Nishant Jindal

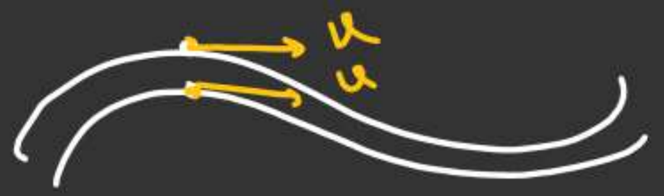
FLUID

* Fluid :- Which Can flow.
  (gases & liquid)

(*) Ideal Fluid

(*) InCompressible :- Density of liquid through its volume remain Constant

(*) Non - Viscious :- Any two Consecutive layer doesnot apply any tangential force on each other.



$f = 0$

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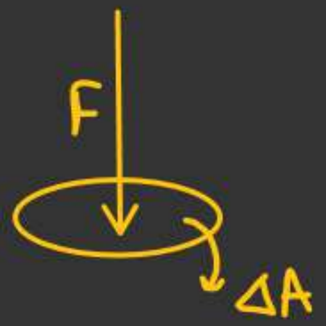
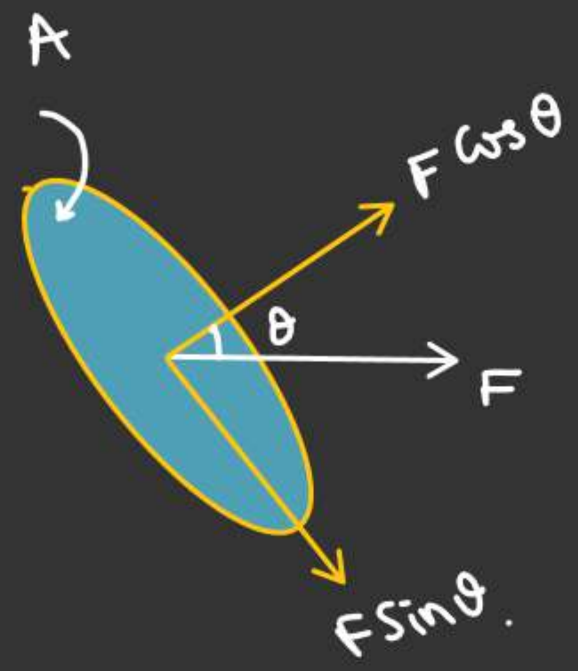
PRESSURE



$$P = \lim_{\Delta A \to 0} \left(\frac{F}{\Delta A} \right)$$

(F always $\perp$ to Area)



$$\boxed{P = \frac{F \cos\theta}{A}}$$

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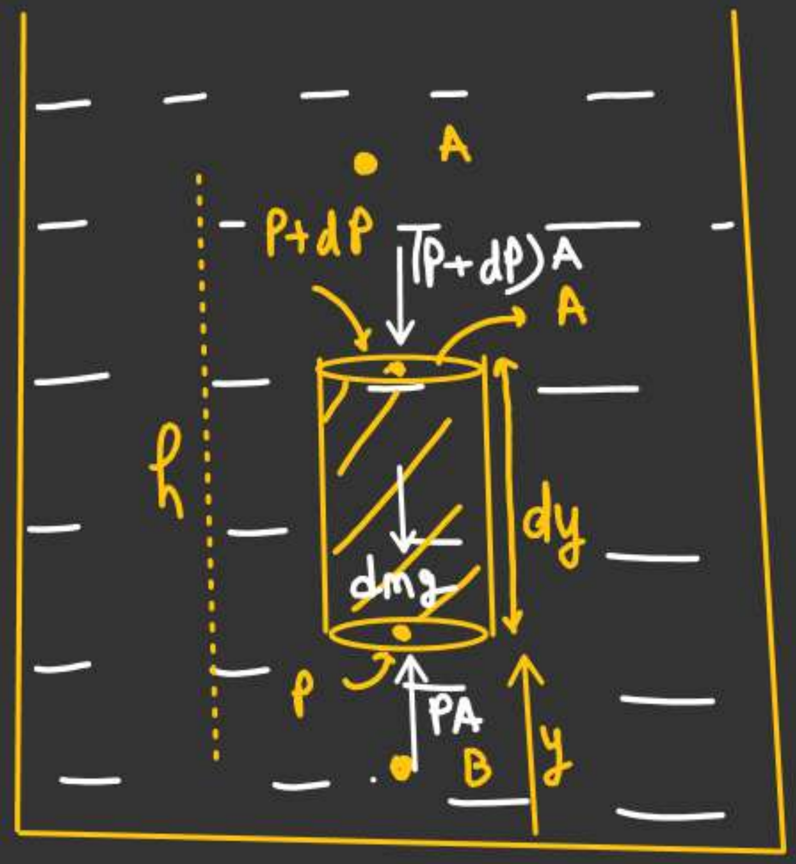
PRESSURE DIFFERENCE IN STATIC LIQUID



