Index

Page numbers in *italics* indicate illustrations; numbers followed by "t" indicate tables; numbers followed by "n" indicate notes.

Abscissa, 7
Absolute rate theory, 297–298
Absolute scale (temperature), 5
Absorbance, transmittance of light and, 81
Absorption, adsorption vs., 370
  of drugs, apparatus and procedures for study of, 330, *330*
    buccal, 350, 527
    gastrointestinal, 342–346, *344*, *345*, 530–531, *531*
    interference with, by adsorption, 382, 383–384
    nasal, 526
    parenteral, *546*, 546t
    percutaneous, 346–350, *347–349*, 538–540, *538*, *539*
    rectal, 536–537
    surface-active agents and, 386
    transcorneal, 346, 522–523, *522*
    vaginal, 350–351, *350*, *351*, 351t
"Absorption base," usage of, 499
Absorption coefficient, Bunsen, 215–216, 216t
Absorption spectroscopy, complex analysis using, 266–268, *266*
Absorptivity, molar, 81, 82t
Acceleration, 3t
Accuracy, analysis of, 14–15
  defined, 12
Acetaminophen, activated charcoal and acetylcysteine for poisoning by, 283
Acetic acid, ionization of, 144–145
Acetone-chloroform solution, vapor pressure of, 108–109, *108*
Acetylcysteine, adsorption of, on activated charcoal, 383
Acetylsalicylic acid. *See* Aspirin
Acid(s), buffer solutions containing, buffer equation for, 169–170
  defined, 143, 144
  polyprotic (polybasic), ionization of, 149
    pH calculation for solutions of, 156–157
  strength of, 143
  strong, pH calculation for solutions of, 154
  triprotic (tribasic), ionization of, 149
    titration curve for, 176, *176*
  weak, ionization of, 144–145, 147t
    pH calculation for solutions of, 155, 158, 159–160
    preservative action of, in oil-water systems, 240–241
α_1-Acid glycoprotein, drug binding by, 268
Acid-base catalysis, general, 303–304, *303*
  specific, 301–303, *302*
Acid-base pair(s), in protolysis, 143
  pH calculation for solutions of, 154–155, 156–157, 158
Acid-base reaction(s), 143–144, 144t. *See also* Hydrolysis; Ionization; Neutralization
  equilibrium in, 144–149
Acidity constant(s), 145, 160–163
  basicity constant and, 146–149
  for weak acids, 147t
Activation energy, 297
  drug transport through cornea and, 523
  for flow, 455
  in collision theory, 297
  in diffusion studies, 352–353, *352*
  in transition state theory, 297
Active center(s), in catalysis, 301
Active transport, in gastrointestinal absorption, 342, 530–531
Activity, 69
  of electrolyte solutions, 131–134
    reference state for, 134
    standard state for, 134
  of solvent, 133–134
Activity coefficient(s), 69
  buffer equation and, 170–171
  calculation of, 135–137, 136t
  in solubility calculations, 223–225
  of solvent, 134
  of strong electrolyte solutions, 131–133
Addition, significant figures in, 11
Addition polymerization, 519–520, *520*, 558
Additive properties, 77–78, 102
  complex analysis using, 260–261, *261*
Adhesion, work of, 368–369, *369*
Adhesive diffusion–controlled system(s), for transdermal drug delivery, 544, *544*
Adhesive patch(es), for buccal drug administration, 527–528
  for transdermal drug delivery. *See* Transdermal device(s)
Adhesive strength, dry film thickness and, in ocular drug delivery systems, 524
Adiabatic expansion, gas cooling by, 28
Adiabatic process, 55
Adsorbate, 380
Adsorbed state, in solubilization, 411, 412
Adsorbent, 380
Adsorption, at liquid interfaces, 370–379
  at solid interfaces, 379–386
    solid-gas, 380–382, *380*, *381*
    solid-liquid, 382, *383*
    solid-solid, 382–383
  chemical, 380
  defined, 370
  Gibbs' equation for, 373–375, *374*, *375*
  monomolecular, in emulsification, 488–490, *489*
  multimolecular, in emulsification, 490
  negative, 370
  physical, 380
  pore size and, 440–442, *440*, *441*
  positive, 370
  solid particle, in emulsification, 490
Adsorption isotherm(s), 380–382, *380–382*
Adsorption method for determining surface area of powder sample, 437–438, *437*, *438*
Aerodynamic diameter, 528
Aerosol(s), emulsification in, 487
  for pulmonary drug administration, 528–530
  principles of preparation of, 28
  Raoult's law and, 107

Aggregation, in lyophobic colloid preparation, 396
  in suspensions, 478, 479
Aggregation number, 396, 417
Air permeability method for determining surface area of powder sample, 438–439, *439*
Albumin, copper binding by, 253
  drug binding by, 268
Alcohol-water-benzene mixture, phase equilibria in, 44–45
Amalgam electrode(s), 191
p-Aminobenzoic acid (PABA), caffeine complexation with, 265–266, *265*
  multilayer diffusion of esters of, 338–339, *339*, *340*
Ampere, 126
Amphiphile(s). *See* Surface-active agent(s)
Amphiphilic colloid. *See* Association colloid(s)
Amphiprotic solvent(s), 143
Ampholyte(s), 149
  pH calculation for solutions of, 157
Amphoteric species. *See* Ampholyte(s)
Ampicillin, decomposition of, 305
Andreasen apparatus for particle size determination, 433, *433*
Angle of repose, of loose powder, 447–448
Angle of rotation, 96, 97t
Angstrom, 2
Anhydroglucose repeat unit, 560
Animal burrows, ventilation of, 354–355, *355*
Anion(s), 125, *125*
  activity of, in aqueous solution, 132
Anisotropism, 35
Anode, 125, *125*, 190, *190*
Antacid(s), drug adsorption by, 382
Antibacterial(s), surface-active agents and, 386
Antibiotic(s), adsorption of, onto sucrose or sorbitol particles, 382–383
Antidiarrheal preparation(s), drug adsorption by, 382
Antifoaming agent(s), 386
Antifreeze, 115–116
Antilogarithm, 6, *6*
Antioxidant(s), determining relative efficiency of, 209
  in drug formulations, 208, 209t
Antithixotropy, 459–460, *460*
Apomorphine, stability of, pH and, 205–206
Aprotic solvent(s), 143
Area, 2, 3t
Arithmetic mean, 12
Aromatic acid(s), solubility of, 232
Arrhenius equation, 295
Arrhenius factor, in collision theory, 296
  in transition state theory, 297
Arrhenius theory of electrolytic dissociation, 130–131
β-Artether, solubilization of, 412, *412*
Ascorbic acid, decomposition of, 207, 308–310, *309*
  photostabilization of, 311
Aspirin (acetylsalicylic acid), buffer capacity and absorption of, 179
  solubility of, 232
Association, entropy change in, 66
  in partition, 227–229
  in solutions of polar compounds, 229
Association colloid(s), 396–398, 398t
  stability of, 408
Asymmetry potential, 200
Atactic polymer, 582
Atmosphere (unit), 4
Atomic spectroscopy, applications of, 80
Atomic spectrum(a), 79–80, 80t
Atomic weight, equivalent weight and, 104–105
Attractive force(s), between molecules, 22–23, *22*, 23t
  between suspended particles, 478–479, *479*
Autoprotolysis constant of water, 146, 148t
Autoprotolytic reaction, 146
Autoxidation, of ascorbic acid, 308–309
Azeotropic mixture, 109–110
Azone, as enhancer of percutaneous absorption, 542, *542*

Balance(s), maintenance of, 3
Bancroft, rule of, 490
Barbiturate(s), solubility of, 232
Barbituric acid(s), substituted, dissociation exponent and free energy change for, 162t
Barrier, defined, 325
Base(s), buffer solutions containing, buffer equation for, 170
  temperature and pH for, 171
  defined, 143, 144
  diacidic, pH calculation for solutions of, 157–158
  polyprotic, ionization of, 149
  strong, pH calculation for solutions of, 154
  weak, ionization of, 145–146, 148t
    pH calculation for solutions of, 155–156, 159–160
Base(s) of compound(s). *See* Semisolid(s)
Basic strength of solvent, 143
Basicity constant(s), 145
  acidity constant and, 146–149
  for weak bases, 148t
Beckmann method for determination of freezing point lowering, 114–115, *115*
Beckmann thermometer, 114n
Beer's law, 81
Beer's law plot, 82, *83*
Benesi-Hildebrand equation, 266, *267*
Benzaldehyde, photooxidation of, 310–311, *311*
Benzene-water-alcohol mixture, phase equilibria in, 44–45
Benzocaine, sodium salicylate complexation with, 256–257
Benzoic acid, caffeine complexation with, 265
  distribution of, between benzene and acidified water, 239, 239t
    between oil phase and water phase, 237–239, *237*
  preservative action of, in oil-water systems, 240–241
  solubility of, 232
BET equation, 381, 437
BET method for determining surface area of powder sample, 437–438
Beta blocker(s), ocular administration of, 522, 523
Bicarbonate/carbonic acid buffer of blood, 177
Binary system(s), distillation of, 109–110, *109*
  liquid, influence of third substance on, 219
  phase diagrams for, 38–43, *40–42*
Binding equilibria, 269
Binding sites, 269
Bingham body(ies). *See* Plastic flow
Binodal curve, in ternary system, 45, *45*
Birefringence, 36
Bleeding, from ointment bases, syneresis vs., 497
Blending, 219
Blood, buffers in, 177
  circulation of, *462*
  freezing point of, 181
  normal osmolality of, 140
Body fluids. *See also* Blood
  normal osmolality of, 140
  viscoelastic analysis of, 471
Bohr magneton, 91
Boiling point, 28–31
  elevation of, equation and proportionality constant for, 121t
    for solutions, 112–113, *112*, 112t, *113*
    molecular weight determination from, 120
  in binary mixture, 108–110, *109*
  latent heat of vaporization and, 30, 30t
Boltzmann distribution law, 296
Boltzmann's formula, 65
Bond energy(ies), 24, 24t
  heat of reaction estimation from, 59–60
Bonded drug system(s), for oral administration, 532
Boric acid, tonicity of solution of, 180
Boundary condition(s), 598
  in diffusion studies, 354
Boyle's law, 28
Breaking of emulsions, 491–492
Breath-holding, in pulmonary drug administration, 528–529
Briggsian logarithm, 5
Brönsted-Lowry theory, 143–144
Brookfield viscometer, 465, *465*
Brownian motion, in colloids, 400
  in suspensions, settling and, 480
  interference by, in particle counting, 493
Buccal absorption, 350, 527

drug product design for, 527–528
Buffer(s). *See also* Buffered solution(s)
defined, 169
drugs as, 171
in vivo biologic, 177
pharmaceutical, 177–178
preparation of, 173–180
reference, for standardizing pH meters, 199, 199t
TRIS, 178
universal, 176–177, *176*, *177*
Buffer capacity, 173–177
calculation of, 173–174, 173t
concentration and, 174
maximum, 174
neutralization curves and, 174–176, *175*, *176*
tissue irritation and, 178–179
Buffer efficiency. *See* Buffer capacity
Buffer equation, 169–173
activity coefficients and, 170–171
for weak acid and its salt, 169–170
for weak base and its salt, 170
Buffer index. *See* Buffer capacity
Buffer value. *See* Buffer capacity
Buffered solution(s), 169–189
factors influencing pH of, 171
isotonic, for dilution, 186t
Bulge, in hysteresis loop of thixotropic material, 459, *459*
Bulk, 446
Bulk density, 443
determination of, 444–445
true density vs., 446t
Bulk polymerization, 519
Bulk volume, 442–443
specific, 446
Bulkiness, 446
Bunsen absorption coefficient, 215–216, 216t
Butesin picrate, 256

Cacao butter, polymorphism of, 33–34
Caffeine, complexation with, 256
by p-aminobenzoic acid, 265–266, *265*
by benzoic acid, 265
by L-tryptophan, 268, *268*
hydrogen-bonded, 268
stability constants for, 266t
solubility of, in dioxane-water mixtures, 227–229, *227*, 228t
Calculator(s), 9–10
Calculus review, 595–601
Calomel electrode(s), 191–192, *191*, 196–197
Calorie, gram (small), 4
kilogram (large), 4
Calorimetry, differential scanning (DSC), 47–48, *47–49*, 584
Camphor-salol system, phase equilibria in, 42
Capacitance, 86
Capacity factors for energy, 53, 54t
Capillary rise method for surface tension measurement, 366–367, *366*
Capillary viscometer, 461–463, *462*
Capsule-type device. *See also* Microcapsule(s); Nanocapsule(s)
drug release from, 341–342, *341*
Carbamazepine, polymorphism of, 34–35, *35*
Carbonic acid/bicarbonate buffer of blood, 177
Carbowax(es), 499
Carboxylic acid(s), solubility of, 232
Carcinogenicity, picric acid complexation and, 256
Cardiovascular system, *462*
Carrier-mediated transport, in gastrointestinal absorption, 342, 530–531
Catalysis, 301–304
acid-base, general, 303–304, *303*
specific, 301–303, *302*
contact, 301
heterogeneous, 301
homogeneous, 301
solvent, 302–303, *302*
Catalyst(s), defined, 301
negative, 301
Catalytic coefficient(s), 303–304
Catecholamine(s), binding of, polyadenylic acid and, 268
lithium complexes with, analysis of, 264
Cathode, 125, *125*, 190, *190*
Cation(s), 125, *125*
activity of, in aqueous solution, 132
CD (circular dichroism), 98, *98*
Cell constant, 127–128
Cellulose, microcrystalline, 583
rheologic properties of, 473, *473*
structure of, 560
Centigrade scale, 5
Centimeter, 2
Cephalosporin(s), circular dichroism spectra of, 98
Cgs system, 1, 2t, 3t
Chain polymerization, 519–520, *520*, 558
Chain reaction(s), in catalysis, 301
Channel lattice complex, 257–258, *258*
Characteristic (logarithm), 6
Charcoal, activated, drug adsorption on, 383–384
Charge-transfer complex(es), 254–255
analysis of, 266–268, *267*, 267t
Charles' law, 25
Chelate(s), 253–254
Chelation, thermodynamics of, 274–275, 276t
Chemical potential, 67–68
Chemical shift, 92–93, *93*, 93t, 94, *94*, 94t
Chemisorption, 380
Chemoembolization, 519, *519*
Chewable tablet(s), extended-release, caffeine complexes in, 256
Chloramphenicol, decomposition of, 305
Chloroform-acetone solution, vapor pressure of, 108–109, *108*
Choleic acid(s), inclusion compounds involving, 257–258
Cholesteric liquid crystal(s), 36
Chromophore(s), 81
Chronoamperometry, 209
Ciliary movement, nasal drug administration's effects on, 527
Circular dichroism (CD), 98, *98*
Cisplatin, microspheres incorporating, 517, *518*
Clapeyron equation, 31, 68
Clark-Lubs buffer(s), 178
Clathrate(s), 258–259, *259*
Clausius-Clapeyron equation, 29, 68
Clausius-Mossotti equation, 87
Closed system(s), defined, 55
diffusion in, 353–354, *353*
Cloud point, 415–416
CMC (critical micelle concentration), 396
Coacervation, 409–410, 574–575
cloud point and, 416
in polymer solutions, 572, 574–575
Coalescence of emulsions, 491–493
Coarse dispersion(s), 477–511. *See also* Emulsion(s); Semisolid(s); Suspension(s)
defined, 101, 393, 394t
drug diffusion in, 504–506, *504–506*
drug kinetics in, 502–503, *503*
Cocoa butter, polymorphism in, 33–34
Cohesion, work of, 369, *369*
Cohesive force(s), interchain, in polymers, 578–580, 579t
Cold drawing, necking and, 578
orientation and, 583
Cold flow, 576, *576*
Colligative properties of solutions, 101–102
coefficients for expression of, 137–140
determining value of one from another, 120–121t, 121t
of concentrated nonelectrolytes, 129–130, *129*
of electrolytes, 129–130, *129*
of nonelectrolytes, 110–119
Collision theory of reaction rates, 296–297
Colloid(s), 393–422
amphiphilic (association), 396–398, 398t
stability of, 408
defined, 101, 394t
electric properties of, 405–410
hydrophilic, 395
as emulsifying agents, 488, 488t, 490

