Section 4

Chlorinated solvents

Methylene chloride

Alternative names
Dichloromethane, MDC, methylene dichloride, **not** methyl chloride

Reference codes			
CAS number	75 09 2	Hazchem code	2Z
UN number	1593	EPA code	U080
Physical properties			
Molecular weight	85	Cubic expansion coeff (per °C × 10^3)	1.37
Empirical formula	$C_1H_2Cl_2$	Surface tension (@20°C dyn/cm)	28.1
Boiling point (°C)	40	Absolute viscosity (@25°C cP)	0.44
Freezing point (°C)	–95	Refractive index (25°C)	1.4211
Specific gravity (20/4)	1.326		
Fire hazards			
Flash point (closed cup °C)	None	Lower explosive limit (ppm)	130000
Autoignition temperature (°C)	605	Upper explosive limit (ppm)	220000
Electrical conductivity	4.3E–11		
Health hazards			
IDLH (ppm)	5000	Vapour concentration @21°C ppm	495000
OES-TWA	50	Vapour density (relative to air)	2.95
OES-STEL	300	Vapour pressure @21°C mmHg	376
Odour threshold (ppm)	250	POCP	0.9
Aqueous effluent			
Solubility in water (25°C %w/w)		1.30	
Solubility of water in (25°C %w/w)		0.20	
Log_{10} activated carbon partition		2.9	
Log_{10} partition in octanol/water (w/w)		+1.25	
Biological oxygen demand w/w (days)			0 (5)
Theoretical oxygen demand w/w		0.56	
Vapour pressure equation constants (Log_{10}, mmHg)			
Antoine equation	A	7.0803	
	B	1138.91	
	C	231.45	
Cox chart	A	6.91821	
	B	1090.1	
Solvent properties			
Solubility parameter	9.7	Kauri butanol value	136
Dipole (D)	1.8	Evaporation time (ether = 1)	1.8
Dielectric constant (20°C)	9.1	Evaporation time (BuAc = 1)	25.0
Polarity (water 100)	30.9		
Thermal information			
Latent heat (cal/mol)	6715		
Nett heat of combustion (kcal/gmol)	122		
Specific heat (cal/mol/°C)	24		
Critical pressure (MN/m^2)	6.08		
Critical temperature (K)	510		
Latent heat of fusion (cal/mol)	1436		
Van der Waals' volume	2.26		
Van der Waals' surface area	1.99		
Molar volume	64.50		

Solute	Azeotrope X% w/w	Azeotrope °C	Azeotrope Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Hydrocarbons							
n-Pentane	49	36	1571	2.9	6a/100		
n-Hexane	None		1575				
n-Heptane							
n-Octane				4.1	1x/3/923		
n-Nonane							
n-Decane							
2,2,4-TMP							
Cyclohexane							
Benzene							
Toluene				1.0	1x/3/923		
Ethylbenzene							
Xylenes							
C_9 Aromatics							
Tetralin							
Alcohols							
Methanol	93	38	1544	7.9	2e/24	9.28	V4/118
Ethanol	95	40	1551	43.7	2c/283		
n-Propanol				4.1	2e/416		
i-Propanol	None		1561	4.1	2f/36		
n-Butanol							
i-Butanol							
s-Butanol							
n-Amyl alc.							
i-Amyl alc.							
Cyclohexanol							
1-Octanol							
Ethanediol							
DEG							
1,2-Propanediol							
Glycol ethers							
PGME							
EGME							
EEE							
EGBE							
Chlorinated							
MDC	–		–	–	–	–	–
Chloroform	None		1426	0.7	8/202		
Carbon tet.				0.9	8/62		
1,2-EDC				1.0	8/263		
1,1,1-TCA				1.2	1x/3/923		
TCE				1.5	1x/3/923		
Perk.				0.9	8/256		
MCB							

Solute	Azeotrope X% w/w	Azeotrope °C	Azeotrope Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Ketones							
Acetone	None		1553	1.1	3b/27		
MEK	None		1564	0.4	3+4/261		
MIBK							
Cyclohexanone							
NMP							
Acetophenone							
Ethers							
Diethyl ether	70	41	1566	0.7	3+4/492		
DIPE							
Dibutyl ether							
MTBE							
1,4-Dioxane				0.4	1x/3/923		
THF					0.09		
Esters							
Me acetate	None		1557	0.5	5/347		
Et acetate				0.4	5/449		
i-Propyl acetate							
n-Butyl acetate							
Cellosolve acetate							
Miscellaneous							
DMF				0.8	8/265	0.39	V4/120
DMAc							
DMSO				0.45	8/264		
Sulfolane				0.8	8/266		
CS_2	65	36	1170				
Acetic acid				4.2	5/64	3.24	V2/36
Aniline							
Nitrobenzene							
Morpholine							
Pyridine				0.6	8/267		
2-Nitropropane							
Acetonitrile	None		1546	1.2	8/258		
Furfuraldehyde				1.2	3a/115		
Phenol							
Water	99	38	208	1324.0	1/1		

