

**Physics 12 Comfort Blanket****Relativity**

$$t_r = \frac{t_o}{\sqrt{1 - \frac{\vec{v}^2}{c^2}}} \quad m_r = \frac{m_o}{\sqrt{1 - \frac{\vec{v}^2}{c^2}}} \quad l_r = l_o \cdot \sqrt{1 - \frac{\vec{v}^2}{c^2}} \quad \vec{v}_{total} = \frac{\vec{v}_1 + \vec{v}_2}{1 + \frac{\vec{v}_1 \vec{v}_2}{c^2}}$$

$$E = m\vec{c}^2 \quad \beta = \frac{\vec{v}}{\vec{c}}$$

**Forces, Dynamics, Collisions, & Equilibrium**

$$\vec{F}_g = m\vec{g} \quad \vec{g} = G \frac{m}{r^2} \quad \vec{F}_g = G \frac{m_1 m_2}{r^2} \quad \vec{F}_{net} = m\vec{a} \quad \vec{F}_f = \mu \vec{F}_N$$

$$\vec{\rho} = m\vec{v} \quad \vec{Impulse} = \vec{F}\Delta t \quad \vec{F}\Delta t = m\Delta\vec{v} \quad \Sigma\vec{\rho}_i = \Sigma\vec{p}_f \quad \vec{\tau} = \vec{F}_\perp d$$

**Energy & Orbital Mechanics**

$$E_p = m\vec{g}h \quad E_k = 1/2 m\vec{v}^2 \quad E_p = -G \frac{m_1 m_2}{r} \quad T = 1/f \quad \vec{a}_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}$$

$$\vec{F}_c = m\vec{a}_c$$

**Electrostatics**

$$\vec{F}_e = k \frac{Q_1 Q_2}{r^2} \quad \vec{E} = \frac{\vec{F}}{Q} \quad \vec{E} = k \frac{Q_1}{r^2} \quad \Delta V = \frac{\Delta E_p}{Q} \quad \vec{E} = \frac{\Delta V}{d}$$

$$E_p = \pm k \frac{Q_1 Q_2}{r} \quad V = k \frac{Q}{r}$$

**Electromagnetism**

$$\vec{F}_m = \vec{B}_\perp I l \quad \vec{F}_m = Qv\vec{B}_\perp \quad \vec{B} = \mu_0 n I = \mu_0 \frac{N}{l} I \quad \varepsilon = \vec{B}_\perp l v$$

$$\Phi = \vec{B}_\perp A \quad \varepsilon = -N \frac{\Delta\Phi}{\Delta t} \quad V_{back} = \varepsilon - I r \quad \frac{V_s}{V_p} = \frac{N_s}{N_p} = \frac{I_p}{I_s}$$

**Kinematics**

$$\vec{v} = \frac{\Delta\vec{d}}{\Delta t} \quad \vec{a} = \frac{\Delta\vec{v}}{\Delta t} \quad \vec{d} = \left(\frac{\vec{v}_f + \vec{v}_i}{2}\right) \Delta t \quad \vec{d} = \vec{v}_i t + 1/2 \vec{a} t^2 \quad \vec{v}_f^2 = \vec{v}_i^2 + 2\vec{a}\vec{d}$$

$$\vec{v}_f = \vec{v}_i + \vec{a}t$$

## Work Power Energy Momentum

$$W = Fd \quad E_p = mg\Delta h \quad E_k = \frac{1}{2}mv^2 \quad P = \frac{W}{\Delta t} \quad \vec{p} = mv \quad \Delta\vec{p} = F_{net}\Delta t$$

$$\Delta\vec{p} = m\Delta v \quad \Delta E_H = F_{fric}d \quad W = \Delta E \quad Efficiency = \frac{W_{out}}{W_{in}} \times 100\% = \frac{P_{out}}{P_{in}} \times 100\%$$

