CAMBRIDGE

Cambridge University Press
0521337151 - An Introduction to Thermal Physics
C. J. Adkins
Index
More information

Index

absolute zero, 6, 7
absorptivity, spectral, 96
adiabatic changes, 2
  in ideal gas, 41
angle, 120
angle of contact, 80
atmosphere, dependence of pressure on height, 52
atomicity of matter, 43
atomic size, 74
averaging over distributions, 121
Avogadro constant, 46
Avogadro's principle, 48

Bernoulli effect, 30
Bernoulli's theorem, 30
bimetallic strip, 9
black body, 95
black body radiation, 95
boiling, 84, 100
bolometers, 91
Boltzmann constant, 47
Boltzmann factor, 11, 53, 54, 81, 82
bond energies, 75
bonding, 74
bound states, 11
Boyle's law, 40
Brownian motion, 44
bubble chamber, 86
bubbles, 85
bulk moduli of ideal gas, 43
bulk modulus, 42, 76
bumping of liquids, 86

caloric, 26
calorific value, 27
calorimeters,
  vacuum, 26
  constant flow, 27, 29
calorimetry, 26
capillary rise, 80
Carnot cycle, 107
Carnot engines, 107
  efficiency of, 109
cascade liquefaction, 69
Celsius temperature, 8
centigrade temperature scales, 5
  differences between, 5
change of phase, 110
change of state, 64
Clausius–Clapeyron equation, 111
Clausius statement of second law, 105
cloud chambers, 84
cloud formation, 84
collision
  of atoms, 74
  of molecules, 60
colour films, 100
colour of hot bodies, 100
colour temperature, 100
compressibility, 42
compression ratio, 110
compressors, 30
condensation nuclei, 84
conductivity, 31
constraint, 2
continuity condition, 30
convection, 63, 90
coordination number, 78
countercurrent heat exchanger, 69
covalent bonding, 74
critical constants, 66
critical temperature, 66
cubic array, 80
cycle, 105

Dalton's law, 49
dead space, 9
degradation of energy, 20, 115
  and entropy increase, 116
degrees of freedom, 2
  in molecular motion, 47, 49, 51
  internal, 49, 50
  translational, 47, 49
detailed balance, 46
dew, 82, 97
dew point, 82
diesel engine, 56
differential air thermometer, 90
diffuse reflexion, 46
diffusion,
  of molecules, 32, 48
  of thermal energy, 31, 32, 60
displacement law, 100
distribution functions, 53, 93
  and averaging, 121
distribution of molecular speeds, 53, 121
  measurement of, 54
droplet formation, 84
Dulong and Petit's law, 51

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
0521337151 - An Introduction to Thermal Physics
C. J. Adkins
Index
More information

efficiency,
of heat engines, 106, 109
of heat pumps, 112
of refrigerators, 112
Einstein, 100
elasticity, 75
electrical conductivity, 31
electromagnetic spectrum, 91
electron diffraction, 44
electronvolt, 53
emissive power, 97
spectral, 92
emissivity,
average, 98
spectral, 96
empirical temperature scales, 5
entropy, 115
equal temperature enclosure, 94
energy density in, 99
equilibrium,
dynamic, 81, 93
thermal, 3
unstable, 84, 85
equilibrium radiation, 94
energy density of, 99
equipartition of energy, 48
and gases, 48–50
and oscillators, 50
breakdown of, 51
evaporation, 82, 84, 110
exchanges, Prévost's theory of, 93
exclusion principle, 74
expansion of solids, 76
expansivity,
cubic, 77
linear, 76

field-ion microscope, 44
figure of merit, 112
first law, 18
differential form of, 25
flow of heat,
along a bar, 32
in insulating solids, 31
in metals, 32
radial, in a cylinder, 33
flow processes, 29
flow work, 29
flux, molecular, 122
force,
interatomic, 73–75
intermolecular, 60, 64, 66–68
van der Waals', 74
work by, 20
'four-terminal' connection, 26
free expansion, 41, 67
friction, 107
frost, 82, 97
function of state, 17
functions, mathematical, 4

gas constant, 40
gases,
ideal, 40
kinetic theory of, 43, 61–64, 120
liquefaction of, 67
non-ideal, 66
gas thermometers, 6, 8
Graham's law of diffusion, 48
greenhouses, 97
guard ring, 33

heat, 18
latent, 78
specific, 24
heat capacities, 23
general definition, 25
molar, 24
of gases, 27, 43, 49
of solids, 51
principal, 24
specific, 24
heat engines, 105
efficiency of, 106
ideal, 109
heat exchanger, 69
heat flow,
along a bar, 32
in insulating solids, 31
in a metal, 32
radial, in a cylinder, 33
heat pumps, 79
efficiency of, 79
ideal, 112
helium, 70
homopolar bonding, 74
Hooke's law, 20, 75
hot air balloons, 55
hotness, 20
sensation of, 3
hysteresis, 107

ice point, 5, 8
ideal gas, 40
adiabatic changes, 41
bulk moduli, 43
compression of, 21
definition of, 40
equation of state, 40, 123
in gravitational field, 52
internal energy of, 41
kinetic theory of, 43, 120
molar volume of, 48
pressure of, 46, 47, 123
principal heat capacities, 42, 49, 50
scale of temperature, 40, 113
ideal gases,
diffusion of, 48
mixtures of, 48
interatomic forces, 73–75
interatomic potential energy, 73

