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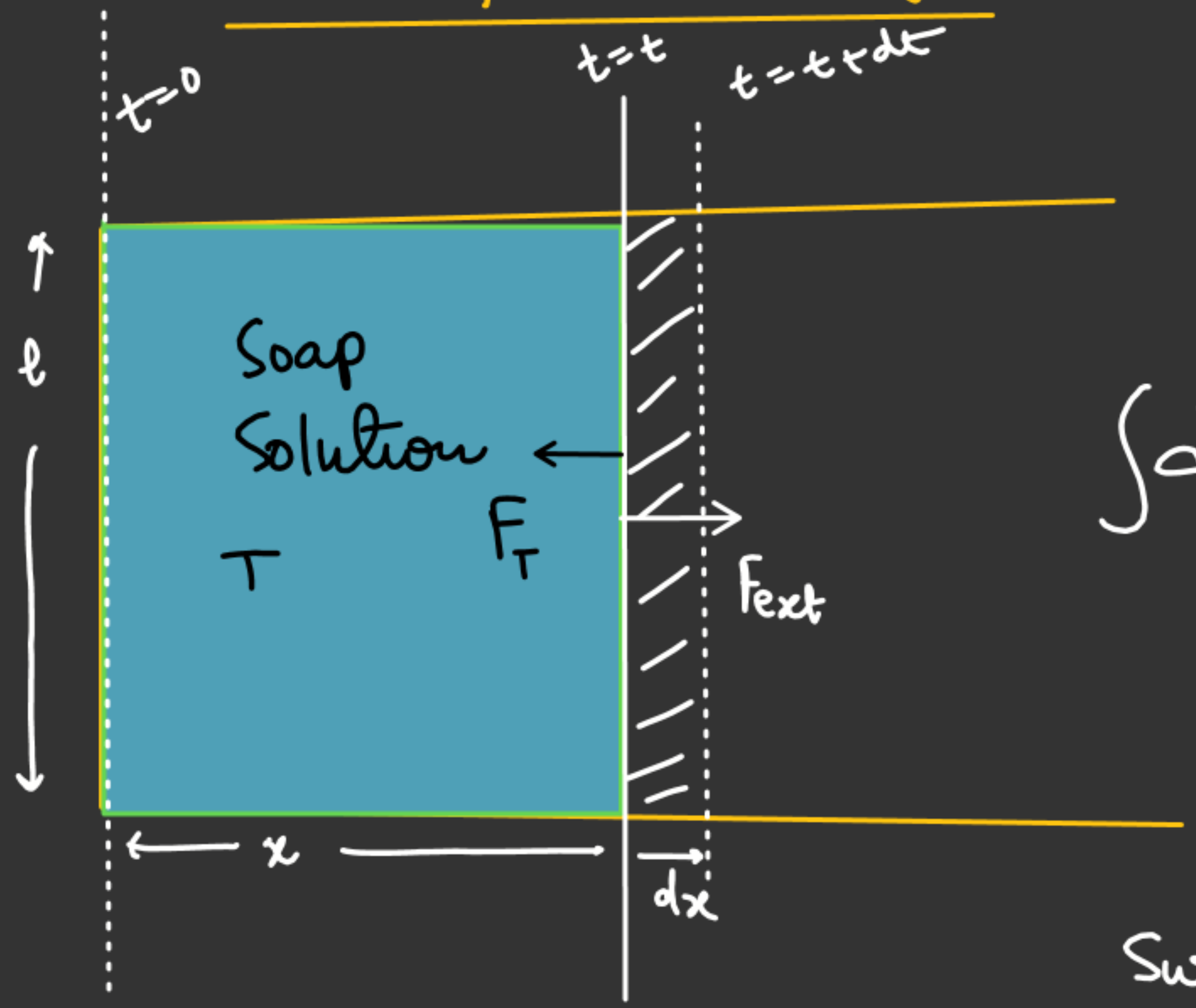
Surface Energy



