

Index

- Aberration, 27–7, 34–10
Absolute zero, 1–5
Absorption, 31–8 ff
Acceleration, 8–8 ff
 components of, 9–3
 of gravity, 9–4
Activation energy, 42–7
Adams, J. C., 7–5
Adiabatic compression, 39–5
Adiabatic expansion, 44–5
Affective future, 17–4
Air trough, 10–5
Algebra, 22–1 ff
Amplitude modulation, 48–3
Amplitude, of oscillation, 21–3
Analog computer, 25–8
Anderson, C. D., 52–10
Angle, of incidence, 26–3
 of reflection, 26–3
Angstrom (unit), 1–3
Angular frequency, 21–3, 29–2
Angular momentum, 7–7, 18–5 f, 20–1
 conservation of, 4–7, 18–6 ff, 20–5
 of rigid body, 20–8
Anomalous refraction, 33–9 f
Antimatter 52–10 f
Antiparticle, 2–8
Aristotle, 5–1
Atom, 1–2
 metastable, 42–10
Atomic clock, 5–5
Atomic hypothesis, 1–2
Atomic particles, 2–9 f
Atomic processes, 1–5 f
Attenuation, 31–8
Avogadro, A., 39–2
Avogadro's number, 41–10
Axial vector, 52–6 f
- Becquerel, A. H., 28–3
Birefringence, 33–3 ff
Blackbody radiation, 41–5 f
Bohm, 52–10
Bohr, N., 42–9
Bohr radius, 38–6
Boltzmann, 41–2
Boltzmann's law, 40–2 f
Born, M., 37–1, 38–9
Boyle's law, 40–8
Bremsstrahlung, 34–6 f
Brewster's angle, 33–6
Briggs, H., 22–6
Brown, R., 41–1
Brownian motion, 1–8, 6–5, 41–1 ff
- Capacitance, 23–5
Capacitor, 14–9, 23–5
Capillary action, 51–8
Carnot, S., 4–2, 44–2 ff
Carnot cycle, 44–5 f, 45–2
Carrier signal, 48–3
Catalyst, 42–8
- Cavendish, H., 7–9
Cavendish's experiment, 7–9
Center of mass, 18–1 f, 19–1 ff
Centrifugal force, 7–5, 12–11
Čerenkov, P. A., 51–2
Čerenkov radiation, 51–2
Charge, conservation of, 4–7
 on electron, 12–7
Chemical energy, 4–2
Chemical kinetics, 42–7 f
Chemical reaction, 1–6 ff
Chromaticity, 35–6 f
Circular motion, 21–4
Clausius, R., 44–2, 44–3
Clausius-Clapeyron equation, 45–6 ff
Coefficient, of friction, 12–4
 gravitational, 7–9
Collision, 16–6
 elastic, 10–7
Color vision, 35–1 ff
 physiochemistry of, 35–9 f
Complex impedance, 23–7
Complex numbers, 22–7 ff, 23–1 ff
Compound eye, 36–6 ff
Compression, adiabatic, 39–5
 isothermal, 44–5
Cones, 35–1
Conservation, of angular momentum,
 4–7, 18–6 ff, 20–5
 of charge, 4–7
 of energy, 3–2, 4–1 ff
 of linear momentum, 4–7, 10–1 ff
Contraction hypothesis, 15–3
Copernicus, 7–1
Coriolis force, 19–8 f
Cornea, 35–1
Coulomb's law, 28–2
Cross section, for scattering, 32–7
Crystal diffraction, 38–4 f
- Dedekind, R., 22–4
Degrees of freedom, 25–2, 39–12
Density, 1–4
Derivative, 8–5 ff
 partial, 14–9
Dicke, R. H., 7–11
Differential calculus, 8–4
Diffraction, 30–1 ff
 by screen, 31–10 f
Diffraction grating, 29–5, 30–3 ff
Diffusion, 43–1 ff
Dipole moment, 12–6
Dipole radiator, 28–5 f, 29–3 ff
Dirac, P., 52–10
Dirac equation, 20–6
Dispersion, 31–6 ff
Distance, 5–5 ff
Distance measurement, color brightness,
 5–6
 triangulation, 5–6
Doppler effect, 17–8, 23–9, 34–7 f, 38–6
Double stars, 7–6
- Dynamics, 7–2 f, 9–1 ff
 relativistic, 15–9 f
- Efficiency, of ideal engine, 44–7 f
Einstein, A., 2–6, 7–11, 12–12, 15–1, 16–1,
 41–8, 42–8, 42–9
Elastic collision, 10–7
Elastic energy, 4–2, 4–6
Electrical energy, 4–2
Electric field, 2–4, 12–7 f
Electromagnetic energy, 29–2
Electromagnetic field, 2–2, 2–5, 10–9
Electromagnetic radiation, 26–1, 28–1 ff
Electromagnetic waves, cosmic rays, 2–5
 gamma rays, 2–5
 infrared, 2–5, 23–8, 26–1
 light, 2–5
 ultraviolet, 2–5, 26–1
 x-rays, 2–5, 26–1
Electron, 2–4, 37–1, 37–4 ff
 charge on, 12–7
 radius of, classical, 32–4
Electron cloud, 6–11
Electron-ray tube, 12–9
Electron volt (unit), 34–4
Ellipse, 7–1
Energy, chemical, 4–2
 conservation of, 3–2, 4–1 ff
 elastic, 4–2, 4–6
 electrical, 4–2
 electromagnetic, 29–2
 gravitational, 4–2 ff
 heat, 4–2, 4–6, 10–7, 10–8
 kinetic, 1–7, 4–2, 4–5 f, 39–4
 mass, 4–2, 4–7
 nuclear, 4–2
 potential, 4–4, 13–1 ff, 14–1 ff
 radiant, 4–2
 relativistic, 16–1 ff
Energy levels, 38–7 f
Energy theorem, 50–7 f
Enthalpy, 45–5
Entropy, 44–10 ff, 46–7 ff
Eötvös, 7–11
Equilibrium, 1–6
Euclid, 5–6
Euclidean geometry, 12–3
Evaporation, 1–5 f
 of a liquid, 40–3 f, 42–1 ff
Expansion, adiabatic, 44–5
 isothermal, 44–5
Exponential atmosphere, 40–1 f
Eye, compound, 36–6 ff
 human, 35–1 f, 36–3 ff
- Farad (unit), 25–7
Fermat, P., 26–3
Fermi (unit), 5–10
Fermi, E., 5–10
Fields, 2–2, 2–4, 2–5, 10–9, 12–7 ff, 13–8 f,
 14–7 ff
 superposition of, 12–9

