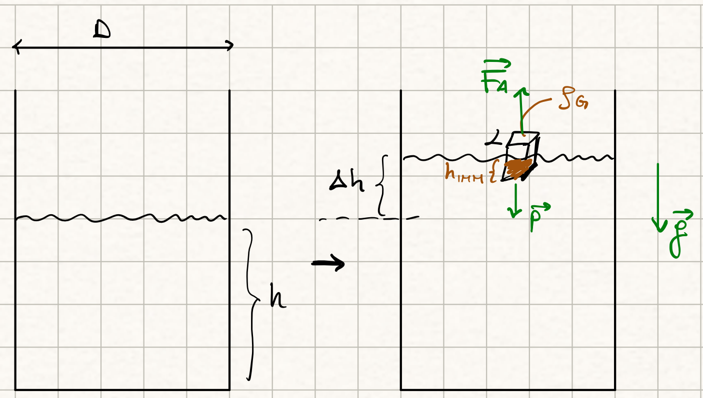
1)



$\rho_0 = 1\ kg/dm^3 = 1000\ kg/m^3$

ρ_G

a) ? Δh

b) ? $V_{non\ imm.}$ (%)

c) ? $\Delta h'$ quando si scioglie il ghiaccio (FUSIONE)

a)

FORZA ARCHIM. : $\vec{F}_A = -\rho_0 V_{IMM} \vec{g}$

↳ parte immersa

EQUILIBRIO : $\vec{F}_A + \vec{P} = 0$

$P = mg = \rho_G L^3 g \quad \Rightarrow \quad \rho_0 V_{IMM} g = \rho_G L^3 g \quad \Rightarrow \quad V_{IMM} = \frac{\rho_G}{\rho_0} L^3$

$\Delta V = V_{IMM} = \pi \left(\frac{D}{2}\right)^2 \Delta h \quad \Rightarrow \quad \Delta h = \frac{4 V_{IMM}}{\pi D^2} = \frac{4 \rho_G L^3}{\pi \rho_0 D^2}$

b)

$V_{IMM} = \cancel{L}^2 h_{IMM} = \frac{\rho_G}{\rho_0} L^{\cancel{3}} \quad \Rightarrow \quad h_{IMM} = \frac{\rho_G}{\rho_0} L$

$\Rightarrow \quad h_{non\ imm} = L - h_{imm} = \left(1 - \frac{\rho_G}{\rho_0}\right) L$

$\Rightarrow \quad V_{non\ IMM}(\%) = \frac{\overbrace{h_{non\ IMM} L^2}^{V_{non\ imm}}}{\underbrace{L^3}_{V_{tot}}} \cdot \overbrace{100}^{\%} = \left(1 - \frac{\rho_G}{\rho_0}\right) 100 = 8,32\ \%$ $\quad (\rho_G = 916,8\ kg/m^3)$

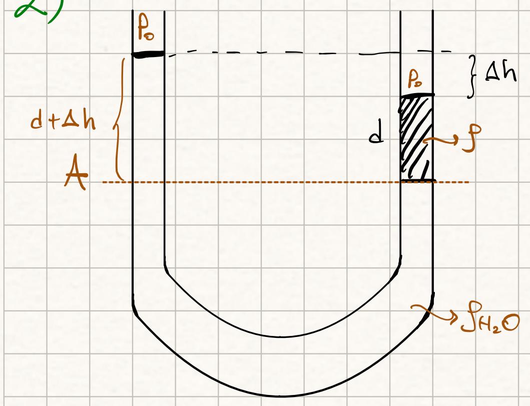
c) CONSERVAZIONE DELLA MASSA DEL CUBETTO : $m_G = V_G \rho_G = V_S \rho_0$

↳ Volume del ghiaccio sciolto

$\Rightarrow V_S = L^3 \frac{\rho_G}{\rho_0}$

$\Rightarrow \Delta h' = \frac{4 V_S}{\pi D^2} = \frac{4 \rho_G L^3}{\pi \rho_0 D^2} = \Delta h$

2)



?ρ

$P(h) = P_0 + \rho g h$ Legge di Stevino

$\forall$ Punti alla stessa h $\Rightarrow$ stessa pressione

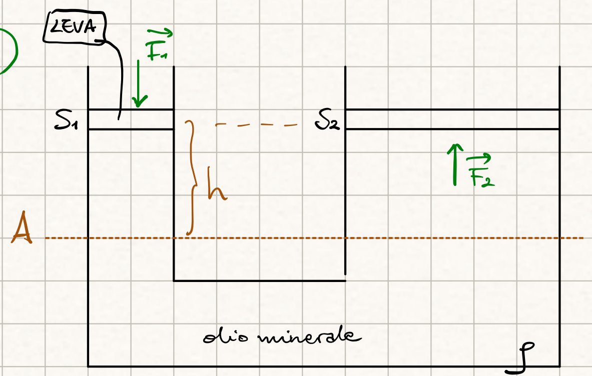
$$P_A = P_0 + \rho_{H_2O}(d+\Delta h)g$$

$$P_A = P_0 + \rho d g$$

$$\cancel{P_0} + \rho_{H_2O}(d+\Delta h)\cancel{g} = \cancel{P_0} + \rho d \cancel{g}$$

$$\Rightarrow \rho = \left(\frac{\Delta h + d}{d}\right)\rho_{H_2O}$$

3)



