ORME 318 **Etude d'un viscosimètre** (CCP - 2017 - Antoine Lavoisier)

1 - $P_2 = P_3 = P_0$

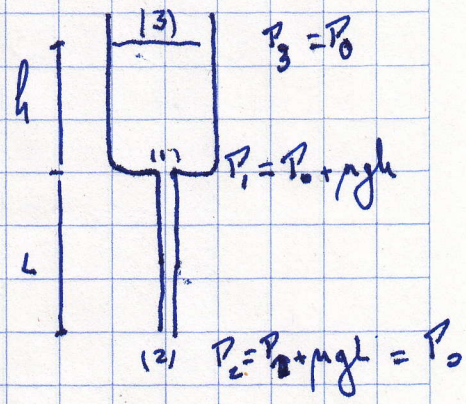
* Statique des fluides dans réservoir : $P_4 - P_3 = \rho g h$

2 - $Q = -\frac{dh}{dt} \times \pi R'^2$

3 - $Q = \frac{\Delta P}{R_H} = -\frac{dh}{dt} \pi R'^2$

$$\frac{dh}{dt} + \underbrace{\frac{\rho g}{\pi R'^2 R_H}}_{1/\tau} h = 0$$

$$\boxed{h(t) = h_0 e^{-t/\tau}}$$



4 - * $h(t_0) = h_0 - \Delta h = h_0 e^{-t_0/\tau}$ où $\Delta h = 5$ cm ; $t_0 = 7$ min

$$1 - \frac{\Delta h}{h_0} = e^{-t_0/\tau} \rightarrow \boxed{\tau = t_0 \ln\left(\frac{1}{1 - \frac{\Delta h}{h_0}}\right)} \quad \tau = 4{,}9 \text{ min}$$

$\tau = t_0 \ln 2$

* $\tau = \frac{\pi R'^2}{\rho g} R_H = \frac{\pi R'^2}{\rho g} \cdot \frac{8 L \eta}{\pi R^4} = \frac{R'^2}{R^4} \frac{8 L \nu}{g}$ $\rightarrow \boxed{\nu = \frac{R^4}{R'^2} g \frac{\pi}{8L}}$ $\nu = 4{,}5\,10^{-4}$ $m^2 s^{-1}$

5 - $R_e = \frac{U \cdot R}{\nu}$; $U \simeq \frac{Q}{\pi R^2} = \frac{\pi R'^2 \cdot \Delta h / \tau}{\pi R^2} = \frac{R'^2}{R^2} \frac{\Delta h}{\tau}$

$$\boxed{R_e = \frac{R'^2 \Delta h}{R \nu \tau}}$$

A.N. $Re \simeq 1{,}7\,10^{-2}$: écoulement rampant.

NB : $Q = \frac{\Delta_{12} P}{R_H} = \frac{\pi R^4}{8 \eta L} (P_1 - P_2)$ où $P_1 - P_2 = \rho g L$