Pressure And Fluid Revision

↖ Force per unit area

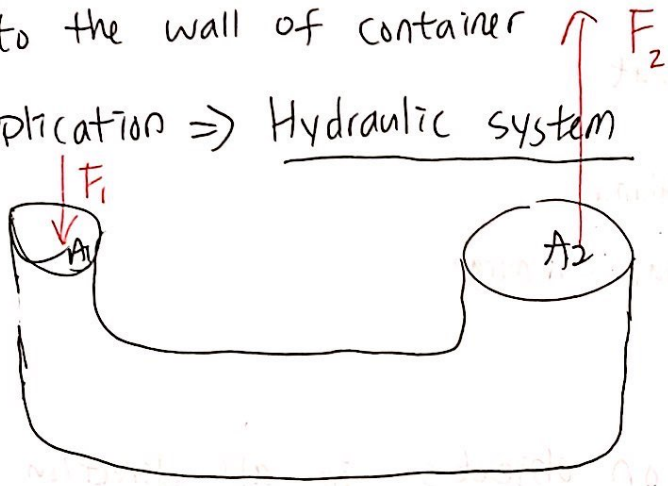
$P = \frac{F}{A}$ unit : $[\frac{N}{m^2}]$

Pascal's Principle

- A change in pressure applied to an enclosed fluid is transmitted undiminished to all portions of the fluid and to the wall of container

liquid Pressure is same everywhere

- Application ⇒ Hydraulic system



$P_1 = P_2$

$\therefore \frac{F_1}{A_1} = \frac{F_2}{A_2}$

Advantage

→ $F_1 < F_2$ (input < output)

→ M.A (mechanical advantage) $= \frac{F_{out}}{F_{in}} = \frac{A_2}{A_1}$

→ V.R (Velocity Ratio) $= \frac{S_{in}}{S_{out}} = \frac{R_1^2}{R_2^2}$ (cylinder only)

$S_1 \cdot \cancel{\pi} R_1^2 = \cancel{\pi} R_2^2 \cdot S_2$

$\frac{S_1}{S_2} = \frac{R_2^2}{R_1^2}$

$h_1 A_1 = h_2 A_2$

Example

$F_1 = 100N$ and $A_2 = 5A_1$

$\therefore \frac{F_1}{A_1} = \frac{F_2}{A_2}$

$\therefore F_2 = \frac{F_1}{A_1} \cdot A_2$

$= \frac{F_1}{A_1} \cdot 5A_1$

$= 5F_1$

$= \boxed{500N}$

→ Conservation of $\vec{E}$

$W_1 = W_2$ $(d_1 = S_{in}, d_2 = S_{out})$

$F_1 d_1 = F_2 d_2$

$P A_1 d_1 = P A_2 d_2$

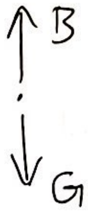
$\boxed{A_1 d_1 = A_2 d_2}$

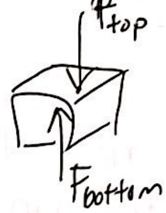
→ $\boxed{M.A. = \frac{F_2}{F_1} = \frac{d_1}{d_2} = \frac{A_2}{A_1}}$

Archimedes' Principle

- Buoyant force = weight of displaced volume of fluid

$$B = mg$$
$$\Downarrow$$
$$-F_{top} + F_{bottom} = \rho V g$$
$$(P_{bottom} - P_{top})A = \rho V g$$
$$\rho_{liquid} g \cdot hA = \rho \cdot Ahg$$





$$\begin{cases} \rho_{liquid} > \rho & \text{Float} \\ \rho_{liquid} = \rho & \text{balance} \\ \rho_{liquid} < \rho & \text{sink/submerge} \end{cases}$$

Bouyant Force F_b

- liquid pressure exerts on objects in all directions
- liquid pressure depends on how much deeper below liquid
- pressure $P = \dfrac{F}{A} = \dfrac{\rho A h g}{A} = \rho h g$ or $\rho \cdot \Delta h g$