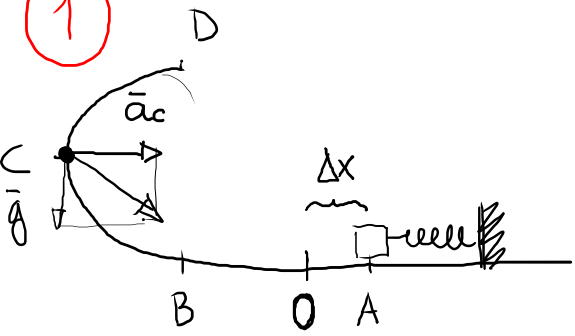
1




$$E_{mecc}^{A} = \cancel{K^A} + U_e^A = \frac{1}{2} K \Delta x^2$$

$$E_{mecc}^{B} = K^B + \cancel{U^B} = \frac{1}{2} m v_B^2$$

a) $v_B = ?$

$$E_{mecc}^{A} = E_{mecc}^{B}$$

$$\cancel{\frac{1}{2}} K \Delta x^2 = \cancel{\frac{1}{2}} m v_B^2 \qquad v_B^2 = \frac{K}{m} \cdot \Delta x^2 \qquad v_B = \sqrt{\frac{K}{m}} \cdot \Delta x$$

$$v_B = \sqrt{\frac{500 \frac{N}{m}}{1\ kg}} \cdot 0{,}50\ m = \sqrt{\frac{500 \frac{kg\ \cancel{m}}{\cancel{m} s^2}}{1\ kg}} \cdot 0{,}50\ m$$

$$= \sqrt{500}\ \frac{1}{s} \cdot 0{,}50\ m = \frac{1}{2} 10\sqrt{5}\ \frac{m}{s} = 5\sqrt{5}\ \frac{m}{s} = 11{,}2\ \frac{m}{s}$$

b) $E_{mecc}^{H} = \cancel{K^{H}} + U_g^{H} = mgh$

$E_{mecc}^{H} = E_{mecc}^{B}$

$\cancel{mgh} = \frac{1}{2}\cancel{m} v_B^2$ $\qquad h = \frac{v_B^2}{2g} = \frac{125 \ \cancel{m^2/s^2}}{2 \cdot 9{,}8 \ \cancel{m/s^2}} = 6{,}38 \ m$

c) $a_C = \frac{v_C^2}{R}$

$E_{mecc}^{C} = E_{mecc}^{B}$

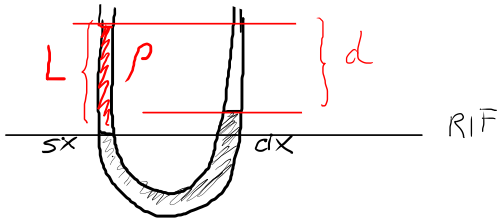
$K^C + U_g^C = E_{mecc}^{B}$

$\frac{1}{2}\cancel{m} v_C^2 + \cancel{mg}R = \frac{1}{2}\cancel{m} v_B^2$

$v_C^2 = v_B^2 - 2gR$ $\qquad a_C = \frac{v_C^2}{R} = \boxed{\frac{v_B^2}{R} - 2g} = 11{,}6 \ \frac{m}{s^2}$

d) $R_V = \boxed{m a_C} = 11{,}6 \ N$

## 2



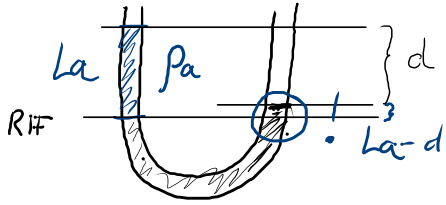

$$p_{sx} = p_0 + \rho g L$$
$$p_{dx} = p_0 + \rho_{Hg} \cdot g \cdot (L-d)$$

### a

$$p_{sx} = p_{dx}$$
$$\cancel{p_0} + \rho g L = \cancel{p_0} + \rho_{Hg} \cdot g \cdot (L-d)$$
$$\rho = \rho_{Hg} \frac{L-d}{L}$$

