INDEX

A

absolute temperature scale, 10, 53
absolute zero, 10, 53
ac current, 662, 689
ac voltage, 662, 689
Adiabatic compressions, 128
adiabatic expansion, 128
adiabatic process, 124, 133
Alternating current (ac), 662
alternating current (ac), 689
amber, 183
ammeter, 466, 479
ampere, 386, 544
Ampère, 386, 495
ampere (amp), 420
Ampère's law, 549, 568
analog meter, 468
anode, 435
Arago, 495
area vector, 237, 274
Aurorae, 503
average power, 676, 689
Avogadro, 72
Avogadro's number, 72, 98

B

back emf, 611, 615
bandwidth, 681, 689
Bardeen, 417
battery, 433
Battery testers, 439
BCS theory, 417
Bernoulli, 79
Biot, 495
Biot-Savart law, 536, 568
Bluetooth, 726
Boltzmann, 70
Boltzmann constant, 70, 98
boundary, 110, 133
Boyle, 69
Boyle's law, 69
braking systems, 605

C

calorie, 20
calorie (cal), 53
calorimeter, 24, 53
calorimetry, 24, 53
camera flashes, 634
capacitance, 347, 376
capacitive reactance, 666, 689
capacitor, 345, 376, 665
Carnot, 155
Carnot cycle, 155, 171
Carnot engine, 155, 171
Carnot principle, 171
Carnot's principle, 158
cathode, 435
Cell membranes, 354
Cell phone, 724
Celsius scale, 10, 53
Chadwick, 187
charging by induction, 190, 220
Charles, 69
Charles's law, 69
circuit, 389, 420
Clausius, 147
Clausius statement of the second law of thermodynamics, 147, 171
closed system, 110, 133
coaxial cable, 353, 574, 637
coefficient of linear expansion, 13, 53
coefficient of performance, 152, 171
coefficient of volume expansion, 16, 53
cold reservoir, 148, 171
Comet McNaught, 699
comets, 719
commutator, 511
compass needle, 494
condensation, 26
conduction, 35, 53
conduction electron, 189, 220
conductor, 189, 220
constant-volume gas thermometer, 12
continuous charge distribution, 204, 220
convection, 43, 53
conventional current, 389, 420
Cooper, 417
Cooper pairs, 418
cosmic rays, 503, 521
coulomb, 184, 220, 545
Coulomb, 184
Coulomb force, 192, 220
Coulomb's law, 220
credit card, 614
critical point, 27, 53
Critical pressure, 27
critical pressure, 53
critical temperature, 27, 53, 76, 98, 416, 420
current density, 395, 420
cyclic process, 125, 133
cyclotron, 518, 521
cylindrical symmetry, 259, 274

D

dalton, 72
Dalton, 85
Dalton's law of partial pressures, 85, 98
Davy, 495
Debye, 26
Debye temperature, 26
dees, 519, 521
defibrillator, 364
degree Celsius, 10, 53
degree Fahrenheit, 10, 53
degree of freedom, 90, 98
density of water, 17
Diamagnetic materials, 561
diamagnetic materials, 568
dielectric, 346, 376
dielectric breakdown, 371, 376
dielectric constant, 365, 376
dielectric strength, 328, 371, 376
diesel cycle, 179
digital meter, 468
Digital signal processing, 630
diode, 408, 420
dipole, 190, 220
dipole antenna, 711
dipole moment, 217, 220
Direct current (dc), 662
direct current (dc), 689
disorder, 167, 171
displacement current, 701, 729
drift velocity, 391, 420
dry ice, 28

E

eddy current, 602, 615
efficiency (*e*), 149, 171
electric charge, 184, 220
electric dipole, 308, 333
electric dipole moment, 310, 333
electric field, 198, 220
electric flux, 237, 274, 701
electric force, 185, 220
electric generator, 615
electric potential, 293, 333
electric potential difference, 294, 333
electric potential energy, 333
electric power, 409

electrical conductivity, 397, 420
electrical current, 386, 420
electrical potential energy, 286
electrical power, 420
electrolytic capacitor, 353
electromotive force (emf), 432, 479
electron, 186, 220
electron-volt, 297, 333
electrostatic attraction, 185, 220
electrostatic force, 196, 220
electrostatic precipitators, 331, 333
electrostatic repulsion, 185, 220
electrostatics, 196, 220
emf, 582
emissivity, 47, 53
energy conservation, 117
energy density, 362, 376, 713
energy flux, 714
entropy, 160, 171
entropy statement of the second law of thermodynamics, 163, 171
environment, 110, 133
equation of state, 111, 133
equilibrium, 111, 133
equipartition theorem, 90, 98
equipotential line, 320, 333
equipotential surface, 320, 333
equivalent resistance, 440, 479
escape velocity, 83
evaporation, 26
expansion joints, 12
extensive variable, 112, 133