Colloid(s), *(cont.)*
stability of, 409–410
hydrophobic, protection of, 410, 410t
sensitization of, 410
kinetic properties of, 400–405
lipophilic, 396
lyophilic, 395–396, 398t
stability of, 408–410
lyophobic, 396, 398t
stability of, 408, *409*
molecular weight of. *See under* Molecular weight(s)
optical properties of, 398–400
pharmaceutical applications of, 395
protective, 410, 410t
in formulation of suspensions, 483–484, *484*
stability of, 408–410, *409*
types of, 395–398
Colloid mill(s), 896, 485
Colloidal particle(s), characteristics of, 393–395, *394*, *395*
separation of, 394, *394*
shapes of, *395*
viscosity and, 405
Colonic pore radius, rectal drug absorption and, 537–538
Colorimetric method for pH determination, 172–173
Combustion, heat of, 59
Common ion effect, buffer equation and, 169
solubility of slightly soluble electrolyte and, 231
Compaction, 448–449, *448*
Complex(es). *See also* Complexation; Inclusion compound(s)
charge-transfer vs. donor-acceptor, 254–255, *255*. *See also* Charge-transfer complex(es); Electron donor–acceptor complex(es)
classification of, 251, 251t
drug, 256–257
in parenteral formulations, 546
hydrogen-bonded, with proton donors, 268
in catalysis, 301
inner-sphere, 253
inorganic, 251–253
metal ion, 251–254
methods of analysis of, 260–268
organic molecular, 254–257, 257t
outer-sphere, 253
polymer, 257, 257t
Complexation, 251–268. *See also* Complex(es); Inclusion compound(s)
factors affecting, 273–274
in multicomponent systems, solubility and, 236
in parenteral formulations, 546
in solution, entropy change in, 66
thermodynamics of, 274–277, 276t
Complexation constant, in spectroscopic complex analysis, 266
Compliance, 468, *469*, *470*
Component(s), defined, 66, 101
Compressed tablet(s), 448–449, *448*
Computer(s), 8–10
Concentration, as function of pH, 152–153
buffer capacity and, 174
expressions for, 102–104, 103t, 104t
Concentration cell(s), 198–199
Condensation, in lyophobic colloid preparation, 396
Condensation polymerization, 519, 558
Condensed system(s), 39
Conductance, 127–129, *127*, *128*
equivalent, *127*, 128–129, *128*
degree of dissociation and, 130–131
specific, 127, *127*
Conductance ratio, 131
Conductivity curve, in assessment of emulsion stability, 493, *494*
Cone and plate viscometer(s), *465*, 466–467, *466*
Configuration, conformation vs., 563n
crystal, solubility and, 237
molecular, solubility and, 237
Conformation of polymers, 563–565, *563*, *564*
at Θ temperature, 573
entropy of fusion and, 584–585
Conjugate pair(s). *See* Acid-base pair(s)
Conjugate phase(s), 40
Consecutive reaction(s), 292–293
Consolute temperature, lower, 41, *41*, 219
upper, 40, *40*, *41*, 218–219
for polymer solutions, 572
Constituent(s), defined, 101
Constitutive properties, 77–78, 102
Contact angle, in surface tension measurement by capillary rise method, 366, *366*
wettability and, 384–386, *384*, 481
Contact catalysis, 301
Container(s), polymeric, drug complexation with, 257
Continental method for preparation of emulsions, 494
Continuous variation method of complex analysis, 260–261, *261*
Contour length, of polymer chain, 564
Controlled delivery. *See* Sustained-release dosage form(s)
Convective diffusion, 334–335
Coordination number, 251
Copolymer(s), 558
alternating, 558
block, 558
graft, 559
random, 558
Copper, as catalyst in ascorbic acid oxidation, 309–310
Cornea, absorption through, 346, 522–523, *522*
Correlation coefficient, 15–16
Cosolvency, 234, *234*
Cosurfactant(s), in microemulsion formation, 495–496, *495*
Cotton effect, 97, *97*
Cottrell boiling point apparatus, 113
Couette-type viscometer, 468
Coulomb, 126
Coulter counter, particle volume measurement using, *431*, 434–436, *434*
Counterion(s). *See* Gegenion(s)
Coupling constant, 94
Covalent bond, strength of, 24
"Cream," usage of, 499
Creaming of emulsions, 490–491
interference by, in particle counting, 493
Creep, 576, *576*
Creep curve(s), 468–469, *469*, *470*
Creep viscometer, 468, *470*
Crenation, in hypertonic solution, 180
Critical micelle concentration (CMC), 396, *397*
prediction of, for mixture, 397–398
Critical point, for emulsion stability, 491–492
Critical pressure, 27
Critical radius, 480
Critical solution temperature, 40, *40*, *41*, 218–219
for polymer solutions, 572
Critical surface tension, wetting and, 385–386, *385*
Critical temperature, 27–28
Critical zeta potential, stability of lyophobic colloid and, 408
Croscarmellose sodium, 559
Crosspovidone, 559
drug complexation with, 257
Cryoscopic constant, 112t, 114, *114*
Cryoscopic method, for molecular weight determination, 120, 121–122
for tonicity adjustment, 182, 183t–184t
Crystal(s). *See also* Solid(s), crystalline
configuration of, solubility and, 237
growth of, during suspension storage, 485–486, *486*
liquid, 24, 36–37, *36*
systems of, 36
Crystallinity of polymers, 580–581, 581t
Crystallite(s), 582
size of, melting point and, 585
Crystallization of polymers, 582
of stretched homopolymer elastomers, 589
thermodynamics of, 583–586, 584t
Cumulative frequency plot, for particle size, 427, *429*
Cup and bob viscometer(s), 463–466, *465*, *464*
Cupric chloride, electrolysis of, 126
Cyclodextrin(s), inclusion compounds involving, 259–260, *259*, *260*

Daniell cell, 190–191, *190*
DDT, dipole moments of isomers of, 88
Deaggregation, 331, *331*
Debye (unit), 87
Debye force, 22, 23t
Debye-Hückel equation, 135–137, 136t
Decomposition, double, in lyophobic colloid preparation, 396
  of drugs, 305–312
    classification of, 305
Decoupling, in nuclear magnetic resonance, 96
Deflocculating effect of surface-active agents, 481–482
Deformation of solids, mechanisms of, 575
Degrees of freedom, in phase rule, 37–38
  in standard deviation estimate, 13
Delta (δ) value, 225
Demal solution, 128
Densitometer, helium, true density determination using, 443–444
Density(ies), 3, 3t
  apparent, 443n
  bulk. *See* Bulk density
  granule, 443
    determination of, 444, *444*
  of emulsion phases, creaming and, 490–491
  of gas, diffusion rate and, 26
  of powder, 443–446
  relative, 3
  true, 445t
    bulk density vs., 446t
    defined, 443
    determination of, 443–444, *444*
Deoxycholic acid, inclusion compounds involving, 257–258
Deposition, 24
Desorption, 380
Detergent(s), 386
Determinate error, 11–12
Deviation, mean, 13–14
  standard, 13–14, 427
Dextrorotatory substance, 96
Diacidic base(s), pH calculation for solutions of, 157–158
Dialysis, defined, 324
  dynamic, for protein-binding determination, 271–272, *271*
  equilibrium, for protein-binding determination, 270
  for separation of colloidal particles, 394, *394*
  gastrointestinal, 383
Diameter(s), aerodynamic, 528
  equivalent, calculation of surface area from, 436
  equivalent spherical, 425
  Feret, 431, *432*
  geometric mean, 427–428, *429*
    on weight basis, 430
  Martin, 431, *432*
  mean effective ionic, 136, 136t
  projected area, 431, *432*
  statistical, 426t
  Stokes', 425
  volume surface, Fisher subsieve sizer for determination of, 439
Dibasic acid(s). *See* Diprotic acid(s)
Dichroism, circular (CD), 98, *98*
Dielectric constant, 86, 87t
  influence of, on reaction rate, 300, 301t
  solubility and, in gas-liquid systems, 213, 214
    in liquid-liquid systems, 219, *220*
Differential(s), 596
  exact, 597
    inexact vs., 54
  total, 597
Differential heat of solution, 59, 230
Differential scanning calorimetry (DSC), 47–48, *47–49*, 584
Differential thermal analysis (DTA), 48–49, *48*, 584
Differentiation, partial, 596–598, *597*
  rules of, 595–596, 595t
  successive, 596–598
Diffuse double layer, 387–388, *387*, *388*
  zeta potential and, *405*
Diffusion, 324–361
  across stratum corneum, 346–349, *348*, 539, *539*
  apparatus and procedures for study of, 329–330, *330*
  aqueous layer control, 338
  convective, 334–335
  defined, 324, *325*
  Doluisio technique, rat gut absorption, 344
  Donnan membrane equilibrium in, 407–408
  ecology and, 354–355, *355*
  in closed system, 353–354, *353*
  in coarse dispersions, 504–506, *504–506*
  in colloids, 400–401
  in systems with one open boundary, 354, *354*
  membrane layer control, 338
  multilayer, 337–339, *337–340*
    under diffusion-layer control, 338–339, *339*
    under membrane control, 338, *339*
  principles of, in biologic systems, 342–351
  rate of, for gas, density and, 26
  steady-state, 325–329
  thermodynamics of, 351–353
  vehicle-controlled, 506
Diffusion cell, Granam, 353–354, *353*
Diffusion coefficient(s), 325, 328t, 329t
  calculation of, 332–333
  factors influencing, 328
  for colloids, 400–401
Diffusion layer, 331, *332*
Diffusion rate, of gas, density and, 26
Diffusional exponent, drug release from gel and, 497
Diffusion-layer control, aqueous, 338
  in gastrointestinal absorption, 344–345
  in multilayer diffusion, 338–339, *339*
Diffusivity. *See also* Diffusion coefficient(s)
  factors influencing, 328
Diflorasone diacetate, percutaneous absorption of, 347–348, *348*
Dilatancy, *454*, 457, *457*
  antithixotropy vs., 460
  defined, 448
  milling of materials exhibiting, 485
Diltiazem, cyclodextrin complexation with, to slow release, 260
Dilution value, 171, 199t
Dimension(s), 1–5, 2t, 3t
  calculations involving, 5
Dimethyl sulfoxide (DMSO), as enhancer of percutaneous absorption, 542, *542*
Dioxane-water mixture(s), caffeine solubility in, 227–229, *227*, 228t
Dipole interaction(s), 22–23, 23t
  solubility and, 214–215
Dipole moment, induced, 86–87
  permanent, 87–89, 88t
Diprotic acid(s), ionization of, 149
  pH calculation for solutions of, 157
Discrepant results, identification of, 15
Disintegration, 331, *331*
Dispersed system(s), 393
  classification of, 393, 394t
  coarse. *See* Coarse dispersion(s); Emulsion(s); Semisolid(s); Suspension(s)
  colloidal. *See* Colloid(s)
  molecular, 393, 394t. *See also* Solution(s)
  solid, 42–43
Dispersion, in lyophobic colloid preparation, 396
  measures of, 12–14
Displacement reaction, 144, 144t
Dissociation, Arrhenius theory of, 130–131
  degree of, 130–131
  in partition, 237–239
Dissociation constant(s), 145. *See also* Acidity constant(s); Basicity constant(s)
  catalytic coefficient and, 304
  of components of universal buffer system, 176, *176*
  of water, 146, 148t
  potentiometric determination of, 204–205, *204*
  temperature and, 163, 163t
Dissociation exponent, 152
Dissolution, 330–335, *331*, *332*
  apparatus for study of, 332, *332*
  of polymers, thermodynamics of, 569–570