$$dW_{ext} = F_{ext} \cdot dx$$

$$F_{ext} = F_T = T \cdot (2l)$$

$$\int dW_{ext} = \int T\, 2(l\, dx)$$

$$W_{ext} = 2T \cdot (l \cdot x)$$

$$\Downarrow$$

$$U = T A_{eff}$$

Surface energy

$$\boxed{\frac{U}{A} = T}$$

$$A_{eff} = \left(A \times \text{No of contact} \right)$$

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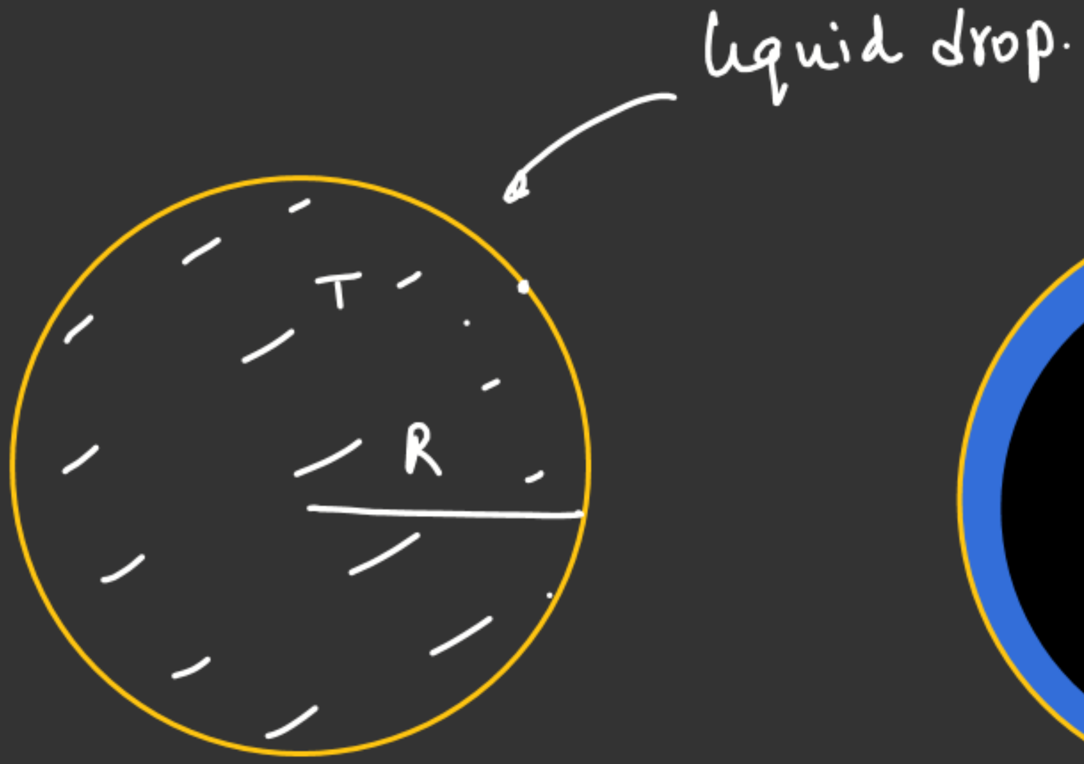

