

PYQSide

NEET NUCLEI — RADIOACTIVITY: LAW OF RADIOACTIVE DECAY, HALF-LIFE AND MEAN LIFE — PYQS

Max. Marks: 92

Questions: 23

Section A (MCQ)

- Q.1** The half life of a radioactive substance is 20 minutes. In how much time, the activity of substance drops to $\left(\frac{1}{16}\right)^{\text{th}}$ of its initial value?

[NEET (UG) 2023]

- (1) 40 minutes (2) 60 minutes
(3) 80 minutes (4) 20 minutes

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- Q.2** Given below are two statements

Statement-I: The law of radioactive decay states that the number of nuclei undergoing the decay per unit time is inversely proportional to the total number of nuclei in the sample.

Statement-II: The half-life of a radionuclide is the sum of the life time of all nuclei, divided by the initial concentration of the nuclei at time $t = 0$.

In the light of the above statements, choose the most appropriate answer from the options given below :

[NEET (UG) 2022 (Phase 2)]

- (1) Statement-I is incorrect but statement II is correct
(2) Both statement I and statement II are correct
(3) Both statement I and statement II are incorrect
(4) Statement-I is correct but statement II is incorrect

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- Q.3** At any instant, two elements X_1 and X_2 have same number of radioactive atoms. If the decay constant of X_1 and X_2 are 10λ and λ respectively, then the time when the ratio of their atoms becomes $\frac{1}{e}$ respectively will be :

[NEET (UG) 2022 (Phase 2)]

- (1) $\frac{1}{5\lambda}$ (2) $\frac{1}{11\lambda}$ (3) $\frac{1}{9\lambda}$ (4) $\frac{1}{6\lambda}$

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- Q.4** The half life of a radioactive nuclide is 100 hours. The fraction of original activity that will remain after 150 hours would be : [NEET (UG) 2021]

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

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- Q.5** 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 [NEET 2018]

- (1) 20 (2) 10 (3) 30 (4) 15

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- Q.6** 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 'B' to that of 'A' will be e ? [NEET 2017]

- (1) $\frac{1}{7\lambda}$ (2) $\frac{1}{8\lambda}$ (3) $\frac{1}{9\lambda}$ (4) $\frac{1}{\lambda}$

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- Q.7** 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 [NEET 2016 (Phase 2)]

- (1) 15 (2) 30 (3) 45 (4) 60

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- Q.8** A radioactive X with a half life 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 [AIPMT 2014]

- (1) 1.96×10^9 years (2) 3.92×10^9 years
(3) 4.20×10^9 years (4) 8.40×10^9 years

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- Q.9** 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 [NEET 2013]

- (1) 80 years (2) 100 years
(3) 40 years (4) 60 years

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full solution



- Q.10** The half life of a radioactive nucleus is 50 days. The time interval $(t_2 - t_1)$ 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 [AIPMT 2012 (Mains)]
(1) 30 days (2) 50 days (3) 60 days (4) 15 days

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- Q.11** A mixture consists of two radioactive materials A_1 and A_2 with half lives of 20 s and 10 s respectively. Initially the mixture has 40 g of A_1 and 160 g of A_2 . The amount of the two in the mixture will become equal after [AIPMT 2012 (Prelims)]
(1) 60 s (2) 80 s (3) 20 s (4) 40 s

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full solution



- Q.12** Two radioactive nuclei P and Q, in a given sample decay into a stable nucleus R. At time $t = 0$, the number of P species is $4N_0$ and that of Q is N_0 . Half-life of P (for conversion to R) is 1 minute whereas that of Q is 2 minutes. Initially there are no nuclei of R present in the sample. When number of nuclei of P and Q are equal, the number of nuclei of R present in the sample would be [AIPMT 2011 (Mains)]

- (1) $2N_0$ (2) $3N_0$ (3) $\frac{9N_0}{2}$ (4) $\frac{5N_0}{2}$

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- Q.13** 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 [AIPMT 2011 (Prelims)]
(1) 150 years (2) 200 years
(3) 250 years (4) 100 years

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- Q.14** The decay constant of a radioisotope is λ . If A_1 and A_2 are its activities at times t_1 and t_2 respectively, the number of nuclei which have decayed during the time $(t_1 - t_2)$ [AIPMT 2010 (Mains)]
(1) $A_1 t_1 - A_2 t_2$ (2) $A_1 - A_2$
(3) $(A_1 - A_2)/\lambda$ (4) $\lambda(A_1 - A_2)$

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full solution



- Q.15** The activity of a radioactive sample is measured as N_0 counts per minute at $t = 0$ and N_0/e counts per minute at $t = 5$ minutes. The time (in minutes) at which the activity reduces to half its value is [AIPMT 2010 (Prelims)]

- (1) $\log_e \frac{2}{5}$ (2) $\frac{5}{\log_e 2}$
(3) $5 \log_{10} 2$ (4) $5 \log_e 2$

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full solution



- Q.16** Two radioactive materials X_1 and X_2 have decay constants 5λ and λ respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of X_1 to that of X_2 will be $\frac{1}{e}$ after a time [AIPMT 2008]
(1) $\frac{1}{4\lambda}$ (2) $\frac{e}{\lambda}$ (3) λ (4) $\frac{1}{\lambda}$

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- Q.17** Two radioactive substances A and B have decay constants 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 $\left(\frac{1}{e}\right)^2$ after a time interval [AIPMT 2007]
(1) 4λ (2) 2λ (3) $\frac{1}{2\lambda}$ (4) $\frac{1}{4\lambda}$

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- Q.18** In a radioactive material the activity at time t_1 is R_1 and at a later time t_2 , it is R_2 . If the decay constant of the material is λ , then [AIPMT 2006]
(1) $R_1 = R_2$ (2) $R_1 = R_2 e^{-\lambda(t_1 - t_2)}$
(3) $R_1 = R_2 e^{\lambda(t_1 - t_2)}$ (4) $R_1 = R_2(t_2/t_1)$.

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- Q.19** The half life of radium is about 1600 years. Of 100 g of radium existing now, 25 g will remain unchanged after [AIPMT 2004]
(1) 4800 years (2) 6400 years
(3) 2400 years (4) 3200 years

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- Q.20** 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 [AIPMT 2003]
(1) 1.35 g (2) 2.50 g (3) 3.70 g (4) 6.30 g

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Q.21 A sample of radioactive element containing 4×10^{16} active nuclei. Half-life of element is 10 days, then number of decayed nuclei after 30 days

[AIPMT 2002]

- (1) 0.5×10^{16} (2) 2×10^{16}
 (3) 3.5×10^{16} (4) 1×10^{16}

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Q.22 Half life of a radioactive element is 12.5 hours and its quantity is 256 g. After how much time its quantity will remain 1 g?

[AIPMT 2001]

- (1) 50 h (2) 100 h (3) 150 h (4) 200 h

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Q.23 The relation between λ and $T_{1/2}$ is ($T_{1/2} \rightarrow$ half-life)

[AIPMT 2000]

- (1) $T_{1/2} = \frac{\ln 2}{\lambda}$ (2) $T_{1/2} \ln 2 = \lambda$
 (3) $T_{1/2} = \frac{1}{\lambda}$ (4) $(\lambda + T_{1/2}) = \ln 2$

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full solution



ANSWER KEY

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	3	3	3	3	1	1	4	3	4	2	4
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	3	2	3	4	1	3	2	4	1	3	2
Ques.	23										
Ans.	1										