$S_1 = 5\ cm^2$

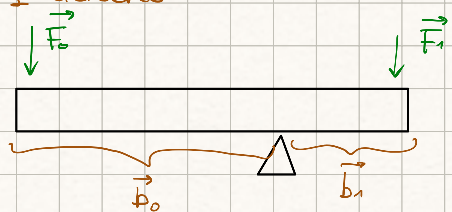
$b_F / b_R = 10$ $\Rightarrow$ leva di 1° genere

b_R resistente

?S_2 | $m = 400$

moltiplicatore di forza

LEVA 1° GENERE



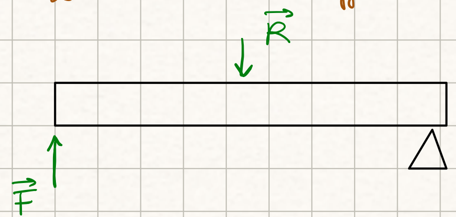
$$\tau^{est} = 0$$

$$\vec{b}_0 \times \vec{F}_0 - \vec{b}_1 \times \vec{F}_1 = 0 \Rightarrow b_0 F_0 = b_1 F_1$$

$$\Rightarrow F_1 = \frac{b_0}{b_1} F_0$$

> 1 $\Rightarrow$ VANTAGGIOSA

LEVA 2° GENERE → vantaggiosa



LEVA 3° GENERE → svantaggiosa sempre

$$F_1 = \frac{b_F}{b_R} F_0 = 10 F_0$$ forza applicata alla leva

$$\left.\begin{aligned} F_1 &= \frac{b_F}{b_R} F_0 = 10 F_0 \\ F_2 &= 400 F_0 \end{aligned}\right\} \Rightarrow F_2 = 40 F_1$$

$$\left.\begin{aligned} P_A &= P_0 + P_1 + \rho g h \\ &\parallel \\ P_A &= P_0 + P_2 + \rho g h \end{aligned}\right\} \Rightarrow P_1 = P_2$$

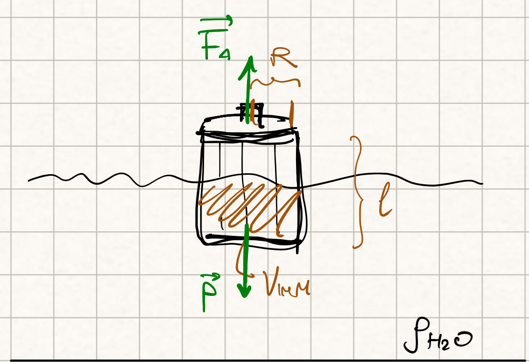
pressione dovuta a $\vec{F}_2$

$$P = [Pa] = \left[\frac{N}{m^2}\right] = \frac{F}{S}$$

$$\Rightarrow \frac{F_1}{S_1} = \frac{F_2}{S_2} = \frac{40 F_1}{S_2} \Rightarrow S_2 = 40 S_1$$

$$\pi\left(\frac{D_2}{2}\right)^2 = 40 S_1 \Rightarrow D_2 = \sqrt{\frac{160 S_1}{\pi}} = 16 \text{ cm}$$

4)



$\rho = 800$ kg/m³

$R = 30$ cm

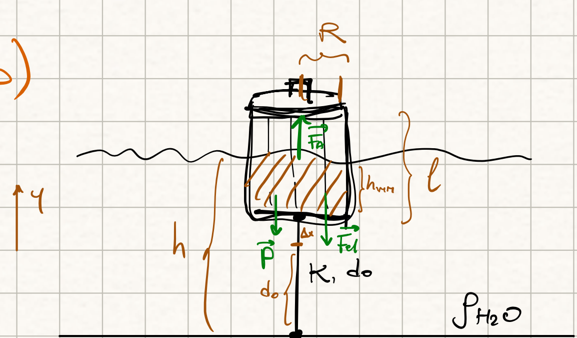
$\ell = 1$ m

a) ? V_{IMM} (%)

a) $\rho V_{Bidone} \cancel{g} = \rho_{H_2O} V_{IMM} \cancel{g} \Rightarrow V_{IMM} = \frac{\rho}{\rho_{H_2O}} V_B$

$$V_{IMM} (\%) = \frac{\rho}{\rho_{H_2O}} \frac{V_B}{V_B} \cdot 100 = \frac{\rho}{\rho_{H_2O}} = 80\%$$

b)



molla : $k = 1000$ N/m

$d_0 = 2,1$ m

$h = 3$ m

? V_{IMM} (%)

