Subject Index
Volumes I and II

Absorption, 110, 113–115, 119
for concentration measurement, 244
probability of, 121
Absorption coefficient, 110, 115, 120
bound-bound, 113
bound-free, 113
continuous spectra, 140
frequency dependence, 138, 139, 144
mass, 111
photon in air, 604, 605, 607
for sound, 74, 75, 559, 564
spectral lines, 140
(see also Attenuation coefficient; Mean absorption coefficient)
Absorption cross section, 113
at line center, 114
spectral line, 294, 295
Absorption curve, 269
Absorption lines, 139
Absorption of ultrasound, 555–564
Absorption spectrum,
hydrogen-like atoms, 293–297
molecular, 321–330
Absorption wave, 344–348
Absorptivity, 118
Acoustic equations, 7
Acoustic impedance, 729
Acoustic wave speeds, 741–744
(see also Sound speed)
Activated complex method, 370–373
in NO₂ formation, 381
reaction rate, 372
Activation energy, 189, 368
for self-diffusion of atoms, 694
Adiabatic condition, 357
quantum mechanical, 400
Adiabatic exponent, 208
Adiabatic invariant, 172
Ag (see Silver)
Air,
cooling by radiation, 626–634
degree of ionization, comparison of exact and approximate calculations, 206
dissociation of, 184, 187
equilibrium composition with dissociation and ionization, 187
internal energy with ionization, 206
ionization of, 187, 188, 413–416, 513–515
photon absorption in, 603–606
radiation intensity curve, 336
reaction rates in, 502, 504
as shock tube test gas, 238
shock waves in, 502–505
spark discharge in, 636–638
species present at high temperature, 331
Air, properties of,
with ionization, 196, 197
radiative, 331 ff.
behind shock waves with dissociation and ionization, 211–213
thermodynamic, 188
Al,
photoionization, 276
(see also Aluminum)
Aluminum,
heat of fusion, 764
heat of vaporization, 690, 764
physical characteristics, 698
properties behind shock, 750
thermal expansion, 700
Angular distribution of radiation, 144–151, 155
Anharmonic molecular vibrations, 183
Anharmonic oscillator, 127
in laser effect, 123
Anomalous absorption, 75
Anomalous dispersion, 553–564
Anomalous thermodynamic properties, 67–69
Ar,
excitation of, 391
ionization by Ar, 400

Volume I ends with page 464
Subject Index

Bulk viscosity coefficient, 73, 76, 353, 469
(see also Second viscosity coefficient)

C,
cross section for photoprocesses, 404
photoionization, 267, 268

Ca,
cross section for photoprocesses, 404
photoionization, 267, 268

Calibrated reflection method, 726-730

Cascade emission, 126, 127

Centered compression wave, impossibility
of continuous solution for, 43

Centered rarefaction wave, 37, 38, 41
head, 38
with phase transition, 761
tail, 38
(see also Self-similar motion)

Centered simple wave, 37
(see also Centered rarefaction wave; Self-
similar motion)

Chain reaction mechanism, in NO forma-
tion, 375

Champlain's theorem, 61

Chapman-Jouguet point, 346, 760

Characteristic equations, 19

Characteristics, 15-18
domain of dependence, 22
isentropic flow, 17, 19-25
nonisentropic flow, 17
numerical integration, 24
region of influence, 23

Charge conservation condition, 193

Charge exchange, 386, 416

Chemical equilibrium, effect on thermo-
dynamic properties, 189

Chemical potential, degenerate free elec-
tron gas, 221, 222

Chemical reaction rate, 189

Chemical reactions, 188-192, 368-373,
564-571

Clapeyron–Clausius equation, 586

CO, vibrational relaxation in shock waves,
498

CO₂,
rotational relaxation time, 353
speed of sound in, 554
vibrational relaxation in shock waves, 498

Coherent light, 123

Cold compression curve (see Cold pressure)

Cold energy (see Potential energy of a solid)

Cold pressure, 687, 689-705
empirical, 731
law for high pressures, 693
from shock experiments, 730, 731

Collapse of bubbles, 807-812
compressibility in, 810, 811
viscosity in, 811, 812

Collision method, 724-726

Color temperature, 140, 141

Compressed atom, 226-228
electron density distribution, 226

Compressibility of solids, 687, 691, 692,
697, 732, 735

Compression shock, 491
(see also Relaxation layer, with shock
waves)

Compression wave,
attainable states, 62
"overshooting" of, 44

Compton effect, 124, 125

Compton scattering, 125

Compton wavelength, 442, 882

Concentrated impact on the surface of a gas,
839-846

Condensation, 585-597
in expanding cloud, 591-595
of iron in laboratory, 597
process, 587, 590
rate of, 590, 593-595
thermodynamics of, 588, 589

Condensation centers, 585-588, 590, 592
activation energy for formation, 592
critical size, 592-595
number of, 592-595
supercritical, 592

Conditional equilibrium (see Metastable
equilibrium)

Conservation of number of atoms, condi-
tion, 185, 190, 193

Contact discontinuity, 87-91
thickness, 90, 91

Contact surface, as a "piston" in shock
tubes, 236, 237
(see also Contact discontinuity)

Continuous absorption, 269-276
Continuous spectra, 112, 113, 248 ff.
Cooling wave, 628–636, 638–651
adiabatic cooling, effect of, 639, 648–651
contraction toward center, 634–636
as endothermic detonation, 631
energy balance, 631, 632, 640
stellar photosphere analogy, 645
strong wave, 642–648
structure, 638–651
structure with adiabatic cooling, 648–651
in supernovae, 636
temperature distribution, 645–648
velocity of propagation, 632–634
Copper,
degeneracy temperature, 707
Hugoniot curve for, 707
physical characteristics, 698
properties behind shock, 749, 750
Correction factor, bound-free transitions, 266
Correlation effect in bremsstrahlung emission, 257
Cosmic dust, formation of, 595, 596
Cosmic rays, origin of, 817–820
Coulomb collisions, 417
Coulomb energy of a gas, 216
Coulomb field, divergence in effective radiation, 251
Coulomb interactions, 215
Coulomb logarithm, 519
Crab nebula, 818
Critical point, 68
Critical temperature, 530, 536
Cross section,
absorption, 113 (see also Absorption cross section)
bound-free absorption, 114
Coulomb collision, 419
for electron capture, 263
emission, 252
excitation, 391, 396
ionization, 388, 392–395, 510
photoionization, 265, 266
photoprocesses, 402
resonant scattering, 114
scattering, 113, 115
Thomson, 115, 443
transport scattering, 256
Cs, photoionization, 267, 268
Cu (see Copper)
Cumulation of energy at shock front, 795
D₂,
rotational excitation energy, 352
rotational relaxation time, 353
Damping constant, 284, 445, 885
Debye-Hückel method, 216–218
Debye radius, 216, 524
Debye temperature, 699
Decibels, 9
Decomposition coordinate, 369
Deexcitation, 382, 390
Deformation of a solid, 732–741
Degeneracy temperature, electron gas, 219, 220, 701
Degenerate electron gas, 220–222, 231
Degree of ionization, 195
Degrees of freedom, 177, 349, 468
Delta band system of NO, 324
Dense gases, 217–232
cold, 223–229
hot, 229–232
Density ratio across a strong shock, 51, 52
(see also Limiting density ratio across a shock)
Detailed balancing principle, 120
Detonation mechanism, 92
Diatomic gas, 184
Diatomic molecules, 178
dissociation, 183–188
energy levels, 303 ff:
notation for electronic state, 306–308
symmetry properties, 308
Diffusion approximation for radiation, 151, 152, 154–156, 163, 164
boundary conditions, 148, 149

