CORRIGE DE L'EXAMEN DE RATTRAPAGE DE CHIMIE 01

EXERCICE N° 1 : 9 x 0,5 = 4,5 Points

$$1H_2O_{(g)} \xrightarrow{CNTP} 1H_{2(g)} + \frac{1}{2} O_{2(g)}$$

① $n_{(H_2O)} = \frac{m}{M} = \frac{9g}{18\ g/mole}$ $n = 0,5$ mole. (0,5)

$n(H_2) = n(H_2O) = 0,5$ mole. (0,5)

$n(O_2) = \frac{1}{2} n(H_2O) = 0,25$ mole ... (0,5)

② $V_{(H_2)} = n_{(H_2)} \cdot V_m = 0,5\ mole \times 22,4 \frac{l}{mole} = 11,2\ l$. (0,5)

$V_{(O_2)} = n_{(O_2)} \times V_m = 0,25\ mole \times 22,4 \frac{l}{mole} = 5,6\ l$ (0,5)

③ $N_{(H_2)} = n_{(H_2)} \cdot N_A = 0,5\ mole \times 6,02 \cdot 10^{23} \frac{molecule}{mole}$

$N_{(H_2)} = 3,011 \times 10^{23}$ molecules H_2 (0,5)

$N_{(O_2)} = n_{(O_2)} \cdot N_A = 0,25\ mole \times 6,02 \times 10^{23} \frac{molecules}{mol}$

$N_{(O_2)} = 1,505 \times 10^{23}$ molecules O_2 (0,5)

④ $N_{(H)} = 2\ N_{(H_2)} = 2 \times 3,011 \times 10^{23} = 6,02 \times 10^{23}$ atome H (0,5)

$N_{(O)} = 2\ N_{(O_2)} = 2 \times 1,505 \times 10^{23} = 3,011 \times 10^{23}$ atome O (0,5)

EXERCICE N°2

$15 \times 0,5 = 6,5$ Points

[1] Nombre de noyaux de ^{238}U (N_0)

$N_0 = n\, N_A = \left(\frac{m}{M}\right) N_A$ (0,5) $N_0 = 25,31 \times 10^{23}$ noyaux U. (0,5)

[2] Nombre de noyaux de Pb Formés (t = 1 année)

$^{238}U \longrightarrow {}^{206}Pb + 8\,{}^{4}He$

$N_{Pb(\text{Formé})} = N_{(U)\text{desintegré}} = N_0 - N_t$. (0,5)

$N_{Pb(\text{Formé})} = N_0 - N_t = N_0 - N_0 e^{-\lambda t} = N_0 (1 - e^{-\lambda t})$ (0,5)

$\lambda = \frac{\ln 2}{T}$ (0,5) $= \frac{0,693}{4,5 \times 10^9 an}$ $=$ $\lambda = 1,54 \times 10^{-10}$ année^{-1} (0,5)

$N_{Pb(\text{Formé})} = 25,31 \times 10^{23} (1 - e^{-1,54 \times 10^{-10} \frac{1}{an} \times 1an})$

$N_{Pb(\text{Formé})} = 38,973 \times 10^{13}$ noyaux (0,5)

[3] masse de Pb Formé :

$m_{(Pb)} = M_{(Pb)} \times \frac{N}{N_A} = \frac{206 \times 38,973 \times 10^{13}}{6,02 \times 10^{23}}$

$m_{(Pb)} = 1,33 \times 10^{-7}\, g$ (0,5)

[4] $N_{(He)} = 8\, N_{(Pb)}$ (0,5) $N_{(He)} = 311,78 \times 10^{13}$ noyau He. (0,5)

[5] $m_{(He)} = M_{(He)} \frac{N}{N_A}$ $m_{(He)} = 2,07 \times 10^{-8}\, g$. (0,5)

[6] $N_t = N_0\, e^{-\lambda t}$ (0,5) $N_t = 25\% N_0$ $\frac{N_0}{N_t} = \frac{100}{25} = 4$

$t = \frac{1}{\lambda} \ln \frac{N_0}{N_t} = \left(\frac{T}{\ln 2}\right) \ln \frac{N_0}{N_t}$ $t = 4,5 \times 10^9 \times 2$

$t = 9 \times 10^9$ année (0,5) $t = 2T$.

