Density

$$\rho = \frac{m}{V} = \left[\frac{kg}{m^3}\right]$$

rho

$$\rho_{water} = \frac{1000kg}{1\,m^3}$$

=> 1 litter of water
=> 1 kg

Fluids

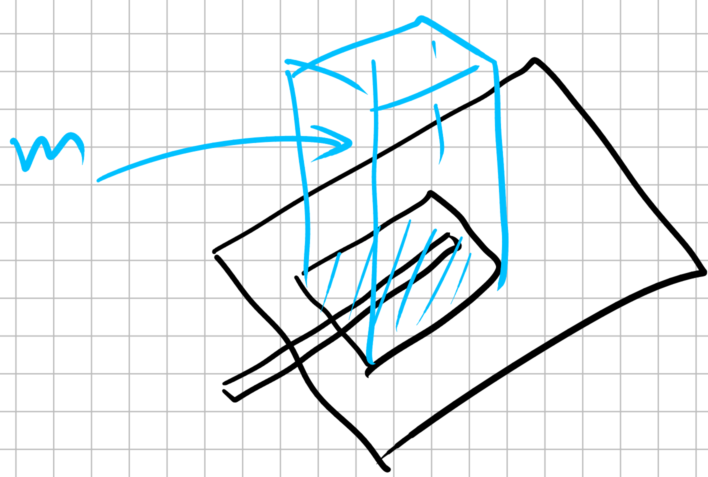
→ inner parts are free to move

- gases
- liquids

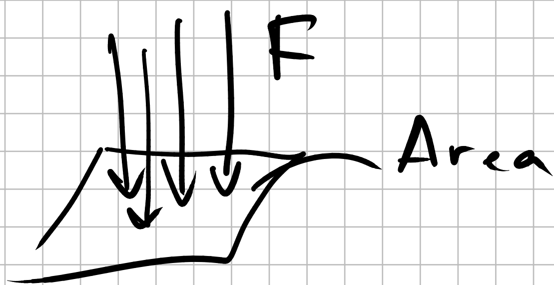
ρ - density

$$\rho_{Air} = 1.2 \frac{kg}{m^3}$$

Breaking a ruler

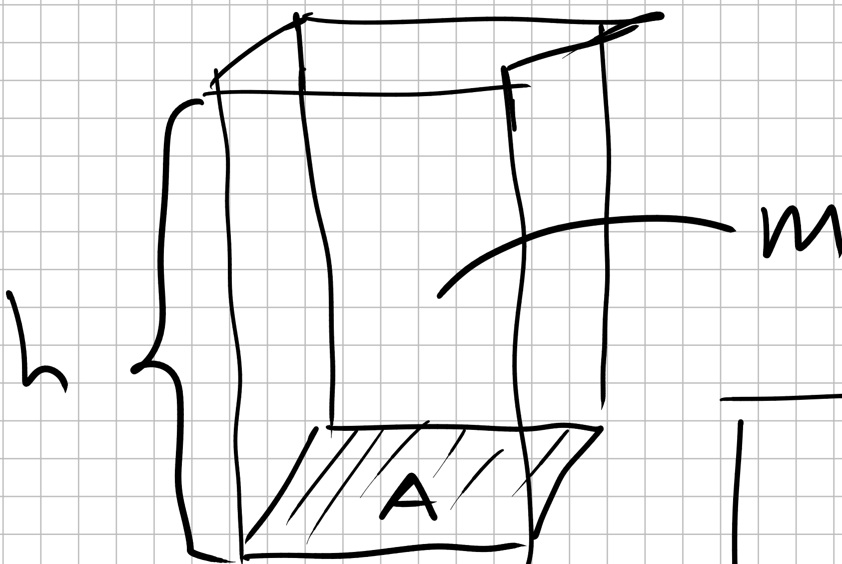


Pressure



$$\Rightarrow \quad p = \frac{F}{A} = \left[\frac{N}{m^2}\right] = [Pa]$$

Pascal



$$F = mg = \rho \cdot V \cdot g =$$
$$= \rho \cdot A \cdot h \cdot g$$

$$p = \frac{F}{A} = \rho g h$$

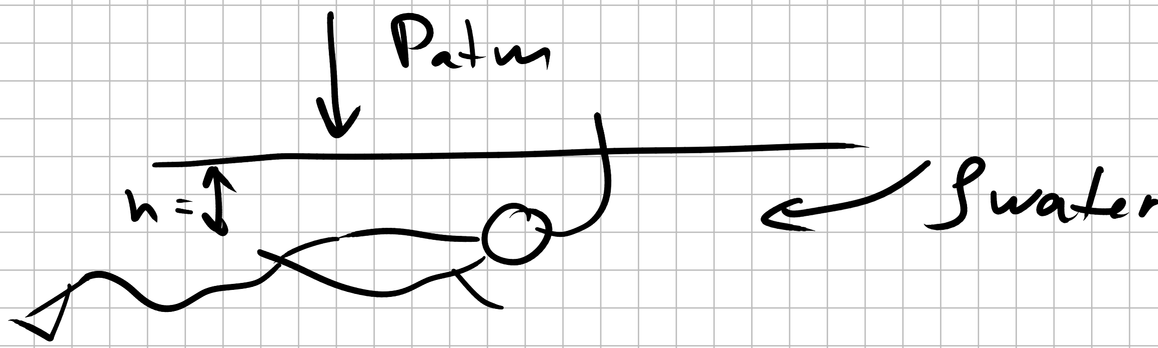