Volume I ends with page 464
Effect of optical thickness, 147
in shock waves, 532
Diffusion coefficient, 90, 471, 483
for photons, 146, 151
pressure, 483
in recombination model, 410–412
thermal, 483, 484
Diffusion equation for photons, 146, 147
Diffusion model for recombination, 408–412
Dilatation, 734
Dilatation wave speed, 743
Dilatational viscosity coefficient, 73
(see also Second viscosity coefficient)
Dipole solution, nonlinear heat conduction, 674–676
Discontinuities,
formation of, 32
propagation velocity of, 46
(see also Arbitrary discontinuities; Weak discontinuities)
Discontinuity relations (see Shock wave relations)
Dispersion relation, for sound with relaxation, 559–564
Dissipative processes,
in shock front, 465
(see also Diffusion; Heat conduction; Viscosity)
Dissociation, 183, 184
frozen, 575
nonequilibrium, 184, 573–577
rate equation for, 500, 501
role of vibrational energy in, 366
Dissociation energy, 186
\( \text{N}_2, \text{NO}, \text{O}_2, \text{184} \)
Dissociation rates, 365–368
Dissociation relaxation, 362–368
in shock waves, 498–504
in air, 502–505
in \( \text{H}_2, \text{502} \)
in \( \text{N}_2, \text{502} \)
in \( \text{O}_2, \text{501, 502} \)
Dissociation relaxation time, 363
Dissociation spectrum, 310
Dissociative equilibrium constant, 186
Dissociative recombination, 385, 386, 414–416
Distortion wave speed, 743
Doublet splitting, NO, 182
Dugdale-McDonald formula, 730
Effective absorption coefficient, 129
Effective adiabatic exponent, 188, 207–210
Effective front thickness, 82
Effective radiation, 250
Effective ratio of specific heats (see Effective adiabatic exponent)
Effective temperature (see Brightness temperature)
Einstein coefficient,
for absorption, 290–292
for emission, 288–292
Einstein coefficients, relation between, 120, 290
Elastic energy (see Potential energy of a solid)
Elastic pressure, 687–690
(see also Cold pressure)
Elastic wave, 744–746
Elastic wave speed, 743
Elasticity, 732–736
relations among moduli, 735
Elastic-plastic medium, 744
Electric field in a shock wave, 522–526
Electrical conductivity, 515
of dielectrics, 780, 781
ionized air, 515
measurement of, 245
measurement of behind strong shocks in nonmetals, 778–781
Electrical contact method, 724, 779
Electrical contact probes, 245
Electrolytic simulation, 780
Electromagnetic frequency scale (see Radiation spectrum)
Electromagnetic shock tubes, 239–243
Electron attachment, 386, 416
Electron avalanche, 340–343, 387, 401
limited by energy transfer, 506–510
in shock waves, 505, 506, 512
Electron beam scattering, 244
Electron capture, 261–264, 394, 395
cross section for, 263
(see also Recombination)
Electron charge, 441, 881
Subject Index

Electron concentration from gas luminosity, 245
Electron density distribution, compressed atom, 226
  free neutral atom, 225
  slightly compressed atom, 226
Electron diffusion, in a shock wave, 513
Electron gas, 220, 701, 702
  equations of motion, 509
Electron heat conduction,
  in plasma, 656
  preheating layer, 518–520
  in a shock wave, 515–518
Electron mass, 441, 881
Electron orbits, 261
Electron radius, 442, 882
Electron scattering from a standing light wave, 124
Electron spin, 306
Electron temperature, 386, 417, 420
Electron thermal diffusivity coefficient, 656
Electron viscosity, in a shock wave, 516
Electron zone structure, change in behind shock, 780, 781
Electronic deexcitation, 382
  (see also Electronic excitation)
Electronic energy, 304
  in condensed media, 701–705
Electronic excitation, 192–197, 382–386
Electronic excitation energy, 193
Electronic Grüneisen coefficient, 703–705
Electronic partition functions, 181, 182, 195, 198–201
  cutoff of, 195, 196, 198–201
  transformed, 194, 195
Electronic pressure, 703–705
Electronic specific heat, 702–705
Electronic transitions, 111, 246 ff.
Emission, 110, 113, 114, 119
Emission coefficient, 110, 119, 120
Emission cross section, 252
Emittance, 134
Endothermic reactions, 190, 368
Energy distribution in radiation (see Spectral radiant energy density)
Energy exchange time,
  ions and electrons, 509
  atoms and electrons, 509
Energy level diagram,
  nitrogen, 307
  proton-electron system, 111
Energy levels, hydrogen-like atom, 262
Energy of radiation (see Radiation energy)
Engineering equation of state, 176
Entropy,
  approximate relation for, with multiple ionization, 205
  of condensed media, 700
  behind strong shocks in solids, 769
  measurement of behind strong shocks in solids, 770–773, 777, 778
Entropy change, with anomalous thermodynamic properties, 67–69
  in frozen degree of freedom, 556
  with nonequilibrium, 551–553
  shock, 53, 60–62, 465, 471, 474
  shock in a solid, 706, 707
  shock with heat conduction only, 479, 480
  shock with viscosity only, 481, 482
  with viscosity and heat conduction, 72, 474
  weak compression shock, 64–67
  weak rarefaction shock, 64
Entropy equation, with radiant heat transfer, 143
Entropy of radiation, 117, 197
Entropy of vibration, 551
Equation of state,
  condensed media, 704, 705
  empirical for condensed media, 710
  liquid, 810
  perfect gas, 3, 177, 478
Equations for shock front structure, 76, 77, 469
Equations of gasdynamics,
  in Eulerian coordinates, 1–4, 785
  in Lagrangian coordinates, 4–7
  nonequilibrium, 549–551
  one-dimensional with viscosity and heat conduction, 69–72, 469
  with radiant heat transfer, 143
  with radiation energy and pressure, 168–172
Equilibrium radiation, 115–118
Equivoluminal wave speed, 743

Volume I ends with page 464
Subject Index

Excitation,  
  by electron impact, 390–392, 396–398  
  of excited atoms, 396–398  
  by heavy particles, 398–401  
  role of in ionization, 507

Excitation energies, 196, 198–201  
  ionic levels, 195  
  N, N₂, NO, O, O₂, 182

Exothermic reactions, 189, 368

Expansion shock waves, 59–62, 757–762

Explosion at the surface of a gas, 839–846

Explosions of wires, 572

Exponential atmosphere,  
  ascending shocks, 859–863  
  ascending shocks, solution after break­through, 862  
  barometric formula, 849  
  descending shocks, 852–859  
  shock waves in, 849–863

Fe,  
  cross section for photoprocesses, 404  
  photoionization, 267, 268

Fe, vapor properties, 591  
  (see also Iron)

Fermi-Dirac statistics for an electron gas, 218–222

Fermi limiting energy, 220, 221, 701

Filtration theory, 657, 675

Fine structure constant, 443, 883

Finite amplitude waves, 29, 44  
  “overshooting” of, 31, 32  
  steepening of, 31, 32

