1500	2.2904
33	1-Pentene	C ₅ H ₁₀	109671	70.134	0.7595	2.5525	1.5820	1.6660	713	200	0.8273	1500	2.8467
34	1-Hexene	C ₆ H ₁₂	592416	84.161	0.9180	3.0220	1.5742	2.0320	715	200	0.9995	1500	3.4088
35	1-Heptene	C ₇ H ₁₄	592767	98.188	1.0775	3.4900	1.5705	2.4030	717.4	200	1.1723	1500	3.9706
36	1-Octene	C ₈ H ₁₆	111660	112.215	1.2355	3.9570	1.5640	2.7669	718.17	200	1.3440	1500	4.5322
37	1-Nonene	C ₉ H ₁₈	124118	126.242	1.3950	4.4255	1.5624	3.1370	719.6	200	1.5168	1500	5.0938
38	1-Decene	C ₁₀ H ₂₀	872059	140.269	1.7573	5.1710	1.7664	3.6210	803.02	200	1.8333	1500	5.8682
39	2-Methylpropene	C ₄ H ₈	115117	56.108	0.6125	2.0660	1.5450	1.2057	676	200	0.6763	1500	2.2814
40	2-Methyl-1-butene	C ₅ H ₁₀	563462	70.134	0.8703	2.5556	1.7757	1.7636	807.82	200	0.9060	1500	2.8923
41	2-Methyl-2-butene	C ₅ H ₁₀	513359	70.134	0.8192	2.6038	1.7593	1.7195	800.93	200	0.8559	1500	2.8709
42	1,2-Butadiene	C ₄ H ₆	590192	54.092	0.5750	1.6476	1.5270	0.9900	677.3	200	0.6269	1500	1.9202
43	1,3-Butadiene	C ₄ H ₆	106990	54.092	0.5095	1.7050	1.5324	1.3370	685.6	200	0.5756	1500	1.9555
44	2-Methyl-1,3-butadiene	C ₅ H ₈	78795	68.119	0.6527	2.2993	1.4943	1.5164	-647.15	200	0.7508	1500	2.5571
45	Acetylene	C ₂ H ₂	74862	26.038	0.3199	0.5424	1.5940	0.4325	607.1	200	0.3566	1500	0.7575
46	Methylacetylene	C ₃ H ₄	74997	40.065	0.4478	1.0917	1.5508	0.6750	658.2	200	0.4882	1500	1.3293
47	Dimethylacetylene	C ₄ H ₆	503173	54.092	0.6534	1.6179	1.7837	1.0242	821.4	200	0.6721	1500	1.9148
48	3-Methyl-1-butyne	C ₅ H ₈	598232	68.119	0.8274	2.1377	1.7550	1.5149	782	200	0.8646	1500	2.5255
49	1-Pentyne	C ₅ H ₈	627190	68.119	0.7530	2.0905	1.5307	1.3780	672.8	200	0.8276	1500	2.4754
50	2-Pentyne	C ₅ H ₈	627214	68.119	0.7074	2.2229	1.5570	1.3125	690.78	200	0.7700	1500	2.5052
51	1-Hexyne	C ₆ H ₁₀	693027	82.145	0.9129	2.5577	1.5290	1.7370	683	200	1.0004	1500	3.0371
52	2-Hexyne	C ₆ H ₁₀	764352	82.145	1.0360	3.0090	2.1160	2.1060	902.4	300	1.2215	1500	3.1894
53	3-Hexyne	C ₆ H ₁₀	928494	82.145	0.9376	3.0150	1.9057	1.9860	817	300	1.1909	1500	3.1889
54	1-Heptyne	C ₇ H ₁₂	628717	96.172	1.0712	3.0258	1.5273	2.0975	689.62	200	1.1721	1500	3.5985

55	1-Octyne	C ₈ H ₁₄	629050	110.199	1.2307	3.4942	1.5280	2.4617	694.81	200	1.3448	1500	4.1604
56	Vinylacetylene	C ₄ H ₄	689974	52.076	0.5598	1.2141	1.6102	0.8908	-710.4	200	0.5967	1500	1.5590
57	Cyclopentane	C ₅ H ₁₀	287923	70.134	0.4160	3.0140	1.4617	1.8095	-668.8	100	0.4165	1500	2.9298
58	Methylcyclopentane	C ₆ H ₁₂	96377	84.161	0.6646	3.5070	1.5892	2.3526	727.13	200	0.7510	1500	3.5495
59	Ethylcyclopentane	C ₇ H ₁₄	1640897	98.188	0.8205	4.0342	1.5670	2.6697	715.52	200	0.9272	1500	4.1472
60	Cyclohexane	C ₆ H ₁₂	110827	84.161	0.4320	3.7350	1.1920	1.6350	-530.1	100	0.4366	1500	3.6516
61	Methylcyclohexane	C ₇ H ₁₄	108852	98.188	0.9227	4.1150	1.6504	2.9006	779.48	200	0.9953	1500	4.3180
62	1,1-Dimethylcyclohexane	C ₈ H ₁₆	590669	112.215	1.0776	4.6718	1.6540	3.3397	792.5	200	1.1535	1500	4.9543
63	Ethylcyclohexane	C ₈ H ₁₆	1678917	112.215	1.1059	4.6306	1.6628	3.2990	781.1	200	1.1875	1500	4.9184
64	Cyclopentene	C ₅ H ₈	142290	68.119	0.4807	2.5159	1.5803	1.7454	718.37	150	0.4918	1500	2.5619
65	1-Methylcyclopentene	C ₆ H ₁₀	693890	82.145	0.6941	3.0209	1.6903	2.1209	781.56	200	0.7464	1500	3.1496
66	Cyclohexene	C ₆ H ₁₀	110838	82.145	0.5817	3.1717	1.5435	2.1273	701.62	150	0.5978	1500	3.2132
67	Benzene	C ₆ H ₆	71432	78.114	0.4442	2.3205	1.4946	1.7213	-678.15	200	0.5340	1500	2.4169
68	Toluene	C ₇ H ₈	108883	92.141	0.5814	2.8630	1.4406	1.8980	-650.43	200	0.7016	1500	3.0029
69	<i>o</i> -Xylene	C ₈ H ₁₀	95476	106.167	0.8521	3.2954	1.4944	2.1150	-675.8	200	0.9643	1500	3.5965
70	<i>m</i> -Xylene	C ₈ H ₁₀	108383	106.167	0.7568	3.3924	1.4960	2.2470	-675.9	200	0.8759	1500	3.5920
71	<i>p</i> -Xylene	C ₈ H ₁₀	106423	106.167	0.7512	3.3970	1.4928	2.2470	-675.1	200	0.8710	1500	3.5923
72	Ethylbenzene	C ₈ H ₁₀	100414	106.167	0.7844	3.3990	1.5590	2.4260	-702	200	0.8912	1500	3.6147
73	Propylbenzene (eqn. 3)	C ₉ H ₁₂	103651	120.194	-21.4827	3.8070	54701	-0.001713	0	200	1.0802	1500	4.1537
74	1,2,4-Trimethylbenzene	C ₉ H ₁₂	95636	120.194	1.0106	3.8314	1.5010	2.3950	678.3	200	1.1354	1500	4.1854
75	Isopropylbenzene	C ₉ H ₁₂	98828	120.194	1.0810	3.7932	1.7505	3.0027	794.8	200	1.1480	1500	4.1808
76	1,3,5-Trimethylbenzene	C ₉ H ₁₂	108678	120.194	0.9154	3.9270	1.4980	2.5090	676.9	200	1.0474	1500	4.1807
77	<i>p</i> -Isopropyltoluene	C ₁₀ H ₁₄	99876	134.221	1.3186	4.3036	1.7734	3.2570	811.9	200	1.3825	1500	4.7952
78	Naphthalene	C ₁₀ H ₈	91203	128.174	0.6805	3.5494	1.4262	2.5984	650.1	200	0.8454	1500	3.7359
79	Biphenyl	C ₁₂ H ₁₀	92524	154.211	0.9060	4.2634	1.4553	3.1550	661.2	200	1.0913	1500	4.5581
80	Styrene	C ₈ H ₈	100425	104.152	0.8930	2.1503	0.7720	0.9990	2442	100	0.8931	1500	3.2416
81	<i>m</i> -Terphenyl	C ₁₈ H ₁₄	92068	230.309	1.6397	6.0125	1.6902	5.1314	757.5	298.15	2.4618	1500	6.6678
82	Methanol	CH ₄ O	67561	32.042	0.3925	0.8790	1.9165	0.5365	896.7	200	0.3980	1500	1.0533
83	Ethanol	C ₂ H ₆ O	64175	46.069	0.4920	1.4577	1.6628	0.9390	744.7	200	0.5224	1500	1.6576
84	1-Propanol	C ₃ H ₈ O	71238	60.096	0.6190	2.0213	1.6293	1.2956	727.4	200	0.6665	1500	2.2458
85	1-Butanol	C ₄ H ₁₀ O	71363	74.123	0.7454	2.5907	1.6073	1.7320	712.4	200	0.8162	1500	2.8509
86	2-Butanol	C ₄ H ₁₀ O	78922	74.123	0.8202	2.5220	1.6010	1.5864	-704.15	200	0.8890	1500	2.8513
87	2-Propanol	C ₃ H ₈ O	67630	60.096	0.5723	1.9100	1.4210	1.2155	626	150	0.5924	1500	2.1792
88	2-Methyl-2-propanol	C ₄ H ₁₀ O	75650	74.123	0.7704	2.5390	1.5502	1.6690	-679.3	200	0.8567	1500	2.8508
89	1-Pentanol	C ₅ H ₁₂ O	71410	88.150	0.9060	3.0620	1.6054	2.1150	-717.97	200	0.9890	1500	3.4133
90	2-Methyl-1-butanol	C ₅ H ₁₂ O	137326	88.150	1.0890	2.1850	0.8530	1.4000	2906	298.15	1.3247	1500.1	3.4718
91	3-Methyl-1-butanol	C ₅ H ₁₂ O	123513	88.150	1.1060	2.2100	0.8760	1.2200	2940	298.15	1.3213	1200.15	3.1770
92	1-Hexanol	C ₆ H ₁₄ O	111273	102.177	1.0625	3.5210	1.5835	2.4620	715.75	200	1.1607	1500	3.9726
93	1-Heptanol	C ₇ H ₁₆ O	111706	116.203	1.2215	3.9910	1.5800	2.8350	717.7	200	1.3330	1500	4.5346
94	Cyclohexanol	C ₆ H ₁₂ O	108930	100.161	0.9043	2.5771	0.7882	1.3068	1952.2	200	0.9648	1500	3.8251
95	Ethylene glycol	C ₂ H ₆ O ₂	107211	62.068	0.8200	1.2780	1.6980	0.9290	-754	200	0.8481	1500	1.8521
96	1,2-Propylene glycol	C ₃ H ₈ O ₂	57556	76.095	2.0114	0.8082	1.8656	-2.4404	279.98	298.15	1.0218	1000.15	2.1175
97	Phenol	C ₆ H ₆ O	108952	94.113	0.4340	2.4450	1.1520	1.5120	-507	100	0.4401	1500	2.6045
98	<i>o</i> -Cresol	C ₇ H ₈ O	95487	108.140	0.7988	2.8530	1.4765	2.0420	-664.7	200	0.9158	1500	3.2163
99	<i>m</i> -Cresol	C ₇ H ₈ O	108394	108.140	0.7515	2.0900	0.6666	1.2120	2214	200	0.8701	1500	3.2075
100	<i>p</i> -Cresol	C ₇ H ₈ O	106445	108.140	0.7384	2.9080	1.4559	2.0910	-650.42	200	0.8707	1500	3.2102
101	Dimethyl ether	C ₂ H ₆ O	115106	46.069	0.5148	1.4420	1.6034	0.7747	725.4	200	0.5436	1500	1.6581
102	Methyl ethyl ether	C ₃ H ₈ O	540670	60.096	0.6868	1.9959	1.5534	1.1168	692.04	200	0.7396	1500	2.2931
103	Methyl- <i>n</i> -propyl ether	C ₄ H ₁₀ O	557175	74.123	0.9215	2.3943	1.6936	1.4896	797.79	298	1.1251	1200	2.6391
104	Methyl isopropyl ether	C ₄ H ₁₀ O	598538	74.123	0.8923	2.4765	1.6960	1.5598	791.4	200	0.9280	1500	2.8696
105	Methyl- <i>n</i> -butyl ether	C ₅ H ₁₂ O	628284	88.150	0.8205	3.0869	1.3864	1.7886	613.87	300	1.3300	1200	3.1994
106	Methyl isobutyl ether	C ₅ H ₁₂ O	625445	88.150	0.7284	3.1713	1.3520	1.8948	585.14	300	1.3200	1200	3.1987

TABLE 2-198 Heat Capacities of Inorganic and Organic Compounds in the Ideal Gas State (Continued)

Cmpd. no.	Name	Formula	CAS no.	Mol wt.	C1 × 1E-05	C2 × 1E-05	C3 × 1E-03	C4 × 1E-05	C5	T_{\min} , K	C_p at T_{\min} × 1E-05	T_{\max} , K	C_p at T_{\max} × 1E-05
107	Methyl tert-butyl ether	C ₅ H ₁₂ O	1634044	88.150	0.9933	3.0667	1.7426	2.0764	795.59	200	1.0394	1500	3.4321
108	Diethyl ether	C ₄ H ₁₀ O	60297	74.123	0.8621	2.5510	1.5413	1.4370	-688.9	200	0.9316	1500	2.9244
109	Ethyl propyl ether	C ₅ H ₁₂ O	628320	88.150	1.1320	2.9400	1.8270	2.0550	-852	298.15	1.3538	1500	3.4535
110	Ethyl isopropyl ether	C ₅ H ₁₂ O	625547	88.150	1.0953	3.0032	1.7988	2.1311	817.35	298.15	1.3620	1200	3.2289
111	Methyl phenyl ether	C ₇ H ₈ O	100663	108.140	0.7637	2.9377	1.6051	2.1700	751.2	300	1.1302	1200	3.0226
112	Diphenyl ether	C ₁₂ H ₁₀ O	101848	170.211	1.0985	4.3412	1.6222	3.6455	743.62	300	1.7298	1200	4.5143
113	Formaldehyde	CH ₂ O	50000	30.026	0.3327	0.4954	1.8666	0.2808	934.9	50	0.3327	1500	0.7113
114	Acetaldehyde	C ₂ H ₄ O	75070	44.053	0.4451	1.0687	1.6141	0.6135	737.8	200	0.4660	1500	1.2994
115	1-Propanal	C ₃ H ₆ O	123386	58.080	0.7174	1.9140	2.0144	1.1708	930.6	200	0.7266	1500	2.1149
116	1-Butanal	C ₄ H ₈ O	123728	72.107	0.8966	2.3731	1.9754	1.5866	904.13	200	0.9119	1500	2.6775
117	1-Pentanal	C ₅ H ₁₀ O	110623	86.134	1.0743	2.8363	1.9549	2.0146	890.44	200	1.0960	1500	3.2404
118	1-Hexanal	C ₆ H ₁₂ O	66251	100.161	1.2320	2.2146	0.8400	1.2190	2205	200	1.2672	1500	3.7314
119	1-Heptanal	C ₇ H ₁₄ O	111717	114.188	1.4040	2.5907	0.8315	1.3120	2201	200	1.4479	1500	4.2863
120	1-Octanal	C ₈ H ₁₆ O	124130	128.214	1.6088	4.2180	1.9126	3.2780	869	200	1.6504	1500	4.9286
121	1-Nonanal	C ₉ H ₁₈ O	124196	142.241	1.7347	4.5115	1.7120	3.3256	810.96	200	1.8005	1500	5.4439
122	1-Decanal	C ₁₀ H ₂₀ O	112312	156.268	1.9641	5.1412	1.8989	4.1278	862.51	200	2.0192	1500	6.0539
123	Acetone	C ₃ H ₆ O	67641	58.080	0.5704	1.6320	1.6070	0.9680	731.5	200	0.6049	1500	1.8820
124	Methyl ethyl ketone	C ₄ H ₈ O	78933	72.107	0.7840	2.1032	1.5488	1.1855	693	200	0.8397	1500	2.4816
125	2-Pentanone	C ₅ H ₁₀ O	107579	86.134	0.9005	2.7085	1.6592	1.8012	743.96	200	0.9591	1500	3.0797
126	Methyl isopropyl ketone	C ₅ H ₁₀ O	563804	86.134	1.5914	1.7640	1.2076	-407.4000	10.503	300	1.1291	1500	2.9991
127	2-Hexanone	C ₆ H ₁₂ O	591786	100.161	1.0940	1.8070	0.6890	1.4740	1772	200	1.1815	1200	3.3207
128	Methyl isobutyl ketone	C ₆ H ₁₂ O	108101	100.161	1.2270	2.1950	0.8420	1.1910	2460	298.15	1.4755	1500.15	3.6532
129	3-Methyl-2-pentanone	C ₆ H ₁₂ O	565617	100.161	1.0028	3.3169	1.6900	2.3000	770.7	300	1.3604	1200	3.4275
130	3-Pentanone	C ₅ H ₁₀ O	96220	86.134	0.9690	2.4907	1.4177	1.3010	646.7	200	1.0536	1500	3.0358
131	Ethyl isopropyl ketone	C ₆ H ₁₂ O	565695	100.161	1.2400	3.2000	1.9670	2.3460	896	298.15	1.4479	1200	3.4234
132	Diisopropyl ketone	C ₇ H ₁₄ O	565800	114.188	1.0869	4.0540	1.7802	2.9786	791.6	300	1.5102	1500	4.3093
133	Cyclohexanone	C ₆ H ₁₀ O	108941	98.145	0.5776	3.3535	1.2202	1.5700	586.92	200	0.7321	1500	3.4870
134	Methyl phenyl ketone	C ₈ H ₈ O	98862	120.151	0.8540	2.3340	0.8310	0.7730	2227	298.15	1.1313	1500	3.2797
135	Formic acid ¹	CH ₂ O ₂	64186	46.026	0.3381	0.7593	1.1925	0.3180	550	50	0.3381	1500	0.9933
136	Acetic acid ²	C ₂ H ₄ O ₂	64197	60.053	0.4020	1.3675	1.2620	0.7003	569.7	50	0.4020	1500	1.5756
137	Propionic acid ²	C ₃ H ₆ O ₂	79094	74.079	1.7778	1.7098	1.2654	1.2654	-763.78	298.15	0.8938	1500	2.1248
138	<i>n</i> -Butyric acid ²	C ₄ H ₈ O ₂	107926	88.106	1.4880	1.3522	1.1460	-678.0000	6.98	298.15	1.1533	1200.1	2.4716
139	Isobutyric acid ²	C ₄ H ₈ O ₂	79312	88.106	0.7469	2.4356	1.7150	1.8484	757.75	298.15	1.0427	1200	2.5383
140	Benzoic acid	C ₇ H ₆ O ₂	65850	122.123	0.7759	2.6455	1.7925	2.2382	835.9	200	0.8126	1500	2.9712
141	Acetic anhydride	C ₄ H ₆ O ₃	108247	102.090	0.7130	2.2220	1.6203	1.6760	746.5	200	0.7665	1500	2.5675
142	Methyl formate	C ₂ H ₄ O ₂	107313	60.053	0.5060	1.2190	1.6370	0.8940	743	250	0.5888	1500	1.5109
143	Methyl acetate	C ₃ H ₆ O ₂	79209	74.079	0.5550	1.7820	1.2600	0.8530	562	298	0.8489	1500	2.0754
144	Methyl propionate	C ₄ H ₈ O ₂	554121	88.106	0.7765	2.4420	1.7140	1.8180	716	300	1.1242	1200	2.5276
145	Methyl <i>n</i> -butyrate	C ₅ H ₁₀ O ₂	623427	102.133	0.8940	2.9100	1.5700	2.0730	678.3	298	1.3461	1200	3.0766
146	Ethyl formate	C ₃ H ₆ O ₂	109944	74.079	0.5370	1.8860	1.2070	0.8640	496	100	0.5412	1500	2.1485
147	Ethyl acetate	C ₄ H ₈ O ₂	141786	88.106	0.9981	2.0931	2.0226	1.8030	928.05	200	1.0126	1500	2.6594
148	Ethyl propionate	C ₅ H ₁₀ O ₂	105373	102.133	0.9370	2.8290	1.6480	2.1550	724.7	300	1.3377	1200	3.0569
149	Ethyl <i>n</i> -butyrate	C ₆ H ₁₂ O ₂	105544	116.160	1.1150	3.3910	1.6705	2.5180	733.6	298	1.5583	1200	3.6213
150	<i>n</i> -Propyl formate	C ₄ H ₈ O ₂	110747	88.106	0.8710	2.4470	1.9254	1.8880	-821.3	298.15	1.1022	1500	2.7484
151	<i>n</i> -Propyl acetate	C ₅ H ₁₀ O ₂	109604	102.133	1.7994	1.7530	1.1960	-4.1200	108.2	298.15	1.3254	1500	3.2024
152	<i>n</i> -Butyl acetate	C ₆ H ₁₂ O ₂	123864	116.160	1.1684	3.7690	1.9560	2.8180	811.2	300	1.5358	1200	3.6724
153	Methyl benzoate	C ₈ H ₈ O ₂	93583	136.150	0.9396	2.5590	0.8250	1.3600	3000	300	1.2586	1200	3.3569
154	Ethyl benzoate	C ₉ H ₁₀ O ₂	93890	150.177	1.0944	4.1794	0.8838	-1.6090	-1183.1	300	1.4598	1500	4.2540
155	Vinyl acetate	C ₄ H ₆ O ₂	108054	86.090	0.5360	2.1190	1.1980	1.1470	510	100	0.5404	1500	2.3750
156	Methylamine	CH ₃ N	74895	31.057	0.4100	1.0578	1.7080	0.6836	735	150	0.4136	1500	1.2388
157	Dimethylamine	C ₂ H ₇ N	124403	45.084	0.5565	1.6384	1.7341	1.0899	793.04	200	0.5812	1500	1.8585
158	Trimethylamine	C ₃ H ₉ N	75503	59.111	0.7107	1.5051	0.7966	0.8454	2187.6	200	0.7439	1500	2.4322
159	Ethylamine	C ₂ H ₇ N	75047	45.084	0.5940	1.6180	1.8120	1.0780	820	200	0.6139	1500	1.8528

