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PHYSICS · JEE MAIN

Nuclei

Previous Year Questions with answers

164 questions · **131** papers · **2002–2026** · newest paper first

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What is in this PDF: every Nuclei question we hold from past JEE Main and AIEEE papers, with its options and answer. Where an answer comes from a source other than the official final key, it says so next to the answer.

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Chapter at a glance

2.6%
of Physics questions, 2019–2026

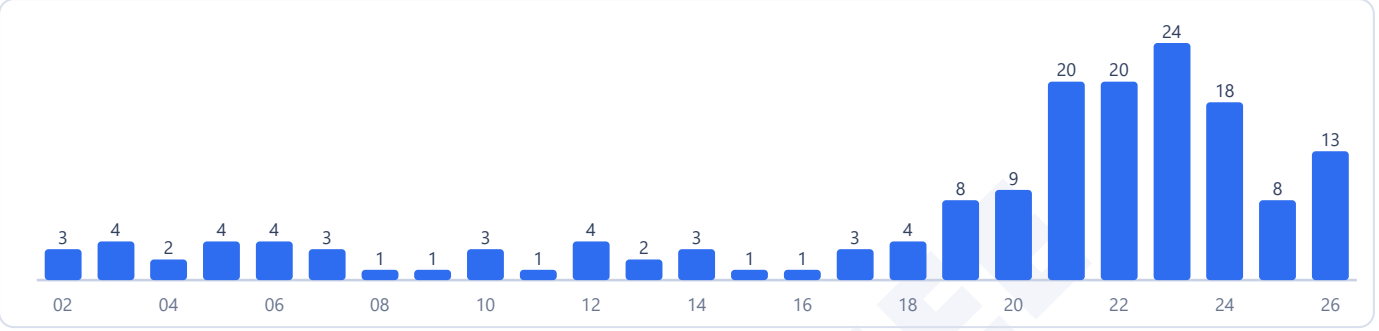
164
questions, 2002–2026

104 of 162
papers asked it, 2019–2026

137 / 27
MCQ / numerical, 2002–2026

Trend. Steady: 0.7 questions per paper in 2024–2026 against 0.8 in 2019–2023.

Questions per year



Counts are the questions we hold: 164 in 131 papers. No question in this chapter was found repeated across papers.

Most-asked topics in this chapter (2002–2026)

Radioactivity	**85**
Nuclear Structure	**50**
Nuclear Reactions	**29**

How often it comes up

Nuclei deals with nuclear binding energy and reactions under Unit 18: Atoms and Nuclei in the Class 12 curriculum, holding rank 23 among the 29 physics chapters with a 2.6 percent share of total physics questions. In the computerized exam period from 2019 to 2026, candidates solved 120 questions from nuclei across 162 papers, representing an average frequency of 0.7 questions per session. The chapter appeared in 104 of those 162 papers, and questions were featured every single year. Examining the three years from 2024 to 2026 reveals 39 questions in 58 papers, maintaining 0.7 questions per test and a 2.5 percent subject share. The chapter's share is down compared to the 2002 to 2018 window, which logged 44 questions across 38 papers for a 3.3 percent share. Measured against the full 2019 to 2026 baseline, its recent share has stayed about the same. In 2026 alone, examiners presented 13 questions across 19 papers, featured in 12 separate shifts. Exactly 27 questions from 2019 to 2026 required numerical answers, with students calculating fission yields, mass defects, and nuclear radius ratios.

Most-asked topics

The chapter distributes questions across three core subtopics:

- **Radioactivity**: 85 questions historically, with 57 asked between 2019 and 2026, tested up to 2026. This area examines exponential radioactive decay laws, half-life and mean life relations, alpha and beta decay energy splits, Q-value apportionment, and decay chain branching.
- **Nuclear Structure**: 50 total questions, including 38 from 2019 to 2026, continuing into 2026. Themes assess the nuclear radius scaling law R proportional to mass number A to the one-third power, constant nuclear density, mass defect calculations, binding energy per nucleon curves, and isobar identification.
- **Nuclear Reactions**: 29 lifetime problems, with 25 concentrated between 2019 and 2026, tested through 2026. Problems evaluate energy released in binary fusion, uranium-235 fission energy calculations, Q-value evaluations from atomic masses, and threshold reaction energies.

