SURFACE TENSION

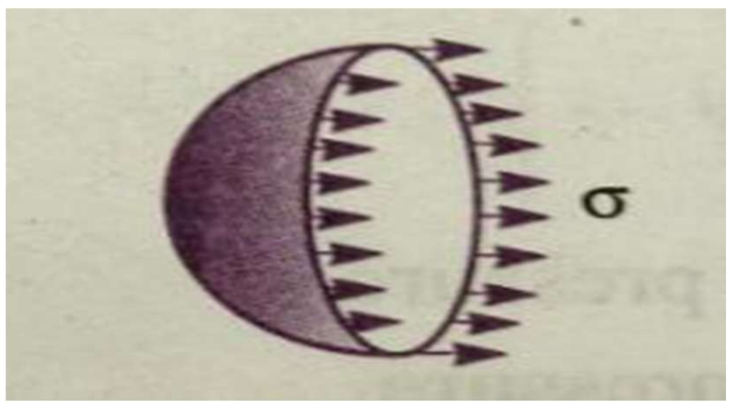
- Surface tension is defined as the tensile force acting on the surface of a liquid is contact with a gas or on the surface behaves like a membrane under tension.
- The magnitude of this force per unit length of free surface will have the same value as the surface energy per unit area.
- In MKS units it is expressed as Kgf/m while in SI units as N/m

- **Surface Tension on Liquid Droplet:**
- Consider a small spherical droplet of a liquid of radius ‘r’ on the entire surface of the droplet, the tensile force due to surface tension will be acting
- Let σ = surface tension of the liquid
- p= pressure intensity inside the droplet (In excess of outside pressure intensity)
- d= Diameter of droplet

Let, the droplet is cut in to two halves. The forces acting on one half (say left half) will be

i) Tensile force due to surface tension acting around the circumference of the cut portion

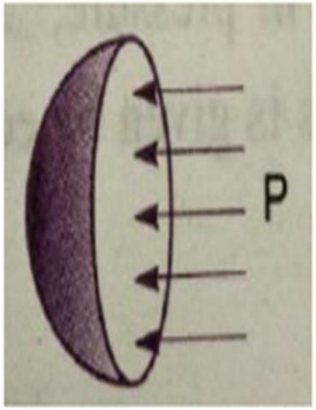
$$= \sigma \times \text{circumference} = \sigma \times \pi d$$



ii) Pressure force on the area $\frac{\pi}{4}d^2 = p \times \frac{\pi}{4}d^2$

These two forces will be equal to and opposite under equilibrium conditions i.e.

$p \times \frac{\pi}{4}d^2 = \sigma \pi d,$ $\quad p = \frac{\sigma \pi d}{\frac{\pi}{4}d^2}$ $\quad p = \frac{4\sigma}{d}$



Surface Tension on a Hallow Bubble: A hallows bubble like soap in air has two surfaces in contact with air, one inside and other outside. Thus, two surfaces are subjected to surface tension

$$p \times \frac{\pi}{4} d^2 = 2(\sigma \pi d)$$

$$p = \frac{8\sigma}{d}$$