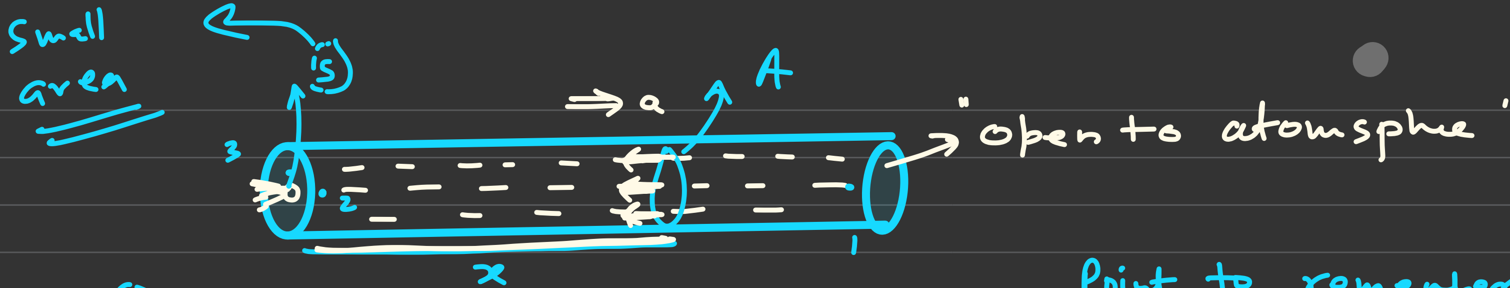
Liquid 4

VMC Vidyamandir Classes SINCE 1986

IIT JEE | MEDICAL | FOUNDATION

Q)



(I) $v_{eff} = \sqrt{2al}$ — (1)

Point to remember:

1 → 3 × (Bor)

2 → 3 (work) done no

(II) "find time after which container gets empty"

$$S \times v_{eff} = A \times v$$

$S \times \sqrt{2ax} = A \times \left(-\frac{dx}{dt}\right)$ → important statement

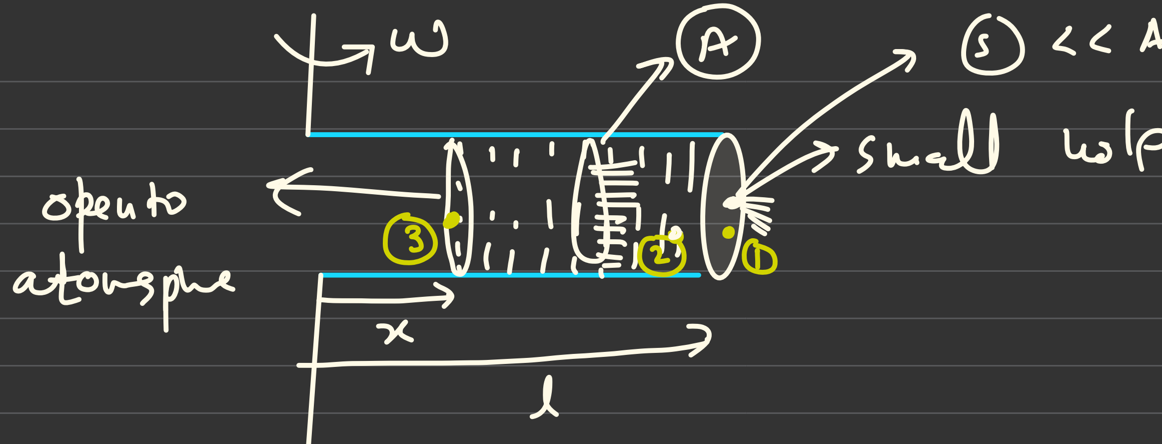
$-\frac{dx}{\sqrt{x}} = \frac{S}{A}\sqrt{2a} \cdot dt$

#

$$\left[\frac{x^{1/2}}{1/2}\right]_{l}^{0} = -\frac{S}{A}\sqrt{2a}\,\left[t\right]_{0}^{t}$$

$\underline{\underline{\text{Ans}}}$

θ)



