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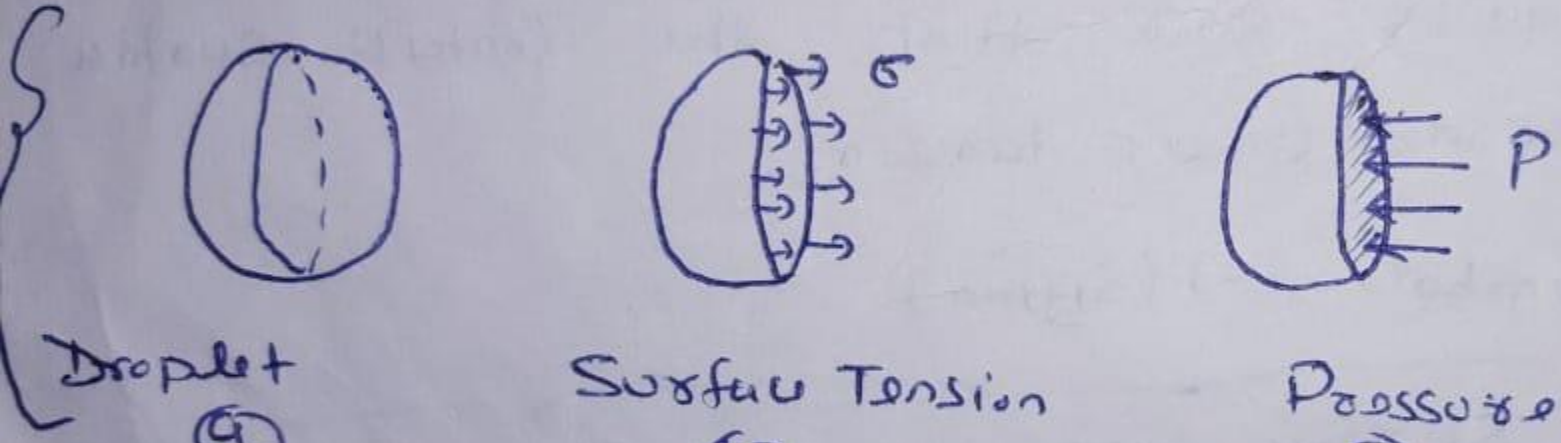
Surface Tension on liquid droplet :-

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.

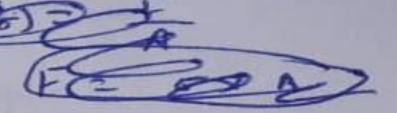


Droplet (a) Surface Tension (b) Pressure forces (c)

Let the Drop cut into two halves.

(i) tensile force due to surface tension acting around the circumference of the cut portion as shown fig (b)

Surface Tension (σ) = $\frac{\text{Force}}{\text{length}}$



$= \sigma \times$ Circumference

$= \sigma \times \pi d$

$2\pi r$
πd

(ii) pressure force on the area $\frac{\pi}{4} d^2$ $= P \times \frac{\pi}{4} d^2$

area of circle
πr^2

$\frac{\pi}{4} \cdot d^2$

$\frac{\pi}{4} \cdot 4r^2$

πr^2

$P = \frac{F}{A}$

$F = P \times A$

These two forces will be equal & opposite under equilibrium conditions -

$$P \times \frac{\pi}{4} d^2 = \sigma \times \pi d$$

$$P = \frac{\sigma \times \pi d}{\frac{\pi}{4} \times d^2} = \frac{4\sigma \times \pi d}{\pi d^2}$$

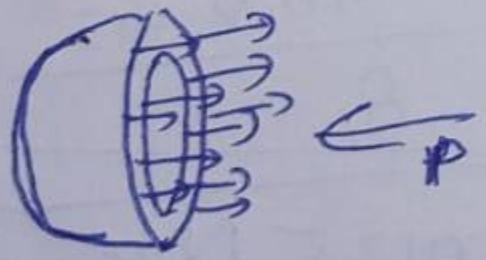
$P_2 - P_1 = \frac{4\sigma}{d}$

σ = Surface tension of the liquid

P_2 Pressure intensity inside the droplet

d Diameter of droplet.

* Surface tension on a hollow Soap Bubble :- A hollow bubble like a soap bubble in air has two surface in contact with air, one inside & other outside. Thus two surfaces are subjected to surface tension. Then

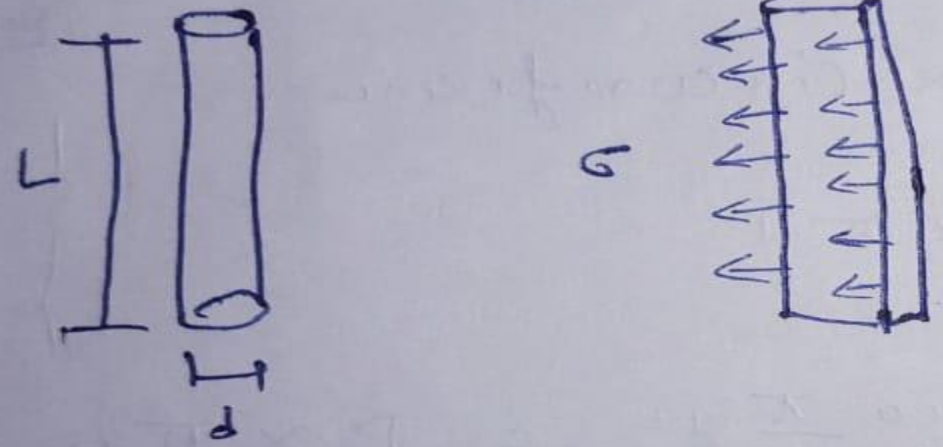


$$P \times \frac{\pi}{4} d^2 = 2 \times (\sigma \times \pi d)$$

$$P = \frac{2 \sigma \pi d}{\frac{\pi}{4} d^2} = \frac{4 \times 2 \times \sigma \times \pi \times d}{\pi d^2}$$

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

* Surface Tension on a liquid Jet :- Consider a liquid Jet of diameter 'd' & length L as shown in fig given below



~~as compare to length~~
dia is ~~very~~ small

assume length of Jet is too high & dia is very small as compare to length

~~P × $\frac{\pi}{4}$ d²~~

Force due to pressure = P × area of semi Jet

= P × L × d

Force due to surface tension = σ × 2L

Force due to surface tension = $\sigma \times 2L$

Then

$$P \times L \times d = \sigma \times 2L$$

$$\boxed{P = \frac{\sigma \times 2L}{L \times d}} \quad = P = \frac{2\sigma}{d} = \frac{2\sigma}{2r}$$

$$P = \frac{\sigma}{r}$$

THANKYOU