Dissolution (cont.)
of powder, 323–334, *333*, 334t
rate of. *See* Dissolution rate
Dissolution rate, 330–332
for film-coated dosage form, 532–533
ocular drug bioavailability and, 522
Dissolution rate constant, calculation of, 332–333
Dissolved state, in solubilization, 411
Distillation, of binary mixtures, 109–110, *109*
steam, 110
Distribution. *See also* Partition
volume of, 543t
Distribution coefficient. *See* Partition coefficient(s)
Distribution law, 237
Distribution method of complex analysis, 264–265, *264*
Distribution ratio. *See* Partition coefficient(s)
Division, significant figures in, 11
DLVO theory of stability of lyophobic colloids, 408, *409*
DMSO (dimethyl sulfoxide), as enhancer of percutaneous absorption, 542, *542*
Doluisio method for in situ rat intestinal absorption, modified, 544, *544*
Donnan membrane equilibrium, 407–408
L-Dopa, prodrug for rectal administration of, 537
Double decomposition, in lyophobic colloid preparation, 396
Double layer. *See* Diffuse double layer
Doxorubicin, decomposition of, 305–306
Draves test, 386
Drug(s), decomposition and stabilization of, 305–312
physical properties of molecules of, 77–100
release of, 335–342
from capsule-type device, 341–342, *341*
from granular matrix, *335*, 336–337
from Ocusert system, 524–525, *525*
from polymer matrix, 335–336, *335*, 340–341
from topical vehicles and matrices, 339–340
sustained. *See* Sustained-release dosage form(s)
Drug carrier(s), 518–521
for oral administration, 533–534
Drug complex(es), 256–257
in parenteral formulations, 546
Drug product design, 512–555
DSC (differential scanning calorimetry), 47–48, *47–48*, 584
DTA (differential thermal analysis), 48–49, *48*, 584
DuNoüy ring method for measuring surface and interfacial tension, 367–368, *367*, 368t
Duplex film, 368
Dustability, 447
Dynamic dialysis, for protein-binding determination, 271–272, *271*
Dyne, 3

e (natural logarithm base), 5
$E_{1cm}^{1\%}$, absorbance, 82
Ebonite, 589
Ebullioscopic constant, 112, 112t, 113, *113*
Ecology, diffusion and, 354–355, *355*
EDTA, 253, 254
Efficiency of heat engine, 60–61
Elasticity, 467
modulus of. *See* Young's modulus
Elastomer(s), 588–590
interchain cohesive forces in, 579
mechanical properties of, 578, 578t
Electric double layer. *See* Diffuse double layer
Electric properties, of colloids, 405–410
of interfaces, 386–388, *387*, *388*
Electricity, units used in, 126
Electrochemical cell(s), 190–199
electromotive force of, 190–191, *190*
calculation of, 197–198
measurement of, 193, *193*
standard, 195–196, *196*
irreversible, 191
reversible, 191
thermodynamics of, 193–194
Electrode(s), 191–193, *191*, *193*
amalgam, 191
calomel, 191–192, *191*, 196–197
combination, 201
fluoride, 202, *202*
gas, 192
glass pH, 192–193, *193*, 200–201, *201*
hydrogen, 192
for pH determination, 199–200
indicator, 191
inert (oxidation-reduction), 192
ion-selective, 201–203, *202*, *203*, 203t
potentiometric titration using, 204
membrane, 192–193, *193*
ion-selective, 201–203, *202*
metal–insoluble salt, 191–192, *191*
metal–metal ion, 191
nickel, 191
pH, 199–201, *201*
platinum, 192
quinhydrone, 192
reference, 191, 196–197, *197*, 199
silver chloride, 192, 196–197
Electrode potential(s), in electrochemical cell, 191
calculation of, 194–195, 195t
standard, 196–197, *197*
Electrodialysis, 394
Electrokinetic potential. *See* Zeta potential
Electrolysis, 125–126, *125*
Electrolyte(s), as flocculating agents, 482–483, *482*
defined, 102
effects of, on electrokinetic potential at solid-liquid interface, 388
monoprotic, 149
polyprotic. *See* Polyprotic electrolyte(s); Tribasic acid(s)
slightly soluble, solubility calculations for, 230–232, 231t
solutions of, 125–142
calculations in preparation of, 105–106
properties of, 125–130
reference state for, 134
standard state for, 134
stability of parenteral emulsions and, 492, *492*
stabilization of lyophobic colloid using, 408
strong, 130
defined, 102
equivalent conductance of, 128–129, *128*
solubility of, 229–230, *229*
theory of, 131–137
weak, 130
defined, 102
equivalent conductance of, 128–129, *128*
solubility of, 232–236
Electrolytic dissociation, Arrhenius theory of, 130–131
Electromagnetic radiation, 78–79
wave characteristics of, 90, *91*
Electromagnetic spectrum, 78, 78t
Electrometry, 193–209
Electromotive force, 190–211
of concentration cell, 198–199
of electrochemical cell, 190–191, *190*
calculation of, 197–198
measurement of, 193, *193*
standard, 195–196, *196*
Electron density map, 31, *31*
Electron donor–acceptor complex(es), 254, 255, *255*
analysis of, 266–268, *266*
thermodynamics of, 275–276, *276*, 276t
Electron gas, 30
Electron microscope, for colloid study, 398–399
Electron paramagnetic (spin) resonance spectroscopy, 90–91
Electronic theory of Lewis, 144
Electronic transition(s), of atoms, 79–80, 80t
of molecules, 80–81, *80*
Electro-osmosis, 406–407
Electrophoresis, 406
Electrostatic interaction, thermodynamics of, 276t
Electrothermodynamic potential, 387
Ellipticity, molar, 98
Elongation, 575
Elongation to break, *576*, 577

Embedded dosage form(s), for oral administration, 533–534
Emulsifiable base(s), 499, 499t
Emulsification, theories of, 487–490
Emulsified base(s), 499, 499t
Emulsifying agent(s), 487, 488, 488t
  desirable qualities in, 492–493
  viscosity of emulsions and, 495
Emulsion(s), 486–496
  Continental method for preparation of, 494
  defined, 486–487
  oil-in-water (o/w), 487
  parenteral, 547
    stability of, 492, *492*
  pharmaceutical applications of, 487
  preservation of, 494
  required hydrophile-lipophile balance for, 371–373, 372t
  rheologic properties of, 494–495
  stability of, 490–494
    evaluation of, 493, *493*, *494*
  types of, 487
    determination of, 487
    factors determining, 490
  water-in-oil (w/o), 487
Emulsion base(s), 499, 499t
  comparison of, 499–500
  water washable, 499, 500
Emulsion polymerization, 519–520, *520*
Enantiotropism, 35
Endothermic process, 58
End-to-end distance of polymer chain, 564, *564*
Energy, 3t, 4
  activation. *See* Activation energy
  bond, 24, 24t
    heat of reaction estimation from, 59–60
  free. *See* Free energy
  ground state, 30
  intensity and capacity factors for, 53, 54t
  internal, components of, 56
    requirements for definition of, 54–55
  kinetic, 53
  lattice, 230
  potential, 53
Energy of activation. *See* Activation energy
Enhancer(s). *See also* Permeability enhancer(s)
  for percutaneous absorption, 541–542, *542*
Enthalpy, 56–57
Entropy, 60, 61–63, *63*
  absolute, 63
  defined, 62
  spontaneity and, 62, 65–66, 66t
  units (e.u.), 249
Entropy of crystallization, for polymers, 584–585
Entropy of fusion, for polymers, 584–585
Entropy of mixing, in polymer solutions, 570–571
Enzyme(s), in ion-selective electrodes, 202–203
Ephedrine, as buffer, 171
Epimerization, reversible, of tetracyclines, 290–291, *291*
Epinephrine, stabilization of, 310
EPR (electron paramagnetic resonance) spectroscopy, 90–91
Equation(s), defined, 3
  first-degree, graphing of, 7–8, *8*, 8t
  second-degree (quadratic), graphing of, 8
Equation of state, 54
  for ideal gas, 25
Equilibrium(a), criteria for, 65–66, 66t
  defined, 144
  Donnan membrane, 407–408
  flocculation, 480, *480*
  in acid-base reactions, 144–149
  in heterogeneous system, 67–68
  in protein binding, 269–270, *269*
  ionic, 143–168
  phase. *See* Phase equilibrium(a)
Equilibrium constant, standard free energy change and, 69–71
Equilibrium dialysis, for protein-binding determination, 270
Equilibrium method for determination of freezing point lowering, 115
Equilibrium swelling, 498
Equivalence point of titration, 175
Equivalent conductance, *127*, 128–129, *128*
  degree of dissociation and, 130–131
Equivalent diameter(s), calculation of surface area from, 436
  spherical, 425
Equivalent weight(s), 104–106
Erg, 4
Error(s), analysis of, 11–17
  defined, 11
  determinate, 11–12
  indeterminate, 12, *12*
  mean, 14–15
  pseudoaccidental (variable determinate), 12
  relative, 15
Erythrocyte(s), buffer systems in, 177
Erythromycin, decomposition of, 306
Escaping tendency, 106
  chemical potential as measure of, 68
ESR (electron spin resonance) spectroscopy, 90–91
Ester(s), complexation of, 256
esu (electrostatic unit), 37n
Ethyl chloride spray, as local anesthetic, 28
Ethylenediaminetetraacetic acid (EDTA), chelation by, 253–254, *254*
Ethynylestradiol, solvates of, 35
Eudragit, 435
Eutectic point, 42, *42*
Eutectic system(s), drug release from, 505–506, *505*, *506*
  regarded as solid dispersions, 42–43
Excipient(s), in dispersion medium, stability of suspension and, 486
  transdermal penetration of drugs and, 540
Exhaled dose fraction, 528–529
Exothermic process, 58
Expansion, adiabatic, gas cooling by, 28
  work of. *See* Work of expansion
Exponent(s), 5, 5t
Exponential relationship, graphing of, 8–9, *9*, 9t
Extended-release system(s). *See* Sustained-release dosage form(s)
Extraction, 239–240
Extrusion, 590–591, *590*, *591*

Fabrication technology, for polymers, 590–591, *590*, *591*
Falling sphere viscometer, 463, *463*
Faraday (unit), 126
Faraday's laws, 126–127
Faraday-Tyndall effect, 398
Fatty acid(s), as enhancers for rectal formulations, 537
  solubility of, 232
FD&C Blue No. 2, photodegradation of, 312
FD&C Red No. 3, photodegradation of, 312
Feret diameter, 431, *432*
Ferranti-Shirley viscometer, 466, *466*
Ferric sulfate solution, electrolysis of, 126
Fick's first law, 325
  applied to colloids, 400–401
Fick's second law, 325–326, *326*, 353–354
Field flow, interference by, in particle counting, 493
Film(s). *See also* Monolayer(s)
  duplex, 368
  insoluble, 375–379
    at liquid surfaces, 373
    effects of compression of, 376–377, *377*, *378*
  polymer. *See* Packaging film(s)
Film balance, 375–378, *376*
  dimensions of molecules determined by, 377–378, 379t
Film pressure, 376–377, *377*
Film-coated dosage form(s), for oral administration, 532–533, 533t
First-order reaction(s), 285, 287–288, *287*, 287t, *288*
First-order transition(s), 587, *587*
Fisher subsieve sizer, 439, *439*
Flavonoid(s), ascorbic acid oxidation and, 309–310 *482*
  degree of, 481
  in structured vehicles, in formulation of suspensions, 483–484, *484*

Flocculation, controlled, in formulation of suspensions *(cont.)*
in suspensions, 476–479, *479*
plastic flow and, 456
sedimentation and, 480
Flocculation equilibrium, 480, *480*
Flory temperature, 572–573, 573t
Flory-Huggins theory of polymer solutions, 570–571, *570*
Flow properties. *See* Rheologic properties; Viscosity
Fluidity, 454–455
Fluocinolone acetonide, in oil-in-water cream base, degradation of, 503, *503*
Fluorescence, 84–85, *85*, 86t
Fluoride electrode, 202, *202*
Fluorinated hydrocarbon(s), as propellants in aerosols, 28
Fluorometer, filter, 84–85, *85*
Flux, 325
Foam(s), 386
Foaming agent(s), 386
Force, 3–4, 3t
Formation, standard heat of, 58–59, 59t
Formation constant(s), in pH titration method of complex analysis, 262–263, 264t
Formation curve, in pH titration method of complex analysis, 263, *263*
Fraction released, for matrix tablets, 534
Fractionation of polymers, 572, *572*
Free energy, 60. *See also* Free energy change
applications of, 63–72
escaping tendency and, 106
partial molar, 67–68
per monomer of micelle, 417
pressure and temperature coefficients of, 64–65
surface. *See* Surface free energy
Free energy change, of complexation, stability constant and, 274
of ionization, 161–162
of micellization, 417–418
standard, 69–71
Free energy of mixing, in polymer solutions, 569, 571
Freedom, degrees of. *See* Degrees of freedom
Free-draining coil model, viscosity of polymer solution in, 565
Freeze-drying, kinetics of, 337
Freezing point, 31. *See also* Melting point
depression of, equation and proportionality constant for, 121t
molecular weight determination from, 120, 121–122
of solutions, 113–116, *115–115*
osmolality and, 139, 140
osmotic pressure and, 121
tonicity adjustment using, 182, 183t–184t
triple point vs., 39
Frequency, characteristic, of electromagnetic radiation, 78
Frequency distribution curve, for errors, 12, *12*
for particle size, 426–427, *427–429*
Frequency factor. *See* Arrhenius factor
Frequency plot, cumulative, for particle size, 427, *429*
Freundlich isotherm, 380
Fugacity, 68–69
Furosemide (Lasix), photodegradation of, 311
Fusion, heat of. *See* Heat of fusion
of polymers, thermodynamics of, 583–586, 584t

g factor, 91
Galvanic cell. *See* Electrochemical cell(s)
Gamma irradiation, polymer grafting with, 559
rigidity of gel and, 501, *502*
Gas(es), 24–27
behavior of molecules of, 26
electron, 30
equation of state for, 25
ideal, 25–26
first law of thermodynamics and, 56
laws concerning, 25
liquefaction of, 27–28
molecular weight of, 25–26
solid interfaces with, adsorption at, 380–382, *380*, *381*
solubility of, in liquids, 215–218
vapor vs., 28n
Gas constant, molar, 25
Gas electrode(s), 192
Gastrointestinal absorption, 342–346, *344*, *345*, 530–531, *531*
drug product design for, 530–536
Gastrointestinal dialysis, 383
Gastrointestinal Therapeutic System, 534–536, *534*, *535*
Gay-Lussac's law, 25
Gegenion(s), 387
in anionic association colloid, 397
Gel(s), 496–497, *497*
classification of, 496–497, *497*
defined, 574
drug release from, 497, 498
formation of, in polymer solutions, 574
rigidity of, 501, *502*
Gelatin, interaction of drugs and excipients with, 498
uses of, 557
General ideal gas law, 25
Geometric mean diameter, 427–428, *429*
on weight basis, 430
Gibbs adsorption equation, 373–375, *374*, *375*
Gibbs free energy function, 63–66
Gibbs-Helmholtz equation, 69
Glass pH electrode, 192–193, *193*, 200–201, *201*
Glass transition temperature, 518, 586–588, *587*
plasticizers' effects on, 588, 588t
Glass-rubber transition, 586–588, *586*, *587*
Glidant(s), 447–448
Glucose, degradation of, 292–293
Glycerin, in formulation of suspensions, 482
Glyptal(s), 558
Gold number, 410, 410t
Graduate(s), measurement using, 2
Grafting, polymer, 559
Graham diffusion cell, 353–354, *353*
Gram, 3
Gram calorie, 4
Granular matrix(ces), drug release from, *335*, 336–337
Granule(s), intraparticle porosity of, 444, 445t
size of, tablet weight variation and, 447
Granule density, 443
determination of, 444, *444*
Granule volume, specific, 446
Graph(s), construction of, 7–9, *8*, 8t, *9*, 9t
Graphic method for reaction order determination, 289
"Greaseless," usage of, 499
Ground state energy, 80
Gyration, radius of, of polymer chain, 564