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

$F = (PA)$

Newton first law for 'dy' length of liquid Column

$PA = (P+dP)A + dmg$

$dm = \rho dV = \rho A dy$

$PA = (P+dP)A + \rho A dy g$

$0 = dPA + \rho A dy g$

$$\boxed{-\frac{dP}{dy} = \rho g}$$

$-\int_{P_B}^{P_A} dP = \rho g \int_{h_B}^{h_A} dy$

$-(P_A - P_B) = \rho g (h_A - h_B)$

$P_B - P_A = \rho g (h_A - h_B)$

$$\boxed{P_B - P_A = \rho g h}$$

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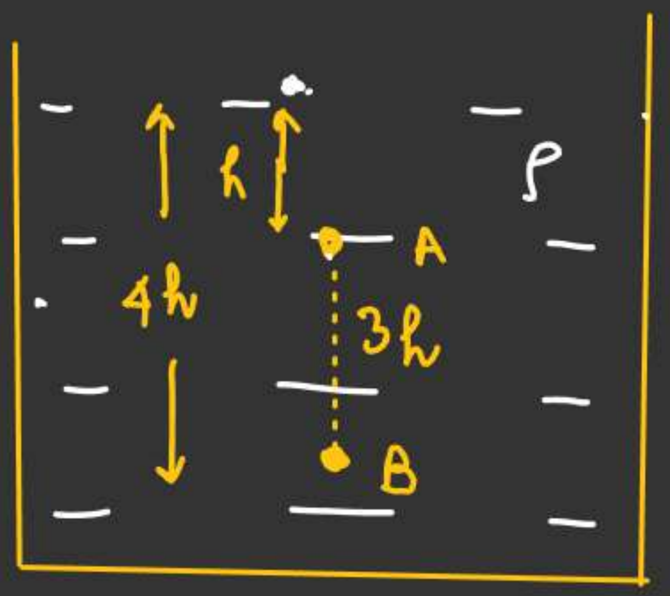


Absolute pressure of A & B

$$P_A = P_{atm} + \rho g h$$

$$P_B = P_{atm} + \rho g 4h$$

$$P_B - P_A = (3\rho g h)$$

$$\rho = (a + by)$$

↓ Density of liquid

y = height from bottom.