Chloroform

Alternative names
Trichloromethane

Reference codes			
CAS number	67 66 3	Hazchem code	2Z
UN number	1888	EPA code	U044
Physical properties			
Molecular weight	119	Cubic expansion coeff (per °C × 10^3)	1.29
Empirical formula	$C_1H_1Cl_3$	Surface tension (@20°C dyn/cm)	27.16
Boiling point (°C)	61	Absolute viscosity (@25°C cP)	0.57
Freezing point (°C)	–23	Refractive index (25°C)	1.444
Specific gravity (20/4)	1.480		
Fire hazards			
Flash point (closed cup °C)	None	Lower explosive limit (ppm)	None
Autoignition temperature (°C)	None	Upper explosive limit (ppm)	None
Electrical conductivity	<1.0E–10		
Health hazards			
IDLH (ppm)	1000	Vapour concentration @21°C ppm	286000
OES-TWA	2	Vapour density (relative to air)	4.13
OES-STEL		Vapour pressure @21°C mmHg	169
Odour threshold (ppm)	300	POCP	1.0
Aqueous effluent			
Solubility in water (25°C %w/w)		0.82	
Solubility of water in (25°C %w/w)		0.072	
Log_{10} activated carbon partition		3.6	
Log_{10} partition in octanol/water (w/w)		+1.97	
Biological oxygen demand w/w (days)		0.02 (5)	
Theoretical oxygen demand w/w		1.35	
Vapour pressure equation constants (Log_{10}, mmHg)			
Antoine equation	A	6.95465	
	B	1170.966	
	C	226.232	
Cox chart	A	6.97909	
	B	1192.6	
Solvent properties			
Solubility parameter	9.3	Kauri butanol value	
Dipole (D)	1.1	Evaporation time (ether = 1)	1.9
Dielectric constant (20°C)	4.8	Evaporation time (BuAc = 1)	
Polarity (water 100)	25.9		
Thermal information			
Latent heat (cal/mol)	70.21		
Nett heat of combustion (kcal/gmol)	91		
Specific heat (cal/mol/°C)	27		
Critical pressure (MN/m^2)	2.38		
Critical temperature (K)	536		
Latent heat of fusion (cal/mol)	2097		
Van der Waals' volume	2.87		
Van der Waals' surface area	2.41		
Molar volume	80.41		

Solute	Azeotrope X% w/w	Azeotrope °C	Azeotrope Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Hydrocarbons							
n-Pentane	None		1482	2.1	1x/3/992		
n-Hexane	83	60	1495	1.9	6a/426		
n-Heptane	None		1500	1.4	6b/77		
n-Octane				2.1	1x/3/922		
n-Nonane							
n-Decane							
2,2,4-TMP							
Cyclohexane	None		1490				
Benzene	None		1486	0.86	1x/1/4		
Toluene	None		1498	0.75	7/352		
Ethylbenzene							
Xylenes							
C_9 Aromatics							
Tetralin							
Alcohols							
Methanol	87	53	1430	7.4	2a/23	3.5	P160
Ethanol	93	59	1442	4.3	2a/285	1.07	P373
n-Propanol	None		1454			0.24	P640
i-Propanol	96	61	1453	6.6	2d/40	0.34	P651
n-Butanol				2.7	2b/136	0.05	P952
i-Butanol	None		1475			0.07	P964
s-Butanol	None		1472			0.08	P976
n-Amyl alc.							
i-Amyl alc.							
Cyclohexanol							
1-Octanol							
Ethanediol							
DEG							
1,2-Propanediol							
Glycol ethers							
PGME							
EGME							
EEE							
EGBE							
Chlorinated							
MDC	None		1426	0.8	8/202		
Chloroform	–		–	–	–	–	–
Carbon tet.	None		1086	1.1	8/56		
1,2-EDC	None		1435	1.1	1x/3/921		
1,1,1-TCA				1.0	1x/3/921		
TCE				1.1	1x/3/921		
Perk.	None		1431	1.2	8/215		
MCB	None		1484	0.8	8/244		

Solute	Azeotrope X% w/w	Azeotrope °C	Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Ketones							
Acetone	78	64	1443	0.5	3+4/90	0.03	P493
MEK	17	80	1460	0.4	3+4/260		
MIBK	None		1492	0.3	3+4/343		
Cyclohexanone							
NMP				0.06	3b/426		
Acetophenone							
Ethers							
Diethyl ether	None		1474	0.4	3+4/486		
DIPE	36	71	1496	0.5	3+4/537		
Dibutyl ether	None		1501a	0.4	3+4/591		
MTBE							
1,4-Dioxane	None		1465	0.3	3+4/441		
THF	66	73	1464	0.25	1x/1/4	0.03	V4/115
Esters							
Me acetate	77	65	1448	0.43	5/341		
Et acetate	28	78	1466	0.23	5/443		
i-Propyl acetate							
n-Butyl acetate	None		1493	0.41	5/574		
Cellosolve acetate							
Miscellaneous							
DMF						0.32	V4/113
DMAc							
DMSO				0.18	8/229		
Sulfolane							
CS_2	None		1169	1.3	8/213		
Acetic acid	None		1437	4.2	5/62	1.04	V2/18
Aniline						0.007	P1714
Nitrobenzene	None		1485				
Morpholine							
Pyridine	None		1480a	0.35	8/240	0.006	P1102
2-Nitropropane							
Acetonitrile	None		1433	1.2	8/217		
Furfuraldehyde	None		1480	10.7	3+4/36		
Phenol						0.07	P1627
Water	97	56	207				

