1.

The binding energies of the nuclei A and B are $E_a \; and \; E_b$ respectively. Three atoms of the element B fuse to give one atom of element A and an energy Q is released.Then E_a, E_b and Q are related as

(1) $E_a - 3E_b = Q$ (2) $3E_b - E_a = Q$

(3) $E_a + 3E_b = Q$ (4) $E_b + 3E_a = Q$

2.

A free neutron decays into a proton, an electron and [1997]

(1) a beta particle (2) an alpha particle

(3) an antineutrino (4) a neutrino

3.

In a radioactive sample the fraction of initial number of radioactive nuclei, which remains undecayed after n mean lives is

(1) $\frac{1}{e^n}$ (2) e^n (3) $1 - \frac{1}{e^n}$ (4) $\left(\frac{1}{e-1}\right)^n$

4.

The activity of a radioactive sample is measured as 9750 counts/min at t = 0 and as 975 counts/min at t = 5 min. The decay constant is approximately [1997]

(1) 0.922 / min (2) 0.691 / min (3) 0.461 / min (4) 0.230 / min

5.

Fission of nuclei is possible because the binding energy per nucleon in them [2005]

(1) increases with mass number at high mass number

(2) decreases with mass number at high mass

(3) increases with mass number at low mass numbers

(4) decreases with mass number at low mass number

6.

A nucleus ${}_nX^m$ emits one α and two $\beta-$particles. The resulting nucleus is [1998]

(1) ${}_nX^{m-4}$ (2) ${}_{n-2}Y^{m-4}$ (3) ${}_{n-4}Z^{m-4}$

(4) None of these

7.

Half-life period of a radioactive substance is 6 h. After 24 h activity is 0.01 μCi, what was the initial activity? [2001]

(1) 0.04 μCi (2) 0.08 μCi (3) 0.24 μCi

(4) 0.16 μCi

8.

The radius of a nucleus of a mass number A is directly proportional to [MH CET 1999; AMU (En.) 2001; UPSEAT 2004; DUMET 2010]

(1) A^3 (2) A (3) $A^{2/3}$ (4) $A^{1/3}$

9.

The half life of Po^{218} is 3 minutes. What fraction of a 10 gram sample of Po^{218}, will remain after 15 minutes?

(1) $\frac{1}{32}$ (2) $\frac{1}{64}$ (3) $\frac{1}{25}$ (4) $\frac{1}{15}$

10.

The radioactivity of a sample is A_1 at a time t_1 and A_2 at time t_2. If the mean life of specimen is T, the number of atoms that have disintegrated in the time interval of $t_2 - t_1$ is

(1) $A_1 - A_2$ (2) $\frac{A_1 - A_2}{T}$ (3) $(A_1 - A_2)T$

(4) $A_1 t_1 - A_2 t_2$

11.

Three fourth of the active nuclei decay in a radioactive sample in 3/4 s. The half life of the sample is [KCET (Engg.) 2001]

(1) $\frac{1}{2}$ s (2) 1 s (3) $\frac{3}{8}$ s (4) $\frac{3}{4}$ s

12.

Which of the following statements is true for nuclear forces? [1990]

(1) They obey the inverse square law of distance.

(2) They obey the inverse third power law of distance.

(3) They are short range forces.

(4) They are equal in strength to electromagnetic forces.

13.

The ratio of the radii of the nuclei ${}_{13}Al^{27}$ and ${}_{52}Te^{125}$ is approximately [1990]

(1) 6 : 10 (2) 13 : 52 (3) 40 : 177

(4) 14 : 73

14.

The relationship between disintegration constant $[\lambda]$ and half-life [T] will be [2000]

(1) $\lambda = \frac{\log_{10} 2}{T}$ (2) $\lambda = \frac{\log_e 2}{T}$

(3) $\lambda = \frac{T}{\log_e 2}$ (4) $\lambda = \frac{\log_2 e}{T}$

15.

If the nuclear force between two protons, two neutrons and between proton and neutron is denoted by $F_{pp},\ F_{nn}\ and\ F_{pn}$ respectively, then [1991]

(1) $F_{pp} \approx F_{nn} \approx F_{pn}$

(2) $F_{pp} \neq F_{nn}\ and\ F_{pp} = F_{nn}$

(3) $F_{pp} = F_{nn} = F_{pn}$

(4) $F_{pp} \neq F_{nn} \neq F_{pn}$

16.

