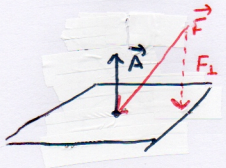
SCHEMA RIASSUNTIVO

- **grandezze utili:**

$$\rho = \frac{m}{V} \qquad [\rho] \rightarrow \frac{kg}{m^3}$$

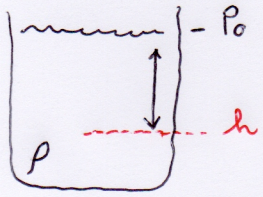
$$p = \frac{F_\perp}{A}$$



$$[p] \Rightarrow \frac{N}{m^2} = Pa$$

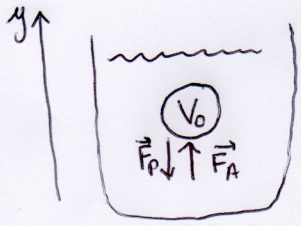
$$1\ atm = 101300\ Pa$$

- **Legge di Stevino**



$$p = p_0 + \rho g h$$

- **Principio di Archimede**



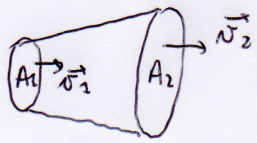
$$|\vec{F}_A| = \underbrace{m_f \cdot g}_{\text{peso liquido spostato}} = \rho_f \cdot V_0 \cdot g$$

$$|\vec{F}_P| = \underbrace{m_0 \cdot g}_{\text{peso oggetto}} = \rho_0 \cdot V_0 \cdot g$$

galleggiamento: $F_A - F_P = V_0 g (\rho_f - \rho_0)$

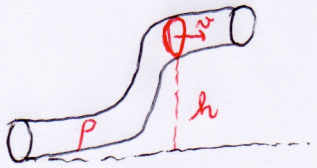
- $\rho_f > \rho_0$ → galleggia
- $\rho_f = \rho_0$ → equilibrio
- $\rho_f < \rho_0$ → affonda

- **Equazione di continuità**



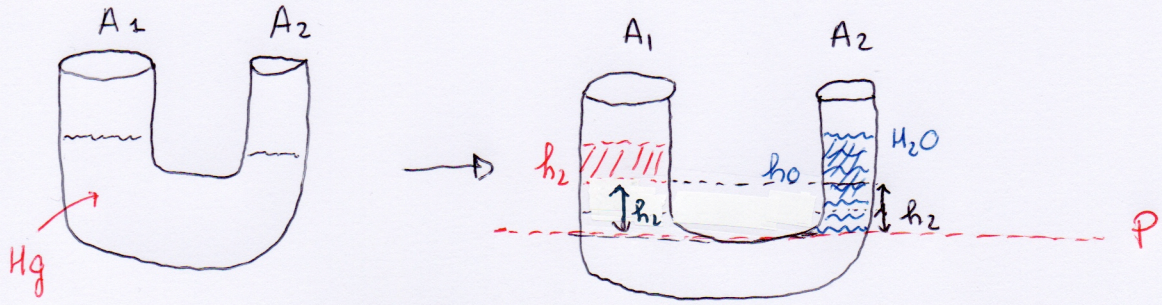
$$A_1 v_1 = A_2 v_2 \Rightarrow A v = \text{costante}$$

- **Teorema di Bernoulli**



$$p + \underbrace{\frac{1}{2}\rho v^2}_{K \text{ per unità di volume}} + \underbrace{\rho g h}_{U_p \text{ per unità di volume}} = \text{costante}$$

ESERCIZIO 1



$A_1 = 10\ cm^2$

$A_2 = 5\ cm^2$

$m_{H_2O} = 100\ g$

$\rho_{Hg} = 13.6 \cdot 10^3\ kg/m^3$

$\rho_{H_2O} = 10^3\ kg/m^3$

$$\rho_{H_2O} = \frac{m_{H_2O}}{V_{H_2O}} = \frac{m_{H_2O}}{A_2 \cdot h_0} \Rightarrow h_0 = \frac{m_{H_2O}}{\rho_{H_2O} \cdot A_2}$$

$$h_0 = \frac{0.1\ kg}{10^3\ kg/m^3 \cdot 5 \cdot 10^{-4}\ m^2} = 0.2\ m = 20\ cm$$

dx: $P_{dx} = P_0 + \rho_{H_2O} g h_0$

Sx: $P_{Sx} = P_0 + \rho_{Hg} g (h_1 + h_2)$

$\Rightarrow P_{dx} = P_{Sx}$

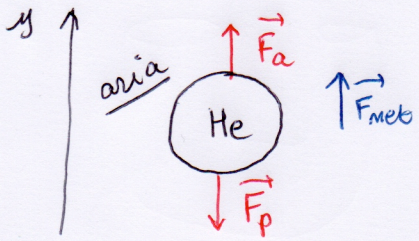
$$P_0 + \rho_{H_2O} g h_0 = P_0 + \rho_{Hg} g (h_1 + h_2) \Rightarrow \rho_{H_2O} h_0 = \rho_{Hg} (h_1 + h_2)$$

$V(h_1) = V(h_2) \Rightarrow A_1 h_1 = A_2 h_2 \Rightarrow h_2 = \boxed{h_1 \frac{A_1}{A_2}}$

$$\rho_{Hg} h_1 \left(1 + \frac{A_1}{A_2}\right) = \rho_{H_2O} h_0 \rightarrow h_1 = \frac{\rho_{H_2O} \cdot h_0}{\rho_{Hg} \left(1 + \frac{A_1}{A_2}\right)}$$

$$h_1 = \frac{10^3\ kg/m^3 \cdot 0.2\ m}{13.6\ 10^3\ kg/m^3 (1+2)} = 4.9 \cdot 10^{-3}\ m = 0.49\ cm$$

ESERCIZIO 2



$m = 5\ g$

$r = 12.5\ cm$

$\rho_{aria} = 1.29\ kg/m^3$

$\rho_{He} = 0.179\ kg/m^3$

? Quanti palloncini servono per sollevare una persona di 70 kg?

$$\vec{F}_p = \vec{F}_p^{\,m} + \vec{F}_p^{\,He}$$

$$F_{net} = F_a - F_p^m - F_p^{He} = \rho_{aria} V g - mg - \rho_{He} V g$$

$$F_{net} = Vg(\rho_{aria} - \rho_{He}) - mg = \frac{4}{3}\pi R^3 g(\rho_{aria} - \rho_{He}) - mg$$

$$F_{net} = \frac{4}{3}\pi \cdot (0.125\ m)^3 \cdot 9.8\ m/s^2 \left(1.29\ kg/m^3 - 0.179\ kg/m^3\right) - 5\cdot 10^{-3} kg \cdot 9.8\ m/s^2$$

$$F_{net} = 0.04\ N$$

$M = 70\ kg$

$$F_M = Mg = 70\ kg \cdot 9.8\ m/s^2 = 686\ N$$

$$\sum_i F_{net_i} = F_M \quad \text{(equilibrio)} \quad \Rightarrow \quad N F_{net} = F_M \quad \Rightarrow \quad N = \frac{F_M}{F_{net}}$$

$$N = \frac{686\ N}{0.04\ N} = 17150$$

per sollevarsi: $N > 17150$