$$\frac{dp}{dy} = \rho g$$

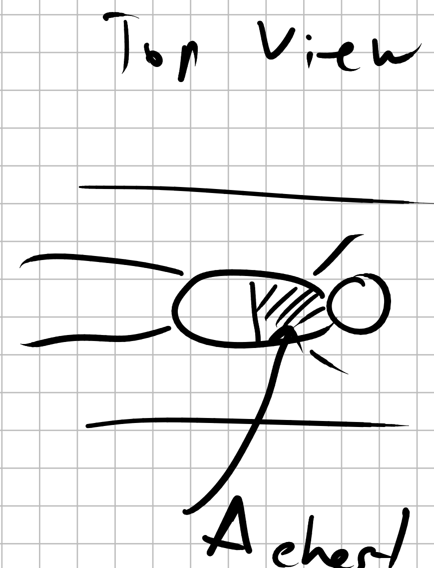
$$P_{Atmospheric} = 1 \text{ Atmosphere} = 10^5 \text{ Pa}$$

$$P = F/A = \frac{mg}{A}$$

$$m = \frac{P \cdot A}{g} = \frac{10^5 \text{ Pa} \cdot 1 \text{ m}^2}{10 \text{ m/s}^2} = 10^4 \text{ kg}$$

Snorkle problem





$$m_{water} = h \cdot A_{chest} \cdot \rho_{water} \approx 100\,kg$$

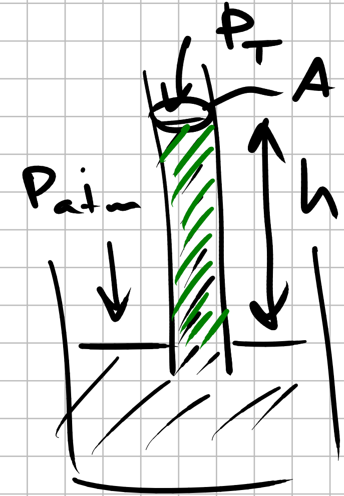
$\rho_{water} \sim 1000 \frac{kg}{m^3}$

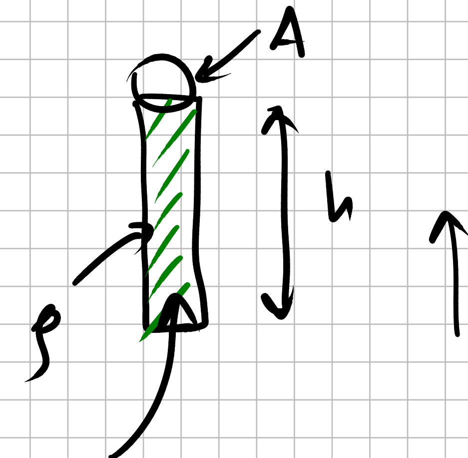
A_{chest}: $0.3\,m \times 0.3\,m$

$$h = \frac{m}{A_{chest} \cdot \rho_w} = \frac{100\,kg}{(0.3)^2 \cdot 1000} = \frac{100}{9 \cdot 10^{-2} \cdot 1000} \approx 1\,m$$