What the questions look like

Questions in nuclei balance conceptual binding energy evaluations with quantitative mass energy conversions:

- **Nuclear radius and area scaling**: Comparing the radii or surface areas of two nuclei whose mass numbers differ by a known factor, applying the cube root relation of atomic mass numbers.
- **Total energy released in nuclear fission**: Calculating the cumulative thermal energy liberated when a specified mass of uranium-235 undergoes complete fission, given the average energy yielded per individual event.
- **Alpha decay kinetic energy partitioning**: Two parent nuclei of differing mass numbers undergo alpha decay with identical reaction Q-values. Students use momentum conservation to compare the kinetic energies carried away by the resulting alpha particles.
- **Binding energy per nucleon curve interpretation**: Analyzing the stability of light nuclei fusing into heavier isotopes or heavy nuclei undergoing fission based on position along the binding energy curve.

How to practise it

Master the cube root scaling law for nuclear dimensions. Nuclear radius R equals R zero multiplied by mass number A to the power one-third. Because nuclear volume is directly proportional to mass number A, nuclear mass density remains approximately constant across all stable nuclei.

Be fluent with mass defect and binding energy calculations. Sum the masses of individual constituent protons and neutrons, subtract the measured nuclear mass, and convert the resulting mass defect in unified atomic mass units into mega-electronvolts.

For radioactive decay, express remaining nuclei as N zero multiplied by one-half raised to the power of the number of elapsed half-lives. In alpha decays, remember that the alpha particle receives a fraction equal to A minus four divided by A of the total reaction Q-value.

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Q1 JEE Main 2026 · 8 Apr · Shift 2 MCQ

Two radioactive substances A and B of mass numbers 200 and 212 respectively, shows spontaneous α -decay with same Q value of 1 MeV. The ratio of energies of α-rays produced by A and B is _____.

(A) $\frac{2548}{2650}$

(B) $\frac{2706}{2646}$

(C) $\frac{2597}{2600}$

(D) $\frac{2862}{2499}$

Answer: (C) $\frac{2597}{2600}$ · Official NTA final key

Q2 JEE Main 2026 · 6 Apr · Shift 1 Numerical

The energy released when $\frac{7}{17.13}$ kg of $^{7}_{3}\mathrm{Li}$ is converted into $^{4}_{2}\mathrm{He}$ by proton bombardment is $\alpha \times 10^{32}$ eV. The value of α is _____. (Nearest integer)

(Mass of $^{7}_{3}\mathrm{Li} = 7.0183$ u, mass of $^{4}_{2}\mathrm{He} = 4.004$ u, mass of proton = 1.008 u and 1 u = 931 MeV/c^2 and Avogadro number = 6.0×10^{23})

Numerical value type: the answer is a number.

Answer: 6. · Official NTA final key

Q3 JEE Main 2026 · 6 Apr · Shift 2 MCQ

The energy released if hydrogen atoms are combined to form $^{4}_{2}\mathrm{He}$ is _____ MeV.

(Take binding energies per nucleon of $^{2}_{1}\mathrm{H}$ and $^{4}_{2}\mathrm{He}$ as 1.1 MeV and 7.2 MeV, respectively)

(A) 6.1

(B) 24.4

(C) 26.6

(D) 5

Answer: (B) 24.4 · Official NTA final key

Q4 JEE Main 2026 · 5 Apr · Shift 2 MCQ

Assuming the experimental mass of $^{12}_{6}\mathrm{C}$ as 12 u, the mass defect of $^{12}_{6}\mathrm{C}$ atom is _____ MeV/c^2.

(Mass of proton = 1.00727 u, mass of neutron = 1.00866 u, 1 u = 931.5 MeV/c^2 and c is the speed of the light in vacuum).

