

: Les connexions / 2015

1-1) $E_{em} = az + b$

$b = 1,92 \text{ J}$

$a = \frac{1,92 - 2,52}{0 - 0,25} = 2,4$

$E_{em} = 2,4z + 1,92$ 1 pt

1-2) $E_{em}(C) = 2,4z_c + 1,92$

$E_{em}(C) = 3 \text{ J}$ 1 pt

1-3) $E_{em}(C) = \frac{1}{2} m v_c^2 + E_{pp}(C)$

$E_{pp}(C) = E_{em}(C) - \frac{1}{2} m v_c^2$
 $= 3 - \frac{1}{2} \cdot 0,4 \cdot 9^2$

$E_{pp}(C) = 1,2 \text{ J}$ 1 pt

1-4) $E_{pp}(C) = m \cdot g \cdot z_c + C$

$C = E_{pp}(C) - m \cdot g \cdot z_c$

$C = 1,2 - 0,4 \times 10 \times 0,45$

$C = -0,6 \text{ J}$ 0,75 pt

$C = -m \cdot g \cdot z_0$

$z_0 = \frac{-C}{m \cdot g}$

$z_0 = \frac{+0,6}{0,4 \times 10} = 0,15 \text{ m}$ 0,75 pt

1-5)

la variation de l'énergie mécanique entre A et C

$\Delta E_{em} = \Delta E_c + \Delta E_{pp}$

$\Delta E_{em} = W(\vec{P}) + W(\vec{R}) + W(\vec{T}) - W(\vec{P})$

$\Delta E_{em} = W(\vec{T})$

$E_{em}(C) - E_{em}(A) = -T \cdot AC$

$a(z_c - z_A) = -T \cdot AC$ 1 pt

$-a \cdot AC \sin \alpha = -T \cdot AC$

$T = a \cdot \sin \alpha$ $T = 1,2 \text{ N}$

1-6) En appliquant T, E_c à (S) entre les positions A et C

$\Delta E_c = W(\vec{P}) + W(\vec{R}) + W(\vec{T})$

$\frac{1}{2} m v_c^2 - \frac{1}{2} m v_A^2 = m \cdot g (z_A - z_c) - T \cdot AC$

$= m \cdot g (z_A - z_c) - T \cdot \frac{z_A - z_c}{\sin \alpha}$

$v_A = \sqrt{2(z_A - z_c) \left(m \cdot g + \frac{T}{\sin \alpha} \right) + v_c^2}$

A.N $v_A = \sqrt{\frac{2(1,25 - 0,15) \cdot 10^{-2}}{0,4} (0,4 \times 10 + 2,4) + 3^2}$

$v_A = 1,6 \text{ m/s}$ 1,5 pt

②

2-1) En appliquant T.E.c à la poulie entre t_A et t_C :

$$\Delta E_c = W(\vec{P}) + W(\vec{R}) + W(\vec{T})$$

$T = T'$: le fil et de masse négligeable
 $\frac{1}{2} J_D \omega_c^2 - \frac{1}{2} J_D \omega_A^2 = T \cdot r_A + M_c \cdot \Delta\theta$

$$\frac{1}{2} J_D \left(\frac{v_c}{r} \right)^2 - \frac{1}{2} J_D \left(\frac{v_A}{r} \right)^2 = T \cdot r \cdot \frac{\Delta\theta}{r} + M_c \cdot \frac{\Delta\theta}{r}$$

$$\left(T + \frac{M_c}{r} \right) \frac{(z_A - z_C)}{\sin\alpha} = \frac{1}{2} J_D \left(\left(\frac{v_c}{r} \right)^2 - \left(\frac{v_A}{r} \right)^2 \right)$$

$$T + \frac{M_c}{r} = \frac{1}{2} \frac{J_D \sin\alpha}{r^2 (z_A - z_C)} (v_c^2 - v_A^2)$$

$$M_c = \frac{1}{2} \frac{J_D \sin\alpha}{r} (v_c^2 - v_A^2) - T \cdot r$$

A.N

$$M_c = \frac{1}{2} \frac{2,3 \cdot 10^{-2} \sin 30^\circ}{2 \cdot 0,2} (3^2 - (1,61)^2)$$

$$= 1,6 \times 10^{-2} \quad 1 \text{ pt}$$

$$M_c = -9,71 \cdot 10^{-3} \text{ N.m}$$

2-2) En appliquant T.E.c à la poulie entre t_C et t_D

$$-\frac{1}{2} J_D \omega_c^2 = W_c$$

$$-\frac{1}{2} J_D \left(\frac{v_c}{r} \right)^2 = M_c \cdot \Delta\theta = M_c \cdot 2\pi \cdot n$$

$$n = -\frac{1}{4\pi} \frac{J_D}{M_c} \left(\frac{v_c}{r} \right)^2$$

A.N $n = 4 \frac{1}{4\pi} \frac{2,3 \cdot 10^{-2}}{0,2} \left(\frac{3}{0,2} \right)^2 \frac{1}{971}$

1 pt

$$n = 42 \text{ tr}$$

EX2:

1) $E_{pp} = m \cdot g \cdot \frac{L}{2} (1 - \cos\theta)$ 1 pt

2) $E_m = E_c + E_{pp}$
 $= \frac{1}{2} J_D \omega^2 + m \cdot g \cdot \frac{L}{2} (1 - \cos\theta)$ 1 pt

