Physics Formula Sheet

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

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CHAPTER 17

Waves and Sound

Wave motion

$$y = A\sin(kx - \omega t), \qquad v = f\lambda = \frac{\omega}{k}, \qquad k = \frac{2\pi}{\lambda}$$

PHASE DIFFERENCE

$$\Delta\phi = \frac{2\pi}{\lambda}\,\Delta x$$

INTENSITY

$$I = 2\pi^2 f^2 A^2 \rho v; \qquad I \propto \frac{1}{r^2}\ \text{(point source)}$$

SOUND LEVEL

$$\beta = 10\log_{10}\frac{I}{I_0}\ \text{dB}$$

Waves on a string and standing waves

SPEED

$$v = \sqrt{\frac{T}{\mu}}$$

STRING FIXED AT BOTH ENDS

$$f_n = \frac{nv}{2L}, \qquad n = 1, 2, 3, \ldots$$

STANDING WAVE

$$y = 2A\sin kx\cos\omega t; \qquad \text{node to node} = \frac{\lambda}{2}$$

Sound, organ pipes and beats

SPEED OF SOUND

$$v = \sqrt{\frac{\gamma P}{\rho}} = \sqrt{\frac{\gamma RT}{M}}; \qquad v_{\text{solid}} = \sqrt{\frac{Y}{\rho}}$$

OPEN PIPE

$$f_n = \frac{nv}{2L}, \qquad n = 1, 2, 3, \ldots$$

CLOSED PIPE

$$f_n = \frac{nv}{4L}, \qquad n = 1, 3, 5, \ldots \text{ (odd harmonics only)}$$

END CORRECTION

$$L \to L + 0.6r \text{ (closed)}, \qquad L + 1.2r \text{ (open)}$$

BEATS

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

RESONANCE TUBE

$$v = 2f(l_2 - l_1)$$

Doppler effect

$$f' = f\,\frac{v \pm v_o}{v \mp v_s}$$

Upper signs when observer and source move towards each other.

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