A radioactive element has half-life period 800 yr. After 6400 yr, what fraction will remain? [1989]

(1) $\frac{1}{2}$ (2) $\frac{1}{16}$ (3) $\frac{1}{8}$ (4) $\frac{1}{256}$

17.

If radius of the $^{27}_{12}Al$ nucleus is taken to be R_{Al}, then the radius of $^{125}_{53}Te$ nucleus is nearly

(1) $\frac{5}{3}R_{Al}$ (2) $\frac{3}{5}R_{Al}$ (3) $\left(\frac{13}{53}\right)^{1/3}R_{Al}$ (4) $\left(\frac{53}{13}\right)^{1/3}R_{Al}$

18.

In a given reaction,

$$_ZX^A \rightarrow\ _{Z+1}Y^A \rightarrow\ _{Z-1}K^{A-4} \rightarrow\ _{Z-1}K^{A-4}$$

Radioactive radiations are emitted in the sequence of

(1) $\alpha,\ \beta,\ \gamma$ (2) $\gamma,\ \alpha,\ \beta$ (3) $\beta,\ \alpha,\ \gamma$ (4) $\gamma,\ \beta,\ \alpha$

19.

A sample of radioactive element has a mass of 10 g at an instant t = 0. The approximate mass of this element in the sample after two mean lives is [2003]

(1) 3.70 g (2) 6.30 g (3) 1.35 g (4) 2.50 g

20.

The mass density of a nucleus varies with mass number A as [1992]

(1) A^2 (2) A (3) Constant (4) $\frac{1}{A}$

21.

A nuclear reaction along with the masses of the particle taking part in it is as follows;

$$A + B \rightarrow C + D + Q\ MeV$$
$$1.002\ amu \quad 1.004\ amu \quad 1.001\ amu \quad 1.003\ amu$$

The energy Q liberated in the reaction is

(1) 1.234 MeV (2) 0.931 MeV

(3) 0.465 MeV (4) 1.862 MeV

22.

A nuclear decay is expressed as

$$_6C^{11} \rightarrow\ _5B^{11} + \beta^+ + X$$

Then the unknown particle X is [2000]

(1) Neutron (2) antineutrino (3) proton (4) neutrino

23.

The minimum wavelength of X-rays produced by electrons accelerated by a potential difference of V volt is equal to

(1) $\frac{eV}{hc}$ (2) $\frac{eh}{cV}$ (3) $\frac{hc}{eV}$ (4) $\frac{cV}{eh}$

24.

The energy released by the fission of one uranium atom is 200 MeV. The number of fission per second required to produce 3.2 W of power is (Take, 1 eV = $1.6\times10^{-19}\ J$) [WB JEE 2010]

(1) 10^7 (2) 10^{10} (3) 10^{15} (4) 10^{11}

25.

The binding energy of deuteron is 2.2 MeV and that of ^4_2He is 28 MeV. If two deuterons are fused to form one ^4_2He, then the energy released is [2006]

(1) 25.8 MeV (2) 23.6 MeV (3) 19.2 MeV (4) 30.2 MeV

26.

Half-life of a radioactive substance is 12.5 h and its mass is 256 g. After what time, the amount of remaining substance is 1 g? [2001]

(1) 75 h (2) 100 h (3) 125 h (4) 150 h

27.

The nucleus $_6C^{12}$ absorbs an energetic neutron and emits a beta particle (β). The resulting nucleus is [1990]

(1) $_7N^{14}$ (2) $_7N^{13}$ (3) $_5B^{13}$ (4) $_6C^{13}$

28.

If in a nuclear fusion process, the masses of the fusion nuclei be $m_1\ and\ m_2$ and the mass of the resultant nucleus be m_3, then [2004]

(1) $m_3 = m_1 + m_2$ (2) $m_3 = |m_1 - m_2|$

(3) $m_3 < (m_1 + m_2)$ (4) $m_3 > (m_1 + m_2)$

29.

If N_0 is the original mass of the substance of half life period $T_{1/2}$= 5 years, then the amount of substance left after 15 years is [AIEEE 2012]

(1) $N_0/8$ (2) $N_0/16$ (3) $N_0/2$ (4) $N_0/4$

30. **The half-life of a radioactive substance is 20 minutes. The approximate time interval $(t_2 - t_1)$ between the time t_2 when $\frac{2}{3}$ of it has decayed and time t_1 when $\frac{1}{3}$ of it had decayed is**

1. 7 min 2. 14 min
3. 20 min 4. 28 min

31.