Fireball, 566, 612, 621  
  breakaway of shock from, 613, 618–621  
  brightness temperature, 625  
  cooling of, 626–636  
  minimum luminosity of, 566, 613, 621–626  
  transparent stage, 635

First law of thermodynamics, 3

First negative band system of N₂²⁺, 305, 330, 334

First positive band system of N₂, 305, 307, 330, 334

First type of self-similar motion, 792, 793

Fluid, 737

Fortrat diagrams, 310

Forward-reverse approximation, 149–151

Fowler T-tube, 239, 240

Frank-Condon factor, 319–321

Frank-Condon principle, 313–321

Free electron states, 111

Free energy, 176, 180, 182  
  of condensed media, 698, 699  
  from Coulomb interactions, 216  
  dissociated diatomic gas, 185  
  ionized gas, 194

  in a high-temperature gas, 258–261

Free neutral atom, electron density distribution, 225

Free piston, compression by, 234

Free surface method, 723, 724

Freezing,  
  of degrees of freedom, 573–585  
  of dissociated molecules, 575  
  of ionized atoms, 583–585  
  of NO, 378, 565, 568  
  of vapor state, 590

Frozen isentrope, 556

Gamma band system of NO, 305, 323, 324, 328–330, 334

Gas constant, 3, 177  
  universal, 3, 177, 441, 881

Gasdynamic equations (see Equations of gasdynamics)

Gaunt factor, 254, 260

Gibbs free energy (see Gibbs potential)

Gibbs potential, 176

Gravitational instability, 818

Gray body, 141, 144

Ground state, proton-electron system, 111

Ground triplet state, O, 182

Grüneisen coefficient, 697–701  
  from cold pressure, 699  
  electronic, 703, 704

H, 199

  cross section for photoprocesses, 404  
  degree of ionization, 195  
  dissociation energy, 212  
  electron energy levels, 112  
  excitation of, 391  
  excited states, 198

Volume I ends with page 464
ionization of, 199, 200, 212
ionization potential, 111, 442, 882
photoionization, 267, 268
\( \text{H}^- \)
binding energy, 268
photodetachment, 269
\( \text{H}_2 \)
dissociation relaxation in shock waves, 502
excitation of, 391
ionization of, 389
properties behind shock waves, 213
rotational energy, 178, 352
rotational relaxation time, 353
as shock tube driver gas, 237, 238
Harmonic oscillator, emission from, 126, 127
\( \text{He} \)
excitation of, 391
ionization by \( \text{He} \), 400
ionization of, 389
as shock tube driver gas, 237
Heat conduction, 69–73, 652–662
approach to self-similar solution, 679–681
at large distance, 659
nonequilibrium radiation, 681–684
(see also Electron, Ion, and Nonlinear heat conduction)
Heat of fusion, 694
Heat of reaction, 190
Heat of vaporization, 690
Heated sphere, transparent, 681–684
Helmholtz free energy (see Free energy)
Hertzberg band system, 323
\( \text{Hg} \)
excitation of, 391
ionization of, 389
photoionization, 276
High pressures in condensed media, experiments, 685, 686, 722–731, 746–750, 770–773
Hugoniot curves, 705–731
thermodynamic properties of solids, 688–705
High-speed photography, 243, 783
Hooke’s law, 733, 735, 744
Hugoniot curves, 49–52, 55–59
for absorption wave, 345–347
anomalous (porous material), 714, 715
anomalous without phase transition, 756
for condensed media, 705–731
empirical for condensed media, 710
experimental methods for solids, 722–731
for iron, 756
with phase transition, 751–756
physically unattainable states, 51
for porous materials, 713–716
with rarefaction shock, 757, 758
Hugoniot relations, 50
with dissociation and ionization, 209–213
with equilibrium radiation, 213–215
Hydrogenic (see Hydrogen-like)
Hydrogen-like atom, 198
binding energy, 199
energy levels, 198
recombination, 405
transformed electronic partition function, 199
Hydrogen-like systems, 248
\( \text{I}_2 \)
dissociation rate, 368, 502
recombination rate, 365
(see also Iodine)
Impact parameter, 250
Impact-radiative recombination, 413
Impedance match method, 726
(see also Calibrated reflection method)
Implosion, 794–807
adiabatic integral for, 800
after collapse, 806
dimensional parameters in, 795
energy integral for, 805, 806
as self-similar motion of second type, 795
similarity exponent for, 803
single differential equation for, 799, 800
singular point condition for, 801
Impulsive load, 820–846
cylindrical analogue, 841, 842
energy conservation, 824–827
exponential atmosphere, 853
infinite energy paradox, 826, 834–839
momentum conservation, 824–827
similarity exponent, 825, 832–834, 842–844
spherical analogue, 839–846

Index of refraction,
  behind strong shocks, 781–784
  compressed water, 783–784
  ice, 784

Induced Compton effect, 124, 125

Induced emission, 118–128

Integrated brightness temperature, 138–140, 165
  plane photosphere, 162

Integrated emission coefficient, bremsstrahlung emission, 258

Integrated radiant energy density, 110, 169–172
  equilibrium radiation, 117, 443, 883

Integrated radiant energy flux, 110
  perfect black body, 118, 443, 883

Integrated radiation intensity, 110

Interferometry, 244

Intermediate complex method (see Activated complex method)

Internal energy,
  air, comparison of exact and approximate calculations, 206
  approximate relation with multiple ionization, 205
  of condensed media, 699
  from Coulomb interactions, 216
  dissociated diatomic gas, 184
  ionized gas, 193, 656
  perfect gas, 183
  power-law relation, 208, 656
  rotational, 178
  of a solid, 694
  translational, 177, 178
  vibrational, 178, 183

"Internal" induced emission, 127

Iodine,
  metallic state, 756
  phase transition, 756

Ion heat conduction, in a shock wave, 515

Ion viscosity, in a shock wave, 516

Ionization, 192–197, 382 ff.
  in air, 413–416
  degree of for air, 206
  by electron impact, 386–390, 392–396, 505–508, 514
  of excited atoms, 392–396
  frozen, 583–585
  by heavy particles, 398–401
  internal energy of air with, 206
  multiple, 201–207
  nonequilibrium, 573–585

Ionization potential,
  average, 203
  effective decrease in, 217, 218
  first, 195
  H, 111, 442, 882
  lowering due to cutoff, 200, 201
  m-ion, 194, 203, 204
  N, N₂, NO, O, O₂, 192
  second, 195

Ionization probes, 245

Ionization rate, 388, 393–396, 405, 578, 579
  in air, 514, 515
  equation for, 508

Ionization relaxation, in shock waves, 505–515
  in air, 513–515
  in Ar, 511–513
  in Xe, 513

Ionization relaxation time, in Ar, 512

Ionized gases, with Coulomb interactions, 215–218

Ionosphere, processes in, 416

Iron,
  cold pressure, 692, 693
  compressibility, 691
  Debye temperature, 699
  elastic moduli, 736
  heat of fusion, 694
  heat of vaporization, 690, 845
  Hugoniot curve for, 714, 756
  melting point, 694
  phase transitions, 751
  porous, Hugoniot curve for, 714
  potential energy, 692
  properties behind shock, 749, 750
  sound speed in, 691, 692
  tensile strength, 691
  threshold temperature, 696