- Focal length, 27-1 ff
Focus, 26-5
Force, centrifugal, 7-5, 12-11
 components of, 9-3
 conservative, 14-3 ff
 Coriolis, 19-8 f
 electrical, 2-3 ff
 gravitational, 2-3
 molecular, 1-3, 12-6 f
 moment of, 18-5
 nonconservative, 14-6 f
 nuclear, 12-12
 pseudo, 12-10 ff
Fourier, J., 50-2 f
Fourier analysis, 50-2 ff
Fourier transform, 25-4
Four-vectors, 15-8 f, 17-5 ff
Fovea, 35-1
Frank, I., 51-2
Frequency, angular, 21-3, 29-2
 of oscillation, 2-5
Fresnel's reflection formulas, 33-8
Friction, 10-5, 12-3 ff
 coefficient of, 12-4

Galileo, 5-1, 7-2, 9-1, 52-3
Galilean relativity, 10-3
Galilean transformation, 12-11
Gauss (unit), 34-4
Gell-Mann, M., 2-9
Geometrical optics, 26-1, 27-1 f
Gravitation, 2-3, 7-1 ff, 12-2
Gravitational acceleration, 9-4
Gravitational coefficient, 7-9
Gravitational energy, 4-2 ff
Gravitational field, 12-8 ff, 13-8 f
Gravity, 13-3 ff
 acceleration of, 9-4
Green's function, 25-4
Gyroscope, 20-5 ff