F

Fahrenheit scale, 10, 53
farad, 347
Faraday, 347, 495, 582
Faraday's law, 615, 629
ferromagnetic material, 560
ferromagnetic materials, 568
field line, 213, 220
field line density, 215, 220
first law of thermodynamics, 116, 133
flash camera, 472
flux, 236, 274
forced convection, 43
Franklin, 184, 390
free electrons, 265, 274
freezing, 26
freezing of water, 16

G

gamma ray (γ ray), 727, 729
Gauss, 235
gauss, 497, 521
Gaussian surface, 247, 274
Gay-Lussac's law, 70
generators, 606
giant magnetoresistance, 495, 613
Gilbert, 184
gradient, 317
greenhouse effect, 50, 53
ground fault circuit interrupter, 478
grounding, 320, 333

H

half-wave antenna, 712
Hall, 514
Hall effect, 514, 521
hard drives, 613
heat, 19, 53
heat engine, 148, 171
heat of fusion, 31, 53
heat of sublimation, 34, 53
heat of vaporization, 31, 53
heat pump, 150, 160, 171
heat transfer, 8, 53
helical motion, 503, 521
Henry, 629
henry (H), 628, 651
Hertz, 705
hot reservoir, 148, 171
hybrid vehicles, 614
hysteresis, 564, 568

I

ideal gas, 70, 98
ideal gas law, 70, 98
impedance, 672, 689
induced dipole, 218, 220
induced electric field, 598, 615
induced electric-dipole moment, 370, 376
induced electrical field, 369, 376
induced emf, 583, 615
induced surface charges, 369, 376
Inductance, 628
inductance, 651
inductive reactance, 668, 689
inductive time constant, 640, 651
inductor, 633, 651, 667
infinite plane, 211, 220
infinite straight wire, 208, 220
infrared radiation, 726, 729
ink jet printer, 331, 333
insulation, 40
insulator, 189, 220
intensity, 714
intensive variable, 112, 133
internal combustion engine, 148
internal energy, 19, 81, 98, 115, 133
internal resistance, 435, 479
ion, 187, 220
irreversibility, 147, 171
irreversible process, 147, 171
isentropic, 168, 171
isobaric process, 124, 133
isochoric process, 124, 133
isothermal expansion, 113
isothermal process, 123, 133

J

Josephson junction, 419, 420
Joule, 20
junction rule, 453, 479

K

Kamerlingh Onnes, 416
Kelvin scale, 10
Kelvin scale (K), 53
Kelvin statement of the second law of thermodynamics, 153, 171
kilocalorie, 20
kilocalorie (kcal), 53
kinetic theory of gases, 78, 98
Kirchhoff, 453
Kirchhoff's rules, 453, 479
Klein bottle, 249

L

laser printer, 330
latent heat coefficient, 31, 53
law of conservation of charge, 186, 220
Law of Dulong and Petit, 92
LC circuit, 645, 651
lead acid battery, 434
Lenz, 586
Lenz's law, 586, 615
Leyden jar, 184
light sail, 721
lightning rod, 328
linear charge density, 205, 220
loop rule, 454, 479
Lorentz force equation, 703

M

magnetic damping, 602, 604, 615
magnetic dipole, 513, 521
magnetic dipole moment, 513, 521
magnetic domains, 563, 568
magnetic energy density, 637, 651
magnetic field lines, 500, 521
magnetic flux, 583, 615
magnetic force, 496, 521
magnetic monopoles, 501
magnetic resonance imaging, 557
magnetic susceptibility, 562, 568
mass spectrometer, 517, 521
Maxwell, 90, 700
Maxwell-Boltzmann distribution, 93, 98
Maxwell's equations, 700, 729
mean free path, 87, 98
mean free time, 87, 98
mechanical equivalent of heat, 20, 53
Meissner effect, 417, 420
melting, 26
metal detectors, 605, 633
microwaves, 725, 729
molar heat capacity at constant pressure, 127, 133
molar heat capacity at constant volume, 88, 126, 133
mole, 72, 98
most probable speed, 96, 98
motionally induced emf, 593, 615
motor (dc), 521
Motors, 511
multi-loop circuit, 453
mutual inductance, 651
mutual inductance (*M*), 628

N

natural convection, 43
net rate of heat transfer by radiation, 49, 53
neutron, 187, 220
non-quasi-static processes, 123
nonohmic, 406, 420
normal vector, 238
north magnetic pole, 494, 521
nucleus, 186