Carbon tetrachloride

Alternative names
Carbon tet., CTET, tetrachloromethane

Reference codes			
CAS number	56 23 5	Hazchem code	2Z
UN number	1846	EPA code	U211
Physical properties			
Molecular weight	154	Cubic expansion coeff (per °C × 10^3)	1.27
Empirical formula	C_1Cl_4	Surface tension (@20°C dyn/cm)	27
Boiling point (°C)	76	Absolute viscosity (@25°C cP)	0.97
Freezing point (°C)	–23	Refractive index (25°C)	1.459
Specific gravity (20/4)	1.58		
Fire hazards			
Flash point (closed cup °C)	None	Lower explosive limit (ppm)	None
Autoignition temperature (°C)	None	Upper explosive limit (ppm)	None
Electrical conductivity	4.0E–18		
Health hazards			
IDLH (ppm)	300	Vapour concentration @21°C ppm	150900
OES-TWA	2	Vapour density (relative to air)	5.34
OES-STEL		Vapour pressure @21°C mmHg	99.6
Odour threshold (ppm)	96	POCP	
Aqueous effluent			
Solubility in water (25°C %w/w)		0.077	
Solubility of water in (25°C %w/w)		0.008	
Log_{10} activated carbon partition		4.3	
Log_{10} partition in octanol/water (w/w)		+2.64	
Biological oxygen demand w/w (days)		0 (5)	
Theoretical oxygen demand w/w		0.21	
Vapour pressure equation constants (Log_{10}, mmHg)			
Antoine Equation	A	6.84083	
	B	1210.595	
	C	229.664	
Cox chart	A	7.02433	
	B	1267.9	
Solvent properties			
Solubility parameter	8.6	Kauri butanol value	
Dipole (D)	0	Evaporation time (ether = 1)	1.8
Dielectric constant (20°C)	2.24	Evaporation Time (BuAc = 1)	
Polarity (water 100)	5.2		
Thermal information			
Latent heat (cal/mol)	7238		
Nett heat of combustion (kcal/gmol)	62		
Specific heat (cal/mol/°C)	32		
Critical pressure (MN/m^2)	4.56		
Critical temperature (K)	556		
Latent heat of fusion (cal/mol)	784		
Van der Waals' volume	3.39		
Van der Waals' surface area	2.91		
Molar volume	97.5		

Solute	Azeotrope X% w/w	Azeotrope °C	Azeotrope Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Hydrocarbons							
n-Pentane							
n-Hexane	None		1162	1.3	6a/403		
n-Heptane	None		1167	1.3	6b/67		
n-Octane	None		1168a	1.0	6b/234		
n-Nonane							
n-Decane							
2,2,4-TMP	None		1168b	1.4	6b/285		
Cyclohexane	None		1159	1.1	6a/142		
Benzene	None		1154	1.1	7/7		
Toluene	None		1166	1.0	7/332		
Ethylbenzene	None		1167a	0.9	7/464		
Xylenes	None		1167c	0.9	7/480		
C_9 Aromatics							
Tetralin							
Alcohols							
Methanol	79	56	1090	10.3	2a/1		
Ethanol	84	65	1105	20.5	2a/276	4.76	P382
n-Propanol	92	73	1116	14.5	2a/509		
i-Propanol	82	67	1115	6.7	2b/36	2.45	V2/10
n-Butanol	98	77	1133	9.5	2f/109	0.32	P958
i-Butanol	95	76	1137				
s-Butanol	92	75	1134	5.4	2f/217		
n-Amyl alc.	None		1147a			0.05	P1269
i-Amyl alc.	None		1149				
Cyclohexanol							
1-Octanol							
Ethanediol							
DEG							
1,2-Propanediol							
Glycol ethers							
PGME							
EGME				4.9	2f/99		
EEE							
EGBE							
Chlorinated							
MDC				1.1	8/63		
Chloroform	None		1086	1.0	8/55		
Carbon tet.	–		–	–	–	–	–
1,2-EDC	80	75	1098	1.5	8/96		
1,1,1-TCA	Azeo			1.2	8/82		
TCE	None		1093	0.7	8/80		
Perk.	None		1091	1.0	8/78		
MCB	None		1152	1.4	8/164		

Solute	Azeotrope X% w/w	Azeotrope °C	Azeotrope Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Ketones							
Acetone	12	56	1108	2.3	3+4/80	0.26	P502
MEK	71	74	1121	1.8	3+4/259		
MIBK							
Cyclohexanone				0.9	3b/495		
NMP							
Acetophenone							
Ethers							
Diethyl ether	None		1136				
DIPE	None		1163	1.1	3+4/529		
Dibutyl ether							
MTBE							
1,4-Dioxane	None		1124	1.6	3+4/440		
THF				0.9	3+4/429	0.06	V4/107
Esters							
Me acetate	None		1110	1.6	5/339	0.05	P519
Et acetate	57	75	1125	1.4	5/436		
i-Propyl acetate	None		1145				
n-Butyl acetate	None		1161	0.8	5/573		
Cellosolve acetate							
Miscellaneous							
DMF				5.4	8/117	5.9	V4/106
DMAc							
DMSO				18.5	8/107	3.8	P387
Sulfolane							
CS_2	None		1085	1.2	8/76		
Acetic acid	98	76	1099	12.2	5/59	6.0	V2/12
Aniline	None			6.0	8/174	0.07	P1720
Nitrobenzene	None		1153	0.7	8/168		
Morpholine							
Pyridine				2.0	8/141		
2-Nitropropane	None		1114	3.2	8/120		
Acetonitrile	83	65	1095	9.6	8/86		
Furfuraldehyde	None		1140	3.8	3+4/35	0.04	
Phenol	None		1155	3.4	2b/355	0.31	P1652
Water	96	66	205				