Half-cell(s), 190
Half-life, 286, 288
Half-life equation(s), 289t
Half-life method for reaction order determination, 289–290, 289t
Half-reaction(s), 190–191
notation for, 194
Hansen paddle equipment, for dissolution study, 332, *332*
Hatch-Choate equation(s), 430, 430t
Heat, specific, heat capacity vs., 72n
work and, 4, 60–61. *See also* Thermodynamics
Heat capacity, molar, 57
specific heat vs., 72n
Heat content, 56–57
Heat engine, efficiency of, 60–61
Heat of combustion, 59
Heat of crystallization, of polymer, 583–584
Heat of formation, standard, 58–59, 59t
Heat of fusion, latent, 31
melting point and, 31–32, 31t
molar, 31, 222t
solubility of solid in ideal solution and, 221–222
of polymer, 584, 584t
Heat of hydration, 230
integral heat of solution and, 59
Heat of mixing, in polymer solutions, 570
Heat of neutralization, 60
Heat of reaction, estimation of, from covalent bond energies, 59–60
standard, 58

Heat of solution, differential (partial), 59, 230
for crystalline substance, 230
integral (total), 59, 230
solubility and, 229, 230, 230t
Heat of vaporization, 29
latent, 29
boiling point and, 30, 30t
solubility and, 224
Helium densitometer, true density determination using, 443–444
Helmholtz free energy function, 63–64, 65
Hemodialysis, 324
Hemoglobin, oxygen binding in, 216
Hemoglobin microcapsule(s), 516, *516*
Hemolysis, in hypotonic solution, 180
Hemolytic method for tonicity measurement, 180
Henderson-Hasselbalch equation. *See* Buffer equation
Henry's law, 109, 215
Henry's law constant, in solubility calculations, 216–218, 217t
inverse, in solubility calculations, 215, 217
Heparin, stability of parenteral emulsions and, 492, *492*
Hess's law of constant heat summation, 59
Heterodisperse substance, average molecular weight for, 560–561
HIAC/Royco particle analyzer, 435
Higuchi equation, 336, 504
Hildebrand solubility approach, extended, 227–229, *227*
Hill-Baldes technique for tonicity measurement, 180–181
Hixson-Crowell cube root law, 333–334
HLB. *See* Hydrophile-lipophile balance
Hoeppler falling ball viscometer, 463, *463*
Hofmeister series, 409
Homogenization, for prevention of creaming, 491
Homopolymer(s), 558
configurations of, 581–582
Hooke's law, 576
HPAMB (antiasthmatic agent), decomposition of, 310, *310*
Huggins equation, 562
Hybridization, 251–253, 252t
Hydration, heat of, 230
integral heat of solution and, 59
in hyophilic colloids, 395
of stratum corneum, permeability and, 540
Hydrocarbon(s), fluorinated, as propellants in aerosols, 28
Hydrocortisone, stability of, 292
Hydrogel(s), 497, 499, 499t
drug release from, 497
swelling and, 498
Hydrogen bond(s), 23–24, 23t, *24*
formation of, solubility and, 213–214
Hydrogen electrode, 192
for pH determination, 199–200
Hydrogen ion concentration. *See also* pH
in oxidation-reduction reactions, 205–206, 206t
pH and, 150, 150t
Hydrolysis, 144, 144t
in hyophobic colloid preparation, 396
Hydronium ion, 130, 148
Hydrophile-lipophile balance (HLB), 371–373, *371*, 372t
of emulsifying agents, 490
required (RHLB), 371–373, 372t
spreading and, 370
wetting and, 384
Hydrophilic colloid(s), 395
as emulsifying agents, 488, 488t, 490
stability of, 409–410
Hydrophilic powder, 481
Hydrophilic properties of semisolids, 500
Hydrophobic colloid(s), protection of, 410, 410t
sensitization of, 410
Hydrophobic interaction, in protein binding of drugs, 272–273, *272*
thermodynamics of, 274–275, *275*, 275t, 276, 276t
Hydrophobic powder, 481
Hydrophobicity, of ligands, formation of water-soluble complexes and, 273
Hydroquinone, clathrate formation by, 259, *259*
Hydroxy acid(s), solubility of, 232
Hydroxyl ion concentration. *See also* pH
pH and, 150t
Hygroscopic substance(s), in formulation of suspensions, 482
Hypertonic solution(s), 180
Hypotonic solution(s), 180

i-factor, 129
Ice skating, 32
Ideal gas(es), 25–26
first law of thermodynamics and, 56
Ideal gas law, 25
Ideal solution(s), solubility of liquids in, 218
solubility of solid in, 221–223
Imbibition, 497
Implant(s), polymer, 591–592
subcutaneous, 547
Inclusion compound(s), 257–260
cage-type, 258–259, *259*
lattice-type, 257–258, *258*
macromolecular, 260
monomolecular, 259–260, *259*, *260*
Indeterminate error, 12, *12*
Indicator(s), for oxidation-reduction titration, 206–207, 207t
of pH, 171–173, 172t
Indicator constant, 171
Indicator electrode(s), 191
Indomethacin (Indocin), complexation of, with cyclodextrin, 260, *260*
solubilization of, 416
Inert electrode(s), 192
Infrared spectroscopy, 89–90, *89*, *90*, 90t
Inhaler, metered-dose, for nasal drug administration, *527*, 527n
Inhibitor(s), 301
Initiator, in chain polymerization, 519–520, 558
Injection molding, 591
Insulin, self-regulating delivery system for, 547, *548*
Integral(s), 599t
definite, 599–600
Integral calculus, 598–601
Integral heat of solution, 59, 230
Integration, 598
between limits, 599–600
rules of, 598–599
Intensity factors for energy, 53, 54t
Interface(s), 362–392
classification of, 362, 362t
curved, pressure differences across, 365, *365*, 367
defined, 362
electric properties of, 386–388, *387*, *388*
liquid, 363–379
adsorption at, 370–379, *371*
of particles in suspension, 478–479, *479*
solid. *See* Solid interface(s)
Interfacial polymerization, microcapsule preparation using, 516
Interfacial tension, 363, 364t
in suspensions, 478
measurement of, 365–368
Intermolecular entanglements, viscosity of polymer solutions and, 566–567
Intermolecular forces, 22–24, *22*, 23t
boiling point and, 29–30
melting point and, 32–33, *33*, 33t
solubility and, 223–224
Internal energy, components of, 56
requirements for definition of, 54–55
Internal pressure, in liquid-liquid systems, solubility and, 218
of gases, 27, 27t
of liquids, 27
Interspace porosity, 445
Intersystem crossing, in phosphorescence, 84, 85, *85*
Intraparticle porosity, of granules, 444, 445t
Intrinsic viscosity. *See under* Viscosity
Invertase, microcapsules incorporating, 516
Ion(s), 130
potential-determining, 387
Ion exchange resin(s), drug binding to, 532
structure of, 559
Ion pair(s), in strong electrolyte solutions, 131–132
Ion product of water, 146, 148t

Ion size parameter, 136, 136t
Ion-dipole interaction, 23, 23t
  solubility and, 214
Ionic activity, mean, of strong electrolyte, 132–133
Ionic dissociation. *See* Dissociation
Ionic equilibrium(a), 143–168
Ionic strength, 134–135
  acidity constants and, 160–161
  influence of, on reaction rate, 299–300
Ion-induced dipole force, 23, 23t
Ionization, drug action and, 130
  free energy change of, 161–162
  of polyprotic electrolytes, 149
  of water, 146, 148t
  of weak acids, 144–145, 147t
  of weak bases, 145–146, 148t
  percent, 342
Ionization constant(s), 145. *See also* Acidity constant(s); Basicity constant(s); Dissociation constant(s)
  temperature and, 163, 163t
Ionization potential, 79–80
Ion-selective electrode(s), 201–203, *202*, *203*, 203t
  potentiometric titration using, 204
Iontophoresis, for transdermal drug delivery, 544–545, *544*
Iontophoretic enhancement factor, 545
Isoelectric point, 149
Isopiestic method for vapor pressure determination, 111, *111*
Isosmotic solution, 180
Isotactic polymer, 582
Isotherm(s), adsorption, 380–382, *380–382*
Isothermal process, defined, 55
Isotonic solution(s), 180–186, 186t
Isotonic value(s), 183t–184t
Isotropism, 35

Jelly, 496
Joule (unit), 4
Joule, James, 58
Joule-Thomson effect, 28

Keesom force, 22, 23t
Kelvin equation, 440–442
Kelvin scale, 5
Ketorolac, photodegradation of, 311, *312*
Kilogram, 3
Kilogram calorie, 4
Kinematic viscosity, 455
Kinetic chain length, in polymerization reaction, 520
Kinetic energy, 53
Kinetic equation, fundamental, 26
Kinetic method for protein-binding determination, 271–272, *271*
Kinetic molecular theory, 26
Kinetics, 284–323
  in coarse dispersions, 502–503, *503*
  in colloids, 400–405
  in solid state, 312–313, *313*
  of lyophilization, 337
Kirchoff equation, 57
Klotz reciprocal plot, 269
Kozeny-Carman equation, 439
Kraemer equation, 563
Krafft point, 415, *416*

L value, 137, *137*
  calculating tonicity using, 181–182, 181t
Lacrimal fluid, buffer capacity of, 177
  freezing point of, 181
  precorneal drug loss in, 522
  substitutes for, rheologic properties of, 472
Lag time, 328, *328*
  in multilayer diffusion, 337–338
    under diffusion-layer control, 339, *340*
Laminar flow, randomly-coiled macromolecules in, 565–566, *566*
Langmuir isotherm, 380–381
Languages, programming, 10
Laplace pressure, 411
Lasix (furosemide), photodegradation of, 311
Latex, in extended-release systems, 536
Lattice defect(s), 30
Lattice energy, 220
Laurocapram, as enhancer of percutaneous absorption, 542, *542*
Layer lattice complex(es), 258
Le Chatelier's principle, 31
Lecithin, stability of parenteral emulsions and, 492, *492*
Length, 2, 2t
Levodopa, prodrug for rectal administration of, 537
Levorotatory substance, 96
Lewis electronic theory, 144
Lidocaine-prilocaine mixture, phase equilibria in, 42
  release of, from emulsions and gels, 505–506, *505*, *506*
Ligand(s), 251
  cis-coordinated, in chelation, 253
  defined, 275n
Light, influence of, on drug decomposition, 310–312, *311*, *312*
  plane-polarized, 96, 98
  transmittance of, absorbance and, 81
Light microscopy, particle size determination using, 431, *431*
Light scattering, by colloid, 399–400, *399*, *400*
  quasi-elastic, 399
Limiting law, 106
Limiting viscosity number. *See* Viscosity, intrinsic
Linear regression analysis, 15–16, *16*
  multiple, 16–17
Lineweaver-Burk equation, 294, *294*
Lipid bilayer(s), in stratum corneum, 538
Lipophilic colloid(s), 396
Liposome(s), as drug carriers, 513–515, *514*
  as flocculating agents, 483
Liquid(s), 27–30
  boiling point of, 29–30
  solid interfaces with, adsorption at, 382, *383*
  solubility in, of gases, 215–218
    of liquids, 218–221
    of nonionic solids, 221–237
  solubility of, in liquids, 218–221
  vapor pressure of, 28–29, *29*
Liquid crystal(s), 24, 36–37, *36*
Liquid displacement method for true density determination, 444
Liquid interface(s), 363–379
  adsorption at, 370–379, *371*
Liquid junction potential, 197
Liter, 2
Lithium, catecholamine complexes with, analysis of, 264
Lithium ion(s), in glass lattice of electrodes, 201, *201*
Logarithm(s), 5–7, 7t
  common (Briggsian), 5
  natural (Napierian), 5
  significant figures in, 11
Logarithmic relationship(s), graphing of, 8–9, *9*, 9t
Log-normal distribution, 427, *429*
Log-probability plot, 427, *429*
Lonapalene, delivery of, from ointment, 504–505, *504*
London force, 22–23, 23t
Lower consolute temperature, 41, *41*, 219
Lyophilic colloid(s), 395–396, 398t
  stability of, 408–410
Lyophilization, kinetics of, 337
Lyophobic colloid(s), 396, 398t
  stability of, 408, *409*
Lyotropic liquid crystal(s), 36
Lyotropic series, 409

MacMichael viscometer, 463
Macromolecular inclusion compound(s), 260
Magnetic microcapsule(s), 517
Mantissa, 6
  significant figures in, 11
Mark-Houwink equation, 562
Martin diameter, 431, *432*
Mass, 2t, 3
  weight and, 4
Mass-action model of micellization, 417
Mathematics, 5–11
  of polymerization, 520