Harmonic motion, 21-4, 23-1 ff
Harmonic oscillator, 10-1, 21-1 ff
 forced, 21-5 f, 23-3 ff
Harmonics, 50-1 ff
Heat, 1-3, 13-3
Heat energy, 4-2, 4-6, 10-7, 10-8
Heat engines, 44-1 ff
Heisenberg, W., 6-10, 37-1, 37-9, 37-11, 37-12, 38-9
Helmholtz, H., 35-7
Henry (unit), 25-7
Hooke's law, 12-6
Huygens, C., 15-2, 26-2
Hypocycloid, 34-3

Ideal gas law, 39-10 ff
Impedance, 25-8 f
 complex, 23-7
Incidence, angle of, 26-3
Inclined plane, 4-4
Index, of refraction, 31-1 ff
Inductance, 23-6
Inductor, 23-6
Inertia, 2-3, 7-11
 moment of, 18-7, 19-5 ff
 principle of, 9-1
Infrared radiation, 23-8, 26-1
Integral, 8-7 f
Interference, 28-6, 29-1 ff
Interfering waves, 37-4
Interferometer, 15-5
Ion, 1-6
Ionic conductivity, 43-6 f
Ionization energy, 42-5
Isothermal atmosphere, 40-2
Isothermal compression, 44-5
Isothermal expansion, 44-5
Isotopes, 3-4 ff

Jeans, J., 40-9, 41-6 f
Johnson noise, 41-2, 41-8
Joule (unit), 13-3
Joule heating, 24-2

Kepler, J., 7-1
Kepler's laws, 7-1 f, 9-1, 18-6
Kerr cell, 33-5
Kinetic energy, 1-7, 4-2, 4-5 f, 39-4
 rotational, 19-7 ff
Kinetic theory, 42-1 ff
 of gases, 39-1 ff
Kirchhoff's laws, 25-9

Laplace, P., 47-7
Laser, 32-6, 42-10
Least time, principle of, 26-3 ff, 26-8
Leibnitz, G. W., 8-4
Lens formula, 27-6
Leverrier, U., 7-5
Light, momentum of, 34-10 f
 polarized, 32-9
 scattering of, 32-5 ff
 speed of, 15-1
Light waves, 48-1
Linear momentum, conservation of, 4-7, 10-1 ff
Linear systems, 25-1 ff
Logarithms, 22-4
Lorentz, H. A., 15-3
Lorentz contraction, 15-7
Lorentz transformation, 15-3, 17-1, 34-8, 52-2

Magnetic field, 12-9 f
Magnetic induction, 12-10
Magnetism, 2-4
Magnification, 27-5
Maser, 42-10
Mass, 9-1, 15-1
 center of, 18-1 f, 19-1 ff
 relativistic, 16-6 ff
Mass energy, 4-2, 4-7
Mass-energy equivalence, 15-10 f
Maxwell, J. C., 6-1, 6-9, 28-1, 40-8, 41-7, 46-5
Maxwell's equations, 15-2, 25-3, 47-7
Mayer, J. R., 3-2
Mean free path, 43-3 f
Mean square distance, 6-5, 41-9
Mendeléev, 2-9
Metastable atom, 42-10
Meter (unit), 5-10
Mev (unit), 2-9
Michelson-Morley experiment, 15-3 ff
Miller, W. C., 35-2
Minkowski, 17-8
Modes, 49-1 ff
Mössbauer, R., 23-9
Mole (unit), 39-10
Molecular attraction, 1-3, 12-6 f
Molecular diffusion, 43-7 ff
Molecular motion, 41-1
Molecule, 1-3
Moment, dipole, 12-6
 of force, 18-5
 of inertia, 18-7, 19-5 ff
Momentum, 9-1 f, 38-2 ff
 angular, 7-7, 18-5 ff, 20-1, 20-5
 of light, 34-10 f
 linear, 4-7, 10-1 ff
 relativistic, 10-8 f, 16-1 ff
Monatomic gas, 39-5
Motion, 5-1, 8-1 ff
 circular, 21-4
 constrained, 14-3
 harmonic, 21-4, 23-1 ff
 parabolic, 8-10
 planetary, 7-1 ff, 9-6 f, 13-5
Music, 50-1