1,2-Dichloroethane

Alternative names
Ethylene dichloride, EDC

Reference codes			
CAS number	107 06 2	Hazchem code	2YE
UN number	1184	EPA code	U077
Physical properties			
Molecular weight	99	Cubic expansion coeff (per °C × 10^3)	1.16
Empirical formula	$C_2H_4Cl_2$	Surface tension (@20°C dyn/cm)	32.2
Boiling point (°C)	83.5	Absolute viscosity (@25°C cP)	0.9
Freezing point (°C)	–36	Refractive index (25°C)	1.444
Specific gravity (20/4)	1.253		
Fire hazards			
Flash point (closed cup °C)	13	Lower explosive limit (ppm)	62000
Autoignition temperature (°C)	413	Upper explosive limit (ppm)	169000
Electrical conductivity	4E–11		
Health hazards			
IDLH (ppm)	1000	Vapour concentration @21°C ppm	94000
OES-TWA	5	Vapour density (relative to air)	3.4
OES-STEL		Vapour pressure @21°C mmHg	71
Odour threshold (ppm)	400	POCP	
Aqueous effluent			
Solubility in water (25°C %w/w)		0.81	
Solubility of water in (25°C %w/w)		0.15	
Log_{10} activated carbon partition		3.8	
Log_{10} partition in octanol/water (w/w)		3.6	
Biological oxygen demand w/w (days)		0.002 (5)	
Theoretical oxygen demand w/w		0.97	
Vapour pressure equation constants (Log_{10}, mmHg)			
Antoine equation	A	7.02530	
	B	1271.254	
	C	222.927	
Cox chart	A	7.04532	
	B	1303.5	
Solvent properties			
Solubility parameter	9.8	Kauri butanol value	
Dipole (D)	1.8	Evaporation time (ether = 1)	2.7
Dielectric constant (20°C)	10.45	Evaporation time (BuAc = 1)	
Polarity (water 100)	32.7		
Thermal information			
Latent heat (cal/mol)	7623		
Nett heat of combustion (kcal/gmol)	269		
Specific heat (cal/mol/°C)	31		
Critical pressure (MN/m^2)	5.38		
Critical temperature (K)	563		
Latent heat of fusion (cal/mol)	2091		
Van der Waals' volume	2.93		
Van der Waals' surface area	2.53		
Molar volume	78.87		

Solute	Azeotrope X% w/w	Azeotrope °C	Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Hydrocarbons							
n-Pentane				4.8	1x/1/18		
n-Hexane	None		3003	3.6	1x/1/19		
n-Heptane	76	81	3009	3.4	6c/444		
n-Octane							
n-Nonane							
n-Decane							
2,2,4-TMP				3.4	1x/1/19		
Cyclohexane	50	74	3001	3.1	6a/159		
Benzene	20	80	2999	1.1	7/142		
Toluene	None		3006	1.1	7/380		
Ethylbenzene				1.0	7/466		
Xylenes				1.3	7/490		
C_9 Aromatics							
Tetralin							
Alcohols							
Methanol	68	61	1930	11.2	2e/44	7.9	V2/83
Ethanol	63	71	2964	4.9	2a/299		
n-Propanol	None		2971	5.1	2a/520		
i-Propanol	57	73	2970	4.9	1x/1/18	1.2	V2/207
n-Butanol	None		2984	3.2	2b/137		
i-Butanol	94	83	2988	4.2	2b/272		
s-Butanol	88	82	2985	2.7	2f/220		
n-Amyl alc.				3.6	2f/375		
i-Amyl alc.	None		2995				
Cyclohexanol							
1-Octanol							
Ethanediol							
DEG							
1,2-Propanediol							
Glycol ethers							
PGME							
EGME							
EEE							
EGBE							
Chlorinated							
MDC				1.0	8/263		
Chloroform	None		1435	1.0	1x/3/957		
Carbon tet.	20	75	1098	1.8	1x/3/957		
1,2-EDC	–		–	–	–	–	–
1,1,1-TCA				1.6	8/363		
TCE	67	82	2281	1.4	8/351		
Perk.				1.7	8/340		
MCB							