160	Diethylamine	C ₄ H ₁₁ N	109897	73.138	0.9102	2.6740	1.7190	1.7926	794.94	200	0.9502	1500	3.0519
161	Triethylamine	C ₆ H ₁₅ N	121448	101.192	1.2766	2.5559	0.8094	1.4829	2231.7	200	1.3278	1500	4.2046
162	<i>n</i> -Propylamine	C ₃ H ₉ N	107108	59.111	0.7608	2.1049	1.7256	1.3936	789.03	200	0.7933	1500	2.4353
163	di- <i>n</i> -Propylamine	C ₆ H ₁₅ N	142847	101.192	1.2114	2.6127	0.7896	1.6903	2394.4	300	1.5900	1500	4.2484
164	Isopropylamine	C ₃ H ₉ N	75310	59.111	0.6855	2.1876	1.5831	1.3855	691.76	200	0.7510	1500	2.4540
165	Diisopropylamine	C ₆ H ₁₅ N	108189	101.192	1.1384	2.5747	0.7384	1.6200	2143	300	1.5995	1500	4.1941
166	Aniline	C ₆ H ₇ N	625333	93.128	0.6533	2.5192	1.4608	1.8870	-653.1	200	0.7705	1500	2.8047
167	<i>N</i> -Methylaniline	C ₇ H ₉ N	100618	107.155	0.7796	3.0280	1.5203	2.3280	699.8	300	1.2602	1500	3.3641
168	<i>N,N</i> -Dimethylaniline	C ₈ H ₁₁ N	121697	121.182	0.8742	2.7204	0.7242	1.1300	1949	300	1.3903	1500	3.8844
											0.0000		
169	Ethylene oxide	C ₂ H ₄ O	75218	44.053	0.3346	1.2116	1.6084	0.8241	737.3	50	0.3346	1500	1.3297
170	Furan	C ₄ H ₄ O	110009	68.075	0.3727	1.6606	1.5112	1.3145	686	200	0.4376	1500	1.7940
171	Thiophene	C ₄ H ₄ S	110021	84.142	0.4040	1.6270	1.4564	1.3212	649	200	0.4884	1500	1.8097
172	Pyridine	C ₅ H ₅ N	110861	79.101	0.4413	2.0830	1.4783	1.5330	676.8	200	0.5220	1500	2.2194
173	Formamide	CH ₃ NO	75127	45.041	0.3822	0.9300	1.8450	0.6900	850	150	0.3833	1500	1.1203
174	<i>N,N</i> -Dimethylformamide	C ₃ H ₇ NO	68122	73.095	0.7220	1.7830	1.5320	1.3100	762	200	0.7594	1500	2.2596
175	Acetamide	C ₂ H ₅ NO	60355	59.068	0.3420	1.2940	1.0750	0.6400	502	100	0.3448	1500	1.4997
176	<i>N</i> -Methylacetamide	C ₃ H ₇ NO	79163	73.095	0.6116	2.0290	1.7683	1.3302	835.5	300	0.7698	1500	2.2209
177	Acetonitrile	C ₂ H ₃ N	75058	41.053	0.4191	0.8876	1.5818	0.5032	699.8	100	0.4192	1500	1.1285
178	Propionitrile	C ₃ H ₅ N	107120	55.079	0.5357	1.4617	1.5530	0.9120	678.2	200	0.5832	1500	1.7235
179	<i>n</i> -Butyronitrile	C ₄ H ₇ N	109740	69.106	0.6906	1.9996	1.5494	1.3146	675	200	0.7607	1500	2.3273
180	Benzonitrile	C ₇ H ₅ N	100470	103.123	0.7186	2.2700	1.4669	1.6930	-680.77	200	0.8053	1500	2.6706
181	Methyl mercaptan	CH ₃ S	74931	48.109	0.4146	0.8307	1.5890	0.4612	716.7	200	0.4329	1500	1.0781
182	Ethyl mercaptan	C ₂ H ₆ S	75081	62.136	0.5576	1.3617	1.5221	0.8073	687.5	200	0.5970	1500	1.6729
183	<i>n</i> -Propyl mercaptan	C ₃ H ₈ S	107039	76.163	0.7474	1.9523	1.6310	1.2112	750.92	200	0.7848	1500	2.3216
184	<i>n</i> -Butyl mercaptan	C ₄ H ₁₀ S	109795	90.189	0.9248	2.7795	1.6837	1.5974	758.68	200	0.9714	1500	3.1008
185	Isobutyl mercaptan	C ₄ H ₁₀ S	513440	90.189	0.9142	2.4513	1.6265	1.6157	745.8	200	0.9660	1500	2.9095
186	sec-Butyl mercaptan	C ₄ H ₁₀ S	513531	90.189	0.9237	2.5166	1.6109	1.5641	739.2	200	0.9763	1500	2.9615
187	Dimethyl sulfide	C ₂ H ₆ S	75183	62.136	0.6037	1.3747	1.6410	0.7988	-743.5	200	0.6298	1500	1.6949
188	Methyl ethyl sulfide	C ₃ H ₈ S	624895	76.163	0.7508	1.9577	1.6424	1.1949	749.19	273.16	0.9004	1500	-2.3178
189	Diethyl sulfide	C ₄ H ₁₀ S	352932	90.189	0.9429	2.6863	1.7624	1.6752	-798.3	200	0.9794	1500	3.0338
190	Fluoromethane	CH ₃ F	593533	34.033	0.3329	0.7399	1.8639	0.4608	891.16	50	0.3329	1500	0.9024
191	Chloromethane	CH ₃ Cl	74873	50.488	0.3409	0.7246	1.7230	0.4480	780.5	150	0.3424	1500	0.9097
192	Trichloromethane	CHCl ₃	67663	119.377	0.3942	0.6573	0.9280	0.4930	399.6	100	0.4048	1500	1.0063
193	Tetrachloromethane	CCl ₄	56235	153.822	0.3758	0.7054	0.5121	0.4850	236.1	100	0.4730	1500	1.0662
194	Bromomethane	CH ₃ Br	74839	94.939	0.3377	0.7150	1.5780	0.4175	691.4	100	0.3378	1500	0.9107
195	Fluoroethane	C ₂ H ₅ F	353366	48.060	0.4437	1.3119	1.6422	0.8544	738.77	200	0.4726	1500	1.5008
196	Chloroethane	C ₂ H ₅ Cl	75003	64.514	0.4568	1.2967	1.5992	0.8590	708.8	100	0.4569	1500	1.5112
197	Bromoethane	C ₂ H ₅ Br	74964	108.966	0.4719	1.2787	1.5957	0.8517	703.87	200	0.5089	1500	1.5121
198	1-Chloropropane	C ₃ H ₇ Cl	540545	78.541	0.6210	1.8430	1.6290	1.2337	724	200	0.6674	1500	2.1126
199	2-Chloropropane	C ₃ H ₇ Cl	75296	78.541	0.6181	1.8023	1.5438	1.1893	685.93	200	0.6768	1500	2.1023
200	1,1-Dichloropropane	C ₃ H ₆ Cl ₂	78999	112.986	0.7145	1.7344	1.5240	1.2230	674.2	150	0.7268	1500	2.1609
201	1,2-Dichloropropane	C ₃ H ₆ Cl ₂	78875	112.986	0.7866	1.7429	1.7157	1.2627	765.1	200	0.8217	1500	2.1894
202	Vinyl chloride	C ₂ H ₃ Cl	75014	62.499	0.4236	0.8735	1.6492	0.6556	739.07	200	0.4457	1500	1.1423
203	Fluorobenzene	C ₆ H ₅ F	462066	96.104	0.6265	2.1646	1.5640	1.7278	-724.29	200	0.6914	1500	2.4736
204	Chlorobenzene	C ₆ H ₅ Cl	108907	112.555	0.8011	2.3100	2.1570	2.0460	-897.6	200	0.8219	1500	2.5327
205	Bromobenzene	C ₆ H ₅ Br	108861	157.100	0.7210	2.0640	1.6504	1.6870	765.3	200	0.7679	1500	2.4628
206	Air		132259100	28.951	0.2896	0.0939	3.0120	0.0758	1484	50	0.2896	1500	0.3496
207	Hydrogen ³	H ₂	1333740	2.016	0.2762	0.0956	2.4660	0.0376	567.6	250	0.2843	1500	0.3225
208	Helium-4 (eqn 2)	He	7440597	4.003	0.2079	0	0	0	0	100	0.2079	1500	0.2079
209	Neon	Ne	7440019	20.180	0.2079	0	0	0	0	100	0.2079	1500	0.2079
210	Argon	Ar	7440371	39.948	0.2079	0	0	0	0	100	0.2079	1500	0.2079
211	Fluorine	F ₂	7782414	37.997	0.2912	0.1013	1.4530	0.0941	662.91	50	0.2912	1500	0.3812

TABLE 2-198 Heat Capacities of Inorganic and Organic Compounds in the Ideal Gas State (Concluded)

Cmpd. no.	Name	Formula	CAS no.	Mol wt.	C1 × 1E-05	C2 × 1E-05	C3 × 1E-03	C4 × 1E-05	C5	T_{min} , K	C_p at T_{min} × 1E-05	T_{max} , K	C_p at T_{max} × 1E-05
212	Chlorine	Cl ₂	7782505	70.905	0.2914	0.0918	0.9490	0.1003	425	50	0.2914	1500	0.3793
213	Bromine	Br ₂	7726956	159.808	0.3011	0.0801	0.7514	0.1078	314.6	100	0.3090	1500	0.3794
214	Oxygen	O ₂	7782447	31.999	0.2910	0.1004	2.5265	0.0936	1153.8	50	0.2910	1500	0.3653
215	Nitrogen	N ₂	7727379	28.014	0.2911	0.0861	1.7016	0.0010	909.79	50	0.2911	1500	0.3484
216	Ammonia	NH ₃	7664417	17.031	0.3343	0.4898	2.0360	0.2256	882	100	0.3343	1500	0.6647
217	Hydrazine	N ₂ H ₄	302012	32.045	0.3871	0.8576	1.7228	0.5664	733.53	200	0.4070	1500	1.0571
218	Nitrous oxide	N ₂ O	10024972	44.013	0.2934	0.3236	1.1238	0.2177	479.4	100	0.2948	1500	0.5828
219	Nitric oxide (eqn 2)	NO	10102439	30.006	0.3498	-3.5320E-04	7.7290E-05	-5.7357E-10	1.4526E-08	100	0.3217	1500	0.3586
220	Cyanogen	C ₂ N ₂	460195	52.036	0.3545	0.5015	1.0570	0.4520	-396	100	0.3648	1500	0.8100
221	Carbon monoxide	CO	630080	28.010	0.2911	0.0877	3.0851	0.0846	1538.2	60	0.2911	1500	0.3521
222	Carbon dioxide	CO ₂	124389	44.010	0.2937	0.3454	1.4280	0.2640	588	50	0.2937	5000	0.6335
223	Carbon disulfide	CS ₂	75150	76.143	0.3010	0.3338	0.8960	0.2893	374.7	100	0.3100	1500	0.6148
224	Hydrogen fluoride	HF	7664393	20.006	0.2913	0.0933	2.9050	0.0020	1326	50	0.2913	1500	0.3224
225	Hydrogen chloride	HCl	7647010	36.461	0.2916	0.0905	2.0938	-0.0011	120	50	0.2914	1500	0.3406
226	Hydrogen bromide	HBr	10035106	80.912	0.2912	0.0953	2.1420	0.0157	1400	50	0.2912	1500	0.3479
227	Hydrogen cyanide	HCN	74908	27.026	0.3013	0.3171	1.6102	0.2179	626	100	0.3014	1500	0.5522
228	Hydrogen sulfide	H ₂ S	7783064	34.082	0.3329	0.2609	0.9134	-0.1798	949.4	100	0.3329	1500	0.5143
229	Sulfur dioxide	SO ₂	7446095	64.065	0.3338	0.2586	0.9328	0.1088	423.7	100	0.3354	1500	0.5695
230	Sulfur trioxide	SO ₃	7446119	80.064	0.3341	0.4968	0.8732	0.2856	393.74	100	0.3408	1500	0.7967
231	Water	H ₂ O	7732185	18.015	0.3336	0.2679	2.6105	0.0890	1169	100	0.3336	2273.15	0.5276

All substances are listed in alphabetical order in Table 2-6a.

Compiled from Daubert, T. E., R. P. Danner, H. M. Sibul, and C. C. Stebbins, DIPPR Data Compilation of Pure Compound Properties, Project 801 Sponsor Release, July, 1993, Design Institute for Physical Property Data, AIChE, New York, NY; and from Thermodynamics Research Center, "Selected Values of Properties of Hydrocarbons and Related Compounds," Thermodynamics Research Center Hydrocarbon Project, Texas A&M University, College Station, Texas (extant 1994).

Temperatures are expressed in kelvins; heat capacities, in J/kmol·K.

J/(kmol·K) × 2.390E-04 = cal/(gmol·°C); J/(kmol·K) × 2.390059E-04 = Btu/(lbmol·°F).

Use heat capacity = $C1 + C2 \left[\frac{C3}{T} / \sinh \left(\frac{C3}{T} \right) \right]^2 + C4 \left[\frac{C5}{T} / \cosh \left(\frac{C5}{T} \right) \right]^2$ unless otherwise specified.

Equation 2 is heat capacity = $C1 + C2 \times T + C3 \times T^2 + C4 \times T^3 + C5 \times T^4$.

Equation 3 is heat capacity = $C1 + C2 \times \ln T + C3/T + C4 \times T$.

¹ For the monomer. Monomer and dimer are in equilibrium below 600 K.

² For the monomer.

³ For equilibrium mixture of *ortho* and *para* hydrogen.

TABLE 2-199 C_p/C_v : Ratios of Specific Heats of Gases at 1-atm Pressure*

Compound	Formula	Temperature, °C	Ratio of specific heats, $(\gamma) = C_p/C_v$	Compound	Formula	Temperature, °C	Ratio of specific heats, $(\gamma) = C_p/C_v$
Acetaldehyde	C ₂ H ₄ O	30	1.14	Hydrogen (<i>Cont.</i>)			
Acetic acid	C ₂ H ₄ O ₂	136	1.15	iodide	HI	20-100	1.40
Acetylene	C ₂ H ₂	15	1.26	sulfide	H ₂ S	15	1.32
		-71	1.31			-45	1.30
Air		925	1.36			-57	1.29
		17	1.403				
		-78	1.408	Iodine	I ₂	185	1.30
		-118	1.415	Isobutane	C ₄ H ₁₀	15	1.11
Ammonia	NH ₃	15	1.310				
Argon	A	15	1.668	Krypton	Kr	19	1.68
		-180	1.76 (?)				
		0-100	1.67	Mercury	Hg	360	1.67
Benzene	C ₆ H ₆	90	1.10	Methane	CH ₄	600	1.113
Bromine	Br ₂	20-350	1.32			300	1.16
						15	1.31
Carbon dioxide	CO ₂	15	1.304			-80	1.34
		-75	1.37			-115	1.41
disulfide	CS ₂	100	1.21	Methyl acetate	C ₃ H ₆ O ₂	15	1.14
monoxide	CO	15	1.404	alcohol	CH ₃ O	77	1.203
		-180	1.41	ether	C ₂ H ₆ O	6-30	1.11
Chlorine	Cl ₂	15	1.355	Methylal	C ₃ H ₈ O ₂	13	1.06
Chloroform	CHCl ₃	100	1.15			40	1.09
Cyanogen	(CN) ₂	15	1.256				
Cyclohexane	C ₆ H ₁₂	80	1.08	Neon	Ne	19	1.64
				Nitric oxide	NO	15	1.400
Dichlorodifluormethane	CCl ₂ F ₂	25	1.139			-45	1.39
						-80	1.38
Ethane	C ₂ H ₆	100	1.19	Nitrogen	N ₂	15	1.404
		15	1.22			-181	1.47
		-82	1.28	Nitrous oxide	N ₂ O	100	1.28
Ethyl alcohol	C ₂ H ₆ O	90	1.13			15	1.303
ether	C ₄ H ₁₀ O	35	1.08			-30	1.31
		80	1.086			-70	1.34
Ethylene	C ₂ H ₄	100	1.18				
		15	1.255	Oxygen	O ₂	15	1.401
		-91	1.35			-76	1.415
						-181	1.45
Helium	He	-180	1.660	Pentane (<i>n</i> -)	C ₅ H ₁₂	86	1.086
Hexane (<i>n</i> -)	C ₆ H ₁₄	80	1.060	Phosphorus	P	300	1.17
Hydrogen	H ₂	15	1.410	Potassium	K	850	1.77
		-76	1.453				
		-181	1.597	Sodium	Na	750-920	1.68
bromide	HBr	20	1.42	Sulfur dioxide	SO ₂	15	1.29
chloride	HCl	15	1.41				
		100	1.40	Xenon	Xe	19	1.66
cyanide	HCN	65	1.31				
		140	1.28				
		210	1.24				

*From *International Critical Tables*, vol. 5, pp. 80-82.

TABLE 2-200 Specific Heat Ratio, C_p/C_v , for Air

Temperature, K	Pressure, bar															
	1	10	20	40	60	80	100	150	200	250	300	400	500	600	800	1000
150	1.410	1.510	1.668	2.333	4.120	3.973	3.202	2.507	2.243	2.091	1.988	1.851	1.768	1.712	1.654	1.639
200	1.406	1.452	1.505	1.630	1.781	1.943	2.093	2.274	2.236	2.140	2.050	1.920	1.832	1.771	1.682	1.619
250	1.403	1.429	1.457	1.517	1.577	1.640	1.699	1.816	1.877	1.896	1.885	1.836	1.782	1.743	1.681	1.636
300	1.402	1.418	1.436	1.470	1.505	1.537	1.570	1.640	1.687	1.716	1.730	1.727	1.707	1.683	1.645	1.619
350	1.399	1.411	1.422	1.446	1.467	1.488	1.509	1.553	1.589	1.612	1.627	1.640	1.638	1.629	1.605	1.585
400	1.395	1.404	1.412	1.429	1.444	1.460	1.472	1.505	1.529	1.548	1.563	1.579	1.584	1.580	1.567	1.555
450	1.392	1.397	1.404	1.416	1.428	1.438	1.449	1.471	1.490	1.505	1.518	1.533	1.541	1.542	1.537	1.528
500	1.387	1.391	1.395	1.406	1.414	1.421	1.430	1.448	1.463	1.474	1.484	1.499	1.507	1.510	1.510	1.504
600	1.377	1.378	1.382	1.386	1.392	1.398	1.403	1.413	1.423	1.432	1.439	1.448	1.457	1.461	1.465	1.466
800	1.353	1.355	1.357	1.359	1.361	1.365	1.366	1.372	1.375	1.381	1.384	1.392	1.397	1.401	1.406	1.409
1000	1.336	1.337	1.338	1.339	1.342	1.343	1.343	1.345	1.348	1.350	1.354	1.358	1.361	1.365	1.368	1.372

Calculated from C_p, C_v values of Sychev, V. V., A. A. Vasserman, et al., "Thermodynamic Properties of Air," Standartov, Moscow, 1978 and Hemisphere, New York, 1988 (276 pp.).

SPECIFIC HEATS OF AQUEOUS SOLUTIONS

UNITS CONVERSIONS

For this subsection, the following units conversions are applicable:

$$^{\circ}\text{F} = \% \text{ } ^{\circ}\text{C} + 32.$$

To convert calories per gram-degree Celsius to British thermal units per pound-degree Fahrenheit, multiply by 1.0.

TABLE 2-201 Acetic Acid (at 38°C)

Mole % acetic acid	0	6.98	30.9	54.5	100
Cal/g °C	1.0	0.911	0.73	0.631	0.535

TABLE 2-202 Ammonia

Mole % NH ₃	Specific heat, cal/g °C			
	2.4°C	20.6°C	41°C	61°C
0	1.01	1.0	0.995	1.0
10.5	0.98	0.995	1.06	1.02
20.9	.96	.99	1.03	
31.2	.956	1.0		
41.4	.985			

TABLE 2-203 Aniline (at 20°C)

Mol % aniline	100	95	90.5	82.3	75.2
Cal/g °C	0.497	0.52	0.53	0.56	0.581

TABLE 2-204 Copper Sulfate

Composition	Temperature	Specific heat, cal/g °C
CuSO ₄ + 50H ₂ O	12° to 15°C	0.848
CuSO ₄ + 200H ₂ O	12° to 14°C	.951
CuSO ₄ + 400H ₂ O	13° to 17°C	.975

TABLE 2-205 Ethyl Alcohol

Mole % C ₂ H ₅ OH	Specific heat, cal/g °C		
	3°C	23°C	41°C
4.16	1.05	1.02	1.02
11.5	1.02	1.03	1.03
37.0	0.805	0.86	0.875
61.0	.67	.727	.748
100.0	.54	.577	.621

TABLE 2-206 Glycerol

Mole % C ₃ H ₅ (OH) ₃	Specific heat, cal/g °C	
	15°C	32°C
2.12	0.961	0.960
4.66	.929	.924
11.5	.851	.841
22.7	.765	.758
43.9	.67	.672
100.0	.555	.576

TABLE 2-207 Hydrochloric Acid

Mole % HCl	Specific heat, cal/g °C				
	0°C	10°C	20°C	40°C	60°C
0.0	1.00				
9.09	0.72	0.72	0.74	0.75	0.78
16.7	.61	.605	.631	.645	.67
20.0	.58	.575	.591	.615	.638
25.9	.55				.61

ADDITIONAL REFERENCES

For additional data, see *International Critical Tables*, vol. 5, pp. 115–116, 122–125.

TABLE 2-208 Methyl Alcohol

Mole % CH ₃ OH	Specific heat, cal/g °C		
	5°C	20°C	40°C
5.88	1.02	1.0	0.995
12.3	0.975	0.982	.98
27.3	.877	.917	.92
45.8	.776	.811	.83
69.6	.681	.708	.726
100	.576	.60	.617

TABLE 2-209 Nitric Acid

% HNO ₃ by Weight	Specific Heat at 20°C, cal/g °C
0	1.000
10	0.900
20	.810
30	.730
40	.675
50	.650
60	.640
70	.615
80	.575
90	.515

TABLE 2-210 Phosphoric Acid*

% H ₂ PO ₄	C _p at 21.3°C cal/g °C	% H ₃ PO ₄	C _p at 21.3°C cal/g °C
2.50	0.9903	50.00	0.6350
3.80	.9970	52.19	.6220
5.33	.9669	53.72	.6113
8.81	.9389	56.04	.5972
10.27	.9293	58.06	.5831
14.39	.8958	60.23	.5704
16.23	.8796	62.10	.5603
19.99	.8489	64.14	.5460
22.10	.8300	66.13	.5349
24.56	.8125	68.14	.5242
25.98	.8004	69.97	.5157
28.15	.7856	69.50	.5160
29.96	.7735	71.88	.5046
32.09	.7590	73.71	.4940
33.95	.7432	75.79	.4847
36.26	.7270	77.69	.4786
38.10	.7160	79.54	.4680
40.10	.7024	80.00	.4686
42.08	.6877	82.00	.4593
44.11	.6748	84.00	.4500
46.22	.6607	85.98	.4419
48.16	.6475	88.01	.4359
49.79	.6370	89.72	.4206

*Z. Physik. Chem., A167, 42 (1933).

