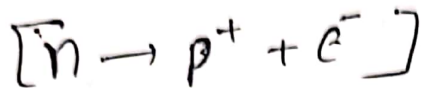
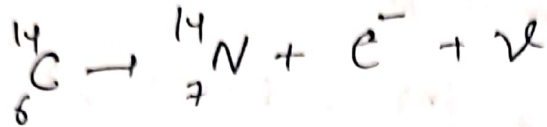


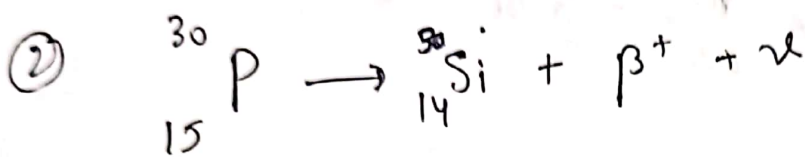
Exercise 0-1

① ${}^{14}_6\text{C}$, ${}^{12}_6\text{C}$ is stable, so for decreasing

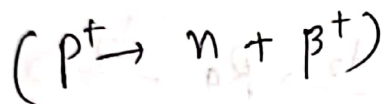
$\frac{n}{p}$ ratio, β^- will be emitted.



(A)

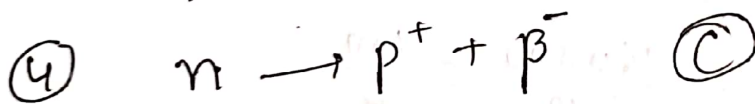


(C)

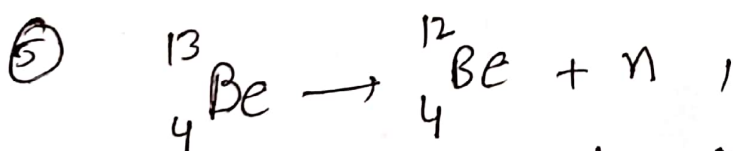


③ ${}^{27}_{13}\text{Al}$ is stable, so ${}^{29}_{13}\text{Al}$ is expected to disintegrate by $-\beta$. (for decreasing $\frac{n}{p}$ ratio).

(B)



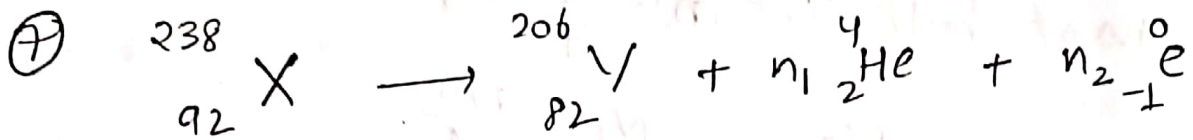
So here increase in proton and decrease in neutron occurs.



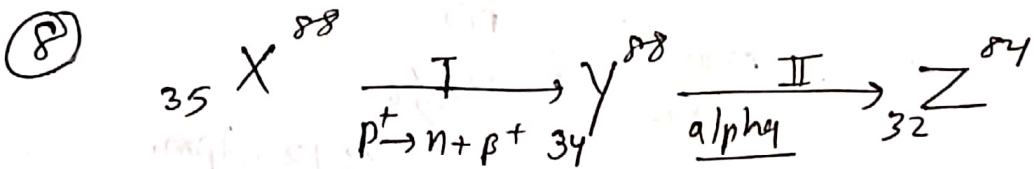
8. from above example, we can say reaction involving neutron emission will generate an isotope.

(A)

⑥ S^{35} is neutron rich, so for decreasing $\frac{n}{p}$ ratio ($n \rightarrow p^+ + e^-$), it will like to undergo beta emission. (B)



