

Subject Index

- Abietadiene, 573
Ab initio calculations,
 on carbenes, 253, 256, 257,
 259, 262–265, 267–269
 on carboxylic acid derivatives,
 43, 58, 60, 63, 68, 78
 on 2+2-cycloadditions, 456
 on Diels–Alder reactions,
 467, 469
 on 1,3-dipolar cycloadditions,
 460
 on electrophilic additions,
 420, 421, 425, 430
 on electrophilic aromatic
 substitution, 287, 292,
 293
 on phosphorus-containing acid
 derivatives, 80
 on silylenes, 271
 on sulphur-containing acid
 derivatives, 97, 104
Acenaphthylene, 498
Acetals,
 acetylenic, 588
 benzaldehyde, 2, 3
 hemi-, 2
 rearrangement, 489
Acetamides,
 hydrolysis, 90
 trichloro-, rearrangement, 518
Acetanilide, halogenation, 288
Acetolysis, 413
Acetonitriles,
 phenyl-, 447
 trihalo-, cycloaddition, 463
Acetophenones,
 nitrobenzylidene-, 442
Acetylide ions, [1,2]-shifts in,
 377
N-Acetylimidazoles, 68, 69
Acid anhydrides, 49–54
Acid halides, 54–56
Acidity scales, 352
Acre equation, 342
Acridine, 504
Acrylates,
 cycloaddition, 467
 hydroxy-, 436
 polymerization, 137
Activation entropy, for
 elimination reactions, 391,
 394
Acylation, aromatic, 290, 291
Acyl azides, rearrangement, 579
Acyl halides, acylation by, 291
Acylhydroxamic acid
 derivatives, 517
Acylium ions, 302
Acylpyridinium salts, 66
N-Acylthioformamides,
 cycloaddition, 475
Adamantanecarboxylate anions,
 fragmentation, 414
2-Adamantyl azoxytosylate,
 solvolysis, 314
Adamantyl derivatives,
 nucleophilic substitution,
 338–341
Adamantylideneadamantane, 561
 bromonium ion, 423
Adamantyl tosylates, solvolysis,
 314
Addition–elimination
 mechanism, 323
Addition reactions,
 electrophilic, 419–435
 electronic effects, 421
 facial selectivity, 419, 420,
 432
 hyperconjugative effects,
 420, 421
 to alkenes, 419–430
 free-radical, 135–138
 nucleophilic, 435–450
 diastereofacial selectivity,
 439
 salt effects, 449
 to carbonyls, 16–23
 to imines, 6
 to nitrones, 6
 σ -Adducts, 279, 282–284
Adenines,
 aza-, 601
 rearrangement, 505
Adenylates, aminoacyl, 89
Adenylyladenosines, 91
Ad_N–*E* mechanism, 395
Ageing, role of radicals, 132
Alanine isopropyl esters, 444
Alcohols,
 dehydration, 298
 oxidation, 217, 219, 229
Aldehydes, alkylation, 370
Aldol condensation, 10–16
 Mukaiyama, 11, 12
 retro-, 10, 596, 599
Aldol–Tishchenko reaction, 355
Alkanes,
 chlorination, 134
 epoxy-, 567
 nitration, 382
 nitroso-, 228
Alkenes,
 alkylation by, 291
 aziridination, 427
 benzyl-, 293
 electrophilic addition,
 419–430
 epoxidation, 221
 halogenation, 134, 421–430
 isomerization, 297
 methoxyselenenylation, 428,
 429
 oxidation, 223, 234, 239
 polyfluorinated, 419
 protonation, 298
 terminal, hydroboration, 432,
 433
Alkenoic acids, conjugate
 addition of RLi, 368
Alkenyliodonium salts, 449
Alkenyloxysilanes, cyclization,
 127
Alkoxide ions, 437
Alkoxysilanes, 431
Alkylation,
 alternative mechanism, 290
 aromatic, 287, 290, 291
 promoters, 290
 selectivity, 291
Alkylbenzenes,
 bromination, 287
 formation, 290
 nitration, 287, 290
Alkyl halides,
 alkylation by, 291
 gas-phase reactions, 336, 337
3-(Alkylthio)-2-siloxyallyl
 cations, cycloaddition, 466

- Alkynes,
 chlorination, 134
 pyrolysis, 192
- Alkynyl aldehydes,
 hydroboration, 432
- Alkynyl cations, 306
- Alkynyl ketones, hydroboration,
 432
- Alkynyl(phenyl)iodonium
 triflates, cycloaddition, 460
- Allene oxide, rearrangement,
 589
- Allenes,
 dilithiated, 368
 heterocyclic, 539
 reactions with nitriles, 61
- Allenic esters,
 pyrolysis, 541
 retro-ene reactions, 541
- Allenylcyclopropanes, ring
 expansion, 535
- Allenylsilanes, ene reactions,
 543
- Alloxan, tautomerism, 599
- N*-Allylanilines, 513
- Allylation, 15, 16
 stereoselectivity, 141
- Allyl compounds, nucleophilic
 substitution, 324–326
- N*-Allylenamines, 513
- Allyl esters, pyrolysis, 498
- Allyl ethers, rearrangement, 513,
 526, 586
- Allyl halides, electrophilic
 addition, 434
- 3-*O*-Allyl-D-hexoses,
 cycloaddition, 461
- Allylic alcohols,
 fluorination, 383
 rearrangement, 514, 551
- Allylic amides, 518
- Allylic cations, 305, 306
- Allylic stannanes,
 rearrangement, 535, 544
- Allylic sulphones,
 4 + 3-cycloaddition, 478
- Allyl imidates, rearrangement,
 517
- Allyllithiums, cycloaddition, 465
- Allyl *N*-oxides, rearrangement,
 526
- Allyloxyindoles, rearrangement,
 514
- Allyloxysilanes, 127
- Allyl phosphites, rearrangement,
 565
- Allyl phosphonates, 565
- Allylsilanes, 136, 550
- Allyl silyl ethers, rearrangement,
 586
- Allylstannanes, 137
- Allylstyrenes, hydrosilylation,
 434
- Alpha effect, 37, 40, 335
- AM1 calculations, 441
- A2 mechanism, 435
- Amides, 58–60
 allylic, 518
 metal, 419
- Amidines, 3
 phosphorylated, 548
- Amine oxides,
 rearrangement, 504
 tertiary, 526
- Amines,
 aliphatic, reactions with
 nitrobenzenes, 277
 basicity, 440
 conjugate addition,
 high-pressure vs. thermal
 activation, 435
 crotyl-, 527
 cyclopropyl-, 537
 glycosyl-, 525
 nitro-, 298
 oxidation, 229, 231
 phenylethyl-, 441, 444
- Aminium salts, 473
- Amino acid enynol esters, 516
- Amino acids,
 addition to alkynes, 438
 oxidation, 223, 230
 polyhydroxylated, 516
 reactions, 133
 synthesis, 543
 γ,δ -unsaturated, 516
- α -Amino acids,
 α,α -disubstituted, 578, 579
N-tosylated, 51
- β -Amino acids, synthesis, 419
- Aminocyclopentanedimethanol
 triacetates, synthesis, 453
- Amino esters,
 enantioselective hydrolysis,
 78, 79
 rearrangement, 528
- Aminolactones, 602
- Aminolysis, 392, 393
- α -Aminonitriles, lithiated, 359,
 439
- Aminophenols, formation, 435
- Aminopyridines, formation, 435
- Amino sugars, 525
- α -Aminothiols, 444
- Aminotricyclodecadienones,
 halogenation, 425
- AM1 LUMO isosurface, 396
- Ammonium ylides,
 rearrangement, 528, 531
- Amphotericin B, 550
- Androstenes,
 derivatives, 574
 methoxy-, 433
- 5 β -Androst-3-enes,
 bromination, 433
 epoxidation, 433
 osmylation, 433
- Anilides, 58–60
- Anilines,
N-allyl-, 513
 chlorination, 288
 iodination, 289
 trifluoromethylation, 292
- Anion translocation, 366
- Anisoles,
 alkylation, 291
 ortholithiation, 366
- Anisotropy, of HOMOs, 420
- Annulenes,
 aromatic Heilbronner Möbius,
 310
 dianion salts, 354
 tautomerism, 603
- Anomeric effect, 1, 2, 139, 141
 quasi-, 141
- Anthracenes, acylation, 291
- Anthraquinone diimines,
 photolysis, 498
- Anthraquinones, nucleophilic
 substitution, vicarious, 362,
 363
- Anthroates, photocycloaddition,
 479
- Anthrone, 439, 440
- Antiaromaticity, 313
- Antibiotics, enediyne
 antitumour, 131
- Apionucleosides, 515
- Arbuzov rearrangement, 83
- Arene oxides, 236
- (Arene)ruthenium complexes,
 446
- Arenium ions, 307
- Arisugacin, 467
- Aromatic substitution, *ipso*, 496
- Arrhenius activation energy, 431
- Arrhenius parameters, 431
- Arsenic ylides, rearrangement,
 531
- Aryl cations, 306
- Aryldiazo phenyl sulphides,
 diazo coupling with
 2-naphthol, 292
- Arylidenes, rearrangement, 567
- Aryliodanes, 513
- Aryl nitrones, cycloaddition,
 460
- 1,2-Aryl shifts, 23
- N*-Arylsulphonimidoyl chlorides,
 reactions, 291

- Arynes,
 as intermediates, 285
 pyrolysis, 192
Asparagines, rearrangement, 579
Aspirin, oxidation, 231
Asymmetric induction, 356, 441
Atomic resonance absorption spectrometry (ARAS),
 bromine atom, 130
Atom-transfer reactions, 130
Azaadenine, tautomerism, 601
Azadienes, Diels–Alder reactions, 44
Azafulvenes, 69
Azaphosphiridine oxides, as intermediates, 593
Azetidine *N*-oxides,
 rearrangement, 526, 531
Azetidines, 7
 pyrolysis, 405
 rearrangement, 595
Azidation, 3
Azides,
 acyl, 579
 cycloaddition, 466
 photolysis, 258, 264, 268
 thermolysis, 268
Azido-1,2,3-triazolide ion,
 rearrangement, 364
Azines, cyclic, 524
Aziridination, 261, 427
 of styrenes, 478
Aziridines,
 formation, 528
 N-halogenation, 382
 nucleophilic substitution, 330
 rearrangement, 554, 592
Aziridinium imides, formation, 543
Aziridinium ions, 508
2*H*-Azirine-3-carboxylates,
 cycloaddition, 469
Azithromycins, synthesis, 579
Azole *N*-oxides, 501
Azoles, rearrangement, 548
Azomethine ylides, 7, 539, 588
 cycloaddition, 457
Azopyridines, reactions, 434, 435
Azulenes,
 diazaphospha-, 508
 synthesis, 524
 tetrahydro-, 582
*B*_{AC}2 mechanism, 38, 40, 68
Baeyer–Villiger oxidation, 240, 241, 581
Baeyer–Villiger rearrangement, 228, 241
Baker–Venkataraman rearrangement, 494
Baldwin's rules, 413, 439
Bamberger rearrangement, 496
Barbalone, 520
Barbiturate ions, reactions, 356
Barrelenes, Diels–Alder reactions, 475
Baylis–Hillman reaction, 14, 357, 358
Beckmann rearrangement, 293, 577
Bell–Evans–Polanyi principle, 157
Belusov–Zhabotinsky reaction, 219, 225
Benz[*a*]aceanthrylenes,
 cycloaddition, 469
Benzamides, *N,N*-dialkyl-, 288
Benzazepines, formation, 505, 531, 539
Benzene,
 alkylation, 290
 halogenation, 288
 non-Kekulé, negative ion, 355
 p-toluenesulphonylation, 293
 topomerization, 499
Benzenes,
 alkyl-, 287, 290
 methyl cation affinities, 287
 reactions with
 Baylis–Hillman adducts of *N*-tosylamines, 293
Benzenesulphinite anions, 449
Benzenesulphonamides, 102
[β -(Benzenesulphonyl)alkenyl]iodonium salts, 449
Benzenium ions, 307
Benzimidazoles, 2-mercapto-, 106
Benzo[*b,f*]azocin-12-ones,
 rearrangement, 508
Benzobicyclooctadiene,
 bromination, 425
Benzodiazocines, 511
Benzofurans, Diels–Alder reactions, 477
Benzohydroxamic acids,
 rearrangement, 580
Benzoin condensation, 377
Benzonitrile oxides,
 cycloaddition, 461
Benzonitriles, reactions with allene, 61
Benzooxazocines, 511
Benzopyrans, formation, 565
Benzoquinone monoketals,
 cycloaddition, 521
Benzothiazines, 101
 formation, 291
Benzothiazocines, 511
Benzothiazole-2-thiol, 107, 108
Benzothionines, formation, 530
Benzothiophenes, 444
Benzo[*c*]thiophenespirothiadiazoles, synthesis, 457
Benzo[*b*]thiophene sulphoxides, 444
O-Benzoylhydroxamic acid, 123
Benzvalene, 499
Benzylalkenes, formation, 293
Benzylates, ammonium, rearrangement, 529
Benzyl cations, 298–300
 calculations, 299
 hardness, maximum, 299
 ion-pairs with benzoate, 299
 α -methoxy- α -methyl-, 299
 α -methyl-, 298
 steric effects, 299
 α -thioamide-substituted, 304
O-Benzylhydroxylamine, 438
Benzylideneacetone, 447
4-Benzylidene-3-oxo[1,3]oxathiolan-5-ones,
 cycloaddition, 475
Benzyloxazolidinones, 441
Benzynes, cycloaddition, 455
Benzynes intermediates, 285
Benzynes, rearrangement, 267
Bergman cyclization, 195
Bergman rearrangement, 539
Bicyclo[3.3.2]decan-9-one,
 rearrangement, 578
Bicyclo[3.1.1]heptanes,
 rearrangement, 550
Bicyclo[4.1.0]heptanes,
 isomerization, 535
Bicyclo[4.1.0]hept-3-enes,
 rearrangement, 588
Bicycloheptenones,
 rearrangement, 533
Bicyclo[4.3.0]non-1(9)-enes,
 formation, 535
Bicyclo[2.2.1]norbornadienes,
 561
Bicyclo[2.2.2]octadienes, 561
Bicyclo[3.2.1]octa-2,6-dienes,
 561
Bicyclo[2.2.2]octanes, 592
 synthesis, 572
Bicyclo[3.2.1]octanes, 561
 synthesis, 526
Bicyclo[3.3.0]octan-2-ones,
 reactions, 357
Bicyclo[4.2.0]octan-7-ones, 456
Bicyclo[3.2.1]octenes, 559
Bicyclo[4.2.0]octenes, 559