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
0521337151 - An Introduction to Thermal Physics
C. J. Adkins
Index
More information

intermolecular forces, 60, 64, 66–68
  in gases, 45
intermolecular potential energy, 41, 64, 67
internal energy, 17
internal pressure, 67
International Practical Temperature Scale, 13
inversion temperature, 66, 68
ionic bonding, 74
isothermal atmosphere, 52
isotherms, 4
  of ideal gas, 4
  of pure substance, 65
  van der Waals', 67
isotropic materials, 77

jet engines, 29
Johnson noise, 50
Joule expansion, 41, 67
Joule–Kelvin effect, 68
Joule's law, 40, 67

kelvin, 7
Kelvin statement of second law, 104
kinetic theory of gases, 43, 61–64, 120
Kirchhoff's law, 96

latent heat, 78
  of fusion, 79
  of vaporization, 27, 78
laws of science, 1
laws of thermodynamics, 1
  first, 18
  second, 104, 105
  zeroth, 3
Leslie's cube, 95
liquefaction of gases, 67
liquid structure, 78
Lorenz number, 32

macroscopic physics, 1
Maxwell distribution, 54, 122
mean free path,
  in a gas, 60, 74
  of phonons, 31
melting, 65, 79, 110
metallic bonding, 74
method of mixtures, 28
microcalorimetry, 27
microscopic physics, 1
mixed phase regions, 66
mixtures, method of, 28
modulus, 76
  bulk, 42, 76
  Young, 75
mole, 46
molecular flux in gases, 122
molecular rotation, 49
molecular size, 60, 65, 67, 74
molecular speeds,
  distribution of, 53, 121
  mean, 47, 122
  mean square, 47, 122
  typical, 47
molecular spin, 51

Newton's law of cooling, 26, 92, 99
noise in electrical circuits, 50
nucleation, 84, 86

oscillators,
  and equipartition, 50
  quantization of, 100
Otto cycle, 110

parameters, thermodynamic, 1
partial differentials, 25
partial pressure, 49
Pauli exclusion principle, 74
perfect gas, see *ideal gas*
perpetual motion,
  of first kind, 18
  of second kind, 104
petrol engine, 110
phase, 66
phase change, 66, 110
phonons, 31
photons, 51, 93
Planck constant, 51, 93, 100
Planck radiation law, 12, 101
pressure difference across curved surfaces, 23
Prévost's theory of exchanges, 93
principal heat capacities, 24
  of ideal gas, 42, 50
pyrometers, 12

quantization, 51, 93, 100
quantum, 51, 100

radian, 120
radiant heat, 90
radiation,
  black body, 95
  equilibrium, 94
  thermal, 90
radiation shield, 97, 102
reference points, 9
refrigerators,
  domestic, 79, 112
  efficiency of, 112
  ideal, 112
regelation, 65
relative atomic mass, 46
relative humidity, 82
relative molecular mass, 46
reservoir, 106
reversibility, 107
rotation of molecules, 49

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
0521337151 - An Introduction to Thermal Physics
C. J. Adkins
Index
More information

scale height, 52
scale of temperature, 4
  Celsius, 8
  centigrade, 5
  empirical, 5
  ideal gas, 6, 40, 113
  International Practical, 13
scattering of electrons, 11, 32
shining of sun, 53
size,
  of atoms, 74
  of molecules, 60, 65, 67, 74
solar constant, 102
solar furnace, 103
solid angle, 121
specific quantities, 24
specular reflexion, 45
speed of sound, 43, 47
spin, 51
standard temperature and pressure, 48
state, 1
states of matter, 64
steam engines, 106, 109
steam point, 5, 8
steam turbines, 109
Stefan–Boltzmann constant, 98, 101
Stefan–Boltzmann law, 13, 98, 101
steradian, 121
streamline flow, 30
sublimation, 66, 110
supercooling, 84
superheating, 85
supersaturation, 84
surface tension, 22
  measurement of, 80
  molecular origin, 79
system, 1

temperature, 3
  measurement of, 8
  thermodynamic, 6, 109, 113
temperature gradient, 31
temperature scale, 4
  Celsius, 8
  centigrade, 5
  empirical, 5
  International Practical, 13
  perfect gas, 6, 40, 113
thermal conductivity, 31
  determination of, 32, 63
  of gases, 62, 124
  of insulating solids, 32
  of metals, 32
thermal contact, 2
thermal energy, 2, 18, 48
  and change of state, 64
  diffusion of, 31, 32, 60
  of oscillators, 50
thermal equilibrium, 3
thermal expansion, 76
thermal interactions, 2
thermal isolation, 2
thermal noise, 50
thermal radiation, 90
  detection of, 90
  energy distribution in, 92, 99–101
thermal resistance, 33
thermionic emission, 82
thermistors, 12
thermocouples, 10
thermodynamic temperature, 6, 109
  identity with ideal gas scale, 113
  unit of, 7
thermoelectric e.m.f., 10
thermography, 92
thermometric quantities, 5
thermometry, 8
thermopile, 92
translational motion, 48
transport phenomena, 61
triple point, 66
  cell, 7
  of water, 7
tube of flow, 30

unified atomic mass constant, 46
units, vii
  conversion of, viii

van der Waals' equation, 67
van der Waals' forces, 74
vaporization, latent heat of, 27, 78
vapour, 66
  saturated, 81
  unsaturated, 82
vapour pressure, 65, 81
  measurement of, 81
  over curved surfaces, 83
  variation with temperature, 81, 111
variables, thermodynamic, 1
velocity gradient, 63
viscosity, 63
  of gases, 64, 124

wave-particle duality, 44
wetting, 80
Wiedemann–Franz law, 32
Wien's displacement law, 100
Wilson cloud chamber, 84
work, various forms of, 20
work function, 82
working fluid, 79
working substance, 106
work-like interactions, 2

X-ray diffraction, 44

Young modulus, 75

zeroth law, 3

© Cambridge University Press www.cambridge.org