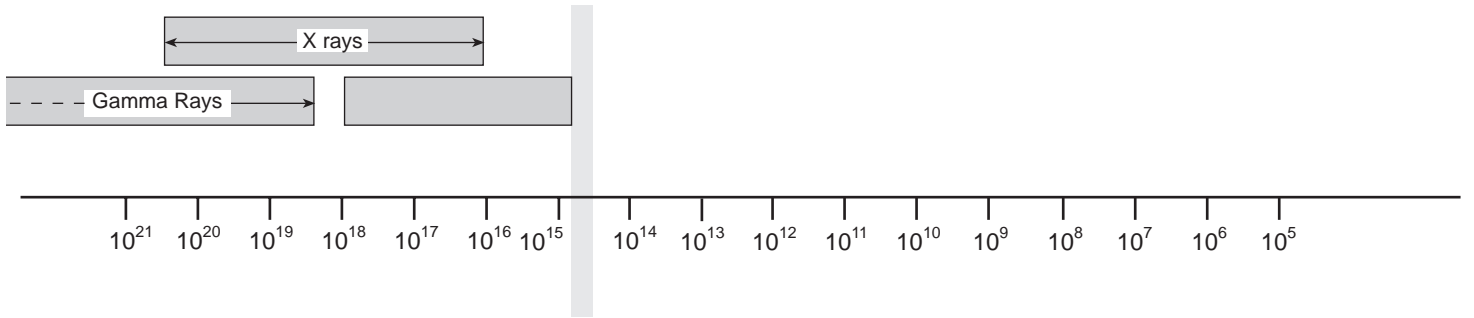


Name	Symbol	Value
Universal gravitational constant	$G$	$6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$
Acceleration due to gravity	$g$	$9.81 \text{ m/s}^2$
Speed of light in a vacuum	$c$	$3.00 \times 10^8 \text{ m/s}$
Speed of sound in air at STP		$3.31 \times 10^2 \text{ m/s}$
Mass of Earth		$5.98 \times 10^{24} \text{ kg}$
Mass of the Moon		$7.35 \times 10^{22} \text{ kg}$
Mean radius of Earth		$6.37 \times 10^6 \text{ m}$
Mean radius of the Moon		$1.74 \times 10^6 \text{ m}$
Mean distance—Earth to the Moon		$3.84 \times 10^8 \text{ m}$
Mean distance—Earth to the Sun		$1.50 \times 10^{11} \text{ m}$
Electrostatic constant	$k$	$8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$
1 elementary charge	$e$	$1.60 \times 10^{-19} \text{ C}$
1 coulomb (C)		$6.25 \times 10^{18} \text{ elementary charges}$
1 electronvolt (eV)		$1.60 \times 10^{-19} \text{ J}$
Planck's constant	$h$	$6.63 \times 10^{-34} \text{ J}\cdot\text{s}$
1 universal mass unit (u)		$9.31 \times 10^2 \text{ MeV}$





$$F_e = \frac{kq_1q_2}{r^2}$$

$$E = \frac{F_e}{q}$$

$$= \frac{1}{q}$$

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

$$= \bar{I}$$

$$= \frac{\rho L}{A}$$

$$P = I^2 R = I^2 \frac{\rho L}{A}$$

$$= Pt = I^2 R t = \frac{I^2 \rho L t}{A}$$

Series Circuits

$$I = I_1 = I_2 = I_3 = \dots$$

$$= I_1 + I_2 + I_3 + \dots$$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

A = cross-sectional area

E = electric field strength

F<sub>e</sub> = electrostatic force

I = current

k = electrostatic constant

L = length of conductor

P = electrical power

q = charge

R = resistance

R<sub>eq</sub> = equivalent resistance

r = distance between centers

t = time

V = potential difference

W = work (electrical energy)

Δ = change

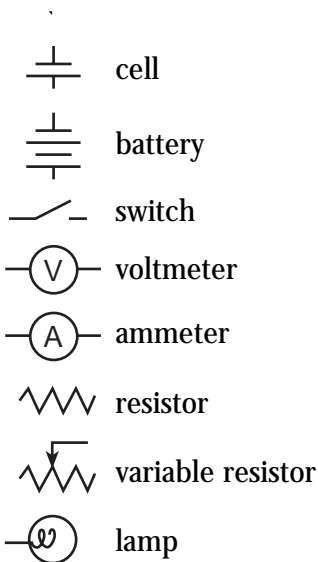
ρ = resistivity

Parallel Circuits

$$I = I_1 + I_2 + I_3 + \dots$$

$$= I_1 = I_2 = I_3 = \dots$$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$



20	
Material	R <sub>resistivity</sub> (Ω•m)
Aluminum	2.82 × 10 <sup>-8</sup>
Copper	1.72 × 10 <sup>-8</sup>
Gold	2.44 × 10 <sup>-8</sup>
Nichrome	150. × 10 <sup>-8</sup>
Silver	1.59 × 10 <sup>-8</sup>
Tungsten	5.60 × 10 <sup>-8</sup>

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$$= f \lambda$$

$$T =$$

$$\theta_i = \theta_r$$

$$=$$

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$= \quad =$$

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$$E_{\text{refl}} = E_i - E_t$$

$$E_{\text{refl}} = E_i - E_t$$

$$E = n c^2$$

---

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

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

$$v_f = v_i + at$$

$$\Delta d = v_i t + \frac{1}{2} at^2$$

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

$$A_y = A \sin \theta$$

$$A_x = A \cos \theta$$

$$a = \frac{F_{\text{net}}}{m}$$

$$F_f = \mu F_N$$

$$F_g = \frac{G m_1 m_2}{r^2}$$

$$g = \frac{F_g}{m}$$

$$v_f = v_i$$

$$v_f r = v_i r$$

$$J = F_{\text{net}} t = \Delta p$$

$$F = kx$$

$$PE = \frac{1}{2} kx^2$$

$$F_c = ma_c$$

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

$$\Delta PE = m g \Delta h$$

$$KE = \frac{1}{2} m v^2$$

$$= F \Delta d = \Delta E_T$$

$$E_T = PE + KE + Q$$

$$P = \frac{W}{t} = \frac{F \Delta d}{t} = F \bar{v}$$

$a$  = acceleration

$a_c$  = centripetal acceleration

$A$  = any vector quantity

$\Delta d$  = displacement or distance

$E_T$  = total energy

$F$  = force

$F_c$  = centripetal force

$F_f$  = force of friction

$F_g$  = weight or force due to gravity

$F_N$  = normal force

$F_{\text{net}}$  = net force

$F$  = force on a spring

$g$  = acceleration due to gravity or gravitational field strength

$G$  = universal gravitational constant

$h$  = height

$J$  = impulse

$k$  = spring constant

$KE$  = kinetic energy

$m$  = mass

$p$  = momentum

$P$  = power

$PE$  = potential energy

$PE$  = potential energy stored in a spring

$Q$  = internal energy

$r$  = radius or distance between centers

$t$  = time interval

$v$  = velocity or speed

$\bar{v}$  = average velocity or average speed

$W$  = work

$x$  = change in spring length from the equilibrium position

$\Delta$  = change

$\theta$  = angle

$\mu$  = coefficient of friction