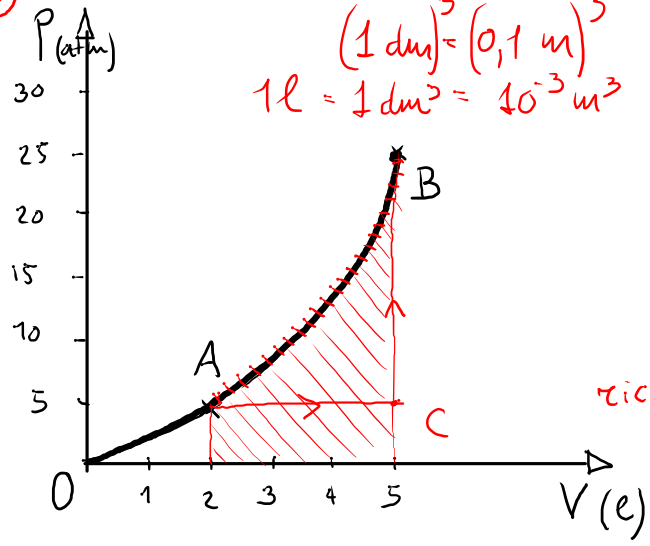
$$\rho = 13{,}6 \cdot 10^3 \frac{Kg}{m^3} \cdot \frac{\cancel{16\ mm}}{\cancel{636\ mm}} = \frac{1}{6}\rho_{Hg}$$
$$= 2{,}27 \cdot 10^3 \frac{Kg}{m^3}$$

### b




$$p_{sx} = p_{dx}$$
$$\cancel{p_0} + \rho_a g L_a = \cancel{p_0} + \rho_{Hg} \cdot g (L_a - d)$$
$$L_a (\rho_{Hg} - \rho_a) = \rho_{Hg} d$$
$$L_a = \frac{\rho_{Hg}}{\rho_{Hg} - \rho_a} \cdot d$$

3




$1\,\ell = 1\,dm^3$

$(1\,dm)^3 = (0{,}1\,m)^3$

$1\,\ell = 1\,dm^3 = 10^{-3}\,m^3$

$p = aV^2 \qquad a = \frac{1\ atm}{\ell^2}$

$p_B = aV_B^2, \quad p_A = aV_A^2$

A: $V = 2\,\ell \qquad p = 4\ atm$

B: $V = 5\,\ell \qquad p = 25\ atm$

monoatomico $C_V = \frac{3}{2}R$

ricorda! → $\Delta E = nC_V \cdot \Delta T$

→ $pV = nRT, \quad T = \frac{pV}{nR}$

a) $\Delta E_{int} = E_{int}^B - E_{int}^A = nC_V \cdot \Delta T = nC_V (T_B - T_A) = nC_V \left( \frac{p_B V_B}{nR} - \frac{p_A V_A}{nR} \right)$

$= \frac{\frac{3}{2}nR}{nR} (p_B V_B - p_A V_A) = \frac{3}{2}(p_B V_B - p_A V_A) = \boxed{\frac{3}{2} a (V_B^3 - V_A^3)}$

$\Delta E_{int} = \frac{3}{2} \cdot \frac{1\ atm}{\ell^2} (125 - 8)\,\ell^3 = 1{,}5 \cdot 117\ atm \cdot \ell = 1{,}5 \cdot 117 \cdot 1{,}013 \cdot 10^5\ Pa \cdot 10^{-3}\ m^3$

$= \boxed{1{,}78 \cdot 10^4\ J}$

b) $\mathcal{L} = -\int_A^B p\,dV = -\int_A^B aV^2\,dV = -a\int_A^B V^2\,dV$

$= -a\left[\frac{1}{3}V^3\right]_A^B = \boxed{-\frac{1}{3}a\left(V_B^3 - V_A^3\right)}$ ....

c) $\boxed{Q = \Delta E_{int} - \mathcal{L}}$ ok $= \frac{3}{2}a\left(V_B^3 - V_A^3\right) + \frac{1}{3}a\left(V_B^3 - V_A^3\right)$

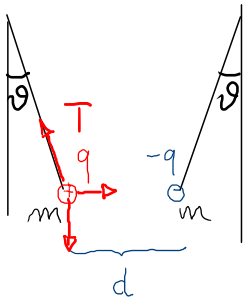
$= \frac{9+2}{6}a\left(V_B^3 - V_A^3\right) = \boxed{\frac{11}{6}a\left(V_B^3 - V_A^3\right)}$ ....

