

CHAPTER 13

Nuclei

Atomic Nucleus, Its Size, Density and Weight

1. A nucleus of mass number 189 splits into two nuclei having mass number 125 and 64. The ratio of radius of two daughter nuclei respectively is : (2022)
 - a. 25 : 16
 - b. 1 : 1
 - c. 4 : 5
 - d. 5 : 4
2. The energy equivalent of 0.5 g of a substance is : (2020)
 - a. 4.5×10^{13} J
 - b. 1.5×10^{13} J
 - c. 0.5×10^{13} J
 - d. 4.5×10^{16} J
3. If radius of the ${}^{27}_{12}\text{Al}$ nucleus is taken to be R_{Al} , then the radius of ${}^{125}_{53}\text{Te}$ nucleus is nearly: (2015)
 - a. $\frac{5}{3}R_{\text{Al}}$
 - b. $\frac{3}{5}R_{\text{Al}}$
 - c. $\left(\frac{13}{53}\right)^{1/3}R_{\text{Al}}$
 - d. $\left(\frac{53}{13}\right)^{1/3}R_{\text{Al}}$

Mass Energy, Nuclear Binding Energy and Nuclear Force

4. A nucleus with mass number 240 breaks into two fragments each of mass number 120, the binding energy per nucleon of unfragmented nuclei is 7.6 MeV while that of fragments is 8.5 MeV. The total gain in the Binding Energy in the process is: (2021)
 - a. 9.4 MeV
 - b. 804 MeV
 - c. 216 MeV
 - d. 0.9 MeV

Radioactive Decay Law, Half-Life and Average Life and Activity of a Radioactive Substance

5. The half life of a radioactive sample undergoing α -decay is 1.4×10^{17} s. If the number of nuclei in the sample is 2.0×10^{21} , the activity of the sample is nearly. [RC] (2020-Covid)
 - a. 10^5 Bq
 - b. 10^6 Bq
 - c. 10^3 Bq
 - d. 10^4 Bq
6. For a radioactive material, half-life is 10 minutes. If initially there are 600 number of nuclei, the time taken (in minutes) for the disintegration of 450 nuclei is [RC] (2018)
 - a. 30
 - b. 10
 - c. 20
 - d. 15
7. Radioactive material 'A' has decay constant ' 8λ ' and material 'B' has decay constant ' λ '. Initially they have same number of nuclei. After what time, the ratio of number of nuclei of material 'A' to that of 'B' will be $1/e$? [RC] (2017-Delhi)
 - a. $\frac{1}{7\lambda}$
 - b. $\frac{1}{8\lambda}$
 - c. $\frac{1}{9\lambda}$
 - d. $\frac{1}{\lambda}$
8. The half-life of a radioactive substance is 30 minutes. The time (in minutes) taken between 40% decay and 85% decay of the same radioactive substance is: [RC] (2016 - II)
 - a. 45
 - b. 60
 - c. 15
 - d. 30
9. A radio isotope X with a half life of 1.4×10^9 years decays to Y which is stable. A sample of the rock from a cave was found to contain X and Y in the ratio 1 : 7. The age of the rock is: [RC] (2014)
 - a. 1.96×10^9 years
 - b. 3.92×10^9 years
 - c. 4.20×10^9 years
 - d. 8.40×10^9 years

10. The half life of a radioactive isotope 'X' is 20 years. It decays to another element 'Y' which is stable. The two elements 'X' and 'Y' were found to be in the ratio 1 : 7 in a sample of a given rock. The age of the rock is estimated to be:

[RC] (2013)

- a. 100 years b. 40 years
c. 60 years d. 80 years

Alpha, Beta and Gamma Decay

11. What happens to the mass number and atomic number of an element when it emits γ -radiation? [RC] (2020-Covid)

- a. Mass number and atomic number remain unchanged.
b. Mass number remains unchanged while atomic number decreases by one
c. Mass number increases by four and atomic number increases by two
d. Mass number decreases by four and atomic number decreases by two

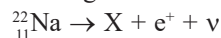
12. α -particle consists of :

[RC] (2019)

- a. 2 protons and 2 neutrons only
b. 2 electrons, 2 protons and 2 neutrons
c. 2 electrons and 4 protons only
d. 2 protons only

Nuclear Reactions

13. In the given nuclear reaction, the element X is :



(2022)

- a. ${}_{12}^{22}\text{Mg}$ b. ${}_{11}^{22}\text{Na}$
c. ${}_{10}^{22}\text{Ne}$ d. ${}_{10}^{22}\text{Ne}$

14. A radioactive nucleus ${}_Z^AX$ undergoes spontaneous decay in the sequence

${}_Z^AX \rightarrow {}_{Z-1}^B \rightarrow {}_{Z-3}^C \rightarrow {}_{Z-2}^D$, where Z is the atomic number of element X. The possible decay particles in the sequence are: (2021)

- a. α , β^+ , β^- b. β^+ , α , β^-
c. β^- , α , β^+ d. α , β^- , β^+

15. When a uranium isotope ${}_{92}^{235}\text{U}$ is bombarded with a neutron,

it generates ${}_{36}^{89}\text{Kr}$, three neutrons and : (2020)

- a. ${}_{40}^{91}\text{Zr}$ b. ${}_{36}^{101}\text{Kr}$
c. ${}_{36}^{103}\text{Kr}$ d. ${}_{56}^{144}\text{Br}$

16. The binding energy per nucleon of ${}_3^7\text{Li}$ and ${}_2^4\text{He}$ nuclei are 5.60 MeV and 7.06 MeV, respectively. In the nuclear reaction ${}_3^7\text{Li} + {}_1^1\text{H} \rightarrow {}_2^4\text{He} + {}_2^4\text{He} + Q$ the value of energy Q released is: (2014)

- a. 19.6 MeV b. -2.4 MeV
c. 8.4 MeV d. 17.3 MeV

Nuclear Fission and Nuclear Fusion

17. A certain mass of Hydrogen is changed to Helium by the process of fusion. The mass defect in fusion reaction is 0.02866 u. The energy liberated per u is (given 1 u = 931 MeV): (2013)

- a. 13.35 MeV b. 2.67 MeV
c. 26.7 MeV d. 6.675 MeV

Answer Key

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| d | a | a | c | d | c | a | b | c | c | a | a | d | b | d | d | d |