$$P_A - P_B = ??$$

$$-\frac{dP}{dy} = \rho_y g$$

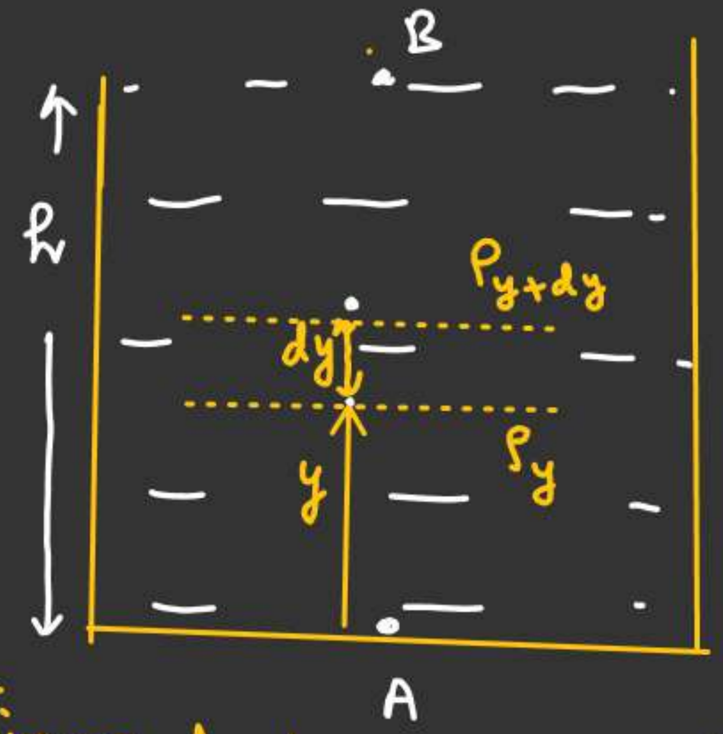
$$dP = -\rho_y \cdot g\, dy$$

$$\int_{P_A}^{P_B} dP = -g\int_0^h (a+by)\,dy$$

$$P_B - P_A = -g\left[a\int_0^h dy + b\int_0^h y\,dy\right]$$

$$P_B - P_A = -g\left[ah + \frac{bh^2}{2}\right]$$

$$P_A - P_B = \left(agh + \frac{bgh^2}{2}\right)$$



Since dy is very small

So $P_y \simeq P_{y+dy}$

$dP \rightarrow$ Pressure difference for dy height

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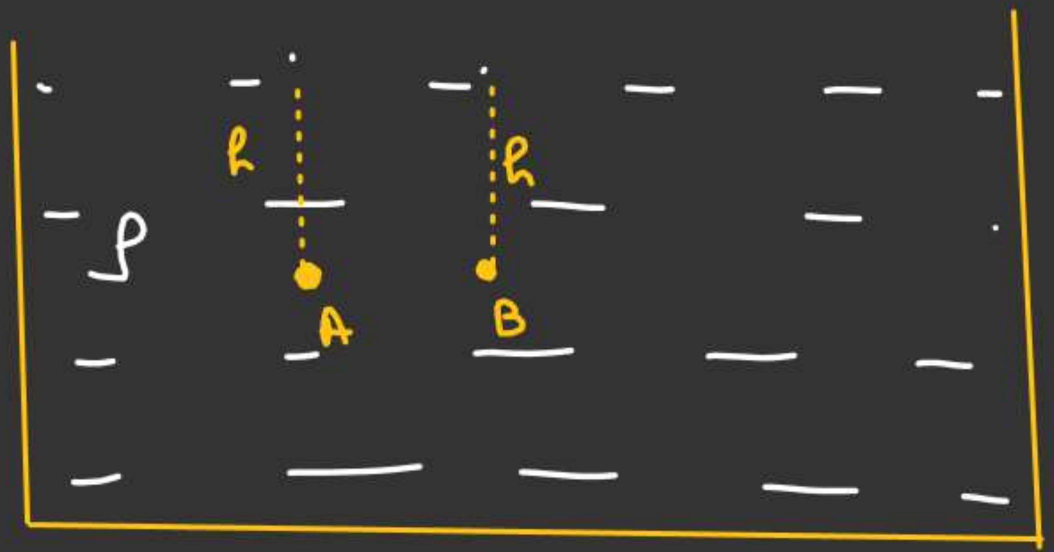
Pressure difference b/w any two point at Same horizontal level

