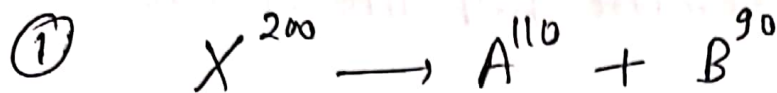


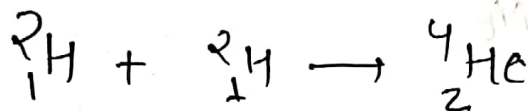
S-II
↔



$\frac{BE}{\text{nucleon}}$ 7.4 MeV 8.2 MeV 8.2 MeV

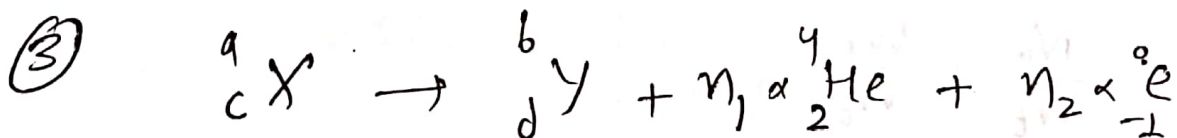
total Energy exchange = $[7.4 \times 200] - [(110 \times 8.2) + (90 \times 8.2)]$
 $\Rightarrow 1480 - 1640 = -160 \text{ MeV}$

② Nuclear Reaction is \rightarrow



$\frac{BE}{\text{nucleon}}$ 1.1 MeV 1.1 MeV 7 MeV

total Energy exchange = $[2 \times 1.1] + [2 \times 1.1] - [7 \times 4]$
 $\Rightarrow 4.4 - 28 \Rightarrow -23.6 \text{ MeV}$



$a = b + 4n_1, \quad n_1 = \frac{a-b}{4}$

$c = d + 2n_1 - n_2$

$n_2 = d - c + 2\left(\frac{a-b}{4}\right)$

$n_2 = d + \frac{a-b}{2} - c$

Q4 Since after 10 sec, 50% of nuclei are decayed, therefore half life will be 10 sec.

① $t_{avg} = 1.44 \times t_{1/2} = 1.44 \times 10 \text{ sec} = 14.4 \text{ sec}$

② Let undecayed nuclei = N_0 ,
Now we have to calculate the time by which it will further reduce to 6.25%, i.e. from N_0 to $\frac{N_0}{16}$ (rest amount of nuclei after t time)

$$\lambda = \frac{\ln 2}{t_0} = \frac{1}{t} \ln \frac{N_0}{N_t}$$

$$\frac{\ln 2}{10} = \frac{1}{t} \ln \frac{N_0}{N_0/16}$$

$$t = \frac{\ln 16 \times 10}{\ln 2} = 40 \text{ sec}$$

Q5 $t_{1/2} = 40 \text{ year}$

$$\frac{N_0}{N_t} = \frac{W_0}{W_t}$$

$$\lambda = \frac{1}{t} \ln \frac{W_0}{W_t}$$

$$\frac{\ln 2}{t_{1/2}} = \frac{1}{20} \ln \frac{1}{W_t}$$

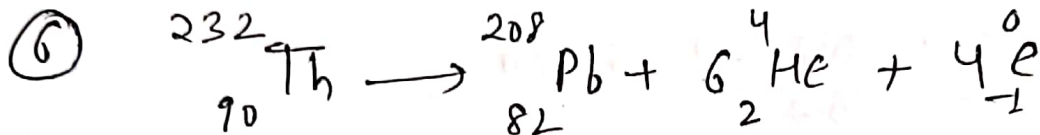
$$\frac{\ln 2}{40} = \frac{1}{20} \times \ln \frac{1}{W_t}$$