- Bicyclo[2.2.2]oct-5-en-2-*exo*-ols, 524
- Bicyclo[3.2.1]oct-6-en-2-ols, rearrangement, 535
- Bicyclo[2.2.2]oct-5-en-2-ones, 533
- Bicyclo[3.2.1]octenones, formation, 478
- Bicyclo[3.3.0]oct-2-en-4-ones, formation, 535
- Bicyclo[9.3.1]pentadecatrienes, 571
- Bicyclo[3.3.3]undecanes, synthesis, 578
- Bicyclo[5.5]undec-2-en-4-ones, 597
- Biradicals, 186–191
- Bisalkynones, cycloaddition, 470
- 1, ω -Bis(2-bromopyridinium) alkanes, 449
- Bisketenes, 4
bromination, 426, 427
- Bismuthonium ylides, 545
- Bisoxazoline complexes, 438
- 1, ω -Bis(2-pyridone)alkanes, 449
- Bi(thiadiazole)s, formation, 453
- Boron enolates, 11
- Boronic esters, rearrangement, 581
- Boulton–Katritzky rearrangement, 504
- Briggs–Raucher reaction, 219
- Bromination, 421–427, 433
- Bromination–debromination, 428
- 9-(α -Bromo- α -aryl)methylene) fluorenes, 446
- Bromocyclization, 423
- 2-(Bromomethyl)-but-2-enoates, 442
- Bromonium ions, 411
bioactive, 303
- Bromo ylides, 47
- Brønsted equation, for:
deprotonation, 374, 375
E1cB reaction, 389
elimination reactions, 391, 393, 394, 397
Michael addition, 359
- Brønsted plots, 23, 25, 440
biphasic, 391
- Brønsted α -values, 356
- Brook rearrangement, 259, 364, 522, 549
retro-, 550
- Butadienes,
4 + 4-cycloaddition, 479
diaryl-, 453
hydroxy-2-sulphinyl-, 469
methoxycarbonyl-, 468
rearrangement, 379
 α -silylallyl, 366
stability and structure, 349–355
 α -sulphonyl, 361, 362
- Carbapenems, 596
- Carbaporphyrin, tautomerism, 602
- Carbazoles, rearrangement, 493
- Carbenes,
adamantylchloro, 567
addition reactions, 262, 263, 419
alkene complexes, 254
alkylacetoxo, 566
alkylaryl, 254
alkylchloro, 566
alkylidene, 260
asymmetric reactions, 253, 261
benzylchloro, 254, 566
t-butylphenylmethylene, 255
carbonyl, 253, 254
conformation, 253
cycloalkyl, 566
cyclopentadienylidene, 267, 499
dialkoxo, 257, 269
dihalo, 253, 261
dimethyl, 264, 566
distonic, 256
from diazirines, 253
2-furylchloro, 255
generation, 259–262
imidazolylidene, 257
in decarboxylation, 77
insertion reactions, 253–255, 260, 263, 264
ketenyl, 253
matrix-isolated, 253, 255, 256, 258, 264
MO calculations, 253, 256, 257, 259, 262–265, 267–269
naphthyl, 255
nucleophilic, 258, 259, 267
phenylchloro, 263
protonation, 256
rearrangement, 264–268, 566
1,2-acyl shift, 265
1,2-C shift, 262, 266, 267
1,2-F shift, 264
1,2-H shift, 253, 264, 265
1,2-Si shift, 267
samarium, 529
sulphenyl, 261
sulphonyl, 260
p-tolyl(trifluoromethyl), 254
- Buta-2,3-dienoates,
cycloaddition, 461
- Butadienylketenes, 535
- C₆₀, cycloaddition, 455
- C₇₀, cycloaddition, 455
- Caffeine, 75
- Calix(*n*)arene esters,
rearrangement, 493, 494
- Calix[4]arenes, 52
- (Camphorsulphonyl)oxaziridines, 546
- Camphorsultams, 441
- Canonical flexible transition-state theory, 129
- Carbacephams, 596
- Carbamates, 56, 64
dithio-, 106
reactions, 365, 366
- Carbamic acids, protonated, 303
- Carbamoylchlorodicyanomethane, cycloaddition, 463
- Carbanions,
acetylide, 551
alkyl benzyl ether, 545
 α -allyloxy, 526
 α -amino, 363
benzotriazole-stabilized, 376, 419
benzyl, 352
cycloalkenyl, 349
cycloalkyl, 349
cyclooctatetraenyl, 350, 351
cyclopentadienide, 349, 350, 369
dianions, 369
annulene, 354
tribenzylidenemethane, 354
Y-shaped, 354, 363, 364
ethenyl, 379
fulminate, 551
gas-phase acidities, 349
heteroatom-stabilized, 363–366
hexadienediyl, 552
homoallylic, 368
in decarboxylation, 77
ionization potentials, 349
lithiated, 352–354, 366–370
malonate, 597
MO calculations, 349–352
7-norbonyl, 351
organometallic, 366–373
oxaziriny, 551
reactions, 355–381
proton-transfer, 373–376
with methyl nitrate, 381
with nitroarenes, 279, 360, 361

- vinylidene, 267
X-ray structure, 257, 258
- Carbenium ions, 288
alkynyl, 306
heteroatom-stabilized, 302
- Carbenium ion salts, 300
- Carbinols, divinyl-, 522
- Carbocations, 297–318, 421
adamantyl, 313–315
addition to nitriles, 303
allylic, 305, 306, 555
aromatic, 309, 310
azaallenium, 303
1-azabicyclo[1.1.0]butyl, 315
azulenium, 553
bicyclic, 315–318
2-bromobutane, 303
butyl, 298
 α -CF₃ group in, 303
cyclic, 310–312
cyclopentadienyl, 310
cyclopropylmethyl, 311, 554
dehydrobenzoyl, 306
destabilized, 303–305
dicoordinated, 306
dihydrobenzofuranyl, 565
fenchyl, 560
fluorenyl, 557
formamidylmethyl, 304
fullerene, 306
3-halobicyclo[1.1.1]pent-1-yl, 315
heteroatom-containing, 302, 303
homoallylic, 391, 554
interactions with anions, 297
isobutonium, 553
norbornyl, 559
oxacarbenium, 555
phenonium, 487
propargyl, 513
2-propyl, 298
pyrenyl, 301
silicon-containing, 302
 β -silyl, 563
simple, 298
spirocyclobutane-substituted, 317, 318
stabilization by sulphur bridging, 305
stabilized, 297
 α -sulphur in, 305
thioformamidylmethyl, 304
tin-containing, 302
triarylvinyl, 487
trichlorocyclopropyl, 309
tris(naphthyl), 300
xanthylum, 300
- Carbocations,
bis(dithia), 567
hexathia, 569
- Carbodiimides, hydration, 5
- Carbohydrate nitroalkenes,
chiral, cycloaddition, 460
- β -Carbolines, synthesis, 471
- Carbon acids, ionization, solvent effects, 376
- Carbonates,
cyclization, 43
dithio-, 106
- Carbocation ions, rearrangement, of protonated, 298
- Carbonylation, free-radical, 137
- Carbonyl compounds,
addition reactions, 16–23
aldol reactions, 10–15
allylation, 15, 16
enolization, 23–26
hydration, 18
redox reactions, 26–28
- Carbonyl oxide, as ozonolysis intermediate, 231, 232
- Carbonyl S-oxides,
cycloaddition, 475
- Carboxamides, rearrangement, 505
- Carboxylic acid derivatives,
catalysed reactions,
association-prefaced, 72–76
enzymic, 77–79
in aprotic solvents, 70
in hydroxylic solvents, 37–70
intermolecular, 37–70
intramolecular, 71, 72
metal ion promoted, 76
- Carotenoids, epoxy-, 590
- Caryophyllene, 572
- Catalysis,
acidic borosilicate, in Beckmann rearrangement, 577
alkali-metal *t*-butoxide cluster, in transesterification, 37, 38
aluminium halide, 293
in cycloaddition, 453
antibodies, in oxy-Cope rearrangement, 522
antimony pentafluoride, 293
association-prefaced, 72–76
bifunctional, 277
boron halide, in cycloaddition, 453
by encapsulation, 476
cerium(III), in oxidation, 219
cerium(IV), 79, 80
chromium(0), in 6 + 4-cycloaddition–pinacol rearrangement, 557
chromium(III), in oxidation, 217
cobalt(III), 79, 91
copper(I), in photocycloaddition of dienes, 558
copper(II), 89
in glyoxylate–ene reaction, 540
 β -cyclodextrin, 75, 110
cyclodextrins, in Smiles rearrangement, 494
Deloxan, in alkylation, 291
enzymic,
by β -lactamase, 78
by peroxidases, 168
by phosphatases, 88
by tyrosinase, 229
by tyrosine hydroxylase, 242
energetics, 78
in phosphoryl transfer, 87
in reactions of carboxylic acid derivatives, 77–79
gallium halide, in cycloaddition, 453
general base, in nitrosation, 382
hafnium triflate, in nitration, 289
hydroperoxide, 143
hydroxoqua copper complex, 80
indium, 11, 15
intermolecular, 37–70
intramolecular, 71, 72
iodine, in aziridination, 427
iron(III), in dimerization of cycloalkenone-2-carboxylates, 599
lanthanides, 12, 23
Lewis acid, in:
Diels–Alder reactions, 468, 473, 475
Michael reactions, 441
magnesium(II) complex, in Diels–Alder reactions, 473
manganese(II), in oxidation, 219
manganese(III) porphyrin, in aziridination, 478
mercury(II), in rearrangements, 555