Matrix tablet(s), for extended oral administration, 534
Matrix-controlled transdermal device(s), 544
Matrix-type subcutaneous device(s), drug release from, 547, *547*
Matter, states of, 22–52
Maximum(a), computation of, 596
Maxwell element, *467*, 468
Mean, arithmetic, 12
  population (universe), 12
Mean deviation, 13–14
Mean diameter, geometric, 427–428, *429*
    on weight basis, 430
Mean effective ionic diameter, 136, 136t
Mean error, 14–15
Mean ionic activity coefficient(s), of electrolytes, 132–133, *133*, 133t
Measurement, 2
  precision in, significant figures and, 10–11
Melting point, 31–33. *See also* Freezing point
  glass transition temperature and, for semicrystalline polymers, 586–587, *587*
  heat of fusion and, 31–32, 31t
  intermolecular forces and, 32–33, *33*, 33t
  of polymers, 585–586
  pressure and, 39
Melting point curve, 38, *38*
Membrane, defined, 325
Membrane control, in gastrointestinal absorption, 345
  in multilayer diffusion, 338, *339*
  transdermal drug delivery systems using, 542–544, *543*
Membrane electrode(s), 192–193, *193*
  ion-selective, 201–203, *202*
Membrane equilibrium, Donnan, 407–408
Mercaptopurine, prodrug delivery system for, 513
Mercury, height of column of, as pressure unit, 4
Mercury displacement method for granule density determination, 444
Mercury poisoning, microsphere system for antidote to, 518–519
Mercury porosimetry, 436
Metal(s), characteristics of crystals of, 30
Metal ion complex(es), 251–254
Metal–insoluble salt electrode(s), 191–192, *191*
Metallic bond, strength of, 24
Metal–metal ion electrode(s), 191
Meter, 2
Metered-dose inhaler, for nasal drug administration, *527*, 527n
Metric system, 1, 2t, 3t
Mho, 127
Micelle(s), 396, *397*
  formation of. *See* Micellization
  globular, rodlike micelles' transition to, 416
  molecular weight of, determination of, using light scattering, 398–400, *400*
  rodlike, transition of, to globular micelles, 416
  solubilization by, 410–416
    factors affecting, 413–414, *415*
    solubility calculations with, 235–236
    thermodynamics of, 414–415, 415t
Micelle concentration, critical, 396, *397*
    prediction of, for mixture, 397–398
Micellization, 396–397, *397*
  standard free energy of, 417–418
  thermodynamics of, 416–418, *417*
Michaelis constant, 294
Michaelis-Menten equation, 293–294, *294*
Microcapsule(s), 516–517, *516*
  coacervation in formation of, 575
  magnetic, 517
  tableted, 517
Microcrystalline cellulose, 583
  rheologic properties of, 473, *473*
Microelectrode(s), 193
Microemulsion(s), 495–496, *495*
Microfiltration, 324–325
Micromeritics, 423–452
Micrometer, 2, 423
Micron, 2, 423
Microorganism(s), propagation of, in emulsions, 494
  size of, 425t
Microparticle(s), *516*, 517–519, *518*, *519*
Microscopy, electron, for colloid study, 398–399
  optical, particle size determination using, 431, *431*
Microsphere(s), *516*, 517–519, *518*, *519*
Milli-equivalent, 105
Milliliter, 2
Millimicron, 2, 423
Minimum(a), computation of, 596
Miscibility, 218–219
Mitomycin C, complexation of, with cyclodextrin, 259, *259*, 260
  decomposition of, 306–307, *307*
  microspheres incorporating, chemoembolization using, 519, *519*
  prodrug delivery system for, 513
Mixer torque rheometer, 473
Mixing, entropy of, in polymer solutions, 570–571
  factors affecting, 448
  free energy of, in polymer solutions, 569, 571
  heat of, in polymer solutions, 570
Mixture(s), "ordered," 382–383
Mobility, in electrophoresis, 406
  in rheology, 456
Mode, 427
Modulus of elasticity. *See* Young's modulus
Molal depression constant, 112t, 114, *114*
Molal elevation constant, 112, 112t, 113, *113*
Molality, 103, 103t
  conversion equations for, 104t
Molar absorptivity, 81, 82t
Molar ellipticity, 98
Molar free energy, escaping tendency and, 106
  partial, 67–68
Molar gas constant, 25
Molar heat capacity, 57
Molar heat of fusion, 31, 222t
  solubility of solid in ideal solution and, 221–222
Molar heat of vaporization, 29
Molar refraction, 96
  additivity and constitutivity in, 77–78, 77t
Molar substitution, 560
Molar volume, computation of, 31
Molarity, 102–103, 103t
  conversion equations for, 104t
Molding, injection, 591
Mole fraction, 103, 103t
  conversion equations for, 104t
Mole percent, 103t
Molecular connectivity, solubility and, 219–220
Molecular dispersion(s), 393, 394t. *See also* Solution(s)
Molecular spectroscopy, 80–84, *80*, 82t, *83*, *84*
Molecular spectrum(a), 80–81, *80*
Molecular weight(s), boiling point and, 28–30
  equivalent weight and, 105
  number-average, 561
  of colloid, light scattering method for determination of, 399, *399*
    osmotic pressure method for determination of, 401–402, *401*, 404t
    sedimentation methods for determining, 402–404, 404t
    Sutherland-Einstein equation for calculation of, 401
    viscosity data for determination of, 404–405, *404*
  of gas, 25–26
  of micelle, light scattering method for determination of, 399–400, *400*
  of nonelectrolytes in solutions, 119–122
  of polymers, average, 560–561
    critical solution temperature and, 572
    determination of, from solution viscosity, 561–563, 562t, *563*
    end-to-end distance and, 564
    melting point and, 585
  viscosity-average, 562
  weight-average, 561
  z-average, 561
Molecularity of reaction(s), 285
Molecule(s), binding forces between. *See* Intermolecular forces
  dimensions of, obtained by using film balance, 377–378, 379t
  physical properties of, 77–100
Monodisperse substance, 560

Monolayer(s). *See also* Film(s)
at liquid surfaces, types of, 373
soluble, 373–375, *374*, *375*
Monolithic delivery device(s), 515, *516*, 517–521
biodegradable, 515–516, *516*
Monomer functionality, 558
Monomolecular inclusion compound(s), 259–260, *259*, *260*
Monoprotic electrolyte(s), 149
Monotropism, 35
Morse equation, 118
Multiple regression analysis, 16–17
Multiplet pattern(s), in nuclear magnetic resonance, 94, *94*
Multiplication, significant figures in, 11

Nanocapsule(s), *516*, 519–521
Nanometer, 2, 423
Nanoparticle(s), 519–521
Napierian logarithm, 5
Narcotic action, partition coefficients and, 241–242, 242t
Nasal absorption, 526
Nasal dosage form(s), buffer capacity and pH of, 179
design of, 525–527, *525*, *527*
Necking, 578
Nematic liquid crystal(s), 36, *36*
Nernst equation, 194–195, 195t
Nernst potential, 387
Nernst-Planck flux equation, 545
Neutral point, 150
Neutralization, 144, 144t
defined, 174
heat of, 60
Neutralization curve(s), buffer capacity and, 174–176, *175*, *176*
Newton (unit), 4
Newtonian system(s), 453–455, *454*, 455t
determination of rheologic properties of, 460–464, 466
Newton's law of flow, 453–454, *454*
Nickel electrode, 191
Nifedipine, photodegradation of, 311–312
Nitrogen, solubility of organic compounds containing, 232
NMR spectroscopy. *See* Nuclear magnetic resonance spectroscopy
NOE (nuclear Overhauser effect), 95
Nonelectrolyte(s), defined, 102
solutions of, 101–124
colligative properties of, 110–119
concentrated, colligative properties of, 129
molecular weight determinations for, 119–122
Non-Newtonian system(s), 455–457
determination of rheologic properties of, 460–461, *461*, 464–466
thixotropy in, 457–460
Norepinephrine, binding of, polyadenylic acid and, 268
Normal distribution, 12, *12*, 427, *427*
Normality, 102–103, 103t
Nuclear magnetic resonance spectroscopy, 91–95, *92–94*, 93t, 94t
complex analysis using, 268
two-dimensional, 95
Nuclear Overhauser effect (NOE), 95
Null-point potentiometry, 193
Number distribution, for particle size, 428–430, *428*, 428t, *429*, 430t

Occlusion compound(s). *See* Inclusion compound(s)
Ocular administration. *See* Ophthalmic formulation(s)
Ocusert system, 524–525, *525*
Ohm (unit), 127
Ohm's law, 126
Oil-water system(s). *See also* Emulsion(s)
preservative action of weak acids in, 240–241
Oligomer, 560
Open system(s), defined, 55
thermodynamics of, 66–67
Ophthalmic formulation(s), absorption of, 346, 522–523, *522*
buffer capacity and pH of, 178–179
controlled delivery systems for, 523–525, *525*
design of, 521–525, *521*, *522*, *525*
microsphere delivery system for, 517–518
Optical activity, 96
Optical microscopy, particle size determination using, 431, *431*
Optical properties of colloids, 398–400
Optical rotation, 96–97, *97*, 97t
Optical rotatory dispersion (ORD), 97, *97*
Oral dosage form(s). *See also* Gastrointestinal absorption
buffer capacity and pH of, 179
design of, 530–536
suspension, 477
ORD (optical rotatory dispersion), 97, *97*
"Ordered" mixture(s), 382–383
Ordinate, 7
Organic acid(s), caffeine complexation with, 256
Organogel(s), 497, 499, 499t
Orientation of polymer chains, 583
Origin (graph), 7
Oscillatory testing, 469, *470*
Osmolality, 137–140
Osmolarity, osmolality and, 139
Osmometer, for freezing point determination, 115, *115*
for osmotic pressure determination, 117, *117*
for vapor pressure determination, 111, *112*
Osmosis, 116–117, *116*
defined, 324
reverse, ultrafiltration vs., 324
Osmotic coefficient, 137, *138*, 138t
Osmotic pressure, 116–119
defined, 117
equations for, 118, 119, 121t
freezing point depression and, 121
molecular weight determination from, 122
of colloid, molecular weight determination from, 401–402, *401*, 404t
proportionality constant for, 121t
vapor pressure lowering and, 118–119, *118*
Osmotic pump, 534–536, *534*, *535*
Ostwald ripening, 485
Ostwald viscometer, 461
Ostwald-Cannon-Fenske viscometer, *462*
Overtone(s), in infrared spectroscopy, 89
Oxidation, 125, *125*. *See also* Oxidation-reduction
in lyophobic colloid preparation, 396
Oxidation potential(s), 194–195, 196
Oxidation-reduction, hydrogen ion concentration in, 205–206, 206t
in pharmacy, 207–209, 209t
multistep, 207
titration of, 206–207, *206*
Oxidation-reduction electrode(s), 192
Oxidation-reduction potential(s), 205–206
chemical structure and, 209, 209t
standard, 209t
Oxonium ion. *See* Hydronium ion
Oxygen, binding of, in hemoglobin, 216

"p" notation, 152
PABA. *See p*-Aminobenzoic acid
Packaging film(s), interchain cohesive forces in, 579–580
mechanical properties of, 578, 578t
orientation in, 583
tubular, extrusion of, 590–591, *591*
Packing, of particles in powder, 443, *443*
Palisade layer, 411
Paraben(s), percutaneous absorption of, 349–350
Parallel reaction(s), 291–292, 292t
Parenteral formulation(s), buffer capacity and pH of, 179
design of, 545–547, *546–548*, 546t
detection of particulate matter in, 435
emulsion, 547
stability of, 492, *492*
suspension, 477, 546–547
Particle(s). *See also* Powder(s)
as emulsifying agents, 488, 488t, 490
colloidal. *See* Colloidal particle(s)
densities of, 443–446
dispersed in liquid, charge acquisition by, 386–387
growth of, during storage, 485–486, *486*
number of, per unit weight, 430.
packing arrangements of, 443, *443*