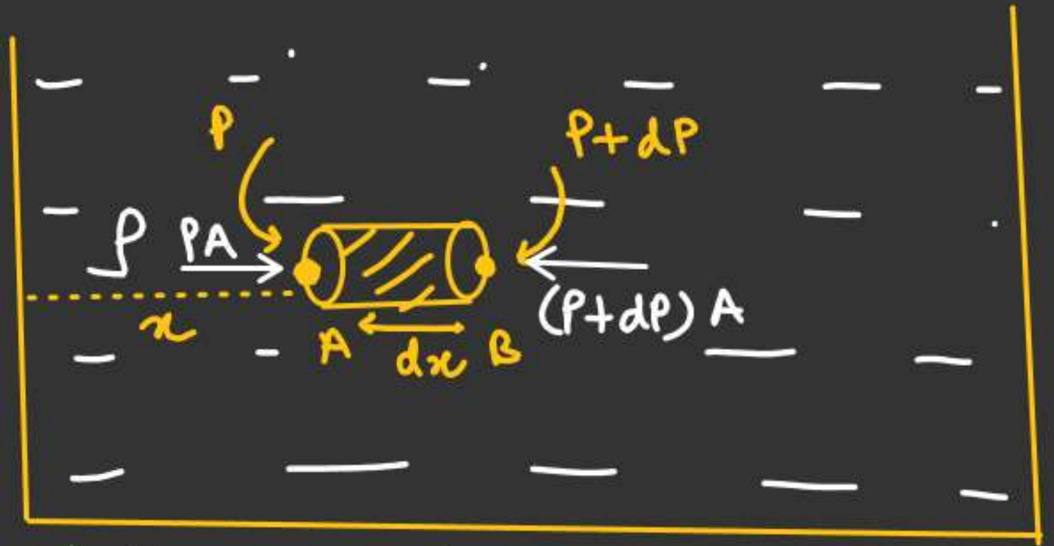


$P_A = P_{atm} + \rho g h$

$P_B = P_{atm} + \rho g h$

$P_A - P_B = 0$

$\boxed{P_A = P_B}$



For 'dx' length liquid

$PA = (P + dP)A$

$dP = 0$

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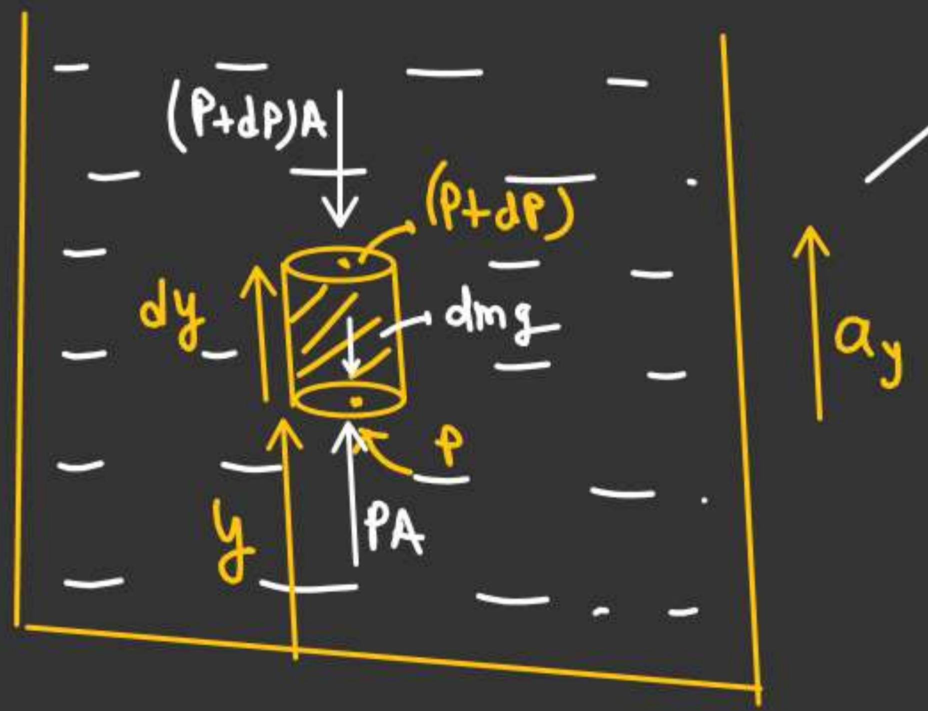
Pressure difference in acclerated frame