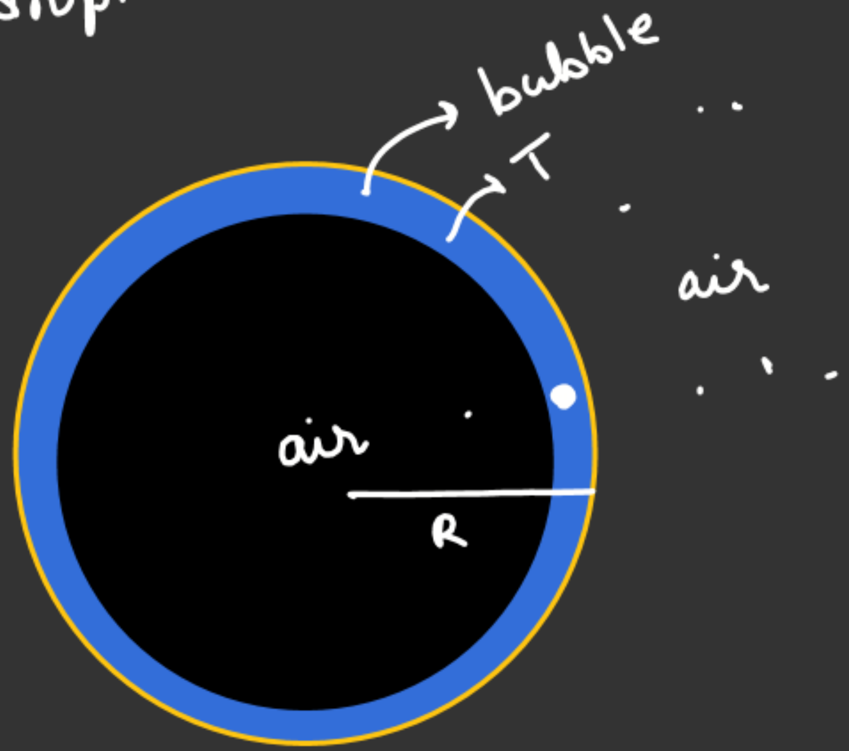

$$\boxed{U = (T \cdot 4\pi R^2)}$$

$$U = T \times 4\pi R^2 \times 2$$

$$\boxed{U = (T \cdot 8\pi R^2)}$$

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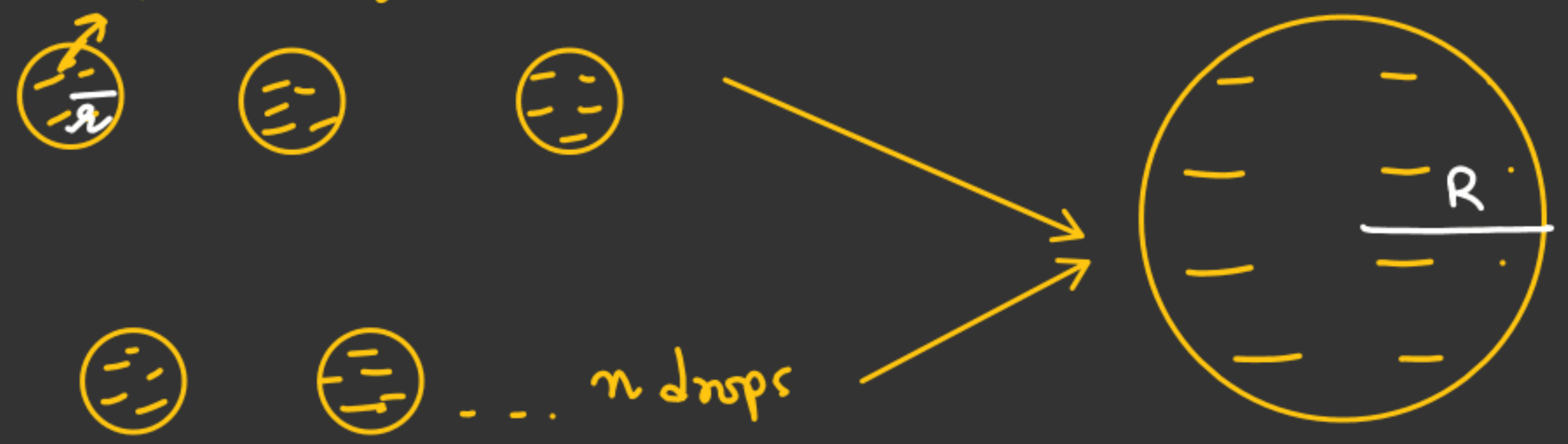
n-liquid drops coalsec to form a single bigger liquid drop.

(T = Surface tension)



$$n \cdot \frac{4}{3}\pi r^3 = \frac{4}{3}\pi R^3$$

$$R = (n^{1/3} \cdot r)$$

$$U_i = n(T\, 4\pi r^2)$$

$$U_f = T \cdot 4\pi R^2$$

$$\Delta U = U_f - U_i$$

$$= T \cdot 4\pi R^2 - n \cdot 4\pi r^2 \cdot T$$

$$= 4\pi T(R^2 - n \cdot r^2)$$

$$\boxed{\Delta U = \underbrace{4\pi r^2 \cdot T \times n}_{\parallel}(n^{-1/3} - 1)}$$

$$\Delta U = U_i(n^{-1/3} - 1)$$

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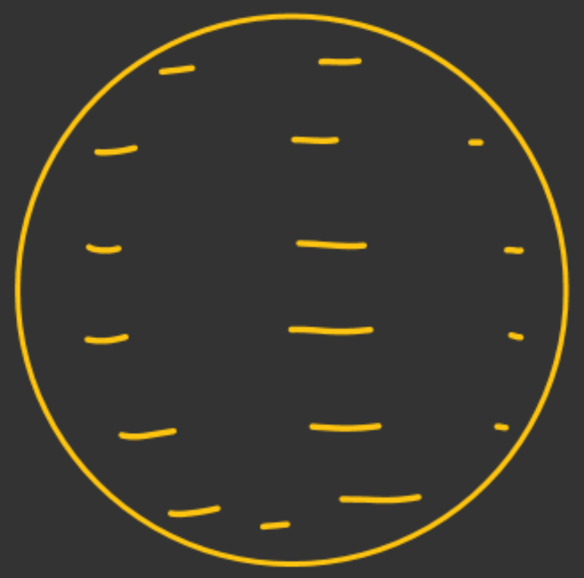
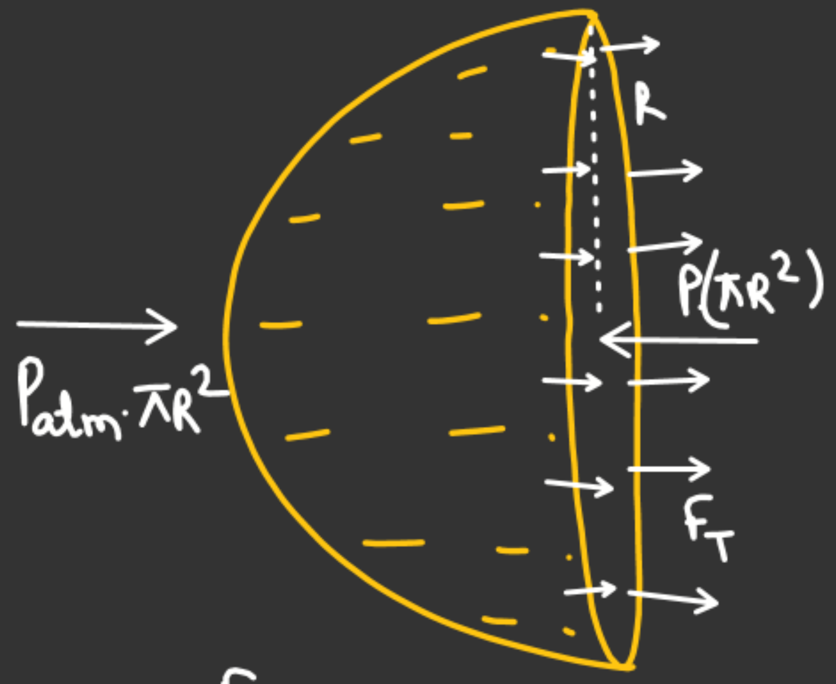
EXCESS PRESSURE INSIDE A LIQUID DROP