Iron vapor, 591
Irrotational wave speed, 743
Isentropes, 50, 55–61, 65–67
with anomalous thermodynamic properties, 67–69, 757, 758
approximate relation for with multiple ionization, 205
of cold pressure, 690
frozen, 556
with phase transition, 757, 758
Isentropic equation,
condensed media, 700, 701
perfect gas, 178
Isentropic exponent, 4, 207
Isotherm, of cold pressure, 690, 701
Isothermal shock wave, 480, 481
for electron temperature, 519
with radiation, 531, 542
Isothermal sphere, 612
Isotropic compression, 734
Isotropic distribution of radiation, 110

K (see Potassium)
Kholev and Poltavchenko shock tube, 242
Kinematic viscosity, 73, 75, 471
Kinetic energy, degenerate electron gas, 220
Kinetic pressure, 225–277
Kirchhoff’s law, 118, 120, 129
Kolb T-tube, 240, 241
Kr,
photoionization, 276
strong shock wave in, 603
Kramers’ formula, 265
Kramers-Unsöld formula, 271

Lagrangian coordinates, 4–7, 827, 828, 855
Lambda-type doubling, 308
Langmuir probe, 245
Laser beam,
breakdown in, 338–343
heating in, 343–348
Laser effect, 122–124
Lasers, 119, 122
Lead,
heat of fusion, 694, 764
heat of vaporization, 764
Hugoniot curve for, 707
melting point, 694
physical characteristics, 698
properties behind shock, 708
vaporization of on unloading, 768–770
Li,
cross section for photoprocesses, 267, 268, 276
Lifetime of activated complex, 371
Light mean free path (see Photon mean free path)
Lightning, 638
Limiting characteristic ξ₀, 802, 803, 831
Limiting compression, 58
(see also Limiting density ratio across a shock)
Limiting density ratio across a shock, 52, 59
with dissociation and ionization, 209–212
porous material, 715
with radiation, 214, 215
for a solid, 708, 709
(see also Density ratio across a strong shock)
Limiting luminosity of strong shocks, 602, 603, 609–611
Limiting velocity for steady flow, 42
Line broadening, 287, 292
Line impact, 841, 842
Line spectra, 112
Line width, total, 287
Liquids, 694
Local radiation equilibrium, 151–156
Longitudinal sound speed, 742
Longitudinal viscosity coefficient, 76
Longitudinal waves, 743
Lorentz line shape, 126
Lorenz-Lorentz formula, 783
Loschmidt number, 441, 881
Luminosity (see Brightness temperature)
Luminosity of metal vapors, 773–778
Luminosity of shock fronts, 598–611
limiting brightness temperature, 602, 609–611
maximum brightness temperature, 606–609
saturation effect, 599, 600
strong screening, 601, 602

Volume I ends with page 464
Luminosity saturation, 603
(see also Limiting luminosity of strong shocks)
Luminous phenomena in strong explosions, 611-636
Lunar craters, 572
Magnetic annular shock tube, 242
Magnetic shock tubes (see Electromagnetic shock tubes)
Magnetic piston, 240-242
Magnetic quantum number, 316
Mass action law, 186, 190
for ionization, 194
Maximum exhaust velocity for unsteady flow, 102, 103, 237
Maxwell distribution function, 258, 444, 884
Maxwell stress tensor, 168
Mean absorption coefficient, 166
bremsstrahlung, 260
multiply ionized gas, 278-281
singly ionized gas, 275
Mean free path, charged particles, 524
molecular, 70
(see also Photon, Planck, Radiation, and Rosseland mean free paths)
Melting of solids, 694, 756
Metallization of dielectrics, 778-781
Metastable equilibrium, 189, 350
Meteorite impacts, 571, 572, 591, 844-846
Meteors, 515
Method of lateral unloading, 746-748
Microscopic reversibility, principle of, 120
Microwave absorption and reflection, 245
Milne problem, 160, 645, 646
Minimum luminosity of fireball, 566, 613, 621-626
Molecular band spectra, 303 ff.
infrared, 308
structure of, 308-312
Molecular complexes, as condensation centers, 592
Molecular transport of momentum, 70
Molecule impact on a body, 846
Moment of inertia, linear molecule, 181

Momentum density of radiation, 168-171
Momentum flux density tensor, 2, 168
of radiation, 168-172
Momentum transfer method, 724
(see also Collision method)
Monatomic gas, 177
Multiple ionization, approximate calculations for, 201-207
Multiple shock compression, 59

N, absorption coefficients, 334
concentration in ionized air, 197
cross section for photoprocesses, 404
first excited electronic state, energy, 182
ionization of, 389
ionization potential, 192, 385
photoionization, 267
statistical weight, ground state, 182
$N^-$, experimental data, 335
$N^{+4}$, photoionization, 268
$N_2$, absorption coefficients, 334
dissociation energy, 184, 213
dissociation of, 187, 188
dissociation relaxation in shock waves, 502
electronic states and band systems, 305-310, 312, 321
energy level diagram, 307
first excited electronic state, energy, 182
ionization of, 389
ionization potential, 192
oscillator strength, 333, 334
recombination rate, 364, 365
rotational energy, 178, 352
rotational relaxation time, 353
statistical weight, ground state, 182
vibrational energy, 178, 352
vibrational relaxation in shock waves, 498
vibrational relaxation time, 361
$N_2^+$, dissociative recombination of, 385
electronic states and band systems, 305, 321
oscillator strength, 334
Na, cross section for photoprocesses, 404

Volume I ends with page 464
photoionization, 267, 268
(see also Sodium)
NaCl (see Sodium chloride)
Natural line width, 114, 285, 292
Ne,
excitation of, 391
ionization of, 389
Negative ions, photon absorption by (see Photodetachment)
Nernst theorem, 230, 690, 691
NH₃, rotational relaxation time, 353
NO,
arborption by, 324
absorption coefficients, 324
activation energy for decomposition, 378
activation energy for formation, 377, 378
concentration in air, 190
dissociation energy, 184
doublet splitting, ground state, 182
electronic states and band systems, 305, 314, 319–321, 324
first excited electronic state, energy, 182
formation in dissociated air, 187
formation of, 189, 374–378
formation of in strong explosions, 564–571
Frank-Condon factors for β-system, 319, 320
ionization of, 389
ionization potential, 385
oscillator strength, 333, 334
potential curves, 314
reaction rate constant for formation of, 191
relaxation time in formation of, 378
rotational energy, 178
statistical weight, ground state, 182
vibrational energy, 178
vibrational relaxation in shock waves, 498
NO⁺,
in air, 385
dissociative recombination of, 385
NO₂⁺,
arbortion by red light, 622
absorption cross section, 337
color of, 565
concentration in air, 338
formation of, 378–382
formation of in strong explosions, 565, 568
relaxation time in formation of, 379, 380
role of in atomic explosion, 618–624
vibrational energy, 178
N₂O, vibrational relaxation in shock waves, 498
N₂O₄, formation of in air, 565
Nonequilibrium gasdynamics, 547–564
state variables, 549
(see also Relaxation)
Nonlinear heat conduction, 654 ff.
dipole solution, 674–676
electron, 520, 521
in moving media, 676–678
with power law, 655, 656
(see also Thermal wave)
Nonuniformly heated body,
radiation from, 138
radiation spectrum, 139, 140
Normal stress, 732
Nova outbursts, 572
(see also Supernovae, explosions of)
Nuclei for condensation (see Condensation centers)
O,
arbortion coefficients, 334
concentration in ionized air, 197
cross section for photoprocesses, 404
first excited electronic state, energy, 182
ground triplet state, energy spacing, 182
ionization of, 389
ionization potential, 192, 385
photoionization, 267, 268
statistical weight, ground state, 182
O²⁻,
arbortion cross section, 268
binding energy, 268
O³⁺, photoionization, 268
O₂⁺,
arbortion coefficients, 334
dissociation energy, 184
dissociation of, 187, 188
dissociation rate, 367
dissociation relaxation in shock waves, 501, 502
dissociation relaxation time, 368