shape of, 436
flow properties of powder and, 447
shapes of, viscosity of colloid and, 405
size of. *See* Particle size
submicron, size determination for, 434, 435
surface area of, 436–437
suspended, interfacial properties of, 478–479, *479*
volume measurement for, *431*, 434–436, *434*
wetting of, in formulation of suspensions, 481–482
Particle size, 423–425
average, 425–426, 426t
classification of, 423, 423t, 424t
distribution of, 425–428, 426t, *427*
in assessment of emulsion stability, 493, *493*
viscosity of emulsions and, 495
in microemulsions, *496*
in nasal dosage forms, 527
methods for determining, 430–436, *431*
number distribution for, 428–430, *428*, 428t, *429*, 430t
solubility and, 236–237
tablet strength and, 448
uniform, 425
viscosity of emulsions and, 495
weight distribution for, 428–430, *428*, 428t, *429*, 430t
Partition, 237–242
ionic dissociation and molecular association in, 237–239
Partition coefficient(s), 237
apparent vs. true, 238
drug action and, 241–242, 242t
Meyer-Overton hypothesis, 241
solubility and, 240
variant usage of, in drug release calculations, 341n
Partition method of complex analysis, 264–265, *264*
Pascal (unit), 4
Passive transport, 342, 530
"Paste," usage of, 498
PBE (proton balance equations), 153–160
Penicillin(s), circular dichroism spectra of, 98, *98*
Peptide(s), nasal absorption of, 526
prodrug delivery systems for, 513
rectal administration of, 537
Percutaneous absorption. *See under* Skin
Permanent set, 576
Permeability, 351–353, *352*
of skin, factors affecting, 540
Permeability coefficient(s), 327, 329t
in gastrointestinal absorption, 343
in multilayer diffusion, 337, 338
in transcorneal permeation, 346
through skin, 528–529
pH and, 540–541
Permeability enhancer(s), for nasal dosage forms, 526–527
for oral formulations, 532
for rectal formulations, 537
for topical formulations, 541–542, 542t
pH, 149–152, 150t
adjustment of, tonicity adjustment and, 185–186, 186t
calculation of, 153–160
colorimetric method for determination of, 172–173
definitions of, 201
operational, 200, 201
electrometric determination of, 198–201, *200*, *201*
gastrointestinal absorption and, 531, *531*
indicators of, 171–173, 172t
microcapsules sensitive to, 517
of buffered solutions, factors influencing, 171
of pharmaceutical specialties and vehicles, 151t–152t
solubility and, 179–180
for weak electrolytes, 233–235
solubilizing power of surfactants and, 413–414
species concentration as function of, 152–153
surface charge of suspension and, 453
tissue irritation and, 178–179
transdermal absorption and, 540–541
pH electrode(s), 199–201, *201*
pH meter, 199–201, *200*
expanded-scale, 203
pH titration method of complex analysis, 261–264, *262*, *263*, 263t, 264t
Phase(s), conjugate, 40
defined, 37, 101
interfacial, 362
Phase diagram(s), applications of, 41
for microemulsions, 495–496, *495*
for single-component systems, 38–39, *38*
for three-component systems, 43–46, *43*, *45*, *46*
for two-component systems, 39–43, *40–42*
ideal solubility equation and, 222–223
Phase equilibrium(a), 37–46
in single-component system, 38–39, *38*, 38t
in three-component system, 43–46, *43*, 44t, *45*, *46*
in two-component system, with liquid phases, 39–41, *40*, *41*
with solid and liquid phases, 41–42, *42*
Phase inversion, in emulsions, 490, 493–494
Phase rule, 37–46
applied to single-component systems, 38, 38t, 39
applied to three-component systems, 43, 45
with two or three pairs of partially miscible liquids, 46
applied to two-component systems, containing liquid phases, 40–41
for solubility, 212, 230
Phase separation, in polymer solutions, 571–573, *572*, 573t
Phase-separation model of micellization, 416–417
Phase-volume ratio of emulsions, rheologic properties and, 495
stability and, 491–492
Phenobarbital, adsorption of, on activated charcoal, particle specific surface area and, 384
solubility of, pH and, 233, 234, *234*
Phenol, solubility of, 232
Phenol-water mixture(s), phase equilibria in, 39–41, *40*
Phosphorescence, 84, 85, *85*
Phosphoric acid, ionization of, 149
Photodegradation, 310–312, *311*, *312*
Photoluminescence, 84–85, *85*, 86t
Photosynthesis, 310
pH-partition hypothesis, 343
modification of, 343–346
Physical pharmacy, defined, 1
Physical properties. *See also* Additive properties; Colligative properties of solutions
extensive, 101
intensive, 101
of molecules, 77–100
additive vs. constitutive, 77–78, 102
defined, 78
of solutions, 101–102
Picric acid complex(es), 255–256
Pilocarpine, ionization of, 71–72, 71t, 72
ocular bioavailability of, 522
ophthalmic delivery systems for, 517–518, 523–525
Pipette method for particle size determination, 433, *433*
pK_a, determination of, 83, 204, 233
dissociation exponent, 152
Plane-polarized light, 96, 98
Plasma, buffer systems in, 177
Plasma extender(s), characterization of, 405
Plastibase, 500, *500*, 574
Plastic(s), interchain cohesive forces in, 579
mechanical properties of, 578, 578t
Plastic flow, *452*, 455–456
analysis of, using Stormer viscometer, 465
thixotropy in, 458–459, *458*, *459*
Plastic viscosity, 456, 465
Plasticization of polymers, 588, 588t
Plasticizer(s), 588, 588t
Platinum electrode(s), 192
Plug flow, 465–466
Pockels, Agnes, 375
Poise (unit), 454
Poiseuille's law, 462
Poising action, 206
Poisoning, activated charcoal as antidote in, 383–384
in catalysis, 301
Polar compound(s), solutions of, solvation and association in, 229

Polar mantle, 411
Polarimeter, 96
Polarity, in solubilization, 410–411, *411*
  of solvents, solubility and, 213–215, 214t
  spreading and, 370
Polarizability, induced, 86–87, 87t
  refractive index and, 96
Poloxamer(s), rheologic behavior of, 471–472
Polyadenylic acid, catecholamine binding and, 268
Polycarbophil, structure of, 559–560
Polydispersity, molecular weight averages and, 560–561
Polyelectrolyte(s), Donnan membrane equilibrium and, 407–408
Polyethylene, crystallinity of, 580–581, 581t
  gel formation by, 574
  heat of fusion of, 584
  interchain cohesive forces in, 580
Polymer(s), 556–594
  as colloids, 395
  as flocculating agents, 483
  as solids, 575–591
    crystallinity of, 580–581, 581t
    interchain cohesive forces in, 578–580, 579t
    mechanical properties of, 575–578, *576*, 576t–578t
    morphology of, 582–583, *583*
    tacticity of, 581–582
    thermodynamics of fusion and crystallization of, 583–586, 584t
  as thickening agents, 565–567, *566*, *567*
  branched, 558, *559*
  coating dosage forms with, for oral extended delivery, 532–533
  conformation of, 563–565, *563*, *564*
    at Θ temperature, 573
    entropy of fusion and, 584–585
  containers made of, drug complexation with, 257
  cross-linked (network), 558, *559*
  defined, 557–560
  fabrication technology for, 590–591, *590*, *591*
  fractionation of, 572, *572*
  future trends in biomedical uses of, 591–592
  heterochain, 557
  history of, 556–557
  homochain, 557
  inhibition of particle growth by, 485–486, *486*
  linear, 557–558, *559*
    conformation of, 563–565, *563*, *564*
  molecular weight of. *See under* Molecular weight(s)
  orientation of chains in, 583
  pharmaceutical applications of, 557
  plasticization of, 588, 588t
  semicrystalline, transition temperatures for, 586–587, *587*
  solutions of. *See* Polymer solution(s)
  thermoplastic, 558
  vinyl, polydispersity of, 561
    structure of, 559
Polymer complex(es), 257, 257t
Polymer film(s). *See* Packaging film(s)
Polymer implant(s), 591–592
Polymer matrix(ces), drug release from, 335–336, *335*, 340–341
Polymer solution(s), 567–575
  coacervation in, 574–575
  gel formation in, 574
  phase separation in, 571–573, *572*, 573t
  preparation of, 569
  rheologic properties of, 565–567, *566*, *567*
  solvent selection for, 567–568, 568t
  thermodynamics of, 569–571
Polymerization, addition (chain), 519–520, *520*, 558
  bulk, 519
  condensation (stepwise), 519, 558
  degree of, 520, 558
    average, 561
  emulsion, 519–520, *520*
  interfacial, microcapsule preparation using, 516
  mathematics of, 520
  solution, 519
  suspension, 519
Polymorphism, bioavailability of drugs and, 34
  in crystalline solids, 33–35, *34*, *35*
Polynomial regression analysis, 17
Polyolefin(s), 560
Polyprotic electrolyte(s). *See also* Tribasic acid(s)
  ionization of, 149
  pH calculation for solutions of, 156–157
Polyvinyl alcohol, crystallinity of, 580
  interchain cohesive forces in, 580
Polyvinyl chloride, plasticizer's effects on, 588, 588t
Pore radius, colonic, rectal drug absorption and, 537–538
Pore size, adsorption and, 440–442, *440*, *441*
Pore-forming agent, in extended-release systems, 536
Porosimetry, mercury, 436
Porosity, in air permeability method for surface area determination, 438, 439
  in drug release from granular matrix, 336–337
  interspace (void), 445
  intraparticle, of granules, 444, 445t
  of powder, 442–443
  total, 445–446
Potassium chloride solution, as salt bridge in electrochemical cell, 197
Potential(s), asymmetry, 200
  chemical, 67–68
  electrode. *See* Electrode potential(s)
  electrokinetic. *See* Zeta potential
  electrothermodynamic (Nernst), 387
  ionization, 79–80
  liquid junction, 197
  oxidation, 194–195, 196
  oxidation-reduction. *See* Oxidation-reduction potential(s)
  reduction, 195t, 196–197
  sedimentation, 407
  streaming, 407
Potential energy, 53
Potential mediator(s), in oxidation-reduction reactions, 207
Potential-determining ion(s), 387
Potentiometric method of complex analysis, 261–264, *262*, *264*, 263t, 264t
Potentiometry, 193, *194*
  acid-base titration using, 203–204, *204*
  null-point, 193
  oxidation-reduction titration using, 206–207, *206*
Povidone, drug complexation with, 257, 257t
Powder(s). *See also* Particle(s)
  cohesive, 447
  compression of, 448–449, *448*
  densities of, 443–446
  derived properties of, 442–449
  dissolution of, 333–334, *333*, 334t
  flow properties of, 446–448
  free-flowing, 447
  hydrophilic, 481
  hydrophobic, 481
  particle size distribution for. *See under* Particle size
  porosity of, 442–443
  surface area of, effects of compression on, 448, *448*
    methods for determining, 437–439
  torque change with addition of water to, 473, *473*
Practical activity coefficient(s), 132
Prairie dog burrow, ventilation of, 354–355, *355*
Precession, 91–92, *92*
Precision, analysis of, 12–14
  in measurement, significant figures and, 10–11
Prednisolone, base-catalyzed degradation of, 291–292, 292t
Preservative(s), for emulsions, 494
  in suspensions, interaction of surfactants with, 486
Pressure, 3t, 4
  critical, 27
  differences across curved interfaces, 365, *365*
    capillary rise and, 367
  internal. *See* Internal pressure
  Laplace, 411
  melting point and, 31–32, 39
  of gas, 24
  solubility of gases in liquids and, 215
  vapor. *See* Vapor pressure
Prilocaine-lidocaine mixture, phase equilibria in, 42

release of, from emulsions and gels, 505–506, *505*, *506*
Procainamide, acid-catalyzed hydrolysis of, 298
  assay for, using chelation, 254
Procaine, acid-catalyzed hydrolysis of, 298
  decomposition of, 307
Prodrug(s), 513
  for buccal administration, 527
  for gastrointestinal administration, 532
  for rectal administration, 537
Programming languages, 10
Projected area diameter, 431, *432*
Proliposome(s), 515
Promoter(s), in catalysis, 301
Propellant(s), in aerosols, 28
Proportion(s), in calculations involving dimensions, 5
Proportionality constant, in expression of variation, 7
Protective colloid(s), 410, 410t
  in formulation of suspensions, 483–484, *484*
Protein(s), as colloids, 395
  nasal absorption of, 526
  prodrug delivery systems for, 513
  rectal administration of, 537
Protein binding, 268–274
  equilibria in, 269–270, *269*
  factors affecting, 273–274
Protein unfolding, thermodynamics of, 276t, 277
Protogenic solvent(s), 143
Protolysis. *See also* Acid-base reaction(s); Hydrolysis; Ionization; Neutralization
  defined, 143
Proton balance equation(s) (PBE), 153–160
Proton donor(s), hydrogen-bonded complexes with, 268
Protophilic solvent(s), 143
Pseudoaccidental error, 12
Pseudo-order reaction(s), 285
Pseudoplastic flow, *454*, 456–457
  analysis of, 461
  in polymer solutions, 567, *567*
  thixotropy in, 457–458, *458*
Pseudopolymorphism, 35
Psychorheology, 471
Pulmonary administration, drug product design for, 525–530, *528*

Quantasorb, 437
Quaternary ammonium compound(s), antibacterial action of, 386
Quinhydrone complex(es), 255
Quinhydrone electrode, 192

Radiation. *See* Electromagnetic radiation; Gamma irradiation
Radius, critical, 480
Radius of gyration, of polymer chain, 564
Random flight, Brownian movement, 564
Range, 13
Raoult's law, deviations from, solubility and, 218
  in ideal solutions, 106–107, *107*
  in real solutions, 107–109, *108*
Rat intestinal preparation, 344
Rate constant(s), 284
  specific, 285–286
  units for, 286
Rate-determining step, 294–295
Rate-pH profile, 304, *304*, *305*
  for general acid-base catalysis, 303, *303*
  for specific acid-base catalysis, 302–303, *302*
Ratio(s), in calculations involving dimensions, 5
Rational activity coefficient, 132
Reaction(s), apparent zero-order, in suspensions, 286–287
  between solute and solvent, solubility of gases in liquids and, 215
  complex, 285, 290–293
  consecutive (series), 292–293
  first-order, 285, 287–288, *287*, 287t, *288*
  heat of. *See* Heat of reaction
  molecularity of, 285
  order of, 284–285
    determination of, 289–290
  parallel (side), 291–292, 292t
  pseudo-order, 285
  rate of. *See* Reaction rate
  rate-determining step of, 294–295
  reversible, 290–291, *291*
  second-order, 288–289
  zero-order, 286
Reaction rate, 284
  collision theory of, 296–297
  factors influencing, 295–304
  limiting step for, 294–295
  specific, in acid-base equilibria, 144–145
  spectrophotometric determination of, 83–84
Rectal administration. *See also* Suppository(ies)
  drug product design for, 536–538
Redox. *See* Oxidation-reduction
Reducing agent(s), as enhancers of percutaneous absorption, 542
Reduction, 125, *125*. *See also* Oxidation-reduction
  in lyophobic colloid preparation, 396
Reduction potential(s), 195t, 196–197, *197*
Reference electrode(s), 191, 196–197, *197*, 199
Reference standard(s), 1–2
Reference state, for activity of solution components, 134
Refraction, 95
  molar, 96
    additivity and constitutivity of, 77–78, 77t
Refractive index, 95–96, *95*
Regnault method, 26
Regression analysis, 15–17, *16*
Regression coefficient, 16
Regular solution(s), 226–227
Reinforcing filler(s), in elastomers, 589
Relative error, 15
Relative vapor pressure lowering, 110
Relative viscosity, 404
  determination of, 461
Repose angle, of loose powder, 447–448
Repulsion, between molecules, 22, *22*
  between suspended particles, 478–479, *479*
Reservoir device(s), 515, 516–517, *516*, 518–521
  laminated, 515, *518*
Resin(s), ion exchange. *See* Ion exchange resin(s)
Resistance, 127
Resonance(s), in infrared spectroscopy, 89, *89*, *90*
Retardation time, 468
Reverse osmosis, ultrafiltration vs., 324
Reversible electrochemical cell, 191
Reversible process, 55
Reversible reaction(s), 290–291, *291*
Reynolds number, 432
Rheogoniometer, 469
Rheogram(s), 454, *454*
Rheologic properties. *See also* Viscosity
  determination of, 460–467
  of emulsions, 494–495
  of polymer solutions, 565–567, *566*, *567*
  of powders, 446–448
  of semisolids, 467, 500–501, *500–501*
Rheology, 453–476. *See also* Rheologic properties; Viscosity
  applications to pharmacy, 471–473, 473t
  in formulation of suspensions, 484, *484*
Rheometer, mixer torque, 473
Rheopexy, antithixotropy vs., 460
RHLB (required hydrophile-lipophile balance), 371–373, 372t
Riboflavin, stability of, 207–208
Rigidity, of gels, 501, *502*
Rigidity index, 501, *502*
Root mean square velocity, 26
Rotation, optical, 96–97, *97*, 97t
Rotational transition(s), 80–81, *80*
Rotovisco viscometer, 463–464, *464*
Rounding off, 11
Route of administration, in drug product design, 521–547
Rubber(s). *See* Elastomer(s)
Rubbery state, characteristics of, 586
Rydberg constant, 79