TABLE 2-211 Potassium Chloride

Mole % KCl	Specific heat, cal/g °C			
	6°C	20°C	33°C	40°C
0.99	0.945	0.947	0.947	0.947
3.85	.828	.831	.835	.837
5.66	.77	.775	.778	.775
7.41		.727		

TABLE 2-212 Potassium Hydroxide (at 19°C)

Mole % KOH	0	0.497	1.64	4.76	9.09
Cal/g °C	1.0	0.975	0.93	0.814	0.75

TABLE 2-213 Normal Propyl Alcohol

Mole % C ₃ H ₇ OH	Specific heat, cal/g °C		
	5°C	20°C	40°C
1.55	1.03	1.02	1.01
5.03	1.07	1.06	1.03
11.4	1.035	1.032	0.99
23.1	0.877	0.90	.91
41.2	.75	.78	.815
73.0	.612	.645	.708
100.0	.534	.57	.621

TABLE 2-214 Sodium Carbonate*

% Na ₂ CO ₃ by weight	Temperature, °C			
	17.6	30.0	76.6	98.0
0.000	0.9992	0.9986	1.0098	1.0084
1.498	.9807			
2.000		.9786		
2.901	.9597			
4.000		.9594		
5.000	.9428		0.9761	
6.000		.9392		
8.000	.9183			
10.000	.9086		.9452	
13.790	.8924			
13.840		.8881		
20.000		.8631	.8936	
25.000			.8615	0.8911

*J. Chem. Soc. 3062-3079 (1931).

TABLE 2-215 Sodium Chloride

Mole % NaCl	Specific heat, cal/g °C			
	6°C	20°C	33°C	57°C
0.249		0.99		
.99	0.96	.97	0.97	
2.44	.91	.915	.915	0.923
9.09	.805	.81	.81	.82

TABLE 2-216 Sodium Hydroxide (at 20°C)

Mole % NaOH	0	0.5	1.0	9.09	16.7	28.6	37.5
Cal/g °C	1.0	0.985	0.97	0.835	0.80	0.784	0.782

TABLE 2-217 Sulfuric Acid*

%H ₂ SO ₄	C _p at 20°C, cal/g °C	%H ₂ SO ₄	C _p at 20°C, cal/g °C
0.34	0.9968	35.25	0.7238
0.68	.9937	37.69	.7023
1.34	.9877	40.49	.6770
2.65	.9762	43.75	.6476
3.50	.9688	47.57	.6153
5.16	.9549	52.13	.5801
9.82	.9177	57.65	.5420
15.36	.8767	64.47	.5012
21.40	.8339	73.13	.4628
22.27	.8275	77.91	.4518
23.22	.8205	81.33	.4481
24.25	.8127	82.49	.4467
25.39	.8041	84.48	.4408
26.63	.7945	85.48	.4346
28.00	.7837	89.36	.4016
29.52	.7717	91.81	.3787
30.34	.7647	94.82	.3554
31.20	.7579	97.44	.3404
33.11	.7422	100.00	.3352

*Vinal and Craig, *Bur. Standards J. Research*, **24**, 475 (1940).

TABLE 2-218 Zinc Sulfate

Composition	Temperature	Specific heat, cal/g °C
ZnSO ₄ + 50H ₂ O	20° to 52°C	0.842
ZnSO ₄ + 200H ₂ O	20° to 52°C	.952

SPECIFIC HEATS OF MISCELLANEOUS MATERIALS

TABLE 2-219 Specific Heats of Miscellaneous Liquids and Solids

Material	Specific heat, cal/g °C
Alumina	0.2 (100°C); 0.274 (1500°C)
Alundum	0.186 (100°C)
Asbestos	0.25
Asphalt	0.22
Bakelite	0.3 to 0.4
Brickwork	About 0.2
Carbon	0.168 (26° to 76°C) 0.314 (40° to 892°C) 0.387 (56° to 1450°C)
(gas retort) (see under Graphite)	0.204
Cellulose	0.32
Cement, Portland Clinker	0.186
Charcoal (wood)	0.242
Chrome brick	0.17
Clay	0.224
Coal	0.26 to 0.37
tar oils	0.34 (15° to 90°C)
Coal tars	0.35 (40°C); 0.45 (200°C)
Coke	0.265 (21° to 400°C) 0.359 (21° to 800°C) 0.403 (21° to 1300°C)
Concrete	0.156 (70° to 312°F); 0.219 (72° to 1472°F)
Cryolite	0.253 (16° to 55°C)
Diamond	0.147
Fireclay brick	0.198 (100°C); 0.298 (1500°C)
Fluorspar	0.21 (30°C)
Gasoline	0.53
Glass (crown) (flint) (pyrex) (silicate)	0.16 to 0.20 0.117 0.20 0.188 to 0.204 (0 to 100°C) 0.24 to 0.26 (0 to 700°C)
wool	0.157
Granite	0.20 (20° to 100°C)
Graphite	0.165 (26° to 76°C); 0.390 (56° to 1450°C)
Gypsum	0.259 (16° to 46°C)
Kerosene	0.47
Limestone	0.217
Litharge	0.055
Magnesia	0.234 (100°C); 0.188 (1500°C)
Magnesite brick	0.222 (100°C); 0.195 (1500°C)
Marble	0.21 (18°C)
Porcelain, fired Berlin	0.189 (60°C)
Porcelain, green Berlin	0.185 (60°C)
Porcelain, fired earthenware	0.186 (60°C)
Porcelain, green earthenware	0.181 (60°C)

TABLE 2-219 Specific Heats of Miscellaneous Liquids and Solids (Concluded)

Material	Specific heat, cal/g °C
Pyrex glass	0.20
Pyrites (copper)	0.131 (30°C)
Pyrites (iron)	0.136 (30°C)
Pyroxylin plastics	0.34 to 0.38
Quartz	0.17 (0°C); 0.28 (350°C)
Rubber (vulcanized)	0.415
Sand	0.191
Silica	0.316
Silica brick	0.202 (100°C); 0.195 (1500°C)
Silicon carbide brick	0.202 (100°C)
Silk	0.33
Steel	0.12
Stone	about 0.2
Stoneware (common)	0.188 (60°C)
Turpentine	0.42 (18°C)
Wood (Oak)	0.570
Woods, miscellaneous	0.45 to 0.65
Wool	0.325
Zirconium oxide	0.11 (100°C); 0.179 (1500°C)

TABLE 2-219a Oils (Animal, Vegetable, Mineral Oils)

$$C_p[\text{cal}/(\text{g} \cdot ^\circ\text{C})] = A/\sqrt{d_4^{15}} + B(t - 15)$$

where d = density, g/cm^3 .

$^\circ\text{F} = \frac{9}{5} ^\circ\text{C} + 32$; to convert calories per gram-degree Celsius to British thermal units per pound-degree Fahrenheit, multiply by 1.0; to convert grams per cubic centimeter to pounds per cubic foot, multiply by 62.43.

Oils	A	B
Castor	0.500	0.0007
Citron	(0.438 at 54°C)	
Fatty drying	0.440	0.0007
non-drying	0.450	0.0007
semidrying	0.445	0.0007
oils (except castor)	0.450	0.0007
Naphthene base	0.405	0.0009
Olive	(0.47 at 7°C)	
Paraffin base	0.425	0.0009
Petroleum oils	0.415	0.0009

HEATS AND FREE ENERGIES OF FORMATION

UNITS CONVERSIONS

$^\circ\text{F} = \frac{9}{5} ^\circ\text{C} + 32$; to convert kilocalories per gram-mole to British thermal units per pound-mole, multiply by 1.799×10^{-3} .

TABLE 2-220 Heats and Free Energies of Formation of Inorganic Compounds

The values given in the following table for the heats and free energies of formation of inorganic compounds are derived from (a) Bichowsky and Rossini, "Thermochemistry of the Chemical Substances," Reinhold, New York, 1936; (b) Latimer, "Oxidation States of the Elements and Their Potentials in Aqueous Solution," Prentice-Hall, New York, 1938; (c) the tables of the American Petroleum Institute Research Project 44 at the National Bureau of Standards; and (d) the tables of Selected Values of Chemical Thermodynamic Properties of the National Bureau of Standards. The reader is referred to the preceding books and tables for additional details as to methods of calculation, standard states, and so on.

Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole	Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole
Aluminum				Barium (<i>Cont.</i>)			
Al	c	0.00	0.00	BaF ₂	c	-287.9	
AlBr ₃	c	-123.4			aq, 1600	-284.6	-265.3
	aq	-209.5	-189.2	BaH ₂	c	-40.8	-31.5
Al ₂ C ₃	c	-30.8	-29.0	Ba(HCO ₃) ₂	aq	-459	-414.4
AlCl ₃	c	-163.8		BaI ₂	c	-144.6	
	aq, 600	-243.9	-209.5		aq, 400	-155.17	-158.52
AlF ₃	c	-329		Ba(IO ₃) ₂	c	-264.5	
	aq	-360.8	-312.6		aq	-237.50	-198.35
AlI ₃	c	-72.8		BaMoO ₄	c	-370	
	aq	-163.4	-152.5	Ba ₃ N ₂	c	-90.7	
AlN	c	-57.7	-50.4	Ba(NO ₂) ₂	c	-184.5	
Al(NH ₄)(SO ₄) ₂	c	-561.19	-486.17		aq	-179.05	-150.75
Al(NH ₄)(SO ₄) ₂ ·12H ₂ O	c	-1419.36	-1179.26	Ba(NO ₃) ₂	c	-236.99	-189.94
Al(NO ₃) ₃ ·6H ₂ O	c	-680.89	-526.32		aq, 600	-227.74	
Al(NO ₃) ₃ ·9H ₂ O	c	-897.59		BaO	c	-133.0	
Al ₂ O ₃	c, corundum	-399.09	-376.87	Ba(OH) ₂	c	-225.9	
	c	-304.8	-272.9		aq, 400	-237.76	-209.02
Al(OH) ₃	c			BaO·SiO ₂	c	-363	
Al ₂ O ₃ ·SiO ₂	c, sillimanite	-648.7		Ba ₃ (PO ₄) ₂	c	-992	
Al ₂ O ₃ ·SiO ₂	c, disthene	-642.4		BaPtCl ₆	c	-284.9	
Al ₂ O ₃ ·SiO ₂	c, andalusite	-642.0		BaS	c	-111.2	
3Al ₂ O ₃ ·2SiO ₂	c, mullite	-1874		BaSO ₃	c	-282.5	
Al ₂ S ₃	c	-121.6		BaSO ₄	c	-340.2	-313.4
Al ₂ (SO ₄) ₃	c	-820.99	-739.53	BaWO ₄	c	-402	
	aq	-893.9	-759.3	Beryllium			
Al ₂ (SO ₄) ₃ ·6H ₂ O	c	-1268.15	-1103.39	Be	c	0.00	0.00
Al ₂ (SO ₄) ₃ ·18H ₂ O	c	-2120		BeBr ₂	c	-79.4	
Antimony					aq	-142	-127.9
Sb	c	0.00	0.00	BeCl ₂	c	-112.6	
SbBr ₃	c	-59.9			aq	-163.9	-141.4
SbCl ₃	c	-91.3	-77.8	BeI ₂	c	-39.4	
SbCl ₅	l	-104.8			aq	-112	-103.4
SbF ₃	c	-216.6		Be ₂ N ₂	c	-134.5	-122.4
SbI ₃	c	-22.8		BeO	c	-145.3	-138.3
Sb ₂ O ₃	c, I, orthorhombic	-165.4	-146.0	Be(OH) ₂	c	-215.6	
	c, II, octahedral	-166.6		BeS	c	-56.1	
Sb ₂ O ₄	c	-213.0	-186.6	BeSO ₄	c	-281	
Sb ₂ O ₅	c	-230.0	-196.1		aq		-254.8
Sb ₂ S ₃	c, black	-38.2	-36.9	Bismuth			
Arsenic				Bi	c	0.00	0.00
As	c	0.00	0.00	BiCl ₃	c	-90.5	-76.4
AsBr ₃	c	-45.9			aq	-101.6	
AsCl ₃	l	-80.2	-70.5	BiI ₃	c	-24	
AsF ₃	l	-223.76	-212.27		aq	-27	
AsH ₃	g	43.6	37.7	BiO	c	-49.5	-43.2
AsI ₃	c	-13.6		Bi ₂ O ₃	c	-137.1	-117.9
As ₂ O ₃	c	-154.1	-134.8	Bi(OH) ₃	c	-171.1	
As ₂ O ₅	c	-217.9	-183.9	Bi ₂ S ₃	c	-43.9	-39.1
As ₂ S ₃	c	-20	-20	Bi ₂ (SO ₄) ₃	c	-607.1	
	amorphous	-34.76		Boron			
Barium				B	c	0.00	0.00
Ba	c	0.00	0.00	BBr ₃	l	-52.7	
BaBr ₂	c	-180.38			g	-44.6	-50.9
	aq, 400	-185.67	-183.0	BCl ₃	g	-94.5	-90.8
BaCl ₂	c	-205.25		BF ₃	g	-265.2	-261.0
	aq, 300	-207.92	-196.5	B ₂ H ₆	g	7.5	19.9
Ba(ClO ₃) ₂	c	-176.6		BN	c	-32.1	-27.2
	aq, 1600	-170.0	-134.4	B ₂ O ₃	c	-302.0	-282.9
Ba(ClO ₄) ₂	c	-210.2			gls	-297.6	-280.3
	aq, 800		-155.3	B(OH) ₃	c	-260.0	-229.4
Ba(CN) ₂	c	-48		B ₂ S ₃	c	-56.6	
Ba(CNO) ₂	c	-212.1		Bromine			
	aq		-180.7	Br ₂	l	0.00	0.00
BaCN ₂	c	-63.6			g	7.47	0.931
BaCO ₃	c, witherite	-284.2	-271.4	BrCl	g	3.06	-0.63
BaCrO ₄	c	-342.2					

*For footnotes see end of table.

TABLE 2-220 Heats and Free Energies of Formation of Inorganic Compounds (Continued)

Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole	Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole
Cadmium				Cesium (Cont.)			
Cd	c	0.00	0.00	Cs ₂ CO ₃	c	-271.88	
CdBr ₂	c	-75.8	-70.7	CsF	c	-131.67	
	aq, 400	-76.6	-67.6		aq, 400	-140.48	-135.98
CdCl ₂	c	-92.149	-81.889	CsH	c	-12	-7.30
	aq, 400	-96.44	-81.2	CsHCO ₃	c	-230.6	
Cd(CN) ₂	c	36.2			aq, 2000	-226.6	-210.56
CdCO ₃	c	-178.2	-163.2	CsI	c	-83.91	
CdI ₂	c	-48.40			aq, 400	-75.74	-82.61
	aq, 400	-47.46	-43.22	CsNH ₂	c	-28.2	
Cd ₃ N ₂	c	39.8		CsNO ₃	c	-121.14	
Cd(NO ₃) ₂	aq, 400	-115.67	-71.05		aq, 400	-111.54	-96.53
CdO	c	-62.35	-55.28	Cs ₂ O	c	-82.1	
Cd(OH) ₂	c	-135.0	-113.7	CsOH	c	-100.2	
CdS	c	-34.5	-33.6		aq, 200	-117.0	-107.87
CdSO ₄	c	-222.23		Cs ₂ S	c	-87	
	aq, 400	-232.635	-194.65	Cs ₂ SO ₄	c	-344.86	
					aq	-340.12	-316.66
Calcium				Chlorine			
Ca	c	0.00	0.00	Cl ₂	g	0.00	0.00
CaBr ₂	c	-162.20		ClF	g	-25.7	
	aq, 400	-187.19	-181.86	ClO	g	33	
CaC ₂	c	-14.8		ClO ₂	g	24.7	29.5
CaCl ₂	c	-190.6	-179.8	ClO ₃	g	37	
	aq	-209.15	-195.36	Cl ₂ O	g	18.20	22.40
CaCN ₂	c	-85		Cl ₂ O ₇	g	63	
Ca(CN) ₂	c	-43.3		Chromium			
	aq		-54.0	Cr	c	0.00	0.00
CaCO ₃	c, calcite	-289.5	-270.8	CrBr ₃	aq		-122.7
	c, aragonite	-289.54	-270.57	Cr ₃ C ₂	c	-21.008	-21.20
CaCO ₃ ·MgCO ₃	c	-558.8		Cr ₄ C	c	-16.378	-16.74
CaC ₂ O ₄	c	-332.2		CrCl ₂	c	-103.1	-93.8
Ca(C ₂ H ₃ O ₂) ₂	c	-356.3			aq		-102.1
	aq	-364.1	-311.3	CrF ₂	c	-152	
CaF ₂	c	-290.2		CrF ₃	c	-231	
	aq	-286.5	-264.1	CrI ₂	c	-63.7	
CaH ₂	c	-46	-35.7		aq		-64.1
CaI ₂	c	-128.49		CrO ₃	c	-139.3	
	aq, 400	-156.63	-157.37	Cr ₂ O ₃	c	-268.8	-249.3
Ca ₃ N ₂	c	-103.2	-88.2	Cr ₂ (SO ₄) ₃	aq		-626.3
Ca(NO ₃) ₂	c	-224.05	-177.38	Cobalt			
	aq, 400	-228.29		Co	c	0.00	0.00
Ca(NO ₃) ₂ ·2H ₂ O	c	-367.95	-293.57	CoBr ₂	c	-55.0	
Ca(NO ₃) ₂ ·3H ₂ O	c	-439.05	-351.58		aq	-73.61	-61.96
Ca(NO ₃) ₂ ·4H ₂ O	c	-509.43	-409.32	Co ₂ C	c	9.49	7.08
CaO	c	-151.7	-144.3	CoCl ₂	c	-76.9	-66.6
Ca(OH) ₂	c	-235.58	-213.9		aq, 400	-95.58	-75.46
	aq, 800	-239.2	-207.9	CoCO ₃	c	-172.39	-155.36
CaO·SiO ₂	c, II, wollastonite	-377.9	-357.5	CoF ₂	aq	-172.98	-144.2
	c, I, pseudo-wollastonite	-376.6	-356.6	CoI ₂	c	-24.2	
					aq	-43.15	-37.4
CaS	c	-114.3	-113.1	Co(NO ₃) ₂	c	-102.8	
CaSO ₄	c, insoluble form	-338.73	-311.9		aq	-114.9	-65.3
	c, soluble form α	-336.58	-309.8	CoO	c	-57.5	
	c, soluble form β	-335.52	-308.8	Co ₃ O ₄	c	-196.5	
CaSO ₄ ·½H ₂ O	c	-376.13		Co(OH) ₂	c	-131.5	-108.9
CaSO ₄ ·2H ₂ O	c	-479.33	-425.47	Co(OH) ₃	c	-177.0	-142.0
CaWO ₄	c	-387		CoS	c	-22.3	-19.8
Carbon				Co ₂ S ₃	c	-40.0	
C	c, graphite	0.00	0.00	CoSO ₄	c	-216.6	
	c, diamond	0.453	0.685		aq, 400		-188.9
CO	g	-26.416	-32.808	Columbium			
CO ₂	g	-94.052	-94.260	Cb	c	0.00	0.00
Cerium				Cb ₂ O ₅	c	-462.96	
Ce	c	0.00	0.00	Copper			
CeN	c	-78.2	-70.8	Cu	c	0.00	0.00
Cesium				CuBr	c	-26.7	-23.8
Cs	c	0.00	0.00	CuBr ₂	c	-34.0	
CsBr	c	-97.64			aq	-42.4	-33.25
	aq, 500	-91.39	-94.86	CuCl	c	-31.4	-24.13
CsCl	c	-106.31		CuCl ₂	c	-48.83	
	aq, 400	-102.01	-101.61		aq, 400	-64.7	

TABLE 2-220 Heats and Free Energies of Formation of Inorganic Compounds (Continued)