$$F_T = T \times 2\pi R$$

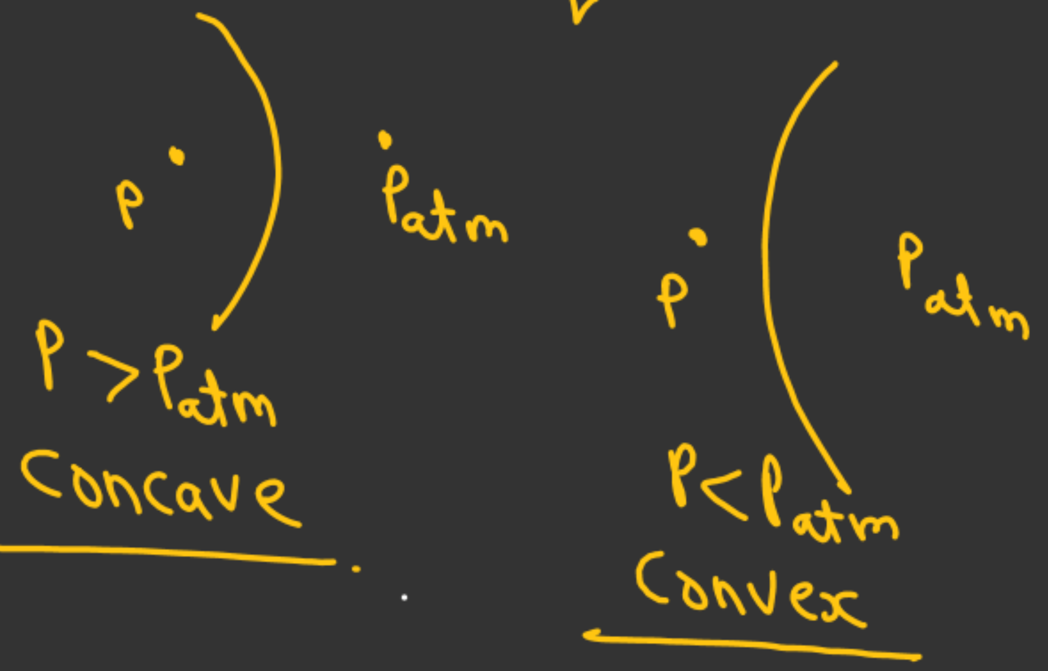
At Equilibrium

$$P_{atm}\cdot\pi R^2 + F_T = P\cdot\pi R^2$$

$$P_{atm}\cdot\pi R^2 + T\cdot 2\pi R = P\cdot\pi R^2$$

$$\boxed{P - P_{atm} = \frac{2T}{R}}$$

Excess pressure inside a liquid drop.



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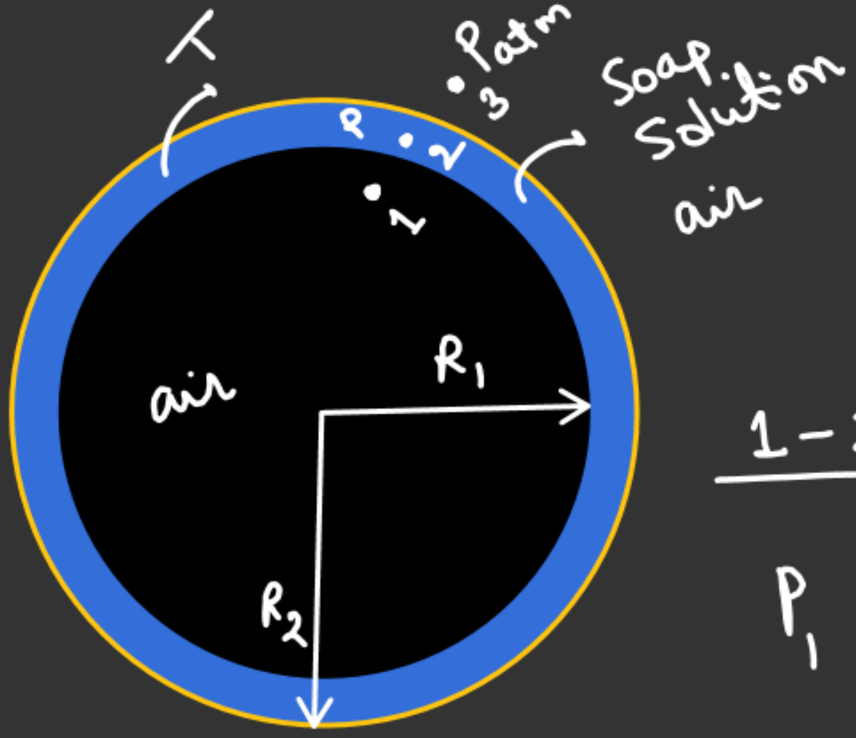
Excess pressure inside a Soap bubble



1 – 2

$$P_1 - P_2 = \frac{2T}{R_1}$$

2 – 3

$$P_2 - P_{atm} = \frac{2T}{R_2}$$

$$\boxed{P_1 - P_{atm} = 2T\left(\frac{1}{R_1} + \frac{1}{R_2}\right)}$$

if $R_1 \simeq R_2 \simeq R$

$$P_1 - P_{atm} = \frac{4T}{R}$$

$$\boxed{\Delta P = \frac{4T}{R}}$$

Excess pressure inside a Soap bubble.

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Excess pressure for any liquid Surface

$$\boxed{\Delta P = 2T\left[\frac{1}{R_1} \pm \frac{1}{R_2}\right]}$$

R_1 & R_2 be the Radius of Curvature of the two Curve Surfaces

$(+) \rightarrow$ When radius of Curvature on Same Side.