- Catalysis, (*continued*)
 metallophthalocyanine, in
 oxidation, 225
 metallotetraphenylporphyrin,
 in oxidation, 225
 micellar, in:
 Diels–Alder reactions, 476
 1,3-dipolar cycloadditions,
 461
 reactions of
 phosphorus-containing
 acid derivatives, 80, 81
 montmorillonite, in
 rearrangement of phenyl
 ethers, 491
 nitrous acid, in nitration,
 289
 nucleophilic, in alcoholysis of
 phosphoramidates, 83
 nucleoside, 40, 41
 osmium(VIII), in oxidation,
 228
 palladium(0), 280
 palladium(II), in:
 aza-Claisen rearrangement,
 517
 Cope rearrangement,
 521
 palladium(IV), in Heck
 reaction, 433, 434
 palladium, in:
 amination, 280
 hydrosilylation, 434
 nucleophilic aliphatic
 substitution, 325
 phase-transfer, in:
 hydroxymethylation,
 291
 nucleophilic aliphatic
 substitution, 341,
 342
 nucleophilic aromatic
 substitution, 280
 phosphate, 42, 43
 phosphinite, 442, 443
 polarity reversal, 132, 136,
 141
 polymer, in ester solvolysis,
 74
 recombinant cyclase, in
 rearrangement of copalyl
 diphosphate, 573
 rhenium, in nucleophilic
 aliphatic substitution,
 331, 332
 rhodium(I), in ring expansion
 of allenylcyclopropanes,
 535
 rhodium(II), 521
 rhodium, in cycloaddition,
 473
 ruthenium(III),
 in oxidation, 226
 in oxidative decarboxyla-
 tion, 76, 77
 ruthenium, in:
 ene reactions, 540
 rearrangements, 534
 samarium iodide, 128
 silver(I), in oxidation, 222
 silver ion, in rearrangements,
 489, 565
 sodium benzoate, 439
 sulphite, 276
 tetracyanoethylene, in ester
 hydrolysis, 38
 thiol, 136, 139
 in radical-chain cyclization,
 127
 tin(IV) chloride, in
 [3,3]-sigmatropic
 rearrangements, 513
 titanium, in ene reactions, 540
 titanium tetrachloride, in
 Diels–Alder reactions,
 473
p-toluenesulphonic acid, in
 alkylation, 291
 zeolites,
 in Beckmann
 rearrangement, 578
 in Claisen rearrangement,
 512
 in Fries rearrangement, 493
 zinc(II), 72, 89
 zinc bromide, in bromination,
 288
 zirconium,
 in nitration, 289
 in rearrangements, 570
 Cephalosporin sulphones, 596
 CFC alternatives, 132
 Chalcogenides, rearrangement,
 586
 Chalcones, formation, 412
 Chaperon effect, 289
 Charge–dipole repulsion, 238
 Cheletropic extrusion, of SO₂,
 445
 Chemical vapour disposition,
 119
 Chemiluminescence, 54
 Chiral auxiliaries, 368, 441
 in Diels–Alder reactions, 468,
 469
 phenylethylamine, 535
 prolinol, 526
 Chiral ligands, 419
 Chiral mediators, 419
N-Chloramines, 245
 Chloramine-T, 427
 Chlorination, 421
 Chloroalkanoic acids,
 elimination reactions, 406
 Chloroformates, 56
N-Chloro-3-methyl-2,6-
 diphenylpiperidin-4-one, as
 chlorinating agent, 288
 Chloronium ions, 313
 Chloropectin L, 577
 Chlorophenoxypropargyls, 449
 α -Chlorothioamides, benzylic,
 solvolysis, 304
 Cieplak effect, 245
 Cinnamaldehyde, 1,2-additions,
 447
 Circumambulation, 379
 Civet cat, 436
 Claisen rearrangement, 291,
 511–519
 aza-, 517
 catalysis, 512, 513, 517
 thio-, 518
 Clovanes, 571
 Complestatin, 577
 Complexes,
 arene–chromium, 280
 chromium(0), 525
 copper(II)–bis(oxazoline), 473
 C₂ symmetric, 473
 in 2+2-cycloadditions, 453
 ion–neutral, 290
 molecular, 476
 rhodium(II), 280
 π -Complexes,
 in electrophilic aromatic
 substitution, 287, 288
 in hydroboration, 432
 σ -Complexes, in electrophilic
 aromatic substitution, 287,
 288, 291
 Copalyl diphosphate, 573
 Cope rearrangement, 244,
 519–525
 aza-, 525
 catalysis, 521, 522
 hetero-, 522
 oxy-, 522
 anionic, 524
 silyloxy-, 524
 Copolymerization, 166
 Coumaranones, 48
 Coumarins, 505
 hydroxy-, 438
 rearrangement, 552
 synthesis, 494
 Criegee intermediates, 231, 232,
 238
 Criegee rearrangement, 241, 581

- Crotylamines, rearrangement, 527
- Cubanes, tetraphospha-, 351
- Cumene hydroperoxide, 239
- Curtius rearrangement, 579
- Cyanohydrins, rearrangement, 545
- Cyanomethanes, proton transfer from, 376
- Cyanomethylenecyclopropane, cycloaddition, 463
- Cyclic voltammetry, 245
- Cyclization, bromo-, 423
endo, 124, 127, 128
exo, 123–126, 138, 143
free-radical, 122–128
of alkenylglycosides, 423
of epoxides, 432
spiro-, 126
thermo-, 195
transannular, 128, 430
vinylous, 208
- Cycloaddition–elimination reactions, 459
- Cycloaddition reactions, 1,2, 453
1,3, 453
1,4, 453
2 + 2, 453–457
 asymmetric, 456
 2 + 2 + 1, intramolecular, 478
 2 + 3, 457–466
 2 + 4, 453, 466–478
 3 + 2, 453, 457, 460, 464–466
 4 + 2, 65, 453, 467, 469, 470, 472, 474, 475, 524, 539, 543, 566
 4 + 2 + 2, 478
 4 + 3, 478
 4 + 4, 479, 539
 4 + 6, 453
 5 + 2, 479, 480
 6 + 4, 453, 557
 8 + 2, 453
 $[\pi^4 + \pi^2]$, 475
 asynchronous, 456
 classification, 466
 1,3-dipolar, 457, 458, 460, 461, 463–465
 inter-[4 + 2]/intra-[3 + 2], 453
 intramolecular, 453, 455, 456
 non-stereospecific, 457
 photochemical, 453, 460, 479
- Cycloalkane-1,3-diones, alkylation, 356
- Cycloalkanes, oxasila-, 563
- Cyclobutanediones, rearrangement, 537
- Cyclobutanes, cycloversion, 402
1,3-disila-, 457
sila-, 431
- Cyclobutenes, ring opening, 402
- Cyclobutylmethanols, rearrangement, 559
- β -Cyclodextrins, 245
- Cyclofenchones, 560
- Cycloheptadienes, formation, 588
- Cycloheptanones, nucleophilic additions to, 368
- Cyclohexadienones, as intermediates, 291
- Cyclohexenes, alkylation by, 291
bromination, 422
- Cyclohexyltoluenes, 291
- Cyclononatetraenes, 534
- Cyclooctatetraene, anions from, 350, 351
- Cyclopentadienes, 4 + 3-cycloaddition, 478
Diels–Alder reactions, 469, 477
- Cyclopenta[*l*]phenanthrene, dimerization, 468
- Cyclopent[*a*]indene, 498
- Cyclophanes, bromination, 287
- Cyclopropanation, 261, 262, 381
asymmetric, 446
tandem with Cope rearrangement, 522
- Cyclopropanecarboxylates, 85
reactions, 36
- Cyclopropanes, allenyl-, 535
cyanomethylene-, 463
formation, 380
nucleophilic substitution, 330
photolysis, 262
polymerization, 310, 381
vinyl-, 479
- Cyclopropanones, as intermediates, 363
ring opening, 536
- Cyclopropenes, ring opening, 588
- Cyclopropenones, formation, 4
- Cyclopropylamines, rearrangement, 537
- Cyclopropyllithiums, 368
- 1-Cyclopropylvinyl cations, 306
- Cycloreversion reactions, 402
4 + 2, 500
- Dakin–West reaction, 57
- Dane's diene, 475
- Dansyl chloride, 438
- Darzens reaction, aza-, 356
- Debromination, 411
- Decarboxylation, 76, 77
- Decarboxylative cleavage, of β -lactones, 44, 45
- Deiazonation, 275
- Dehydrogenases, 244
- Denitrosation, 64, 65, 102
- Density functional theory, 422, 430, 453, 457, 461, 474–476
- Deoxyadenosines, 507
- Deoxybenzoin, 545
- Deoxyinosines, 507
- Desilylation, 570
fluoride ion-induced, 530
- Dewar–Becker mechanism, 178
- N,N*-Dialkylbenzamides, halogenation, 288
- Diaryleureas, formation, 580
- 1,3-Diaza-2-azoniaallene salts, cycloaddition, 461
- Diazaphosphaazulenes, 508
- Diazaphosphinines, 508
- Diazaphospholidines, 510, 511
- Diazenes, nitroso-, 6
- Diazepindiones, rearrangement, 508
- Diazepine salts, 311
- Diazetidines, as intermediates, 511
- Diazirines, carbenes from, 253
photolysis, 254, 255, 260, 263–265, 269
- Diazoacetates, cycloaddition, 460
vinyl-, 521
- Diazoacetyl compounds, 531
rearrangement, 565
- Diazo compounds, photolysis, 254, 263, 270
- Diazo coupling, 292
- Diazodiphenylmethane, 50
- Diazoimides, 65
- Diazonium salts, 6
dediazonation, 275
reactions with hydride adducts, 284
- vic*-Dibromides, debromination, 411
- Dications, benzylic, 312
difluorenyl, 313
from benzoanthracene, 313
from nitropyrene, 313
S–S, 429
- 2,3-Dicyano-*p*-benzoquinone, cycloaddition, 475

- Dicyanovinyl acrylates, cycloaddition, 467
- Dicyclohexylborane, in hydroboration, 432
- Diels–Alder reactions, 44, 173, 181, 260, 441, 466–478, 544
- asymmetric, 469, 473, 475, 476
- aza-, 469
- catalysis, by encapsulation, 476 by Lewis acids, 468, 473, 475 by Mg(II) complexes, 473 by transition metal compounds, 473 micellar, 476 cation radical, 473 chiral reagents in, 470 enantioselective, 475 hetero-, 469, 475–477 high-pressure, 476, 477 intramolecular, 470, 476 inverse electron demand, 471, 472 kinetics, 467, 472 of barrelene, 475 of benzofurans, 477 of benzoquinone monoketals, 521 of bicyclic systems, 315 of butadienes, 469, 472 of cyclohexa-1,3-diene, 467 of cyclopentadienes, 469, 477 of electron-deficient alkenes, 473 of fullerenes, 468 of furandienes, 500 of hexafluorobutyne, 478 of imines, 469 of methacrolein, 473 of 2-pyridones, 469 of triazolinedione, 476 of trienes, 473 retro-, 266, 402, 467 reverse, 477 solvent effects, 476, 477 stereochemistry, 477 stereofacial selectivity, 469, 470 tandem, with sigmatropic rearrangements, 478, 525 valence-bond description, 466 Dienoic esters, 514 Dienones, nitro-, 289 Dienyl cations, 306 Dihalomalononitriles, cycloaddition, 463 3,4-Dihydro- β -carboline 2-oxide, cycloaddition, 465 1,4-Dihydro-1,4-ethanonaphthalenes, bromination, 424, 425 Dihydroisoxazoles, synthesis, 460 Dihydronaphthalenes, solvolysis, 401 Dihydrooxepins, 522 Dihydropentalenes, rearrangement, 535 1,2-Dihydropyridines, rearrangement, 290 Dihydropyridinium salts, synthesis, 461 Dihydrothiazines, rearrangement, 507 Diketene, reactions with nitrones, 505 Dimroth rearrangement, 505 4,6-Dinitrobenzofuroxan, 284, 292 Dinitrogen pentoxide, nitration by, 289, 290 Dinucleoside monophosphates, 93 Diols, oxidation, 231 1,2-Diols, 3, 11, 27 1,3-Diols, 13 Dioxetanes, 236 Dioxiranes, as oxidizing agents, 233–236, 238 Dioxopiperazines, 65, 66 Dioxygen, 244 1,4-Diphenylbuta-1,3-diene, cycloaddition, 453 Diphenylketene, cycloaddition, 453 Diphenylphosphinic acids, 84 Diradicals, 1,4-aryl, 131 in Cope rearrangement, 519 in ring-opening rearrangements, 588 in [5,5]-sigmatropic rearrangements, 536 in sulphenate–sulphoxide rearrangements, 531 in vinylcyclopropane rearrangements, 535 1,3-Disilacyclobutane, synthesis, 457 Disilanes, thermolysis, 271 Disproportionation, 246 1,4-Dithiane 1-oxide, 429 Dithiazadithiafulvalenes, 165 Dithiazolothiazines, formation, 453 Dithiins, synthesis, 535 Dithiocarbamates, 106 Dithiocarbonates, 106 Divinylcarbinols, 522 DNA cleavage, oxidative, 145 radical-induced strand, 132 Domino reactions, 61, 65 Dötz benzannulation, 481 Dötz reaction, 263 *E1cB*–*E2* borderline, 389 *E1cB* mechanism, 40, 42, 82, 96, 100, 361 Electron affinities, for radical carbanion precursors, 350 Electron spin resonance spectroscopy, 130, 134, 136, 145, 255 of peroxy radicals, 118 Electron transfer, 172–177 in nucleophilic aliphatic substitution, 338 of carbanions, 357 photo-induced, 172–174 single, 16 Electrophilic addition, 419–435 Electrophilic aliphatic substitution, 382, 383 Electrophilic aromatic substitution, 287–294 acylation, 290, 291 alkylation, 287, 290, 291 deuteration, 287 diazo coupling, 292 gas-phase reactions, 287, 290 halogenation, 287–289 hydrogen exchange, 292 hydroxymethylation, 291 MO calculations, 287, 292, 293 nitration, 287, 289, 290 of aromatic amines, 288, 289 of aromatic hydrocarbons, 287, 288, 290–293 of heteroaromatics, 288, 290 of indoles, 293 of phenols, 291 protonation, 292 radiolytic, 287, 292 trifluoromethylation, 292 vinylation, 291 with 4,6-dinitrobenzofuroxan, 292 Electrophilicity, at silicon, 431 Electrostatic acceleration, 449 Electrostatic field effects, 238 Electrostatic models, 421 Electrostatic potential fields, 420 Elemanolides, 521