Compound	State†	Heat of formation‡§ ΔH (forma- tion) at 25°C, kcal/mole	Free energy of forma- tion ¶ ΔF (formation) at 25°C, kcal/mole	Compound	State†	Heat of formation‡§ ΔH (forma- tion) at 25°C, kcal/mole	Free energy of forma- tion ¶ ΔF (formation) at 25°C, kcal/mole
Copper (Cont.)				Hydrogen (Cont.)			
CuClO ₄	aq	-28.3	1.34	H ₂ CO ₃	aq	-167.19	-149.0
Cu(ClO ₃) ₂	aq, 400		15.4	HF	g	-64.2	-64.7
Cu(ClO ₄) ₂	aq		-5.5		aq, 200	-75.75	
CuI	c	-17.8	-16.66	HI	g	6.27	0.365
CuI ₂	c	-4.8			aq, 400	-13.47	-12.35
	aq	-11.9	-8.76	HIO	aq	-38	-23.33
Cu ₃ N	c	17.78		HIO ₃	c	-56.77	
Cu(NO ₃) ₂	c	-73.1			aq	-54.8	-32.25
	aq, 200	-83.6	-36.6	HN ₃	g	70.3	78.50
CuO	c	-38.5	-31.9	HNO ₃	g	-31.99	-17.57
Cu ₂ O	c	-43.00	-38.13		l	-41.35	-19.05
Cu(OH) ₂	c	-108.9	-85.5		aq, 400	-49.210	
CuS	c	-11.6	-11.69	HNO ₃ ·H ₂ O	l	-112.91	-78.36
Cu ₂ S	c	-18.97	-20.56	HNO ₃ ·3H ₂ O	l	-252.15	-193.70
CuSO ₄	c	-184.7	-158.3	H ₂ O	g	-57.7979	-54.6351
	aq, 800	-200.78	-160.19		l	-68.3174	-56.6899
Cu ₂ SO ₄	c	-179.6		H ₂ O ₂	l	-45.16	-28.23
	aq		-152.0		aq, 200	-45.80	-31.47
Erbium				H ₃ PO ₂	c	-145.5	
Er	c	0.00	0.00		aq	-145.6	-120.0
Er(OH) ₃	c	-326.8		H ₃ PO ₃	c	-232.2	
Fluorine					aq	-232.2	-204.0
F ₂	g	0.00	0.00	H ₃ PO ₄	c	-306.2	
F ₂ O	g	5.5	9.7		aq, 400	-309.32	-270.0
Gallium				H ₂ S	g	-4.77	-7.85
Ga	c	0.00	0.00		aq, 2000	-9.38	
GaBr ₃	c	-92.4		H ₂ S ₂	l	-3.6	
GaCl ₃	c	-125.4		H ₂ SO ₃	aq, 200	-146.88	-128.54
GaN	c	-26.2		H ₂ SO ₄	l	-193.69	
Ga ₂ O	c	-84.3			aq, 400	-212.03	
Ga ₂ O ₃	c	-259.9		H ₂ Se	g	20.5	17.0
Germanium					aq	18.1	18.4
Ge	c	0.00	0.00	H ₂ SeO ₃	c	-126.5	
Ge ₃ N ₄	c	-15.7			aq	-122.4	-101.36
GeO ₂	c	-128.6		H ₂ SeO ₄	c	-130.23	
Gold					aq, 400	-143.4	
Au	c	0.00	0.00	H ₂ SiO ₃	c	-267.8	-247.9
AuBr	c	-3.4		H ₂ SiO ₄	c	-340.6	
AuBr ₃	c	-14.5		H ₂ Te	g	36.9	33.1
	aq	-11.0	24.47	H ₂ TeO ₃	c	-145.0	-115.7
AuCl	c	-8.3			aq	-145.0	
AuCl ₃	c	-28.3		H ₂ TeO ₄	aq	-165.6	
	aq	-32.96	4.21	Indium			
AuI	c	0.2	-0.76	In	c	0.00	0.00
Au ₂ O ₃	c	11.0	18.71	InBr ₃	c	-97.2	
Au(OH) ₃	c	-100.6			aq	-112.9	-97.2
Hafnium				InCl ₃	c	-128.5	
Hf	c	0.00	0.00		aq	-145.6	-117.5
HfO ₂	c	-271.1	-258.2	InI ₃	c	-56.5	
Hydrogen					aq	-67.2	-60.5
H ₃ AsO ₃	aq	-175.6	-153.04	InN	c	-4.8	
H ₃ AsO ₄	c	-214.9		In ₂ O ₃	c	-222.47	
	aq	-214.8	-183.93	Iodine			
HBr	g	-8.66	-12.72	I ₂	c	0.00	0.00
	aq, 400	-28.80	-24.58		g	14.88	4.63
HBrO	aq	-25.4	-19.90	IBr	g	10.05	1.24
HBrO ₃	aq	-11.51	5.00	ICl	g	4.20	-1.32
HCl	g	-22.063	-22.778	ICl ₃	c	-21.8	-6.05
	aq, 400	-39.85	-31.330	I ₂ O ₅	c	-42.5	
HCN	g	31.1	27.94	Iridium			
	aq, 100	24.2	26.55	Ir	c	0.00	0.00
HClO	aq, 400	-28.18	-19.11	IrCl	c	-20.5	-16.9
HClO ₃	aq	-23.4	-0.25	IrCl ₂	c	-40.6	-32.0
HClO ₄	aq, 660	-31.4	-10.70	IrCl ₃	c	-60.5	-46.5
HC ₂ H ₃ O ₂	l	-116.2	-93.56	IrF ₆	l	-130	
	aq, 400	-116.74	-96.8	IrO ₂	c	-40.14	
H ₂ C ₂ O ₄	c	-196.7		Iron			
	aq, 300	-194.6	-165.64	Fe	c, α	0.00	0.00
HCOOH	l	-97.8	-82.7		c	-57.15	
	aq, 200	-98.0	-85.1	FeBr ₂	aq, 540	-78.7	-69.47

TABLE 2-220 Heats and Free Energies of Formation of Inorganic Compounds (Continued)

Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole	Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole
Iron (Cont.)				Lithium (Cont.)			
FeBr ₃	aq	-95.5	-76.26	LiC ₂ H ₃ O ₂	aq	-183.9	-160.00
Fe ₃ C	c	5.69	4.24	Li ₂ CO ₃	c	-289.7	-269.8
Fe(CO) ₅	l	-187.6			aq, 1900	-293.1	-267.58
FeCO ₃	c, siderite	-172.4	-154.8	LiCl	c	-97.63	
FeCl ₂	c	-81.9	-72.6		aq, 278	-106.45	-102.03
	aq	-100.0	-83.0	LiClO ₃	aq	-87.5	-70.95
FeCl ₃	c	-96.4		LiClO ₄	aq	-106.3	-81.4
	aq, 2000	-128.5	-96.5	LiF	c	-145.57	
FeF ₂	aq, 1200	-177.2	-151.7		aq, 400	-144.85	-136.40
FeI ₂	c	-24.2		LiH	c	-22.9	
	aq	-47.7	-45	LiHCO ₃	aq, 2000	-231.1	-210.98
FeI ₃	aq	-49.7	-39.5	LiI	c	-65.07	
Fe ₄ N	c	-2.55	0.862		aq, 400	-80.09	-83.03
Fe(NO ₃) ₂	aq	-118.9	-72.8	LiIO ₃	aq	-121.3	-102.95
Fe(NO ₃) ₃	aq, 800	-156.5	-81.3	Li ₃ N	c	-47.45	-37.33
FeO	c	-64.62	-59.38	LiNO ₃	c	-115.350	
Fe ₂ O ₃	c	-198.5	-179.1		aq, 400	-115.88	-96.95
Fe ₃ O ₄	c	-266.9	-242.3	Li ₂ O	c	-142.3	
Fe(OH) ₂	c	-135.9	-115.7	Li ₂ O ₂	c	-151.9	-138.0
Fe(OH) ₃	c	-197.3	-166.3		aq	-159	
FeO·SiO ₂	c	-273.5		LiOH	c	-116.58	-106.44
Fe ₂ P	c	-13			aq, 400	-121.47	-108.29
FeSi	c	-19.0		LiOH·H ₂ O	c	-188.92	
FeS	c	-22.64	-23.23	Li ₂ O·SiO ₂	gls	-374	
FeS ₂	c, pyrites	-38.62	-35.93	Li ₂ Se	c	-84.9	
	c, marcasite	-33.0			aq	-95.5	-105.64
FeSO ₄	c	-221.3	-195.5	Li ₂ SO ₄	aq	-340.23	-314.66
	aq, 400	-236.2	-196.4		aq, 400	-347.02	
Fe ₂ (SO ₄) ₃	aq, 400	-653.3	-533.4	Li ₂ SO ₄ ·H ₂ O	c	-411.57	-375.07
FeTiO ₃	c, ilmenite	-295.51	-277.06	Magnesium			
Lanthanum				Mg	c	0.00	0.00
La	c	0.00	0.00	Mg(AsO ₄) ₂	c	-731.3	
LaCl ₃	c	-253.1			aq	-749	-630.14
	aq	-284.7		MgBr ₂	c	-123.9	
La ₃ H ₈	c	-160			aq, 400	-167.33	-156.94
LaN	c	-72.0	-64.6	Mg(CN) ₂	aq	-39.7	-29.08
La ₂ O ₃	c	-539		MgCN ₂	c	-61	
LaS ₂	c	-148.3		Mg(C ₂ H ₃ O ₂) ₂	aq	-344.6	-286.38
La ₂ S ₃	c	-351.4		MgCO ₃	c	-261.7	-241.7
La ₂ (SO ₄) ₃	aq	-972		MgCl ₂	c	-153.220	-143.77
Lead					aq, 400	-189.76	
Pb	c	0.00	0.00	MgCl ₂ ·H ₂ O	c	-230.970	-205.93
PbBr ₂	c	-66.24	-62.06	MgCl ₂ ·2H ₂ O	c	-305.810	-267.20
	aq	-56.4	-54.97	MgCl ₂ ·4H ₂ O	c	-453.820	-387.98
PbCO ₃	c, cerussite	-167.6	-150.0	MgCl ₂ ·6H ₂ O	c	-597.240	-505.45
Pb(C ₂ H ₃ O ₂) ₂	c	-232.6		MgF ₂	c	-263.8	
	aq, 400	-234.2	-184.40		c	-86.8	
PbC ₂ O ₄	c	-205.3		MgI ₂	c	-136.79	-132.45
PbCl ₂	c	-85.68	-75.04	MgMoO ₄	c	-329.9	
	aq	-82.5	-68.47	Mg ₃ N ₂	c	-115.2	-100.8
PbF ₂	c	-159.5	-148.1	Mg(NO ₃) ₂	c	-188.770	-140.66
PbI ₂	c	-41.77	-41.47		aq, 400	-209.927	-160.28
Pb(NO ₃) ₂	c	-106.88		Mg(NO ₃) ₂ ·2H ₂ O	c	-336.625	
	aq, 400	-99.46	-58.3	Mg(NO ₃) ₂ ·6H ₂ O	c	-624.48	-496.03
PbO	c, red	-51.72	-45.53	MgO	c	-143.84	-136.17
	c, yellow	-50.86	-43.88	MgO·SiO ₂	c	-347.5	-326.7
PbO ₂	c	-65.0	-52.0	Mg(OH) ₂	c, ppt.	-221.90	-200.17
Pb ₃ O ₄	c	-172.4	-142.2		c, brucite	-223.9	-193.3
Pb(OH) ₂	c	-123.0	-102.2	MgS	c	-84.2	
PbS	c	-22.38	-21.98		aq	-108	
PbSO ₄	c	-218.5	-192.9	MgSO ₄	c	-304.94	-277.7
Lithium					aq, 400	-325.4	-283.88
Li	c	0.00	0.00	MgTe	c	-25	
LiBr	c	-83.75		MgWO ₄	c	-345.2	
	aq, 400	-95.40	-95.28	Manganese			
LiBrO ₃	aq	-77.9	-65.70	Mn	c, α	0.00	0.00
Li ₃ C ₂	c	-13.0		MnBr ₂	c	-91	
LiCN	aq	-31.4	-31.35		aq	-106	-97.8
LiCNO	aq	-101.2	-94.12	Mn ₃ C	c	1.1	1.26

TABLE 2-220 Heats and Free Energies of Formation of Inorganic Compounds (Continued)

Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole	Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole
Manganese (Cont.)				Nickel (Cont.)			
Mn(C ₂ H ₃ O ₂) ₂	c	-270.3		NiF ₂	aq, 400	-94.34	-74.19
MnCO ₃	aq	-282.7	-227.2		c	-157.5	
MnC ₅ O ₄	c	-211	-192.5	NiI ₂	aq	-171.6	-142.9
MnCl ₂	c	-240.9			c	-22.4	
	c	-112.0	-102.2	Ni(NO ₃) ₂	aq	-42.0	-36.2
	aq, 400	-128.9			c	-101.5	
MnF ₂	aq, 1200	-206.1	-180.0	NiO	aq, 200	-113.5	-64.0
MnI ₂	c	-49.8			c	-58.4	-51.7
	aq	-76.2	-73.3	Ni(OH) ₂	c	-129.8	-105.6
Mn ₅ N ₂	c	-57.77	-46.49	Ni(OH) ₃	c	-163.2	
Mn(NO ₃) ₂	c	-134.9		NiS	c	-20.4	
	aq, 400	-148.0	-101.1	NiSO ₄	c	-216	
Mn(NO ₃) ₂ ·6H ₂ O	c	-557.07	-441.2		aq, 200	-231.3	-187.6
MnO	c	-92.04	-86.77	Nitrogen			
MnO ₂	c	-124.58	-111.49	N ₂	g	0.00	0.00
Mn ₂ O ₃	c	-229.5	-209.9	NF ₃	g	-27	
Mn ₃ O ₄	c	-331.65	-306.22	NH ₃	g	-10.96	-3.903
MnO·SiO ₂	c	-301.3	-282.1		aq, 200	-19.27	
Mn(OH) ₂	c	-163.4	-143.1	NH ₄ Br	c	-64.57	
Mn(OH) ₃	c	-221	-190		aq	-60.27	-43.54
Mn ₃ (PO ₄) ₂	c	-736		NH ₄ C ₂ H ₃ O ₂	c	-148.1	
MnSe	c	-26.3	-27.5		aq, 400	-148.58	-108.26
MnS	c, green	-47.0	-48.0	NH ₄ CN	c	-0.7	
MnSO ₄	c	-254.18	-228.41		aq	3.6	20.4
	aq, 400	-265.2		NH ₄ CNS	c	-17.8	
Mn ₂ (SO ₄) ₃	c	-635			aq	-12.3	4.4
	aq	-657		(NH ₄) ₂ CO ₃	aq	-223.4	-164.1
Mercury				(NH ₄) ₂ C ₂ O ₄	c	-266.3	
Hg	l	0.00	0.00		aq	-260.6	-196.2
HgBr	g	23	18	NH ₄ Cl	c	-75.23	-48.59
HgBr ₂	c	-40.68	-38.8		aq, 400	-71.20	
	aq	-38.4	-9.74	NH ₄ ClO ₄	c	-69.4	
Hg(C ₂ H ₃ O ₂) ₂	c	-196.3			aq	-63.2	-21.1
	aq	-192.5	-139.2	(NH ₄) ₂ CrO ₄	c	-276.9	
HgCl ₂	c	-53.4	-42.2		aq	-271.3	-209.3
	aq	-50.3	-23.25	NH ₄ F	c	-111.6	
HgCl	g	19	14		aq	-110.2	-84.7
Hg ₂ Cl ₂	c	-63.13		NH ₄ I	c	-48.43	
Hg(CN) ₂	c	62.8			aq	-44.97	-31.3
	aq, 1110	66.25		NH ₄ NO ₃	c	-87.40	
HgC ₂ O ₄	c	-159.3			aq, 500	-80.89	
HgH	g	57.1	52.25	NH ₄ OH	aq	-87.59	
HgI ₂	c, red	-25.3	-24.0	(NH ₄) ₂ S	aq, 400	-55.21	-14.50
HgI	g	33	23	(NH ₄) ₂ SO ₄	c	-281.74	-215.06
Hg ₂ I ₂	c	-28.88	-26.53		aq, 400	-279.33	-214.02
Hg(NO ₃) ₂	aq	-56.8	-13.09	N ₂ H ₄	l	12.06	
Hg ₂ (NO ₃) ₂	aq	-58.5	-15.65	N ₂ H ₄ ·H ₂ O	l	-57.96	
HgO	c, red	-21.6	-13.94	N ₂ H ₄ ·H ₂ SO ₄	c	-232.2	
	c, yellow ppt.	-20.8		N ₂ O	g	19.55	24.82
Hg ₂ O	c	-21.6	-12.80	NO	g	21.600	20.719
HgS	c, black	-10.7	-8.80	NO ₂	g	7.96	12.26
HgSO ₄	c	-166.6		N ₂ O ₄	g	2.23	23.41
Hg ₂ SO ₄	c	-177.34	-149.12	N ₂ O ₅	c	-10.0	
Molybdenum				NOBr	l	11.6	19.26
Mo	c	0.00	0.00	NOCl	g	12.8	16.1
Mo ₂ C	c	4.36	2.91	Osmium			
Mo ₂ N	c	-8.3		Os	c	0.00	0.00
MoO ₂	c	-130	-118.0	OsO ₄	c	-93.6	-70.9
MoO ₃	c	-180.39	-162.01		g	-80.1	-68.1
MoS ₂	c	-56.27	-54.19	Oxygen			
MoS ₃	c	-61.48	-57.38	O ₂	g	0.00	0.00
Nickel				O ₃	g	33.88	38.86
Ni	c	0.00	0.00	Palladium			
NiBr ₂	c	-53.4		Pd	c	0.00	0.00
	aq	-72.6	-60.7	PdO	c	-20.40	
Ni ₃ C	c	9.2	8.88	Phosphorus			
Ni(C ₂ H ₃ O ₂) ₂	aq	-249.6	-190.1	P	c, white ("yellow")	0.00	0.00
Ni(CN) ₂	aq	230.9	66.3		c, red ("violet")	-4.22	-1.80
NiCl ₂	c	-75.0			g	150.35	141.88

TABLE 2-220 Heats and Free Energies of Formation of Inorganic Compounds (Continued)

Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole	Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole
Phosphorus (Cont.)				Potassium (Cont.)			
P ₂	g	33.82	24.60	KNH ₂	c	-28.25	
P ₄	g	13.2	5.89	KNO ₂	aq	-86.0	-75.9
PBr ₃	l	-45		KNO ₃	c	-118.08	-94.29
PBr ₅	c	-60.6			aq, 400	-109.79	-93.68
PCl ₃	g	-70.0	-65.2	K ₂ O	c	-86.2	
	l	-76.8	-63.3	K ₂ O·Al ₂ O ₃ ·SiO ₂	c, leucite	-1379.6	
PCl ₅	g	-91.0	-73.2		gls	-1368.2	
PH ₃	g	2.21	-1.45	K ₂ O·Al ₂ O ₃ ·SiO ₂	c, adularia	-1784.5	
PI ₃	c	-10.9			c, microcline	-1784.5	
P ₂ O ₅	c	-360.0			gls	-1747	
POCl ₃	g	-138.4	-127.2	KOH	c	-102.02	
Platinum					aq, 400	-114.96	-105.0
Pt	c	0.00	0.00	K ₃ PO ₃	aq	-397.5	
PtBr ₄	c	-40.6		K ₃ PO ₄	aq	-478.7	-443.3
	aq	-50.7		KH ₂ PO ₄	c	-362.7	-326.1
PtCl ₂	c	-34		K ₂ PtCl ₄	c	-254.7	
PtCl ₄	c	-62.6			aq	-242.6	-226.5
	aq	-82.3		K ₂ PtCl ₆	c	-299.5	-263.6
PtH ₄	c	-18			aq, 9400	-286.1	
Pt(OH) ₂	c	-87.5	-67.9	K ₂ Se	c	-74.4	
PtS	c	-20.18	-18.55		aq	-83.4	-99.10
PtS ₂	c	-26.64	-24.28	K ₂ SeO ₄	aq	-267.1	-240.0
Potassium				K ₂ S	c	-121.5	
K	c	0.00	0.00		aq, 400	-110.75	-111.44
K ₃ AsO ₃	aq	-323.0		K ₂ SO ₃	c	-267.7	
K ₃ AsO ₄	aq	-390.3	-355.7		aq	-269.7	-251.3
KH ₂ AsO ₄	c	-271.2	-236.7	K ₂ SO ₄	c	-342.65	-314.62
KBr	c	-94.06	-90.8		aq, 400	-336.48	-310.96
	aq, 400	-89.19	-92.0	K ₂ SO ₄ ·Al ₂ (SO ₄) ₃	c	-1178.38	-1068.48
KBrO ₃	c	-81.58	-60.30	K ₂ SO ₄ ·Al ₂ (SO ₄) ₃ ·24H ₂ O	c	-2895.44	-2455.68
	aq, 1667	-71.68		K ₂ S ₂ O ₆	c	-418.62	
KC ₂ H ₃ O ₂	c	-173.80		Rhenium			
	aq, 400	-177.38	-156.73	Re	c	0.00	0.00
KCl	c	-104.348	-97.76	ReF ₆	g	-274	
	aq, 400	-100.164	-98.76	Rhodium			
KClO ₃	c	-93.5	-69.30	Rh	c	0.00	0.00
	aq, 400	-81.34		RhO	c	-21.7	
KClO ₄	c	-103.8	-72.86	Rh ₂ O	c	-22.7	
	aq, 400	-101.14		Rh ₂ O ₃	c	-68.3	
KCN	c	-28.1		Rubidium			
	aq, 400	-25.3	-28.08	Rb	c	0.00	0.00
KCNO	c	-99.6		RbBr	c	-95.82	
	aq	-94.5	-90.85		g	-45.0	-52.50
KCNS	c	-47.0			aq, 500	-90.54	-93.38
	aq, 400	-41.07	-44.08	RbCN	aq	-25.9	
K ₂ CO ₃	c	-274.01		Rb ₂ CO ₃	c	-273.22	
	aq, 400	-280.90	-264.04		aq, 220	-282.61	-263.78
K ₂ C ₂ O ₄	c	-319.9		RbCl	c	-105.06	-98.48
	aq, 400	-315.5	-293.1		g	-53.6	-57.9
K ₂ CrO ₄	c	-333.4			aq, ∞	-101.06	-100.13
	aq, 400	-328.2	-306.3	RbF	c	-133.23	
K ₂ Cr ₂ O ₇	c	-488.5			aq, 400	-139.31	-134.5
	aq, 400	-472.1	-440.9	RbHCO ₃	c	-230.01	
KF	c	-134.50			aq, 2000	-225.59	-209.07
	aq, 180	-138.36	-133.13	RbI	c	-81.04	
K ₃ Fe(CN) ₆	c	-48.4			g	-31.2	-40.5
	aq	-34.5			aq, 400	-74.57	-81.13
K ₄ Fe(CN) ₆	c	-131.8		RbNH ₂	c	-27.74	
	aq	-119.9		RbNO ₃	c	-119.22	
KH	c	-10	-5.3		aq, 400	-110.52	-95.05
KHCO ₃	c	-229.8		Rb ₂ O	c	-82.9	
	aq, 2000	-224.85	-207.71	Rb ₂ O ₂	c	-107	
KI	c	-78.88	-77.37	RbOH	c	-101.3	
	aq, 500	-73.95	-79.76		aq, 200	-115.8	-106.39
KIO ₃	c	-121.69	-101.87	Ruthenium			
	aq, 400	-115.18	-99.68	Ru	c	0.00	0.00
KIO ₄	aq	-98.1		RuS ₂	c	-46.99	-44.11
KMnO ₄	c	-192.9	-169.1	Selenium			
	aq, 400	-182.5	-168.0	Se	c, I, hexagonal	0.00	0.00
K ₂ MoO ₄	aq, 880	-364.2	-342.9				

TABLE 2-220 Heats and Free Energies of Formation of Inorganic Compounds (Continued)

Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole	Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole
Selenium (<i>Cont.</i>)				Sodium (<i>Cont.</i>)			
	c, II, red, mono- clenic	0.2			aq, 476	-97.66	-73.29
Se ₂ Cl ₂	l	-22.06	-13.73	Na ₂ CrO ₄	c	-319.8	
SeF ₆	g	-246	-222		aq, 800	-323.0	-296.58
SeO ₂	c	-56.33		Na ₂ Cr ₂ O ₇	aq, 1200	-465.9	-431.18
Silicon				NaF	c	-135.94	-129.0
Si	c	0.00	0.00		aq, 400	-135.711	-128.29
SiBr ₄	l	-93.0		NaH	c	-14	-9.30
SiC	c	-28	-27.4	NaHCO ₃	c	-226.0	-202.66
SiCl ₄	l	-150.0	-133.9		aq	-222.1	-202.87
	g	-142.5	-133.0	NaI	c	-69.28	
SiF ₄	g	-370	-360		aq, ∞	-71.10	-74.92
SiH ₄	g	-14.8	-9.4	NaIO ₃	aq, 400	-112.300	-94.84
SiI ₄	c	-29.8		Na ₂ MoO ₄	c	-364	
Si ₃ N ₄	c	-179.25	-154.74		aq	-358.7	-333.18
SiO ₂	c, cristobalite, 1600° form	-202.62		NaNO ₂	c	-86.6	
	c, cristobalite, 1100° form	-202.46			aq	-83.1	-71.04
	c, quartz	-203.35	-190.4	NaNO ₃	c	-111.71	-87.62
	c, tridymite	-203.23			aq, 400	-106.880	-88.84
Silver				Na ₂ O	c	-99.45	-90.06
Ag	c	0.00	0.00	Na ₂ O ₂	c	-119.2	-105.0
AgBr	c	-23.90	-23.02	Na ₂ O·SiO ₂	c	-383.91	-361.49
Ag ₂ C ₂	c	84.5		Na ₂ O·Al ₂ O ₃ ·3SiO ₂	c, natrolite	-1180	
Ag ₂ C ₂ H ₃ O ₂	c	-95.9		Na ₂ O·Al ₂ O ₃ ·4SiO ₂	c	-1366	
	aq	-91.7	-70.86	NaOH	c	-101.96	-90.60
AgCN	c	33.8	38.70		aq, 400	-112.193	-100.18
Ag ₂ CO ₃	c	-119.5	-103.0	Na ₃ PO ₃	c	-389.1	
Ag ₂ C ₂ O ₄	c	-158.7		Na ₃ PO ₄	aq, 1000	-457	
AgCl	c	-30.11	-25.98		aq, 400	-471.9	-428.74
AgF	c	-48.7		Na ₂ PtCl ₄	aq	-237.2	-216.78
	aq, 400	-53.1	-47.26	Na ₂ PtCl ₆	c	-272.1	
AgI	c	-15.14	-16.17		aq	-280.9	
AgIO ₃	c	-42.02	-24.08	Na ₂ Se	c	-59.1	
AgNO ₂	c	-11.6	3.76		aq, 440	-78.1	-89.42
	aq	-2.9	9.99	Na ₂ SeO ₄	c	-254	
AgNO ₃	c	-29.4	-7.66		aq, 800	-261.5	-230.30
	aq, 6500	-24.02	-7.81	Na ₂ S	c	-89.8	
Ag ₂ O	c	-6.95	-2.23		aq, 400	-105.17	-101.76
Ag ₂ S	c	-5.5	-7.6	Na ₂ SO ₃	c	-261.2	-240.14
Ag ₂ SO ₄	c	-170.1	-146.8		aq, 800	-264.1	-241.58
	aq	-165.8	-139.22	Na ₂ SO ₄	c	-330.50	-302.38
					aq, 1100	-330.82	-301.28
Sodium				Na ₂ SO ₄ ·10H ₂ O	c	-1033.85	-870.52
Na	c	0.00	0.00	Na ₂ WO ₄	c	-391	
Na ₃ AsO ₃	aq, 500	-314.61			aq	-381.5	-345.18
Na ₃ AsO ₄	c	-366		Strontium			
	aq, 500	-381.97	-341.17	Sr	c	0.00	0.00
NaBr	c	-86.72		SrBr ₂	c	-171.0	
	aq, 400	-86.33	-87.17		aq, 400	-187.24	-182.36
NaBrO	aq	-78.9		Sr(C ₂ H ₃ O ₂) ₂	c	-358.0	
NaBrO ₃	aq, 400	-68.89	-57.59		aq	-364.4	-311.80
NaC ₂ H ₃ O ₂	c	-170.45		Sr(CN) ₂	aq	-59.5	-54.50
	aq, 400	-175.450	-152.31	SrCO ₃	c	-290.9	-271.9
NaCN	c	-22.47		SrCl ₂	c	-197.84	
	aq, 200	-22.29	-23.24		aq, 400	-209.20	-195.86
NaCNO	c	-96.3		SrF ₂	c	-289.0	
	aq	-91.7	-86.00	Sr(HCO ₃) ₂	aq	-459.1	-413.76
NaCNS	c	-39.94		SrI ₂	c	-136.1	
	aq, 400	-38.23	-39.24		aq, 400	-156.70	-157.87
Na ₂ CO ₃	c	-269.46	-249.55	Sr ₃ N ₂	c	-91.4	-76.5
	aq, 1000	-275.13	-251.36	Sr(NO ₃) ₂	c	-233.2	
NaCO ₂ NH ₂	c	-142.17			aq, 400	-228.73	-185.70
Na ₂ C ₂ O ₄	c	-313.8		SrO	c	-140.8	-133.7
	aq, 600	-309.92	-283.42	SrO·SiO ₂	gls	-364	
NaCl	c	-98.321	-91.894	SrO ₂	c	-153.3	-139.0
	aq, 400	-97.324	-93.92	Sr ₂ O	c	-153.6	
NaClO ₃	c	-83.59		Sr(OH) ₂	c	-228.7	
	aq, 400	-78.42	-62.84		aq, 800	-239.4	-208.27
NaClO ₄	c	-101.12		Sr ₃ (PO ₄) ₂	c	-980	
					aq	-985	-881.54
				SrS	c	-113.1	

TABLE 2-220 Heats and Free Energies of Formation of Inorganic Compounds (Continued)

Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole	Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole
Strontium (Cont.)				Tin			
SrSO ₄	aq	-120.4	-109.78	Sn	c, II, tetragonal	0.00	0.00
	c	-345.3			c, III, "gray," cubic	0.6	1.1
	aq, 400	-345.0	-309.30	SnBr ₂	c	-61.4	
SrWO ₄	c	-393		SnBr ₄	aq	-60.0	-55.43
Sulfur					c	-94.8	
S	c, rhombic	0.00	0.00		aq	-110.6	-97.66
	c, monoclinic	-0.071	0.023	SnCl ₂	c	-83.6	
	l, λ	0.257	0.072		aq	-81.7	-68.94
	l, λμ equilibrium		0.071	SnCl ₄	l	-127.3	-110.4
	g	53.25	43.57		aq	-157.6	-124.67
S ₂	g	31.02	19.36	SnI ₂	c	-38.9	
S ₈	g	27.78	13.97		aq	-33.3	-30.95
S ₈	g	27.090	12.770	SnO	c	-67.7	-60.75
S ₂ Br ₂	l	-4		SnO ₂	c	-138.1	-123.6
SrCl ₄	l	-13.7		Sn(OH) ₂	c	-136.2	-115.95
S ₂ Cl ₂	l	-14.2	-5.90	Sn(OH) ₄	c	-268.9	-226.00
S ₂ Cl ₄	l	-24.1		SnS	c	-18.61	
SF ₆	g	-262	-237	Titanium			
SO	g	19.02	12.75	Ti	c	0.00	0.00
SO ₂	g	-70.94	-71.68	TiC	l	-110	-109.2
SO ₃	g	-94.39	-88.59	TiCl ₄	l	-181.4	-165.5
	l	-103.03	-88.28	TiN	c	-80.0	-73.17
	c, α	-105.09	-88.22	TiO ₂	c, III, rutil	-225.0	-211.9
	c, β	-105.92	-88.34		amorphous	-214.1	-201.4
	c, γ	-109.34	-88.98	Tungsten			
SO ₂ Cl ₂	g	-82.04	-74.06	W	c	0.00	0.00
	l	-89.80	-75.06	WO ₂	c	-130.5	-118.3
Tantalum				WO ₃	c	-195.7	-177.3
Ta	c	0.00	0.00	WS ₂	c	-84	
TaN	c	-51.2	-45.11	Uranium			
Ta ₂ O ₅	c	-486.0	-453.7	U	c	0.00	0.00
Tellurium				UC ₂	c	-29	
Te	c	0.00	0.00	UCl ₃	c	-213	
TeBr ₄	c	-49.3		UCl ₄	c	-251	
TeCl ₄	c	-77.4	-57.4	U ₃ N ₄	c	-274	-249.6
TeF ₆	g	-315	-292	UO ₂	c	-256.6	-242.2
TeO ₂	c	-77.56	-64.66	UO ₂ (NO ₃) ₂ ·6H ₂ O	c	-756.8	-617.8
Thallium				UO ₃	c	-291.6	
Tl	c	0.00	0.00	U ₃ O ₈	c	-845.1	
TlBr	c	-41.5	-39.43	Vanadium			
	aq	-28.0	-32.34	V	c	0.00	0.00
TlCl	c	-49.37	-44.46	VCl ₂	c	-147	
	aq	-38.4	-39.09	VCl ₃	l	-187	
TlCl ₃	c	-82.4		VCl ₄	l	-165	
	aq	-91.0	-44.25	VN	c	-41.43	-35.08
TlF	aq	-77.6	-73.46	V ₂ O ₂	c	-195	
TlI	c	-31.1	-31.3	V ₂ O ₃	c	-296	-277
	aq	-12.7	-20.09	V ₂ O ₄	c	-342	-316
TlNO ₃	c	-58.2	-36.32	V ₂ O ₅	c	-373	-342
	aq	-48.4	-34.01	Zinc			
Tl ₂ O	c	-43.18		Zn	c	0.00	0.00
Tl ₂ O ₃	c	-120		ZnSb	c	-3.6	-3.88
TlOH	c	-57.44	-45.54	ZnBr ₂	c	-77.0	-72.9
	aq	-53.9	-45.35		aq, 400	-93.6	
Tl ₂ S	c	-22		Zn(C ₂ H ₃ O ₂) ₂	c	-259.4	
Tl ₂ SO ₄	c	-222.8	-197.79		aq, 400	-269.4	-214.4
	aq, 800	-214.1	-191.62	Zn(CN) ₂	c	17.06	
Thorium				ZnCO ₃	c	-192.9	-173.5
Th	c	0.00	0.00	ZnCl ₂	c	-99.9	-88.8
ThBr ₄	c	-281.5			aq, 400	-115.44	
	aq	-352.0	-295.31	ZnF ₂	aq	-192.9	-166.6
ThC ₂	c	-45.1		ZnI ₂	c	-50.50	-49.93
ThCl ₄	c	-335			aq	-61.6	
	aq	-392	-322.32	Zn(NO ₃) ₂	aq, 400	-134.9	-87.7
ThI ₄	aq	-292.0	-246.33	ZnO	c, hexagonal	-83.36	-76.19
Th ₃ N ₄	c	-309.0	-282.3	ZnO·SiO ₂	c	-282.6	
ThO ₂	c	-291.6	-280.1	Zn(OH) ₂	c, rhombic	-153.66	
Th(OH) ₄	c, "soluble"	-336.1		ZnS	c, wurtzite	-45.3	-44.2
Th(SO ₄) ₂	c	-632		ZnSO ₄	c	-233.4	
	aq	-668.1	-549.2		aq, 400	-252.12	-211.28

TABLE 2-220 Heats and Free Energies of Formation of Inorganic Compounds (Concluded)

Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole	Compound	State†	Heat of formation‡§ ΔH (formation) at 25°C, kcal/mole	Free energy of formation ¶ ΔF (formation) at 25°C, kcal/mole
Zirconium				Zirconium (Cont.)			
Zr	c	0.00	0.00	ZrO ₂	c, monoclinic	-258.5	-244.6
ZrC	c	-29.8	-34.6	Zr(OH) ₄	c	-411.0	
ZrCl ₄	c	-268.9		ZrO(OH) ₂	c	-337	-307.6
ZrN	c	-82.5	-75.9				

† The physical state is indicated as follows: *c*, crystal (solid); *l*, liquid; *g*, gas; *gls*, glass or solid supercooled liquid; *aq*, in aqueous solution. A number following the symbol *aq* applies only to the values of the heats of formation (not to those of free energies of formation); and indicates the number of moles of water per mole of solute; when no number is given, the solution is understood to be dilute. For the free energy of formation of a substance in aqueous solution, the concentration is always that of the hypothetical solution of unit molality.

‡ The increment in heat content, ΔH , in the reaction of forming the given substance from its elements in their standard states. When ΔH is negative, heat is evolved in the process, and, when positive, heat is absorbed.

§ The heat of solution in water of a given solid, liquid, or gaseous compound is given by the difference in the value for the heat of formation of the given compound in the solid, liquid, or gaseous state and its heat of formation in aqueous solution. The following two examples serve as an illustration of the procedure: (1) For NaCl(*c*) and NaCl(*aq*, 400H₂O), the values of ΔH (formation) are, respectively, -98.321 and -97.324 kg-cal per mole. Subtraction of the first value from the second gives $\Delta H = 0.998$ kg-cal per mole for the reaction of dissolving crystalline sodium chloride in 400 moles of water. When this process occurs at a constant pressure of 1 atm, 0.998 kg-cal of energy are absorbed. (2) For HCl(*g*) and HCl(*aq*, 400H₂O), the values for ΔH (formation) are, respectively, -22.06 and -39.85 kg-cal per mole. Subtraction of the first from the second gives $\Delta H = -17.79$ kg-cal per mole for the reaction of dissolving gaseous hydrogen chloride in 400 moles of water. At a constant pressure of 1 atm, 17.79 kg-cal of energy are evolved in this process.

|| The increment in the free energy, ΔF , in the reaction of forming the given substance in its standard state from its elements in their standard states. The standard states are: for a gas, fugacity (approximately equal to the pressure) of 1 atm; for a pure liquid or solid, the substance at a pressure of 1 atm; for a substance in aqueous solution, the hypothetical solution of unit molality, which has all the properties of the infinitely dilute solution except the property of concentration.

¶ The free energy of solution of a given substance from its normal standard state as a solid, liquid, or gas to the hypothetical one molal state in aqueous solution may be calculated in a manner similar to that described in footnote § for calculating the heat of solution.

HEATS OF COMBUSTION

TABLE 2-221 Enthalpies and Gibbs Energies of Formation, Entropies, and Net Enthalpies of Combustion of Inorganic and Organic Compounds at 298.15 K

Cmpd. no.	Name	Formula	CAS no.	Mol wt	Ideal gas enthalpy of formation, J/kmol × 1E-07	Ideal gas Gibbs energy of formation, J/kmol × 1E-07	Ideal gas entropy, J/(kmol·K) × 1E-05	Standard net enthalpy of combustion, J/kmol × 1E-09
1	Methane	CH ₄	74828	16.043	-7.4520	-5.0490	1.8627	-0.8026
2	Ethane	C ₂ H ₆	74840	30.070	-8.3820	-3.1920	2.2912	-1.4286
3	Propane	C ₃ H ₈	74986	44.097	-10.4680	-2.4390	2.7020	-2.0431
4	<i>n</i> -Butane	C ₄ H ₁₀	106978	58.123	-12.5790	-1.6700	3.0991	-2.6573
5	<i>n</i> -Pentane	C ₅ H ₁₂	109660	72.150	-14.6760	-0.8813	3.4945	-3.2449
6	<i>n</i> -Hexane	C ₆ H ₁₄	110543	86.177	-16.6940	-0.0066	3.8874	-3.8551
7	<i>n</i> -Heptane	C ₇ H ₁₆	142825	100.204	-18.7650	0.8165	4.2798	-4.4647
8	<i>n</i> -Octane	C ₈ H ₁₈	111659	114.231	-20.8750	1.6000	4.6723	-5.0742
9	<i>n</i> -Nonane	C ₉ H ₂₀	111842	128.258	-22.8740	2.4980	5.0640	-5.6846
10	<i>n</i> -Decane	C ₁₀ H ₂₂	124185	142.285	-24.9460	3.3180	5.4570	-6.2942
11	<i>n</i> -Undecane	C ₁₁ H ₂₄	1120214	156.312	-27.0430	4.1160	5.8493	-6.9036
12	<i>n</i> -Dodecane	C ₁₂ H ₂₆	112403	170.338	-29.0720	4.9810	6.2415	-7.5137
13	<i>n</i> -Tridecane	C ₁₃ H ₂₈	629505	184.365	-31.1770	5.7710	6.6337	-8.1229
14	<i>n</i> -Tetradecane	C ₁₄ H ₃₀	629594	198.392	-33.2440	6.5990	7.0259	-8.7328
15	<i>n</i> -Pentadecane	C ₁₅ H ₃₂	629629	212.419	-35.3110	7.4260	7.4181	-9.3424
16	<i>n</i> -Hexadecane	C ₁₆ H ₃₄	544763	226.446	-37.4170	8.2160	7.8102	-9.9515
17	<i>n</i> -Heptadecane	C ₁₇ H ₃₆	629787	240.473	-39.4450	9.0830	8.2023	-10.5618
18	<i>n</i> -Octadecane	C ₁₈ H ₃₈	593453	254.500	-41.5120	9.9100	8.5945	-11.1715
19	<i>n</i> -Nonadecane	C ₁₉ H ₄₀	629925	268.527	-43.5790	10.7400	8.9866	-11.7812
20	<i>n</i> -Eicosane	C ₂₀ H ₄₂	112958	282.553	-45.6460	11.5700	9.3787	-12.3908
21	2-Methylpropane	C ₄ H ₁₀	75285	58.123	-13.4180	-2.0760	2.9539	-2.6490
22	2-Methylbutane	C ₅ H ₁₂	78784	72.150	-15.3700	-1.4050	3.4374	-3.2395
23	2,3-Dimethylbutane	C ₆ H ₁₄	79298	86.177	-17.6800	-0.3125	3.6592	-3.8476
24	2-Methylpentane	C ₆ H ₁₄	107835	86.177	-17.4550	-0.5338	3.8089	-3.8492
25	2,3-Dimethylpentane	C ₇ H ₁₆	565593	100.204	-19.4100	0.5717	4.1455	-4.4608
26	2,3,3-Trimethylpentane	C ₈ H ₁₈	560214	114.231	-21.8450	1.8280	4.2702	-5.0688
27	2,2,4-Trimethylpentane	C ₈ H ₁₈	540841	114.231	-22.4010	1.3940	4.2296	-5.0653
28	Ethylene	C ₂ H ₄	74851	28.054	5.2510	6.8440	2.1920	-1.3230
29	Propylene	C ₃ H ₆	115071	42.081	1.9710	6.2150	2.6660	-1.9257

TABLE 2-221 Enthalpies and Gibbs Energies of Formation, Entropies, and Net Enthalpies of Combustion of Inorganic and Organic Compounds (Continued)