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(A) 127.5
(B) 89.03
(C) 272.0
(D) 92.0

Answer: (B) 89.03 · Official NTA final key

Q5 JEE Main 2026 · 4 Apr · Shift 1 MCQ

Two nuclei of mass number 3 combine with another nucleus of mass number 4 to yield a nucleus of mass number 10. If the binding energy per nucleon for the mass numbers 3, 4 and 10 are 5.6 MeV, 7.4 MeV and 6.1 MeV, respectively, then in the process, $\Delta \mathrm{Mc}^2 =$ _____ MeV.

(A) 6.9
(B) 7.9
(C) 2.2
(D) 4.3

Answer: (C) 2.2 · Official NTA final key

Q6 JEE Main 2026 · 2 Apr · Shift 2 MCQ

The binding energy per nucleon of $^{209}_{83}Bi$ is _____ MeV.

[Take $\mathrm{m}\left(^{209}_{83}Bi\right) = 208.980388$ u, $\mathrm{m_p} = 1.007825$ u, $\mathrm{m_n} = 1.008665$ u, 1 u $= 931$ MeV/c^2]

(A) 7.48
(B) 7.84
(C) 8.79
(D) 6.94

Answer: (B) 7.84 · Official NTA final key

Q7 JEE Main 2026 · 28 Jan · Shift 1 MCQ

An atom $^{8}_{3}X$ is bombarded by shower of fundamental particles and in 10 s this atom absorbed 10 electrons, 10 protons and 9 neutrons. The percentage growth in the surface area of the nucleons is recorded by:

(A) 150 %
(B) 250%
(C) 900%
(D) 225%

Answer: (D) 225% · Official NTA final key

Q8 JEE Main 2026 · 28 Jan · Shift 2 MCQ

A nucleus has mass number α and radius R_α. Another nucleus has mass number β and radius R_β. If $\beta = 8\alpha$ then R_α / R_β is :

(A) 1

(B) 8

(C) 0.5

(D) 2

Answer: (C) 0.5 · Official NTA final key

Q9 JEE Main 2026 · 24 Jan · Shift 1 MCQ

Given below are two statements:

Statement I: For all elements, greater the mass of the nucleus, greater is the binding energy per nucleon.

Statement II: For all elements, nuclei with less binding energy per nucleon transforms to nuclei with greater binding energy per nucleon.

In the light of the above statements, choose the *__correct__* answer from the options given below

(A) Statement I is true but Statement II is false

(B) Both Statement I and Statement II are false

(C) Statement I is false but Statement II is true

(D) Both Statement I and Statement II are true

Answer: (C) Statement I is false but Statement II is true · Official NTA final key

Q10 JEE Main 2026 · 24 Jan · Shift 2 MCQ

The binding energy for the following nuclear reactions are expressed in MeV.

$_2\mathrm{He}^3 + {}_0\mathrm{n}^1 \rightarrow {}_2\mathrm{He}^4 + 20$ MeV

$_2\mathrm{He}^4 + {}_0\mathrm{n}^1 \rightarrow {}_2\mathrm{He}^5 - 0.9$ MeV

If X_3, X_4, X_5 denote the stability of $_2\mathrm{He}^3$, $_2\mathrm{He}^4$ and $_2\mathrm{He}^5$, respectively, then the correct order is :

(A) $\mathrm{X}_4 > \mathrm{X}_5 > \mathrm{X}_3$

(B) $\mathrm{X}_4 = \mathrm{X}_5 = \mathrm{X}_3$

(C) $\mathrm{X}_4 > \mathrm{X}_5 < \mathrm{X}_3$

(D) $\mathrm{X}_4 < \mathrm{X}_5 < \mathrm{X}_3$

Answer: (A) $\mathrm{X}_4 > \mathrm{X}_5 > \mathrm{X}_3$ · Official NTA final key

Q11 JEE Main 2026 · 23 Jan · Shift 2 MCQ

Which of the following pair of nuclei are isobars of the element?