- Elimination–addition mechanism, 369
- Elimination reactions, 389–415
- 1,4, 397
 - catalysed by biomolecules, 406, 407
 - dehydration, 403
 - dehydrohalogenation, 391
 - E1cB* mechanism, 389–395
 - E2* mechanism, 395–399
 - in synthesis, 407–412
 - isotope effects, 389, 391, 393, 408
 - MO calculations, 396, 398, 403, 407
 - nitrile-forming, 397
 - of chloroalkanoic acids, 406
 - of lactones, 403
 - of oximes, 397
 - of sulphonyl halides, 391
 - of β -sultams, 414
 - of triazine derivatives, 403, 404
 - of trihaloethane derivatives, 389
 - of vinylidonium salts, 396
 - pyrolytic, 402–406
 - solvolytic, 399–401
 - steric effects, 391
 - strain effects, 395
 - syn*-, 391
- Enamines, 24
- chiral, 441
 - tautomers, 9
- Enantioselectivity, of
- asymmetric Michael addition, 438
- Enediynes, 368
- rearrangement, 539
 - synthesis, 555
- cis*-Enediynes, formation, 305
- Ene reactions, 14, 15, 540–544
- aza-, 543
 - imino-, 543
 - oxo-, 541
 - phospha-, 544
 - retro-, 541
 - zinc-, 544
- Enolates, 26
- asymmetric protonation, 376
 - boron, 11
 - reactions, 355–363
 - alkylation, 356
 - nitrosation, 357
- Enol esters, formation, 490
- Enol ethers, silyl, 549
- Enol lactones, 46, 47
- α -Enones, cyclic, 1,4-additions, 447
- Entropy of activation, for elimination reactions, 414
- Epihalonium ions, 420
- Episulphidation, 239
- Episulphonium ions, 577
- Epoxidation, 233, 234, 419, 433
- by dioxiranes, 233, 234
 - by oxone, 236, 237
 - of alkenes, 221, 239
- Epoxides,
- formation, 358, 359
 - ring opening, 327, 328, 396, 507
 - steroidal, 574
 - 5,6-unsaturated, cyclization, 432
- Epoxy alcohols, rearrangement, 555
- Epoxyalkanes, rearrangement, 567
- Epoxycaranes, rearrangement, 570
- Epoxy-carotenoids, rearrangement, 590
- Epoxyisocyanides, 62
- Epoxy silyl ethers, rearrangement, 579, 590
- Epoxysqualenes, cyclization, 432
- EPR spectroscopy, 127, 133, 136, 137, 144, 254
- Equilibrium constants, for reactions with thiolate and alkoxide ions, 437
- E1* reactions, 399
- E2* reactions, 337
- Erythrodiene, 513, 544
- Eschenmoser–Claisen rearrangement, 514
- Esters,
- allenic, 541
 - allyl, 498
 - amino, 528
 - aminolysis, 40, 41
 - boronic, 581
 - dienoic, 514
 - formation, 37
 - glycine, 528
 - hydrolysis, 38–42
 - imino, 543, 546
 - phenylthiomethyl, 530
 - squarate, 537
 - thiocarbamic, 519
 - transesterification, 37, 38
- Ethers,
- alkyl phenyl, 491
 - allyl, 513, 526, 586
 - benzyl, 526
 - α -chlorobenzyl alkyl, ionization, 299
 - dicyclopentadienyl, 514
 - epoxy, 525, 579, 590
 - halocyclohexenylmethyl, 491
 - imino, 546
 - propargylic, 526
 - rearrangement, 491, 513, 525, 526, 546, 579, 586, 590
 - silyl, 579, 586, 590
 - desilylation, 570
 - vinyl, 513, 514
 - deprotonation, 375
- 4-Ethoxy-2*H*-oxetes, 456
- Ethyl cations, as Brønsted acids, 298
- elimination of hydrogen from, 298
- Ethyne, vinylation by, 291
- E2*-type mechanism, 99
- Excess acidity method, 317, 435
- Exocyclic effect, 143
- Favorskii rearrangement, 29, 549
- Fenchyl alcohols, rearrangement, 317, 560
- Fenton's reagent, 167, 241
- Ferricenium ion, 143
- Fischer carbene complexes, alkynyl, cycloaddition, 463
- Flame-suppression chemistry, 134
- Fluoranthene, 499
- Fluorene *S*-oxide, cycloaddition, 460
- Fluorene anion, 359
- Fluorenyl cations, 300
- Fluorescein, 438
- 4-Fluorophenol, nitration, 289
- Force-field energies, calculated, 432
- Formaldehyde, hydroxymethylation by, 291
- oxidation, 229, 230
- Formaldehyde *N*-benzyl nitron, cycloaddition, 463
- Formates, halo-, 56
- Formic acid, oxidation, 219, 231
- N*-Formylnorephedrine, 446
- Forrester–Hepburn mechanism, 164
- Fourier transform ion cyclotron resonance (FT-ICR) spectrometry, 44
- Friedel–Crafts reaction, 298, 307
- Fries rearrangement, 493
- photo-, 200, 493, 534
- Frontier orbitals, 420
- FTIR spectroscopy, 476
- Fullerenes, cycloaddition, 468
- tautomerism, 603

- Fulvalenes, dithiazadithia-, 165
 Fulvenes,
 aza-, 69
 hydroxy-, 561
 Fumarates, 2-phenylseleno-, 48
 Fumaryl dibromides, formation, 426
 Furanienes, 500
 Furanones,
 naphtho-, 537
 photocycloaddition, 457
 Furans,
 alkylation, 287
 benzo-, 477
 tetrahydro-, 461, 463
 trimethylsilyloxy-, 441
 Furopyridines, electrophilic aromatic substitution, 288
 Furoxans, 284, 292, 504
- Galanthamine, 577
 Germacranolides, 521
 Germyl cations, 302
 (+)-Gibberellic acid, 456
 Gibbs reaction, 176
 Gif system, 225
 Glucals, rearrangement, 555
 Glycals,
 rearrangement, 576
 synthesis, 551
 Glycine esters, 528
 Glycosidases, 3
S-Glycoside dioxides, 551
 Glycosides, reactions, 3, 4
 Glycosylamines, rearrangement, 525
 Glycosylation, 480
 Goniodiol, synthesis, 555
 Grignard reagents, 20
 asymmetric addition of, 370
 in nucleophilic aliphatic substitution, 331
 reactions, with:
 nitrones, 371
 orthoesters, 371
 Grunwald–Winstein equation, 55, 96, 339–342
 Guanidines, nitrosation, 382
 Guanine, 601
- Halobenzenes,
 alkylation, 287
 halogenation, 288
 Halobullvalenes, 520
 Haloetherification, 3
 Haloethylenes, reactions, 135, 136
 Halogen abstraction, 133, 134
 Halogenation, 383, 421–428
 aromatic, 288, 289
 free-radical, 134, 135
 Halogen extrusion, 449
 Halolactonization, 21
 Halopentadienals,
 rearrangement, 597
 Halophilic reactions, 381
N-Halosuccinimides, as
 halogenating agents, 425
 Hammett correlations, 498
 Hammett ρ - σ relationship, for:
 dehydrochlorination, 361
 elimination reactions, 391, 392, 397
 nucleophilic aliphatic substitution, 337, 340, 342, 343
 nucleophilic aromatic substitution, 278
 proton-transfer reactions, 373
 Hammett ρ values, 431, 447
 Haptens, 406
 Harringtonolide, 561
 Hartree–Fock calculations, 61
 Hartree–Fock/density-functional theory, 154
 H–D exchange, aryl, 284
 Heck reaction, 433, 434
 Heptapeptides, 87
 Heterocyclic derivatives,
 rearrangement, 499–511
 Hexa-1,5-dienes, rearrangement, 519
 Hexa-1,2-dien-5-yne,
 rearrangement, 519
 Hexa-1,5-diyne, rearrangement, 519
 Hexa-1-en-5-yne, rearrangement, 520
 Hexafluorobut-2-yne,
 Diels–Alder reactions, 478
 Hexa-1,2,4,5-tetraene,
 rearrangement, 520
 Hexa-1,2,5-triene,
 rearrangement, 519
 Hexatrienes, formation, 529
 Hexylamines, reactions, 277
 HFCs, reactions with hydroxyl radicals, 146
 Histidine, oxidation, 167
 Hofmann rearrangement, 579
 Homoallylic alcohols, 551
 Homoallyloxysilanes, 127
 Homoconjugation, 277
 Homodrin, rearrangement, 561
 β -Homothreonines, 437, 438
 Horner–Wadsworth–Emmons reaction, 15, 365
 MO calculations, 407
 HSAB principle, 396
 Hydrazoaromatics,
 rearrangement, 498
 Hydride adducts, 284
 Hydride shifts,
 1,2, 491
 1,4, 562
 1,6, 555
 Hydrindanes, 559
 Hydroacylation, 136, 419
 Hydroboration, 419, 432, 433
 Hydrocyanation, 591
 Hydrodediazonization, 138
 Hydrogen abstraction, 130
 by carbon-centred radicals, 130, 131
 by heteroatom-centred radicals, 131–133
 by peroxy radicals, 145
 Hydrogenation, transfer, 245
 Hydrogen bonding, 277
 intramolecular, 280, 281
 Hydrogen halides, addition reactions, 430
 Hydrogen migrations, 534
 1,2, 529, 565, 566, 582
 1,3, 582
 1,4, 131
 1,5, 535
 Hydroperoxides, 239, 241
 synthesis, 581
 Hydrophosphination, of Michael acceptors, 438
 Hydrosilylation, 141, 419, 434
 Hydroxamic acids, 57
 acyl-, 517
 benzo-, 580
 O-benzoyl-, 123
 α -Hydroxy acids, oxidation, 218
 Hydroxyacrylates, 436
 7-Hydroxycoumarin, 438
 2-Hydroxyhex-5-enoates,
 iodocyclization, 426
 Hydroxylamines, 56
 allyl-, 526
 O-benzyl-, 438
 rearrangement, 496, 526, 533, 552
 Hydroxylation, enzymatic, 244
 Hydroxymethylation, 291
 Hydroxysuccinimides, 441
 Hydroxy-2-sulphinylbutadienes,
 cycloaddition, 469
 α -Hydroxythiol acids, 444
 Hyperconjugation, 17, 153
 homo-, 155
 Hypoiodous acid, as iodinating agent, 289
- Illicinones, 512
 Imidates, 138
 allyl, 517
 Imidazoles,