Solute	Azeotrope X% w/w	Azeotrope °C	Azeotrope Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Ketones							
Acetone	None		2966	0.8	3+4/144		
MEK	Azeo		2977	0.8	3b/271		
MIBK				0.8	3b/519		
Cyclohexanone							
NMP							
Acetophenone						<0.01	P2746
Ethers							
Diethyl ether	None		2987				
DIPE	None		3004				
Dibutyl ether							
MTBE							
1,4-Dioxane	None		2979	0.9	3+4/447	0.98	V4/180
THF				0.7	1x/3/957		
Esters							
Me acetate							
Et acetate	None		2980	0.8	1x/1/18		
i-Propyl acetate	None		2992				
n-Butyl acetate							
Cellosolve acetate							
Miscellaneous							
DMF							
DMAc							
DMSO							
Sulfolane							
CS_2				2.6	1x/1/17		
Acetic acid	None		2961	4.4	5/74	1.61	V2/202
Aniline						<0.01	P1721
Nitrobenzene							
Morpholine							
Pyridine				0.9	1x/1/18		
2-Nitropropane							
Acetonitrile	51	79	2757	1.4	8/364		
Furfuraldehyde				1.1	3a/119	0.14	V4/181
Phenol							
Water	91	72	227				

1,1,1-Tricloroethane

Alternative names
Methyl chloroform, TCA, chlorothene, M.C., **not** 1,1,2-trichloroethane

Reference codes			
CAS number	71 55 6	Hazchem code	2Z
UN number	2831	EPA code	U226
Physical properties			
Molecular weight	133	Cubic expansion coeff (per °C × 10^3)	1.3
Empirical formula	$C_2H_3Cl_3$	Surface tension (@20°C dyn/cm)	30
Boiling point (°C)	74	Absolute viscosity (@25°C cP)	0.65
Freezing point (°C)	–30	Refractive index (25°C)	1.438
Specific gravity (20/4)	1.338		
Fire hazards			
Flash point (closed cup °C)	None	Lower explosive limit (ppm)	65000
Autoignition temperature (°C)	537	Upper explosive limit (ppm)	155000
Electrical conductivity	7.3E–9		
Health hazards			
IDLH (ppm)		Vapour concentration @21°C ppm	154700
OES-TWA	350	Vapour density (relative to air)	4.62
OES-STEL	450	Vapour pressure @21°C mmHg	101.8
Odour threshold (ppm)	300	POCP	0.1
Aqueous effluent			
Solubility in water (25°C %w/w)		0.13	
Solubility of water in (25°C %w/w)		0.03	
Log_{10} activated carbon partition		4.3	
Log_{10} partition in octanol/water (w/w)		4.0	
Biological oxygen demand w/w (days)			
Theoretical oxygen demand w/w		0.48	
Vapour pressure equation constants (Log_{10}, mmHg)			
Antoine equation	A	6.90633	
	B	1211.31	
	C	226.816	
Cox chart	A	7.01846	
	B	1257.7	
Solvent properties			
Solubility parameter	7.7	Kauri butanol value	124
Dipole (D)	1.7	Evaporation time (ether = 1)	2.6
Dielectric constant (20°C)	7.25	Evaporation time (BuAc = 1)	6.0
Polarity (water 100)	17.0		
Thermal information			
Latent heat (cal/mol)	7780		
Nett heat of combustion (kcal/gmol)	233		
Specific heat (cal/mol/°C)	32		
Critical pressure (MN/m^2)	4.4		
Critical temperature (K)	550		
Latent heat of fusion (cal/mol)	651.7		
Van der Waals' volume	3.54		
Van der Waals' surface area	3.03		
Molar volume	100.4		

Solute	Azeotrope X% w/w	Azeotrope °C	Azeotrope Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Hydrocarbons							
n-Pentane							
n-Hexane	29	67	2730b	1.3	6a/473		
n-Heptane							
n-Octane							
n-Nonane							
n-Decane							
2,2,4-TMP							
Cyclohexane							
Benzene				1.0	7/121		
Toluene							
Ethylbenzene							
Xylenes							
C_9 Aromatics							
Tetralin							
Alcohols							
Methanol	78	56	1923				
Ethanol							
n-Propanol							
i-Propanol							
n-Butanol				1.6	2f/123	0.11	V4/158
i-Butanol							
s-Butanol							
n-Amyl alc.							
i-Amyl alc.				24.8	2f/373		
Cyclohexanol							
1-Octanol							
Ethanediol							
DEG							
1,2-Propanediol							
Glycol ethers							
PGME							
EGME							
EEE							
EGBE							
Chlorinated							
MDC							
Chloroform				1.0	1x/3/948		
Carbon tet.	Azeo			1.1	8/82		
1,2-EDC	None		2729	1.2	1x/3/948		
1,1,1-TCA	–		–	–	–	–	–
TCE				1.0	1x/3/948		
Perk.							
MCB							

Solute	Azeotrope X% w/w	Azeotrope °C	Azeotrope Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Ketones							
Acetone							
MEK							
MIBK							
Cyclohexanone							
NMP							
Acetophenone							
Ethers							
Diethyl ether							
DIPE							
Dibutyl ether							
MTBE							
1,4-Dioxane							
THF						0.04	V4/160
Esters							
Me acetate							
Et acetate							
i-Propyl acetate							
n-Butyl acetate							
Cellosolve acetate							
Miscellaneous							
DMF							
DMAc							
DMSO							
Sulfolane							
CS_2							
Acetic acid							
Aniline							
Nitrobenzene							
Morpholine							
Pyridine							
2-Nitropropane							
Acetonitrile							
Furfuraldehyde						0.04	V4/159
Phenol							
Water	96	65					

