

Topic :- NUCLEI

1 (b)

By using $R = R_0 A^{1/3} \Rightarrow \frac{R_1}{R_2} = \left(\frac{A_1}{A_2}\right)^{1/3}$

$$\Rightarrow \frac{R}{R_{He}} = \left(\frac{A}{4}\right)^{1/3} \Rightarrow (14)^{1/3} = \left(\frac{A}{4}\right)^{1/3}$$

$$\Rightarrow A = 56 \text{ so } Z = 56 - 30 = 26$$

2 (d)

Extremely high temperature needed for fusion make KE large enough to overcome repulsion between nuclei.

3 (c)

Number of lines in absorption spectrum = $(n - 1)$

$$\Rightarrow 5 = n - 1 \Rightarrow n = 6$$

\therefore Number of bright lines in the emission spectrum

$$= \frac{n(n-1)}{2} = \frac{6(6-1)}{2} = 15$$

4 (c)

From conservation of momentum

$$4v = (A - 4)v_1$$

$$v_1 = \left(\frac{4v}{A-4}\right)$$

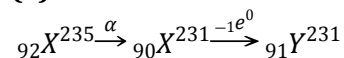
5 (d)

$$\text{Number of } \alpha \text{ - particles emitted} = \frac{238 - 222}{4} = 4$$

This decreases atomic number to $90 - 4 \times 2 = 82$

Since atomic number of ${}_{83}\text{Y}^{222}$ is 83, this is possible of one β - particle is emitted

6 (a)



7 (b)

By using $N = N_0 e^{-\lambda t}$ and $t = \tau = \frac{1}{\lambda}$

$$\text{Substance remains} = N = \frac{N_0}{e} = 0.37N_0 \approx \frac{N_0}{3}$$

$$\therefore \text{Substance disintegrated} = N_0 - \frac{N_0}{3} = \frac{2N_0}{3}$$

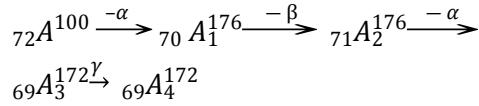
8

(c)

After t second fractional amount of X left is $\frac{1}{16}$ or $\left(\frac{1}{2}\right)^4$

$$\therefore t = 4 \times T_{1/2} = 4 \times 50 = 200 \text{ years}$$

9

(d)

10

(c)

Charge density is uniform inside and then falls rapidly near the surface of the nucleus

11

(a)

$$\text{Number of protons} = 2 + 2 + 6 + 2 + 6 = 18$$

$$\text{Number of neutrons} = 40 - 18 = 22$$

12

(d)

$$\text{By using } N = N_0 e^{-\lambda t} \text{ and } \frac{dN}{dt} = -\lambda N$$

It shows that N decreases exponentially with time

13

(c)

In critical condition, $k=1$. The chain reaction will be steady. The size of the fissionable material used is said to be critical size and its mass the critical mass.

14

(c)

Radius of n^{th} orbit for any hydrogen like atom

$$r_n = r_0 \left(\frac{n^2}{Z}\right) \quad (r_0 = \text{radius of first orbit of } H_2\text{-atom})$$

$$\text{If } r_n = r_0 \Rightarrow n = \sqrt{Z}. \text{ For } Be^{+++}, Z = 4 \Rightarrow n = 2$$

16

(a)

For $n = 1$, maximum number of states = $2n^2 = 2$ and for $n = 2, 3, 4$, maximum number of states would be 8, 18, 32 respectively, Hence number of possible elements

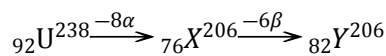
$$= 2 + 8 + 18 + 32 = 60$$

17

(b)

After one α - emission, the daughter Nucleus reduces in mass number by 4 unit and in atomic number by 2 unit. In β - emission the atomic number of daughter nucleus increases by 1 unit.

The reaction can be written as



Thus, the resulting nucleus is ${}_{82}Y^{206}$ i.e., ${}_{82}Pb^{206}$.

19

(d)

In the given case, 12 days = 3 half lives Number of atoms left after 3 half live

$$= 6.4 \times 10^{10} \times \frac{1}{2^3} = 0.8 \times 10^{10}$$

20

(d)

Radioactive decay does not depend upon the time of creation.

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	B	D	C	C	D	A	B	C	D	C
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	D	C	C	D	A	B	A	D	D

PE