Physics 11 EXTRA Formula Sheet

Indices of Refraction:

Medium	n
Vacuum	1.0000
Air	1.0003
Water	1.33
Ethanol	1.36

Medium	n
Crown glass	1.52
Quartz	1.54
Flint glass	1.61
Diamond	2.42

Kinematics

$$v_{average} = \frac{\Delta d}{\Delta t} \qquad a = \frac{\Delta v}{\Delta t} \qquad \mathrm{d} = \frac{1}{2}(v_f + v_o)t \qquad \mathrm{at} = v_f - v_o$$

Forces

$$F_e = kx \qquad F_f = \mu F_N \qquad F_g = mg \qquad a = \frac{Fnet}{m}$$

Energy, Work and Power

$$\mathrm{E_h = mc\Delta t} \qquad \mathrm{E = mc^2} \qquad \mathrm{E_e = \frac{1}{2}kx^2} \qquad \mathrm{eff} = \frac{\text{useful output}}{\text{total input}}(100\%)$$

Waves

$$\mathrm{T} = \frac{1}{\mathrm{f}} \qquad \mathrm{f} = \frac{1}{\mathrm{T}} \qquad \mathrm{v} = \lambda \mathrm{f} \qquad \mathrm{v} = \frac{\lambda}{\mathrm{T}}$$

Light

$$\mathrm{n_i \sin\theta_i = n_r \sin\theta} \qquad \mathrm{n} = \frac{\mathrm{c}}{\mathrm{v}} \qquad \frac{1}{\mathrm{f}} = \frac{1}{\mathrm{d_i}} + \frac{1}{\mathrm{d_o}} \qquad \mathrm{M} = -\frac{\mathrm{d_i}}{\mathrm{d_o}} = \frac{\mathrm{h_i}}{\mathrm{h_o}}$$

Relativity

$$\mathrm{t} = \frac{\mathrm{t_o}}{\sqrt{1 - \frac{\mathrm{v}^2}{\mathrm{c}^2}}} \qquad \mathrm{L} = \mathrm{L_o}\sqrt{1 - \frac{\mathrm{v}^2}{\mathrm{c}^2}} \qquad \mathrm{m} = \frac{\mathrm{m_o}}{\sqrt{1 - \frac{\mathrm{v}^2}{\mathrm{c}^2}}}$$

Nuclear

$$\mathrm{E = mc^2} \qquad \%\text{remaining} = 100(\tfrac{1}{2})^n$$

Constants

1kWh = 3.6×10^6 J

STUDENT REFERENCE

FUNDAMENTAL CONSTANTS AND PHYSICAL DATA

Gravitational constant	G	$= 6.67 \times 10^{-11}\ \mathrm{N \cdot m^2/kg^2}$
Constant in Coulomb's Law	k	$= 9.00 \times 10^{9}\ \mathrm{N \cdot m^2/C^2}$
Elementary charge	e	$= 1.60 \times 10^{-19}\ \mathrm{C}$
Mass of electron	m_e	$= 9.11 \times 10^{-31}\ \mathrm{kg}$
Mass of proton	m_p	$= 1.67 \times 10^{-27}\ \mathrm{kg}$
Permeability of free space	μ_o	$= 4\pi \times 10^{-7}\ \mathrm{T \cdot m/A}$
Speed of light	c	$= 3.00 \times 10^{8}\ \mathrm{m/s}$

Earth

radius		$= 6.38 \times 10^{6}\ \mathrm{m}$
mass		$= 5.98 \times 10^{24}\ \mathrm{kg}$
acceleration due to gravity at the surface of Earth (for the purposes of this examination)	g	$= 9.80\ \mathrm{m/s^2}$
period of rotation		$= 8.61 \times 10^{4}\ \mathrm{s}$
radius of orbit around Sun		$= 1.50 \times 10^{11}\ \mathrm{m}$
period of orbit around Sun		$= 3.16 \times 10^{7}\ \mathrm{s}$

Moon

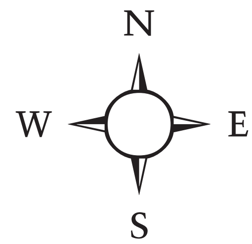
radius		$= 1.74 \times 10^{6}\ \mathrm{m}$
mass		$= 7.35 \times 10^{22}\ \mathrm{kg}$
period of rotation		$= 2.36 \times 10^{6}\ \mathrm{s}$
radius of orbit around Earth		$= 3.84 \times 10^{8}\ \mathrm{m}$
period of orbit around Earth		$= 2.36 \times 10^{6}\ \mathrm{s}$

Sun

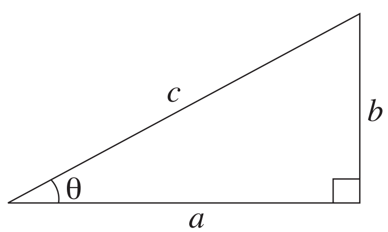
mass		$= 1.98 \times 10^{30}\ \mathrm{kg}$

Mathematical Formulae

Metric Prefixes			
Prefix	**Symbol**	**Numerical**	**Exponential**
mega	M	1 000 000	10^6
kilo	k	1 000	10^3
hecto	h	100	10^2
deca	da	10	10^1
		1	10^0
deci	d	0.1	10^{-1}
centi	c	0.01	10^{-2}
milli	m	0.001	10^{-3}
micro	μ	0.000001	10^{-6}



For Right-angled Triangles:

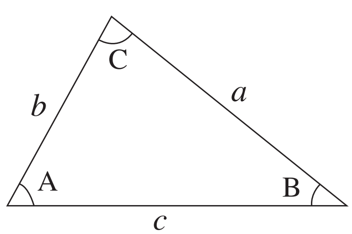


$$a^2 + b^2 = c^2$$

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

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

For All Triangles:



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

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:

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

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

Quadratic Equation:

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

PHYSICS FORMULAE

Vector Kinematics in Two Dimensions:

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

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

Vector Dynamics:

$$F_{\text{net}} = ma \qquad F_{\text{g}} = mg$$

$$F_{\text{fr}} = \mu F_{\text{N}}$$

Work, Energy, and Power:

$$W = Fd \qquad E_{\text{p}} = mgh$$

$$E_{\text{k}} = \frac{1}{2}mv^2 \qquad P = \frac{W}{\Delta t}$$

Momentum:

$$p = mv \qquad \Delta p = F\Delta t$$

Equilibrium:

$$\tau = Fd$$

Circular Motion:

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

$$a_{\text{c}} = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}$$

Gravitation:

$$F = G\frac{m_1 m_2}{r^2} \qquad E_{\text{p}} = -G\frac{m_1 m_2}{r}$$

Electrostatics:

$$F = k\frac{Q_1 Q_2}{r^2} \qquad E = \frac{F}{Q} \qquad E = \frac{kQ}{r^2}$$

$$\Delta V = \frac{\Delta E_{\text{p}}}{Q} \qquad E = \frac{\Delta V}{d}$$

$$E_{\text{p}} = k\frac{Q_1 Q_2}{r} \qquad V = \frac{kQ}{r}$$

Electric Circuits:

$$I = \frac{Q}{\Delta t} \qquad V = IR$$

$$V_{\text{terminal}} = \varepsilon \pm Ir \qquad P = VI$$

Electromagnetism:

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

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

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

$$V_{\text{back}} = \varepsilon - Ir$$

$$\frac{V_{\text{s}}}{V_{\text{p}}} = \frac{N_{\text{s}}}{N_{\text{p}}} = \frac{I_{\text{p}}}{I_{\text{s}}}$$