Trichloroethylene

Alternative names
1,2,2-trichloroethylene, trike, TCE, triclene, trilane, trichloroethene, **not** trichlorethane

Reference codes			
CAS number	79 01 6	Hazchem code	2Z
UN number	1710	EPA code	U228
Physical properties			
Molecular weight	131	Cubic expansion coeff (per °C × 10^3)	1.17
Empirical formula	$C_2H_1Cl_3$	Surface tension (@20°C dyn/cm)	29.5
Boiling point (°C)	87	Absolute viscosity (@25°C cP)	0.57
Freezing point (°C)	–86	Refractive index (25°C)	1.475
Specific gravity (20/4)	1.464		
Fire hazards			
Flash point (closed cup °C)	32*	Lower explosive limit (ppm)	80000
Autoignition temperature (°C)	420	Upper explosive limit (ppm)	105000
Electrical conductivity	8E–12		
Health hazards			
IDLH (ppm)	500	Vapour concentration @21°C ppm	80260
OES-TWA	100	Vapour density (relative to air)	4.55
OES-STEL	150	Vapour pressure @21°C mmHg	56.5
Odour threshold (ppm)	200	POCP	6.6
Aqueous effluent			
Solubility in water (25°C %w/w)		0.11	
Solubility of water in (25°C %w/w)		0.033	
Log_{10} activated carbon partition		5.0	
Log_{10} partition in octanol/water (w/w)		+2.29	
Biological oxygen demand w/w (days)			
Theoretical oxygen demand w/w		0.61	
Vapour pressure equation constants (Log_{10}, mmHg)			
Antoine equation	A	6.51827	
	B	1018.603	
	C	192.731	
Cox chart	A		
	B		
Solvent properties			
Solubility parameter	8.0	Kauri butanol value	130
Dipole (D)	0.9	Evaporation time (ether = 1)	3.1
Dielectric constant (20°C)	3.42	Evaporation time (BuAc = 1)	4.9
Polarity (water 100)	16.0		
Thermal information			
Latent heat (cal/mol)	7467		
Nett heat of combustion (kcal/gmol)	206		
Specific heat (cal/mol/°C)	30		
Critical pressure (MN/m^2)	4.90		
Critical temperature (K)	571		
Latent heat of fusion (cal/mol)			
Van der Waals' volume	3.31		
Van der Waals' surface area	2.86		
Molar volume	90.01		

*Very resistant to flashing.

Solute	Azeotrope X% w/w	Azeotrope °C	Azeotrope Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Hydrocarbons							
n-Pentane	None		1482				
n-Hexane	None		2330	1.5	6a/463		
n-Heptane	None		2335				
n-Octane							
n-Nonane							
n-Decane							
2,2,4-TMP							
Cyclohexane	17	80	2328	1.3	6a/155		
Benzene	None		2326	1.0	7/114		
Toluene				0.8	7/370		
Ethylbenzene							
Xylenes							
C_9 Aromatics							
Tetralin							
Alcohols							
Methanol	62	59	1915	6.9	2a/40	8.9	V2/79
Ethanol	71	72	2286	7.3	2a/295	2.03	CEH
n-Propanol	83	82	2296	2.7	2a/518	0.24	V4/152
i-Propanol	70	75	2295	3.1	2d/43		
n-Butanol	97	87	2306	3.7	2f/121	0.08	V4/154
i-Butanol	91	85	2309				
s-Butanol	85	84	2307	3.8	2f/217		
n-Amyl alc.							
i-Amyl alc.	None		2321				
Cyclohexanol							
1-Octanol							
Ethanediol	None		2287				
DEG							
1,2-Propanediol							
Glycol ethers							
PGME							
EGME							
EEE							
EGBE							
Chlorinated							
MDC							
Chloroform				1.1	1x/3/943		
Carbon tet.	None		1093	1.0	1x/3/943		
1,2-EDC	33	82	2281	1.4	8/351		
1,1,1-TCA				1.0	1x/3/943		
TCE	–		–	–	–	–	–
Perk.				1.6	8/326		
MCB							

Chlorinated solvents

Solute	Azeotrope X% w/w	Azeotrope °C	Azeotrope Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Ketones							
Acetone	None		2289	1.0	3b/51		
MEK	None		2299	1.3	3+4/264	0.05	V2/157
MIBK				1.1	3b/517		
Cyclohexanone							
NMP							
Acetophenone							
Ethers							
Diethyl ether							
DIPE	None		2331				
Dibutyl ether							
MTBE							
1,4-Dioxane	None		2301				
THF						0.05	V4/151
Esters							
Me acetate							
Et acetate	None		2302	1.0	5/454		
i-Propyl acetate	None		2317				
n-Butyl acetate				0.6	5/575		
Cellosolve acetate							
Miscellaneous							
DMF							
DMAc							
DMSO							
Sulfolane							
CS^2							
Acetic acid	96	86	2282	4.7	5/72	2.7	V2/151
Aniline							
Nitrobenzene							
Morpholine							
Pyridine							
2-Nitropropane							
Acetonitrile	71	75	2280	5.5	8/349		
Furfuraldehyde				3.1	3+4/37	0.03	V4/155
Phenol							
Water	94	73	218				

