Les corrections

1-1) $E_m = a z + b$

$b = 1,92\ J$

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

1 pt

$$E_m = 2,4 z + 1,92$$

1-2) $E_m(C) = 2,4 z_c + 1,92$

$E_m(C) = 3\ J$ 1 pt

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

$E_{pp}(C) = E_m(C) - \frac{1}{2} m V_c^2$

$= 3 - \frac{1}{2} 0,4 \times 3^2$

1 pt

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

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

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

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

0,75 pt

$C = -0,6\ J$

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

$z_0 = \frac{-C}{m \cdot g}$ 0,75 pt

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

1-5) La variation de l'énergie mécanique entre A et C

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

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

$\Delta E_m = W(\vec{T})$

$E_m(C) - E_m(A) = -T \cdot AC$

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

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

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

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

$\Delta E_{c\ A \to C} = W(\vec{P}) + W(\vec{R}) + W(\vec{T})$

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

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

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

A.N $V_A = \sqrt{\frac{2(125 - 45) \cdot 10^{-3}}{0,4}(0,4 \times 10 + 2,4) + 3^2}$

1,5 pt

$V_A = 1,61\ m/s$

(e)

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

$$\Delta E_C = W(\vec{P}) + W(\vec{R}) + W(\vec{T'})$$

(W($\vec{P}$) = 0, W($\vec{R}$) = 0, + W_C)

T = T' : le fil est de masse négligeable

$$\frac{1}{2}J_\Delta \omega_C^2 - \frac{1}{2}J_\Delta \omega_A^2 = T \cdot r\Delta\theta + M_C \cdot \Delta\theta$$

$$\frac{1}{2}J_\Delta\left(\left(\frac{V_C}{r}\right)^2 - \left(\frac{V_A}{r}\right)^2\right) = T \cdot r \cdot \frac{AC}{r} + M_C \cdot \frac{AC}{r}$$

$$\left(T + \frac{M_C}{r}\right)\frac{(z_A - z_C)}{\sin\alpha} = \frac{1}{2}J_\Delta\left(\left(\frac{V_C}{r}\right)^2 - \left(\frac{V_A}{r}\right)^2\right)$$

$$T + \frac{M_C}{r} = \frac{1}{2}\frac{J_\Delta}{r^2}\frac{\sin\alpha}{z_A - z_C}\left(V_C^2 - V_A^2\right)$$

$$\boxed{M_C = \frac{1}{2}\frac{J_\Delta}{r}\frac{\sin\alpha}{z_A - z_C}\left(V_C^2 - V_A^2\right) - T \cdot r}$$

A.N

$$M_C = \frac{1}{2}\frac{2{,}3.10^{-2}}{0{,}2}\frac{\sin 30°}{0{,}8}\left(3^2 - (1{,}61)^2\right)$$

$$- 1{,}2 \times 0{,}92$$

1pt

$$\boxed{M_C = -9{,}71.10^{-3}\ N.m}$$

2-2) En appliquant T.E$_c$ à la poulie entre t_C et t_F

$$-\frac{1}{2}J_\Delta \omega_C^2 = W_C$$

$$-\frac{1}{2}J_\Delta\left(\frac{V_C}{r}\right)^2 = M_C \cdot \Delta\theta$$

$$= M_C \cdot 2\pi \cdot n$$

$$\boxed{n = -\frac{1}{4\pi} \cdot J_\Delta\left(\frac{V_C}{r}\right)^2 \cdot \frac{1}{M_C}}$$

A.N $n = 4\frac{1}{4\pi}2{,}3.10^{-2}\left(\frac{3}{0{,}2}\right)^2\frac{1}{9{,}71}$

1pt

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

EX2 :

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

2) $E_m = E_c + E_{pp}$

$$= \frac{1}{2}J_\Delta \omega^2 + m \cdot g\frac{L}{2}(1 - \cos\theta)$$

1pt

3) $E_m = cte \Leftrightarrow \Delta E_m = 0$

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

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

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

A.N $\omega_0 = \sqrt{\frac{0{,}5 \times 10}{3.10^{-2}}0{,}4(1 - \cos 60°)}$

1pt

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

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

$$E_m = 2E_{pp} = 2E_{pp} = E_{pp\,max}$$

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

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

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

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

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

$$\cos\theta_1 = 0{,}75$$ 1 pt

$$\boxed{\theta_1 = 41{,}41°}$$

Chimie :

Partie I :

$$ZnSO_{4\,(s)} \xrightarrow{eau} Zn^{2+}_{(aq)} + SO^{2-}_{4\,(aq)}$$

$$c = [Zn^{2+}] = [SO_4^{2-}]$$ 1 pt

$$AlCl_{3\,(s)} \xrightarrow{eau} Al^{3+}_{(aq)} + 3Cl^-_{(aq)}$$

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

$$[Cl^-] = 3.c$$ 1 pt

partie II :

1) $2Ag^+ + Cu \longrightarrow Cu^{2+} + 2Ag$ 1 pt

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

$$= 0{,}15 \times 20.10^{-3}$$

$$= 3.10^{-3}\ mol$$

$$n_0(Cu) = \frac{m}{M} = \frac{0{,}127}{63{,}5} = 2.10^{-3}\ mol$$ 1 pt

3) $\frac{n_0(Ag^+)}{2} = 1{,}5.10^{-3}\ mol$

$$\frac{n_0(Cu)}{1} = 2.10^{-3}\ mol$$ 1 pt

Le réactif limitant est Ag^+

$$x_{max} = 1{,}5.10^{-3}\ mol$$

4- $n_f(Cu) = 2.10^{-3} - 1{,}5.10^{-3} = 0{,}5.10^{-3}\ mol$

$$n_f(Cu^{2+}) = 1{,}5.10^{-3}\ mol$$ 1 pt

$$n_f(Ag) = 3.10^{-3}\ mol$$

5- $[Cu^{2+}]_f = \frac{n_f(Cu^{2+})}{V}$ 1 pt

$$= \frac{1{,}5.10^{-3}}{20.10^{-3}} = 75.10^{-3}\ mol/L$$

$m = n \times M$

$m_f(Cu) = n_f(Cu) \cdot M(Cu)$

$= 0{,}5 \cdot 10^{-3} \times 63{,}5$

$= 3{,}175 \cdot 10^{-2}\ g$

$m_f(Ag) = n_f(Ag) \cdot M(Ag)$

$= 3 \cdot 10^{-3} \times 107{,}9$

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