1. A radioactive reaction is $_{92}U^{238} \rightarrow {}_{82}Pb^{206}$. How many α and β particles are emitted.

(1) 10α, 6β (2) 4 protons, 8 neutrons

(3) 6 electrons 8 protons (4) 6β, 8α

2. In the given nuclear reaction A, B, C, D, E represents

$$_{92}U^{238} \xrightarrow{\alpha} {}_{B}Th^{A} \xrightarrow{\beta} {}_{D}Pa^{C} \xrightarrow{E} {}_{92}U^{234}$$

(1) A = 234, B = 90, C = 234, D = 91, E = β

(2) A = 234, B = 90, C = 238, D = 94, E = α

(3) A = 238, B = 93, C = 234, D = 91, E = β

(4) A = 234, B = 90, C = 234, D = 93, E = α

3. The stable nucleus which has a radius half of Fe^{56} is -

(1) Ca^{40} (2) S^{16}

(3) Na^{21} (4) Li^{7}

4. The binding energies of the atoms of elements A and B are E_a and E_b respectively. Three atoms of the element B fuse to give one atom of element A. This fusion process is accompained by release of energy e. Then, E_a, E_b and e are related to each other as :

(1) $E_a + e = 3E_b$ (2) $E_a = 3E_b$

(3) $E_a - e = 3E_b$ (4) $E_a + 3E_b + e = 0$

5. If 200 MeV energy is released in the fission of a single U_{235} nucleus, the number of fissions required per second in a nuclear reactor are 3.125×10^{13}, find the power of the reactor.

(Given $1\ eV = 1.6 \times 10^{-19} J$)

(1) 1 Kilo watt (2) 2 Kilo watt

(3) 4 Kilo watt (4) 2.5 Kilo watt

6. A nuclear reactor delivers a power of 10^9 W. What is the amount of fuel consumed by the reactor in one hour ?

(1) 0.04 g (2) 0.08 g

(3) 0.72 g (4) 0.96 g

7. A typical nuclear fusion reaction is given by :-

$$_1H^2 + {}_1H^2 \rightarrow {}_1H^3 + {}_1H^1 + 4.0\ MeV$$

$$_1H^2 + {}_1H^2 \rightarrow {}_2He^4 + {}_0n^1 + 17.6\ MeV$$

The net result of two reactions is :-

$$3 \times {}_1H^2 \rightarrow {}_2He^4 + {}_0n^1 + {}_1H^1 + 21.6\ MeV$$

The energy released per nucleon of the reactant, in the above thermonuclear reaction is :-

(1) 1.8 MeV (2) 3.6 MeV

(3) 7.2 MeV (4) 21.6 MeV

8. The rest mass of the deuteron, $_1^2H$, is equivalent to an energy of 1876 MeV, the rest mass of a proton is equivalent to 939 MeV and that of a neutron to 940 MeV. A deuteron may disintegrate to a proton and a neutron if it :

(1) emits a γ-ray photon of energy 2 MeV

(2) captures a γ-ray photon of energy 2 MeV

(3) emits a γ-ray photon of energy 3 MeV

(4) captures a γ-ray photon of energy 3 MeV

9. If there is a mass defect of 0.1% in nuclear fission, then the energy released in the fission of 1 kg mass would be-

(1) 2.5×10^5 kWh (2) 2.5×10^7 kWh

(4) 2.5×10^9 kWh (4) 2.4×10^{-7} kWH

10. If the average number of neutrons liberated per fission is 2.5 and energy released per fission is 250 MeV then the number of neutrons generated per second in a nuclear reactor of 100 MW, will be :-

(1) 2.5×10^{18} (2) 2.5×10^{19}

(3) 6.25×10^{18} (4) 6.25×10^{19}

11. The half life of a radioactive substance is 20 minutes. The approximate time interval $(t_2 - t_1)$ between the time t_2 when $\frac{4}{5}$ of it has decayed and time t_1 when $\frac{1}{5}$ of it had decayed is :-

(1) 20 min (2) 28 min (3) 40 min (4) 14 min

12. Half life of a radioactive substance A is twice the half life of substance B. Initially the number of nuclei of A and B are N_A and N_B respectively. After three half life of A, activities of both the samples are equal. The ratio $\frac{N_A}{N_B}$ is :-

(1) $\frac{1}{4}$ (2) $\frac{1}{8}$ (3) $\frac{1}{3}$ (4) $\frac{1}{6}$

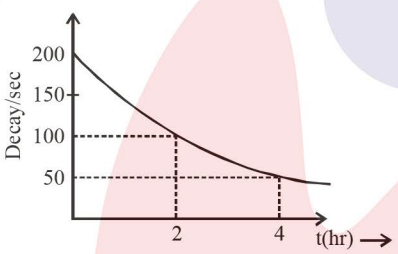
13. Decay rate for a certain mass of a radioactive substance measured at different times varies with time as shown in fig. The number of active nuclei at t = 8 hr will be :-

(1) 12.5

(2) 25

(3) 9×10^4

(4) 1.3×10^5



14. In a radioactive element the fraction of initial amount remaining after its mean life time is

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

15. Activity of a radioactive substance is R_1 at time t_1 and R_2 at time $t_2(t_2 > t_1)$. Then the ratio $\frac{R_2}{R_1}$ is:

(1) $\frac{t_2}{t_1}$ (2) $e^{-\lambda(t_1+t_2)}$

(3) $e\left(\frac{t_1-t_2}{\lambda}\right)$ (4) $e^{\lambda(t_1-t_2)}$

16. The activity of a sample reduces from A_0 to $A_0/\sqrt{3}$ in one hour. The activity after 3 hours more will be :-

(1) $\frac{A_0}{3\sqrt{3}}$ (2) $\frac{A_0}{9}$ (3) $\frac{A_0}{9\sqrt{3}}$ (4) $\frac{A_0}{27}$

17. A radioactive element emits 200 particles per second. After three hours 25 particles per second are emitted. The half life period of element will be

(1) 50 minutes (2) 60 minutes

(3) 70 minutes (4) 80 minutes

18. The half life of the isotope $_{11}Na^{24}$ is 15 hrs. How much time does it take for $\frac{7}{8}$ th fo a sample of this isotope to decay :-

(1) 75 hrs (2) 65 hrs

(3) 55 hrs (4) 45 hrs

19. 16 gm sample of a radioactive element is taken from Bombay to Delhi in 2 hour and it was found that 1 gm of the element remained (undisintegrated). Half life of the element is

(1) 2 hour (2) 1 hour (3) $\frac{1}{2}$ hour (4) $\frac{1}{4}$ hour

20. The activity of a sample of a radioactive material is A, at time t_1 and A_2 at time t_2 $(t_2 > t_1)$. if its mean life T, then

(1) $A_1t_1 = A_2t_2$ (2) $A_1 - A_2 = t_2t_1$

(3) $A_2 = A_1e^{(t_1-t_2)/T}$ (4) $A_2 = A_1e^{(t_1/t_2)/T}$

21. A nucleus with mass number 220 initially at rest emits an α - particle. If the Q value of the reaction is 5.5 MeV, calculate the kinetic energy of the α - particle.

(1) 4.4 MeV (2) 5.4 MeV

(3) 5.6 MeV (4) 6.5 MeV

22. A and B are two radioactive substances whose half lives are 1 and 2 years respectively. Initially 10 gm of A and 1 gm of B is taken. The time (approximate) after which they will have same quantity remaining is

(1) 6.62 years (2) 5 years

(3) 3.2 years (4) 7 years

23. The half life of a radioactive isotope 'X' is 50 years. It decays to another element 'Y' which is stable. The two elements 'X' and 'Y' were found to be in the ratio of 1 : 15 in a sample of a given rock. The age of the rock was estimated to be :-

(1) 150 years (2) 200 years

(3) 250 years (4) 100 years

24. In an α-decay kinetic energy of α particle is 98 MeV and Q-value of the reaction is 100 MeV. The mass number of the mother nucleus is. (Assume that daughter nucleus is in ground state):-

(1) 100 (2) 200

(3) 300 (4) None of these

25. The ratio of molecular mass of two radioactive substances is $\frac{3}{2}$ and the ratio of their decay constants is $\frac{4}{3}$. Then the ratio of their initial activity per mole will be :-

(1) 2 (2) 8/9 (3) 4/3 (4) 9/8

26. A radioactive element A with a half-value period of 2 hours decays giving a stable element Y. After a time the ratio of X to Y atoms is 1 : 7. Then, t is:

(1) 6 hour (2) 4 hour

(3) between 4 and 6 hour (4) 14 hour

27. Two radioactive materials X_1 and X_2 contain same number of nuclei. If $6\lambda s^{-1}$ and $4\lambda s^{-1}$ are the decay constants of X_1 and X_2 respectively, the ratio of number of nuclei, undecayed of X_1 to that of X_2 will be (1/e) after a time :-

(1) $\frac{1}{2\lambda}$ sec (2) $\frac{1}{10\lambda}$ sec (3) $\frac{1}{5\lambda}$ sec (4) $\frac{1}{\lambda}$ sec

28. A gamma ray photon creates an electron-positron pair. If the rest mass of electron is 0.5 MeV and the total KE of electron-positron pair is 0.78 MeV, the energy of gamma ray photon must be :

(1) 0.78 MeV (2) 1.78 MeV

(3) 1.28 MeV (4) 0.28 MeV

29. A radioactive sample consists of two distinct species having equal number of atoms N_0 initially. The mean-life of one species is τ and of the other is 5τ. The decay products in both cases is stable. The total number of radioactive nuclei at $t = 5\tau$ is:-

(1) $N_0\left(\frac{e^5+1}{e^5}\right)$ (2) $N_0\left(\frac{e^4+1}{e^5}\right)$

(3) $N_0\left(\frac{e+e^5}{e^5}\right)$ (4) N_0e^{-3}

30. Samples of two radioactive nuclides, X and Y, each have equal activity A_0 at time t = 0. X has half–life of 24 years and Y a half–life of 16 years. The samples are mixed together. What will be the total activity of the mixture at t = 48 years?

(1) $\frac{1}{2}A_0$ (2) $\frac{1}{4}A_0$

(3) $\frac{3}{16}A_0$ (4) $\frac{3}{8}A_0$

ANSWER KEY — Exercise-I

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**4**	**1**	**4**	**3**	**1**	**1**	**2**	**4**	**2**	**3**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**3**	**1**	**4**	**3**	**4**	**1**	**2**	**4**	**3**	**3**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**2**	**1**	**2**	**2**	**3**	**1**	**1**	**2**	**2**	**4**