Elasticity - II

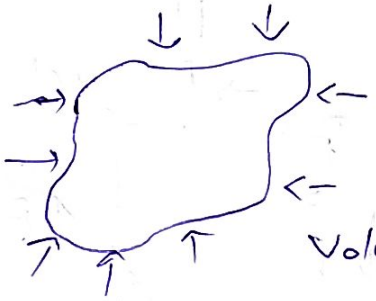
Stress → Cause of deformation

Volume stress –

Forces act in such a way that

i) At any point the force (F) is normal to the surface

ii) magnitude of the force on any small surface area (ΔS) is directly proportional to the area



Volume stress

Forces acting everywhere on the surface

Volume stress = $\frac{F}{A}$ → force per unit area

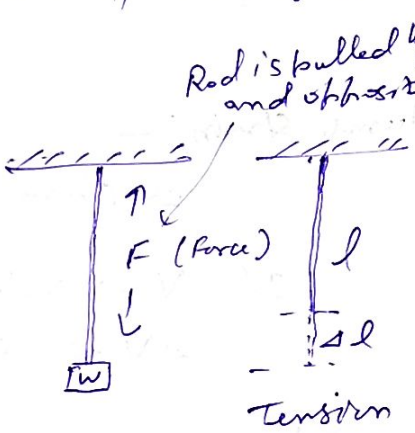
Strain → Effect of deformation → Relative change in the dimension or shape of the object due to an applied stress

Longitudinal strain:

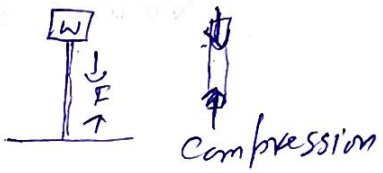
l → length of the rod

Δl → change in length

Longitudinal strain = $\frac{\Delta l}{l}$



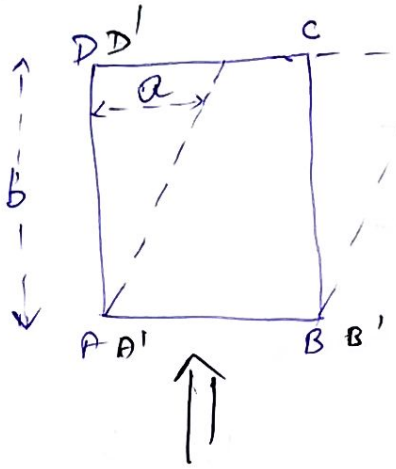
If length increases from its natural length, longitudinal strain is called → tensile strain



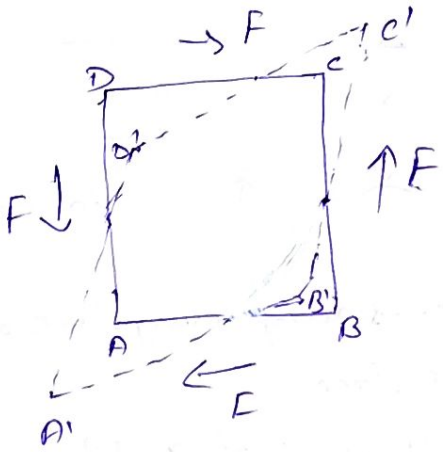
If it decreases from its natural length → compressive strain

Shearing strain (or shear):

Shape of the body changes volume remains unchanged.



→ Faces are displaced due to the tangential forces acting parallel to the faces



← Forces are parallel to the surfaces
→ Resultant force = 0
Total torque = 0

Body with a square cross section

$$\text{Shearing strain} = \frac{DD'}{DA} = \frac{a}{b}$$

Volume strain :—

∴ change in volume due to applied stress

If V → volume of unstressed body,
ΔV → change in volume,

$$\text{Volume strain} = \frac{\Delta V}{V}$$