

الحلول المقترحة

التمرين الأول :

1/ حساب النقص في الكتلة :

$${}_{19}^{39}K\left({}_{20}^{19}p\right), {}_{19}^{40}K\left({}_{21}^{19}p\right), {}_{19}^{41}K\left({}_{22}^{19}p\right)$$

$$\Delta m = | Z m_p + (A - Z)m_n - m_K |$$

$$\Delta m_1 = | [19 (1,00728) + 20 (1,00867)] - 38,9637 |$$

$$\Delta m_1 = 0,3480 \text{ Uma}$$

$$\Delta m_2 = | [19 (1,00728) + 21 (1,00867)] - 39,9640 |$$

$$\Delta m_2 = 0,3564 \text{ Uma}$$

$$\Delta m_3 = | [19 (1,00728) + 22 (1,00867)] - 40,9618 |$$

$$\Delta m_3 = 0,3673 \text{ Uma}$$

$$\Delta E_N = \Delta m \times 931$$

2/ حساب الطاقة النووية لكل نظير بـ Mev :

$$\Delta E_{N1} = 0,3480 \times 931, \Delta E_{N1} = 323,988 \text{ MeV}$$

$$\Delta E_{N2} = 0,3564 \times 931, \Delta E_{N2} = 331,808 \text{ MeV}$$

$$\Delta E_{N3} = 0,3673 \times 931, \Delta E_{N3} = 341,956 \text{ MeV}$$

3/ حساب طاقة النيوكليون ثم المقارنة بين استقرار الأنوية :

$$a_1 = \frac{\Delta E_{N1}}{A_1} = \frac{323,988}{39}, \quad a_1 = 8,307 \text{ MeV/Nucléon}$$

$$a_2 = \frac{\Delta E_{N2}}{A_2} = \frac{331,808}{40}, \quad a_2 = 8,295 \text{ MeV/Nucléon}$$

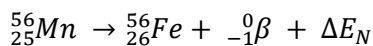
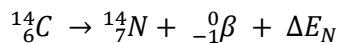
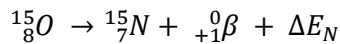
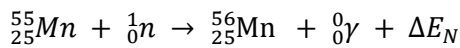
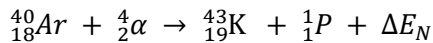
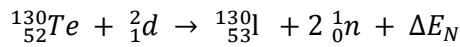
$$a_3 = \frac{\Delta E_{N3}}{A_3} = \frac{341,956}{41}, \quad a_2 = 8,340 \text{ MeV/Nucléon}$$

العنصر الذي يحتاج طاقة أكبر هو الأكثر استقرار إذن:

$${}^{41}K > {}^{39}K > {}^{40}K$$

التمرين الثاني:

(1)



(2)



$$m_0 \quad m' \text{ (نتيجة)}$$

$$m_{\text{المتبقية}} = m_0 - m' = 56 - 49 = 7 \text{ g}$$

$$m = m_0 \times e^{-\lambda t} \Rightarrow \frac{m}{m_0} = e^{-\lambda t} \Rightarrow \ln \frac{m_0}{m} = \lambda t \quad (3)$$

$$\Rightarrow \lambda = \frac{1}{t} \times \ln \frac{m_0}{m} = \frac{1}{7,5} \times \ln \frac{56}{7}$$

$$\Rightarrow \lambda = 0,277 \text{ h}^{-1}$$

$$T = \frac{\ln 2}{\lambda} = 2,49 \text{ h} = 8964 \text{ Sec}$$

$$A_0 = \lambda \times N_0 \Rightarrow A_0 = \lambda \times n_0 \times \mathcal{N}_A \Rightarrow A_0 = \lambda \times \frac{m_0}{M} \times \mathcal{N}_A \quad (4)$$

$$\Rightarrow m_0 = \frac{A_0 \times M}{\lambda \times \mathcal{N}_A}$$

$$\lambda = \frac{\ln 2}{T} \Rightarrow m_0 = \frac{A \times M \times T}{\mathcal{N}_A \times \ln 2} = \frac{2 \times 10^6 \times 3,7 \times 10^{10} \times 56 \times 8964}{6,023 \times 10^{23} \times \ln 2}$$

$$\Rightarrow m_0 = 0,08899 \text{ g} = 88,99 \text{ mg}$$

$$\Delta m = |m_{Fe} - m_{Mn}| = 55,93493 - 55,93948 \quad (5)$$

$$\Delta m = 0,00455 \text{ Uma}$$

$$\Delta E_N = \Delta m \times 931 = 0,00455 \times 931$$

$$\Delta E_N = 4,23605 \text{ MeV}$$

$$\Delta E_N (1 \text{ mol}) = \Delta E_N \times \mathcal{N}_A = 4,23605 \times 6,023 \times 10^{23}$$

$$\Delta E_N (1 \text{ mol}) = 2,55 \times 10^{24} \text{ MeV}$$

التمرين الثالث:

