Homework 21

① $M = 45\,kg$, $A = 0.15\,m^2$

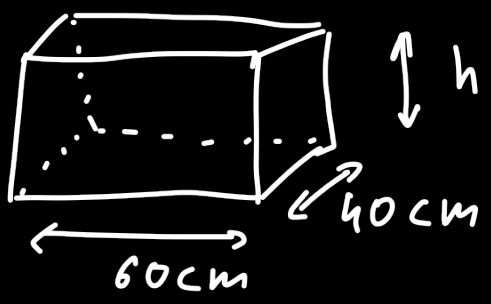
$$P = \frac{F}{2A} = \frac{M \cdot g}{2A} = 1.5\,kPa$$

② $F = 50\,N$, $A = 0.01\,mm^2$

$$A = 0.01\,mm^2 = 10^{-2}\,(10^{-3})^2\,m^2 = 10^{-8}\,m^2$$

$$\boxed{P = \frac{F}{A} = 5 \cdot 10^9\,Pa}$$

③



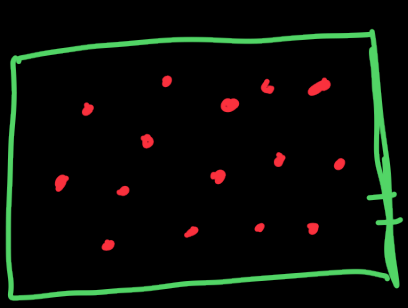
$$P = \rho g h = 3\,kPa$$

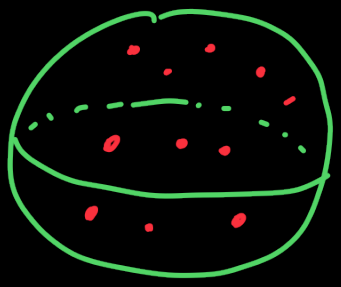
$V = 0.6 \times 0.4 \times 0.3\,m^3 \Rightarrow M = \rho \cdot V$

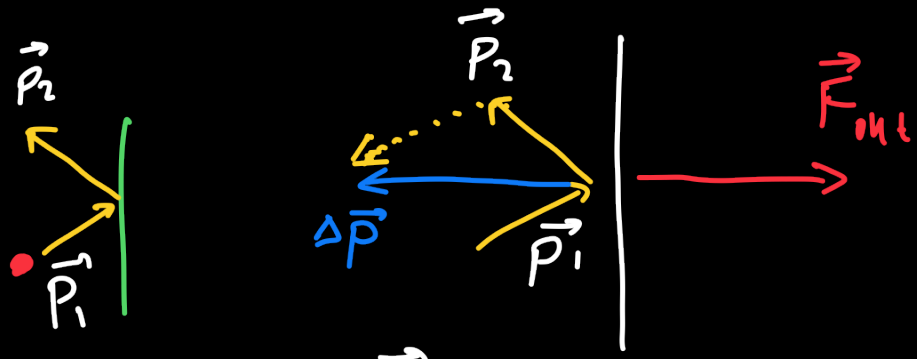
$$P = \rho \cdot V \cdot g / L \cdot W = \rho g h$$

Classwork

Pressure in gases







$$\Delta\vec{p} = \vec{p}_2 - \vec{p}_1$$

$$\vec{F}_{in}\,\Delta t = m\,\Delta\vec{p}$$

$$\vec{F}_{out} = -\vec{F}_{in}$$

$$F_{out} \sim A$$

$$p = \frac{F_{out}}{A} \rightarrow$$ indep. of the vessel properties.

Pressure of a gas depends on the parameters of the gas it self.