(A) $^{236}_{92}\mathrm{U}$ and $^{238}_{92}\mathrm{U}$

(B) $^{2}_{1}\mathrm{H}$ and $^{3}_{1}\mathrm{H}$

(C) $^{3}_{1}\mathrm{H}$ and $^{3}_{2}\mathrm{He}$

(D) $^{198}_{80}\mathrm{Hg}$ and $^{197}_{79}\mathrm{Au}$

Answer: (C) $^{3}_{1}\mathrm{H}$ and $^{3}_{2}\mathrm{He}$ · Official NTA final key

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Q12 JEE Main 2026 · 23 Jan · Shift 2 Numerical

The average energy released per fission for the nucleus of $^{235}_{92}\mathrm{U}$ is 190 MeV. When all the atoms of 47 g pure $^{235}_{92}\mathrm{U}$ undergo fission process, the energy released is $\alpha \times 10^{23}$ MeV. The value of α is _____.

(Avogadro Number $= 6 \times 10^{23}$ per mole)

Numerical value type: the answer is a number.

Answer: 228. · Official NTA final key

Q13 JEE Main 2026 · 22 Jan · Shift 1 MCQ

The minimum frequency of photon required to break a particle of mass 15.348 amu into 4 α particles is _____ kHz.

[mass of He nucleus $= 4.002$ amu, 1 amu $= 1.66 \times 10^{-27}$ kg, h $= 6.6 \times 10^{-34}$ J.s and c $= 3 \times 10^{8}$ m/s]

(A) 9×10^{19}

(B) 9×10^{20}

(C) 14.94×10^{20}

(D) 14.94×10^{19}

Answer: (D) 14.94×10^{19} · Official NTA final key

Q14 JEE Main 2025 · 8 Apr · Shift 2 MCQ

For a nucleus of mass number A and radius R, the mass density of nucleus can be represented as 1.

(A) $A^{\frac{2}{3}}$

(B) $A^{\frac{1}{3}}$

(C) Independent of A

(D) A^{3}

Answer: (C) Independent of A · Key from source paper

Q15 JEE Main 2025 · 7 Apr · Shift 2 MCQ

Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : The density of the copper $\left(^{64}_{29}Cu\right)$ nucleus is greater than that of the carbon $\left(^{12}_{6}C\right)$ nucleus.

Reason (R): The nucleus of mass number A has a radius proportional to $A^{1/3}$.

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

(A) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(B) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(C) (A) is correct but (R) is not correct

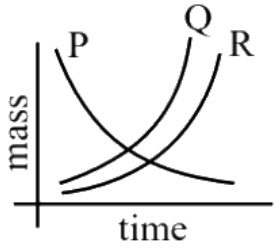
(D) (A) is not correct but (R) is correct

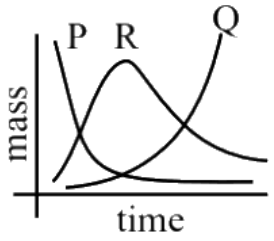
Answer: (D) (A) is not correct but (R) is correct · Key from source paper

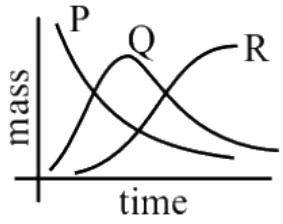
Q16 JEE Main 2025 · 4 Apr · Shift 2 MCQ

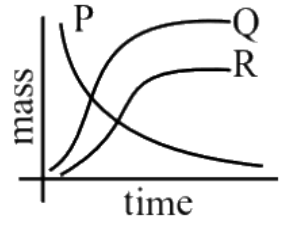
A radioactive material P first decays into Q and then Q decays to non-radioactive material R. Which of the following figure represents time dependent mass of P, Q and R ?

11. A radioactive material P first decays into Q and then Q decays to non-radioactive material R. Which of the following figure represents time dependent mass of \$P, Q\$ and R ?

(1) 

(2) 

(3) 

(4) 

(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (C) · Key from source paper

Q17 JEE Main 2025 · 3 Apr · Shift 1 MCQ

Match the LIST-I with LIST-II

List-I	List-II
A. ${}_0^1n + {}_{92}^{235}U \rightarrow {}_{54}^{140}Xe + {}_{38}^{94}Sr + 2{}_0^1n$	I. Chemical reaction
B. $H_2 + O_2 \rightarrow 2H_2O$	II. Fusion with +ve Q value
C. ${}_1^2H + {}_1^2H \rightarrow {}_2^3He + {}_0^1n$	III. Fission