$${}_{27}^{60}\text{X} \rightarrow {}_{28}^{60}\text{Y} + {}_{-1}^0\beta + \Delta E_N \quad (1)$$

$$m_0 = 0,012 \text{ Kg} \xrightarrow{t=15\text{j}} N'_{\text{نتيجة}} = 9,0345 \times 10^{22} \text{ Noyaux} \quad (2)$$

$$N_0 = \frac{m_0}{M} \times \mathcal{N}_A \rightarrow N'$$

$$N = N_0 \times e^{-\lambda t}, \quad N_{\text{متبقية}} = N_0 - N'_{\text{نتيجة}}$$

$$\Rightarrow N_0 - N' = N_0 \times e^{-\lambda t} \Rightarrow N' = N_0 - N_0 \times e^{-\lambda t} \Rightarrow N' = N_0 \times (1 - e^{-\lambda t})$$

$$N_0 = \frac{m_0}{M} \times \mathcal{N}_A; \lambda = \frac{\ln 2}{T} \quad : \text{ بما أن}$$

$$\Rightarrow N' = \frac{m_0}{M} \times \mathcal{N}_A \times \left(1 - e^{-\frac{\ln 2}{T} t}\right)$$

$$\Rightarrow \frac{N' \times M}{m_0 \times \mathcal{N}_A} = 1 - e^{-\frac{\ln 2}{T} t} \Rightarrow 1 - \frac{N' \times M}{m_0 \times \mathcal{N}_A} = e^{-\frac{\ln 2}{T} t} \Rightarrow \ln \left(1 - \frac{N' \times M}{m_0 \times \mathcal{N}_A}\right) = -\frac{\ln 2}{T} t$$

$$\Rightarrow T = \frac{-t \times \ln 2}{\ln \left(1 - \frac{N' \times M}{m_0 \times \mathcal{N}_A}\right)} = \frac{-15\text{j} \times \ln 2}{\ln \left(1 - \frac{9,0345 \times 60 \times 10^{-3}}{0,012 \times 6,023 \times 10^{23}}\right)}$$

$$\Rightarrow T = 7,5 \text{ j}$$

$$A = \lambda \times N = \lambda \times N_0 \times e^{-\lambda t}; N_0 = \frac{m_0}{M} \times N_A; \lambda = \frac{\ln 2}{T} \quad (3)$$

$$\Rightarrow A = \frac{\ln 2}{T} \times \frac{m_0}{M} \times N_A \times e^{-\frac{\ln 2}{T} t}$$

$$A = \frac{\ln 2}{7,5 \times 24 \times 3600} \times \frac{12 \times 6,023 \times 10^{23}}{60} \times e^{-\frac{\ln 2}{7,5} \cdot 30 \text{ j}}$$

$$A = 8,05 \times 10^{15} \text{ DPS}$$

$$A = 2,18 \times 10^5 \text{ Ci}$$

التمرين الرابع:

(1)

$$1 \text{ mol} : 57,5 \text{ g (NaCl)} \rightarrow 22 \text{ g (Na)}$$

$$10 \times 10^{-3} \text{ g} \rightarrow m_0$$

$$m_0(\text{Na}) = 3,83 \times 10^{-3} \text{ g}$$

$$A_0 = \lambda \times N_0 = \lambda \times n_0 \times N_A = \lambda \times \frac{m_0}{M} \times N_A$$

$$\Rightarrow \lambda = \frac{A_0 \times M}{m_0 \times N_A} = \frac{8,85 \times 10^{11} \times 22 \times 10^{-3}}{3,83 \times 10^{-3} \times 10^{-3} \times 6,023 \times 10^{23}} \Rightarrow \lambda = 8,45 \times 10^{-9} \text{ Sec}^{-1}$$

$$T = \frac{\ln 2}{\lambda} = \frac{\ln 2}{8,45 \times 10^{-9}} = 8,2 \times 10^7 \text{ Sec}$$

(2)

$$N_0 = 100, \quad N = 25$$

$$N = N_0 \times e^{-\lambda t} \Rightarrow t = \frac{1}{\lambda} \ln \frac{N_0}{N} = \frac{1}{8,45 \times 10^{-9}} \ln \frac{100}{25}$$

$$t = 1,64 \times 10^8 \text{ Sec}$$

(3)

$$N_0 = 100, \quad N'_{\text{متبقية}} = 1, \quad N_{\text{متبقية}} = 99$$

$$t = \frac{1}{\lambda} \ln \frac{100}{99} = \frac{1}{8,45 \times 10^{-9}} \ln \frac{100}{99}$$

$$t = 1,19 \times 10^6 \text{ Sec}$$

(4)

$$A_0, A = \frac{A_0}{1000} = A_0 \times 10^{-3}$$

$$A = A_0 \times e^{-\lambda t} \Rightarrow t = \frac{1}{\lambda} \ln \frac{A_0}{A_0 \times 10^{-3}}$$

$$t = 8,17 \times 10^8 \text{ Sec}$$