Perchloroethylene

Alternative names
Tetrachloroethylene, perk, tetrachloroethene

Reference codes			
CAS number	127 18 4	Hazchem code	2Z
UN number	1897	EPA code	U210
Physical properties			
Molecular weight	166	Cubic expansion coeff (per °C × 10^3)	1.02
Empirical formula	C_2Cl_4	Surface tension (@20°C dyn/cm)	32
Boiling point (°C)	122	Absolute viscosity (@25°C cP)	0.88
Freezing point (°C)	–36	Refractive index (25°C)	1.504
Specific gravity (20/4)	1.63		
Fire hazards			
Flash point (closed cup °C)	None	Lower explosive limit (ppm)	None
Autoignition temperature (°C)	None	Upper explosive limit (ppm)	None
Electrical conductivity	5.5E–4		
Health hazards			
IDLH (ppm)	400	Vapour concentration @21°C ppm	20600
OES-TWA	50	Vapour density (relative to air)	5.8
OES-STEL	150	Vapour pressure @21°C mmHg	15.4
Odour threshold (ppm)	300	POCP	0.5

Aqueous effluent	
Solubility in water (25°C %w/w)	0.015
Solubility of water in (25°C %w/w)	0.0105
Log_{10} activated carbon partition	5.4
Log_{10} partition in octanol/water (w/w)	+2.60
Biological oxygen demand w/w (days)	0.06 (5)
Theoretical oxygen demand w/w	0.39

Vapour pressure equation constants (Log_{10}, mmHg)		
Antoine equation	A	7.62930
	B	1803.96
	C	258.976
Cox chart	A	
	B	

Solvent properties			
Solubility parameter	4.5	Kauri butanol value	90
Dipole (D)	0	Evaporation time (ether = 1)	6.0
Dielectric constant (20°C)	2.3	Evaporation time (BuAc = 1)	2.6
Polarity (water 100)			

Thermal information	
Latent heat (cal/mol)	8316
Nett heat of combustion (kcal/gmol)	162
Specific heat (cal/mol/°C)	35
Critical pressure (MN/m^2)	4.48
Critical temperature (K)	613
Latent heat of fusion (cal/mol)	
Van der Waals' volume	3.89
Van der Waals' surface area	3.40
Molar volume	101.84

Solute	Azeotrope X% w/w	Azeotrope °C	Azeotrope Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Hydrocarbons							
n-Pentane							
n-Hexane	None		2217a	1.5	6a/453		
n-Heptane							
n-Octane	92	120	2227				
n-Nonane							
n-Decane							
2,2,4-TMP							
Cyclohexane							
Benzene				1.3	7/112		
Toluene	None		2220				
Ethylbenzene	None		2225				
Xylenes	None		1167c				
C_9 Aromatics							
Tetralin							
Alcohols							
Methanol	36	64	1914	16.4	2a/37		
Ethanol	37	77	2162	5.4	2c/285		
n-Propanol	30	82	2176				
i-Propanol	52	94	2177	5.9	2d/42	2.6	CEH
n-Butanol	71	109	2186	3.8	2d/155		
i-Butanol	60	103	2189			21.7	CEH
s-Butanol	43	97	2187	3.3	2d/240		
n-Amyl alc.	85	117	2201				
i-Amyl alc.	81	116	2203				
Cyclohexanol							
1-Octanol							
Ethanediol	94	119	2163				
DEG							
1,2-Propanediol							
Glycol ethers							
PGME	95	121	2205				
EGME	76	110	2178				
EEE	84	116	2190				
EGBE	None		2218				
Chlorinated							
MDC				1.1	8/256		
Chloroform	None		1431	1.2	8/215		
Carbon tet.	None		1091	1.0	8/78		
1,2-EDC				2.0	8/340		
1,1,1-TCA							
TCE				1.1	8/327		
Perk.	–		–	–	–	–	–
MCB							

Solute	Azeotrope X% w/w	Azeotrope °C	Azeotrope Reference	Solute γ^{∞}	Reference	Part coefficient	Reference
Ketones							
Acetone	None		2168	2.6	3b/49	4.2	CEH
MEK							
MIBK	48	114	2209				
Cyclohexanone							
NMP							
Acetophenone							
Ethers							
Diethyl ether							
DIPE							
Dibutyl ether							
MTBE							
1,4-Dioxane	None		2181				
THF					0.08	V4/149	
Esters							
Me acetate							
Et acetate							
i-Propyl acetate							
n-Butyl acetate	79	120	2210				
Cellosolve acetate							
Miscellaneous							
DMF							
DMAc							
DMSO							
Sulfolane							
CS_2				1.4	8.316		
Acetic acid	61	107	2158			7.25	V2/147
Aniline							
Nitrobenzene							
Morpholine							
Pyridine	52	113	2192	2.0	8/346		
2-Nitropropane							
Acetonitrile							
Furfuraldehyde	None		2191	4.3	3a/117	0.05	V4/150
Phenol							
Water	84	88	217				

