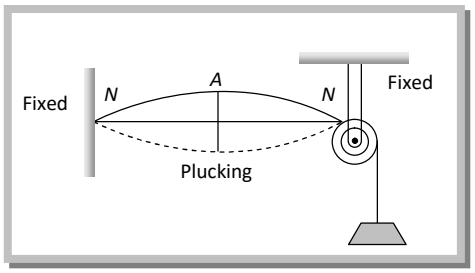
Vibration of a String.



Fundamental frequency $n = \frac{1}{2L}\sqrt{\frac{T}{m}}$

General formula $n_p = \frac{p}{2L}\sqrt{\frac{T}{m}}$

L = Length of string, T = Tension in the string

m = Mass per unit length (linear density), p = mode of vibration

Important points

(1) As a string has many natural frequencies, so when it is excited with a tuning fork, the string will be in resonance with the given body if any of its natural frequencies concides with the body.

(2) (i) $n \propto \frac{1}{L}$ if T and m are constant (ii) $n \propto \sqrt{T}$ if L and m are constant (iii) $n \propto \frac{1}{\sqrt{m}}$ if T and L are constant

(3) If M is the mass of the string of length L, $m = \frac{M}{L}$

So $n = \frac{1}{2L}\sqrt{\frac{T}{m}} = \frac{1}{2L}\sqrt{\frac{T}{M/L}} = \frac{1}{2}\sqrt{\frac{T}{ML}} = \frac{1}{2L}\sqrt{\frac{T}{\pi r^2 \rho}} = \frac{1}{2Lr}\sqrt{\frac{T}{\pi\rho}}$ where m = πr2ρ (r = Radius, ρ = Density)