$a \times v_1 = v_2 \times A$

$v_2 = \frac{a v_1}{A}$

$v_2 \simeq 0$

we can apply Bernoulli's theorem at 1 and 2

$v_1 = v_{eff}$

$P_0 + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho v_2^2$ — 1

$P_2 - P_0 = \rho a_c (y)$ → sep between two point

$P_2 = P_0 + \rho \omega^2 \left(\frac{l-x}{2} + x\right)(l-x)$

$\{ P_3 = P_0$

$$P_2 = P_0 + \rho\omega^2\left(\frac{l^2 - x^2}{2}\right) \quad \text{--- (II)}$$

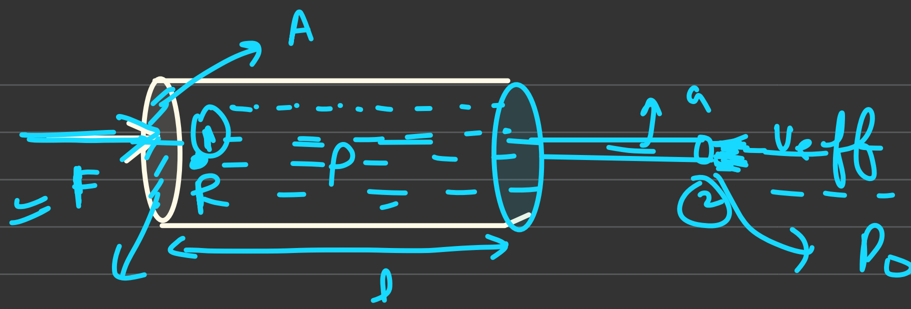
from (I) & (II)

as green small ignore

$$\cancel{P_0} + \frac{1}{2}\cancel{\rho}v_1^2 = \cancel{P_0} + \cancel{\rho}\omega^2\left(\frac{l^2 - x^2}{2}\right) + \cancel{\frac{1}{2}\rho v_2^2}$$

$$\boxed{v_1 = v_{eff} = \sqrt{\omega^2(l^2 - x^2)}}$$

9)



$$P = \frac{F}{A} + P_0$$

$$v_2 = v_{eff}$$

1 and 2

$$\cancel{P_0} + F/A + \frac{1}{2}\rho v_1^2 = \cancel{P_0} + \frac{1}{2}\rho v_2^2$$

$$\frac{F}{A} + \underbrace{\cancel{\frac{1}{2}\rho v_1^2}}_{0} = \frac{1}{2}\rho v_2^2$$

$$F/A = \frac{1}{2}\rho v_{eff}^2$$

$$\boxed{V_{eff} = \sqrt{\frac{2F}{\rho A}}}$$

$\not{d}$ =

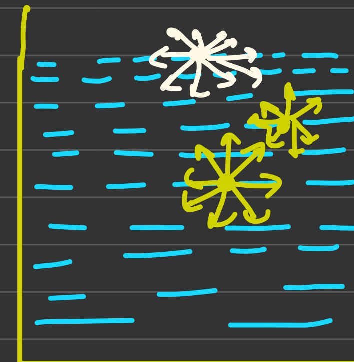
Cohesive:

Intra-molecular force

Adhesive:

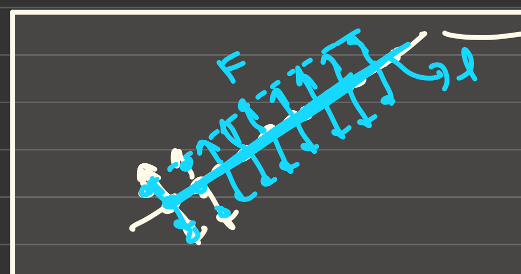
Inter molecular force

Surface Tension:



$\sigma = \frac{F}{l} \Rightarrow F = \sigma l$

σ → Surface Tension



→ This surface behave like stretched membran

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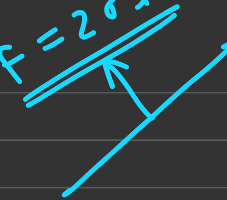

