Physics Formula Sheet

Chapter by chapter, topic by topic. Written by the PadhoNa team for quick revision.

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CHAPTER 10

Gravitation

Law of gravitation and field

$$F = \frac{Gm_1m_2}{r^2}, \qquad E = \frac{GM}{r^2}$$

SHELL AND SPHERE

$$\text{shell: } E = 0 \ (r < R); \qquad \text{solid sphere: } E = \frac{GMr}{R^3} \ (r < R)$$

Acceleration due to gravity

$$g = \frac{GM}{R^2}$$

HEIGHT H

$$g_h = \frac{g}{(1 + h/R)^2} \approx g\left(1 - \frac{2h}{R}\right) \ (h \ll R)$$

DEPTH D

$$g_d = g\left(1 - \frac{d}{R}\right)$$

LATITUDE

$$g_\phi = g - \omega^2 R \cos^2 \phi$$

Potential, energy and escape velocity

$$V = -\frac{GM}{r}, \qquad U = -\frac{GMm}{r}$$

ESCAPE VELOCITY

$$v_e = \sqrt{\frac{2GM}{R}} = \sqrt{2gR} \approx 11.2 \text{ km/s}$$

Satellites and Kepler's laws

ORBITAL SPEED AND PERIOD

$$v_o = \sqrt{\frac{GM}{r}}, \qquad T = 2\pi\sqrt{\frac{r^3}{GM}}$$

ENERGY

$$K = \frac{GMm}{2r}, \qquad U = -\frac{GMm}{r}, \qquad E = -\frac{GMm}{2r}$$

KEPLER'S LAWS

$$T^2 \propto a^3; \qquad \frac{dA}{dt} = \frac{L}{2m} = \text{constant}$$

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