FORMULAE SHEET

Motion, forces and gravity

Module 5 | Projectile Motion →

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

$$v = u + at$$

$$\vec{F}_{\text{net}} = m\vec{a}$$ → Newtons 2nd Law

$$\Delta U = mg\Delta h$$

$$W = F_{||}s = Fs\cos\theta$$

$$P = \frac{\Delta E}{\Delta t}$$

$$K = \frac{1}{2}mv^2$$

$$P = F_{||}v = Fv\cos\theta$$

elastic collisions →

$$\sum \frac{1}{2}mv^2_{\text{before}} = \sum \frac{1}{2}mv^2_{\text{after}}$$

$$\sum m\vec{v}_{\text{before}} = \sum m\vec{v}_{\text{after}}$$ → Conservation of momentum

$$\Delta\vec{p} = \vec{F}_{\text{net}}\Delta t$$

$$a_c = \frac{v^2}{r}$$

$$F_c = \frac{mv^2}{r}$$

Module 5 Circular Motion

Module 5 angular velocity →

$$\omega = \frac{\Delta\theta}{t}$$

$$\tau = r_{\perp}F = rF\sin\theta$$

$$v = \frac{2\pi r}{T}$$

$$F = \frac{GMm}{r^2}$$ → Newtons Law of Universal Gravitation

Objects in orbit, need to derive KE / Total energy →

$$U = -\frac{GMm}{r}$$

$$\frac{r^3}{T^2} = \frac{GM}{4\pi^2}$$

Kepler's 3rd Law, 'r' is from planet centre – not surface

Waves and thermodynamics

simple, used a lot in Module 7/8 →

$$v = f\lambda$$

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

$$d\sin\theta = m\lambda$$ ← diffraction - Module 7

$$n_x = \frac{c}{v_x}$$

$$I = I_{\max}\cos^2\theta$$ → Malus Law

$$Q = mc\Delta T$$

refraction in Module 3

$$f_{\text{beat}} = |f_2 - f_1|$$

$$f' = f\frac{(v_{\text{wave}} + v_{\text{observer}})}{(v_{\text{wave}} - v_{\text{source}})}$$ → "Doppler Effect!"

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

$$\sin\theta_c = \frac{n_2}{n_1}$$

Module 3 refraction formulas

$$I_1r_1^2 = I_2r_2^2$$

$$\frac{Q}{t} = \frac{kA\Delta T}{d}$$