$F = 2\sigma l$

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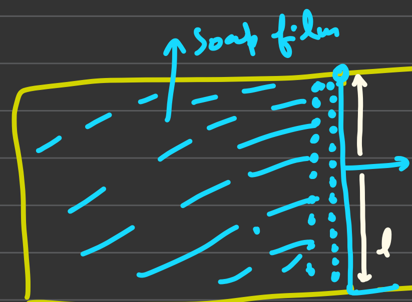
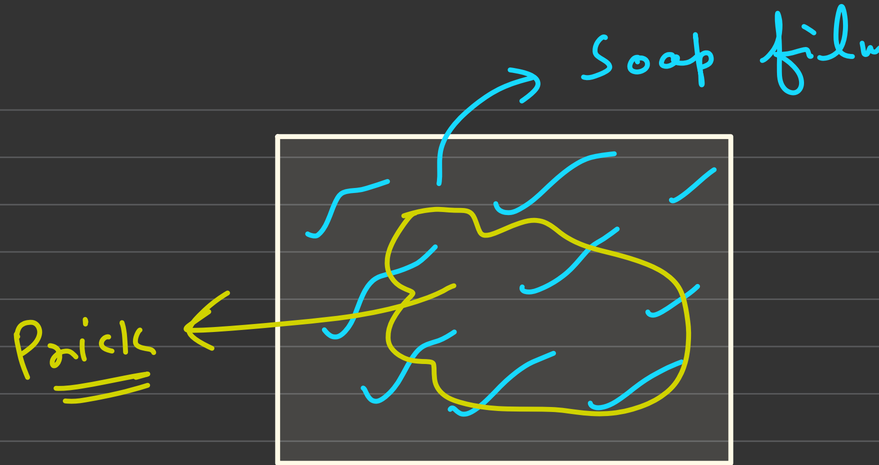
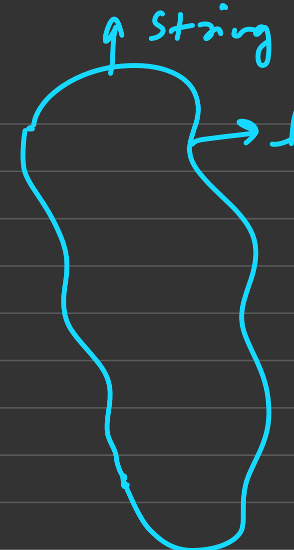


$2\sigma l = F_{ext}$

find net F_{ext} for which rod is stationary

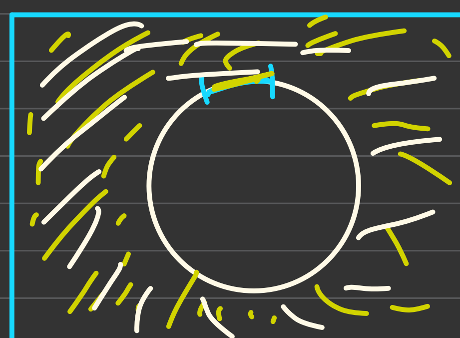
Q)





find Tension in string?

After Pricking

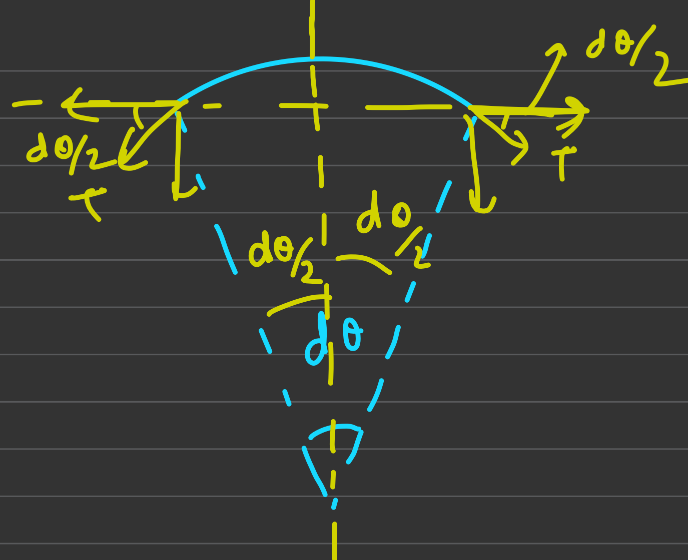


$$l = 2\pi R$$

$$R = \frac{l}{2\pi}$$

{for given length area of circle is max.}

$$F_{net} = 2\sigma (R\,d\theta)$$



$\sin\theta = \theta$ (θ = small)