Volume I ends with page 464
effect of H₂O on vibrational excitation, 361
electronic states and band systems, 305, 313, 321
first excited electronic state, 182
ionization of, 389
ionization potential, 192, 385
oscillator strength, 333, 334
potential curves, 314
recombination rate, 368
rotational energy, 178, 352
rotational relaxation time, 353
statistical weight, ground state, 182
vibrational energy, 178, 353
vibrational relaxation in shock waves, 498
vibrational relaxation time, 361
O₁, binding energy, 268
O₂, dissociative recombination of, 385
O₃, formation of, 367
ultraviolet absorption in, 604
One-sided integrated radiant energy flux, equilibrium radiation, 117, 118.
One-sided spectral radiant energy flux, equilibrium radiation, 117, 118
(see also Surface brightness, spectral)
Optical characteristics, 110
Optical pyrometry, 245, 598, 770, 771
Optical thickness, 111, 135, 151, 532
Optically thick body, 135, 136
Optically thin body, 135, 137
Orbital quantum number, 306
Oscillator, bound electron as, 284–286
Oscillator strength, 290–292
for the continuum, 298–300
hydrogen-like atoms, 296, 297
molecular transitions, 321–323, 332
negative, for emission, 291
Overlapping of spectral lines, 294
Overtaking unloading method, 749
Oxidation of nitrogen, 189, 191, 374–382
rate of, 377, 570, 571
in strong explosions, 564–571
p, u diagrams, 90, 91
p, V diagrams, 55–69
Partial pressures, 186
Partition functions, 179–182
activated complex, 372, 373
free electron, 194
harmonic oscillator, 181
m-ion, 194
monatomic gas, 182
(see also Electronic, Rotational, and Vibrational partition functions)
Pauli exclusion principle, 220, 701
Pb (see Lead)
Peclet number, 72
Perfect black body, 118
Perfect gas, 3, 183
constant specific heats, 176–178
Phase transition of solids, 69, 750–762
relaxation, 753
Phase transitions of the first kind, 751
(see also Polymorphic transformations)
Phosphorous, black, 781
Photochronogram, 783
Photodetachment, 268
Photoelectric effect, 113, 114
Photoexcitation, 406
cross section, 265, 266
Photon absorption, 110
in air, 603–606
Photon and electron collision processes, relation between, 256
Photon distribution function, 108
Photon emission, probability of, 119
Photon gas, 116
Photon lifetime, 111
Photon mean free path, 111
absorption, 115
in air, 605, 607, 611
scattering, 15
(see also Radiation mean free path)
Photon number as invariant of electromagnetic field, 172–175
Photon scattering, 110
Photorecombination, 112, 384, 385, 402–406
Photospheres (see Stellar photospheres)
Pinch effect, 242
Planck constant, 441, 881
Planck distribution function, 121
Planck function, 116
Volume I ends with page 464
Planck mean free path, 166
Plane heat source, linear conduction, 657–659
  nonlinear conduction, 660, 663–668
Plane photosphere problem, 158–164
Plasma relaxation, in shock waves, 515–526
Plasmas,
  polarization in, 509, 522–526
  relaxation in, 416–421, 515–526
Plastic state, 737–741
Plastic wave, 745, 746
Plastic wave speed, 743
Point explosion, 93
  with counterpressure, 99–101
  (see also Strong explosion)
Point heat source, nonlinear conduction, 668–672
Point impact, 839
Poisson’s adiabatics (see Isentropes)
Poisson’s equation, with spherical symmetry, 224
Poisson’s ratio, 734, 737, 742
Polarization of a plasma, 509, 522–526
Polyatomic molecules,
  dissociation, 183
  linear, 178
  nonlinear, 178
Polymorphic transformations, 69, 751, 752
  (see also Phase transition of solids)
Population inversion, 123
Porous media,
  gas flow in, 657
  shock waves in, 712–716
  strong explosions in, 846–849
Potassium, degeneracy temperature, 701
Potential energy of a solid, 689–705
Potential pressure, 225–227
Poynting vector, 108, 169
Poynting-Robertson effect, 596
Prandtl front thickness, 82
Prandtl number, 471
Precursor wave, 745
Preheating layer, 661, 662
  electron heat conduction, 518–520
  radiation, 529–537, 539, 542, 601
Preheating temperature, 529, 530, 536, 601
Pressure,
  approximate relation for, with multiple ionization, 205
  in condensed media, 686, 687, 694, 699
  from Coulomb interactions, 217
degenerate electron gas, 220
electronic, 703–705
  ionized gas, 193
  radiation (see Radiation pressure)
Pressure diffusion, 483
  with viscous stress, 484
Priming electrons, 340, 384, 401
  in shock waves, 505, 506, 510, 513
Probability of atomic transitions, 288–292
Probability of molecular transitions, 316–321
Proton mass, 441, 881
Quantum numbers, molecular, 304, 306–308, 316
Quasi-energy, 125
Quasi-equilibrium, 120
Quasi-momentum, 126
Radiant energy conservation, 130
Radiant heat exchange in a fluid, 141–144
Radiating layer, 139, 540, 602, 610, 644, 645, 774–776
Radiation, 107 ff., 246 ff.
  continuity equation, 130, 145
Radiation cooling of air, 626–634
Radiation energy, 168, 197
  in shock waves, 526, 543–546
Radiation energy losses, 164–168
Radiation entropy (see Entropy of radiation)
Radiation, equilibrium (see Equilibrium radiation)
Radiation from a plane layer, 135–137
Radiation from accelerated electron, 249
Radiation front, 613
Radiation heat conduction approximation, 151–156, 163, 164, 654–656
  in shock waves, 540
Radiation in shock waves, 526–536
  critical case, 530, 536
  with radiation pressure, 543–546
  subcritical case, 529, 535–539
  supercritical case, 530, 539–543