Acclerated in y-direction

$dm = \rho A dy$



$PA - (P+dP)A - dmg = dm a_y$

$\cancel{PA} - \cancel{PA} - dPA = \rho A dy (g + a_y)$

$-\frac{dP}{dy} = \rho (g + a_y)$

$$\boxed{-\frac{dP}{dy} = \rho g_{eff}}$$

$g_{eff} = (g + a_y)$ when elivator moving upward

$g_{eff} = (g - a_y)$ when elivator moving downward

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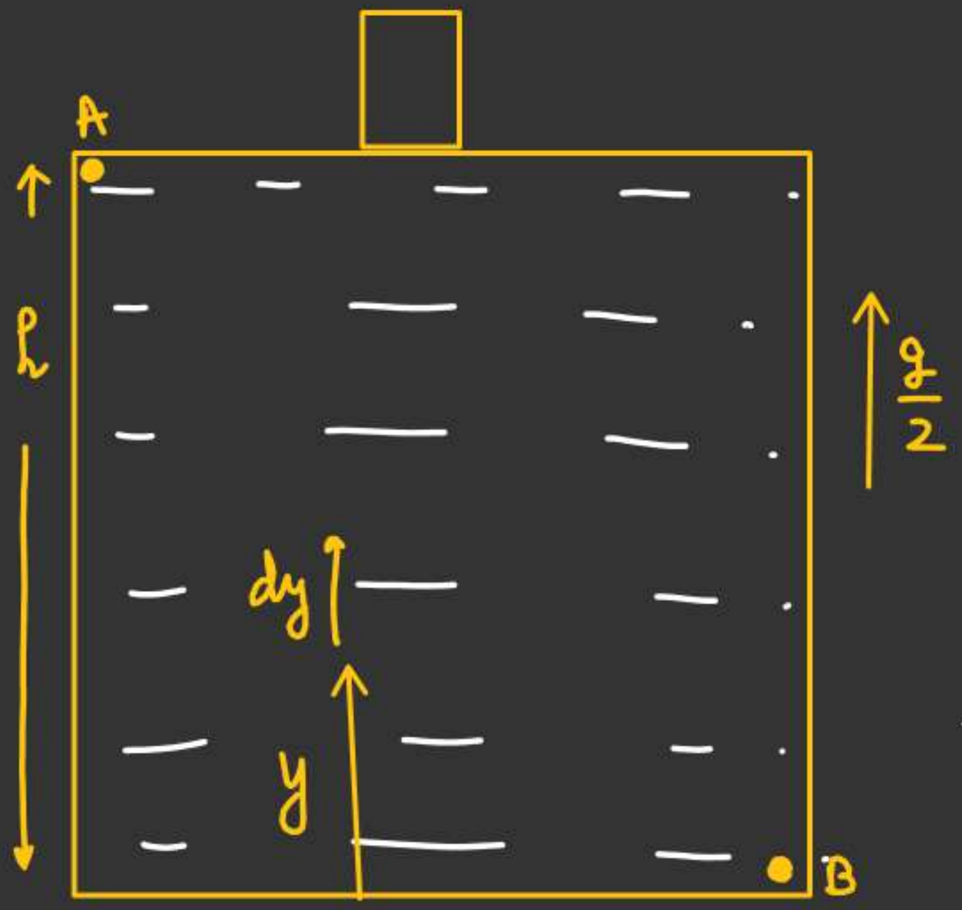