What are the parameters of gas:

- N (number of molecules)
- V (volume of gas)
- T (temperature)
  - ↳ measures average kinetic energy! $\frac{mv^2}{2} = \frac{p^2}{2m}$

In general:

$$\boxed{P = P(N, V, T)}$$

$$\rho \sim \frac{N}{V} \Rightarrow P(\rho, T)$$

Atmospheric pressure

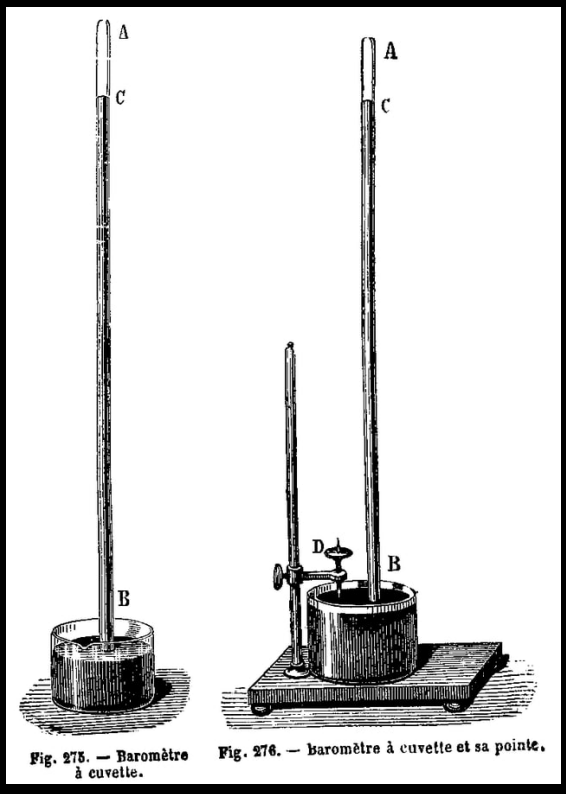
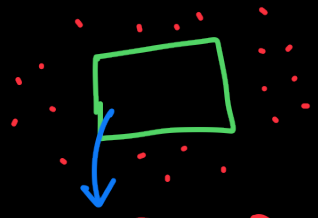


Fig. 275. — Baromètre à cuvette.

Fig. 276. — Baromètre à cuvette et sa pointe.

In vacuum:



$P = 0$

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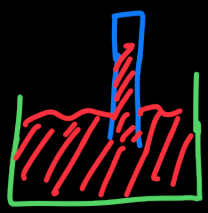
Torricelli's experiment

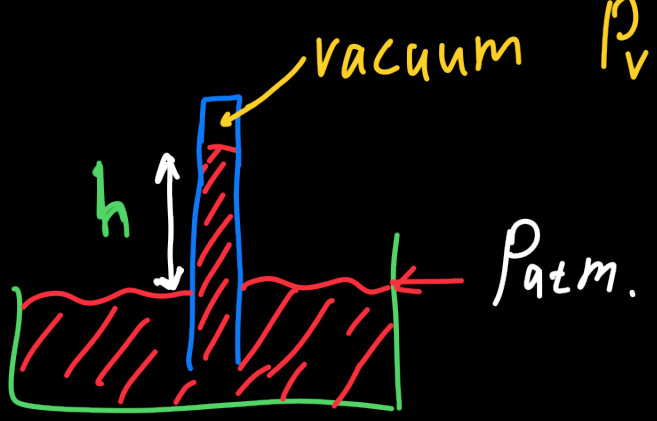
glass tube:

no air bubbles!

mercury inside

closed end.





$P_{atm} = ?$

$$\boxed{P_{atm} = \rho_m g h}$$

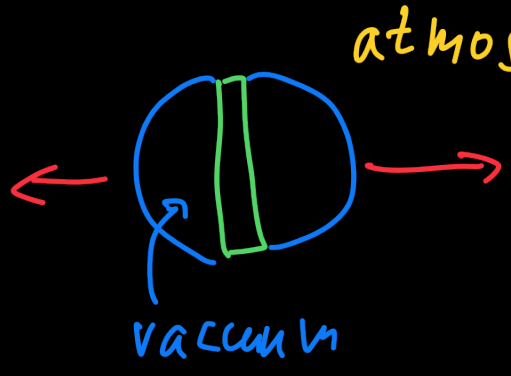
$h = 760\,mm = 0.76\,m$

$\rho_m = 13690 \frac{kg}{m^3}$

$$P_{atm} = 13690 \frac{kg}{m^3} \cdot 10 \frac{m}{s^2} \cdot 0.76\,m \quad (N)$$

$$= 10400 \cdot 10\ Pa$$

$$\simeq 10^5\ Pa$$



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Magdeburg hemispheres