Cmpd. no.	Name	Formula	CAS no.	Mol wt	Ideal gas enthalpy of formation, J/kmol × 1E-07	Ideal gas Gibbs energy of formation, J/kmol × 1E-07	Ideal gas entropy, J/(kmol·K) × 1E-05	Standard net enthalpy of combustion, J/kmol × 1E-09
30	1-Butene	C ₄ H ₈	106989	56.108	-0.0540	7.0270	3.0775	-2.5408
31	<i>cis</i> -2-Butene	C ₄ H ₈	590181	56.108	-0.7400	6.5360	3.0120	-2.5339
32	<i>trans</i> -2-Butene	C ₄ H ₈	624646	56.108	-1.1000	6.3160	2.9650	-2.5303
33	1-Pentene	C ₅ H ₁₀	109671	70.134	-2.1300	7.8450	3.4699	-3.1296
34	1-Hexene	C ₆ H ₁₂	592416	84.161	-4.2000	8.7390	3.8389	-3.7394
35	1-Heptene	C ₇ H ₁₄	592767	98.188	-6.2800	9.4830	4.2549	-4.3489
36	1-Octene	C ₈ H ₁₆	111660	112.215	-8.3600	10.3000	4.6469	-4.9606
37	1-Nonene	C ₉ H ₁₈	124118	126.242	-10.4000	11.1500	5.0399	-5.5684
38	1-Decene	C ₁₀ H ₂₀	872059	140.269	-12.4700	11.9800	5.4319	-6.1781
39	2-Methylpropene	C ₄ H ₈	115117	56.108	-1.7100	5.8080	2.9309	-2.5242
40	2-Methyl-1-butene	C ₅ H ₁₀	563462	70.134	-3.5300	6.6680	3.3950	-3.1159
41	2-Methyl-2-butene	C ₅ H ₁₀	513359	70.134	-4.1800	6.0450	3.3860	-3.1088
42	1,2-Butadiene	C ₄ H ₆	590192	54.092	16.2300	19.8600	2.9300	-2.4617
43	1,3-Butadiene	C ₄ H ₆	106990	54.092	10.9240	14.9720	2.7889	-2.4090
44	2-Methyl-1,3-butadiene	C ₅ H ₈	78795	68.119	7.5730	14.5896	3.1564	-2.9842
45	Acetylene	C ₂ H ₂	74862	26.038	22.8200	21.0680	2.0081	-1.2570
46	Methylacetylene	C ₃ H ₄	74997	40.065	18.4900	19.3840	2.4836	-1.8487
47	Dimethylacetylene	C ₄ H ₆	503173	54.092	14.5700	18.4900	2.8330	-2.4189
48	3-Methyl-1-butyne	C ₅ H ₈	598232	68.119	13.8000	20.7200	3.1890	-3.0460
49	1-Pentyne	C ₅ H ₈	627190	68.119	14.4400	21.0300	3.2980	-3.0510
50	2-Pentyne	C ₅ H ₈	627214	68.119	12.5100	19.0700	3.3084	-3.0291
51	1-Hexyne	C ₆ H ₁₀	693027	82.145	12.3700	21.8500	3.6940	-3.6610
52	2-Hexyne	C ₆ H ₁₀	764352	82.145	10.5000	19.9000	3.7200	-3.6400
53	3-Hexyne	C ₆ H ₁₀	928494	82.145	10.6000	19.9000	3.7600	-3.6400
54	1-Heptyne	C ₇ H ₁₂	628717	96.172	10.3000	22.7000	4.0850	-4.2717
55	1-Octyne	C ₈ H ₁₄	629050	110.199	8.2300	23.5000	4.4780	-4.8815
56	Vinylacetylene	C ₄ H ₄	689974	52.076	30.4600	30.6000	2.7940	-2.3620
57	Cyclopentene	C ₅ H ₁₀	287923	70.134	-7.7030	3.8850	2.9290	-3.0709
58	Methylcyclopentane	C ₆ H ₁₂	96377	84.161	-10.6200	3.6300	3.3990	-3.6741
59	Ethylcyclopentane	C ₇ H ₁₄	1640897	98.188	-12.6900	4.4800	3.7830	-4.2839
60	Cyclohexane	C ₆ H ₁₂	110827	84.161	-12.3300	3.1910	2.9728	-3.6560
61	Methylcyclohexane	C ₇ H ₁₄	108872	98.188	-15.4800	2.7330	3.4330	-4.2571
62	1,1-Dimethylcyclohexane	C ₈ H ₁₆	590669	112.215	-18.1000	3.5229	3.6501	-4.8639
63	Ethylcyclohexane	C ₈ H ₁₆	1678917	112.215	-17.1500	3.9550	3.8260	-4.8705
64	Cyclopentene	C ₅ H ₈	142290	68.119	3.3100	11.0500	2.9127	-2.9393
65	1-Methylcyclopentene	C ₆ H ₁₀	693890	82.145	-0.3800	10.3800	3.2640	-3.5340
66	Cyclohexene	C ₆ H ₁₀	110838	82.145	-0.4600	10.7700	3.1052	-3.5320
67	Benzene	C ₆ H ₆	71432	78.114	8.2880	12.9600	2.6930	-3.1360
68	Toluene	C ₇ H ₈	108883	92.141	5.0170	12.2200	3.2099	-3.7340
69	<i>o</i> -Xylene	C ₈ H ₁₀	95476	106.167	1.9080	12.2000	3.5383	-4.3330
70	<i>m</i> -Xylene	C ₈ H ₁₀	108383	106.167	1.7320	11.8760	3.5854	-4.3318
71	<i>p</i> -Xylene	C ₈ H ₁₀	106423	106.167	1.8030	12.1400	3.5223	-4.3330
72	Ethylbenzene	C ₈ H ₁₀	100414	106.167	2.9920	13.0730	3.6063	-4.3450
73	Propylbenzene	C ₉ H ₁₂	103651	120.194	0.7910	13.8090	3.9843	-4.9542
74	1,2,4-Trimethylbenzene	C ₉ H ₁₂	95636	120.194	-1.3800	11.7100	3.9610	-4.9307
75	Isopropylbenzene	C ₉ H ₁₂	98828	120.194	0.4000	13.7900	3.8600	-4.9510
76	1,3,5-Trimethylbenzene	C ₉ H ₁₂	108678	120.194	-1.9000	11.8100	3.8560	-4.9291
77	<i>p</i> -Isopropyltoluene	C ₁₀ H ₁₄	99876	134.221	-2.9000	13.3520	4.2630	-5.5498
78	Naphthalene	C ₁₀ H ₈	91203	128.174	15.0580	22.4080	3.3315	-4.9809
79	Biphenyl	C ₁₂ H ₁₀	92524	154.211	18.2420	28.0230	3.9367	-6.0317
80	Styrene	C ₈ H ₈	100425	104.152	14.7400	21.3900	3.4510	-4.2190
81	<i>m</i> -Terphenyl	C ₁₅ H ₁₄	92068	230.309	27.6600	42.3000	5.2630	-9.0530
82	Methanol	CH ₃ O	67561	32.042	-20.0940	-16.2320	2.3988	-0.6382
83	Ethanol	C ₂ H ₅ O	64175	46.069	-23.4950	-16.7850	2.8064	-1.2350
84	1-Propanol	C ₃ H ₇ O	71238	60.096	-25.5200	-15.9900	3.2247	-1.8438
85	1-Butanol	C ₄ H ₉ O	71363	74.123	-27.4600	-15.0300	3.6148	-2.4560
86	2-Butanol	C ₄ H ₉ O	78922	74.123	-29.2900	-16.9600	3.6469	-2.4408
87	2-Propanol	C ₃ H ₇ O	67630	60.096	-27.2700	-17.3470	3.0920	-1.8300
88	2-Methyl-2-propanol	C ₄ H ₉ O	75650	74.123	-31.2400	-17.7600	3.2630	-2.4239
89	1-Pentanol	C ₅ H ₁₁ O	71410	88.150	-29.8737	-14.6022	4.0250	-3.0605
90	2-Methyl-1-butanol	C ₅ H ₁₁ O	137326	88.150	-30.2085	-14.6709	3.9351	-3.0620
91	3-Methyl-1-butanol	C ₅ H ₁₁ O	123513	88.150	-30.2100	-14.5000	3.8770	-3.0623
92	1-Hexanol	C ₆ H ₁₃ O	111273	102.177	-31.6500	-13.4400	4.4010	-3.6766
93	1-Heptanol	C ₇ H ₁₅ O	111706	116.203	-33.6400	-12.5300	4.7919	-4.2860
94	Cyclohexanol	C ₆ H ₁₁ O	108930	100.161	-28.6200	-10.9500	3.2770	-3.4639
95	Ethylene glycol	C ₂ H ₄ O ₂	107211	62.068	-38.7500	-30.2600	3.2350	-1.0590
96	1,2-Propylene glycol	C ₃ H ₈ O ₂	57556	76.095	-42.1500	-30.4000	3.5200	-1.6476

TABLE 2-221 Enthalpies and Gibbs Energies of Formation, Entropies, and Net Enthalpies of Combustion of Inorganic and Organic Compounds (Continued)

Cmpd. no.	Name	Formula	CAS no.	Mol wt	Ideal gas enthalpy of formation, J/kmol × 1E-07	Ideal gas Gibbs energy of formation, J/kmol × 1E-07	Ideal gas entropy, J/(kmol·K) × 1E-05	Standard net enthalpy of combustion, J/kmol × 1E-09
97	Phenol	C ₆ H ₆ O	108952	94.113	-9.6399	-3.2637	3.1481	-2.9210
98	<i>o</i> -Cresol	C ₇ H ₈ O	95487	108.140	-12.8570	-3.5430	3.5259	-3.5280
99	<i>m</i> -Cresol	C ₇ H ₈ O	108394	108.140	-13.2300	-4.0190	3.5604	-3.5278
100	<i>p</i> -Cresol	C ₇ H ₈ O	106445	108.140	-12.5350	-3.1660	3.5075	-3.5226
101	Dimethyl ether	C ₂ H ₆ O	115106	46.069	-18.4100	-11.2800	2.6670	-1.3284
102	Methyl ethyl ether	C ₃ H ₈ O	540670	60.096	-21.6400	-11.7100	3.0881	-1.9314
103	Methyl <i>n</i> -propyl ether	C ₄ H ₁₀ O	557175	74.123	-23.8200	-11.1000	3.5200	-2.5174
104	Methyl isopropyl ether	C ₄ H ₁₀ O	598538	74.123	-25.2000	-12.1800	3.4160	-2.5311
105	Methyl <i>n</i> -butyl ether	C ₅ H ₁₂ O	628284	88.150	-25.8100	-10.1700	3.9010	-3.1282
106	Methyl isobutyl ether	C ₅ H ₁₂ O	625445	88.150	-26.6000	-10.7000	3.8100	-3.1220
107	Methyl tert-butyl ether	C ₅ H ₁₂ O	1634044	88.150	-28.3500	-11.7500	3.5780	-3.1049
108	Diethyl ether	C ₄ H ₁₀ O	60297	74.123	-25.2100	-12.2100	3.4230	-2.5035
109	Ethyl propyl ether	C ₅ H ₁₂ O	628320	88.150	-27.2200	-11.5200	3.8810	-3.1200
110	Ethyl isopropyl ether	C ₅ H ₁₂ O	625547	88.150	-28.5800	-12.6400	3.8000	-3.1030
111	Methyl phenyl ether	C ₇ H ₈ O	100663	108.140	-6.7900	2.2700	3.6100	-3.6072
112	Diphenyl ether	C ₁₂ H ₁₀ O	101848	170.211	5.2000	17.5000	4.1300	-5.8939
113	Formaldehyde	CH ₂ O	50000	30.026	-10.8600	-10.2600	2.1866	-0.5268
114	Acetaldehyde	C ₂ H ₄ O	75070	44.053	-16.6200	-13.3100	2.6420	-1.1045
115	1-Propanal	C ₃ H ₆ O	123386	58.080	-18.6300	-12.4600	3.0440	-1.6857
116	1-Butanal	C ₄ H ₈ O	123728	72.107	-20.7000	-11.6300	3.4365	-2.3035
117	1-Pentanal	C ₅ H ₁₀ O	110623	86.134	-22.7800	-10.7100	3.8289	-2.9100
118	1-Hexanal	C ₆ H ₁₂ O	66251	100.161	-24.8600	-10.0050	4.2214	-3.5200
119	1-Heptanal	C ₇ H ₁₄ O	111717	114.188	-26.9400	-9.1910	4.6138	-4.1360
120	1-Octanal	C ₈ H ₁₆ O	124130	128.214	-29.0200	-8.3770	5.0063	-4.7400
121	1-Nonanal	C ₉ H ₁₈ O	124196	142.241	-31.0900	-7.5530	5.3988	-5.3500
122	1-Decanal	C ₁₀ H ₂₀ O	112312	156.268	-33.1700	-6.7390	5.7912	-5.9590
123	Acetone	C ₃ H ₆ O	67641	58.080	-21.5700	-15.1300	2.9540	-1.6590
124	Methyl ethyl ketone	C ₄ H ₈ O	78933	72.107	-23.9000	-14.7000	3.3940	-2.2680
125	2-Pentanone	C ₅ H ₁₀ O	107879	86.134	-25.9200	-13.8300	3.7860	-2.8796
126	Methyl isopropyl ketone	C ₅ H ₁₀ O	563804	86.134	-26.2400	-13.9000	3.6990	-2.8770
127	2-Hexanone	C ₆ H ₁₂ O	591786	100.161	-27.9826	-13.0081	4.1786	-3.4900
128	Methyl isobutyl ketone	C ₆ H ₁₂ O	108101	100.161	-28.8000	-13.5000	4.0700	-3.4900
129	3-Methyl-2-pentanone	C ₆ H ₁₂ O	565617	100.161	-28.1000	-12.9000	4.1200	-3.4900
130	3-Pentanone	C ₅ H ₁₀ O	96220	86.134	-25.7900	-13.4400	3.7000	-2.8804
131	Ethyl isopropyl ketone	C ₆ H ₁₂ O	565695	100.161	-28.6100	-13.3000	4.0690	-3.4860
132	Diisopropyl ketone	C ₇ H ₁₄ O	565800	114.188	-31.1400	-13.2000	4.5700	-4.0950
133	Cyclohexanone	C ₆ H ₁₀ O	108941	98.145	-22.6100	-8.6620	3.2200	-3.2990
134	Methyl phenyl ketone	C ₈ H ₈ O	98862	120.151	-8.6700	-10.1364	3.8450	-3.9730
135	Formic acid	CH ₂ O ₂	64186	46.026	-37.8600	-35.1000	2.4870	-0.2115
136	Acetic acid	C ₂ H ₄ O ₂	64197	60.053	-43.2800	-37.4600	2.8250	-0.8146
137	Propionic acid	C ₃ H ₆ O ₂	79094	74.079	-45.3500	-36.6700	3.2300	-1.3950
138	<i>n</i> -Butyric acid	C ₄ H ₈ O ₂	107926	88.106	-47.5800	-36.0000	3.6200	-2.0077
139	Isobutyric acid	C ₄ H ₈ O ₂	79312	88.106	-48.4100	-36.2100	3.4120	-2.0004
140	Benzoic acid	C ₇ H ₆ O ₂	65850	122.123	-29.4100	-21.4200	3.6900	-3.0951
141	Acetic anhydride	C ₄ H ₆ O ₃	108247	102.090	-57.2500	-47.3400	3.8990	-1.6750
142	Methyl formate	C ₂ H ₄ O ₂	107313	60.053	-35.2400	-29.5000	2.8520	-0.8924
143	Methyl acetate	C ₃ H ₆ O ₂	79209	74.079	-41.1900	-32.4200	3.1980	-1.4610
144	Methyl propionate	C ₄ H ₈ O ₂	554121	88.106	-42.7500	-31.1000	3.5960	-2.0780
145	Methyl <i>n</i> -butyrate	C ₅ H ₁₀ O ₂	623427	102.133	-45.0700	-30.5300	3.9880	-2.6860
146	Ethyl formate	C ₃ H ₆ O ₂	109944	74.079	-38.8300	-30.3100	3.2820	-1.5070
147	Ethyl acetate	C ₄ H ₈ O ₂	141786	88.106	-44.4500	-32.8000	3.5970	-2.0610
148	Ethyl propionate	C ₅ H ₁₀ O ₂	105373	102.133	-46.3600	-31.9300	4.0250	-2.6740
149	Ethyl <i>n</i> -butyrate	C ₆ H ₁₂ O ₂	105544	116.160	-48.5500	-31.2200	4.4170	-3.2840
150	<i>n</i> -Propyl formate	C ₄ H ₈ O ₂	110747	88.106	-40.7600	-29.3600	3.6780	-2.0410
151	<i>n</i> -Propyl acetate	C ₅ H ₁₀ O ₂	109604	102.133	-46.4800	-32.0400	4.0230	-2.6720
152	<i>n</i> -Butyl acetate	C ₆ H ₁₂ O ₂	123864	116.160	-48.5600	-31.2600	4.4250	-3.2800
153	Methyl benzoate	C ₈ H ₈ O ₂	93583	136.150	-28.7900	-18.1000	4.1400	-3.7720
154	Ethyl benzoate	C ₉ H ₁₀ O ₂	93890	150.177	-32.6000	-19.0500	4.5500	-4.4100
155	Vinyl acetate	C ₄ H ₆ O ₂	108054	86.090	-31.4900	-22.7900	3.2800	-1.9500
156	Methylamine	CH ₅ N	74895	31.057	-2.2970	3.2070	2.4330	-0.9751
157	Dimethylamine	C ₂ H ₇ N	124403	45.084	-1.8450	6.8390	2.7296	-1.6146
158	Trimethylamine	C ₃ H ₉ N	75503	59.111	-2.4310	9.8990	2.8700	-2.2449
159	Ethylamine	C ₂ H ₇ N	75047	45.084	-4.7150	3.6160	2.8480	-1.5874
160	Diethylamine	C ₄ H ₁₁ N	109897	73.138	-7.1420	7.3080	3.5220	-2.8003
161	Triethylamine	C ₆ H ₁₅ N	121448	101.192	-9.5800	11.4100	4.0540	-4.0405
162	<i>n</i> -Propylamine	C ₃ H ₉ N	107108	59.111	-7.0500	4.1700	3.2420	-2.1650

TABLE 2-221 Enthalpies and Gibbs Energies of Formation, Entropies, and Net Enthalpies of Combustion of Inorganic and Organic Compounds (Continued)

Cmpd. no.	Name	Formula	CAS no.	Mol wt	Ideal gas enthalpy of formation, J/kmol × 1E-07	Ideal gas Gibbs energy of formation, J/kmol × 1E-07	Ideal gas entropy, J/(kmol·K) × 1E-05	Standard net enthalpy of combustion, J/kmol × 1E-09
163	di- <i>n</i> -Propylamine	C ₉ H ₁₉ N	142847	101.192	-11.6000	8.6800	4.2900	-4.0189
164	Isopropylamine	C ₃ H ₉ N	75310	59.111	-8.3800	3.1920	3.1240	-2.1566
165	Diisopropylamine	C ₆ H ₁₅ N	108189	101.192	-15.0000	5.7900	4.1200	-3.9900
166	Aniline	C ₆ H ₇ N	62533	93.128	8.7100	16.6800	3.1980	-3.2390
167	<i>N</i> -Methylaniline	C ₇ H ₉ N	100618	107.155	8.8000	20.2000	3.4100	-3.9000
168	<i>N,N</i> -Dimethylaniline	C ₈ H ₁₁ N	121697	121.182	10.0500	24.7728	3.6600	-4.5250
169	Ethylene oxide	C ₂ H ₄ O	75218	44.053	-5.2630	-1.3230	2.4299	-1.2180
170	Furan	C ₄ H ₄ O	110009	68.075	-3.4800	0.0823	2.6714	-1.9959
171	Thiophene	C ₄ H ₄ S	110021	84.142	11.5440	12.6620	2.7865	-2.4352
172	Pyridine	C ₅ H ₅ N	110861	79.101	14.0370	19.0490	2.8278	-2.6721
173	Formamide	CH ₃ NO	75127	45.041	-19.2200	-14.7100	2.4857	-0.5021
174	<i>N,N</i> -Dimethylformamide	C ₃ H ₇ NO	68122	73.095	-19.1700	-8.8400	3.2600	-1.7887
175	Acetamide	C ₂ H ₅ NO	60355	59.068	-23.8300	-15.9600	2.7220	-1.0741
176	<i>N</i> -Methylacetamide	C ₃ H ₇ NO	79163	73.095	-24.0000	-13.5000	3.2000	-1.7100
177	Acetonitrile	C ₂ H ₃ N	75058	41.053	7.4040	9.1868	2.4329	-1.1904
178	Propionitrile	C ₃ H ₅ N	107120	55.079	5.1800	9.7495	2.8614	-1.8007
179	<i>n</i> -Butyronitrile	C ₄ H ₇ N	109740	69.106	3.4058	10.8658	3.2543	-2.4148
180	Benzonitrile	C ₇ H ₅ N	100470	103.123	21.8823	26.0872	3.2104	-3.5224
181	Methyl mercaptan	CH ₃ S	74931	48.109	-2.2900	-0.9800	2.5500	-1.1517
182	Ethyl mercaptan	C ₂ H ₅ S	75081	62.136	-4.6300	-0.4814	2.9610	-1.7366
183	<i>n</i> -Propyl mercaptan	C ₃ H ₇ S	107039	76.163	-6.7500	0.2583	3.3650	-2.3458
184	<i>n</i> -Butyl mercaptan	C ₄ H ₁₀ S	109795	90.189	-8.7800	1.1390	3.7520	-2.9554
185	Isobutyl mercaptan	C ₄ H ₁₀ S	513440	90.189	-9.6900	0.5982	3.6280	-2.9490
186	sec-Butyl mercaptan	C ₄ H ₁₀ S	513531	90.189	-9.6600	0.5120	3.6670	-2.9490
187	Dimethyl sulfide	C ₂ H ₆ S	75183	62.136	-3.7240	0.7302	2.8585	-1.7449
188	Methyl ethyl sulfide	C ₃ H ₈ S	624895	76.163	-5.9600	1.1470	3.3320	-2.3531
189	Diethyl sulfide	C ₄ H ₁₀ S	352932	90.189	-8.3470	1.7780	3.6800	-2.9607
190	Fluoromethane	CH ₃ F	593533	34.033	-23.4300	-21.0400	2.2273	-0.5219
191	Chloromethane	CH ₃ Cl	74873	50.488	-8.1960	-5.8440	2.3418	-0.6754
192	Trichloromethane	CHCl ₃	67663	119.377	-10.2900	-7.0100	2.9560	-0.3800
193	Tetrachloromethane	CCl ₄	56235	153.822	-9.5810	-5.3540	3.0991	-0.2653
194	Bromomethane	CH ₃ Br	74839	94.939	-3.7700	-2.8190	2.4580	-0.7054
195	Fluoroethane	C ₂ H ₅ F	353366	48.060	-26.4400	-21.2300	2.6440	-1.1270
196	Chloroethane	C ₂ H ₅ Cl	75003	64.514	-11.2260	-6.0499	2.7578	-1.2849
197	Bromoethane	C ₂ H ₅ Br	74964	108.966	-6.3600	-2.5820	2.8730	-1.2850
198	1-Chloropropane	C ₃ H ₇ Cl	540545	78.541	-13.3180	-5.2610	3.1547	-1.8670
199	2-Chloropropane	C ₃ H ₇ Cl	75296	78.541	-14.4770	-6.1360	3.0594	-1.8630
200	1,1-Dichloropropane	C ₃ H ₆ Cl ₂	78999	112.986	-15.0800	-6.5200	3.4480	-1.7200
201	1,2-Dichloropropane	C ₃ H ₆ Cl ₂	78875	112.986	-16.2800	-8.0180	3.5480	-1.7070
202	Vinyl chloride	C ₂ H ₃ Cl	75014	62.499	2.8450	4.1950	2.7354	-1.1780
203	Fluorobenzene	C ₆ H ₅ F	462066	96.104	-11.6566	-6.9036	3.0263	-2.8145
204	Chlorobenzene	C ₆ H ₅ Cl	108907	112.558	5.1090	9.8290	3.1403	-2.9760
205	Bromobenzene	C ₆ H ₅ Br	108861	157.010	10.5018	13.8532	3.2439	-3.0192
206	Air		132259100	28.951	0	0	1.9900	0
207	Hydrogen	H ₂	1333740	2.016	0	0	1.3057	-0.2418
208	Helium-4	He	7440597	4.003	0	0	1.2604	0
209	Neon	Ne	7440019	20.180	0	0	1.4622	0
210	Argon	Ar	7440371	39.948	0	0	1.5474	0
211	Fluorine	F ₂	7782414	37.997	0	0	2.0268	0
212	Chlorine	Cl ₂	7782505	70.905	0	0	2.2297	0
213	Bromine	Br ₂	7726956	159.808	3.0910	0.3140	2.4535	0
214	Oxygen	O ₂	7782447	31.999	0	0	2.0504	0
215	Nitrogen	N ₂	7727379	28.014	0	0	1.9150	0
216	Ammonia	NH ₃	7664417	17.031	-4.5898	-1.6400	1.9266	-0.3168
217	Hydrazine	N ₂ H ₄	302012	32.045	9.5353	15.9170	2.3861	-5.3420
218	Nitrous oxide	N ₂ O	10024972	44.013	8.2050	10.4160	2.1985	-0.0820
219	Nitric oxide	NO	10102439	30.006	9.0250	8.6570	2.1060	-0.0902
220	Cyanogen	CN ₂	460195	52.036	30.9072	29.7553	2.4146	-1.0961
221	Carbon monoxide	CO	630080	28.010	-11.0530	-13.7150	1.9756	-0.2830
222	Carbon dioxide	CO ₂	124389	44.010	-39.3510	-39.4370	2.1368	0
223	Carbon disulfide	CS ₂	75150	76.143	11.6900	6.6800	2.3790	-1.0769
224	Hydrogen fluoride	HF	7664393	20.006	-27.3300	-27.5400	1.7367	0.1524
225	Hydrogen chloride	HCl	7647010	36.461	-9.2310	-9.5300	1.8679	-0.0286
226	Hydrogen bromide	HBr	10035106	80.912	-3.6290	-5.3340	1.9859	-0.0690
227	Hydrogen cyanide	HCN	74908	27.026	13.5143	12.4725	2.0172	-0.6233

TABLE 2-221 Enthalpies and Gibbs Energies of Formation, Entropies, and Net Enthalpies of Combustion of Inorganic and Organic Compounds (Concluded)

Cmpd. no.	Name	Formula	CAS no.	Mol wt	Ideal gas enthalpy of formation, J/kmol × 1E-07	Ideal gas Gibbs energy of formation, J/kmol × 1E-07	Ideal gas entropy, J/(kmol·K) × 1E-05	Standard net enthalpy of combustion, J/kmol × 1E-09
228	Hydrogen sulfide	H ₂ S	7783064	34.082	-2.0630	-3.3440	2.0560	-0.5180
229	Sulfur dioxide	SO ₂	7446095	64.065	-29.6840	-30.0120	2.4810	0
230	Sulfur trioxide	SO ₃	7446119	80.064	-39.5720	-37.0950	2.5651	0.0989
231	Water	H ₂ O	7732185	18.015	-24.1814	-22.8590	1.8872	0

All substances are listed in alphabetical order in Table 2-6a.