$P_B - P_A = ??$

$$-\frac{dP}{dy} = \rho\left(g + \frac{g}{2}\right)$$

$$-\frac{dP}{dy} = \frac{3\rho g}{2}$$

$$-\int_{P_B}^{P_A} dP = \frac{3\rho g}{2}\int_0^h dy$$

$$P_B - P_A = \frac{3\rho g h}{2} \checkmark$$

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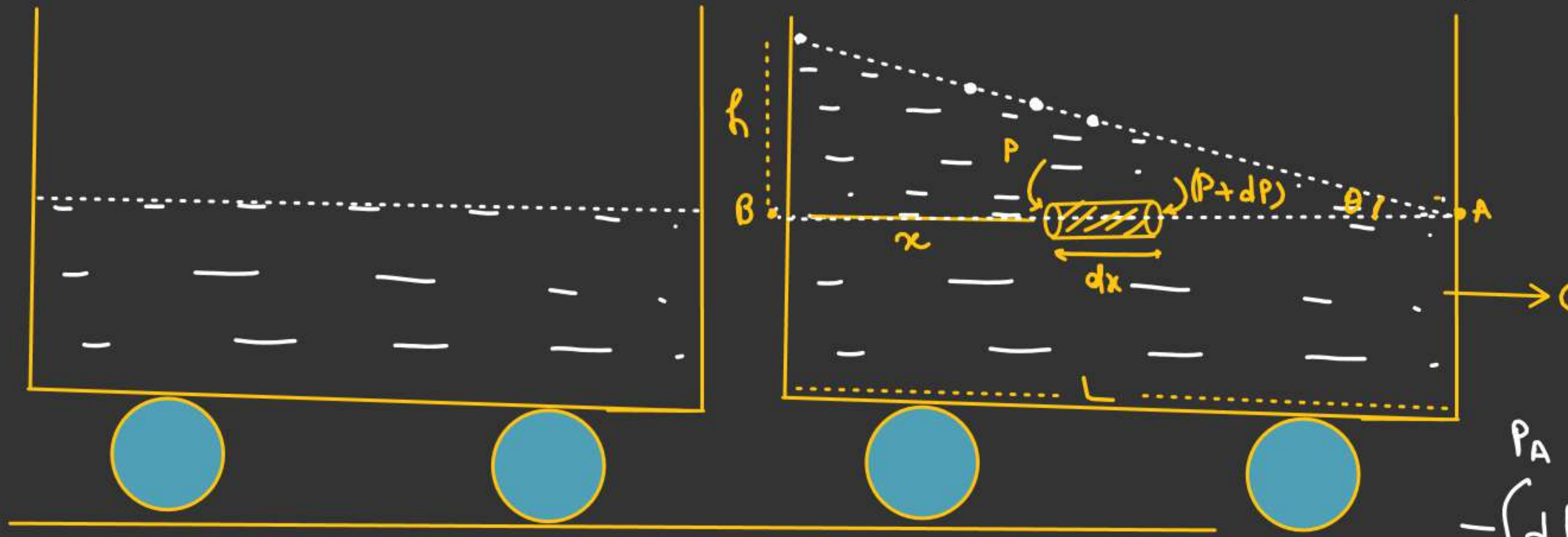
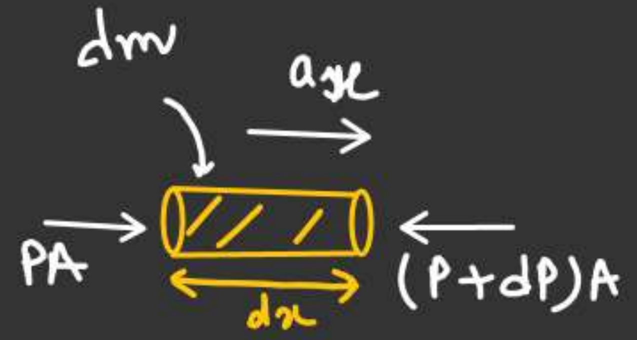
Acclerated in x- direction