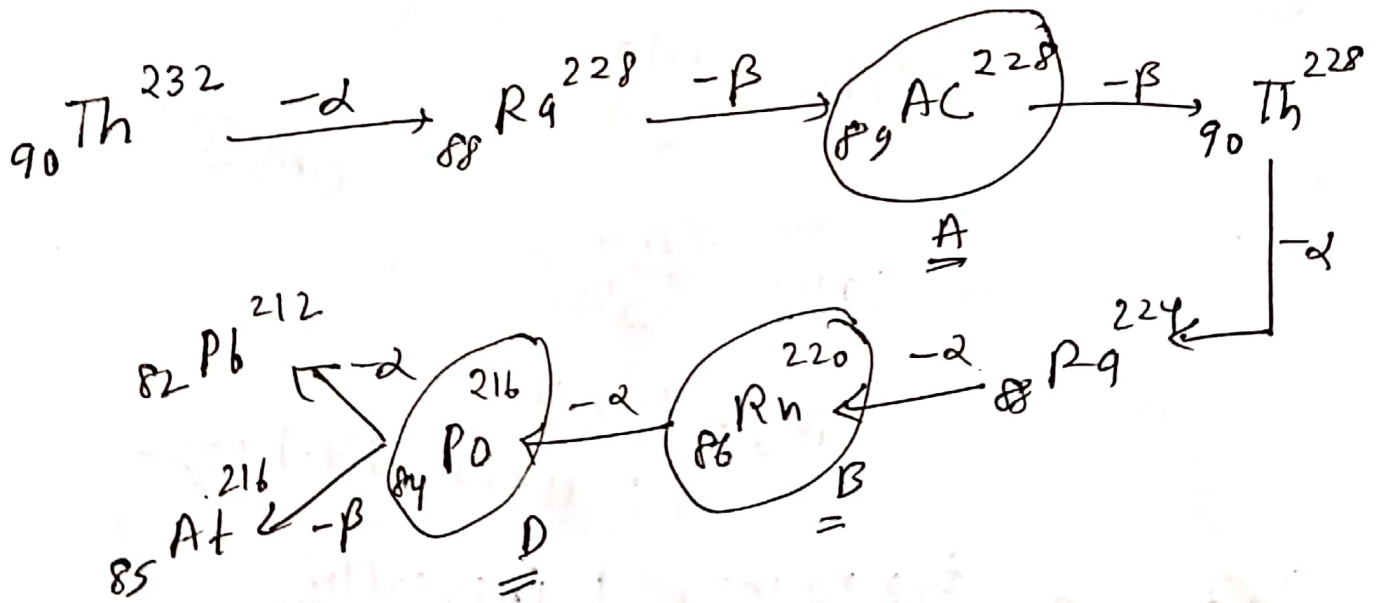
$$\begin{array}{l|l} 238 = 206 + 4n_1 & q_2 = 82 + 2n_1 - n_2 \\ n_1 = 32/4 = 8 & 10 = 2 \times 8 - n_2 \\ & n_2 = 6 \end{array}$$



A-22 value of $y = 88 - 2 \times 34 = 20$

and for $Z = 84 - 2 \times 32 = 20$

So y and z are isomorphs.



(Ans) C \Rightarrow ${}_{88}\text{Ra}^{226}$, This is not a natural decay product of ${}_{90}\text{Th}^{232}$.

(10) no of half life = $\frac{18}{3} = 6$ (Ans) = B

from $M_t = \frac{M_0}{2^n}$, $M_t = \frac{256}{2^6} = 4 \text{ gm.}$

(11) no of half life (n) = $\frac{24}{4} = 6$

$N_t = \frac{N_0}{2^n}$, $N_t = \frac{N_0}{2^6}$

from relation, $A = N\lambda$

$\frac{A_1}{A_2} = \frac{N_1}{N_2}$

$\frac{200}{A_2} = \frac{N_0}{N_0/2^6}$

$A_2 = \frac{200}{64} = 3.125 \text{ dpm.}$

(Ans) (C)

(12) no of half life = (n) = $\frac{3}{6} = \frac{1}{2}$

$M_t \Rightarrow \frac{M_0}{2^n}$

$10 \text{ mg} = \frac{M_0}{2^{1/2}}$

$M_0 = 10 \times \sqrt{2}$

$\Rightarrow 1.41 \times 10 = 14.1 \text{ mg}$

(Ans) (C)

(13)

A $\xrightarrow{t_{1/2}} 50 \text{ min}$

B $\xrightarrow{t_{1/2}} 10 \text{ min}$

initially
no of nuclides of A &
B are N and 8N
respectively.

and after some time (t) , no of nuclides of A & B are $2N'$ & N' respectively

$$\text{no of half life for A} = \frac{t}{50}$$

$$\text{and for B} = \frac{t}{10}$$

$$\text{for A, } N_t = \frac{N_0}{2^n}, \quad 2N' = \frac{N}{2^{t/50}} \quad \text{--- (I)}$$

$$\text{for B, } N' = \frac{8N}{2^{t/10}} \quad \text{--- (II)}$$

$$\text{I} \div \text{II}$$

$$2 = \frac{2^{t/10}}{8 \times 2^{t/50}}$$

$$16 = 2^{t/10 - t/50}$$

$$2^4 = 2^{\frac{40t}{500}}$$

$$4 = \frac{40t}{500}$$

$$t = \frac{4 \times 500}{40} = 50 \text{ min,}$$

Ans (C)

Q14

$$A = N\lambda$$

$$\lambda = \frac{\ln 2}{t_{1/2}}$$

$$\frac{A_1}{N_1} = \frac{A_2}{N_2}$$

Given initial activity is 56 dpm and after 69.3 min it was found 28 dpm.

$$\frac{56}{N_1} = \frac{28}{N_2} \quad \Bigg| \quad \frac{N_1}{N_2} = \frac{56}{28}$$

$$\boxed{\frac{N_1}{N_2} = \frac{2}{1}}$$

final no of atom is just half, so time 69.3 is $t_{1/2}$.