For a substance the average life for α-emission is 1620 years and for β emission is 405 years. After how much time the 1/4 of the material remains after α and β emission

(a) 1500 years (b) 300 years
(c) 449 years (d) 810 years

32.

A radioactive nucleus undergoes α-emission to form a stable element. What will be the recoil velocity of the daughter nucleus if v is the velocity of α-particle and A is the atomic mass of radioactive nucleus ?

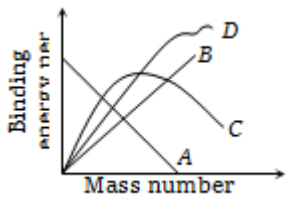
(a) $\frac{4V}{A-4}$ (b) $\frac{2V}{A-4}$
(c) $\frac{4V}{A+4}$ (d) $\frac{2V}{A+4}$

33.

Half life of a radio-active substance is 20 minutes. The time between 20% and 80% decay will be
(a) 20 minutes (b) 40 minutes
(c) 30 minutes (d) 25 minutes

34.

Binding energy per nucleon plot against the mass number for stable nuclei is shown in the figure. Which curve is correct ?



(a) A
(b) B
(c) C
(d) D

35.

Half-lives of two radioactive substances A and B are respectively 20 min and 40 min. Initially the samples of A and B have equal number of nuclei. After 80 min the ratio of remaining number of A and B nuclei is

1. 1:16

2. 4:1

3. 1:4

4. 1:1

36.

In one α and 2β-emissions

1. mass number reduces by 2

2. mass number reduces by 6

3. atomic number reduces by 2

4. atomic number remains unchanged

37.

m_P and m_n are masses of proton and neutron respectively. An element of mass M has Z protons and N neutrons then

1. $M > Zm_P + Nm_n$

2. $M = Zm_P + Nm_n$

3. $M < Zm_P + Nm_n$

4. M may be greater than, less than or equal to $Zm_P + Nm_n$, depending on nature of element.

38.

A sample of radioactive element contains 4×10^{16} active nuclei. The half-life of the element is 10 days. Then number of decayed nuclei after 30 days is

1. 0.5×10^{16}

2. 2×0^{16}

3. 3.5×10^{16}

4. 1×10^{16}

39.

A nuclear reaction is given by

$${}_zX_A \rightarrow {}_{z+1}Y_4 + {}_{-1}e_0 + \overrightarrow{v}$$

represents

1. $\beta-$ decay

2. $\gamma-$ decay

3. fusion

4. fission

40.

The mass of proton is 1.0073 u and that of neutron is 1.0087 u (u=atomic mass unit). The binding energy of $_{2}^{4}\mathrm{He}$ is (Given: helium nucleus mass=4.0015 u)

1. 0.0305 J

2. 0.0305 erg

3. 28.4 MeV

4. 0.061 u

41.

A nucleus represented by the symbol $_{Z}^{A}\mathrm{X}$ has

1. Z protons and A-Z neutrons

2. Z protons and A neutrons

3. A protons and Z-A neutrons

4. Z neutrons and A-Z protons

42.

In the reaction $_{1}^{2}\mathrm{H}+{}_{1}^{3}\mathrm{H}\rightarrow{}_{2}^{4}\mathrm{He}+{}_{0}^{1}\mathrm{n}$. If the binding energies of $_{1}^{2}\mathrm{H}$, $_{1}^{3}\mathrm{H}$ and $_{2}^{4}\mathrm{He}$ are respectively a, b and c (in MeV), then the energy (in MeV) released in this reaction is

1. a+b+c

2. c+a-b

3. c-a-b

4. a+b+c

43.

Two radioactive substances A and B have decay constant 5λ and λ respectively. At t=0 they have the same number of nuclei. The ratio of number of nuclei of A to those of B will be $(1/\mathrm{e})^{2}$ after a time interval

1. 4λ

2. 2λ

3. $1/2\lambda$

4. $1/4\lambda$

44.

The half-life of radioactive nucleus is 50days. The time interval $(\mathrm{t}_{2}-\mathrm{t}_{1})$ between the time t_{2} when $\frac{2}{3}$ of it has decayed and the time t_{1} when $\frac{1}{3}$ of it had decayed is

1. 60 days

2. 15 days

3. 30 days

4. 50 days

45.

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

1. 30

2. 10

3. 20

4. 15

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