- N*-acetyl-, 68, 69
benz-, 106
Imidazolidines, tautomerism, 602
Imidazolines, as acyl anion equivalents, 363
Imidazol-4(5*H*)-one, 59
Imides,
 diazo-, 65
 rearrangement, 364
Imines, 5–7
 chiral, 441
 Diels–Alder reactions, 469
 isomerization, 535
 macrocyclic, 511
 metathesis, 7
 reactions, with:
 chiral sulphoxides, 6
 organometallics, 6, 7
Iminium ions, 2, 7
Imino esters,
 ene reactions, 543
 formation, 546
Imino ethers, rearrangement, 546
5-Imino-1,2,4-thiadiazolidin-3-ones,
 cycloaddition–elimination, 459
Iminothiocarbonates, 519
Indanes, formation, 434
Indenes, rearrangement, 1,3-prototropic, 376
Indoles,
 allyloxy-, 514
 reactions, 293
 rearrangement, 499
Indolines, rearrangement, 517
Indolizines, formation, 439
Indolizinones, synthesis, 464
Indoxyl derivatives,
 halogenation, 289
Inositols, synthesis, 543
Iodination, 425, 426
Iodine, hypervalent, 3
Iodocyclization, 426
Iododecenones, formation, 441
Iodohydrin, 427, 428
Iodolactonization, 426
Iodonium ions, 449
Iodotoluene difluoride, in ring contraction, 559
Ion cyclotron resonance mass spectrometry, 381
Ion–neutral complexes, 290
Ion pairs, 561
Ips-attack, 291, 292
Ireland–Claisen rearrangement, 514, 515
Iridolactones, synthesis, 549
Isatin, 68
Isobenzindene, dimerization, 468
Isochromanones, deprotonation, 48
Isocomene, 571
Isocyanates, 62–64
 rearrangement, 539
Isocyanides, benzyl,
 rearrangement, 498
Isomerizations,
 alkene, mechanisms, 297
 buta-1,3-diene–but-2-yne, 588
Isomunchnones, cycloaddition, 459
Isoparametricity, in Hammett ρ – σ relationship, 342, 343
Isoprenoids, biosynthesis, 432
Isoquinolines,
 rearrangement, 505
 tetrahydro-, 531
Isoquinolinium-*N*-arylimides,
 cycloaddition, 457
Isothiazoles, 453
Isothiazoloisothiazoles,
 formation, 453
Isothiochromenes, 508
Isothiocyanates, 107
Isotope effects, 29
 calculation, 356
 carbon, 335
 kinetic, 408
 chlorine, 335
 deuterium, 399, 449
 equilibrium, 422
 kinetic, 366, 367, 374, 389, 391, 421, 422, 431
 secondary, 335
 in electrophilic aromatic substitution, 293
 in elimination reactions, 389, 391, 393, 408
 in nitrosation, 382
 in nucleophilic aliphatic substitution, 335
 kinetic, 13, 25, 174, 263, 264, 277, 279, 284, 334, 335, 423, 440
 muonium, 137
 solvent, 25, 393, 423
 steric hindrance, 374
Isotopic labelling studies, 2, 6
Isoxazoles,
 dihydro-, 460
 formation, 460
Johnson–Claisen rearrangement, 514
Kamlet–Taft equation, 338, 339
Kaurenols, 572
Ketene acetals,
 rearrangement, 529
 silyl, 529
Ketene aminals, ene reactions, 543
Ketene dithioacetals,
 rearrangement, 528
Ketenes,
 bromination, 427
 butadienyl-, 535
 diaryl-, 453
 imidoyl-, 534
 oxo-, 534
 reactions, 4, 505
 vinyl-, 541
Ketenimines,
 formation, 534
 α -oxo-, 539
 rearrangement, 537
Ketones,
 alkynyl, 432
 aryl, rearrangement, 490
 nitro-, 549
 norbornyl, 317
 silyloxy-, 549
Ketophosphonates,
 rearrangement, 565
Ketophosphoranes, reactions, 46
Ketoximes, 80
Kirkwood–Onsager equation, 97
Knoevenagel condensation, 14
Koppel–Palm equation, 338, 339
Lactams, 7, 60, 61
 hydrosilylation, 141
 rearrangement, 596
 β -Lactams, 124
 hydrolysis, 60
 γ -Lactams, 68
Lactones,
 amino-, 602
 elimination reactions, 403
 formation, 426
 hydrosilylation, 141
 irido-, 549
 panto-, 441
 reactions, 44–49
 β -Lactones,
 decarboxylation, 44, 45
 synthesis, 526
 γ -Lactones, 487, 491
 formation, 46, 94, 95
 proton affinities, 44
 δ -Lactones, 487
 proton affinities, 44
Lanosterol, formation, 574
Laser flash photolysis, 120, 132, 431
Lasiols, 524

- Leaving-group effects,
 in elimination reactions, 389, 391
 in nucleophilic substitution, 323
- Leffler parameters, 40
- Ligand-transfer reactions, 130
- Lignans, furanofuran, 515
- Lobry de Bruyn–Van Ekenstein reaction, 228
- Lossen rearrangement, 580
- Lupenones, rearrangement, 574
- Macrocycles, tetrathia-, 594
- Maleimides, cycloaddition, 459
- Malononitriles, dihalo-, 463
- Mannich reaction, 7, 8
- Marcus theory, 10
- Markovnikov addition, 420, 421
 anti-, 208, 420
- Mass spectrometry, in
 determination of isotope effects, 421, 422
- Matrix isolation, 567
- Meerwein–Ponndorf reduction, 13
- Meisenheimer complexes, 283–285
- Meisenheimer rearrangement, 526
- Meldrum's acid, 437
 derivatives, thermolysis, 403
- Menshutkin reaction, 336, 343
- Mercaptophosphonates, rearrangement, 531
- Mercuration, 419
- Mesitonitrile oxide, cycloaddition, 460
- Mesitylene, alkylation, 291
- Metal hydrides, complex, reduction by, 245
- Metallation, asymmetric diastereoselective, 377
- Metalloproteinase inhibitors, 514
- Metathesis reactions, 585
 ring-closing, 516
- Methacrolein, Diels–Alder reactions, 473
- Methacrylates, polymerization, 137
- Methanesulphonamides, 90
- Methanesulphonyl chloride, 97
- Methoxyandrost-4-enes, hydroboration, 433
- 2-Methoxycarbonylbuta-1,3-diene, dimerization, 468
- N*-(Methoxycarbonyl)sulphamates, 100, 101
- Methoxyselenenylation, asymmetric, 428
- 3-Methoxythiophene, reactions with
 4,6-dinitrobenzofuroxan, 293
- 2-Methylbutane, alkylation by, 290
- Methyl cation affinity, of benzene, 287
- Methyl cations, complexation with benzene, 297
 reactions, with:
 amines, 298
 methane, 298
- Methylenecyclohexanes, electrophilic additions, 420
- 5-Methylene-1,3-dioxane, electrophilic additions, 420
- 2-Methylene-1,3-dithiolane-1,3-dioxides, cycloaddition, 461, 463
- 9-Methylenenorbornanes, electrophilic additions, 419, 420
- Methylmalonyl-CoA, 551
- Micelles, 280, 282
- Michael addition, 12, 13, 56, 419, 435–439, 505
 asymmetric, 437, 441
 intramolecular, 596
 MO calculations, 359
 retro-, 504
 vinylogous, 599
- Microwave irradiation, 244, 277, 435
- Migration, of:
 acyl groups, 493, 534, 546, 575
 alkoxycarbonyl groups, 548
 alkyl groups, 504, 550, 567, 581, 591
 aryl groups, 546
 aryl groups, 23, 118, 119, 487, 535, 567
 benzamido groups, 493
 benzoyl groups, 501
 boron, 534
 bromine, 588
 chlorine, 534
 cyanomethyl groups, 591
 cyclopropane rings, 379
 hydrogen, 131, 529, 534, 535, 565, 566, 582
 methoxycarbonyl groups, 68
 phenylthio groups, 535
 phosphorus, 552
 phosphoryl groups, 87, 548
 silicon, 529, 563
- silyl groups, 500, 550
- sulphinyl groups, 500
- sulphonyl groups, 500
- tin, 535
- vinyl groups, 567
- Migratory aptitude, 379
- Modhephenne, 533, 571
- Molecular mechanics
 calculations, on
 photocycloaddition, 453
- Molecular mechanics–valence bond dynamics, 479
- Molecular-orbital calculations, on:
 acetylide ions, 377
 addition reactions, 368, 376
 Beckmann rearrangement, 577
 Boulton–Katritzky rearrangement, 504
 bromination of
 benzobicyclooctadiene, 561
 carbanions, 349–352
 cyclopropane polymerization, 381
 electrophilic aromatic substitution, 287, 292, 293
 elimination reactions, 396, 398, 403, 407
 ene reactions, 540
 Favorskii rearrangement, 549
 Grignard reactions, 371
 1,5-hydrogen shift in pentadienes, 535
 interconversion of isobutonium ions, 553
 isomerizations, 551
 buta-1,3-diene–but-2-yne, 588
 isotope effects, 356
 Michael addition, 359
 1,2-migrations in acetylide anions, 551
 nucleophilic aliphatic substitution, 326–328, 332–334, 336, 337, 341
 oxy-Cope rearrangement, anionic, 524
 Payne rearrangement, 590
 pericyclic reactions, 536
 protonation, 363
 rearrangements,
 circumambulatory, 512
 of amine oxides, 526
 of carbenes, 566
 of propylene 1,2-glycol, 556
 of tungsten–acetylene complexes, 582

- sigmatropic, 519
sulphenate–sulphoxide, 531
ring opening, of:
 cyclobutene radical cation, 536
 cyclopropenes, 588
Simmons–Smith reaction, 587
Stevens rearrangement, 531
sulphur radical cations, 565
tautomerism, 599–602
thio-Claisen rearrangement, 518
Wallach rearrangement, 497, 498
Wittig reaction, 365
Molecular recognition, in
 cycloaddition, 466
Monosaccharides,
 rearrangement, 575
Monoselenophosphates,
 reactions, 88, 89
Monothioformic acid, 104
Monothiophosphates, reactions, 89
More O'Ferrall–Jencks diagram, 397, 398
Munchnones, 502
 cycloaddition, 459
Muon spin relaxation, 138
Myers–Saito
 cycloaromatization, 188

Naphthalenes,
 acylation, 291
 dihydro-, 401
Naphthamides, tautomerism, 602
Naphthofuranones, formation, 537
Naphtho[1,8-*b,e*][1,3]oxazine, 59
1,4-Naphthoquinones, 441
Natural products, synthesis, 478
Neber rearrangement, 553
Neighbouring-group
 participation, 427
 in reactions of carboxylic acid
 derivatives, 71, 72
Neomycin B, 91
Nitramines, rearrangement, 497
Nitrations, 277
Nitration,
 aromatic, 118, 289, 290
 chaperon effect, 289
 electron-transfer mechanism, 289
 kyodai, 289
 nitrous acid catalysis, 289
 of alkanes, 382
 of aromatics, 144
 ozone-mediated, 289
 steric effects, 290
 transition-state solvation, 290
Nitrenes,
 o-fluorophenyl-, 268
 matrix-isolated, 258
 sulphonyl, 262
Nitrenium ions, 268
 N-acetyl-*N*-(2-fluorenyl)-, 309
 aryl-, 307
 as intermediates, 289
 calculations, 307
 formation, 308
 nucleophilic additions, 308
 physiological effects, 308
Nitric acid, nitration by, 289, 290
Nitric oxide,
 cycloaddition, 457
 reactions with activated
 alkenes, 136
Nitrile oxides, cycloaddition, 460, 461
Nitriles,
 amino-, 359, 439
 benzo-, 61
 formation, 397
 reactions, 61, 62
Nitrilimines, cycloaddition, 457, 464
Nitrite esters, hydrolysis, 108, 109
Nitroalkanes, proton-transfer
 reactions, 374
Nitroalkenes, addition reactions, 443, 444, 446
N-Nitroamidines, 68
N-Nitroamines, decomposition, 298
Nitroarenes, reactions, 277, 278
 VNS, 278
 with carbanions, 279
 with phenylacetonitrile, 279
Nitrobenzenes, reactions, 277, 278
 with carbanions, 360, 361
Nitrobenzofuroxans,
 rearrangement, 504
3-Nitro-*ω*-
 benzylideneacetophenone, 442
Nitrodienones, 289
Nitrogen dioxide, nitration by, 289
Nitrogen trioxide, nitration by, 289
Nitro group displacement, 278
Nitroketones, rearrangement, 549

Nitrones,
 addition, 6
 aryl, 460
 cycloaddition, 461, 463
 formation, 539
 reactions with Grignard
 reagents, 371
 rearrangement, 539
 tautomers, 8
Nitrophenyloxetanes, 290
3-Nitropyridines, 290
N-Nitropyridinium nitrates, 290
Nitrosation, 107
 isotope effects, 382
 of guanidines, 382
 of ureas, 382
Nitrosoalkanes, oxidation, 228
N-Nitrosobenzenesulphon-
 amides, 102
S-Nitrosocysteine, 110
Nitrosodiazenes, as
 intermediates, 6
Nitrosonium ions, nitration by, 289
S-Nitrosothiols, 110
α-Nitrostilbenes, 437
Nitrostyrenes, additions, 444
o-Nitrotoluene, nitration, 289
Nitrous acid, nitration by, 289
Nitroxides, spin trapping,
 163–166
Non-linear effects, 223
Norbornadienes, rearrangement, 533
Norbornanones, rearrangement, 559
Norbornenes, hydration, 317
Norbornyl compounds,
 nucleophilic substitution, 326
Norbornyl ketones, 317
Norsnoutanes, methylene-, 419, 420
Nortricyclanes, hydration, 317
Nortricyclanol, hydrolysis, 317
 rearrangement, 560
Nuclear magnetic resonance
 spectroscopy,
 ¹³C, 421
 ¹H, 424, 439, 442, 465
Nucleophilic addition, 435–450
Nucleophilic aliphatic
 substitution,
 allylic systems, 324–326
 ambident nucleophiles, 335
 at elements other than carbon,
 331, 332
 epoxides, 326–330