Monochlorobenzene

Alternative names
Chlorobenzene, MCB, phenyl chloride

Reference codes			
CAS number	108 90 7	Hazchem code	2Y
UN number	1134	EPA code	U037
Physical properties			
Molecular weight	113	Cubic expansion coeff (per °C × 10^3)	0.98
Empirical formula	$C_6H_5Cl_1$	Surface tension (@20°C dyn/cm)	33
Boiling point (°C)	132	Absolute viscosity (@25°C cP)	0.8
Freezing point (°C)	–46	Refractive index (25°C)	1.523
Specific gravity (20/4)	1.106		
Fire hazards			
Flash point (closed cup °C)	29	Lower explosive limit (ppm)	13000
Autoignition temperature (°C)	640	Upper explosive limit (ppm)	71000
Electrical conductivity	7E–11		
Health hazards			
IDLH (ppm)	2400	Vapour concentration @21°C ppm	12650
OES-TWA	50	Vapour density (relative to air)	3.9
OES-STEL		Vapour Pressure @21°C mmHg	9.5
Odour threshold (ppm)	1	POCP	
Aqueous effluent			
Solubility in water (25°C %w/w)		0.049	
Solubility of water in (25°C %w/w)		0.033	
Log_{10} activated carbon partition		4.9	
Log_{10} partition in octanol/water (w/w)		+2.84	
Biological oxygen demand w/w (days)		0.03 (5)	
Theoretical oxygen demand w/w		2.05	
Vapour pressure equation constants (Log_{10}, mmHg)			
Antoine equation	A	7.17294	
	B	1549.200	
	C	229.260	
Cox chart	A	7.18576	
	B	1558.4	
Solvent properties			
Solubility parameter	9.5	Kauri butanol value	90
Dipole (D)	1.3	Evaporation time (ether = 1)	10.0
Dielectric constant (20°C)	5.62	Evaporation time (BuAc = 1)	
Polarity (water 100)	18.8		
Thermal information			
Latent heat (cal/mol)	8814		
Nett heat of combustion (kcal/gmol)	754		
Specific heat (cal/mol/°C)	35		
Critical pressure (MN/m^2)	4.52		
Critical temperature (K)	632		
Latent heat of fusion (cal/mol)	2305		
Van der Waals' volume	3.81		
Van der Waals' surface area	2.84		
Molar volume	102.24		

Solute	Azeotrope X% w/w	Azeotrope °C	Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Hydrocarbons							
n-Pentane							
n-Hexane	None		10519	1.6	6a/529		
n-Heptane	None		10531	1.8	6b/119		
n-Octane	None		10536	2.2	1x/3/1175		
n-Nonane							
n-Decane				1.5	6b/392		
2,2,4-TMP							
Cyclohexane	None		10515	1.3	6a/202		
Benzene	None		10509	1.0	7/243		
Toluene	None		10524	1.0	7/416		
Ethylbenzene	None		10532	1.0	7/469		
Xylenes	None		10534	0.9	7/508		
C_9 Aromatics							
Tetralin							
Alcohols							
Methanol	None		2063	4.9	2a/204		
Ethanol	None		4070	4.2	2a/397		
n-Propanol	20	97	6489	3.0	2a/552		
i-Propanol	None		6273	3.4	2d/64		
n-Butanol	44	115	8133	2.5	2b175		
i-Butanol	37	107	8331	2.8	2d/357		
s-Butanol	None		8230	2.8	2b/258		
n-Amyl alc.	75	126	9747				
i-Amyl alc.	66	124	9819				
Cyclohexanol	None			2.6	2b/395		
1-Octanol							
Ethanediol	94	130	4233				
DEG							
1,2-Propanediol							
Glycol ethers							
PGME	None		9960				
EGME	53	119	6566	3.4	2d/120		
EEE	68	127	8423				
EGBE	None		10521			0.16	P3988
Chlorinated							
MDC							
Chloroform	None		1484	1.2	8/244		
Carbon tet.	None		1152	1.2	8/166		
1,2-EDC							
1,1,1-TCA							
TCE							
Perk.							
MCB	–		–	–	–	–	–

Chlorinated solvents

Solute	Azeotrope X% w/w	°C	Reference	Solute γ^{∞}	Reference	Partition coefficient	Reference
Ketones							
Acetone	None		5372	1.3	3+4/192	0.17	V2/477
MEK	None			1.3	3+4/283	0.08	V3/22
MIBK	None			1.1	3b/543		
Cyclohexanone	None		10512				
NMP							
Acetophenone							
Ethers							
Diethyl ether							
DIPE							
Dibutyl ether	None		10537				
MTBE							
1,4-Dioxane				0.9	1x/3/1175		
THF							
Esters							
Me acetate				1.2	5/374		
Et acetate	None		7578	1.4	5/492		
i-Propyl acetate							
n-Butyl acetate	None		10516				
Cellosolve acetate							
Miscellaneous							
DMF							
DMAc							
DMSO							
Sulfolane							
CS_2							
Acetic acid	41	115	3160			3.7	CEH
Aniline	None		10511	1.8	8/527		
Nitrobenzene	None		10508	1.1	1x/3/1175		
Morpholine							
Pyridine						0.08	V3/226
2-Nitropropane							
Acetonitrile	None		2794a	3.3	8/381	0.32	V2/176
Furfuraldehyde	None		8758			0.01	V4/255
Phenol	None		10510				
Water	72	90	484				