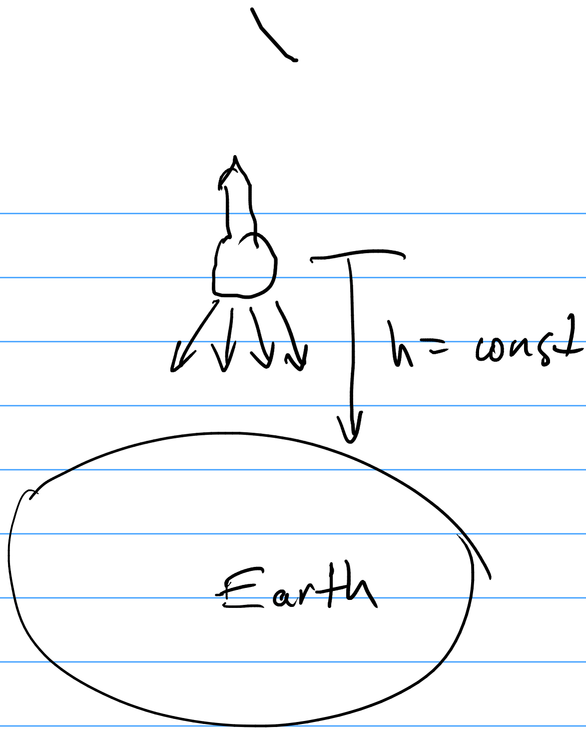
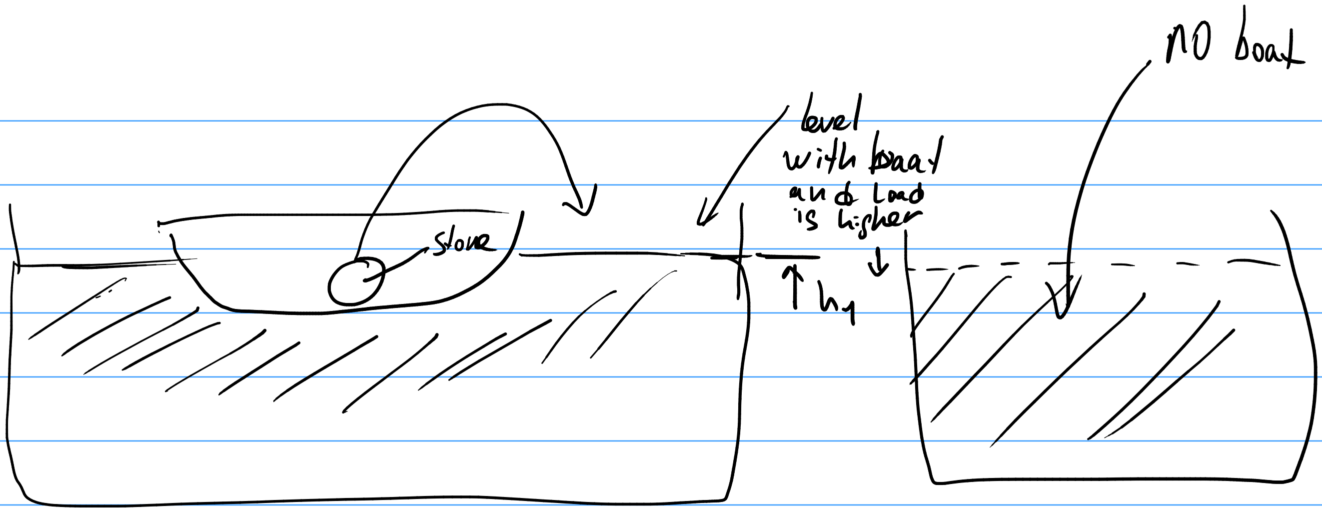

h = const
Earth



$$F_{b_1} = W_b + W_s = \rho_w g \cdot V_{\text{water displaced}_1} \Rightarrow V_{w.d.1}$$

displaced water

$$F_{b_2} = W_b = \rho_w g\, V_{\text{water displaced}_2} \Rightarrow V_{wd_2} + V_s$$

$$V_{w.d_1} = \frac{W_b + W_s}{\rho_w \cdot g} = \boxed{\frac{W_b}{\rho_w \cdot g}} + \frac{W_s}{\rho_w g} = \boxed{} + \frac{m_s}{\rho_w}$$