- Nucleophilic aliphatic substitution, (*continued*)
 gas-phase reactions, 325, 327, 329, 335–337
 intramolecular, 332–334
 isotope effects, 334, 335
 kinetic studies, 344
 leaving-group effects, 323
 linear free energy relationships, 342
 MO calculations, 326–328, 332–334, 336, 337, 341
 norbornyl systems, 326
 phase-transfer catalysis, 341, 342
 radical reactions, 338
 salt effects, 341
 small rings, 326–331
 solvent effects, 338–341
 structural effects, 342, 343
 vinylic systems, 323, 324
- Nucleophilic aromatic substitution, 202, 275–285
 of polynitrobenzenes, 175
 of pyridazines, 282
 of pyridines, 281, 282
 of thiophenes, 280, 281
 of triazines, 282, 283
 photolytic, 280
 vicarious, 278, 282
- Nucleophilic assistance, intramolecular, 427
- Nucleophilicity, 339, 340
 at carbon, 431
- Nucleophilic substitution, vicarious, 399, 442
- Nucleosides, reactions, 576
 rearrangement, 507
- Nystatin, 524, 550
- Oligonucleotides, 93
- O(3P) atoms, by microwave irradiation, 244
- Organoboron compounds, rearrangement, 581, 582
- Organochromium compounds, 218
- Organocobalt compounds, rearrangement, 585
- Organocopper compounds, conjugate addition, 447–449
 in S_N2 reactions, 372
- Organogold compounds, rearrangement, 587
- Organoiridium compounds, rearrangement, 586
- Organoiron compounds, rearrangement, 585
- Organolithium compounds, aggregation, 354
 nucleophilic addition, 447
- Organomanganese compounds, rearrangement, 584
- Organomolybdenum compounds, rearrangement, 582
- Organopalladium compounds, rearrangement, 587
- Organoplatinum compounds, rearrangement, 587
- Organorhenium compounds, rearrangement, 584
- Organorhodium compounds, rearrangement, 586
- Organoruthenium compounds, rearrangement, 585
- Organotin compounds, reactions with carbonyls, 373
 rearrangement, 588
- Organotungsten compounds, rearrangement, 582
- Organozinc compounds, enantioselective addition of, 371
- Ortho* effect, 41
- Ortho* esters, cleavage by Grignard reagents, 371
- Ortho* interactions, hyper-, 281
- Osmylation, 433
- Oxabicyclic systems, hetero-, eliminative ring opening, 412
- Oxaborolidines, 26
- Oxadiazole anions, rearrangement, 504
- Oxadiazolines, photolysis, 269
 thermolysis, 257, 269
- Oxalic acid, oxidation, 218, 219, 231
- Oxamacrolides, rearrangement, 515
- Oxaphosphetanes, 15
 decomposition, 408
 formation, 364, 408
- Oxasilacycloalkanes, rearrangement, 563
- Oxastannetanes, 535
- Oxathionines, synthesis, 530
- Oxazines, 62
 formation, 531
 naphtho-, 59
 tautomerism, 602
- Oxaziridines, 228, 546
- Oxazolidines, 7, 18, 26, 28
- Oxazolidinones, benzyl-, 441
- Oxazoline *N*-oxides, 517
 cycloaddition, 465
- Oxazolines, acyloxy-, 517
- Oxazolium salts, as intermediates, 499
- Oxazolones, cycloaddition, 459
- Oxazolol[3,2-*c*]pyrimidines, synthesis, 469
- Oxepanes, synthesis, 461, 462
- Oxepins, 499
 dihydro-, 522
- Oxetanes, aryl-, 290
 formation, 535
- Oxidation, anodic, 487
 asymmetric, 223
 electron transfer-induced, 143
 photochemical, 241, 242
- Oxidation, by:
 benzyltrimethylammonium tribromide, 231
 2,2'-bipyridinium chlorochromate, 219
 bromamines, 226, 231
N-bromophthalimide, 231
N-bromosuccinimide, 231
 cerium(IV), 217, 222–224
 chloramines, 230, 231
 chlorine, aqueous, 229
 chlorite, 229
 chromium, 217–219
 cobalt, 223
 copper, 222
 dianisyltellurium oxide, 229
 dioxiranes, 233–236, 238
 Fenton system, 167
 gold, 222
 Group VIII metals, 225–228
 halogens, 229
 iridium, 225
 iron(III), 225, 226
 manganese, 219–222
 nickel, 222
 nitric acid, 245
 oxaziridines, 228, 546
 oxochromium(V) complexes, 218
 oxone, 229, 236, 237
 palladium, 224, 225
 peracids, 233
 periodate, 231
 permanganate, 221
 peroxytrifluoroacetic acid, 229
 platinum, 225
 potassium ferricyanide, 489
 pyridinium dichromate, 218
 pyridinium halochromates, 218, 219
 quinolinium dichromate, 219
 quinolinium fluorochromate, 219
 rhenium, 223

- ruthenium(IV), 227
salen–Mn(III), 221
silver, 222
tempo, 167
tetrachloroaurate, 222
titanium, 223
tungsten, 223
vanadium(V), 223
- Oxidation, of:
alcohols, 217, 219, 229
alkenes, 223, 234
amines, 229, 231
amino acids, 223, 230
aspirin, 231
1,3-dicarbonyls, 546
diols, 231
formaldehyde, 229, 230
formic acid, 219, 231
histidine, 167
 α -hydroxy acids, 218
nitrosoalkanes, 228
oxalic acid, 218, 219, 231
sulphides, 218, 219, 225, 229
sulphoxides, 233
thiosulphinates, 233
- Oxidative substitution, of
hydrogen, 279
- Oxidosilanes, rearrangement,
550
- Oxidosqualenes, cyclization, 573
- Oximes, 8, 9
elimination reactions, 397
rearrangement, 498, 577
- Oxocarbenium ions, 4
2-deoxyglucosyl-, 311
- Oxonium ylides, rearrangement,
526
- Oxoquinolines, rearrangement,
504
- Oxyallyl intermediates, 29, 589
- Oxygen,
atomic, 243
singlet, 234, 241, 242
triplet, 243
- Ozonation, 231–233
in atmospheric chemistry, 232
- Ozone, 136, 146
- Ozonides, secondary, 232
- Ozonolysis, 231–233, 444
- Paclitaxels, 524
- Palladacycles, 433, 601
- Pantolactones, 441
- Parthenin, rearrangement, 570
- Paterno–Büchi reactions, 175,
456
- Payne rearrangement, 590
aza-, 592
- Pellitorine, synthesis, 543
- Penicillins, 60, 61
- Pentachlorophenyl esters,
hydrolysis, 39, 40
- Pentacycloundecanes, 561
- Pentadienals, halo-, 597
- Penta-1,3-dienes, [1,5]-hydrogen
shifts in, 535
- Pentane, alkylation by, 290
- Peptide bond,
hydrolysis, 60
isomerization, 66
- Peptides, unsaturated, 516
- Peracids, 233
- Perfluoroalkyl iodides,
electrophilic additions of,
434
- Perfluoro esters, eliminative
fragmentation, 403
- Perhalogenated aromatics,
reactions with carbanions,
280
- Perhydrohistrionicotoxin,
synthesis, 543
- Peroxide nucleophiles, 39
- Peroxides, 239–241
rearrangement, 241
thermal decomposition, 192
- Persilphiperfolanols, 572
- Peterson olefination, 22, 365,
366, 411
- Phenanthramides, tautomerism,
602
- Phenanthrenes, 301
photolysis, 254
- Phenanthridenes, photolysis,
265, 266
- Phenanthrolines, cycloaddition,
460
- Phenolic esters, rearrangement,
493
- Phenols,
amino-, 435
nitration, 289
vinylation, 291
- Phenonium ion, 46, 307
- N*-Phenoxybenzamides,
rearrangement, 491
- Phenoxy radicals, as
intermediates, 289
- Phenoxytins, as intermediates,
291
- Phenylacetone nitrile, lithiated, 447
- Phenyl cation, lifetime of triplet,
307
- Phenylethylamines, 441, 444
- 3-Phenylloxetane, nitration, 290
- 3-Phenylpropanenitrile, nitration,
290
- 1-Phenylpropan-2-one, nitration,
289
- 3-Phenylpropenoic acid,
additions, 447
- 2-Phenylselenofumarates,
reactions with aldehydes,
48
- Phosphates, 79–82
cyclic, 91
hydrolysis, 79, 80
rearrangement, 552
- Phosphenes, as intermediates, 82
- Phosphinic acids, 84
- Phosphinines, diaza-, 508
- Phosphirenium cations, 309
- Phosphites, 85
allyl, 565
- Phosphocarbonates, 43
- 2-*H*-Phospholes, cycloaddition,
470
- Phosphonamides, 90
rearrangement, 593
- Phosphonates, 79–82
allyl, 565
aminocyclohexenonealkyl,
553
formation, 593
keto-, 552, 565
mercapto-, 531
rearrangement, 548
- epi*-Phosphonium salts, 365, 594
- Phosphonothioates, 86
- Phosphoramidates, 82, 83
formation, 593
- Phosphorothioates, 86
- Phosphorothiolates,
rearrangement, 531
- Phosphorus-containing acids and
derivatives, 79–94
- Phosphorus ylides, 364
rearrangement, 531
thermolysis, 260
- Phosphoylides, halogenated, 365
- Photocycloaddition, 558
2 + 2, 453, 457
3 + 2, 460
4 + 4, 479
 $\pi 2 + \pi$, 457
intramolecular, 453
- Photolysis, of:
anthraquinone diimines, 498
azides, 258, 264, 268
cyclopropanes, 262
diazirines, 254, 255, 260,
263–265, 269
diazo compounds, 254, 263,
270
dihydrothiazine, 507
indoles, 499
oxadiazolines, 269
phenanthrenes, 254
phenanthridenes, 265, 266

- Photooxidation, 241, 242
 Photorearrangement, of:
 allylic stannanes, 535
 allyl phosphites, 565
 carbenes, 566
 dihydropentalenes, 535
 enediynes, 539
 1-naphthyl acetate, 200
 tropolone methyl ether, 537
 α,β -unsaturated carbonyls, 589
- Pinene hydroperoxide, 239
- Piperidines,
 formation, 436
 polyhydroxylated, 516
 reactions, 277
- Piperidinones, 449
- PM3 method, 38
- Polonovski reaction, 577
- Polyethers, macrocyclic, 513
- Porphyrins, tautomerism, 602
- Potential energy surfaces, 421
- Prins reaction, 419
- Prolines, rearrangement, 499
- Prolinol, 445
- Propane, protonated, 298
- Propan-2-ol, alkylation by, 291
- Propanols, hydrogen abstraction from, 130
- Propellanes, rearrangement, 561
 [2.2.2]Propellanes, 519
- Propene, supercritical, alkylation by, 291
- Proton activating factors, 24
- Proton affinity, of benzenes, 287
- Protonation,
 asymmetric, 437
 MO calculations, 363
 of aromatics, 292
- Proton sponges, 376
- Proton transfer, 276, 373–376
 steric hindrance, 374
 unimolecular, 431
- Proximates, 457
- Pseudocodeine, 531
- PTOC oxalates, 125
- Pulsed laser photolysis, 146
- Pulsed radiolysis UV-vis
 absorption system, 132
- Pummerer rearrangement, 141, 245, 312, 569
- Pyranones, rearrangement, 513
- Pyrans, benzo-, 565
- Pyrazinium ion, 560
- Pyrazoles,
 rearrangement, 501
 thermolysis, 261, 263
- Pyrazolidinones, hydrolysis, 68
- Δ -Pyrazolines, synthesis, 464
- Pyrazolone *N,N*-dioxide,
 cycloaddition, 465
- Pyridazines, nucleophilic
 aromatic substitution, 282
- Pyridazinium ion, 560
- Pyridine-1-oxides,
 rearrangement, 504
- Pyridines,
 amino-, 435
 azo-, 434, 435
 dihydro-, 290
 furo-, 288
 2-mercapto-, 106
 nitro-, 290
 nucleophilic aromatic
 substitution, 281, 282
 tetrahydro-, 476
- Pyridinium micellar aggregates,
 449
- Pyridinium salts, acyl-, 66
- Pyridones, cycloaddition, 469
- Pyridoxal, reactions, 5, 6
- N*-(2-Pyridyl)imide,
 cycloaddition, 457
- Pyrimidines,
 fluoro-, 67
 oxazolo-, 469
- Pyrolysis, of:
 allenic esters, 541
 allyl esters, 498
 azetidine, 405
 ketophosphonates, 565
 polycyclic aromatic
 hydrocarbons, 498
 [4.3.1]propellanes, 561
 pyrazoles, 501
 sulphenamides, 405
 sulphonylhydrazones, 405
 triazines, 403, 404
 triazoles, 539
 trihaloethanes, 406
 vinyl azides, 405
- Pyrrolenines, rearrangement, 499
- Pyrrroles,
 alkylation, 287
 lithiation, 366
 rearrangement, 499
 synthesis, 460
- Pyrrolidines, reactions, 277
- Pyrroline *N*-oxide,
 cycloaddition, 464
- Pyrrrolines, synthesis, 528
- Quantum mechanical tunnelling,
 264, 265
- Quinolinecarboxylates,
 rearrangement, 504
- Quinolines,
 oxo-, 504
 selenolo-, 507
- Quinones,
 naphtho-, 441
 sulpho-, 96
 tetracyclic, 475
- Radical anions, 144, 183–186
 tin-associated ketyl, 516
- Radical cations, 144, 177–183
 bisected trimethylenemethane,
 565
 cyclobutene, 536, 537
 dimethyl sulphide, 565
 enol, 25
 methanethiol, 565
 of dithiazadithiafulvalenes,
 165
 rearrangement, 563
- Radical reactions,
 addition, 135–138
 intramolecular, 122–129
 stereoselectivity, 140, 141
 annulation, 128, 129
 asymmetric, 118
 atom abstraction, 130–134
 stereoselectivity, 141–143
 autoxidation, 209
 cyclization, 122–128, 139
 stereoselectivity, 139, 140
 fragmentation, 118, 129, 133
 group migration, 118, 119
 halogenation, 134, 135
 homolysis, 129
 oxidation, 166–170
 photolysis, 200–202
 pyrolysis, 191–200
 radiolysis, 202–209
 reactivity effects, 139
 rearrangement, 118–122, 133
 recombination, 129, 130
 reduction, 166, 170–172
 ring expansion, 122
 ring opening, 120–122
 tandem, 128
 thermolysis, 191–200
- Radicals,
 β -(acyloxy)alkyl, 118
 alkoxy carbonyl, 125
 amidyl, 122, 123
 aryl, 126, 128, 129, 138
 pyrolysis, 192
t-butoxy, 121
t-butyl, 130, 131
 carbamoyl, 127
 carbohydrate, 136
 chloro, 130, 131
 cyclization, 118
 cyclohexadienyl, 119, 126
 cyclopropylcarbonyl, 120
 fluoro, 130, 131, 139
 germyl, 137