EQUILIBRIO : $\vec{F_A} + \vec{P} + \vec{F_{el}} = 0$

$F_A - P - F_{el} = 0 \Rightarrow \rho_{H_2O} \overset{?}{V_{imm}} g - \rho V_B g - k \overset{?}{\Delta x} = 0$

2 eq 2 incognite $\left\{ d_0 + \overset{?}{\Delta x} + h_{imm} = h \right.$

$\hookrightarrow V_{imm} = \pi R^2 h_{imm}$

! $V_{lago} >>> V_B$ (innalzamento liv. acqua trascurabile)

$$\begin{cases} \rho_{H_2O} V_{imm} g - \rho V_B g - k\Delta x = 0 \\ d_0 + \Delta x + \dfrac{V_{imm}}{\pi R^2} = h \end{cases} \Rightarrow \begin{cases} \Delta x = (\rho_{H_2O} V_{imm} - \rho V_B) \dfrac{g}{k} \\ d_0 + (\rho_{H_2O} V_{imm} - \rho V_B) \dfrac{g}{k} + \dfrac{\overset{?}{V_{imm}}}{\pi R^2} = h \end{cases}$$

$$\Rightarrow V_{imm} = \frac{\pi R^2 [k(h-d_0) + \rho g V_B]}{\pi R^2 g \rho_{H_2O} + k} = [m^3]$$

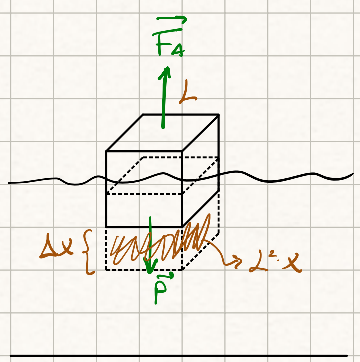
$$\Rightarrow V_{imm}(\%) = \frac{V_{imm}}{V_B} 100 = 100 \frac{\overset{*}{[k(h-d_0) + \rho g V_B]}}{\ell(\pi R^2 g \rho_{H_2O} + k)} = 82,6\%$$

c) ? $V'_{imm(\%)}$ se $h' = 4\,m$

* usando la stessa espressione $V'_{imm}(\%) = 105\%$

$\Rightarrow$ il bidone è interamente sommerso : $V'_{imm} = 100\%$

5)



$L = 10\,cm$

$\rho_{legno} = 0,5\,kg/dm^3$

? T

EQUILIBRIO : $\vec{F_{RIS}} = 0 = \vec{F_A} + \vec{P} \Rightarrow \rho_L L^3 \cancel{g} = \rho_{H_2O} V_{imm} \cancel{g}$

$\Rightarrow V_{imm\,eq} = \dfrac{\rho_L}{\rho_{H_2O}} L^3$

+ IMMERSIONE Δx : $\vec{F_{RIS}} \neq 0 = \overset{m}{\rho_L L^3} \vec{a} = \vec{F_A} + \vec{P}$

$\Rightarrow \rho_L L^3 g - \rho_{H_2O} V'_{imm} g = ma \quad ; \quad V'_{imm} = V_{imm\,eq} + x L^2$

$$\Rightarrow V'_{IMM} = L^2\left(\frac{\rho_L}{\rho_{H_2O}} L + x\right)$$

$$\Rightarrow \rho_L L^3 g - \rho_{H_2O}\, g\, L^2\left[\frac{\rho_L}{\rho_{H_2O}} L + x\right] = \rho_L L^3 \underline{\underline{a}} \quad ; \quad a = \frac{d^2x}{dt^2}$$

$$\Rightarrow \frac{d^2x}{dt^2} = \cancel{g} - \cancel{\frac{\rho_L L^3 g}{\rho_L L^3}} - \frac{\rho_{H_2O}\, g\, \cancel{L^2}\, x}{\rho_L L^{\cancel{3}}} \Rightarrow \frac{d^2x}{dt^2} + \underbrace{\frac{\rho_{H_2O}}{\rho_L}\frac{g}{L}}_{\omega^2} x = 0 \Rightarrow \frac{d^2x}{dt^2} + \omega^2 x = 0$$

$\Rightarrow$ MOTO ARMONICO : $T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{\rho_L L}{\rho_{H_2O}\, g}} = 0{,}45\ s$

dipende da L $\Rightarrow$ geometria dell'ogg.

ρ_L $\Rightarrow$ materiale dell'ogg.

ρ_{H_2O} $\Rightarrow$ fluido