DPP

DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 3

Topic :- NUCLEI

1 **(a)**

In increasing order of penetrating powers, the radiations are,

$\alpha < \beta < \gamma$

2 **(a)**

B.E. per nucleon is maximum for Fe^{56}. For futher detail refer theory

3 **(c)**

$N = N_0\left(\frac{1}{2}\right)^n$

$\Rightarrow \frac{1}{100}N_0 = N_0\left(\frac{1}{2}\right)^n \Rightarrow \frac{1}{100} = \left(\frac{1}{2}\right)^n \Rightarrow n = \frac{2}{\log 2}$

$\Rightarrow \frac{t}{T} = \frac{2}{\log 2} \Rightarrow t = 6.6T\ year$

4 **(a)**

Mass number decreases by $8 \times 4 = 32$

Atomic number decreases by $8 \times 2 - 5 = 11$

5 **(a)**

Activity of $S_1 = \frac{1}{2}$ (activity of S_2)

Or $\lambda_1 N_1 = \frac{1}{2}(\lambda_2 N_2)$

Or $\frac{\lambda_1}{\lambda_2} = \frac{N_2}{2N_1}$

Or $\frac{T_1}{T_2} = \frac{2N_1}{N_2}$

Given $N_1 = 2N_2$

$\therefore \frac{T_1}{T_2} = 4$

6 **(a)**

Since electron and positron annihilate

$\lambda = \frac{hc}{E_{Total}} = \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{(0.51 + 0.51) \times 10^6 \times 1.6 \times 10^{-19}}$

$= 1.21 \times 10^{-12} m = 0.012\text{Å}$

7 **(b)**

Activity $= -\frac{dN}{dt} = \lambda N = \lambda N_0 e^{-\lambda t}$

$i.e.$, graph between activity and t, is exponential having negative slope

8 **(d)**

Rydberg constant $R = \frac{\varepsilon_0 n^2 h^2}{\pi m Z e^2}$

Velocity $v = \frac{Ze^2}{2\varepsilon_0 nh}$ and energy $E = -\frac{mZ^2e^4}{8\varepsilon_0^2 n^2 h^2}$

Now, it is clear from above expressions $R.v \propto n$

10 **(b)**

Nuclear forces are charge independent so,

$F_1 = F_2 = F_3$.

11 **(d)**

$r = r_0(A)^{1/3}$

$\therefore \quad \frac{r_1}{r_2} = \left(\frac{A_1}{A_2}\right)^{1/3} = \left(\frac{64}{125}\right)^{1/3}$

$= \left[\left(\frac{4}{5}\right)^3\right]^{1/3} = \frac{4}{5}$

12 **(b)**

In a material medium, when a positron meets an electron both the particles annihilate leading to the emission of two γ-ray photons. This process forms the basis of an important diagnostic procedure called PET

13 **(a)**

For Balmer series $\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$ where $n = 3, 4, 5$

For second line $n = 4$

So $\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{4^2}\right) = \frac{3}{16}R \Rightarrow \lambda = \frac{16}{3R}$

14 **(a)**

$m_0c^2 = 0.54\ MeV$ and K.E. $= mc^2 - m_0c^2$

Also $m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{m_0}{\sqrt{1-(0.8)^2}} = \frac{m_0}{0.6}$

$\therefore E = mc^2 = \frac{m_0}{0.6}c^2 = \frac{0.54}{0.6} = 0.9\ MeV$

$\therefore$ K.E. $= (0.9 - 0.54) = 0.36\ MeV$

15 **(b)**

In order to compare the stability of the nuclei of different atoms, binding energy per nucleon is determined. Higher the binding energy per nucleon more stable is the nucleus.

$\therefore$ BE per nucleon of deuteron $= \frac{1.125}{2}$

$= 0.5625$ MeV

BE per nucleon of alpha particle $= \frac{7.2}{4} = 1.8$ MeV

Since, binding energy per nucleon of alpha particle is more, hence it is more stable.

17 **(d)**

Here, $\frac{N_{x_1}(t)}{N_{x_2}(t)} = \frac{1}{e}$

or $\frac{N_0 e^{-10\lambda t}}{N_0 e^{-\lambda t}} = \frac{1}{e}$

(Because initially, both have the same number of nuclei, N_0).

or $e = \frac{e^{-\lambda t}}{e^{-10\lambda t}} = e^{9\lambda t}$

$9\lambda t = 1$

$t = \frac{1}{9\lambda}$

18 **(b)**

$\lambda = \frac{0.693}{T_{1/2}} = \frac{0.693}{77} = 9 \times 10^{-3}/day$

19 **(c)**

Since the $^{133}_{55}Cs$ has larger size among the four atoms given, thus the electrons present in the outermost orbit will be away from the nucleus and the electrostatic force experienced by electrons due to nucleus will be minimum. Therefore the energy required to liberate electron from outer will be minimum in the case of $^{133}_{55}Cs$

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