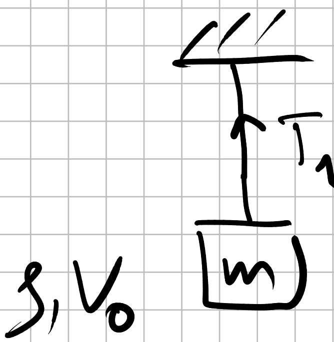
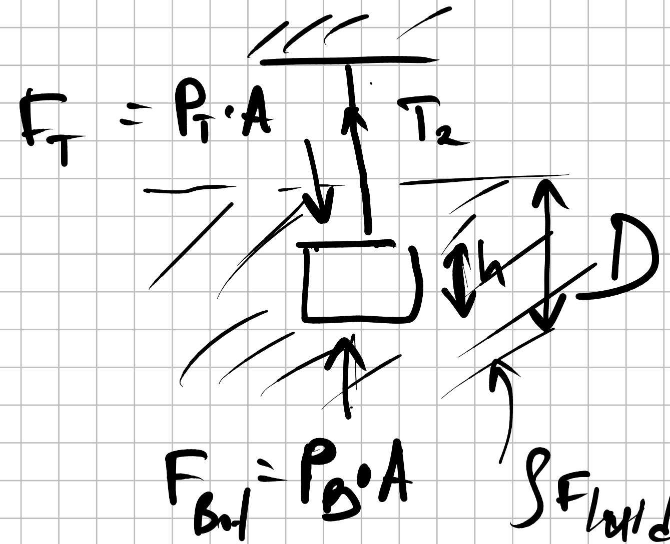
Buoyancy





$$P_T = \rho_F \cdot g (D - h)$$

$$P_B = \rho_F \cdot g \cdot D$$

$$T_1 = mg$$

$$T_2 - P_T \cdot A - P_{Bot} \cdot A - mg = 0$$

$$T_2 = mg - \underbrace{(P_{Bot} - P_T) \cdot A}_{F_{Buoyancy}}$$

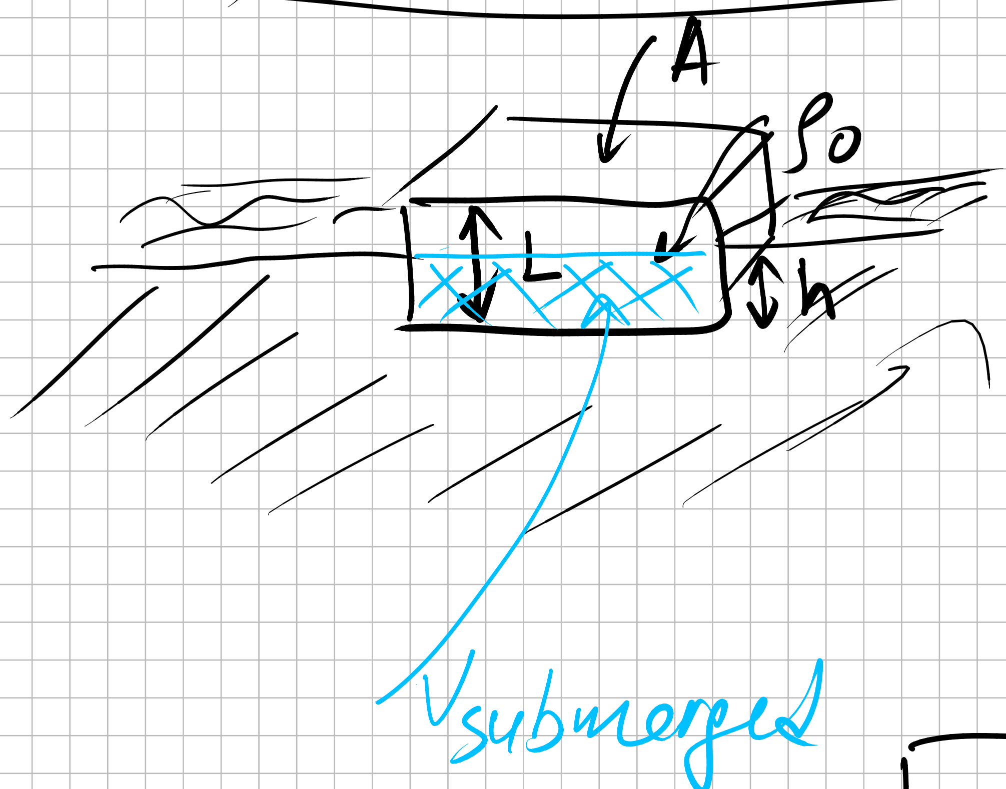
$$= mg - \rho_F g h \cdot A$$

$$T_1 = mg$$

$$\frac{T_1 - T_2}{T_1} = \frac{\rho_F \cdot g h A}{\rho_0 \cdot g \cdot V_0}$$

$$\rho_O = \rho_F \cdot \frac{T_1}{T_1 - T_2}$$

Partially submerged case

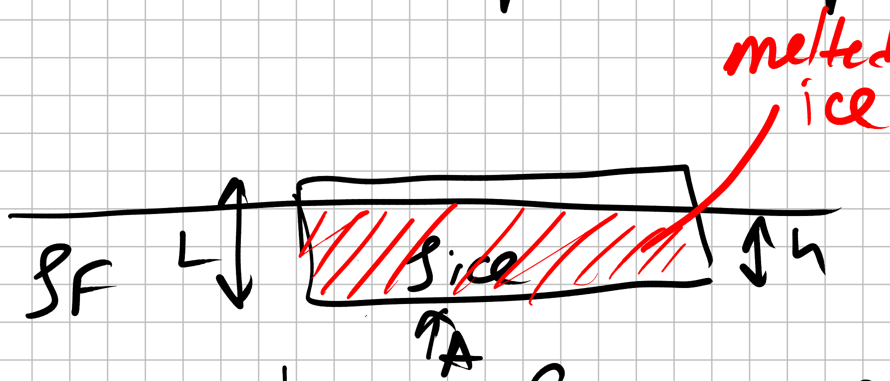


$$mg = F_{Buoyancy} = \rho_F \cdot g \cdot \underbrace{V_{submerged}}_{A \cdot h}$$

$$mg = \rho_O \underbrace{V_{object}}_{A \cdot L} \cdot g$$

$$\frac{\rho_O}{\rho_F} = \frac{h}{L}$$

Ice pack problem



$$\rho_{ice} = 917 \text{ kg/m}^3$$

$$\rho_F = 1000 \text{ kg/m}^3$$

$$\frac{h_{ice}}{L} = \frac{\rho_{ice}}{\rho_F} = \frac{917}{1000} \approx 0.92$$

$$m_{ice} = \rho_{ice} \cdot V_{ice} = \rho_{water} \cdot V_{water}$$

$$\Rightarrow \frac{h_{ice}}{L} = \frac{\rho_{ice}}{\rho_{water}} = \frac{V_{water}}{V_{ice}} = \frac{\cancel{A} \cdot h_{meltwater}}{\cancel{A} \cdot L}$$