Physics Reference Tables

Physical Constants and Conversion Factors

Acceleration due to gravity	g	9.8 m/s/s or m/s^2
Speed of light in a vacuum	c	3.00×10^8 m/s
Electron rest mass	m_e	9.11×10^{-31} kg
Electron charge	e	1.6×10^{-19} C
Proton rest mass	m_p	1.67×10^{-27} kg
Gravitation constant	G	6.67×10^{-11} N•m^2/kg^2
Coulomb's law constant	k	9.0×10^9 N•m^2/C^2
Speed of sound at STP		331 m/s

The Index of Refraction For Common Substances

($\lambda = 5.9 \times 10^{-7}$ m)

Air	1.00
Alcohol	1.36
Canada Balsam	1.53
Corn Oil	1.47
Diamond	2.42
Glass, Crown	1.52
Glass, Flint	1.61
Glycerol	1.47
Lucite	1.50
Quartz, Fused	1.46
Water	1.33

Wavelengths of Light in a Vacuum

Violet	$4.0 - 4.2 \times 10^{-7}$ m
Blue	$4.2 - 4.9 \times 10^{-7}$ m
Green	$4.9 - 5.7 \times 10^{-7}$ m
Yellow	$5.7 - 5.9 \times 10^{-7}$ m
Orange	$5.9 - 6.5 \times 10^{-7}$ m
Red	$6.5 - 7.0 \times 10^{-7}$ m

Heat Constants

	Specific Heat (average) (kJ/kg•°C) or (J/g•°C)	**Melting Point** (°C)	**Boiling Point** (°C)
Alcohol (ethyl)	2.43 (liq.)	–117	79
Aluminum	0.90 (sol.)	660	2467
Ammonia	4.71 (liq.)	–78	–33
Copper	0.39 (sol.)	1083	2567
Iron	0.45 (sol.)	1535	2750
Lead	0.13 (sol.)	328	1740
Mercury	0.14 (liq.)	–39	357
Platinum	0.13 (sol.)	1772	3827
Silver	0.24 (sol.)	962	2212
Tungsten	0.13 (sol.)	3410	5660
Water (solid)	2.05 (sol.)	0	——
Water (liquid)	4.18 (liq.)	——	100
Water (vapor)	2.01 (gas)	——	——
Zinc	0.39 (sol.)	420	907

FORMULAS

MECHANICS

$$\bar{v} = \frac{\Delta s}{\Delta t}$$

$$\bar{v} = \frac{v_f + v_i}{2}$$

$$\bar{a} = \frac{\Delta v}{\Delta t}$$

$$\Delta s = v_i \Delta t + \frac{1}{2} a (\Delta t)^2$$

$$v_f^2 = v_i^2 + 2a\Delta s$$

$$F = ma$$

$$w = mg$$

$$F = \frac{Gm_1 m_2}{r^2}$$

$$p = mv$$

$$F\Delta t = \Delta(mv)$$

$$\tau = Fd\sin\theta$$

$$\sum \tau_{cw} - \sum \tau_{ccw} = 0$$

$$a_c = \frac{v^2}{r}$$

$$F_c = \frac{mv^2}{r}$$

a = acceleration
a_c = centripetal acceleration
v = velocity
r = radius
F = force
F_c = centripetal force
θ = angle
g = accleration due to gravity
G = universal gravitational constant
m = mass
p = momentum
Δs = displacement
t = time
τ = torque
w = weight

ELECTRICITY AND MAGNETISM

$$F = \frac{kq_1 q_2}{r^2}$$

$$V = \frac{W}{q}$$

$$I = \frac{\Delta q}{\Delta t}$$

$$I = \frac{V}{R}$$

$$P = VI$$

$$F = qvB$$

$$V = B\ell v$$

$$W = Pt = VIt$$

r = distance between centers
F = force
I = current
k = electrostatic constant
P = power
q = charge
R = resistance
V = electrical potential difference
W = energy
B = flux density
ℓ = length of a conductor
v = velocity

Series Circuits

$$I_t = I_1 = I_2 = I_3 = \ldots$$
$$V_t = V_1 + V_2 + V_3 + \ldots$$
$$R_t = R_1 + R_2 + R_3 + \ldots$$

Parallel Circuits

$$I_t = I_1 + I_2 + I_3 + \ldots$$
$$V_t = V_1 = V_2 = V_3 = \ldots$$
$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

FORMULAS

ENERGY

$$W = F\Delta s$$
$$P = \frac{W}{\Delta t} = \frac{F\Delta s}{\Delta t} = F\bar{v}$$
$$\Delta PE_g = mg\Delta h$$
$$KE = \frac{1}{2}mv^2$$
$$F = kx$$
$$PE_s = \frac{1}{2}kx^2$$
$$\mu_s = \frac{F_{s,\max}}{F_n}$$

F = force
g = acceleration due to gravity
h = height
k = spring constant
x = change in length of a spring from the equilibrium position
KE = kinetic energy
m = mass
P = power
PE_g = gravitational potential energy
PE_s = potential energy stored in a spring
Δs = displacement
t = time
v = velocity
W = work
μ_s = coefficient of static friction

INTERNAL ENERGY

$$Q = mC_p\Delta T$$
$$Q = \Delta E - W = (E_f - E_i) - W$$

Q = amount of heat
C_p = specific heat
T = temperature
W = work
E_f = final energy of the system
E_i = initial energy of the system

WAVE PHENOMENA

$$T = \frac{1}{f}$$
$$v = f\lambda$$
$$n = \frac{c}{v}$$
$$\sin\theta_{c\,air} = \frac{1}{n}$$
$$\frac{n_1}{n_2} = \frac{\sin\theta_2}{\sin\theta_1}$$
$$\frac{n_1}{n_2} = \frac{v_2}{v_1}$$

c = speed of light in a vacuum
f = frequency
n = index of absolute refraction
T = period
v = speed
λ = wavelength
θ = angle
$\theta_{c\,air}$ = critical angle of incidence relative to air

GEOMETRIC OPTICS

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$
$$\frac{S_o}{S_i} = \frac{d_o}{d_i}$$

d_i = image distance
d_o = object distance
S_i = image size
S_o = object size
f = focal length

INVESTIGATIONS

$$\%\ \text{Error} = \frac{\text{Accepted value} - \text{Experimental value}}{\text{Accepted value}} \times 100$$

Electromagnetic Spectrum