# PHYSICS 12 FORMULAE

## Kinematics

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

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

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

## Dynamics

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

$F_{fr} = \mu F_N$

## Circular Motion

$T = \frac{1}{f}$ $a_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}$

$F_c = ma_c$ $F_g = \frac{Gm_1m_2}{r^2}$

$\frac{T_1^2}{R_1^3} = \frac{T_2^2}{R_2^3}$ $GEP = E_p = -\frac{Gm_1m_2}{r}$

## Momentum and Impulse

$\Delta p = J$ $p = mv$

$J = F_{net}\Delta t$

## Energy

$KE = E_k = \frac{1}{2}mv^2$ $PE = E_p = mgh$

$W = Fd$ $W = Fcos\theta d$

$Eff = \frac{W_{out}}{W_{in}} = \frac{P_{out}}{P_{in}}$ $P = \frac{W}{\Delta t}$

## Equilibrium

$\tau = Fl$ $F_1 l_1 = F_2 l_2$

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

## Special Relativity

$$t = \frac{t_0}{\sqrt{1-\frac{v^2}{c^2}}} \qquad l = l_0\sqrt{1-\frac{v^2}{c^2}}$$

$$E = mc^2$$

$$m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}} \qquad v_{tot} = \frac{v_1+v_2}{1+\frac{v_1 v_2}{c^2}}$$

## Electric Circuits

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

$P = IV$ $V_{term} = \varepsilon \pm Ir$

## Electrostatics

$$F = \frac{kq_1q_2}{r^2} \qquad E = \frac{F}{q}$$

$$\Delta v = \frac{\Delta E_p}{q} \qquad E = \frac{\Delta v}{d}$$

$$E_p = \frac{kq_1q_2}{r} \qquad E = \frac{kq}{r^2}$$

$$V = \frac{kq}{r}$$

## Electromagnetism

$$F = BIl \qquad F = qvB$$

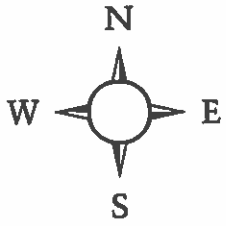
$$B = \mu_0 nI = \mu_0 \frac{N}{l} I \qquad \varepsilon = Blv$$

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

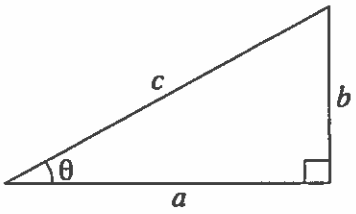
$$V_{back} = \varepsilon - Ir \qquad \frac{I_p}{I_s} = \frac{N_s}{N_p} = \frac{V_s}{V_p}$$

# 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:**

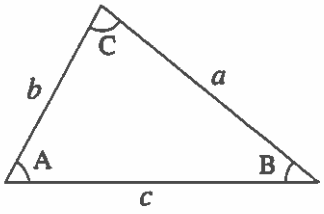



$$a^2 + b^2 = c^2$$

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

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

**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:**

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

## FUNDAMENTAL CONSTANTS AND PHYSICAL DATA

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

Earth

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

Moon

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

Sun

| | | |
|---|---|---|
| mass | | $= 1.98 \times 10^{30}\ \text{kg}$ |