Nernst heat theorem, 44-11
Neutrons, 2-4
Newton, I., 8-4, 15-1, 37-1
Newton-meter (unit), 13-3
Newton's laws, 2-6, 7-3 ff, 7-11, 9-1 ff, 10-1 ff, 11-7 f, 12-1, 39-2, 41-1, 46-1
Nishijima, 2-9
Nodes, 49-2
Noise, 50-1
Nuclear cross section, 5-9
Nuclear energy, 4-2
Nuclear forces, 12-12
Nucleus, 2-4, 2-8 ff
Numerical analysis, 9-6
Nutation, 20-7

Ohm (unit), 25-7
Ohm's law, 25-7, 43-7
Optic axis, 33-3
Optic nerve, 35-2
Optics, 26-1 ff
 geometrical, 26-1, 27-1 ff
Oscillation, amplitude of, 21-3
 damped, 24-3 f
 frequency of, 2-5
 period of, 21-3
 periodic, 9-4
 phase of, 21-3
Oscillator, 5-2
 harmonic, 10-1, 21-1, 21-5 f, 23-3 ff

Pappus, theorem of, 19-4
Parabolic antenna, 30-6 f
Parabolic motion, 8-10
Parallel-axis theorem, 19-6
Parallel-plate capacitor, 14-9
Paraxial rays, 27-2
Partial derivative, 14-9
Pascal's triangle, 6-4
Pendulum, 49-6 f
Pendulum clock, 5-2
Period, of oscillation, 21-3
Periodic time, 5-1 f
Perpetual motion, 46-2
Phase, of oscillation, 21-3
Phase shift, 21-3
Phase velocity, 48-6
Photon, 2-7, 26-1, 37-8
Physiochemistry, of color vision, 35-9 f
Planck, M., 41-6, 42-8, 42-9
Planck's constant, 5-10, 6-10, 17-8, 37-11
Planetary motion, 7-1 ff, 9-6 f, 13-5