D. $_1^1H + _1^3H \rightarrow _1^2H + _1^2H$ IV. Fusion with -ve Q value

Choose the correct answer from the options given below:

(A) A-III, B-I, C-IV, D-II

(B) A-II, B-I, C-III, D-IV

(C) A-III, B-I, C-II, D-IV

(D) A-II, B-I, C-IV, D-III

Answer: (C) A-III, B-I, C-II, D-IV · Key from source paper

Q18 JEE Main 2025 · 2 Apr · Shift 2 MCQ

Energy released when two deuterons $\left(_1H^2\right)$ fuse to form a helium nucleus $\left(_2He^4\right)$ is :

(Given : Binding energy per nucleon of $_1H^2 = 1.1MeV$ and binding energy per nucleon of $_2He^4 = 7.0MeV$)

(A) 5.9 MeV

(B) 26.8 MeV

(C) 8.1 MeV

(D) 23.6 MeV

Answer: (D) 23.6 MeV · Key from source paper

Q19 JEE Main 2025 · 28 Jan · Shift 1 MCQ

Choose the correct nuclear process from the below options [p: proton, n : neutron, e^-: electron, e^+: positron, v : neutrino, $\bar{v}$: antineutrino]

(A) $n \rightarrow p + e^+ + \bar{v}$

(B) $n \rightarrow p + e^+ + v$

(C) $n \rightarrow p + e^- + v$

(D) $n \rightarrow p + e^- + \bar{v}$

Answer: (D) $n \rightarrow p + e^- + \bar{v}$ · Key from source paper

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Q20 JEE Main 2025 · 23 Jan · Shift 1 MCQ

A radioactive nucleus n_2 has 3 times the decay constant as compared to the decay constant of another radioactive nucleus n_1. If initial number of both nuclei are the same, what is the ratio of number of nuclei of n_2 to the number of nuclei of n_1, after one half-life of n_1 ?

(A) 1/8

(B) 8

(C) 4

(D) 1/4

Answer: (D) 1/4 · Key from source paper

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Q21 JEE Main 2025 · 23 Jan · Shift 2 MCQ

Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A) : The binding energy per nucleon is found to be practically independent of the atomic number A, for nuclei with mass numbers between 30 and 170. Reason (R): Nuclear force is long range. In the light of the above statements, choose the correct answer from the options given below :

(A) (**A**) is true but (R) is false
(B) (A) is false but (R) is true
(C) Both (**A**) and (**R**) are true and (**R**) is the correct explanation of (**A**)
(D) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

Answer: (A) (**A**) is true but (R) is false · Key from source paper

Q22 JEE Main 2024 · 9 Apr · Shift 1 MCQ

The energy equivalent of 1 g of substance is :

(A) 5.6×10^{12}MeV
(B) 5.6×10^{26}MeV
(C) 11.2×10^{24}MeV
(D) 5.6eV

Answer: (B) 5.6×10^{26}MeV · Key from source paper

Q23 JEE Main 2024 · 9 Apr · Shift 1 Numerical

A star has 100% helium composition. It starts to convert three ^{4}He into one ^{12}C via triple alpha process as $^4\mathrm{He} + {}^4\mathrm{He} + {}^4\mathrm{He} \rightarrow {}^{12}\mathrm{C} + \mathrm{Q}$. The mass of the star is 2.0×10^{32} kg and it generates energy at the rate of 5.808×10^{30} W. The rate of converting these ^{4}He to ^{12}C is n $\times 10^{42}$ s^{-1}, where n is _____ [Take, mass of ^{4}He = 4.0026u, mass of ^{12}C = 12u]

Numerical value type: the answer is a number.