$$2\sigma R\,d\theta = 2T\sin\left(\frac{d\theta}{2}\right)$$

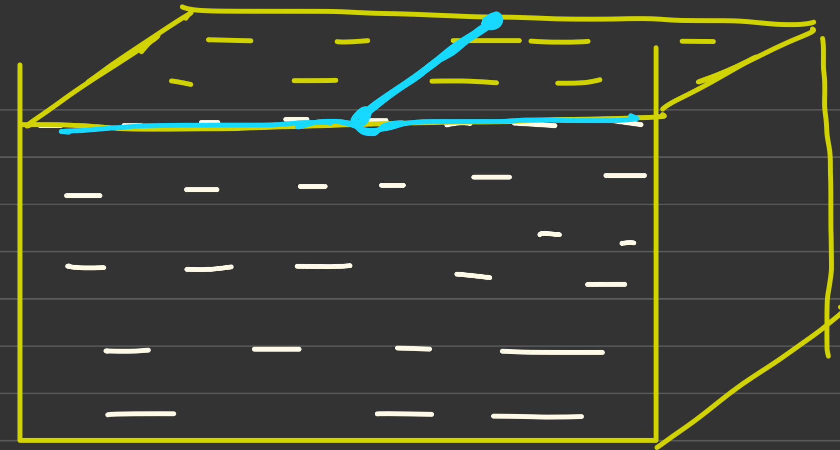
$$2\sigma R\,\cancel{d\theta} = \cancel{2}T\cdot\frac{\cancel{d\theta}}{\cancel{2}}$$

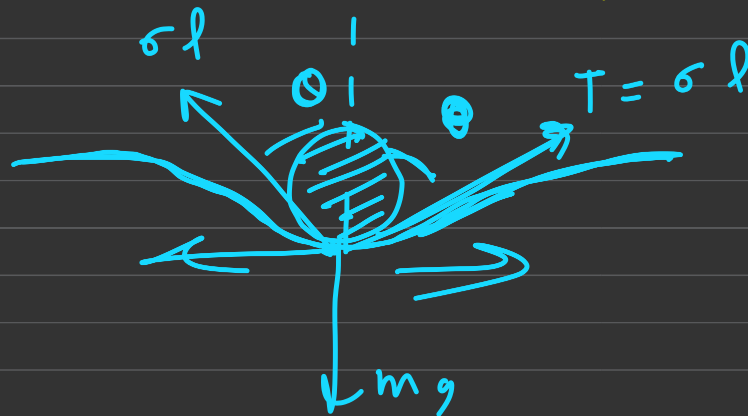
$$2\sigma R = T$$

$$T = 2\sigma\left(\frac{l}{2\pi}\right)$$

$$T = \left(\frac{\sigma l}{\pi}\right) \quad \underline{\underline{\text{Ans}}}$$

Q)





$$2\sigma l \cos\theta = mg$$

$$m_{max} = \frac{2\sigma l \cos\theta}{g}$$

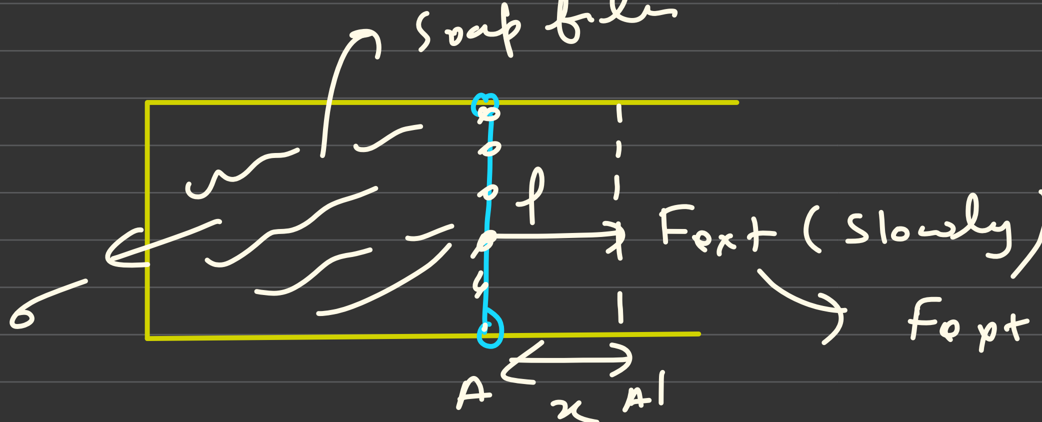
$\cos\theta \uparrow$

$\theta = 0$

$\cos 0 = 1$

$$m_{max} = \left(\frac{2\sigma l}{g}\right)$$

Surface Potential Energy :



