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Elasticity

Hand Notes For JEE Mains, Advance, NEET UG, Class 11 & 12 etc…

Hand Notes

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ELASTICITY

If we apply any force on any body then the shape of body will change & after removing the force body again come back to its original shape then that property of body is called Elasticity & the force applied on body is called deforming force.

Stress = $\frac{\text{Restoring force}}{\text{Area}} = \frac{F}{A}$ * SI unit = N/m^2 * $[ML^{-1}T^{-2}]$

Strain = $\frac{\text{change in configuration (length or, volume)}}{\text{origenal configuration (length or, volume)}}$

Hook's Law → Stress $\propto$ Strain

$\boxed{\text{Stress} = \epsilon \times \text{Strain}}$ ϵ → coefficient of Elasticity.

It is of three types-

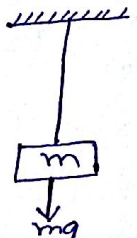
|i| → Young Modulus of Elasticity (Y) →

$$Y = \frac{\text{Longitudnal Stress}}{\text{Longitunal Strain}}$$

$\boxed{Y = \frac{F/A}{\Delta L/L}}$ $\boxed{Y = \frac{FL}{A\Delta L}}$

A → Area of cross section
L → orginal length
ΔL → change in length.

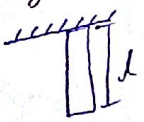
|a| → change in length of a Massless wire when 'M' Mass is hanged at Lower end →



$\boxed{Y = \frac{FL}{A\Delta L}}$ $\boxed{\Delta L = \frac{mgL}{YA}}$ $\boxed{\Delta L = \frac{mgL}{4\pi r^2}}$

r → Radius of Wire

|b| → change in length due to its own weight of a uniform of mass 'm'



* $\boxed{\Delta L = \frac{mg(L/2)}{4\pi r^2}}$ $\boxed{\Delta L = \frac{mgL}{2Y\pi r^2}}$

|c| → Potential energy stored in a streached wire-

$F = K\Delta L$ (like spring)

So, ~~because~~ behave like spring of force const.

$\boxed{K = \frac{YA}{L}}$

pot. energy stored ⇒ $\boxed{U = \frac{1}{2}K\Delta L^2}$

$\boxed{U = \frac{1}{2}\left(\frac{YA}{L}\right)(\Delta L)^2}$

$\boxed{\Delta L = U(\text{vol.})}$