PREFIX	SYMBOL	MULTIPLIER	EXPONENT FORM
exa	E	1, 000, 000, 000, 000, 000, 000	$10^{18}$
peta	P	1, 000, 000, 000, 000, 000	$10^{15}$
tera	T	1, 000, 000, 000, 000	$10^{12}$
giga	G	1, 000, 000, 000	$10^9$
mega	M	1, 000, 000	$10^6$
kilo	k	1, 000	$10^3$
hecto	h	100	$10^2$
deca	da	10	$10^1$
Basic Unit	Basic Unit	1	$10^0$
deci	d	0.1	$10^{-1}$
centi	c	0.01	$10^{-2}$
milli	m	0.001	$10^{-3}$
micro	$\mu$	0.000,001	$10^{-6}$
nano	n	0.000,000,001	$10^{-9}$
pico	p	0.000,000,000,001	$10^{-12}$
femto	f	0.000,000,000,000,001	$10^{-15}$
atto	a	0.000,000,000,000,000,001	$10^{-18}$

### Useful Constants and Physical Data:

Gravitational Acceleration at Earth's surface.....  $\vec{g} = -9.80 \frac{m}{s^2}$

Universal Gravitational Constant .....  $G = 6.67 \times 10^{-11} N \frac{m^2}{kg^2}$

Speed of light in a vacuum.....  $c = 3.00 \times 10^8 \frac{m}{s}$

Coulomb's Constant.....  $k = 9.00 \times 10^9 N \frac{m^2}{C^2}$

Elementary charge.....  $e = \pm 1.60 \times 10^{-19} C$

Mass of a proton.....  $m_{p^+} = 1.67 \times 10^{-27} kg$

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

Mass of an alpha particle.....  $m_{\alpha^{2+}} = 6.65 \times 10^{-27} kg$

Permeability of free space.....  $\mu_0 = 4\pi \times 10^{-7} T \frac{m}{A}$

#### **Earth Data:**

Mass of the Earth.....  $m_E = 5.98 \times 10^{24} kg$

Radius of the Earth .....  $r_E = 6.38 \times 10^6 m$

Orbital Radius around the Sun .....  $r = 1.50 \times 10^{11} m$

Orbital Period around the Sun .....  $T = 3.16 \times 10^7 s$

Period of Rotation on axis (length of day) .....  $T = 8.61 \times 10^4 s$

#### **Moon Data:**

Mass of the Moon.....  $m_M = 7.35 \times 10^{22} kg$

Radius of the Moon .....  $r_M = 1.74 \times 10^6 m$

Period of orbit around Earth .....  $T = 2.36 \times 10^6 s$

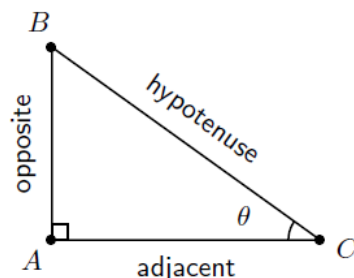
Radius of orbit around Earth.....  $r = 3.84 \times 10^8 m$

Period of rotation on axis (length of day).....  $T = 2.36 \times 10^6 s$

#### **Sun Data:**

Mass of Sun.....  $m_s = 1.98 \times 10^{30} kg$

### 90° Triangle Geometry



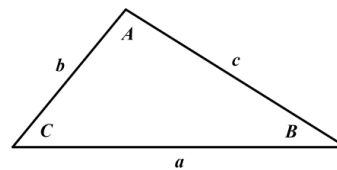
$$\sin \theta = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

$$\cos \theta = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

$$\tan \theta = \frac{\text{Opposite}}{\text{Adjacent}}$$

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

### Non 90° Triangle Geometry (Or all triangles)



#### Cosine Law

$$c^2 = a^2 + b^2 - (2ab \cdot \cos C)$$

#### Sine Law

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

**If,  $ax^2 + bx + c = 0$  then,**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$