Volume I ends with page 464
Radiation intensity (see Spectral radiation intensity)
Radiation mean free path,
averaged for optically thick body (see Rosseland mean free path)
averaged for optically thin body (see Planck mean free path)
power-law relation, 655, 678
Radiation momentum (see Momentum density of radiation)
Radiation pressure, 142, 168, 172, 197
  isotropic field, 117
  in shock waves, 526, 543–546
Radiation specific heat, 654
Radiation spectrum, 108
  optically thick body, 167
  optically thin body, 167
Radiation thermal conductivity coefficient,
  power-law relation, 655
Radiation thermal diffusivity coefficient, 655
Radiation wave, 344, 348
Radiative capture (see Electron capture)
Radiative emission in spectral lines, 300–303
Radiative equilibrium, in a star, 157–164, 817
Radiative transfer, 107
Radiative transfer equation, 128–130, 132
  quasi-steady, 133
  in shock waves, 532, 533
Rarefaction shock waves, 59–62, 757–762
  with anomalous thermodynamic properties, 67–69
  collision of, 761
Rarefaction wave, 33–37
  attainable states, 62
  cylindrically symmetric, 43
  spherically symmetric, 43
  (see also Centered rarefaction wave)
Rate equations, 550
  vibrational relaxation, 550
Rate of excitation or deexcitation (see Relaxation)
Ratio of specific heats, 4
  (see also Specific heat ratio)
Rayleigh problem, 807–810
Rayleigh-Jeans law, 116
Rayleigh-Jeans region of spectrum, 122
Rb, photoionization, 267, 268
RbH, potential curves, 319
Reaction rate, by activated complex method, 372
  (see also Chemical reactions; Relaxation)
Recombination, 382, 387, 577, 578
diffusion model for, 408–412
  impact-radiative, 413
  kinetics of, 574, 575, 578–585
  molecular, 364–368, 387
  role of energy balance in, 580–585
  role of resonance radiation, 585
  by three-body collisions, 406–413
  (see also Dissociation; Ionization)
Recombination coefficient, 387, 578, 579
Recombination rate, 388, 395, 578, 579
Red edge, 311, 312
Reduced functions, 788
  equations for, 797, 798
Reflection method (see Calibrated reflection method)
Reflectivity, 118
Refractive index,
  behind strong shocks, 781–784
  compressed water, 783–784
  ice, 784
Relaxation,
  dissociation, 362–368
  in plasmas, 416–421
  phase transition, 753
  rotational, 352, 353
  translational, 349
Relaxation in shock waves, 489 ff.
  dissociation, 498–504
  ionization, 505–515
  molecular vibrations, 494–498
  plasma, 515–526
Relaxation layer, 234, 468
  with shock waves, 489 ff. (see also Relaxation in shock waves)
Relaxation processes, 349 ff.
  order of, 351
  in sound waves, 556–564
Relaxation times, 351, 548, 561, 562
  for dissociation, 363
  for equilibrium radiation, 130
  in NO formation, 378

Volume I ends with page 464
Subject Index

in NO₂ formation, 379, 380
for photoprocesses, 403
in a plasma, 421
rotational, 353, 469, 470
turbocational, 356, 360-362, 550
Remote ignition, 92
Representatives, 786
(see also Reduced functions)
Re-radiation, 129
Resonance radiation, 507, 513
diffusion of, 581, 582, 585
Resonant energy transfer, 122
Resonant photons, 507
Resonant scattering, 114
Resonant scattering cross section at line
center, 114
Rest mass energy of electron, 442, 882
Restricted equilibrium, 120
Reversible reactions, 189
Reynolds number, 72, 811
Riemann invariants, 19-21, 26
Rosseland mean free path, 152, 153
air, 280
bremsstrahlung, 260
effect of spectral lines on, 297, 298
multiply ionized gas, 278-281
singly ionized gas, 274, 275
Rosseland weighting factor, 153
Rotating mirror camera, 243
Rotation wave speed, 743
Rotational energies, 181, 304
H₂, 178, 352
N₂, 178, 352
NO, 178
O₂, 178, 352
Rotational partition function, 181
Rotational quantum number, 304
Rotational relaxation, 352, 353
and bulk viscosity, 469, 470
Rotational relaxation times, 353, 469, 470
Rotational structure of band spectra, 308-312
Rydberg, 293, 442, 882
Scabbing, 720-722
from rarefaction shocks colliding, 761, 762
Scale height, 849
Scale transformation, 786, 787
Scattering, 110, 114, 115, 286
Scattering coefficient, 110
mass, 111
Scattering cross section, 113, 115
Schlieren photography, 244
Schumann-Runge band system, 305, 323, 330, 333, 334
Schwarzschild approximation (see Forward-reverse approximation)
Screening effect, 251
Screening radius, in a plasma, 418
Second law of thermodynamics, 4, 552
Second positive band system of N₂, 305, 307-310, 312, 330, 334
Second type of self-similar motion, 794
Second viscosity coefficient, 73, 74, 76, 469, 564
and internal degrees of freedom, 74, 469
from rotational relaxation, 469, 470
Selection rules, diatomic molecules, 308
Selective absorption, 114
Self-adsorption, 136
Self-consistent electric field, 223, 224
Self-similar compression wave, impossibility
of continuous solution for, 43, 44
Self-similar motion, 39, 785-863
adiabatic integral for, 800
as asymptotic limit, 679-681, 792, 809, 834-839
centered rarefaction wave, 38-41, 761
centered simple wave (see Centered rarefaction wave)
conditions for, 790-792
dimensional parameters in, 791-794
energy conservation, 824-827
exponential, 789
exponentially decreasing density, 859-863
exponentially increasing density, 852-859
of first type, 792, 793
with impulsive load, 820-846
infinite energy paradox, 826, 834-839
Lagrangian coordinate, 827, 828, 855

Saha equation, 194, 195, 444, 884
Saturated vapor, 586
Sawtooth absorption curve, 273, 274