Compiled from Daubert, T. E., R. P. Danner, H. M. Sibul, and C. C. Stebbins, DIPPR Data Compilation of Pure Compound Properties, Project 801 Sponsor Release, July, 1993, Design Institute for Physical Property Data, AIChE, New York, NY; and from Thermodynamics Research Center, "Selected Values of Properties of Hydrocarbons and Related Compounds," Thermodynamics Research Center Hydrocarbon Project, Texas A&M University, College Station, Texas (extant 1994).

The compounds are considered to be formed from the elements in their standard states at 298.15 K and 101.325 P_a. These include C (graphite) and S (rhombic). Enthalpy of combustion is the net value for the compound in its standard state at 298.15K and 101.325 Pa.

Products of combustion are taken to be CO₂ (gas), H₂O (gas), F₂ (gas), Cl₂ (gas), Br₂ (gas), I₂ (gas), SO₂ (gas), N₂ (gas), H₃PO₄ (solid), and SiO₂ (crystalbite).
 J/kmol × 2.390E-04 = cal/gmol; J/kmol × 4.302106E-04 = Btu/lbmol.
 J/(kmol·K) × 2.390E-04 = cal/(gmol·°C); J/(kmol·K) × 2.390059E-04 = Btu/(lbmol·°F).

TABLE 2-222 Ideal Gas Sensible Enthalpies, h_T – h₂₉₈ (kJ/kgmol), of Combustion Products

Temperature, K	CO	CO ₂	H	OH	H ₂	N	NO	NO ₂	N ₂	N ₂ O	O	O ₂	SO ₂	H ₂ O
200	-2858	-3414	-2040	-2976	-2774	-2040	-2951	-3495	-2857	-3553	-2186	-2868	-3736	-3282
240	-1692	-2079	-1209	-1756	-1656	-1209	-1743	-2104	-1692	-2164	-1285	-1703	-2258	-1948
260	-1110	-1383	-793	-1150	-1091	-793	-1142	-1392	-1110	-1438	-840	-1118	-1496	-1279
280	-529	-665	-377	-546	-522	-378	-543	-672	-528	-692	-398	-533	-718	-609
298.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	54	69	38	55	53	38	55	68	54	72	41	54	74	62
320	638	823	454	654	630	454	652	816	636	854	478	643	881	735
340	1221	1594	870	1251	1209	870	1248	1571	1219	1654	913	1234	1702	1410
360	1805	2382	1285	1847	1791	1286	1845	2347	1802	2470	1346	1828	2538	2088
380	2389	3184	1701	2442	2373	1701	2442	3130	2386	3302	1777	2425	3387	2769
400	2975	4003	2117	3035	2959	2117	3040	3927	2971	4149	2207	3025	4250	3452
420	3563	4835	2532	3627	3544	2533	3638	4735	3557	5010	2635	3629	5126	4139
440	4153	5683	2948	4219	4131	2949	4240	5557	4143	5884	3063	4236	6015	4829
460	4643	6544	3364	4810	4715	3364	4844	6392	4731	6771	3490	4847	6917	5523
480	5335	7416	3779	5401	5298	3780	5450	7239	5320	7670	3918	5463	7831	6222
500	5931	8305	4196	5992	5882	4196	6059	8099	5911	8580	4343	6084	8758	6925
550	7428	10572	5235	7385	6760	5235	7592	10340	7395	10897	5402	7653	11123	8699
600	8942	12907	6274	8943	8811	6274	9144	12555	8894	13295	6462	9244	13544	10501
650	10477	15303	7314	10423	10278	7314	10716	14882	10407	15744	7515	10859	16022	12321
700	12023	17754	8353	11902	11749	8353	12307	17250	11937	18243	8570	12499	18548	14192
750	13592	20260	9392	13391	13223	9329	13919	19671	13481	20791	9620	14158	21117	16082
800	15177	22806	10431	14880	14702	10431	15548	22136	15046	23383	10671	15835	23721	18002
850	16781	25398	11471	16384	16186	11471	17195	24641	16624	26014	11718	17531	26369	19954
900	18401	28030	12510	17888	17676	12510	18858	27179	18223	28681	12767	19241	29023	21938
950	20031	30689	13550	19412	19175	13550	20537	29749	19834	31381	13812	20965	31714	23954
1000	21690	33397	14589	20935	20680	14589	22229	32344	21463	34110	14860	22703	34428	26000
1100	25035	38884	16667	24024	23719	16667	25653	37605	24760	39647	16950	26212	39914	30191
1200	28430	44473	18746	27160	26797	18746	29120	42946	28109	45274	19039	29761	45464	34506
1300	31868	50148	20824	30342	29918	20824	32626	48351	31503	50976	21126	33344	51069	38942
1400	35343	55896	22903	33569	33082	22903	36164	53808	34936	56740	23212	36957	56718	43493
1500	38850	61705	24982	36839	36290	24982	39729	59309	38405	62557	25296	40599	62404	48151
1600	42385	67569	27060	40151	39541	27060	43319	64846	41904	68420	27381	44266	68123	52908
1700	45945	73480	29139	43502	42835	29139	46929	70414	45429	74320	29464	47958	73870	57758
1800	49526	79431	31217	46889	46169	31218	50557	76007	48978	80254	31547	51673	79642	62693
1900	53126	85419	33296	50310	49541	33296	54201	81624	52548	86216	33630	55413	85436	67706
2000	56744	91439	35375	53762	52951	35375	57859	87259	56137	92203	35713	59175	91250	72790
2100	60376	97488	37453	57243	56397	37454	61530	92911	59742	98212	37796	62961	97081	77941
2200	64021	103562	39532	60752	59876	39534	65212	98577	63361	104240	39878	66769	102929	83153
2300	67683	109660	41610	64285	63387	41614	68904	104257	66995	110284	41962	70600	108792	88421
2400	71324	115779	43689	67841	66928	43689	72606	109947	70640	116344	44045	74453	114669	93741
2500	74985	121917	45768	71419	70498	45777	76316	115648	74296	122417	46130	78328	120559	99108
2600	78673	128073	47846	75017	74096	47860	80034	121357	77963	128501	48216	82224	126462	104520
2700	82369	134246	49925	78633	77720	49945	83759	127075	81639	134596	50303	86141	132376	109973
2800	86074	140433	52004	82267	81369	52033	87491							

TABLE 2-223 Ideal Gas Entropies, s° , kJ/kgmol-K, of Combustion Products

Temperature, K	CO	CO ₂	H	OH	H ₂	N	NO	NO ₂	N ₂	N ₂ O	O	O ₂	SO ₂	H ₂ O
200	186.0	200.0	106.4	171.6	119.4	145.0	198.7	225.9	180.0	205.6	152.2	193.5	233.0	175.5
240	191.3	206.0	110.1	177.1	124.5	148.7	204.1	232.2	185.2	211.9	156.2	198.7	239.9	181.4
260	193.7	208.8	111.8	179.5	126.8	150.4	206.6	235.0	187.6	214.8	158.0	201.1	242.8	184.1
280	195.3	211.5	113.3	181.8	129.2	151.9	208.8	237.7	189.8	217.5	159.7	203.3	245.8	186.6
298.15	197.7	213.8	114.7	183.7	130.7	153.3	210.8	240.0	191.6	220.0	161.1	205.1	248.2	188.8
300	197.8	214.0	114.8	183.9	130.9	153.4	210.9	240.3	191.8	220.2	161.2	205.3	248.5	189.0
320	199.7	216.5	116.2	185.9	132.8	154.8	212.9	242.7	193.7	222.7	162.6	207.2	251.1	191.2
340	201.5	218.8	117.4	187.7	134.5	156.0	214.7	245.0	195.5	225.2	163.9	209.0	253.6	193.3
360	203.2	221.0	118.6	189.4	136.2	157.2	216.4	247.2	197.2	227.5	165.2	210.7	256.0	195.2
380	204.7	223.2	119.7	191.0	137.7	158.3	218.0	249.3	198.7	229.7	166.3	212.5	258.2	197.1
400	206.2	225.3	120.8	192.5	139.2	159.4	219.5	251.3	200.2	231.9	167.4	213.8	260.4	198.8
420	207.7	227.3	121.8	194.0	140.6	160.4	221.0	253.2	201.5	234.0	168.4	215.3	262.5	200.5
440	209.0	229.3	122.8	195.3	141.9	161.4	222.3	255.1	202.9	236.0	169.4	216.7	264.6	202.0
460	210.4	231.2	123.7	196.6	143.2	162.3	223.7	257.0	204.2	238.0	170.4	218.0	266.6	203.6
480	211.6	233.1	124.6	197.9	144.5	163.1	225.0	258.8	205.5	239.9	171.3	219.4	268.5	205.1
500	212.8	234.9	125.5	199.1	145.7	164.0	226.3	260.6	206.7	241.8	172.2	220.7	270.5	206.5
550	215.7	239.2	127.5	201.8	148.6	166.0	229.1	264.7	209.4	246.2	174.2	223.7	274.9	210.5
600	218.3	243.3	129.3	204.4	151.1	167.8	231.9	268.8	212.2	250.4	176.1	226.5	279.2	213.1
650	220.8	247.1	131.0	206.8	153.4	169.4	234.4	272.6	214.6	254.3	177.7	229.1	283.1	215.9
700	223.1	250.8	132.5	209.0	155.6	171.0	236.8	276.0	216.9	258.0	179.3	231.5	286.9	218.7
750	225.2	255.4	133.9	211.1	157.6	172.5	239.0	279.3	219.0	261.5	180.7	233.7	290.4	221.3
800	227.3	257.5	135.2	213.0	159.5	173.8	241.1	282.5	221.0	264.8	182.1	235.9	293.8	223.8
850	229.2	260.6	136.4	214.8	161.4	175.1	243.0	285.5	223.0	268.0	183.4	237.9	297.0	226.2
900	231.1	263.6	137.7	216.5	163.1	176.3	245.0	288.4	224.8	271.1	184.6	239.9	300.1	228.5
950	232.8	266.5	138.8	218.1	164.7	177.4	246.8	291.3	226.5	274.0	185.7	241.8	303.0	230.6
1000	234.5	269.3	139.9	219.7	166.2	178.5	248.4	293.9	228.2	276.8	186.8	243.6	305.8	232.7
1100	237.7	274.5	141.9	222.7	169.1	180.4	251.8	298.9	231.3	282.1	188.8	246.9	311.0	236.7
1200	240.7	279.4	143.7	225.4	171.8	182.2	254.8	303.6	234.2	287.0	190.6	250.0	315.8	240.5
1300	243.4	283.9	145.3	228.0	174.3	183.9	257.6	307.9	236.9	291.5	192.3	252.9	320.3	244.0
1400	246.0	288.2	146.9	230.3	176.6	185.4	260.2	311.9	239.5	295.8	193.8	255.6	324.5	247.4
1500	248.4	292.2	148.3	232.6	178.8	186.9	262.7	315.7	241.9	299.8	195.3	258.1	328.4	250.6
1600	250.7	296.0	149.6	234.7	180.9	188.2	265.0	319.3	244.1	303.6	196.6	260.4	332.1	253.7
1700	252.9	299.6	150.9	236.8	182.9	189.5	267.2	322.7	246.3	307.2	197.9	262.7	335.6	256.6
1800	254.9	303.0	152.1	238.7	184.8	190.7	269.3	325.9	248.3	310.6	199.1	264.8	338.9	259.5
1900	256.8	306.2	153.2	240.6	186.7	191.8	271.3	328.9	250.2	313.8	200.2	266.8	342.0	262.2
2000	258.7	309.3	154.3	242.3	188.4	192.9	273.1	331.8	252.1	316.9	201.3	268.7	345.0	264.8
2100	260.5	312.2	155.3	244.0	190.1	193.9	274.9	334.5	253.8	319.8	202.3	270.6	347.9	267.3
2200	262.2	315.1	156.3	245.7	191.7	194.8	276.6	337.2	255.5	322.6	203.2	272.4	350.6	269.7
2300	263.8	317.8	157.2	247.2	193.3	195.8	278.3	339.7	257.1	325.3	204.2	274.1	353.2	272.0
2400	265.4	320.4	158.1	248.7	194.8	196.7	279.8	342.1	258.7	327.9	205.0	275.7	355.7	274.3
2500	266.9	322.9	158.9	250.2	196.2	197.5	281.4	344.5	260.2	330.4	205.9	277.3	358.1	276.5
2600	268.3	325.3	159.7	251.6	197.7	198.3	282.8	346.7	261.6	332.7	206.7	278.8	360.4	278.6
2700	269.7	327.6	160.5	253.0	199.0	199.1	284.2	348.9	263.0	335.0	207.5	280.3	362.6	280.7
2800	271.0	329.9	161.3	254.3	200.3	199.9	285.6	350.9	264.3	337.3	208.3	281.7	364.8	282.7
2900	272.3	332.1	162.0	255.6	201.6	200.6	286.9	352.9	265.6	339.4	209.0	283.1	366.9	284.6
3000	273.6	334.2	162.7	256.8	202.9	201.3	288.2	354.9	266.9	341.5	209.7	284.4	368.9	286.5
3500	279.4	343.8	165.9	262.5	208.7	204.6	294.0	363.8	272.6	350.9	212.9	290.7	378.1	295.2
4000	284.4	352.2	168.7	267.6	213.8	207.4	299.0	371.5	277.6	359.2	215.8	296.2	386.1	302.9
4500	288.8	359.7	171.1	272.1	218.5	210.1	303.5	378.3	282.1	366.5	218.3	301.1	393.3	309.8
5000	292.8	366.4	173.3	276.1	222.8	212.5	307.5	384.4	286.0	373.0	220.6	305.5	399.7	316.0

Usually rounded off from JANAF Thermochemical Tables, NSRDS-NBS-37, 1971 (1141 pp.). Equilibrium constants can be calculated by combining Δh_f° values from Table 2-221, $h_T - h_{298}$ from Table 2-222, and s° values from the above, using the formula $\ln K_p = -\Delta G^\circ/(RT)$, where $\Delta G^\circ = \Delta h_f^\circ + (h_T - h_{298}) - T_s^\circ$.

HEATS OF SOLUTION

TABLE 2-224 Heats of Solution of Inorganic Compounds in Water

Heat evolved, in kilogram-calories per gram formula weight, on solution in water at 18°C. Computed from data in Bichowsky and Rossini, *Thermochemistry of Chemical Substances*, Reinhold, New York, 1936.

Substance	Dilution ^a	Formula	Heat, kg-cal/ g-mole	Substance	Dilution ^a	Formula	Heat, kg-cal/ g-mole
Aluminum bromide	aq	AlBr ₃	+85.3	Calcium—(Cont.)			
chloride	600	AlCl ₃	+77.9	bromide	∞	CaBr ₂	+24.86
	600	AlCl ₃ ·6H ₂ O	+13.2		∞	CaBr ₂ ·6H ₂ O	-0.9
fluoride	aq	AlF ₃	+31	chloride	∞	CaCl ₂	+4.9
	aq	AlF ₃ ·½H ₂ O	+19.0		∞	CaCl ₂ ·H ₂ O	+12.3
	aq	AlF ₃ ·3½H ₂ O	-1.7		∞	CaCl ₂ ·2H ₂ O	+12.5
iodide	aq	AlI ₃	+89.0		∞	CaCl ₂ ·4H ₂ O	+2.4
sulfate	aq	Al ₂ (SO ₄) ₃	+126		∞	CaCl ₂ ·6H ₂ O	-4.11
	aq	Al ₂ (SO ₄) ₃ ·6H ₂ O	+56.2	formate	400	Ca(CHO ₂) ₂	+0.7
	aq	Al ₂ (SO ₄) ₃ ·18H ₂ O	+6.7	iodide	∞	CaI ₂	+28.0
Ammonium bromide	aq	NH ₄ Br	-4.45		∞	CaI ₂ ·8H ₂ O	+1.8
chloride	∞	NH ₄ Cl	-3.82	nitrate	∞	Ca(NO ₃) ₂	+4.1
chromate	aq	(NH ₄) ₂ CrO ₄	-5.82		∞	Ca(NO ₃) ₂ ·H ₂ O	+0.7
dichromate	600	(NH ₄) ₂ Cr ₂ O ₇	-12.9		∞	Ca(NO ₃) ₂ ·2H ₂ O	-3.2
iodide	aq	NH ₄ I	-3.56		∞	Ca(NO ₃) ₂ ·3H ₂ O	-4.2
nitrate	∞	NH ₄ NO ₃	-6.47		∞	Ca(NO ₃) ₂ ·4H ₂ O	-7.99
perborate	aq	NH ₄ BO ₃ ·H ₂ O	-9.0	phosphate, mono-	aq	Ca(H ₂ PO ₄) ₂ ·H ₂ O	-0.6
sulfate	∞	(NH ₄) ₂ SO ₄	-2.75	dibasic	aq	CaHPO ₄ ·2H ₂ O	-1
sulfate, acid	800	NH ₄ HSO ₄	+0.56	sulfate	∞	CaSO ₄	+5.1
sulfite	aq	(NH ₄) ₂ SO ₃	-1.2		∞	CaSO ₄ ·½H ₂ O	+3.6
	aq	(NH ₄) ₂ SO ₃ ·H ₂ O	-4.13		∞	CaSO ₄ ·2H ₂ O	-0.18
Antimony fluoride	aq	SbF ₃	-1.7	Chromous chloride	aq	CrCl ₂	+18.6
iodide	aq	SbI ₃	-0.8			CrCl ₂ ·3H ₂ O	+5.3
Arsenic acid	aq	H ₃ AsO ₄	-0.4			CrCl ₂ ·4H ₂ O	+2.0
						CrI ₂	+5.7
Barium bromate	∞	Ba(BrO ₃) ₂ ·H ₂ O	-15.9			CoBr ₂	+18.4
bromide	∞	BaBr ₂	+5.3	Cobaltous bromide	aq	CoBr ₂	+18.4
	∞	BaBr ₂ ·H ₂ O	-0.8		aq	CoBr ₂ ·6H ₂ O	-1.25
	∞	BaBr ₂ ·2H ₂ O	-3.87	chloride	400	CoCl ₂	+18.5
chlorate	∞	Ba(ClO ₃) ₂	-6.7		400	CoCl ₂ ·2H ₂ O	+9.8
	∞	Ba(ClO ₃) ₂ ·H ₂ O	-10.6	iodide	400	CoCl ₂ ·6H ₂ O	-2.9
chloride	∞	BaCl ₂	+2.4		aq	CoI ₂	+18.8
	∞	BaCl ₂ ·H ₂ O	-2.17	sulfate	400	CoSO ₄	+15.0
	∞	BaCl ₂ ·2H ₂ O	-4.5		400	CoSO ₄ ·6H ₂ O	-1.4
cyanide	aq	Ba(CN) ₂	+1.5		400	CoSO ₄ ·7H ₂ O	-3.6
	aq	Ba(CN) ₂ ·H ₂ O	-2.4	Cupric acetate	aq	Cu(C ₂ H ₃ O ₂) ₂	+2.4
	aq	Ba(CN) ₂ ·2H ₂ O	-4.9	formate	aq	Cu(CHO ₂) ₂	+0.5
iodate	∞	Ba(IO ₃) ₂	-9.1	nitrate	200	Cu(NO ₃) ₂	+10.3
	∞	Ba(IO ₃) ₂ ·H ₂ O	-11.3		200	Cu(NO ₃) ₂ ·3H ₂ O	-2.6
iodide	∞	BaI ₂	+10.5		200	Cu(NO ₃) ₂ ·6H ₂ O	-10.7
	∞	BaI ₂ ·H ₂ O	+2.7	sulfate	800	CuSO ₄	+15.9
	∞	BaI ₂ ·2H ₂ O	+0.14			CuSO ₄ ·H ₂ O	+9.3
	∞	BaI ₂ ·2½H ₂ O	-0.58			CuSO ₄ ·3H ₂ O	+3.65
	∞	BaI ₂ ·7H ₂ O	-6.61	Cuprous sulfate	aq	CuSO ₄ ·5H ₂ O	-2.85
nitrate	∞	Ba(NO ₃) ₂	-10.2			Cu ₂ SO ₄	+11.6
perchlorate	∞	Ba(ClO ₄) ₂	-2.8	Ferric chloride	1000	FeCl ₃	+31.7
	∞	Ba(ClO ₄) ₂ ·3H ₂ O	-10.5		1000	FeCl ₃ ·2½H ₂ O	+21.0
sulfide	∞	BaS	+7.2		1000	FeCl ₃ ·6H ₂ O	+5.6
Beryllium bromide	aq	BeBr ₂	+62.6	nitrate	800	Fe(NO ₃) ₃ ·9H ₂ O	-9.1
chloride	aq	BeCl ₂	+51.1	Ferrous bromide	aq	FeBr ₂	+18.0
iodide	aq	BeI ₂	+72.6	chloride	400	FeCl ₂	+17.9
sulfate	aq	BeSO ₄	+18.1		400	FeCl ₂ ·2H ₂ O	+8.7
	aq	BeSO ₄ ·H ₂ O	+13.5		400	FeCl ₂ ·4H ₂ O	+2.7
	aq	BeSO ₄ ·2H ₂ O	+7.9	iodide	aq	FeI ₂	+23.3
	aq	BeSO ₄ ·4H ₂ O	+1.1	sulfate	400	FeSO ₄	+14.7
Bismuth iodide	aq	BiI ₃	+3		400	FeSO ₄ ·H ₂ O	+7.35
Boric acid	aq	H ₃ BO ₃	-5.4		400	FeSO ₄ ·4H ₂ O	+1.4
					400	FeSO ₄ ·7H ₂ O	-4.4
Cadmium bromide	400	CdBr ₂	+0.4	Lead acetate	400	Pb(C ₂ H ₃ O ₂) ₂	+1.4
	400	CdBr ₂ ·4H ₂ O	-7.3		400	Pb(C ₂ H ₃ O ₂) ₂ ·3H ₂ O	-5.9
chloride	400	CdCl ₂	+3.1	bromide	aq	PbBr ₂	-10.1
	400	CdCl ₂ ·H ₂ O	+0.6	chloride	aq	PbCl ₂	-3.4
	400	CdCl ₂ ·2½H ₂ O	-3.00	formate	aq	Pb(CHO ₂) ₂	-6.9
nitrate	400	Cd(NO ₃) ₂ ·H ₂ O	+4.17	nitrate	400	Pb(NO ₃) ₂	-7.61
	400	Cd(NO ₃) ₂ ·4H ₂ O	-5.08	Lithium bromide	∞	LiBr	+11.54
sulfate	400	CdSO ₄	+10.69		∞	LiBr·H ₂ O	+5.30
	400	CdSO ₄ ·H ₂ O	+6.05		∞	LiBr·2H ₂ O	+2.05
	400	CdSO ₄ ·2½H ₂ O	+2.51		∞	LiBr·3H ₂ O	-1.59
Calcium acetate	∞	Ca(C ₂ H ₃ O ₂) ₂	+7.6	chloride	∞	LiCl	+8.66
	∞	Ca(C ₂ H ₃ O ₂) ₂ ·H ₂ O	+6.5				

^aThe numbers represent moles of water used to dissolve 1 g formula weight of substance; ∞ means "infinite dilution"; and aq means "aqueous solution of unspecified dilution."