$F_{ext} = \underline{\underline{2\sigma\ell}}$

change S.P.E " is work done by external agent to bring this rod from A to A' slowly "

$$\left\{ W_{ext} = \Delta SPE + \cancel{\Delta KE}_{0} \right.$$

$$\Sigma W_{ext} = \underline{\underline{\Delta U}}$$

$$\Rightarrow \quad (2\sigma l x) = \Delta U$$

$$\Delta U = \sigma (2 l x)$$

$$\underline{(\Delta U)_{SPE}} = \underline{\sigma} \, (\underline{\Delta A})$$

Change surface P-E = σ (change in surface)

① liquid Drop

liquid Drop

$$U_f - \cancel{U_i} = \sigma\left(4\pi R^2\right)$$

$$U_i = 0$$

$$U_f = \sigma 4\pi R^3$$

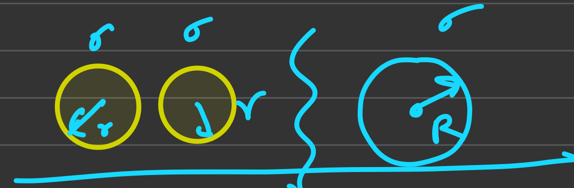
(ii) Soap bubble

$$U_f - \cancel{U_i} = 2\sigma\left(4\pi R^2\right)$$

$$U_i = 0$$

$$U_f = 8\sigma\pi R^2$$

Q) two identical liquid drops



$\sigma 4\pi r^2 \quad \sigma 4\pi r^2$

$U_i = 2\sigma 4\pi r^2 \qquad U_f = \sigma(4\pi R^2)$

$U_i = \sigma 4\pi r^2 \; 2 =$

$\frac{4}{3}\pi r^3 \times 2 = \frac{4}{3}\pi R^3$

$R = r\, 2^{1/3} \qquad 2^1 \quad 2^{2/3}$

$U_f = \sigma 4\pi (r\, 2^{1/3})^2$

$$U_f = \underline{4 \cdot 6 \pi r^2} \, (2^{2/3}) =$$

$$\{ \underbrace{U_i > U_f} \}$$

loss in Enry = $\underline{\underline{U_i - U_f}}$ (Heat $\underline{\underline{\text{loss}}}$)

=

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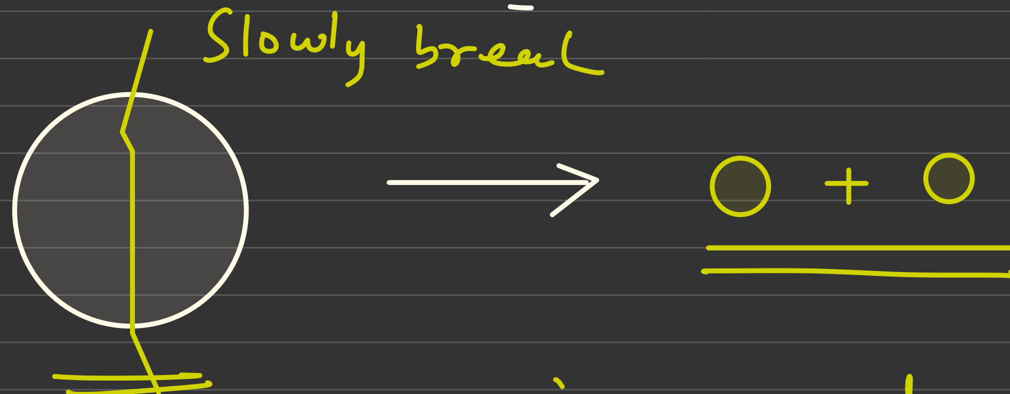
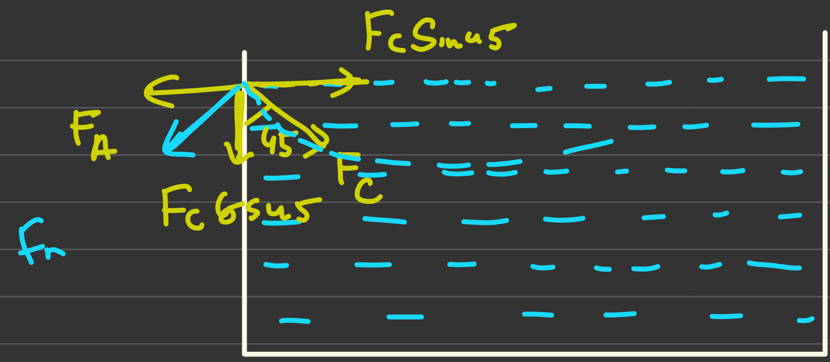
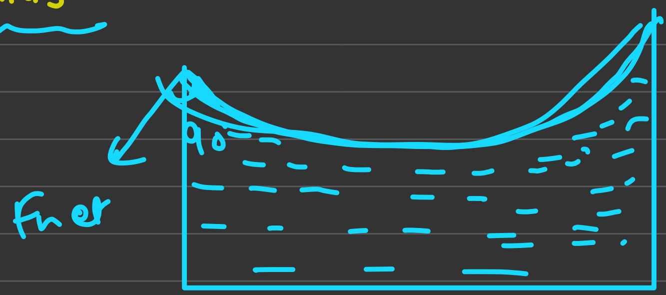