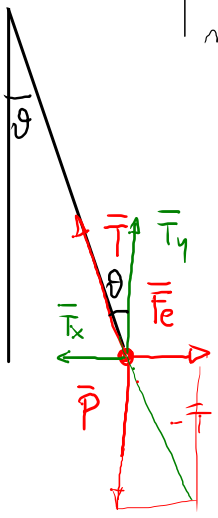
d) $Q = n\,c\,\Delta T$

$\boxed{c = \frac{Q}{n\,\Delta T}}$ ....

$c = \dfrac{\frac{11}{6}a\left(V_B^3 - V_A^3\right)}{\frac{n}{nR}a\left(V_B^3 - V_A^3\right)} = \boxed{\frac{11}{6}R}$

4




$\Sigma \vec{F} = \vec{T} + \vec{F}_e + \vec{P} = 0$

$\vec{T}_x + \vec{F}_e = 0$

$\vec{T}_y + \vec{P} = 0$

considerazioni preliminari

$q = 100\ nC = 10^{-7}\ C$

$d = 2{,}05\ cm = 2{,}05 \cdot 10^{-2}\ m$

$\vartheta = 20°$

a) $F_e = \dfrac{1}{4\pi\varepsilon_0}\dfrac{q^2}{d^2}$

$= k\dfrac{q^2}{d^2} = 9 \cdot 10^9 \dfrac{Nm^2}{C^2} \cdot \dfrac{(10^{-7}C)^2}{(2{,}05 \cdot 10^{-2}m)^2}$

$= \dfrac{9}{2{,}05^2} \cdot 10^{-1}\ N = 2{,}14 \cdot 10^{-1}\ N$

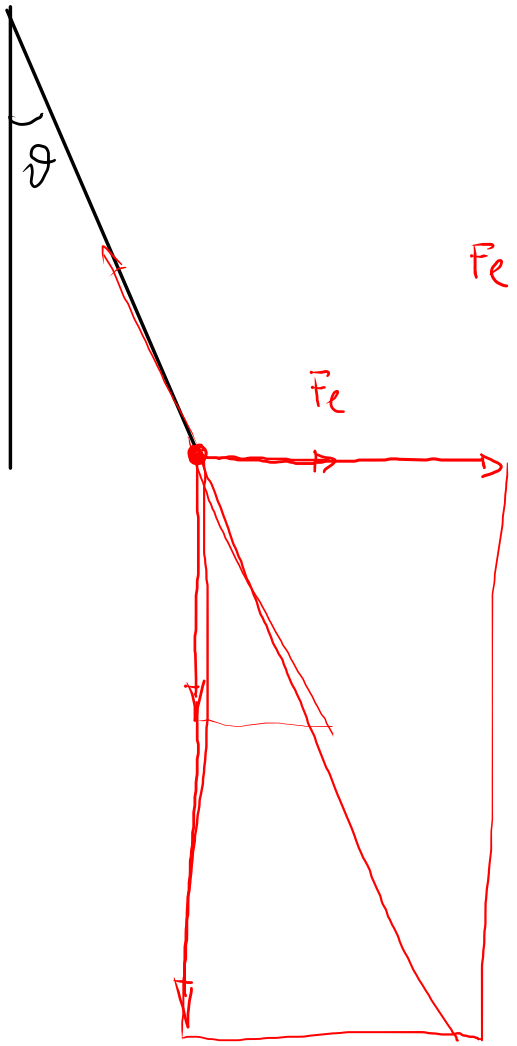
b) $T_x = F_e$ (moduli!)

$T_x = T \operatorname{sen}\vartheta \qquad T = \dfrac{T_x}{\operatorname{sen}\vartheta} = 6{,}26 \cdot 10^{-1}\ N$

$T_y = T\cos\vartheta = 5{,}88 \cdot 10^{-1}\ N$

$m = \dfrac{5{,}88 \cdot 10^{-1}\ N}{9{,}8\ \frac{N}{kg}} = 0{,}6 \cdot 10^{-1}\ kg = 60\ g$

c) $T_y = P = mg \qquad m = \dfrac{T_y}{g}$




$m \rightarrow M = 2m$

$F_e \rightarrow F_e' = 2F_e$

$F_e = k\frac{q^2}{d^2}$ $\qquad$ $F_e' = k\frac{Q^2}{d^2}$

$Q^2 = 2q^2$

$$\boxed{Q = \sqrt{2}\, q}$$

$Q = 141\ nC$

. . .