Answer: 15. · Key from source paper

Q24 JEE Main 2024 · 9 Apr · Shift 2 MCQ

The energy released in the fusion of 2 kg of hydrogen deep in the sun is E_H and the energy released in the fission of 2 kg of $^{235}\mathrm{U}$ is E_U. The ratio $\frac{E_H}{E_U}$ is approximately: (Consider the fusion reaction as $4 \mid H + 2e^- \rightarrow {}^4_2\mathrm{He} + 2v + 6\gamma + 26.7\,\mathrm{MeV}$, energy released in the fission reaction of $^{235}\mathrm{U}$ is 200MeV per fission nucleus and $\mathrm{N_A} = 6.023 \times 10^{23}$)

(A) 7.62
(B) 25.6
(C) 15.04
(D) 9.13

Answer: (A) 7.62 · Key from source paper

Q25 JEE Main 2024 · 8 Apr · Shift 1 MCQ

Binding energy of a certain nucleus is 18×10^8 J. How much is the difference between total mass of all the nucleons and nuclear mass of the given nucleus:

(A) 10μg
(B) 20μg
(C) 0.2μg
(D) 2μg

Answer: (B) 20μg · Key from source paper

Q26 JEE Main 2024 · 8 Apr · Shift 2 MCQ

If M_o is the mass of isotope $^{12}_{5}B$, M_P and M_n are the masses of proton and neutron, then nuclear binding energy of isotope is :

(A) $(M_o - 5M_p)C^2$
(B) $(5M_p + 7M_n - M_o)C^2$
(C) $(M_0 - 12M_n)C^2$
(D) $(M_o - 5M_p - 7M_n)C^2$

Answer: (B) $(5M_p + 7M_n - M_o)C^2$ · Key from source paper

Q27 JEE Main 2024 · 8 Apr · Shift 2 MCQ

In a hypothetical fission reaction $_{92}X^{236} \rightarrow {}_{56}Y^{141} + {}_{36}Z^{92} + 3R$ The identity of emitted particles (R) is :

(A) Electron
(B) Neutron
(C) γ-radiations
(D) Proton

Answer: (B) Neutron · Key from source paper

Q28 JEE Main 2024 · 5 Apr · Shift 1 Numerical

If three helium nuclei combine to form a carbon nucleus then the energy released in this reaction is _____ $\times 10^{-2}$MeV. (Given 1u = 931MeV/c^2, atomic mass of helium = 4.002603u)

Numerical value type: the answer is a number.

Answer: 727. · Key from source paper

Q29 JEE Main 2024 · 4 Apr · Shift 1 MCQ

Which of the following nuclear fragments corresponding to nuclear fission between neutron $(^1_0\mathrm{n})$ and uranium isotope $(^{235}_{92}\mathrm{U})$ is correct :

(A) $^{144}_{56}\mathrm{Ba} + ^{89}_{36}\mathrm{Kr} + 4^1_0\mathrm{n}$

(B) $^{144}_{56}\mathrm{Ba} + ^{89}_{36}\mathrm{Kr} + 3^1_0\mathrm{n}$

(C) $^{140}_{56}\mathrm{Xe} + ^{94}_{38}\mathrm{Sr} + 3^1_0\mathrm{n}$

(D) $^{153}_{51}\mathrm{Sb} + ^{99}_{41}\mathrm{Nb} + 3^1_0\mathrm{n}$

Answer: (B) $^{144}_{56}\mathrm{Ba} + ^{89}_{36}\mathrm{Kr} + 3^1_0\mathrm{n}$ · Key from source paper

Q30 JEE Main 2024 · 4 Apr · Shift 2 Numerical

The disintegration energy Q for the nuclear fission of $^{235}\mathrm{U} \rightarrow ^{140}\mathrm{Ce} + ^{94}\mathrm{Zr} + n$ is _____ MeV. Given atomic masses of $^{235}\mathrm{U}$: 235.0439u; $^{140}\mathrm{Ce}$: 139.9054u, $^{94}\mathrm{Zr}$: 93.9063u; n : 1.0086u, Value of c^2 = 931MeV/u

Numerical value type: the answer is a number.

Answer: 208. · Key from source paper

Q31 JEE Main 2024 · 1 Feb · Shift 1 Numerical

The radius of a nucleus of mass number 64 is 4.8 fermi. Then the mass number of another nucleus having radius of 4 fermi is $\frac{1000}{x}$, where x is _____.

Numerical value type: the answer is a number.

Answer: 27. · Key from source paper

Q32 JEE Main 2024 · 1 Feb · Shift 2 MCQ

From the statements given below :

(A) The angular momentum of an electron in n^{th} orbit is an integral multiple of h.