3) $E_m = \text{cte} \Leftrightarrow \Delta E_m = 0$

$$E_m = E_{c \max} = E_{pp \max}$$

$$\frac{1}{2} J_D \omega_0^2 = m \cdot g \cdot \frac{L}{2} (1 - \cos\theta_m)$$

$$\omega_0 = \sqrt{\frac{m \cdot g \cdot L (1 - \cos\theta_m)}{J_D}}$$

A.N $\omega_0 = \sqrt{\frac{0,5 \times 10}{3 \cdot 10^{-2}} 0,4 (1 - \cos 60^\circ)}$

$$\omega_0 = 5,77 \text{ rad/s}$$

1 pt

②

4- $E_{pp}(\theta_1) = E_c$
on pose

$$E_m = 2E_{pp} = 2E_{pp} = E_{ppmax}$$

$$E_{pp}(\theta_1) = \frac{E_{ppmax}}{2}$$

$$m \cdot g \frac{L}{2} (1 - \cos \theta_1) = m \cdot g \frac{L}{4} (1 - \cos \theta_1)$$

$$1 - \cos \theta_1 = \frac{1}{2} (1 - \cos \theta_{max})$$

$$\cos \theta_1 = 1 - \frac{1}{2} (1 - \cos \theta_m)$$

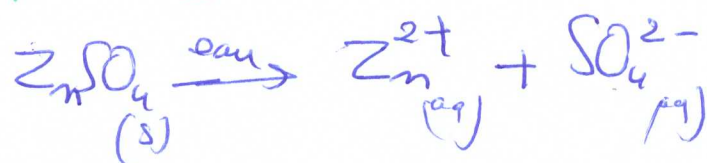
$$\cos \theta_1 = 1 - \frac{1}{2} (1 - \cos 60^\circ)$$

$$\cos \theta_1 = 0,75 \quad 1 \text{ PT}$$

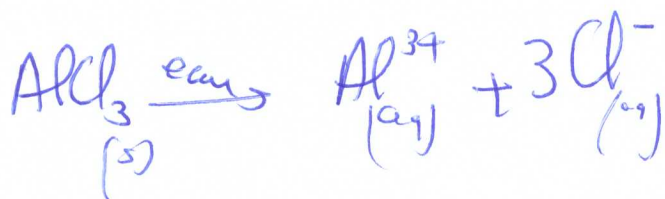
$$\boxed{\theta_1 = 41,41^\circ}$$

Chimie :

Partie I :



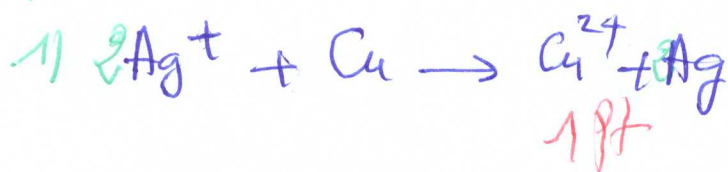
$$c = [Z_n^{2+}] = [SO_4^{2-}] \quad 1 \text{ PT}$$



$$[Al^{3+}] = c$$

$$[Cl^-] = 3 \cdot c \quad 1 \text{ PT}$$

partie II :



$$2) n_0(Ag^+) = [Ag^+] \cdot V$$

$$= 0,15 \times 20 \cdot 10^{-3}$$

$$= 3 \cdot 10^{-3} \text{ mol}$$

$$n_0(Cu) = \frac{m}{M}$$

$$= \frac{0,127}{63,5} \quad 1 \text{ PT}$$

$$= 2 \cdot 10^{-3} \text{ mol}$$

$$3) \frac{n_0(Ag^+)}{2} = 1,5 \cdot 10^{-3} \text{ mol}$$

$$\frac{n_0(Cu)}{1} = 2 \cdot 10^{-3} \text{ mol}$$

le réactif limitant est Ag^+ 1 PT

$$x_{ma} = 1,5 \cdot 10^{-3} \text{ mol}$$

$$4) n_f(Cu) = 2 \cdot 10^{-3} - 1,5 \cdot 10^{-3}$$

$$= 0,5 \cdot 10^{-3} \text{ mol}$$

$$n_f(Cu^{2+}) = 1,5 \cdot 10^{-3} \text{ mol} \quad 1 \text{ PT}$$

$$n_f(Ag) = 3 \cdot 10^{-3} \text{ mol}$$

$$5) [Cu^{2+}]_f = \frac{n_f(Cu^{2+})}{V}$$

$$= \frac{1,5 \cdot 10^{-3}}{2 \cdot 10^{-3}} = 7,5 \cdot 10^{-3} \text{ mol/L} \quad 1 \text{ PT}$$

$$m = n \times M$$

$$\begin{aligned}m_p(\text{Cu}) &= n_p(\text{Cu}) \cdot M(\text{Cu}) \\ &= 0,15 \cdot 10^{-3} \times 63,5 \\ &= 3,175 \cdot 10^{-2} \text{ g}\end{aligned}$$

$$\begin{aligned}m_p(\text{Ag}) &= n_p(\text{Ag}) \cdot M(\text{Ag}) \\ &= 3 \cdot 10^{-3} \times 107,9\end{aligned}$$

$$m_p(\text{Ag}) = 0,324 \text{ g}$$