Salicylate, as enhancer for rectal administration, 537
Salicylic acid, as buffer, 171
  solubility of, 232
Salol-camphor system, phase equilibria in, 42
Salol-thymol system, phase equilibria in, 41–42, *42*
Salt(s), influence of, on reaction rate, 304
  pH calculation for solutions of, 158–160
Salt bridge, in electrochemical cell, 197
"Salting in" constant, 160
Salting out, in polymer solutions, 574
  of colloid, 409
  solubility of gases in liquids and, 215
"Salting out" constant, 160
Saturated solution, 212
Saturation, liquid, of powder mass, stages of, 473, *473*
Scatchard plot, 269–270, *269*
Scatter. *See* Dispersion
Schlieren patterns, 403
Schulze-Hardy rule, 408
Schwartzenbach method for complex analysis, 264
Searle-type viscometer(s), 463–465, *463*, *464*
Second-order reaction(s), 288–289
Second-order transition(s), 587, *587*
Secretin, nasal absorption of, osmolality and, 139
SediGraph 5100, 433
Sedimentation, in colloids, 402–404, *403*, 404t
  of flocculated particles, 480
  particle size determination using, *431*, 432–434, *433*
  theory of, 479–480
  thixotropy and, 460
Sedimentation coefficient, 402, 403
Sedimentation dose fraction, 529
Sedimentation efficiency, 528
Sedimentation equilibrium technique, 403–404, 404t
Sedimentation parameter(s), 480–481, *480*
Sedimentation potential, 407
Sedimentation velocity technique, 402–403, 404t
Sedimentation volume, 480–481, *480*
Self-association of drugs, 273
Self-regulating delivery system(s), 547, *548*
Semilogarithmic graph paper, 9, *9*
Semipermeable membrane, 116
Semisolid(s), 496–502
  classification of, 498–500, 499t
  hydrophilic properties of, 500
  rheologic properties of, 467, 500–501, *500–502*
Sensitization of colloid, 410
Series reaction(s), 292–293
Settling. *See also* Sedimentation
  free, 479
  hindered, 479
Shape factor(s), 436
Shear, effects of, on polymer solutions, 567, *567*
Shear rate, 454, *454*
Shearing stress, 454, *454*
Shear-thickening system(s). *See* Dilatancy
Shear-thinning system(s). *See* Pseudoplastic flow
Shielding constant, 91–92
Shrinkage on cooling, of molded polymers, 591
SI units, 2, 2t, 3t
Side reaction(s), 291–292, 292t
Sieving, particle size determination using, 431–432, *431*
Significant figure(s), 10–11, 10t
Silastic capsule, drug release from, 341–342, *341*
Silver chloride electrode, 192, 196–197
Singlet(s), in nuclear magnetic resonance, *93*, 94
Sink conditions, in diffusion experiments, 326
  in drug dissolution, 331, 333
Skin, absorption through, 346–350, *347–349*, 538–540, *538*, *539*
    drug product design for, 538–545
    studies of, 330, *330*
  drug binding to, 541
  drug metabolism in, 541
  factors affecting permeability of, 540
  structures of, *347*, 538, *538*
Skin substitute, 592
Slope, 8
Slow-release preparation(s). *See* Sustained-release dosage form(s)
Smectic liquid crystal(s), 36, *36*
Smoothness, 471
Sodium chloride equivalent method for tonicity adjustment, 182–185, 183t–184t
Sodium error, with glass pH electrode, 192, 200–201, *201*
Sodium polystyrene sulfonate, structure of, 559
Sodium salicylate, benzocaine complexation with, 256–257
  inhibition of self-association by, 273
Sodium stearate–based sticks, rheologic properties of topical drug preparations in, 472
Sodium transport, intestinal drug transport and, 343
Sodium-amalgam electrode, 191
Sol(s). *See* Colloid(s)
Solid(s), 24, 30–36
  amorphous, 35–36
  crystalline, 30–35, *30*
    polymorphism in, 33–35, *34*, *35*
  deformation of, mechanisms of, 575
  interactions of, classification of, 313
  kinetics of, 312–313, *313*
  nonionic, solubility of, in liquids, 221–237
Solid dispersion(s), 42–43
Solid dosage form(s). *See also* Tablet(s)
  interactions of ingredients in, 313
  kinetics of, 313
Solid interface(s), adsorption at, 379–386,
    with gas, 380–382, *380*, *381*,
    with liquid, 382, *383*,
    with solid, 382–383
Solid solution(s), 43
Solubility, 212–250
  calculation of, 215–218, 216t, 217t
  defined, 212
  expression of, 212–213, 213t
  for film-coated dosage form, 533
  in stratum corneum, 540
  melting point and, 33, 33t
  of gases in liquids, 215–218
  of liquids in liquids, 218–221
  of nonionic solids in liquids, 221–237
  partition coefficients and, 240
  pH and, 179–180
Solubility coefficient, 215
Solubility method of complex analysis, 265–266, *265*
Solubility parameter(s), 224–227, 225t, 226t
  of polymers, determination of, 568, 568t
    interchain cohesive forces and, 580
  protein binding of drugs and, 274
  reaction rate and, 299, 299t
Solubility product, 230–232, 231t
Solubilization, 410–416
  factors affecting, 413–414, *413*
  formulation of drug systems using, 412–413, *412*, *413*
  solubility calculations with, 235–236
  thermodynamics of, 414–415, 415t
Solute(s), defined, 101
  distribution of, between immiscible solvents, 237–242
  solvent interactions with, 213–215
Solution(s), 393, 394t
  binary, defined, 101
  electrolyte, 125–142
    calculations in preparation of, 105–106
    properties of, 125–130
    reference state for, 134
    standard state for, 134
  heat of. *See* Heat of solution
  hypertonic, 180
  hypotonic, 180
  ideal, real solution vs., 106
    solubility of liquids in, 218
    solubility of solid in, 221–223
  isosmotic, 180
  isotonic, 180–186, 186t
  measuring conductance of, 127–128, *127*
  nonelectrolyte, 101–124
    colligative properties of, 110–119

concentrated, colligative properties of, 129
molecular weight determinations for, 119–122
parenteral, 546
buffer capacity and pH of, 179
detection of particulate matter in, 435
physical properties of, 101–102
polymer. *See* Polymer solution(s)
regular, 226–227
saturated, 212
solid, 43
subsaturated, 212
supersaturated, 212
true, 101
types of, 102, 102t
unsaturated, 212
Solution polymerization, 519
Solution temperature, critical, 40, *40*, *41*, 218–219
for polymer solutions, 572
Solvate(s), 35
Solvation, 218
activity coefficient and, 133
in lyophilic colloids, 395
in solutions of polar compounds, 229
Solvent(s), activity of, 133–134
amphiprotic, 143
aprotic, 143
basic strength of, 143
classification of, 143
defined, 101
immiscible, distribution of solutes between, 237–242
influence of, on reaction rate, 298–299, 299t
on solubility of drugs, 234–235, *234*
nonpolar, 214
polar, 213–214, 214t
polarity of, complex formation and, 274
protogenic, 143
protophilic, 143
selection of, for polymer solutions, 567–568, 568t
for preparation of PLA microspheres, 518
semipolar, 214–215
solute interactions with, 213–215
Θ, 573
transdermal penetration of drugs and, 540
Solvent catalysis, 302–303, *302*
Solvent evaporation method, microsphere preparation using, 517, 518, *518*
Sorbitol, adsorption of antibiotic onto particles of, 382–383
Sorensen's pH scale, 149–152, 150t
Span(s), as emulsifying agents, 489, *489*, 490
Specific bulk volume, 446
Specific conductance, 127, *127*
Specific granule volume, 446
Specific gravity, 3
Specific heat, heat capacity vs., 72n
Specific reaction rate(s), in acid-base equilibria, 144–145
Specific resistance, 127
Specific rotation, 96, 97t
Specific surface, 436–437
defined, 393
determination of, from adsorption data, 382
Fisher subsieve sizer for determination of, 439
of colloidal particles, 393–394
Quantasorb for determination of, 437–438
Specific viscosity, 404
Specific volume, crystallinity and, 581
Spectrophotometer, 82, *82*
Spectrophotometry, ultraviolet and visible, 81–84, 82t, *82*, *84*
Spectroscopy, absorption, complex analysis using, 266–268, *266*
atomic, applications of, 80
electron paramagnetic (spin) resonance, 90–91
for solubilization study, 411
infrared, 88–90, *89*, *90*, 90t
molecular, 80–84, *80*, 82t, *82*, *84*
nuclear magnetic resonance. *See* Nuclear magnetic-resonance spectroscopy
Spectrum(a), atomic, 79–80, 80t
molecular, 80–81, *80*
Spherical diameter, equivalent, 425
Spherulite(s), 582–583, *583*
Spin decoupling, 95
Spin label, 91
Spin quantum number, 91
Spiperone, polymorphism of, 34, *34*
Splitting factor, 91
Spontaneous process(es), criteria for, 62, 65–66, 66t
work obtained from, 60–62
Spreading, wetting and, 384–385
Spreading coefficient, 368–370, *369*, 370t
Sprowls method for tonicity adjustment, 183t–184t, 186
Spur, in hysteresis loop of thixotropic material, 459, *459*
Stability, accelerated analysis of, 313–316, *314*, *315*
of colloid systems, 408–410, *409*
of drugs, strategies for improving, 305–312
of emulsions, 490–494
evaluation of, 493, *493*, *494*
of suspensions, 478, 485–486, *486*
thixotropy and, 460
optimum therapeutic response vs., buffer capacity and pH and, 179
pH and, 205–206
Stability constant(s), by absorption spectroscopy, 266–267, *267*, 267t
by distribution method, 264–265
by method of continuous variation, 261
by pH titration method, 262–263, 264t
by solubility method, 265–266
for caffeine complexes, 266t
thermodynamic treatment of, 274–277
Stability index, for emulsions, 493
Standard deviation, 13–14, 427
Standard free energy change, 69–71
of micellization, 417–418
Standard heat of formation, 58–59, 59t
Standard heat of reaction, 58
Standard state, for activity of solution components, 134
Starch derivative(s), structure of, 560
State, defined, 54
equation of, 54
for ideal gas, 25
Statistical diameter, 426t
Statistics, 11–17
Steady-state approximation, 293–294, *294*
Steady-state diffusion, 325–329
Steam distillation, 110
Stepwise polymerization, 519, 558
Stereoregularity, polymer properties and, 582, 582t
Steroid(s), percutaneous absorption of, 346–349
Stoichiometric ratio, for complex formation, 260–261, *261*
Stoke (unit), 455
Stokes' diameter, 425
Stokes' law, 402, 479
applied to sedimentation method of particle size determination, 432–433
creaming of emulsions and, 490–491
Stokes-Einstein equation, 401
Stormer viscometer, 464–465, *465*
STP, standard conditions of temperature and pressure, 594
Strain, 575
Strain hardening, 577
Stratum corneum, 538, *538*
drug diffusion across, 346–349, *348*, 539, *539*
drug solubility in, 540
hydration of, permeability and, 540
Streaming potential, 407
Stress, response to, time and, 577
shearing, 454, *454*
tensile, 575
units of, 575
Stress-strain curve(s), 576–578, *576*, 577t
Structured vehicle(s), flocculation in, in formulation of suspensions, 483–484, *484*
in formulation of suspensions, 481
Student's *t* value, 14n
Subcutaneous implant(s), 547

Sublimation, 24
Sublimation curve, 38, *38*
Subsaturated solution, 212
Subsidence, 480
Substitution, degree of, 560
  molar, 560
Substitution method for reaction order determination, 289
Substrate(s), in catalysis, 301
Subtraction, significant figures in, 11
Sucrose, adsorption of antibiotic onto particles of, 382–383
Sulfathiazole sodium, stabilization of, 311
Sulfite ion, as antioxidant, 208
Sulfonamide(s), solubility of, 232
Sulfonylurea(s), activated charcoal as antidote for poisoning by, 383
Supersaturated solution, 212
Supersaturation, in lyophobic colloid preparation, 396
Supersaturation ratio, crystal growth and, during suspension storage, 485–486
Suppository(ies), design of, 537–538
  fatty, drug release from, 505
  rheologic properties of, 472
Surface, as interface, 362
  specific. *See* Specific surface
Surface area, of molecule, solubility and, 220–221, 221t
  of particle, 436–437
  of powder sample, effects of compression on, 448, *448*
    methods for determining, 437–439
Surface excess (surface concentration), 375
Surface free energy, 364–365
  change in, in dispersion of two immiscible liquids, 488
    in suspensions, 478
  spreading and, 369
Surface pressure, 376–377, *377*
Surface tension, 363–364, *363*, 364t
  critical, wetting and, 385–386, *385*
  measurement of, 365–368
  micelle formation and, 396, *397*
  surface-active agent's effects on, 376
  work of adhesion and, 368–369
Surface-active agent(s), adsorption at liquid interfaces and, 370–371, *371*
  applications of, 386
  as emulsifying agents, 488–490, 488t, *489*
  as enhancers of percutaneous absorption, 541–542
  as flocculating agents, 483
  hydrophile-lipophile classification of, 371–373, *371*, 372t
  in microemulsion formation, 495–496, *495*
  in suspensions, 481–482
    interaction of preservatives with, 486
  mechanism of surface tension lowering by, 376
  selection of, for solubilized drug system, 412
  solubilization by, 235–236
    factors affecting, 413–414, *413*
  transdermal penetration of drugs and, 540
Surfactant(s). *See* Surface-active agent(s)
Suspending agent(s), 483–484, *484*
Suspension(s), 477–486
  apparent zero-order kinetics in, 286–287
  desirable qualities for, 477–478
  externally applied, 477
  formulation of, 481–486
  interfacial properties of particles in, 478–479, *479*
  oral, 477
  parenteral, 477, 546–547
  polymers used in, 557
  preparation of, 484–485
  settling in, 479–481, *480*
  stability of, 478, 485–486, *486*
    thixotropy and, 460
Suspension polymerization, 519
Sustained-release dosage form(s), for oral use, 532–536
    chewable, caffeine complexes in, 256
  ion-selective electrodes in monitoring of, 203
  polymers used in, 557
  rationale for, 512–513, *512*
Sutherland-Einstein equation, 401
Svedberg sedimentation coefficient, 402, 403
Swelling of gel, 497–498, *497*
Syndiotactic polymer, 582
Syneresis, 497, 574
Synovial fluid, viscoelastic analysis of, 471
System(s), closed, 55
    diffusion in, 353–354, *353*
  condensed, 39
  defined, 101
  open, 55
    thermodynamics of, 66–67
Système International, 2, 2t, 3t

