Physics Formulas

MODULE 1

$$\text{Speed} = \frac{\Delta \text{ distance}}{\Delta \text{ time}}$$

$$\text{Velocity} = \frac{\Delta \text{ displacement}}{\Delta \text{ time}}$$

$$\text{Acceleration} = \frac{\Delta \text{ velocity}}{\Delta \text{ time}}$$

MODULE 2

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

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

$$v_f = v_i + at$$

$$v_f^2 = v_i^2 + 2a\,\Delta x$$

$$\Delta x = v_i t + \tfrac{1}{2} at^2$$

MODULE 3

$$\text{Magnitude} = \sqrt{X^2 + Y^2}$$

$$\tan\theta = \frac{Y}{X}$$

$$R_x = |R| \cos\theta$$

$$R_y = |R| \sin\theta$$

MODULE 4

$$\text{Range} = \frac{v_i^2 \sin(2\theta)}{g}$$

MODULE 5

$$\Sigma F = ma$$

$$w = mg$$

Friction force: $f = \mu F_n$

MODULE 6

Torque: $\tau = F_\perp \cdot r$

MODULE 7

Centripetal force: $F_c = \frac{mv^2}{r}$

Centripetal acceleration: $a_c = \frac{v^2}{r}$

Gravitational force: $F_g = \frac{Gm_1m_2}{r^2}$

$G = 6.67 \times 10^{-11}$

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

MODULE 8

Work: $W = F_{\parallel} \cdot \Delta x$

Potential Energy: $PE = mgh$

Kinetic Energy: $KE = \tfrac{1}{2} mv^2$

Total Energy: $TE = PE + KE$

Power: $P = \frac{\Delta W}{\Delta t}$

MODULE 9

Momentum: $p = mv$

Impulse: $\Delta p = F \Delta t$

Angular momentum: $L = mvr$

MODULE 10

$F = -k \Delta x$

Period$_{spring}$: $T = 2\pi\sqrt{\frac{m}{k}}$

$PE_{spring} = \frac{1}{2} k(\Delta x)^2$

$KE_{spring} + PE_{spring} = \frac{1}{2} kA^2$

Period$_{pendulum}$: $T = 2\pi\sqrt{\frac{L}{g}}$

MODULE 11

Frequency: $f = \frac{v}{\lambda}$

$v = (331.5 + 0.606T)$

$f_{observed} = \frac{v_{sound} \pm v_{observer}}{v_{sound} \pm v_{source}} f_{true}$

Light energy: $E = hf$ $\quad h = 6.63 \times 10^{-34}$

MODULE 12

Focal length: $f = \frac{R}{2}$

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

Index of refraction: $n = c/v$ $\quad c = 3 \times 10^8$

MODULE 13

Electrostatic force: $F_e = \frac{kq_1q_2}{r^2}$

$k = 9 \times 10^9 \text{ N m}^2/\text{C}$

Electric field: $E = \frac{F}{q_0}$

Electric field of a stationary charge: $E = \frac{kQ}{r^2}$

MODULE 14

Electric potential: $V = \frac{kQ}{r}$

$PE = qV$

$\Delta PE = q\Delta V$

Electric potential across a capacitor: $V = \frac{Q}{C_q}$

MODULE 15

Current: $I = \frac{\Delta Q}{\Delta t}$

$V = I R$

$P = I V$ or $P = I^2 R$

For series:
$R_{effective} = R_1 + R_2 + R_3 + \ldots$

For parallel:
$\frac{1}{R_{effective}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots.$

Thermodynamics Formulas and Constants

$q = m\ c\ \Delta T$

$q = m\ L$

$q = n\ C_p\ \Delta T$

$q = n\ C_v\ \Delta T$

$\Delta L = \alpha\ (\text{Length})\ \Delta T$

$\Delta V = \beta\ (\text{Volume})\ \Delta T$

$PV = nRT$

$\Delta U = q - W$

$W = P\ (\Delta V)$

$\Delta S_{rev} = q/T$

$K = °C + 273$

$R = 8.31\ \text{Pa m}^3\text{/mole K}$ or $8.31\ \text{J/mole K}$

$c_{ice} = 2.090\ \text{J/g °C}$

$L_f = 333\ \text{J/g}$ for water

$c_{water} = 4.19\ \text{J/g °C}$

$L_v = 2260\ \text{J/g}$ for water

$c_{steam} = 2.01\ \text{J/g °C}$

Isothermal:	$\Delta U = 0$	$q = W$
Isochoric:	$\Delta U = q$	$W = 0$
Isobaric:	$\Delta U = q - W$	$W = P\ (\Delta V)$
Adiabatic:	$\Delta U = -W$	$q = 0$

Fluids Formulas and Constants

$Q = vA$

$v_1A_1 = v_2A_2$

Density = Mass/Volume

$B = \rho_{fluid}\ V_{object}\ g$

$$\frac{\rho_{object}}{\rho_{fluid}} = \frac{V_{fluid}}{V_{object}}$$

$P = F/A$

$P = P_o + \rho hG$

$P_1 + \frac{1}{2}\rho v_1^2 + \rho y_1 g = P_2 + \frac{1}{2}\rho v_2^2 + \rho y_2 g$

Density of water = $1000\ \text{kg/m}^3$

Density of seawater = $1024\ \text{kg/ m}^3$

Density of air = $1.29\ \text{kg/ m}^3$