Table of Constants

Gravitational constant .... $G = 6.67 \times 10^{-11} Nm^2/kg^2$

Acceleration due to gravity at the surface of Earth
(for the purposes of this examination) .... $g = 9.81 m/s^2$

Earth
radius .... = 6.38×10^6 m
radius of orbit about Sun .... = 1.50×10^{11} m
period of rotation .... = 8.61×10^4 s
period of revolution about Sun .... = 3.16×10^7 s
mass .... = 5.98×10^{24} kg

Moon
radius .... = 1.74×10^6 m
radius of orbit about Earth .... = 3.84×10^8 m
period of rotation .... = 2.36×10^6 s
period of revolution about Earth .... = 2.36×10^6 s
mass .... = 7.35×10^{22} kg

Sun
mass .... = 1.98×10^{30} kg

Constant in Coulomb's Law .... $k = 9.00 \times 10^9 Nm^2/C^2$

Elementary charge (+ proton, - electron) .... $e = 1.60 \times 10^{-19}$ C

Alpha particle charge .... $\alpha = 3.20 \times 10^{-19}$ C

Mass of electron.. $m_e = 9.11 \times 10^{-31}$ kg

Mass of proton .... $m_p = 1.67 \times 10^{-27}$ kg

Mass of neutron .... $m_n = 1.68 \times 10^{-27}$ kg

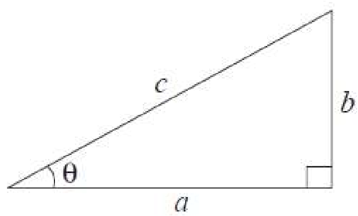
Mass of alpha particle .... $m_\alpha = 6.65 \times 10^{-27}$ kg

Permeability of free space .... $\mu_o = 4\pi \times 10^{-7}$ Tm/A

Speed of light .... $c = 3.00 \times 10^8$ m/s

Mathematical Equations

For Right-angled Triangles:

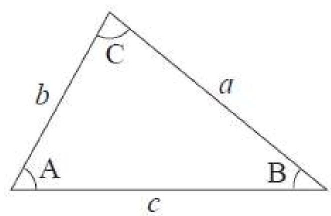


$$a^2 + b^2 = c^2$$

$$\sin\theta = \frac{b}{c} \quad \cos\theta = \frac{a}{c} \quad \tan\theta = \frac{b}{a}$$

$$\text{area} = \frac{1}{2}ab$$

For All Triangles:



$$\text{area} = \frac{1}{2}\text{ base} \times \text{height}$$

$$\sin 2A = 2\sin A\cos A$$

Sine Law: $\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$

Cosine Law: $c^2 = a^2 + b^2 - 2ab\cos C$

Circle:

$$\text{Circumference} = 2\pi r$$

$$\text{Area} = \pi r^2$$

Sphere:

$$\text{Surface area} = 4\pi r^2$$

$$\text{Volume} = \frac{4}{3}\pi r^3$$

Quadratic Equation:

If $ax^2 + bx + c = 0$, then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Provincial Formulae

Extra Formulae

Vector Kinematics in Two Dimensions:

$$v = v_0 + at \qquad \bar{v} = \frac{v + v_0}{2}$$

$$v^2 = v_0^2 + 2ad \qquad d = v_0 t + \frac{1}{2}at^2$$

$$d = \left(\frac{v_f + v_i}{2}\right)t$$

Vector Dynamics:

$$F_{net} = ma \qquad F_g = mg$$

$$F_{net} = F_{applied} - F_{against}$$

$$F_{fr} = \mu F_N$$

Work, Energy, and Power:

$$W = Fd \qquad E_p = mgh$$

$$Work = \Delta E = E_f - E_i$$

$$E_k = \frac{1}{2}mv^2 \qquad P = \frac{W}{t}$$

$$Efficiency = \frac{P_{out}}{P_{in}} \times 100\%$$

Relativity

t_o, L_o, m_o: These are the variables that are measured when the observer is at rest with respect to the measurement being made. (When the observer is "not" moving wrt measurement.)

$$t = \frac{t_o}{\sqrt{1-\frac{v^2}{c^2}}} \qquad L = L_o\sqrt{1 - \frac{v^2}{c^2}} \qquad m = \frac{m_o}{\sqrt{1-\frac{v^2}{c^2}}} \qquad u = \frac{v + u'}{1 + \frac{vu'}{c^2}}$$

$$t > t_o \qquad L < L_o \qquad m > m_o \qquad E = mc^2 \qquad E_k = ½mv^2$$

Equilibrium

$F = mg$ $\tau = F_{\perp}\, l$ or $\tau = F\, l \sin\theta$ $\sum\tau_{cw} = \sum\tau_{ccw}$

Circular Motion:

$$a_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}$$

$$T = \frac{1}{f}$$

Gravitation:

$$F = G\frac{m_1 m_2}{r^2} \qquad E_p = -G\frac{m_1 m_2}{r}$$

$$\frac{T_1^2}{R_1^3} = \frac{T_2^2}{R_2^3} \qquad F_g = mg$$

orbits: $F_c = F_g$
escape velocity: $E_k = E_p$

Electrostatics

$$\vec{F}_E = \frac{kQ_1Q_2}{R^2} \qquad \vec{E} = \frac{\vec{F}}{Q_t} \qquad \vec{E} = \frac{kQ_s}{R^2} \qquad \Delta E_p = Q_t\vec{E}\Delta d_{moved} \qquad E_p = \frac{kQ_1Q_2}{R}$$

$$\Delta V = \frac{\Delta E_p}{Q_t} \qquad V = \frac{kQ_s}{R} \qquad \vec{E} = \frac{\Delta V}{d_{btwn}} \qquad V_a = \frac{E_k}{Q_e}$$

Electromagnetism:

$$F = BIl \qquad F = QvB$$

$$B = \mu_0 n I = \mu_0 \frac{N}{l} I \qquad \varepsilon = Blv$$

$$\Phi = BA \qquad \varepsilon = -N\frac{\Delta\Phi}{\Delta t}$$

$$V_{back} = \varepsilon - Ir \qquad V = IR$$

$$\frac{V_s}{V_p} = \frac{N_s}{N_p} = \frac{I_p}{I_s} \qquad P = IV = I^2R = \frac{V^2}{R}$$

Momentum:

$$p = mv \qquad \Delta p = F\Delta t \qquad m_T v_T = m_1 v_1 + m_2 v_2 \qquad \Delta p = p_f - p_i$$