$(-) \rightarrow$ When radius of Curvature on opposite Side.

Excess pressure for thin film

$$\boxed{\Delta P = 4T\left[\frac{1}{R_1} \pm \frac{1}{R_2}\right]}$$

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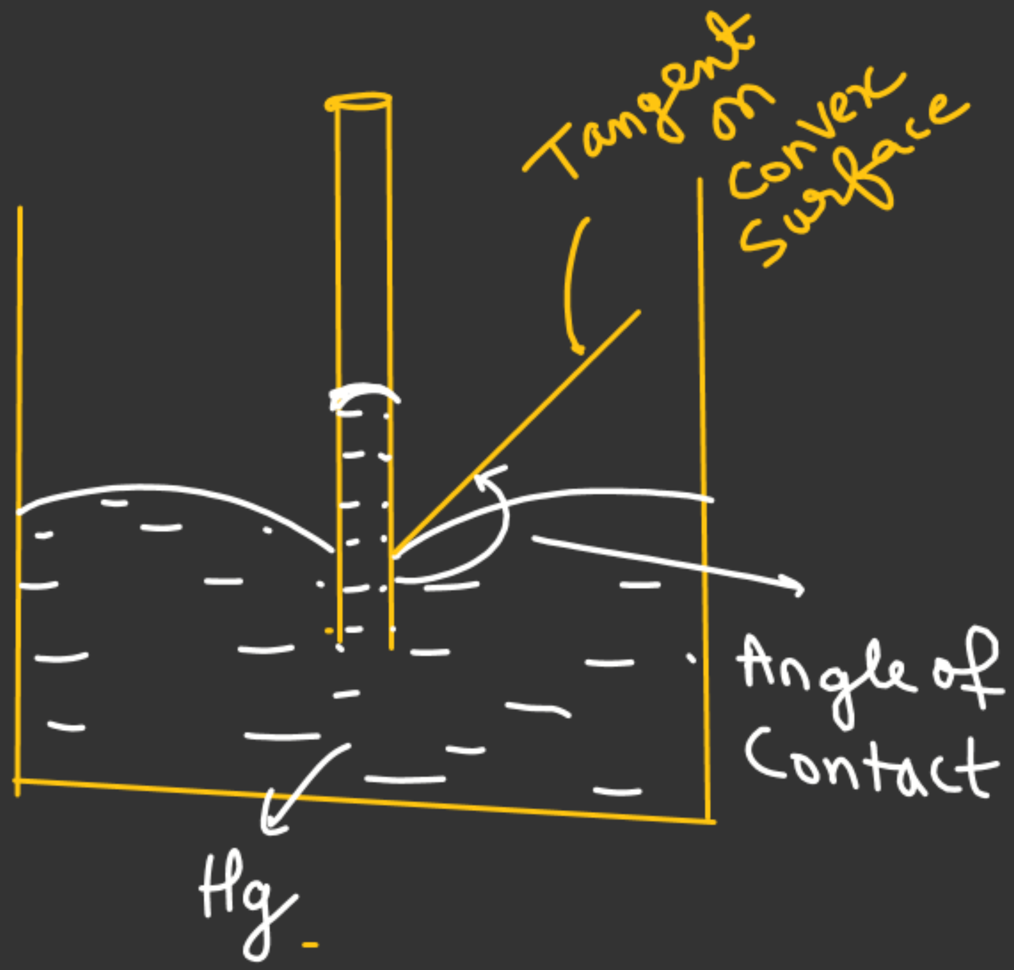
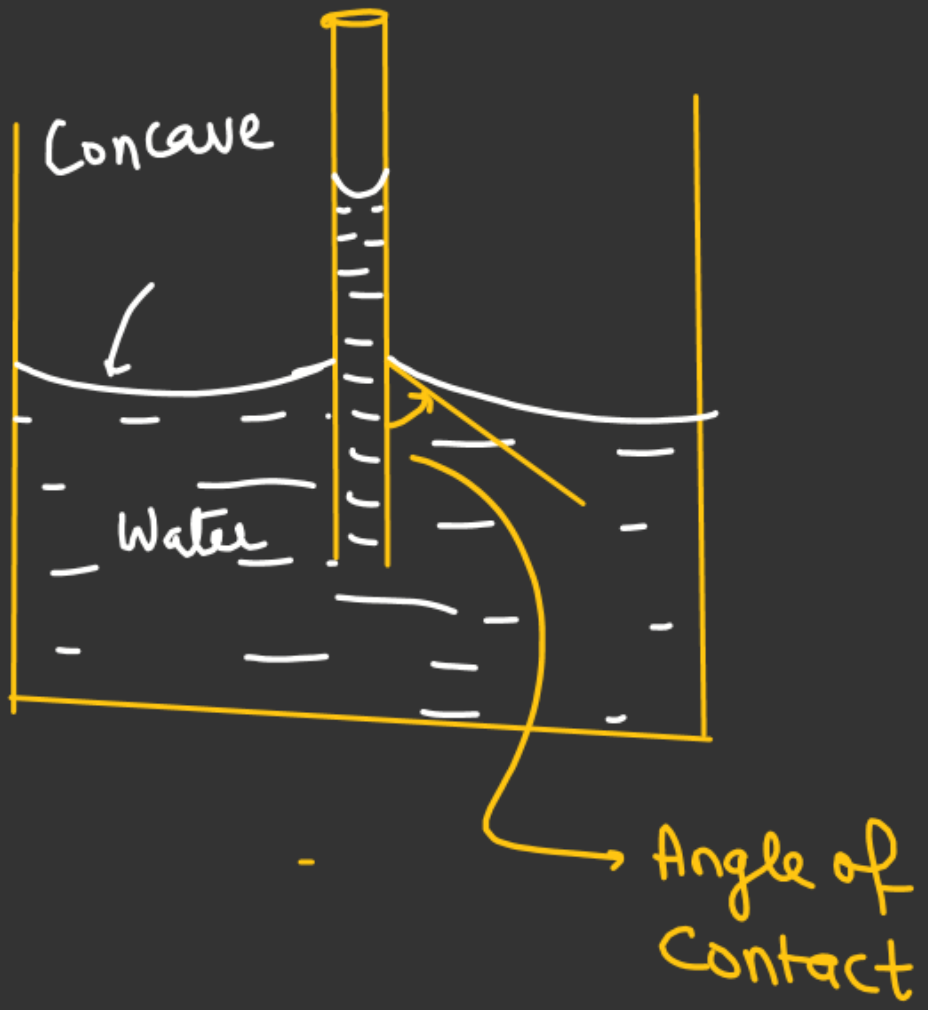
Angle of Contact