O

Oersted, 495
ohm, 397, 420
Ohm, 406
ohmic, 406, 420
ohmmeter, 468
Ohm's law, 406, 407, 420
open system, 110, 133
Otto cycle, 178

P

pacemaker, 473
parallel circuit, 440
parallel combination, 357, 376
parallel-plate capacitor, 346, 376
paramagnetic material, 560
paramagnetic materials, 568
partial pressure, 85, 98
peak emf, 615
peak speed, 96, 98
perfect engine, 153, 171
perfect refrigerator, 153
perfect refrigerator (heat pump), 171
permanent dipole, 217, 220
permeability of free space, 536, 568
permittivity of free space, 701
permittivity of vacuum, 193, 221
phase angle, 670, 689
phase diagram, 27, 53
phase transition, 76
Phase transitions, 26
phasor diagrams, 665
photoconductor, 330, 333
pinch effect, 544
planar symmetry, 263, 274
polarization, 189, 221, 265
potential difference, 432, 479
potential drop, 437, 454, 479
Power capacitors, 673
power factor, 677, 689
Power plants, 148
Poynting vector, 714, 729
principle of superposition, 195, 221
proton, 186, 221
pV diagram, 75, 98

Q

quality factor, 681, 689
quasi-static process, 113, 123, 133

R

R factor, 40
radar, 725, 729
radiation, 35, 54
radiation pressure, 719, 729
radio waves, 724, 729
rail gun, 592
rate of conductive heat transfer, 38, 54
RC circuit, 469, 479
refrigerator, 150, 171, 450
relative humidity, 86
resistance, 401, 420
resistivity, 397, 420
resistor, 664
resonant frequency, 680, 689
reversible process, 125, 133, 146, 171
right-hand rule, 541
right-hand rule 2, 587
right-hand rule-1, 497, 521
RLC circuit, 648, 651
RLC series circuit, 670
rms current, 667, 689
rms voltage, 667, 689
root-mean-square (rms) speed, 82, 98
Rutherford, 186

S

Savart, 495
scalar field, 199
schematic, 389, 420
Schrieffer, 417
self-inductance, 632, 651
series circuit, 440
series combination, 356, 376
shock hazard, 475, 479
short circuit, 475
smartphone, 627
Snow, 145
solar cells, 465
solenoid, 555, 568, 587
south magnetic pole, 494, 521
spark chamber, 302
specific heat, 21, 54
speed of light, 709
spherical symmetry, 252, 274
SQUID, 419, 420
standard temperature and pressure (STP), 72
starter motor, 387
state functions, 117
state variable, 21
static electricity, 182, 221
Stefan-Boltzmann law of radiation, 48, 54
step-down transformer, 686, 689
step-up transformer, 686, 689
Stirling engine, 164

sublimation, 28, 54
superconductivity, 416, 420
supercritical, 77, 98
supercritical fluid, 27
superposition, 203, 221
surface charge density, 205, 221
surroundings, 110, 133

T

tablet computers, 613
television, 724
temperature, 8, 54
terminal voltage, 434, 479
tesla, 497, 521
thermal agitation, 725, 729
thermal conductivity, 39, 54
thermal energy, 19
thermal equilibrium, 8, 54, 111
thermal expansion, 12, 54
thermal hazard, 475, 479
thermal stress, 18, 54
thermodynamic process, 123, 133
thermodynamic system, 110, 133
thermodynamic variables, 123
thermographs, 48
Thermometers, 10
third law of thermodynamics, 168, 171
Thomson, 186
three-wire system, 477, 479
time constant, 470
toroid, 568
traffic signals, 633
transcranial magnetic stimulation (TMS), 614
transformer, 684, 689
transformer equation, 686, 689
transmission lines, 684
triple point, 12, 27, 54

U

ultraviolet radiation, 727, 729
unified atomic mass unit (u), 72
universal gas constant, 73, 98

V

Van Allen radiation belts, 503
Van de Graaff generator, 306, 329, 333
van der Waals, 75
van der Waals equation of state, 75, 98
van der Waals gas, 114
vapor, 28, 54
vapor pressure, 28, 54, 86, 98
variable air capacitor, 353
vector field, 199
velocity selector, 515, 521
Visible light, 726
visible light, 729
volt (V), 294
Volta, 294
voltage, 294, 333
voltaic pile, 432
voltmeter, 466, 479
volume charge density, 205, 221

W

weber, 584
WiFi, 726
work, 112
working substance, 149

X

X-ray, 727, 729
xerography, 329, 333

Y

Young, 705

Z

zeroth law of thermodynamics, 8, 54, 111