- haloalkyl, 134
 halogen atom, 146
 heptenyl, 124
 hexenyl, 123
 hydroxyl, 76, 146, 147
 inositol-based, 136
 α -keto, 136
 malonyl, 136, 576
 β -nitroalkyl, 136
 nitrogen-centred, 118, 121, 122, 133
 nucleophilic, 135
 2-oxetanone-4-ylcarbinyl, 120, 121
 oxiranyl, 141
 perfluoroalkyl, 130, 135
 peroxy, 118, 129, 133, 144, 145
 philicity, 139
 β -(phosphatoxy)alkyl, 118
 polarity, 139
 stability, 139
 structure and stability, 153–163
 succinimidyl, 121
 sulphur, 158
 vinyl, 139
- Radicophiles, 588
- Radionucleides, nucleophilic exchange reactions, 280
- Ramberg–Bäcklund reaction, 594
 phosphonium analogue, 365
 phosphorus, 410
- Ramberg–Bäcklund rearrangement, 550
- Rearrangement,
 allylic, 527, 555
 anionic, 544–553
 aromatic, 487–511
 benzidine, 498, 504
 cationic, 430, 553–581
 circumambulatory, 511, 512
 cyclobutylcarbinyl–cyclopentyl, 572
 cyclopropyl–cyclobutyl, 502
 di- π -methane, 119, 533
 dyotropic, 533
 electrocyclic, 246, 536–544
 electrooxidative, 487
 enone–benzene, 574
 furandione, 500
 homoallyl–homoallyl radical, 572
 iminoamine, 535
 indole-dione–indole, 499
 involving electron-deficient heteroatoms, 577–581
 isomerization, 599–603
 methylenecyclopropene, 565
 neopentyl, 554
 nitramine, 497
 oxadi- π -methane, 533
 pinacol, 556, 557, 574
 photochemical, 300
 prototropic, 376
 ring-expansion, 122
 ring-opening, 120–122, 588–598
 semibenzilic acid, 549
 sigmatropic, 290, 457, 478, 505, 511–536
 sulphenate–sulphoxide, 531
 thione–thiol, 504
 vinylcyclopropane, 535
- Rearrangement, of:
 acetals, 489
 acetylide ions, 377
 acyl azides, 579
 acylhydroxamic acid derivatives, 517
 adamantanes, 561
 adenines, 505
 alkyl phenyl ethers, 491
 allene oxides, 589
N-allylanilines, 513
 allyl benzyl ethers, 526
N-allylenamines, 513
 allylhydroxylamines, 526
 allylic alcohols, 514
 allylic sulphides, 529
 allylic xanthates, 519
 allyl imidates, 517
 allyl *N*-oxides, 526
 allyloxyindoles, 514
 allyl silyl ethers, 586
 amine oxides, tertiary, 504, 526
 amino acid enynol esters, 516
 amino esters, 528
 ammonium benzylates, 529
 ammonium ylides, 528, 531
 arsenic ylides, 531
 arylidenes, 567
 aryl ketones, 490
 asparagines, 579
 azetidine *N*-oxides, 526, 531
 azetidines, 595
 azido-1,2,3-triazolide ion, 364
 aziridines, 554, 592
 azoles, 548
 barbaralone, 520
 benzo[*b,f*]azocin-12-ones, 508
 benzohydroxamic acids, 580
 benzyl ethers, 526
 benzyl isocyanides, 498
 benzynes, 267
 bicyclo[3.3.2]decan-9-one, 578
 bicyclo[3.1.1]heptanes, 550
 bicyclo[4.1.0]hept-3-enes, 588
 bicyclo[2.2.1]hept-5-en-2-one, 533
 bicyclo[3.2.1]oct-6-en-2-ols, 535
 boronic esters, 581
 calix(*n*)arene esters, 493, 494
 carbanions, 379
 carbapenems, 596
 carbazoles, 493
 carbenes, 253, 262, 264–268, 566
 carboxamides, 505
 cephalosporin sulphones, 596
 chalcogenides, 586
 chromium(0) complexes, 525
 complestatin, 577
 coumarins, 552
 crotylamines, 527
 cyanohydrins, 545
 cyclobutanediones, 537
 cyclobutylmethanols, 559
 cyclononatetraenyl systems, 534
 cyclopropylamines, 537
 diazepindiones, 508
 diazocarbonyls, 565
 dicyclopentadienyl vinyl ethers, 514
 dihydropyridines, 290
 divinylcarbinols, 522
 epoxy alcohols, 555
 epoxyalkanes, 567
 epoxycaranes, 570
 epoxycarotenoids, 590
 epoxy ethers, 525, 579, 590
 erythromycin oxime, 579
 fenchyl alcohols, 560
 fulminate anion, 551
 germacranolides, 521
 glucals, 555
 glycals, 576
S-glycoside dioxides, 551
 glycosylamines, 525
 halobullvalenes, 520
 halocyclohexenylmethyl ethers, 491
 halopentadienals, 597
 heterocyclic allenes, 539
 heterocyclic derivatives, 499–511
 hexa-1,5-dienes, 519
 hexa-1,2-dien-5-yne, 519
 hexa-1,5-diyne, 519
 hexa-1-en-5-yne, 520
 hexa-1,2,4,5-tetraene, 520
 hexa-1,2,5-triene, 519
 homodrin, 561
 hydrazoaromatics, 498
 hydroxylamines, 533, 552

- Rearrangement, of: (*continued*)
 imides, 364
 imino ethers, 546
 iminothiocarbonates, 519
 indolines, 517
 isoquinolines, 505
 ketene dithioacetals, 528
 ketenes, 534
 ketenimines, 537
 lactams, 596
 lupenones, 574
 macrocyclic imines, 511
 macrocyclic polyethers, 513
 methylmalonyl-CoA, 551
 monosaccharides, 575
 natural products, 570–577
 nitramines, 497
 nitrobenzofuroxans, 504
 nitroketones, 549
 nitrones, 539
 norbornadienes, 533
 norbornanones, 559
 nortricyclanol, 560
 nucleosides, 507
 organometallics, 581–588
 oxadiazole anions, 504
 oxamacrolides, 515
 oxasilacycloalkanes, 563
 oxazoline *N*-oxides, 517
 oxidosilanes, 550
 oximes, 498, 577
 oxonium ylides, 526
 oxoquinolines, 504
 parthenin, 570
 peroxides, 241
 phenolic esters, 493
N-phenoxybenzamides, 491
 phenylhydroxylamines, 496
 phenyl isocyanates, 539
 phenyl sulphides, 494
 phosphates, 552
 phosphoramidates, 593
 phosphonates, 548
 phosphorothiolates, 531
 phosphorus ylides, 531
 pinacol, 557
 prolines, 499
 propargyl ethers, 526
 pyranones, 513
 pyrazoles, 501
 pyridine-1-oxides, 504
 pyrrolenines, 499
 pyrroles, 499
 quinuclidinecarboxylates, 504
 selenium intermediates, 531
 semibullvalenes, 520
 silphinine, 572
 silyl ketene acetals, 515, 529
 silyloxyketones, 549
 stannanes, 544
 steroidal epoxides, 574
 sulphones, 550
 sulphonium ylides, 529, 530
 sulphoxides, 527, 550, 569
 tetraethynylethenes, 539
 tetrahydroheptalenes, 536
 tetrahydrophosphinine oxide, 505
 tetrazoles, 552
 tetrazolides, 503
 thiazolines, 502
 thiocarbonimidates, 519
 thiohydrazonates, 496
 thionitrosoarenes, 498
 triazoles, 503, 524
 trichloroacetamides, 518
 uracils, 527
 vinyl ethers, 513
 vinylsilanes, 562
 xanthates, 504
 xanthenones, 555
 xyluloses, 574
 Redox reactions, 143
 Reduction,
 catalytic, 420
 electrochemical, 245
 Reduction, by:
 complex hydrides, 245
 metal hydrides, 245
 sodium dithionate, 246
 Reimer–Tiemann reaction, 269
 Reimer–Tiemann rearrangement, 499
 Ring contraction, 559
 Ring expansion,
 cascade, 464
 of allenylcyclopropanes, 535
 Ring opening,
 eliminative, 396, 412
 of cyclobutene radical cations, 536, 537
 of cyclobutenes, 402
 of cyclopropanones, 536
 of epoxides, 327, 328
 of thiazolidines, 413
 of thiiranes, 330
 Rotaxanes, 587
 Ruthenium complexes, 446
 Salt effects, in nucleophilic
 aliphatic substitution, 341
 Samarium diiodide, 155
 Sanger's reagent, 269
 Sarin, hydrolysis, 80
 SB–GA mechanism, 281
 SCF theory, 58
 Schenck reaction, 242
 Schiff bases, enolates from, 359
 S_EAr substitution, 284
 Securinines, 75
 Selenenylation, methoxy-, 428
 Seleniranium ions, 428, 429
 Selenium electrophiles, chiral, 428
 Selenoquinolines, 507
 Semibullvalene, 520
 S_H1 reactions, 138
 S_H2 reactions, 138
 Sigmatropic rearrangements, 478
 [1,2], 457
 [1,3], 534, 535
 [1,5], 290, 505, 535
 [2,3], 525–531
 [3,3], 505, 511–525
 [5,5], 536
 Silacyclobutanes, as silene
 precursors, 431
 Silanes,
 acylpoly-, 563
 alkenyloxy-, 127
 alkoxy-, 431
 allenyl-, 543
 allyl-, 136, 550
 allyloxy-, 127
 homoallyloxy-, 127
 oxido-, 550
 tris(trimethylsilyl)-, 563
 vinyl-, 562
 Silanols, formation, 563
 Silenes,
 allylic, 544
 electrophilic addition, 431
 Silylyl cations,
 cycloaddition, 466
 Silphinine, rearrangement, 572
 Silphinyl mesylates, solvolysis, 572
 Silylbistriflimides, 563
 Silyl cations, γ -effect, 302
 Silylenes, 270, 271
 matrix-isolated, 271
 MO calculations, 271
 Silyl enol ethers, formation, 549
 Silyl ethers, desilylation, 570
 Silyl ketene acetals,
 rearrangement, 515
 Silyloxyketones, rearrangement, 549
 Simmons–Smith reaction, 262, 381, 587
 Singlet oxygen, 234, 241, 242
 ene reactions, 543
 Smiles rearrangement, 494
 S_NAr mechanism, 275–282
 S_Ni reactions, 329, 330, 333, 334, 336
 S_N1 reactions, 337, 340, 341
 S_N2 reactions, 281, 325, 330, 333–339, 341–344, 372, 489, 504