$W_s = mg$

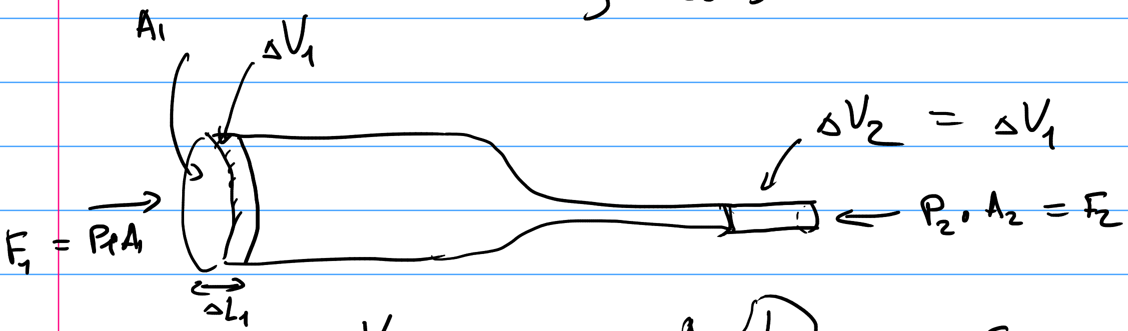
compare

$$V_{w.d_2} = \frac{W_b}{\rho_w g} = \frac{W_b}{\rho_w g}$$

$\vee$ smaller

$$V_{total} = V_{wd_2} + V_s = \boxed{\frac{W_b}{\rho_w g}} + \frac{m_s}{\rho_s} = \boxed{} + \frac{m_s}{\rho_s}$$

$\rho = \text{const} = \text{uncompressible !}$



$$Q = \frac{\Delta V}{\Delta t} = \text{const} = \frac{A_1 \cdot \Delta L_1}{\Delta t} = A_1 \cdot v_1 = A_2 \cdot v_2$$

flow rate

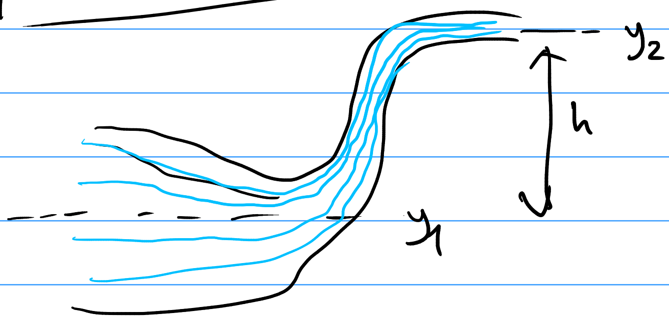
$$\Delta K = \frac{m v_2^2}{2} - m\frac{v_1^2}{2} = W_{ext} = F_1 \cdot \Delta L_1 - F_2 \Delta L_2$$

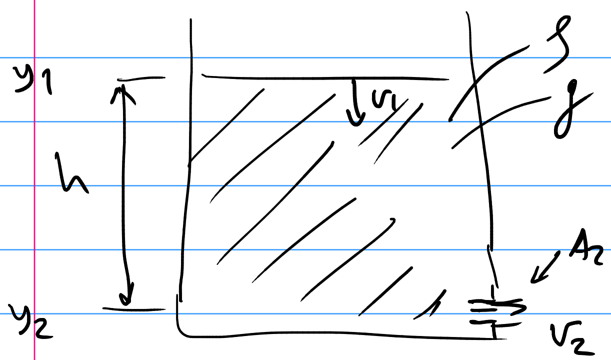
$$= P_1 \cdot \underbrace{A_1 \cdot \Delta L_1}_{\Delta V} - P_2 \underbrace{A_2 \Delta L_2}_{\Delta V}$$

$$\frac{\Delta K}{\Delta V} = \underbrace{\frac{m}{\Delta V}}_{=\rho}\frac{v_2^2}{2} - \underbrace{\frac{m}{\Delta V}}_{=\rho}\frac{v_1^2}{2} = P_1 - P_2$$

$$\boxed{\rho g y_2 + P_2 + \rho \frac{v_2^2}{2} = P_1 + \rho \frac{v_1^2}{2} + \rho g y_1} = \text{const}$$

laminar flow



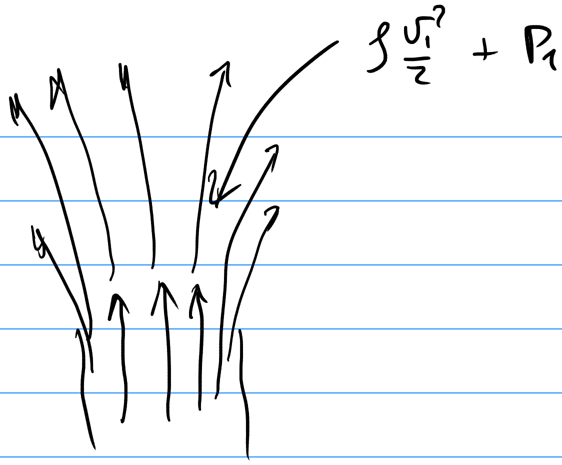


$A_2 \ll A_1 \Rightarrow v_1 \approx 0$

$$1{:}\quad \rho g y_1 + \rho\frac{v_1^2}{2} = \rho g y_2 + \rho\frac{v_2^2}{2} \quad :\rho$$

$$g\underbrace{(y_1 - y_2)}_{h} = \frac{v_2^2}{2}$$

$$v_2 = \sqrt{2gh}$$


$\rho \frac{v_1^2}{2} + P_1$