enry increases due to external work

Meniscus:

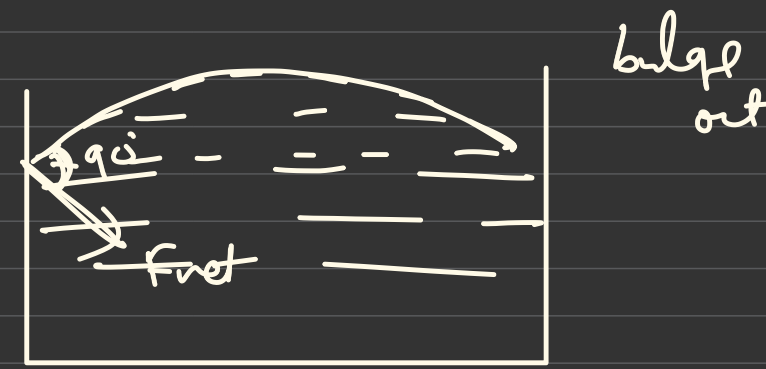


Case I: if $F_A > F_C \sin 45$

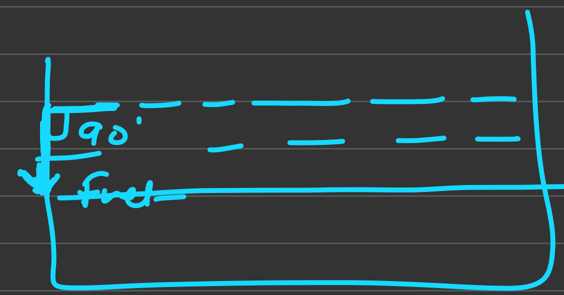


bulge in

Case II: if $F_A < F_C \sin\alpha$



Case III: if $F_A = F_C \sin\alpha$

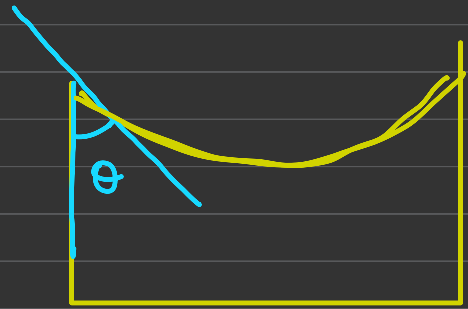


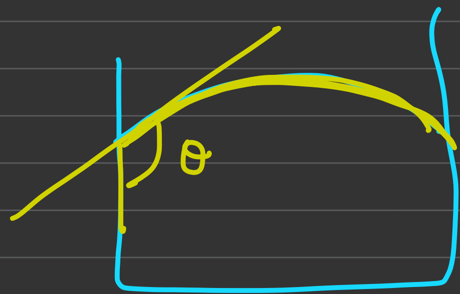
Contact Angle :

Angle between surface of the liquid & the wall inside liquid

θ = angle of contact

①





"In case of water (By default)

$\theta = 0°$

in of mercury

$\theta = 180°$

mercury