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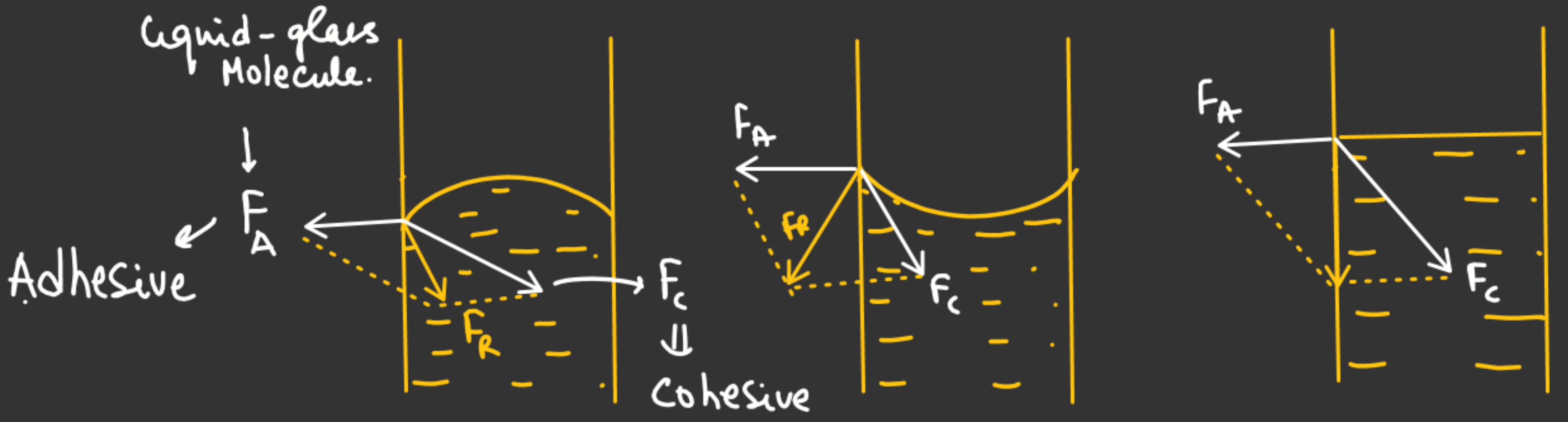
Shape of liquid Meniscus



$F_c > F_A \Rightarrow$ Convex Meniscus.

$F_A > F_c$

Concave Meniscus.