Volume I ends with page 464
limitations on similarity exponent, 833, 834, 840–842
momentum conservation, 824–827
plane arbitrary discontinuities, 86, 87
power-law, 789
with power-law density, 812–817
rarefaction wave, 33–38, 791
of second type, 794
single differential equation for, 799, 800
singular point condition for, 801
thermal wave, 664–676
unloading, 761–763
(see also Strong explosion; Sudden expansion of a gas cloud into vacuum)
Shadow photography, 244
Shear modulus of elasticity, 735, 736, 742
Shear strain, 735
Shear stress, 732
critical, 740
Shear wave speed, 743
Shock adiabatics (see Hugoniot curves)
with binary diffusion, 485–489
with Burnett approximation, 476
with diffusion only, 488, 489
with dissociation, 498–504
with heat conduction only, 477–481
with ionization, 505–515
with kinetic theory, 476
in a plasma, 515–526
in a polarized plasma, 524–526
with radiation, 526–546 (see also Radiation in shock waves)
with relaxation, 489 ff. (see also Relaxation in shock waves)
with vibrational relaxation, 494–498
with viscosity only, 481–482
viscous, 468–477
Shock front thickness, 73, 467, 468, 471, 474–476, 489
with binary diffusion, 486
measurement of, 244
in N₂ with vibrational relaxation, 498
in O₂ with vibrational relaxation, 498
Shock tubes, 88, 89, 233–245
with combustion, 238
conditions behind reflected wave, 238, 239
driver gas, 234, 235
methods of measurement, 243–245
principle of operation, 234–236
test gas, 234, 235
Shock wave front, 491
(see also Relaxation layer, with shock waves)
Shock wave reflection from end of shock tube, 89, 238, 239
Shock wave relations, 45–49, 471
Shock wave structure (see Shock front structure)
Shock waves,
in air, 502–505
with anomalous thermodynamic properties, 67–69
with electric fields, 522–526
formation of, 23, 44
isothermal, 480, 481 (see also Isothermal shock wave)
in lead, 708
limiting density ratio (see Limiting density ratio across a shock)
moving downward in atmosphere, 852–859
moving upward in atmosphere, 859–863
in a plasma, 515–526
in porous materials, 712–716
with radiation (see Radiation in shock waves)
rarefaction, 757–762
reflection at free surface, 716–722, 762–778 (see also Unloading)
with relaxation, 489 ff. (see also Relaxation in shock waves)
in solids (see Shock waves in solids)
Shock waves in solids, 685 ff.
electrical conductivity behind, 778–781
experimental determination of temperature and entropy, 770–773
Hugoniot curves, 705 ff.
linear velocity approximation, 710
refractive index behind, 781–784
weak, 710
Short-duration pulse, 821
(see also Impulsive load)
Silica, heat of vaporization, 845
Silver, degeneracy temperature, 701
Similarity exponent,
  exponentially decreasing density, 860
  exponentially increasing density, 858
  for implosion, 803
  for impulsive load, 825, 832–834, 842–844
  limitations on, 833, 834, 840–842
  with power-law density, 814
  singular point condition for, 802
Similarity transformations (see Transformation groups)
Similarity variable, 788
  exponential, 789
  exponential atmosphere, 854
  power-law, 789
  strong explosion, 793
  thermal wave, 665
Simple waves, 27–30, 32
Slater-Landau formula, 730
Slightly compressed atom, electron density distribution, 228
Sodium, degeneracy temperature, 701
Sodium chloride, cold pressure, 692, 731
Sound absorption, 74, 75, 555–564
  coefficient of, 74, 75
  frequency dependence, 558, 563
Sound dispersion, 75, 553–564
Sound intensity, 9
  (see also Decibels)
Sound speed, 7, 554, 691, 692, 732, 741–744
  complex, 561–563
  frozen, 554, 562
  longitudinal, 742
  measurement of in compressed material, 746–750
  thin plate, 742
  thin rod, 742
Sound wave propagation with viscosity and heat conduction, 74, 75
Sound waves,
  energy of, 12
  monochromatic, 10
  plane, 7, 8, 10
  propagation velocity of, 8
  spherical, 13–15
  (see also Finite amplitude waves)
Spalling, 720
  (see also Scabbing)
Spark discharge in air, 636–638
Specific heat, 177, 179
  of condensed media, 695–697
  diatomic molecules, 183
  with dissociation, 184, 186, 187
  electronic, 702–705
  with ionization, 656
  power-law relation, 656
  rotational, 178, 554
  translational, 177, 178, 554
  vibrational, 178, 183, 554
Specific heat ratio,
  complex, 561
  diatomic gas, vibrations excited, 179
  diatomic gas, vibrations frozen, 179
  effective nonequilibrium, 548
  equilibrium radiation, 117
  monatomic gas, 179
Spectra in nebulae, 201
Spectral emission coefficient, bremsstrahlung emission, 258
Spectral energy flux, one-sided (see One-sided spectral energy flux)
Spectral line shape, 127
Spectral line width, 126, 127
Spectral lines, 283–292
Spectral measurement of light intensity, 244
Spectral radiant energy density, 109
  equilibrium radiation, 116, 444, 884
  (see also Planck function)
Spectral radiant energy flux, 109
Spectral radiant energy flux vector, 109
Spectral radiation intensity, 109, 128–130
  equilibrium radiation, 116, 444, 884
  integral expressions for, 131, 132
Spectroscopic notation, 306–308
Speed of light, 441, 881
Speed of sound (see Sound speed)
Split-off (see Scabbing)
Split-off method (see Free surface method)
Splitting of waves,
  elastic-plastic, 744–746
  with phase transition, 751–756
Spontaneous emission, 119, 121, 127, 129
  probability of, 121
Stark effect, 200