$$\frac{\ln 2}{2} = \ln \frac{1}{w_t}$$

$$\ln 2^{1/2} = \ln \frac{1}{w_t}$$

$$w_t = \frac{1}{\sqrt{2}} = 0.707 \text{ microgram.}$$

$$w_t = 7.07 \times 10^{-7} \text{ gm}$$



$$t=0, 928\text{g}$$

$$\Rightarrow 4 \text{ mol}$$

$$4-a$$

$$a$$

$$6a$$

$$4a = \frac{9.3 \times 10^{27}}{6 \times 10^{23}}$$

$$a = \frac{93}{6 \times 4} = 3.875$$

from 1st order kinetics

$$k = \frac{1}{t} \ln \frac{N_0}{N_t}$$

$$\frac{\ln 2}{T} = \frac{1}{t} \ln \frac{4}{4-a}$$

$$\frac{t}{T} = \frac{1}{\ln 2} \times \ln \frac{4}{4-3.875}$$

$$\frac{t}{T} = \frac{1}{\ln 2} \times \ln 32 = 5$$

Q7

$$\frac{N_0}{N_t} = \frac{A_0}{A_t}$$

$$\lambda = \frac{1}{t} \propto \ln \frac{A_0}{A_t}$$

$$\frac{\ln 2}{5770} = \frac{1}{t} \ln \frac{15.5}{12.4}$$

$$t = \frac{(\ln 5 - 2 \times \ln 2) \times 5770}{\ln 2}$$

$$t = \frac{(1.6 - 0.7 \times 2) \times 5770}{0.7}$$

$$t = 1648.6 \text{ year}$$

Q8 18 gm of H_2O has 2N hydrogen atoms in it and $H^2 : H^1$ is $8 \times 10^{-18} : 1$.

i.e. 18 gm of H_2O contains $(8 \times 10^{-18} \times 6.023 \times 10^{23} \times 2)$ H^3 atoms.

So 10 gm of H_2O contains $(8 \times 10^{-18} \times 6.023 \times 10^{23} \times 2 \times \frac{10}{18})$ H^3 atom initially

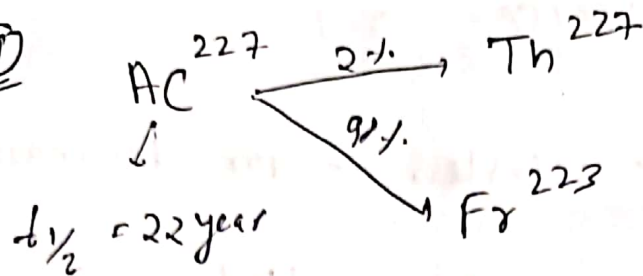
$$t = \frac{1}{\lambda} \ln \frac{N_0}{N}$$

$$3\lambda = \frac{\ln \frac{8 \times 10^{-18} \times 6.023 \times 10^{23} \times 2 \times 10}{18 \times N}}{\ln 2}$$

$$\ln 2^3 = \ln \frac{5.35 \times 10^6}{N}$$

$$N = \frac{5.35}{8} \times 10^6 = 6.67 \times 10^5$$

Q9

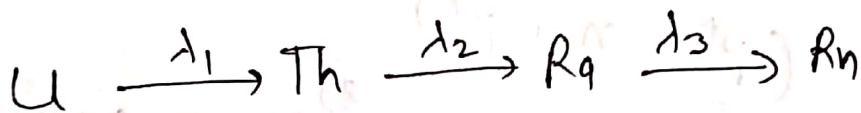


$\lambda_1 = \text{fraction of } Th^{227} \times \lambda$

$= \frac{2}{100} \times \frac{\ln 2}{22} = 6.3 \times 10^{-4} \text{ yr}^{-1}$

$\lambda_2 = \frac{98}{100} \times \frac{\ln 2}{22} = 3.087 \times 10^{-2} \text{ yr}^{-1}$

Q10



$\lambda_2 \times N_{Th} = 2(\lambda_3 \times N_{Ra})$

$\frac{\ln 2}{80,000} \times N_{Th} = 2 \times \frac{\ln 2}{1600} \times N_{Ra}$

$\frac{N_{Th}}{N_{Ra}} = \frac{160000}{1600} = \frac{100}{1}$