EXERCICE N° 3 — $18 \times 0{,}5 = 9$ Points

$${}^{7}_{3}Li - 2e^{-} \longrightarrow Li^{2+} \qquad Z = 3$$

1 $R_{(n)} = \dfrac{a_0 n^2}{Z} = \dfrac{0{,}53\text{Å}\ n^2}{Z}$ (Å) --- (0,5)

1ère orbitre $\Rightarrow n = 1$ $\quad R_1 = 0{,}1763\ \text{Å}$ (0,5)

2 $mVR = n\left(\dfrac{h}{2\pi}\right) \Rightarrow V_{(e)} = \dfrac{nh}{2\pi m R}$ (0,5)

$V = 6{,}57 \times 10^{6}\ m/s$ ---- (0,5)

3 Calcul de la force d'attraction

$$F_{(a)} = \frac{-KZe^2}{R^2} \ (0{,}5) = \frac{9 \times 10^{9}\ N\frac{m^2}{C^2} \times 3 \times (1{,}6 \times 10^{-19}\ C)^2}{(0{,}1763 \times 10^{-10}\ m)^2}$$

$F_{(a)} = 2222{,}5\ N$ ... (0,5)

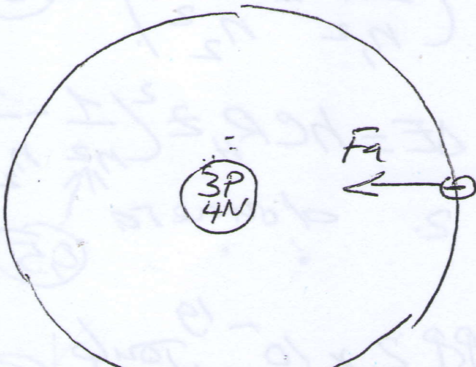
4 Energie totale de l'electron de Li^{2+}

$E_{totale} = E_{Potentielle} + E_{cinetique} = E_p + E_c$

$$* \ E_p = \int_0^{\infty} F_{(a)}\, dR = -\int_0^{\infty} \left(K\frac{Ze^2}{R^2}\right) dR = -KZe^2 \int_0^{\infty} \frac{dR}{R^2}$$

$E_p = -KZ\dfrac{e^2}{R}$ --- (0,5)

$* \ E_c = \dfrac{1}{2} mv^2$.



$F_{(a)} = KZ\dfrac{e^2}{R^2}$ (attraction)

$F_c = \dfrac{mv^2}{R}$ (Force centrifuge

Pour que l'electron de Li^{2+} soit stable sur la 1ère orbite il faut que $F_{(a)} = F_c$.

$$KZ\frac{e^2}{R^2} = \frac{mv^2}{R} \Longrightarrow \frac{mv^2}{2} = KZ\frac{e^2}{2R} = E_c$$

. Il en Resulte que $E_c = KZ\frac{e^2}{2R}$ ... (0,5)

$$E_{totale} = E_p + E_c = -KZ\frac{e^2}{R} + KZ\frac{e^2}{2R}$$

$$E_{totale} = -KZ\frac{e^2}{2R} \quad ...\ (0,5)$$

[5] $E_{totale} = -KZ\frac{e^2}{2R}$ ... (0,5) → $E_{total} = -196,03 \times 10^{-19}$ Joule

$E_{totale} = -122,5\ eV$ (0,5)

[6] Calcul de la plus petite λ du spectre d'emission de Li^{2+} (λ_{mini}) : $\Delta E_{max} = hC/\lambda_{mini}$

$\Delta E_{maxi} \Longleftrightarrow \lambda_{mini} = \lambda_{1\to\infty}$ ($n_1 = 1$ $n_2 = \infty$)

$\Delta E_{mini} \Longleftrightarrow \lambda_{maxi} = \lambda_{1\to 2}$ ($n_1 = 1$ $n_2 = 2$)

$\Delta E_{maxi} = \frac{hC}{\lambda_{mini}}$ et $\lambda_{mini} = \lambda_{1\to\infty}$ (0,5), $\Delta E_{maxi} = \Delta E_{1\to\infty}$

$\Delta E_{1\to\infty} = E_\infty - E_1$ où $E_n = \frac{-13,6eV Z^2}{n^2}$ (0,5) $Z = 3$, $n = 1$

$E_\infty = 0$ et $E_1 = -122,4\ eV$ $\quad \Delta E_{1\to\infty} = +122,4\ eV$

$\Delta E_{1\to\infty} = +195,84 \times 10^{-19}$ Joule $= \Delta E_{maxi}$

$$\lambda_{mini} = \frac{hC}{\Delta E_{maxi}} \ (0,5) = \frac{6,62 \times 10^{-34} J.S \times 3.10^8 m/S}{195,84 \times 10^{-19} J} \ (0,5)$$

$$\lambda_{mini} = \lambda_{1\to\infty} = 0,1014 \times 10^{-7} m = 101,4 \mathring{A} \ (0,5)$$

[7] $\Delta E = \frac{hC}{\lambda_{max}}$ ....① $\quad \frac{1}{\lambda} = R_H Z^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ ...②

on met ② dans ① on aura $\Delta E = hCR_H Z^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ (0,5)

$\lambda_{maxi} = \lambda_{1\to 2} \Rightarrow n_1 = 1 \quad n_2 = 2$ donnera

$\Delta E = \frac{3\,hCR_H Z^2}{4}$ $\quad \Delta E = 588,2 \times 10^{-19}$ Joule (0,5)

$\Delta E = 367,6\ eV$