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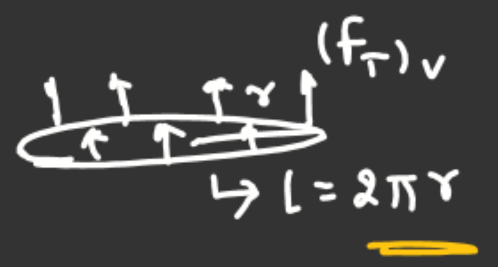
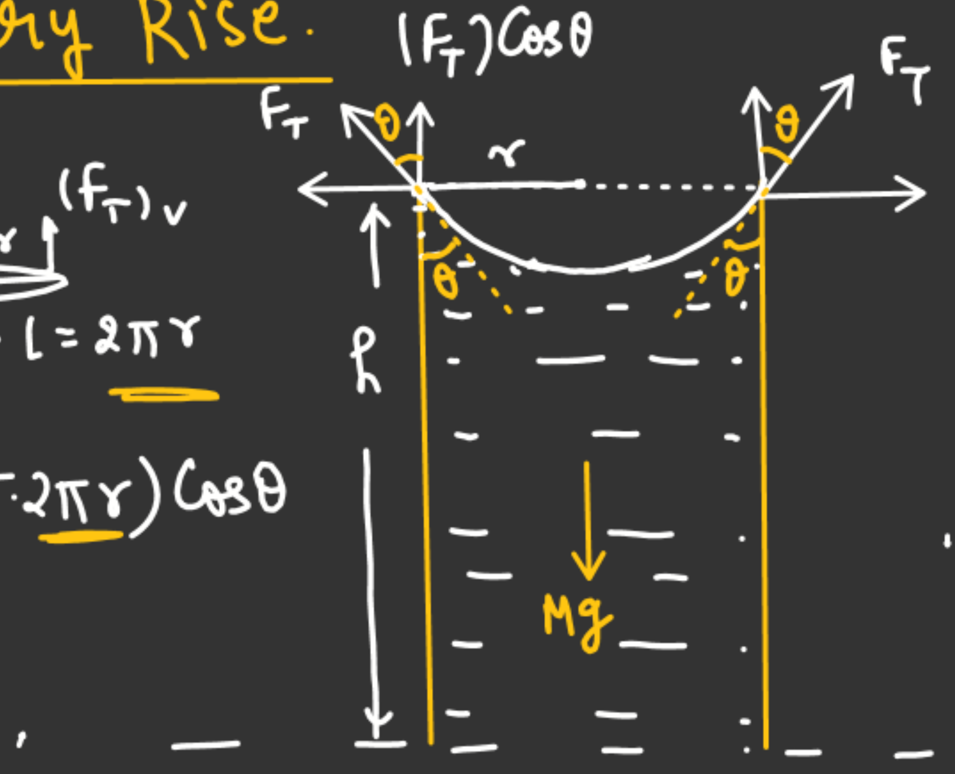
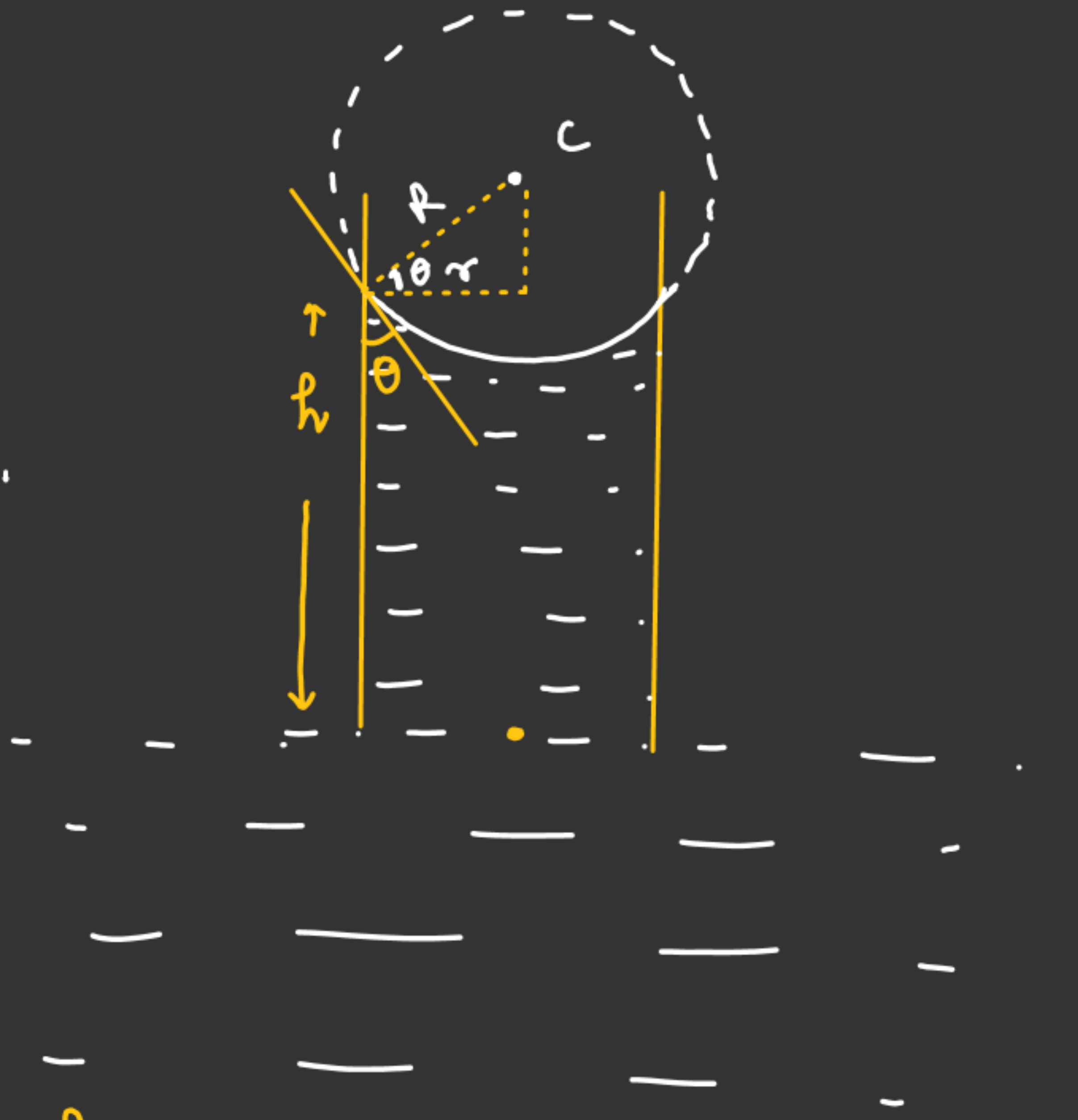
Capillary Rise.







$$(F_T)_v = (T\cdot 2\pi r)\cos\theta$$

$$T\cdot 2\pi r\cdot\cos\theta = Mg \qquad M = (\pi r^2 h)\rho$$

$$T\cdot 2\pi r\cdot\cos\theta = (\pi r^2 h)\rho g$$

$$\boxed{h = \frac{2T\cos\theta}{\rho g r}}$$

θ = Angle of Contact

r = radius of Capillary

ρ = density of liquid.