Tablet(s), chewable, extended-release, caffeine complexes in, 256
  compression of, 448–449, *448*
  matrix, for extended oral administration, 534
  polymers used in, 557
  weight variation in, granule size and, 447
Tablet binder(s), 385
Tabletted microcapsule(s), 517
Tacticity of polymers, 581–582
Tamoxifen citrate, polymorphism of, 34, *35*
Tartaric acid salt(s), solubility of, 232
Taste of preparations for buccal administration, 527
Tears. *See* Lacrimal fluid
TEAS (triethanolamine stearate), rheologic properties of mineral oil–water emulsions stabilized with, 472, *472*
Temperature(s), 5
  consistency of ointment bases and, 500, *500*, *501*
  critical, 27–28
  critical solution (upper consolute), 40, *40*, *41*, 218–219
    for polymer solutions, 572
  film pressure and, 379
  Flory, 572–573, 573t
  ionization constants and, 163, 163t
  lower consolute, 41, *41*, 219
  mechanical properties of polymers and, 577
  of gas, 24–25
  pH of buffered solutions and, 171
  phase equilibria and, in ternary system, 45–46, *45*, *46*
  reaction rate and, 295–298, *295*, *296*
  solubility and, of gases in liquids, 215
    of liquids in liquids, 218, 219
    of salts, 229–230, *229*
  stability of suspensions and, 485
  surface tension and, 366
  Θ, 572–573, 573t
  transition. *See* Freezing point; Glass transition temperature; Melting point; Transition temperature
  vapor pressure and, 29, *29*
  viscosity and, 455, 456t
Temperature coefficient of pH, 171
Tensile strength, *576*, 576t, 577
Tensile stress, 575
Tensiometer, DuNouy, 367, *367*
Ternary system(s), phase diagrams for, 43–46, *43*, *45*, *46*
  solubility in, 219, *219*, *220*
Testosterone, cyclodextrin complexation with, 260
Tetracycline(s), reversible epimerization of, 290–291, *291*
  solubilization of, 413–414
Tetramethylsilane (TMS), in nuclear magnetic resonance, 92
Textile fiber(s), interchain cohesive forces in, 579–580
  mechanical properties of, 578, 578t
TGA (thermogravimetric analysis), 49
Theobroma oil, polymorphism of, 33–34
Therapeutic response, buffer capacity and pH and, 179
Thermal analysis, 46–49, *47–49*
  differential (DTA), 48–49, *48*, 584
Thermochemistry, 58–60
Thermodynamic activity, narcotic action and, 241–242, 242t
Thermodynamic properties, 54
Thermodynamic state, defined, 54
Thermodynamics, 53–76
  first law of, 53–58
    ideal gases and, 56
    modifications of, 58t
  of complexation, 274–277, 276t
  of diffusion, 351–353

of drug action and partitioning, 241
of electrochemical cells, 193–194
of fusion and crystallization of polymers, 583–586, 584t
of ionization, 161–163
of micellization, 416–418, *417*
of osmotic pressure, 118, 119
of polymer solutions, 569–571
of solubility, 223–227
of solubilization, 414–415, 415t
second law of, 60–63
third law of, 63
Thermoelectric method for vapor pressure determination, 111, *111*, *112*
Thermogram, *47*
Thermogravimetric analysis (TGA), 49
Thermomechanical analysis (TMA), 49
Thermometer, Beckmann, 114n
Thermoplastic polymer(s), 558
Thermosetting, 558
Thermotropic liquid crystal(s), 36
Θ temperature, 572–573, 573t
Thickening agent(s). *See also* Viscosity-increasing agent(s)
for prevention of creaming, 491
polymers as, 565–567, *566*, *567*
Thixotropy as a rheological property, 471
Thixotropy, 457–460
in formulation, 460
in suspending agents, 484, *484*
measurement of, 458–459, *458*, *459*
negative, 459–460, *460*
of semisolids, temperature and, 500, *501*
Thymol-salol system, phase equilibria in, 41–42, *42*
Tie line, 40, *40*
in ternary system, 45, *45*
Time, units of, 2t
Tissue irritation, influence of buffer capacity and pH on, 178–179
Titration, equivalence point of, 175
of oxidation-reduction system, 206–207, *206*
pH, complex analysis using, 261–264, *262*, *263*, 263t, 264t
potentiometric, 203–204, *204*
Titration curve(s), buffer capacity and, 174–176, *175*, *176*
TMA (thermomechanical analysis), 49
TMS (tetramethylsilane), in nuclear magnetic resonance, 92
Tonicity, calculation of, 181–182, 181t
measurement of, 180–181
methods for adjustment of, 182–186, 183t–184t
Topical formulation(s), drug release from vehicles in, 339–340
emulsification in, 487
universe of, 501–502, *502*
Torque, 472
Tortuosity, in drug release from granular matrix, *336*, 337
Transdermal device(s), adhesive diffusion-controlled, 544, *544*
defined, 542, *543*
matrix-controlled, 544
membrane-controlled, 542–544, *543*
Transference number, 126
Transition(s), electronic, of atoms, 79–80, 80t
of molecules, 80–81, *80*
first-order, 587, *587*
rotational, 80–81, *80*
second-order, 587, *587*
translational, 80
vibrational, 80–81, *80*
Transition state theory, 297–299
Transition temperature. *See also* Freezing point; Glass transition temperature; Melting point
for semicrystalline polymers, 586–587, *587*
in polymorphism, 35
Translational transition(s), 80
Transmittance of light, absorbance and, 81
Transport number, 126
Triamcinolone acetonide, decomposition of, 307
Triangular diagram(s), 43–44, *43*
for microemulsion, 495–496, *495*
prism, for three-component systems, 45–46, *45*
Tribasic acid(s), ionization of, 149
titration curve for, 176, *176*
Triethanolamine stearate (TEAS), rheologic properties of mineral oil–water emulsions stabilized with, 472, *472*
Triple point, 38, *38*, 39, 113–114, *113*
Triprotic acid(s). *See* Tribasic acid(s)
Trouton's rule, 19
L-Tryptophan, caffeine complexation with, 268, *268*
Turbidity of colloid, 399
in presence of micelles, 399–400
Tween(s), as emulsifying agents, 489, *489*, 490
Two-point form, linear equation, 8
Tyndall cone, 398

Ultracentrifuge, for measuring sedimentation and molecular weights in colloids, 402–404, *403*
Ultrafiltration, 324
for protein-binding determination, 270–271
for separation of colloidal particles, 394
Ultramicroscope, 398
Ultraviolet spectrophotometry, 81–84
Unit(s), 1–5, 2t, 3t
Universe of topical medications, 501–502, *502*
Upper consolute temperature, 40, *40*, *41*, 218–219
for polymer solutions, 572
Urea, inclusion compounds involving, 258, *258*
inhibition of self-association by, 273
solubility enhancement by, mechanism of, 273
Urease, in ion-selective electrodes, 202–203
Uric acid, as photostabilizer, 311, 312
Urine, buffer systems for, 177
Uterine diffusion, 350–351, *350*, *351*, 351t

Vaginal absorption, 350–351, *350*, *351*, 351t
Valence, equivalent weight and, 105
Valinomycin, in ion-selective electrodes, 202
Van der Waals constant(s), for gases, 27t
Van der Waals equation, for real gases, 26–27
Van der Waals forces, 22–23, 23t
Van't Hoff equation, for colligative properties in dilute solutions, 137, *137*
for effect of temperature on equilibrium constants, 71–72
for molecular weight determination for colloid, 401–402, *401*
for osmotic pressure, 118
Van't Hoff *i* factor, 129–130, *129*
degree of dissociation and, 131
Vapor, defined, 28n
Vapor pressure, activity of solvent and, 134
in solutions, determination of, 111, *111*, *112*
ideal, 106–107, *107*
real, 107–108, *108*
lowering of, equation and proportionality constant for, 121t
in solutions, 110
molecular weight determination from, 119–120
osmotic pressure and, 118–119, *118*
relative, 110
of liquids, 28–29, *29*
Vapor pressure curve, 38, *38*
Vaporization, heat of. *See* Heat of vaporization
Variation, 7, 7t
Vehicle(s), structured. *See* Structured vehicle(s)
topical, drug release from, 339–340
Vehicle-controlled diffusion, 506
Velocity, 3t
root mean square, 26
Velocity gradient, 454, *454*
Ventilation of animal burrows, 354–355, *355*
Vibrational transition(s), 80–81, *80*
Victor Meyer method, 26
Video recording technique, for microscopic determination of particle size, 431
Vinblastine, 307, *308*
Vincristine, decomposition of, 307–308, *308*, 308t
Vindesine, structure of, *308*
Vinyl polymer(s), polydispersity of, 561
structure of, 559
Viscoelasticity, 467–471, *467–470*

Viscometer(s), Brookfield, 465, *465*
capillary, 461–463, *462*
choice of, 460–461, *461*
cone and plate, *465*, 466–467, *466*
Couette-type, 463
creep, 468, *47*
cup and bob, 463–466, *463*, *464*
falling sphere, 463, *463*
Ferranti-Shirley, 466, *466*
for evaluation of semisolids, 500
Hoeppler falling ball, 463, *463*
MacMichael, 463
Ostwald, 461
Ostwald-Cannon-Fenske, *462*
rotovisco, 463–464, *464*
Searle-type, 463–465, *463*, *464*
Stormer, 464–465, *464*
Viscosity, defined, 453
determination of, 460–467
for polymer solutions, 562–563
emulsion stability and, 491
inherent, determination of intrinsic viscosity from, 562–563, *563*
intrinsic, 404
determination of, for polymers, 562–563, *563*
molecular weight of polymers and, 562
kinematic, 455
of colloid, 404–405, *404*
of Newtonian liquids, 455t
of polymer solutions, determination of molecular weight from, 561–563, 562t, *563*
of semisolids, 500–501, *500*, *501*
of suspending agents, 484, *484*
plastic, 456
polymers' effects on, 565–567, *566*
reduced, determination of intrinsic viscosity from, 562, *563*
molecular weight and, 561–562
relative, 404
determination of, 461
specific, 404
temperature and, 455, 456t
Viscosity coefficient, 454
Viscosity-increasing agent(s). *See also* Thickening agent(s)
for prevention of creaming, 491
in parenteral solutions, 546
Vitamin B_{12}, stability of, 207–208
Void porosity, 445
Void volume, 443
Voigt element, 468, *468*
Volt, 126
Voltage. *See* Electromotive force
Voltammetry, 209
Voltmeter, 193
Volume, 2, 3t
bulk, 442–443
specific, 446
excluded, of gases, 27, 27t
molar, computation of, 31
of gas, 24
specific, crystallinity and, 581
specific bulk, 446
specific granule, 446
specific true, 446
void, 443
Volume fraction, solvent (or solute), 224
Volume of distribution, 543n
Volume surface diameter, Quantasorb and Fisher subsieve sizer for determination of, 438, 439
Vulcanization, 589

Warfarin, protein binding of, 273, 273t
Water, air-free, triple point of, 39
critical temperature and pressure of, 27–28
hydrogen bonds in, 23, *24*
ionization of, 146, 148t
melting point of, pressure and, 31–32
phase equilibria of, 38–39, *38*
Water number, 500
Water-alcohol-benzene mixture, phase equilibria in, 44–45
Water-dioxane mixture(s), caffeine solubility in, 227–229, *227*, 228t
Waterfall, energy of, 57–58, *57*
Water-phenol mixture(s), phase equilibria in, 39–41, *40*
Wavelength, 78
Wavenumber, 78
Weight(s), atomic, equivalent weight and, 104–105
defined, 3–4
equivalent, 104–106
molecular. *See* Molecular weight(s)
Weight distribution, for particle size, 428–430, *428*, 428t, *429*, 430t
Weight undersize, in sedimentation method for particle size determination, 433
Wettability, contact angle and, 384–386, *384*, 481
Wetting, 384–386
of particles in formulation of suspensions, 481–482
Wetting agent(s), 384
selection of, 482
tests of efficiency of, 386
Wheatstone bridge, 127, *127*
White-Vincent method for tonicity adjustment, 185–186
Work, 4
heat and, 4, 60–61. *See also* Thermodynamics
maximum, 55, 56
maximum net (useful), 65
Work function, 63–64, 65
Work of adhesion, 368–369, *369*
Work of cohesion, 369, *369*
Work of expansion, against constant pressure, 55–56
heat content and, 57
isothermal, against variable pressure, 56

x axis, 7
Xerogel, 496
X-ray diffraction, crystal structure investigation using, 30–31, *31*

y axis, 7
y intercept, 8
Yield point, 576, *576*
Yield stress, 576, *576*
Yield value, 35, 455–456
Young's equation, 384
Young's modulus, 576, 576t
temperature and, for amorphous polymers, 586, *586*, 588

Zeolite(s), 260
Zero-order reaction(s), 286
Zero-order release, 327, *327*
Zeta potential, 387–388, *388*
critical, stability of lyophobic colloid and, 408
diffuse double layer and, *405*
flocculation and, 482–483, *482*
measurement of, 406, *406*, 407
of emulsion droplets, emulsion stability and, 492, *492*
Zwitterion, 149