$$A = N\lambda$$

$$10 = N \times \frac{\ln 2}{t_{1/2}} \quad \Bigg| \quad 10 = N \times \frac{0.693}{69.3}$$

$$\boxed{N = 10^3}$$

Ans (B)

Q15

$$A = N\lambda$$

$$R_1 = N_1 \times \frac{\ln 2}{T}, \quad R_2 = N_2 \times \frac{\ln 2}{T}$$

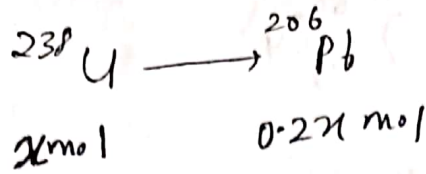
$$N_1 = \frac{R_1 T}{\ln 2}, \quad N_2 = \frac{R_2 T}{\ln 2}$$

$$N_1 - N_2 \Rightarrow \frac{T}{0.693} (R_1 - R_2)$$

Ans (A)

Q16

at time t



$x \text{ mol}$

$0.2x \text{ mol}$

$$\frac{n_{\text{Pb}}}{n_{\text{U}}} = \frac{0.2}{1}$$

So at initially

at $t=0$,

$1.2x \text{ mol}$

0 mol

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

Ans D

$$\lambda = \frac{1}{t} \ln \frac{1.2x}{x}$$

$$t = \frac{1}{\lambda} \ln \frac{6}{5}$$

Q17

$$A = N\lambda$$

$$\frac{A_1}{A_2} = \frac{N_1}{N_2} \quad \left| \quad \frac{7.6}{15.2} = \frac{N_1}{N_2} \right.$$

$$\frac{N_1}{N_2} = \frac{1}{2} \quad ; \quad N_2 = 2N_1$$

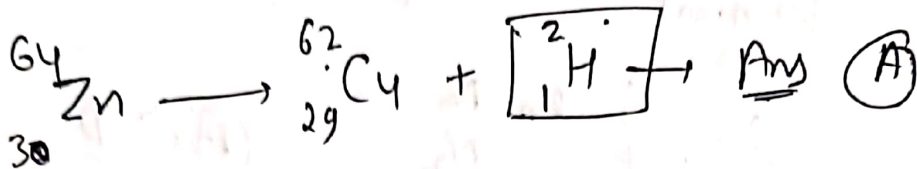
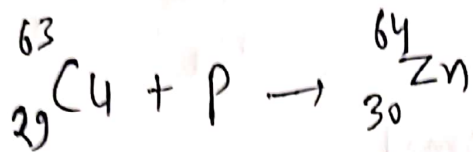
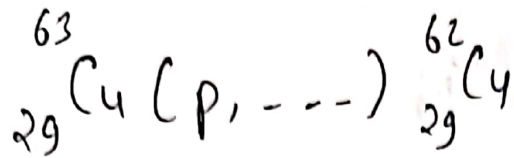
$$t = \frac{1}{\lambda} \ln \frac{N_0}{N_t}$$

$$t = \frac{t_{1/2}}{\ln 2} \ln \frac{2N}{N}$$

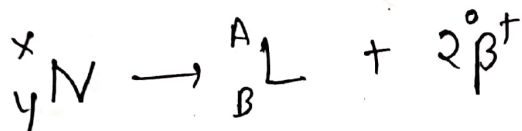
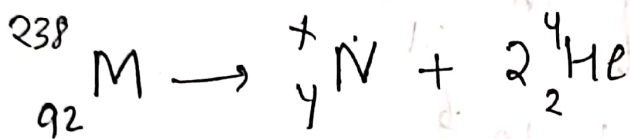
Ans A

$$t = t_{1/2} \quad t = 5760$$

(18)



(19)



$$238 = X + 2 \times 4 \quad | \quad X = 230$$

$$92 = Y + 4 \quad | \quad Y = 88$$

$$X = A + 2 \times 0$$

$$230 = A$$

$$Y = B + 2 \times 1$$

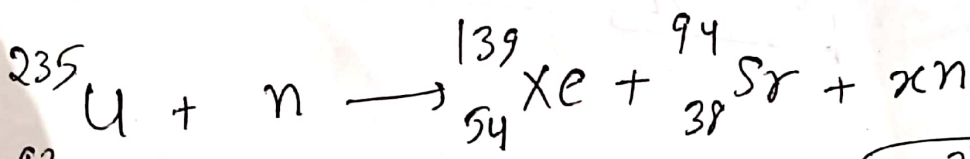
$$88 = B + 2$$

$$B = 86$$

Ans B

$$\begin{matrix} 230 \\ 86 \end{matrix} \text{L} \rightarrow \text{no of neutrons} = 230 - 86 \Rightarrow 144$$

(20)



$$235 + 1 = 139 + 94 + x \quad | \quad \boxed{x=3}$$

Ans = D