(B) Nuclear forces do not obey inverse square law.

(C) Nuclear forces are spin dependent.

(D) Nuclear forces are central and charge independent.

(E) Stability of nucleus is inversely proportional to the value of packing fraction.

Choose the correct answer from the options given below :

(A) (A), (B), (C), (D) only
(B) (A), (C), (D), (E) only
(C) (A), (B), (C), (E) only
(D) (B), (C), (D), (E) only

Answer: (C) (A), (B), (C), (E) only · Key from source paper

Q33 JEE Main 2024 · 31 Jan · Shift 1 Numerical

The mass defect in a particular reaction is 0.4 g. The amount of energy liberated is $n \times 10^7$ kW h, where $n =$ _____. (speed of light = 3×10^8 m s^{-1})

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q34 JEE Main 2024 · 31 Jan · Shift 2 MCQ

The mass number of nucleus having radius equal to half of the radius of nucleus with mass number 192 is:

(A) 24
(B) 32
(C) 40
(D) 20

Answer: (A) 24 · Key from source paper

Q35 JEE Main 2024 · 31 Jan · Shift 2 Numerical

A nucleus has mass number A_1 and volume V_1. Another nucleus has mass number A_2 and volume V_2. If relation between mass number is $A_2 = 4A_1$, then $\frac{V_2}{V_1} =$ _____.

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q36 JEE Main 2024 · 30 Jan · Shift 2 MCQ

In a nuclear fission reaction of an isotope of mass M, three similar daughter nuclei of same mass are formed. The speed of a daughter nuclei in terms of mass defect ΔM will be :

(A) $\sqrt{\frac{2c\Delta M}{M}}$
(B) $\frac{\Delta M c^2}{3}$
(C) $c\sqrt{\frac{2\Delta M}{M}}$
(D) $c\sqrt{\frac{3\Delta M}{M}}$

Answer: (C) $c\sqrt{\frac{2\Delta M}{M}}$ · Key from source paper

Q37 JEE Main 2024 · 29 Jan · Shift 1 MCQ

The explosive in a Hydrogen bomb is a mixture of $_1H^2$, $_1H^3$ and $_3Li^6$ in some condensed form. The chain reaction is given by $_3Li^6 + _0n^1 \rightarrow _2He^4 + _1H^3$; $_1H^2 + _1H^3 \rightarrow _2He^4 + _0n^1$

During the explosion the energy released is approximately [Given : $M(\text{Li}) = 6.01690$ amu, $M(_1H^2) = 2.01471$ amu, $M(_2He^4) = 4.00388$ amu and 1 amu = 931.5 MeV]

(A) 28.12 MeV
(B) 12.64 MeV
(C) 16.48 MeV
(D) 22.22 MeV

Answer: (D) 22.22 MeV · Key from source paper

Q38 JEE Main 2024 · 27 Jan · Shift 1 Numerical

In a nuclear fission process, a high mass nuclide ($A \approx 236$) with binding energy 7.6 MeV /Nucleon dissociated into two middle mass nuclides ($A \approx 118$), having binding energy of 8.6 MeV /Nucleon. The energy released in the process would be _____ MeV.

Numerical value type: the answer is a number.

Answer: 236. · Key from source paper

Q39 JEE Main 2024 · 27 Jan · Shift 2 MCQ

The atomic mass of $_6C^{12}$ is 12.000000 u and that of $_6C^{13}$ is 13.003354 u. The required energy to remove a neutron from $_6C^{13}$, if mass of neutron is 1.008665 u, will be:

(A) 62.5MeV
(B) 6.25MeV
(C) 4.95MeV
(D) 49.5MeV

Answer: (C) 4.95MeV · Key from source paper

Q40 JEE Main 2023 · 15 Apr · Shift 1 MCQ

The half-life of a radioactive nucleus is 5 years. The fraction of the original sample that would decay in 15 years is :

(A) $\frac{1}{8}$
(B) $\frac{1}{4}$
(C) $\frac{7}{8}$
(D) $\frac{3}{4}$

Answer: (C) $\frac{7}{8}$ · Key from source paper

Q41 JEE Main 2023 · 13 Apr · Shift 1 MCQ

$^{238}_{92}\mathrm{A} \rightarrow {}^{234}_{90}\mathrm{B} + {}^{4}_{2}\mathrm{D} + Q$