Volume I ends with page 464
<table>
<thead>
<tr>
<th>Subject Index</th>
<th>Page Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Star surface, shock emerging from</td>
<td>812–820</td>
</tr>
<tr>
<td>Stars (see Stellar photospheres)</td>
<td></td>
</tr>
<tr>
<td>State variables, nonequilibrium</td>
<td>549</td>
</tr>
<tr>
<td>Statistical weight,</td>
<td></td>
</tr>
<tr>
<td>free electron state, 192, 194</td>
<td></td>
</tr>
<tr>
<td>ground state N, N₂, NO, O, O₂, 182</td>
<td></td>
</tr>
<tr>
<td>hydrogen-like atom, 265</td>
<td></td>
</tr>
<tr>
<td>Stefan-Boltzmann constant, 117, 443, 883</td>
<td></td>
</tr>
<tr>
<td>Stellar photospheres, 154</td>
<td></td>
</tr>
<tr>
<td>radiative equilibrium in, 157–164, 817</td>
<td></td>
</tr>
<tr>
<td>Steric factor, 370</td>
<td></td>
</tr>
<tr>
<td>Stimulated emission (see Induced emission)</td>
<td></td>
</tr>
<tr>
<td>Stirling's formula, 180</td>
<td></td>
</tr>
<tr>
<td>Strain tensor, 732</td>
<td></td>
</tr>
<tr>
<td>Streak photography, 783</td>
<td></td>
</tr>
<tr>
<td>Stress,</td>
<td></td>
</tr>
<tr>
<td>normal, 732</td>
<td></td>
</tr>
<tr>
<td>shear, 732</td>
<td></td>
</tr>
<tr>
<td>Stress tensor, 732, 736</td>
<td></td>
</tr>
<tr>
<td>viscous, 71</td>
<td></td>
</tr>
<tr>
<td>Strong explosion, 93–99, 566–567</td>
<td></td>
</tr>
<tr>
<td>approximate treatment, 97–99</td>
<td></td>
</tr>
<tr>
<td>with counterpressure, 94</td>
<td></td>
</tr>
<tr>
<td>in exponential atmosphere, 849–852</td>
<td></td>
</tr>
<tr>
<td>in a porous medium, 846–849</td>
<td></td>
</tr>
<tr>
<td>similarity law, 95, 793</td>
<td></td>
</tr>
<tr>
<td>Strong shock relations, 51, 52, 94</td>
<td></td>
</tr>
<tr>
<td>with equilibrium radiation, 213–215</td>
<td></td>
</tr>
<tr>
<td>Subcritical shock wave, 535–539</td>
<td></td>
</tr>
<tr>
<td>Sudden expansion of a gas cloud into vacuum, 101–106, 571–585</td>
<td></td>
</tr>
<tr>
<td>condensation in, 591–595</td>
<td></td>
</tr>
<tr>
<td>conditions for self-similarity, 104–106</td>
<td></td>
</tr>
<tr>
<td>with energy release, 106</td>
<td></td>
</tr>
<tr>
<td>frequency of Coulomb collisions, 575</td>
<td></td>
</tr>
<tr>
<td>isothermal, 106</td>
<td></td>
</tr>
<tr>
<td>plane layer, 104</td>
<td></td>
</tr>
<tr>
<td>translational temperature, 575, 576</td>
<td></td>
</tr>
<tr>
<td>Sum rule,</td>
<td></td>
</tr>
<tr>
<td>molecular, 318, 319</td>
<td></td>
</tr>
<tr>
<td>for oscillator strengths, 299</td>
<td></td>
</tr>
<tr>
<td>Sun, unit of illumination, 616</td>
<td></td>
</tr>
<tr>
<td>Supercooled (see Supersaturated)</td>
<td></td>
</tr>
<tr>
<td>Supercritical shock wave, 539–543</td>
<td></td>
</tr>
<tr>
<td>Supernovae, cooling wave in, 636</td>
<td></td>
</tr>
<tr>
<td>explosions of, 817–820</td>
<td></td>
</tr>
<tr>
<td>Supersaturated vapor, 585–588, 590, 592</td>
<td></td>
</tr>
<tr>
<td>Surface brightness,</td>
<td></td>
</tr>
<tr>
<td>black body, 137</td>
<td></td>
</tr>
<tr>
<td>integrated (see Integrated brightness temperature)</td>
<td></td>
</tr>
<tr>
<td>spectral, 136, 137</td>
<td></td>
</tr>
<tr>
<td>Symmetry factor, 181</td>
<td></td>
</tr>
<tr>
<td>Symmetry properties, diatomic molecules, 308</td>
<td></td>
</tr>
<tr>
<td>Taper tube, 242, 243</td>
<td></td>
</tr>
<tr>
<td>Temperature, effect on dissociation, 186, 187</td>
<td></td>
</tr>
<tr>
<td>measurement of behind strong shocks in solids, 770–773</td>
<td></td>
</tr>
<tr>
<td>translational, 350, 550</td>
<td></td>
</tr>
<tr>
<td>vibrational, 356, 552</td>
<td></td>
</tr>
<tr>
<td>Tensile wave, 742</td>
<td></td>
</tr>
<tr>
<td>(see also Unloading wave)</td>
<td></td>
</tr>
<tr>
<td>Thermal conductivity coefficient, 71, 652, 653</td>
<td></td>
</tr>
<tr>
<td>of radiation (see Radiation thermal conductivity coefficient)</td>
<td></td>
</tr>
<tr>
<td>Thermal diffusion, 483, 484</td>
<td></td>
</tr>
<tr>
<td>Thermal diffusivity coefficient, 72, 75, 471, 653, 654</td>
<td></td>
</tr>
<tr>
<td>electron (see Electron thermal diffusivity coefficient)</td>
<td></td>
</tr>
<tr>
<td>radiation (see Radiation thermal diffusivity coefficient)</td>
<td></td>
</tr>
<tr>
<td>Thermal energy, 693–705</td>
<td></td>
</tr>
<tr>
<td>Thermal expansion coefficient, 56, 65, 697</td>
<td></td>
</tr>
<tr>
<td>Thermal pressure, 687, 693–705</td>
<td></td>
</tr>
<tr>
<td>temperature dependence, 697</td>
<td></td>
</tr>
<tr>
<td>Thermal radiation, 107</td>
<td></td>
</tr>
<tr>
<td>Thermal wave, 660 ff</td>
<td></td>
</tr>
<tr>
<td>almost-spherical, 670</td>
<td></td>
</tr>
<tr>
<td>approach to self-similar solution, 681</td>
<td></td>
</tr>
<tr>
<td>constant flux boundary, 673, 674</td>
<td></td>
</tr>
<tr>
<td>constant temperature boundary, 672, 673</td>
<td></td>
</tr>
<tr>
<td>dipole solution, 674–676</td>
<td></td>
</tr>
<tr>
<td>leading edge, 662</td>
<td></td>
</tr>
<tr>
<td>luminosity, 672</td>
<td></td>
</tr>
<tr>
<td>plane source, 663–668</td>
<td></td>
</tr>
<tr>
<td>point source, 668–672</td>
<td></td>
</tr>
<tr>
<td>self-similar solution with motion, 678</td>
<td></td>
</tr>
<tr>
<td>self-similar solutions, 664–676</td>
<td></td>
</tr>
</tbody>
</table>
speed compared with shock speed, 671, 672, 677, 678
Thermodynamic equilibrium, 349
disturbed in shock front, 466
Thermodynamic functions,
of condensed media, 688-705
with Coulomb corrections, 216-218
monatomic gas, 182, 183
rotational contribution to, 183
behind strong shocks in solids, 770-773
vibrational contribution to, 183
Thermodynamic properties of solids, 688-705
Thermonuclear reactions, rate of, 359
Thin plate wave speed, 742
Thin rod wave speed, 742
Thomas-Fermi method, 220-229
generalized for nonzero temperature, 229-232
Thomas-Fermi-Dirac method, 693
Thomson cross section, 115, 443, 883
Thomson theory for recombination, 406
Threshold for breakdown, 342
Threshold temperature, 696
Total absorption coefficient (see Attenuation coefficient)
Total emission coefficient, 120
Transformation groups, 668, 785-787
scale, 786, 787
Transition probabilities,
atomic, 288-292
hydrogen atom, 300-302
molecular, 316-321
vibrational (see Vibrational excitation, probability of)
Transitions,
between excited states, 396-398
bound-bound, 112, 114, 283 ff.
bound-free, 112, 261 ff.
electronic, 111, 246 ff.
free-free, 112-114, 248 ff.
Translational motion in condensed media, 695
Translational partition function, 180, 182
Translational relaxation, 349
Translational temperature, 350, 550
Transparency temperature, 607, 608
in cooling wave, 628, 632, 633
heated sphere problem, 682
Transport scattering cross section, 256
Transverse wave speed, 743
Transverse waves, 743
True absorption coefficient, 110
Ultraviolet light, absorption in air, 604
Unimolecular reactions, 369
Unimpeded molecules, 659
Unimpeded photons, 662
Unloading, 762-778
complete vaporization, 766-773
luminosity of metal vapors, 773-778
self-similar wave, 763
supercooled vapor, 766
superheated liquid, 764, 765
weak, 716-722
Unloading wave, 717, 742
self-similar, 763
(see also Unloading)
Unsteady flow into vacuum, 42, 101-106, 237, 547
van der Waals’ gas, 69
entropy correction, 769
Vapor condensation (see Condensation)
Vaporization,
of ground on meteorite impact, 845, 846
in shock waves, 762
on unloading, 776-773
Vegard-Kaplan forbidden band system, 305, 307, 323
Velocity doubling method, 723
(see also Free surface method)
Velocity doubling rule, 716-718
accuracy of, 718
porous materials, 724
Viable nuclei (see Condensation centers, supercritical)
Vibrational energies, 182, 304
of condensed media, 695
N₂, 178, 354
NO, 178
NO₂, 178
O₂, 178, 354

Volume I ends with page 464
Vibrational entropy, 551
Vibrational excitation, 355–361
rate equation for, 355, 496
Vibrational partition function, 181
Vibrational quantum number, 304
Vibrational relaxation, 494–498
in CO, CO₂, N₂, NO, N₂O, O₂, 498
Vibrational relaxation time, 356, 360–362, 496, 497
Vibrational-rotational coupling, 183
Vibrational temperature, 356, 552
Violet edge, 311, 312
Virial theorem, 227, 228
Viscosity, 69–73
concept of, 467
Viscosity coefficient, 71, 73, 473
“Viscous” pressure, 71
Viscous stress tensor, 71
Visible spectrum, 108
Volume radiator, 135, 136
Water,
properties behind shock, 749
refractive index, 783, 784
Wave equation, 7
for density change in plane motion, 8
solutions of in plane motion, 8
for velocity in plane motion, 8
Wave number, 442, 882
complex, 560, 563
Weak discontinuities, 32
Weak shock front structure, 79–81
heat conduction but no viscosity, 77–81
viscosity but no heat conduction, 81–84
Weak shock wave relations, 53, 63–67
Weak shock waves, 56
reflection at free surface, 716–722
in solids, 710, 711
Weakly anisotropic radiation field, 145–151
Weakly imperfect gases, 215, 216
Weakly ionized gas, 281
photon absorption in, 421
relaxation in, 281
Wien region, 121
Wien’s displacement law, 116
Wilson cloud chamber, 586, 587, 590
x-ray absorption, 244
Xe, 207
ionization relaxation in, 513
photoionization, 276
properties behind shock waves, 213
strong shocks in, 603
Young’s modulus, 733, 742
Zero-point energy, vibrations, 181, 689
Zero volume, 689