- Poincaré, H., 15-3, 15-5, 16-1
 Polarization, 33-1 ff
 Polarized light, 32-9
 Potential energy, 4-4, 13-1 ff, 14-1 ff
 Power, 13-2
 Pressure, 1-3
 Probability, 6-1 ff
 Probability density, 6-8 f
 Probability distribution, 6-7 ff
 Proton, 2-4
 Pseudo force, 12-10 ff
 Ptolemy, 26-2
 Purkinje effect, 35-2
 Pythagoras, 50-1
- Quantum electrodynamics, 2-7, 28-3
 Quantum mechanics, 2-2, 2-6 ff, 6-10, 10-9, 37-1 ff, 38-1 ff
- Radiant energy, 4-2
 Radiation, infrared, 23-8, 26-1
 relativistic effects, 35-1 ff
 synchrotron, 34-3 ff, 34-6
 ultraviolet, 26-1
 Radiation damping, 32-3 f
 Radiation resistance, 32-1 ff
 Radioactive clock, 5-3 ff
 Radius, of electron, 32-4
 Ramsey, N., 5-5
 Random walk, 6-5 ff, 41-8 ff
 Ratchet and pawl machine, 46-1 ff
 Rayleigh's criterion, 30-6
 Rayleigh's law, 41-6
 Reciprocity principle, 30-7
 Rectification, 50-9
 Reflection, 26-2 f
 angle of, 26-3
 Refraction, 26-2 f
 anomalous, 33-9 f
 index of, 31-1 ff
 Relativistic dynamics, 15-9 f
 Relativistic energy, 16-1 ff
 Relativistic mass, 16-1 ff
 Relativistic momentum, 10-8 f, 16-1 ff
 Relativity, special theory of, 15-1 ff
 Galilean, 10-3
 theory of, 7-11, 17-1
 Resistance, 23-5
 Resistor, 23-5
 Resolving power, 27-7 f, 30-5 f
 Resonance, 23-1 ff
 electrical, 23-5 ff
 in nature, 23-7 ff
 Resonance interaction, 2-9
 Retarded time, 28-2
 Retina, 35-1
 Rigid body, 18-1
 angular momentum of, 20-8
 rotation of, 18-2 ff
 Ritz combination principle, 38-8
- Rods, 35-1, 36-6
 Roemer, O., 7-5
 Root-mean-square distance, 6-6
 Rotation, of axes, 11-3 f
 plane, 18-1
 of a rigid body, 18-2 ff
 in space, 20-1 ff
 in two dimensions, 18-1 ff
 Rushton, 35-9
 Rydberg (unit), 38-6
- Scalar, 11-5
 Scattering, of light, 32-5 ff
 Schrödinger, E., 35-6, 37-1, 38-9
 Scientific method, 2-1 f
 Screw jack, 4-5
 Second (unit), 5-5
 Seismograph, 51-5
 Shannon, C., 44-2
 Shear wave, 51-4
 Side bands, 48-4 f
 Simultaneity, 15-7 f
 Sinusoidal waves, 29-2 f
 Smoluchowski, 41-8
 Smooth muscle, 14-2
 Snell, W., 26-3
 Snell's law, 26-3, 31-2
 Sound, 2-3, 47-1 ff, 50-1
 speed of, 47-7 f
 Space, 8-2
 Space-time, 2-6, 17-1 ff
 Special theory of relativity, 15-1 ff
 Specific heat, 40-7 f, 45-2
 Speed, 8-2 ff, 9-2
 of light, 15-1
 of sound, 47-7 f
 Spontaneous emission, 42-9
 Standard deviation, 6-9
 Statistical fluctuations, 6-3 ff
 Statistical mechanics, 3-1, 40-1 ff
 Stevinus, S., 4-5
 "Strangeness" number, 2-9
 Striated muscle, 14-2
 Superposition, of fields, 12-9
 principle of, 25-2 ff
 Symmetry, 1-4, 11-1 ff
 of physical laws, 16-3, 52-1 ff
 Synchrotron, 2-5, 15-9, 34-3 ff, 34-6
- Tamm, I., 51-2
 Temperature, 39-6 ff
 Thermal conductivity, of a gas, 43-9 f
 Thermal equilibrium, 41-3 ff
 Thermal ionization, 42-5 ff
 Thermodynamics, 39-2, 45-1 ff
 laws of, 44-1 ff
 Thompson scattering cross section, 32-8
 Three-body problem, 10-1
 Tides, 7-4 f
 Time, 2-3, 5-1 ff, 8-1, 8-2
 retarded, 28-2
- standard of, 5-5
 transformation of, 15-5 ff
 Torque, 18-4, 20-1 ff
 Transformation, Fourier, 25-4
 Galilean, 12-11
 linear, 11-6
 Lorentz, 15-3, 17-1, 34-8, 52-2
 of time, 15-5 ff
 of velocity, 16-4 ff
 Transient, 24-1 ff
 electrical, 24-5 f
 Transient response, 21-6
 Translation, of axes, 11-1 ff
 Twin paradox, 16-3 f
 Tycho Brahe, 7-1
- Ultraviolet radiation, 26-1
 Uncertainty principle, 2-6, 6-10 f, 37-9, 37-11, 38-8 f
 Unit cell, 38-5
 Unit vector, 11-10
- Vector, 11-5 ff
 Vector algebra, 11-6 f
 Vector analysis, 11-5, 52-2
 Vector product, 20-4
 Velocity, 8-3, 9-2 f
 components of, 9-3
 transformation of 16-4 ff
 Vinci, Leonardo da, 36-2
 Virtual work, principle of, 4-5
 Vision, 36-1 ff
 binocular, 36-4
 color, 35-1 ff
 Visual cortex, 36-4
 Visual purple, 35-9
- Wapstra, 52-10
 Watt (unit), 13-3
 Wave, shear, 51-4
 sinusoidal, 29-2 f
 Wave equation, 47-1 ff
 Wavefront, 47-3
 Wavelength, 19-3, 26-1
 Wave number, 29-2
 Waves, 51-1 ff
 light, 48-1
 Weyl, H., 11-1
 Work, 13-1 ff, 14-1 ff
- X-rays, 2-5, 26-1
- Young, 35-7
 Yukawa, H., 2-8
 Yustova, 35-8
- Zeno, 8-3
 Zero, absolute, 1-5
 Zero mass, 2-10