TABLE 2-224 Heats of Solution of Inorganic Compounds in Water (Continued)

Substance	Dilution ^o	Formula	Heat, kg-cal/g-mole	Substance	Dilution ^o	Formula	Heat, kg-cal/g-mole	
Lithium—(Cont.)	∞	LiCl·H ₂ O	+4.45	Phosphoric acid, ortho-	400	H ₃ PO ₄	+2.79	
	∞	LiCl·2H ₂ O	+1.07		400	H ₃ PO ₄ ·½H ₂ O	-0.1	
	fluoride	∞	LiCl·3H ₂ O	-1.98	pyro-	aq	H ₄ P ₂ O ₇	+25.9
		∞	LiF	-0.74		aq	H ₄ P ₂ O ₇ ·½H ₂ O	+4.65
	hydroxide	∞	LiOH	+4.74	Potassium acetate	∞	KC ₂ H ₃ O ₂	+3.55
		∞	LiOH·½H ₂ O	+4.39		600	KAl(SO ₄) ₂	+48.5
	iodide	∞	LiOH·H ₂ O	+9.6	600	KAl(SO ₄) ₂ ·3H ₂ O	+26.6	
		∞	LiI	+14.92		KAl(SO ₄) ₂ ·12H ₂ O	-10.1	
		∞	LiI·½H ₂ O	+10.08	bicarbonate	2000	KHCO ₃	-5.1
		∞	LiI·H ₂ O	+6.93	bromate	∞	KBrO ₃	-10.13
		∞	LiI·2H ₂ O	+3.43	bromide	∞	KBr	-5.13
		∞	LiI·3H ₂ O	-0.17	carbonate	∞	K ₂ CO ₃	+6.58
nitrate	∞	LiNO ₃	+0.466			K ₂ CO ₃ ·½H ₂ O	+4.25	
	∞	LiNO ₃ ·3H ₂ O	-7.87	chlorate	∞	K ₂ CO ₃ ·1½H ₂ O	-0.43	
sulfate	∞	Li ₂ SO ₄	+6.71	chloride	∞	KClO ₃	-10.31	
	∞	Li ₂ SO ₄ ·H ₂ O	+3.77	chromate	∞	KCl	-4.404	
Magnesium bromide	∞	MgBr ₂	+43.7	chrome sulfate	2185	K ₂ CrO ₄	-4.9	
	∞	MgBr ₂ ·H ₂ O	+35.9	600	KCr(SO ₄) ₂	+55		
	chloride	∞	MgBr ₂ ·6H ₂ O	+19.8			KCr(SO ₄) ₂ ·H ₂ O	+42
		∞	MgCl ₂	+36.3			KCr(SO ₄) ₂ ·2H ₂ O	+33
	∞	MgCl ₂ ·2H ₂ O	+20.8			KCr(SO ₄) ₂ ·6H ₂ O	+7	
	∞	MgCl ₂ ·4H ₂ O	+10.5			KCr(SO ₄) ₂ ·12H ₂ O	-9.5	
	iodide	∞	MgCl ₂ ·6H ₂ O	+3.4			KCN	-3.0
		∞	MgI ₂	+50.2			K ₂ Cr ₂ O ₇	-17.8
	nitrate	∞	Mg(NO ₃) ₂ ·6H ₂ O	-3.7			KF	+3.96
		∞	Mg ₃ (PO ₄) ₂	+10.2			KF·2H ₂ O	-1.85
	phosphate	aq	MgSO ₄	+21.1	hydrosulfide	∞	KF·4H ₂ O	-6.05
		∞	MgSO ₄ ·H ₂ O	+14.0			KHS	+0.86
sulfate	∞	MgSO ₄ ·2H ₂ O	+11.7			KHS·½H ₂ O	+1.21	
	∞	MgSO ₄ ·4H ₂ O	+4.9	hydroxide	∞	KOH	+12.91	
sulfide	∞	MgSO ₄ ·6H ₂ O	+0.55			KOH·¾H ₂ O	+4.27	
	∞	MgSO ₄ ·7H ₂ O	-3.18			KOH·H ₂ O	+3.48	
Manganic nitrate	aq	MgS	+25.8			KOH·7H ₂ O	+0.86	
	400	Mn(NO ₃) ₂	+12.9	iodate	∞	KIO ₃	-6.93	
sulfate	400	Mn(NO ₃) ₂ ·3H ₂ O	-3.9	iodide	∞	KI	-5.23	
	400	Mn(NO ₃) ₂ ·6H ₂ O	-6.2	nitrate	∞	KNO ₃	-8.633	
Manganous acetate	aq	Mn ₂ (SO ₄) ₃	+22	oxalate	400	K ₂ C ₂ O ₄	-4.6	
	aq	Mn(C ₂ H ₃ O ₂) ₂	+12.2			K ₂ C ₂ O ₄ ·H ₂ O	-7.5	
bromide	aq	Mn(C ₂ H ₃ O ₂) ₂ ·4H ₂ O	+1.6	perchlorate	∞	KClO ₄	-12.94	
	aq	MnBr ₂	+15	permanganate	400	KMnO ₄	-10.4	
chloride	aq	MnBr ₂ ·H ₂ O	+14.4	phosphate, dihydrogen	aq	KH ₂ PO ₄	+4.7	
	aq	MnBr ₂ ·4H ₂ O	+16.1	pyrosulfite	aq	K ₂ S ₂ O ₅	-11.0	
formate	400	MnCl ₂	+16.0	sulfate	aq	K ₂ S ₂ O ₅ ·½H ₂ O	-10.22	
	400	MnCl ₂ ·2H ₂ O	+8.2	sulfate, acid	∞	K ₂ SO ₄	-6.32	
iodide	400	MnCl ₂ ·4H ₂ O	+1.5	sulfide	800	KHSO ₄	-3.10	
	aq	Mn(CHO ₂) ₂	+4.3	sulfite	∞	K ₂ S	-11.0	
nitrate	aq	Mn(CHO ₂) ₂ ·2H ₂ O	-2.9		aq	K ₂ SO ₃	+1.8	
	aq	MnI ₂	+26.2	thiocyanate	aq	K ₂ SO ₃ ·H ₂ O	+1.37	
Mercurous nitrate	aq	MnI ₂ ·H ₂ O	+24.1	thionate, di-	∞	KCNS	-6.08	
	aq	MnI ₂ ·2H ₂ O	+22.7	thiosulfate	aq	K ₂ S ₂ O ₆	-13.0	
sulfate	aq	MnI ₂ ·4H ₂ O	+19.9		∞	K ₂ S ₂ O ₃	-4.5	
	400	MnI ₂ ·6H ₂ O	+21.2	Silver acetate	aq	AgC ₂ H ₃ O ₂	-5.4	
Mercuric acetate	400	MnSO ₄	+13.8	nitrate	200	AgNO ₃	-4.4	
	400	MnSO ₄ ·H ₂ O	+11.9	Sodium acetate	∞	NaC ₂ H ₃ O ₂	+4.085	
bromide	400	MnSO ₄ ·7H ₂ O	-1.7		∞	NaC ₂ H ₃ O ₂ ·3H ₂ O	-4.665	
	aq	Hg(C ₂ H ₃ O ₂) ₂	-4.0	arsenate	500	Na ₃ AsO ₄	+15.6	
chloride	aq	HgBr ₂	-2.4		500	Na ₃ AsO ₄ ·12H ₂ O	-12.61	
	aq	HgCl ₂	-3.3	bicarbonate	1800	NaHCO ₃	-4.1	
nitrate	aq	Hg(NO ₃) ₂ ·½H ₂ O	-0.7	borate, tetra-	900	Na ₂ B ₄ O ₇	+10.0	
	aq	Hg ₂ (NO ₃) ₂ ·2H ₂ O	-11.5		900	Na ₂ B ₄ O ₇ ·10H ₂ O	-16.8	
Nickel bromide	aq	NiBr ₂	+19.0	bromide	∞	NaBr	-0.58	
	aq	NiBr ₂ ·3H ₂ O	+0.2		∞	NaBr·2H ₂ O	-4.57	
Nickel chloride	800	NiCl ₂	+19.23	carbonate	∞	Na ₂ CO ₃	+5.57	
	800	NiCl ₂ ·2H ₂ O	+10.4		∞	Na ₂ CO ₃ ·H ₂ O	+2.19	
iodide	800	NiCl ₂ ·4H ₂ O	+4.2		∞	Na ₂ CO ₃ ·7H ₂ O	-10.81	
	800	NiCl ₂ ·6H ₂ O	-1.15	chlorate	∞	Na ₂ CO ₃ ·10H ₂ O	-16.22	
nitrate	aq	NiI ₂	+19.4	chloride	∞	NaClO ₃	-5.37	
	200	Ni(NO ₃) ₂	+11.8	chromate	800	NaCl	-1.164	
sulfate	200	Ni(NO ₃) ₂ ·6H ₂ O	-7.5		800	Na ₂ CrO ₄	+2.50	
	200	NiSO ₄	+15.1		800	Na ₂ CrO ₄ ·4H ₂ O	-7.52	
	200	NiSO ₄ ·7H ₂ O	-4.2		800	Na ₂ CrO ₄ ·10H ₂ O	-16.0	
					200	NaCN	-0.37	
					200	NaCN·½H ₂ O	-0.92	

TABLE 2-224 Heats of Solution of Inorganic Compounds in Water (Concluded)

Substance	Dilution°	Formula	Heat, kg-cal/ g-mole	Substance	Dilution°	Formula	Heat, kg-cal/ g-mole
Sodium—(Cont.)				Sodium—(Cont.)			
fluoride	200	NaCN·2H ₂ O	-4.41	thionate, di-	aq	Na ₂ S ₂ O ₆	-5.80
hydrosulfide	∞	NaF	-0.27		aq	Na ₂ S ₂ O ₆ ·2H ₂ O	-11.86
	∞	NaHS	+4.62	Sodium thiosulfate	aq	Na ₂ S ₂ O ₃	+2.0
	∞	NaHS·2H ₂ O	-1.49		aq	Na ₂ S ₂ O ₃ ·5H ₂ O	-11.30
Sodium hydroxide	∞	NaOH	+10.18	Stannic bromide	aq	SnBr ₄	+15.5
	∞	NaOH·½H ₂ O	+8.17	Stannous bromide	aq	SnBr ₂	-1.6
	∞	NaOH·¾H ₂ O	+7.08	iodide	aq	SnI ₂	-5.8
	∞	NaOH·¾H ₂ O	+6.48	Strontium acetate	∞	Sr(C ₂ H ₃ O ₂) ₂	+6.2
	∞	NaOH·H ₂ O	+5.17		∞	Sr(C ₂ H ₃ O ₂) ₂ ·½H ₂ O	+5.9
iodide	∞	NaI	+1.57	bromide	∞	SrBr ₂	+16.4
	∞	NaI·2H ₂ O	-3.89		∞	SrBr ₂ ·H ₂ O	+9.25
metaphosphate	600	NaPO ₃	+3.97		∞	SrBr ₂ ·2H ₂ O	+6.5
nitrate	∞	NaNO ₃	-5.05		∞	SrBr ₂ ·4H ₂ O	+0.4
nitrite	aq	NaNO ₂	-3.6		∞	SrBr ₂ ·6H ₂ O	-6.1
perchlorate	∞	NaClO ₄	-4.15	chloride	∞	SrCl ₂	+11.54
phosphate di-	1600	Na ₂ HPO ₄	+5.21		∞	SrCl ₂ ·H ₂ O	+6.4
tri-	1600	Na ₃ PO ₄	+13		∞	SrCl ₂ ·2H ₂ O	+2.95
phosphate di-	1600	Na ₃ PO ₄ ·12H ₂ O	-15.3	iodide	∞	SrCl ₂ ·6H ₂ O	-7.1
	1600	Na ₂ HPO ₄ ·2H ₂ O	-0.82		∞	SrI ₂	+20.7
	1600	Na ₂ HPO ₄ ·7H ₂ O	-12.04		∞	SrI ₂ ·H ₂ O	+12.65
	1600	Na ₂ HPO ₄ ·12H ₂ O	-23.18		∞	SrI ₂ ·2H ₂ O	+10.4
phosphite, mono-	600	NaH ₂ PO ₃	+0.90	nitrate	∞	SrI ₂ ·6H ₂ O	-4.5
	600	NaH ₂ PO ₃ ·2½H ₂ O	-5.29		∞	Sr(NO ₃) ₂	-4.8
di-	800	Na ₂ HPO ₃	+9.30	sulfate	∞	Sr(NO ₃) ₂ ·4H ₂ O	-12.4
	800	Na ₂ HPO ₃ ·5H ₂ O	-4.54	Sulfuric acid, pyro-	∞	SrSO ₄	+0.5
pyrophosphate	1600	Na ₄ P ₂ O ₇	+11.9			H ₂ S ₂ O ₇	-18.08
	1600	Na ₄ P ₂ O ₇ ·10H ₂ O	-11.7	Zinc acetate	400	Zn(C ₂ H ₃ O ₂) ₂	+9.8
	1200	Na ₂ H ₂ P ₂ O ₇	-2.2		400	Zn(C ₂ H ₃ O ₂) ₂ ·H ₂ O	+7.0
	1200	Na ₂ H ₂ P ₂ O ₇ ·6H ₂ O	-14.0	bromide	400	Zn(C ₂ H ₃ O ₂) ₂ ·2H ₂ O	+3.9
sulfate	∞	Na ₂ SO ₄	+0.28	chloride	400	ZnBr ₂	+15.0
	∞	Na ₂ SO ₄ ·10H ₂ O	-18.74		400	ZnCl ₂	+15.72
sulfate, acid	800	NaHSO ₄	+1.74	iodide	aq	ZnI ₂	+11.6
	800	NaHSO ₄ ·H ₂ O	+0.15	nitrate	400	Zn(NO ₃) ₂ ·3H ₂ O	-5
sulfide	∞	Na ₂ S	+15.2		400	Zn(NO ₃) ₂ ·6H ₂ O	-6.0
	∞	Na ₂ S·4½H ₂ O	+0.09	sulfate	400	ZnSO ₄	+18.5
	∞	Na ₂ S·5H ₂ O	-6.54		400	ZnSO ₄ ·H ₂ O	+10.0
	∞	Na ₂ S·9H ₂ O	-16.65		400	ZnSO ₄ ·6H ₂ O	-0.8
sulfite	∞	Na ₂ SO ₃	+2.8		400	ZnSO ₄ ·7H ₂ O	-4.3
	∞	Na ₂ SO ₃ ·7H ₂ O	-11.1				
thiocyanate	∞	NaCNS	-1.83				

NOTE: To convert kilocalories per gram-mole to British thermal units per pound-mole, multiply by 1.799 × 10⁻³.

TABLE 2-225 Heats of Solution of Organic Compounds in Water (at Infinite Dilution and Approximately Room Temperature)Recalculated and rearranged from *International Critical Tables*, vol. 5, pp. 148–150. (g-cal)/(g-mole) = Btu/(lb-mol) \times 1.799.

Solute	Heat of Solution, G-cal/g-mole Solute ^a	Solute	Heat of Solution, G-cal/g-mole Solute ^a
Acetic acid (solid), C ₂ H ₄ O ₂	-2,251	Oxalic acid, C ₂ H ₂ O ₄	-2,290
Acetylacetone, C ₈ H ₈ O ₂	-641	(2H ₂ O)	-8,485
Acetylurea, C ₃ H ₆ N ₂ O ₂	-6,812	Phenol (solid), C ₆ H ₆ O	-2,605
Aconitic acid, C ₆ H ₆ O ₆	-4,206	Phthalic acid, C ₈ H ₆ O ₄	-4,871
Ammonium benzoate, C ₇ H ₉ NO ₂	-2,700	Picric acid, C ₆ H ₃ N ₃ O ₇	-7,098
picrate	-8,700	Piperic acid, C ₁₂ H ₁₀ O ₄	-10,492
succinate (<i>n</i> -)	-3,489	Piperonylic acid, C ₈ H ₆ O ₄	-9,106
Aniline, hydrochloride, C ₆ H ₅ ClN	-2,732	Potassium benzoate	-1,506
Barium picrate	-4,708	citrate	2,820
Benzoic acid, C ₇ H ₆ O ₂	-6,501	tartrate (<i>n</i> -) (0.5 H ₂ O)	-5,562
Camphoric acid, C ₁₀ H ₁₆ O ₄	-502	Pyrogallol, C ₆ H ₆ O ₃	-3,705
Citric acid, C ₆ H ₈ O ₇	-5,401	Pyrotartaric acid	-5,019
Dextrin, C ₁₂ H ₂₀ O ₁₀	268	Quinone	-3,991
Fumaric acid, C ₄ H ₄ O ₄	-5,903	Raffinose, C ₁₈ H ₃₂ O ₁₆ (5H ₂ O)	-9,703
Hexamethylenetetramine, C ₆ H ₁₂ N ₄	4,780	Resorcinol, C ₆ H ₆ O ₂	-3,960
Hydroxybenzamide (<i>m</i> -), C ₇ H ₇ NO ₂	-4,161	Silver malonate (<i>n</i> -)	-9,799
(<i>m</i> -), (HCl)	-7,003	Sodium citrate (tri-)	5,270
(<i>o</i> -), C ₇ H ₇ NO ₂	-4,340	picrate	-6,441
(<i>p</i> -)	-5,392	potassium tartrate	-1,817
Hydroxybenzoic acid (<i>o</i> -), C ₇ H ₆ O ₃	-6,350	succinate (<i>n</i> -) (4H ₂ O)	-12,342
(<i>p</i> -), C ₇ H ₆ O ₃	-5,781	tartrate (<i>n</i> -) (6H ₂ O)	2,390
Hydroxybenzyl alcohol (<i>o</i> -), C ₇ H ₈ O ₃	-3,203	tartrate (<i>n</i> -) (2H ₂ O)	-10,994
Inulin, C ₃₆ H ₆₂ O ₃₁	-96	Strontium picrate	-1,121
Isosuccinic acid, C ₄ H ₆ O ₄	-3,420	(6H ₂ O)	-5,882
Itaconic acid, C ₅ H ₆ O ₄	-5,922	Succinic acid, C ₄ H ₆ O ₄	7,887
Lactose, C ₁₂ H ₂₂ O ₁₁ ·H ₂ O	-3,705	Succinimide, C ₄ H ₅ NO ₂	-14,412
Lead picrate	-7,098	Sucrose, C ₁₂ H ₂₂ O ₁₁	-6,405
(2H ₂ O)	-13,193	Tartaric acid (<i>d</i> -)	-4,302
Magnesium picrate	14,699	Thiourea, CH ₄ N ₂ S	-1,319
(8H ₂ O)	-15,894	Urea, CH ₄ N ₂ O	-3,451
Maleic acid, C ₄ H ₄ O ₄	-4,441	acetate	-5,330
Malic acid, C ₄ H ₆ O ₅	-3,150	formate	-3,609
Malonic acid, C ₃ H ₄ O ₄	-4,493	nitrate	-8,795
Mandelic acid, C ₈ H ₈ O ₃	-3,090	oxalate	-7,194
Mannitol, C ₆ H ₁₄ O ₆	-5,260	Vanillic acid	-10,803
Menthol, C ₁₀ H ₂₀ O	0	Vanillin	-17,806
Nicotine dihydrochloride, C ₁₀ H ₁₆ Cl ₂ N ₂	6,561	Vanillin	-5,160
Nitrobenzoic acid (<i>m</i> -), C ₇ H ₅ NO ₄	-5,593	Zinc picrate	-5,210
(<i>o</i> -), C ₇ H ₅ NO ₄	-5,306	(8H ₂ O)	-11,496
(<i>p</i> -), C ₇ H ₅ NO ₄	-8,891		-15,894
Nitrophenol (<i>m</i> -), C ₆ H ₅ NO ₃	-5,210		
(<i>o</i> -), C ₆ H ₅ NO ₃	-6,310		
(<i>p</i> -), C ₆ H ₅ NO ₃	-4,493		

^a+ denotes heat evolved, and - denotes heat absorbed. All values are positive unless otherwise noted. The data in the *International Critical Tables* were calculated by E. Anderson.