$dm = \rho A dx$



$PA - (P+dP)A = dm\,a_x$

$-dP\cdot \cancel{A} = \rho \cancel{A} dx \cdot a_x$

$$\boxed{-\frac{dP}{dx} = \rho a_x}$$

$$-\int_{P_B}^{P_A} dP = \rho a_x \int_0^L dx$$

$P_B - P_A = \rho a_x L \rightarrow$ 2

$P_A = P_{atm}$

$P_B = P_{atm} + \rho g h$

$P_B - P_A = \rho g h$ — 1

From 1 & 2

$\cancel{\rho} g h = \cancel{\rho} a_x L$

$$\boxed{\frac{a_x}{g} = \frac{h}{L} = \tan\theta}$$

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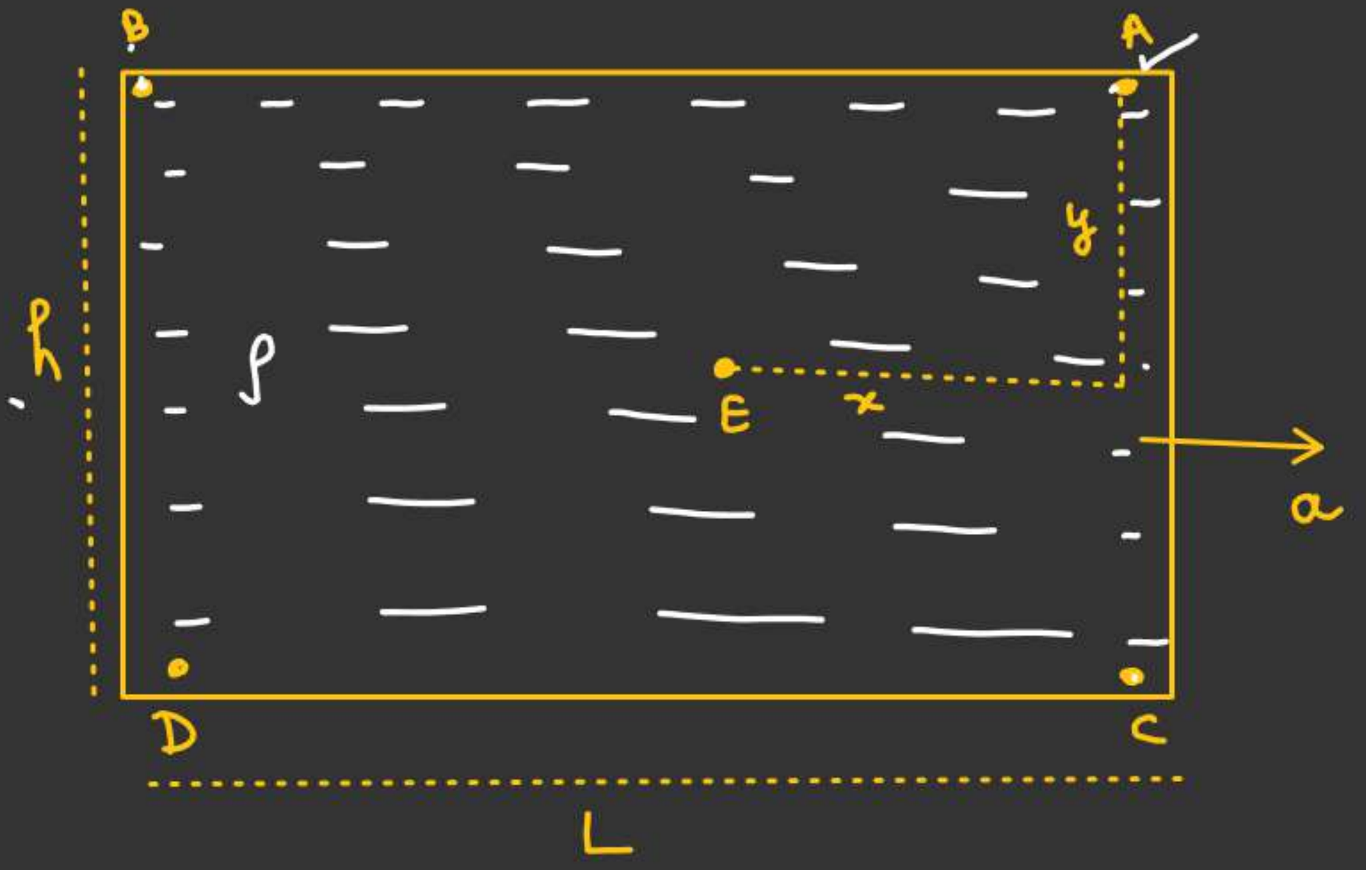
$P_A = P_{atm}$

$P_B = P_{atm} + \rho a L$ ✓

$P_C = P_{atm} + \rho g h$

$P_D = P_{atm} + \rho a L + \rho g h$

$P_E = P_{atm} + \rho g y + \rho a x$



$P_D = \underline{P_B} + \rho g h$

$$-\frac{dP}{dx} = \rho a$$

$$-\int_{P_B}^{P_A} dP = \rho a \int_0^L dx$$

$$P_B - P_A = \rho a L$$