

EX01: $W_{AB} = \frac{P_B - P_A}{\rho} + \frac{1}{2} (q_B^2 - q_A^2) + g(z_B - z_A) + g J_{AB} + \sum_A^B \xi_i \frac{q_A^2}{2} = 0$

$\Rightarrow \frac{P_B - P_A}{\rho} + (\xi_1 + 1) \frac{q_A^2}{2} + g(z_B - z_A) + g J_{AB} = 0$ (*)

$W_{CA} = \frac{P_A - P_C}{\rho} + \frac{1}{2} (q_A^2 - q_C^2) + g(z_A - z_C) + g J_{CA} + \sum_C^A \xi_i \frac{q_C^2}{2} = 0$

$\Rightarrow \frac{P_A - P_C}{\rho} + (\xi_2 + 1) \frac{q_C^2}{2} + g(z_A - z_C) + g J_{CA} = 0$ (+)

(*) + (+) $\Rightarrow \frac{P_B - P_C}{\rho g} + (\xi_1 + 1) \frac{q_A^2}{2g} + (\xi_2 - 1) \frac{q_C^2}{2g} + (z_B - z_A) + (J_A + J_C) = 0$

$\Delta P = P_C - P_B = \rho g H_p \Rightarrow \frac{P_B - P_C}{\rho g} = -H_p$ b'au:

$H_p = (\xi_1 + 1) \frac{q_A^2}{2g} + (\xi_2 - 1) \frac{q_C^2}{2g} + (z_B - z_A) + J_A + J_C$

$q_A = \frac{4Q_r}{\pi D_a^2} = \frac{4 \cdot 0,07}{\pi (0,3)^2} = 0,99 \text{ m/s}$ (0,5) $q_C = \frac{4Q_r}{\pi D_r^2} = \frac{4 \cdot 0,07}{\pi (0,2)^2} = 2,23 \text{ m/s}$ (0,5)

$Re_a = \frac{q_A D_a}{\nu} = \frac{0,99 \cdot 0,3}{10^{-6}} = 2,97 \cdot 10^5 > Re_c \Rightarrow R.T \xrightarrow{C.W} \lambda_a = 0,01763$ (1)

$Re_r = \frac{q_C D_r}{\nu} = \frac{2,23 \cdot 0,2}{10^{-6}} = 4,46 \cdot 10^5 > Re_c \Rightarrow R.T \xrightarrow{C.W} \lambda_r = 0,01842$ (1)

$J_a = \lambda_a \frac{L_a}{D_a} \frac{q_A^2}{2g} = 0,01763 \cdot \frac{150}{0,3} \cdot \frac{(0,99)^2}{20} = 0,4363 \text{ m}$ (0,5)

$J_r = \lambda_r \frac{L_r}{D_r} \frac{q_C^2}{2g} = 0,01842 \cdot \frac{1500}{0,2} \cdot \frac{(2,23)^2}{20} = 34,35 \text{ m}$ (0,5)

$\Rightarrow H_p = 1,05 \cdot \frac{(0,99)^2}{20} + 0 + (70 - 38) + 0,4363 + 34,35 \Rightarrow H_p = 66,84 \text{ m}$ (0,5)

$P_f = \rho g H_p Q_r = 10^3 \cdot 10 \cdot 66,84 \cdot 0,07 \Rightarrow P_f = 46,8 \text{ kW}$ (0,5)

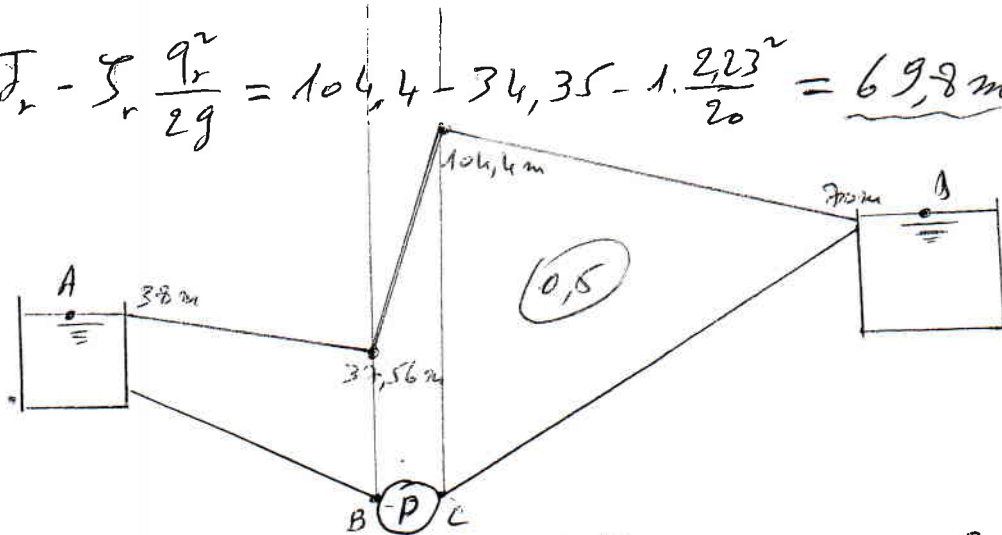
Signa de charge de l'installation:

$$X_A = \frac{P_A^{=0}}{f g} + \frac{q_A^2}{2g} + z_A = z_A = \underline{38 \text{ m}} \quad (0,5)$$

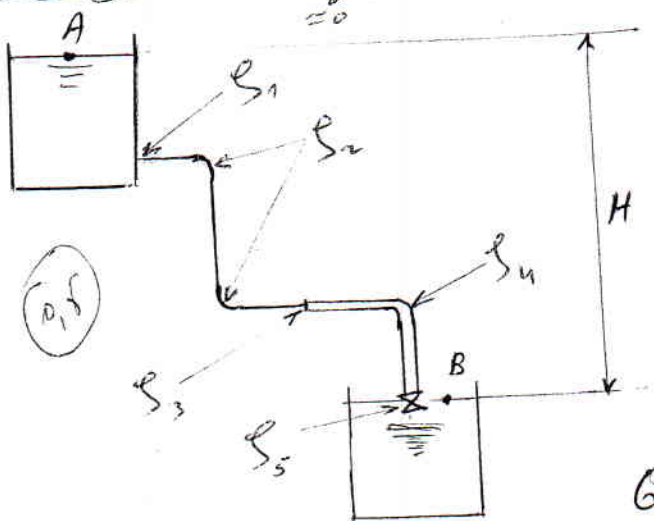
$$X_B = X_A - J_{AB} - \sum \frac{q_i^2}{2g} = 38 - 0,4363 - 0,05 \frac{9,99^2}{20} = \underline{37,56 \text{ m}} \quad (0,5)$$

$$X_C = X_B + H_p = 37,56 + 66,84 = \underline{104,4 \text{ m}} \quad (0,5)$$

$$X_D = X_C - J_{r} - \sum \frac{q_r^2}{2g} = 104,4 - 34,35 - 1 \cdot \frac{2,23^2}{20} = \underline{69,8 \text{ m}} \approx \underline{70 \text{ m}} \quad (0,5)$$



EX φ 2: $(6) P_A = P_B + \frac{1}{2} f \frac{q^2}{D^5} L_{AB} + f g z_{AB} + \sum \xi_i \frac{q_i^2}{2g}$ (1)



$$\Rightarrow z_A - z_B = H = J_{AB} + \sum \xi_i \frac{q_i^2}{2g}$$

$$H \Rightarrow H = \lambda_1 \frac{L_1}{D_1^5} \frac{q_1^2}{2g} + \lambda_2 \frac{L_2}{D_2^5} \frac{q_2^2}{2g} + (\xi_1 + 2\xi_2 + \xi_3) \frac{q_1^2}{2g} + (\xi_4 + \xi_5) \frac{q_2^2}{2g}$$

$$Q_0 = q_1 S_1 = q_2 S_2$$

$$\Rightarrow q_1 = \frac{4 Q_0}{\pi D_1^2} \text{ et } q_2 = \frac{4 Q_0}{\pi D_2^2} \text{ soit: } (0,5)$$

$$H = \left(\lambda_1 \frac{L_1}{D_1^5} + \lambda_2 \frac{L_2}{D_2^5} + \frac{\xi_1 + 2\xi_2 + \xi_3}{D_1^4} + \frac{\xi_4 + \xi_5}{D_2^4} \right) \frac{8 Q_0^2}{\pi^2 g} = K Q_0^2 \quad (1)$$

$$\frac{D_1}{D_2} = 0,5 \Rightarrow \xi_3 = \frac{0,7 + 0,4}{2} = 0,55 \quad \left[Q_0 = \sqrt{\frac{H}{K}} \right] = \underline{15,7 \text{ l/s}} \quad (0,5)$$