h ← maximum depth

Straw





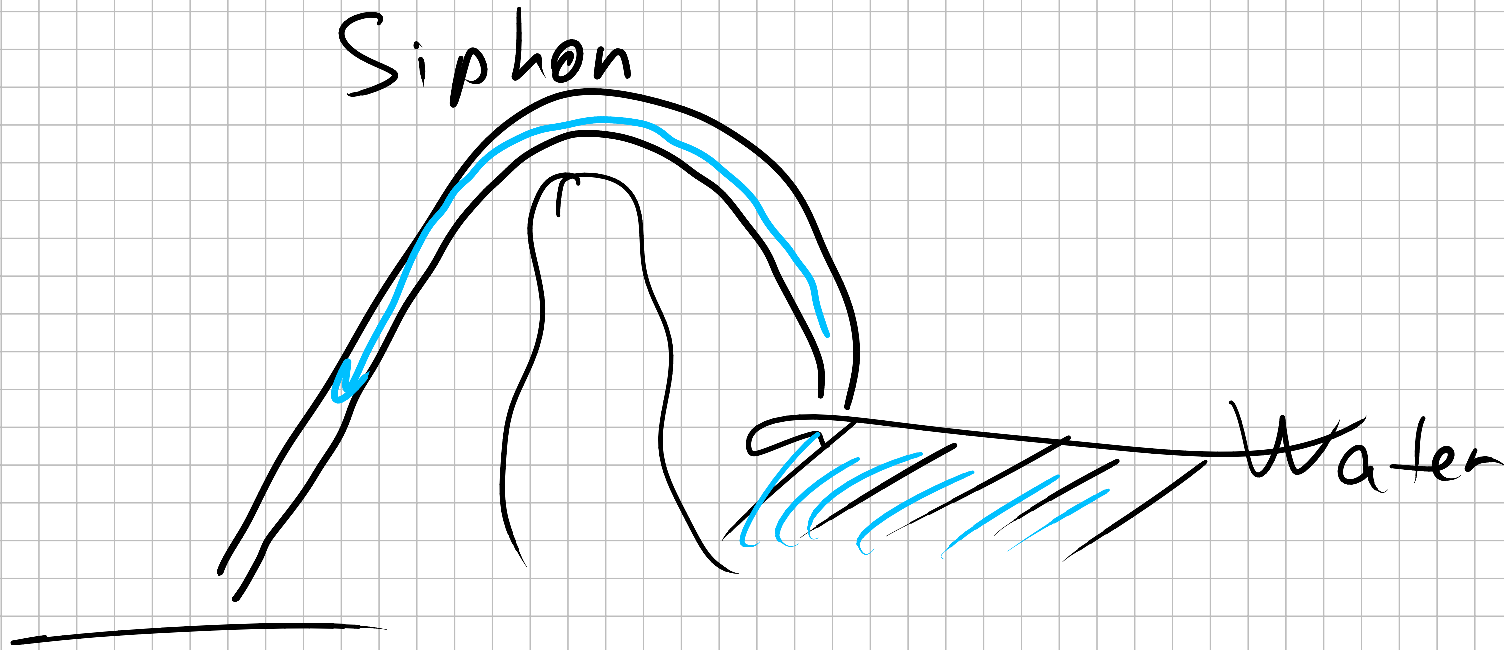
$m = \rho \cdot A \cdot h$

$$\vec{F}_{net} = F_{Bot} - mg - F_{top}$$

$$= P_{atm} \cdot A - \rho \cdot A \cdot h \cdot g - P_{top} \cdot A = 0$$

$$h = \frac{P_{atm} - P_{TOP}}{\rho \cdot g} \quad (P_{TOP} = 0) \quad = \frac{10^5 \, Pa}{1000 \frac{kg}{m^3} \cdot 10 \frac{m}{s^2}}$$

$$= 10 \, m$$


Siphon
Water