T = surface tension of liquid

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If height of Capillary is insufficient

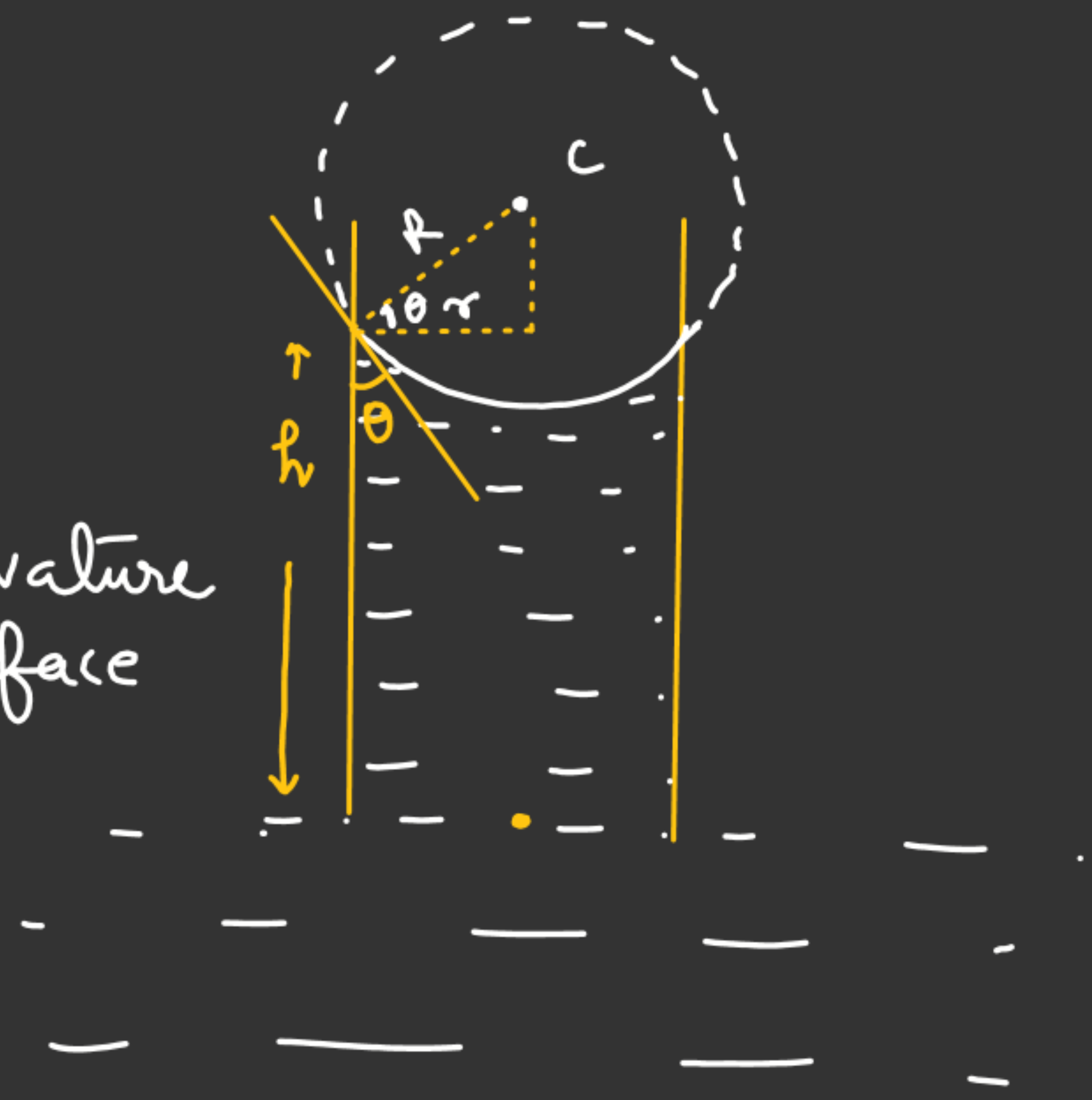
$$h = \frac{2T\cos\theta}{\rho g r}$$

θ = Angle of Contact
r = radius of Capillary
ρ = density of liquid.
T = Surface tension of liquid

$$\cos\theta = \left(\frac{r}{R}\right)$$

$$\boxed{h = \frac{2T}{\rho g R}}$$

R = Radius of Curvature of liquid Surface



$$Rh = \frac{2T}{\rho g}$$

$$\boxed{Rh = \text{Constant}}$$

$$\frac{R_1}{R_2} = \frac{h_2}{h_1} \Leftarrow R_1 h_1 = R_2 h_2 = C$$

$h_1 > h_2$
$R_1 < R_2$