- S_N2'* reactions, 325, 326
Solvent effects,
 in carbon acid ionization, 376
 in nucleophilic aliphatic
 substitution, 338–341
Solvents, fluorinated, 144
Sommelet rearrangement, 529
Spin–orbit coupling, in
 carbenes, 256
Spin trapping, 163–166
Spiro compounds,
 as intermediates, 293, 593
 dioxaspiro[4.4]non-1-en-3-
 ones, 514
 spiro-annellated cyclobutane
 rings, 559
 spiroaziridines, 435
 spirocyclamines, 435
 spirocyclopropanes, 502
 spiro[4.5]decan-2-ones, 513
 spirofluorenenanthrenones,
 557
 spirojatamol, 513
 spiro[4.4]lactones, 54, 55
 spiro- λ_4 -sulphanes, 104
 spiro- λ_4 -sulphuranes, 98
Squalenes,
 cyclization, 299
 epoxy-, 432
 oxido-, 573
Squarate esters, 537
S_{RN}1 mechanism, 175, 202,
 203, 338
S_{RN}1 reactions, 134, 275, 356
Stannanes,
 allylic, 137, 535, 544
 rearrangement, 544
Stannylyethynes, as intermediates,
 291
Stephens rearrangement, 365
1,2-Stereochemical induction,
 119
Steric acceleration, 133
Steric effects, in elimination
 reactions, 391
Steroids,
 formation, 128
 hydroboration, 432
Stevens rearrangement, 261,
 528, 531, 585
Stilbenes,
 bromination, 423
 nitro-, 437
Stopped-flow kinetics, 422
Strecker reaction, 2, 23
Styrenes,
 allyl-, 434
 aziridination, 427, 478
 polymerization, 137
Substitution, homolytic, 118,
 138, 139
Succinates, synthesis, 514
Succinimides, 67
 hydroxy-, 441
Sudan 1, 438
Sugar nucleotides, 89
Sulphamates,
 aminolysis, 392
 N-(methoxycarbonyl)-, 100,
 101
Sulphamoyl halides, 99
 aminolysis, 393
Sulphenamides, pyrolysis, 405
Sulphenes,
 as intermediates, 391
 formation, 361
Sulphides,
 cyclic, transannular
 cyclization, 430
 oxidation, 218, 219, 225, 229
 phenyl, 292
 rearrangement, 494
Sulphines, formation, 550
 α -Sulphinyl alcohols, 363
Sulphites, cyclic, 94
Sulphonamides,
 benzene-, 102
 methane-, 90
 N-nitrosobenzene-, 102
Sulphones,
 alkylation, 362
 allylic, 478
 formation, 293
 rearrangement, 550
 epi-Sulphonium ions, 594
Sulphonium salts, formation, 430
Sulphonium ylides,
 rearrangement, 529, 530
Sulphonyl halides,
 elimination reactions, 391
 methane-, 97
 sulphenes from, 361
Sulphonylhydrazones, pyrolysis,
 405
Sulphoquinones, as
 intermediates, 96
Sulphoxides,
 asymmetric cyclopropanation,
 446
 chiral, 6, 23
 oxidation, 233
 rearrangement, 527, 550, 569
Sulphur-containing acids and
 derivatives, 94–110
 β -Sultams, elimination reactions,
 414
Sultines, synthesis, 460
Supercritical solvents, 291
Superdienophiles, in
 Diels–Alder reactions, 475
Sydnones, lithiation, 368
Taft equation, 16, 28
Taft correlations,
 solvatochromatic, 97
Tautomerism,
 amino–imino, 602
 azo–hydrazo, 601
 enol–enaminone, 600
 enone–dienol, 599
 keto–enol, 589, 599
 MO calculations, 599–602
 ring–chain, 602
 valence, 603
Taxanes, synthesis, 541
Taxols, 571
Tellurium intermediates, 411
Template effects, 19
Tetracyanomethane,
 cycloaddition, 463
Tetracyclotetradecatrienediones,
 formation, 475
Tetraethynylethenes,
 rearrangement, 539
Tetrahedral intermediates, in
 reactions of carboxylic acid
 derivatives, 36, 37
Tetrahydroazulenes, formation,
 582
Tetrahydrofurans, synthesis, 461,
 463
Tetrahydroheptalenes, 536
Tetrahydroisoquinolines,
 formation, 531
Tetrahydronaphthalene
 complexes, synthesis, 473
Tetrahydrophosphepine oxides,
 505
Tetrahydrophosphinine oxides,
 rearrangement, 505
Tetrahydropyridines, synthesis,
 476
Tetraimine oligomers, 511
Tetraphosphacubane,
 deprotonation, 351
Tetrazaoles,
 lithiation, 368
 rearrangement, 552
Tetrazolides, rearrangement, 503
Tetrazolium salts, 461
Thallium trinitrate, in ring
 contractions, 559
Thermolysis, of:
 azides, 268
 disilanes, 271
 oxadiazolines, 257, 269
 phosphorus ylides, 260
 pyrazoles, 261, 263

- Thermolysis, of: (*continued*)
 sulphinyl ylides, 260
 tosylhydrazones, 265
- Thiadiazine dioxides,
 tautomerism, 602
- Thiadiazoles, 503
- 1,2-Thiazetidone 1,1-dioxides,
 reactions with
 organometallics, 372
- Thiazines,
 benzo-, 101
 dihydro-, 507
 dithiazolo-, 453
- Thiazinodithiazepines,
 formation, 453
- Thiazolide ions, 364
- Thiazolidines, ring opening, 413
- Thiazolines, rearrangement, 502
- Thiazolium salts, 14
- Thienopyridines, electrophilic
 aromatic substitution, 288
- Thiiranes, ring opening, 330
- Thioamides, halo-, 304
- Thiocarbamic esters, 519
- Thiocarbonimidates, 519
- Thiocarbonyl *S*-oxides,
 cycloaddition, 475
- Thiohydrazides, formation, 496
- Thiohydrazonates,
 rearrangement, 496
- Thiolate ions, 437
- Thiols, *S*-nitroso-, 110
- Thiomethylation, 529
- Thiones, azole, 501
- Thionitrosoarenes,
 rearrangement, 498
- Thionofornates, chloro-, 105
- Thiophene endoperoxides, 239
- Thiophenes,
 alkylation, 287
 benzo-, 444
 methoxy-, 293
 nucleophilic aromatic
 substitution, 280, 281
 reactivity, 284
- S*-Thiophenyl acetates, 105
- Thiosulphinates, 223
 oxidation, 233
- Thioureas, 106
- Through-bond interactions, in
 electrophilic additions, 420
- Through-space acceleration, 449
- Through-space interactions, in
 electrophilic additions, 420
- Tin hydrides, pyridyl-containing,
 159
- Tishchenko reaction, 13
- Titanium(IV) hydroperoxide,
 239
- α -Tocopherol, synthesis, 291
- Toluene,
 alkylation, 291
p-toluenesulphonylation, 293
- Toluenes,
 cyclohexyl-, 291
 nitro-, 289
 protonation, 292
- p*-Toluidine, iodination, 289
- Tolyl cations, stabilities, 299
- (*p*-Tolylsulphinyl)methylquinols,
 cycloaddition, 469
- Topomerization, of benzene, 499
- N*-Tosylamines, Baylis–Hillman
 adducts, 293
- Tosylates,
 adamantyl, solvolysis, 314
 alkylation by, 291
- Tosylhydrazones, thermolysis,
 265
- Tremulane sesquiterpenes, 522
- Triazines,
 nucleophilic aromatic
 substitution, 282, 283
 pyrolysis, 403, 404
- 1,3,5-Triazines, 52
- Triazoles,
 formation, 596
 lithiation, 368
 pyrolysis, 539
 rearrangement, 503, 524
 tautomerism, 602
- Triazolinediones,
 Diels–Alder reactions, 476
 ene reactions, 543
- Triazolium salts, 14
 synthesis, 461
- Trichodienes, 519
- Trichonine, synthesis, 543
- Tricyanomethanes, halo-,
 cycloaddition, 463
- Tricyclo[3.2.2.0^{2,4}]nonanes, 591
- Tricyclo[3.2.2.0^{2,4}]nonene
 alcohols, 561
- Tricyclo[3.3.3.3^{2,4}]octanes, 563
- Tricyclo[5.2.2.0.2⁶]undeca-3,8-
 dienes,
 520
- Tricycloundecanes, 570
- Tricycloundecatrienes, 553, 551
- Trienes, Diels–Alder reactions,
 470, 473
- Trifluoromethanesulphonic acid,
 use in fluorination, 288
- Trifluoromethylanilines, 292
- Trifluoromethyl anion, 20
- S*-(Trifluoromethyl)
 diphenylsulphonium
 triflates,
 trifluoromethylation by, 292
- Trifluoromethyl hypofluorite,
 243
- 5-*exo*-*Trig* mechanism, 71
- Trihaloethanes, pyrolysis,
 406
- 1,3,5-Trimethoxybenzene,
 reactions with
 4,6-dinitrobenzofuroxan,
 292, 293
- Trimethylenemethane,
 cycloaddition, 466
- Trimethylsilyloxyfurans, 441
- Trinaphthophenalenium
 trifluoroacetate, 309
- Trinitrobenzenes,
 formation of adducts, 283,
 284
 reactions, 275, 276
- Trioxatriangulenium ions,
 acidity, 311
- Triplet oxygen, 243
- Triquinanes, 514
- Triterpenoid tosylates,
 acetolysis, 413
- Trityl cations,
 dimethoxy-, 300
 hydride affinities, 300
- Tropolone methyl ether,
 rearrangement, 537
- Tropylium ions, 302, 309
- Tryptamines, photo-irradiation,
 208
- Tyrosine hydroxylase, 242
- Tyrosine kinase, 87
- Tyrosines, fluoro-, 87
- UMCT reactions, 138
- Undecatrienyl anions, 379
- α,β -Unsaturated carbonyl
 compounds,
 photo-irradiation, 208
 photorearrangement, 589
- Uracils, rearrangement, 527
- Ureas, 56
 diaryl-, 580
 nitrosation, 382
- Uridine alkylphosphates,
 91, 92
- UV absorption spectroscopy,
 431
- Vanadium(V) oxytrinitrate,
 nitration by, 289
- Verrucarol, synthesis, 559
- Vicarious nucleophilic
 substitution, 399
- Vinylation, 291
- Vinyl azides, pyrolysis, 405
- Vinylcarbene complexes, Dötz
 benzannulation, 481

- Vinyl cations,
 1,2-aryl rearrangements in,
 306
 1-cyclopropyl-, 306
 reviews, 297, 306
- Vinylcyclopropanes,
 cycloaddition, 479
- Vinyl diazoacetates,
 decomposition, 521
- Vinyl ethers, deprotonation, 375
- Vinylidonium salts, elimination
 reactions, 396
- Vinylketenes, 541
- 2 β -Vinyl-*trans*-octahydro-1,3-
 benzoxazine, cycloaddition,
 460
- Vinylsilanes, rearrangement,
 562
- Vitamin D, synthesis, 541
- Vitamin K, oxidation, 243,
 244
- Wacker reaction, 224
- Wagner–Meerwein
 rearrangement, 425, 560,
 571
- Wallach rearrangement, 498
- Walsh orbitals, 420
- Wasabidienone A, 546
- Whiffen effect, 153
- Witkop cyclization, vinylogous,
 208
- Wittig reaction, 21, 364,
 408
 MO calculations, 365
 of ylides, 456
 phospha-, 22
 thio-, 22, 409
- Wittig rearrangement, 377, 525
 [1,2], 544
 aza-, 527
 sparteine-mediated, 526
- Wolff rearrangement, 254, 261,
 264, 269, 565
- Xanthates, 125
 allylic, 519
 rearrangement, 504
- Xanthenones, 556
 rearrangement, 555
- Xanthines, 75
- X-ray structure, of carbenes,
 257, 258
- Xyluloses, 574
- Ylides,
 ammonium, 528, 531
 arsenic, 531
 azomethine, 7, 539, 588
 bismuthonium, 545
 bromo, 47
 carbonyl, 269
 cycloaddition, 457, 461
 formation, 376
 oxonium, 526
 phosphorus, 260, 364, 531
 sulphinyl, 260
 sulphonium, 529, 530
 Wittig reaction, 456
- Yukawa–Tsuno equation,
 for arenium ions, 307
 for benzyl cations, 298, 299,
 304
 for cyclopropylmethyl cations,
 310
 for nitrenium ions, 308
 for nucleophilic aliphatic
 substitution, 340, 343
- Zinc–metalloporphyrin
 oligomers, 477
- Zwitterions, 595, 602

Indexes compiled by P. and K. Raven.