In the given nuclear reaction, the approximate amount of energy released will be:

[Given, mass of $^{238}_{92}\mathrm{A}$ = 238.05079 $\times$ 931.5 MeV c^{-2}, mass of $^{234}_{90}\mathrm{B}$ = 234.04363 $\times$ 931.5 MeV c^{-2}, mass of $^{4}_{2}\mathrm{D}$ = 4.00260 $\times$ 931.5 MeV c^{-2}]

(A) 3.82 MeV

(B) 5.9 MeV

(C) 2.12 MeV

(D) 4.25 MeV

Answer: (D) 4.25 MeV · Key from source paper

Q42 JEE Main 2023 · 13 Apr · Shift 2 MCQ

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R

Assertion A : The binding energy per nucleon is practically independent of the atomic number for nuclei of mass number in the range 30 to 170.

Reason R : Nuclear force is short ranged.

In the light of the above statements, choose the correct answer from the options given below

(A) A is false but R is true

(B) Both A and R are true and R is the correct explanation of A

(C) Both A and R are true but R is NOT the correct explanation of A

(D) A is true but R is false.

Answer: (B) Both A and R are true and R is the correct explanation of A · Key from source paper

Q43 JEE Main 2023 · 12 Apr · Shift 1 Numerical

A common example of alpha decay is

^{238}_{92}\mathrm{U} \rightarrow\,{}^{234}_{90}\mathrm{Th} +\, _{2}\mathrm{He}^{4} + Q

Given:

$^{238}_{92}\mathrm{U} = 238.05060$ u

$^{234}_{90}\mathrm{Th} = 234.04360$ u

$^{4}_{2}\mathrm{He} = 4.00260$ u and $1\mathrm{u} = 931.5\ \frac{\mathrm{MeV}}{c^2}$

The energy released (Q) during the alpha decay of $^{238}_{92}\mathrm{U}$ is _____ MeV.

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q44 JEE Main 2023 · 11 Apr · Shift 1 MCQ

Two radioactive elements A and B initially have same number of atoms. The half life of A is same as the average life of B. If λ_A and λ_B are decay constants of A and B respectively, then choose the correct relation from the given options.

(A) $\lambda_A \ln 2 = \lambda_B$
(B) $\lambda_A = \lambda_B$
(C) $\lambda_A = \lambda_B \ln 2$
(D) $\lambda_A = 2\lambda_B$

Answer: (C) $\lambda_A = \lambda_B \ln 2$ · Key from source paper

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Q45 JEE Main 2023 · 11 Apr · Shift 2 Numerical

A nucleus disintegrates into two nuclear parts, in such a way that ratio of their nuclear sizes is $1 : 2^{1/3}$. Their respective speed have a ratio of $n : 1$. The value of n is _____

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q46 JEE Main 2023 · 10 Apr · Shift 1 Numerical

The decay constant for a radioactive nuclide is $1.5 \times 10^{-5}\ \mathrm{s}^{-1}$. Atomic weight of the substance is $60\ \mathrm{g\,mole}^{-1}$, $N_A = 6 \times 10^{23}$. The activity of $1.0\ \mu\mathrm{g}$ of the substance is _____ $\times 10^{10}$ Bq.

Numerical value type: the answer is a number.

Answer: 15. · Key from source paper

Q47 JEE Main 2023 · 10 Apr · Shift 2 MCQ

The half life of a radioactive substance is T. The time taken, for disintegrating $\frac{7}{8}^{th}$ part of its original mass will be:

(A) $2T$
(B) $3T$
(C) T
(D) $8T$

Answer: (B) $3T$ · Key from source paper

Q48 JEE Main 2023 · 8 Apr · Shift 1 MCQ

For a nucleus ${}^{A}_{Z}X$ having mass number A and atomic number Z
A. The surface energy per nucleon $(b_s) = -a_1 A^{\frac{2}{3}}$.
B. The Coulomb contribution to the binding energy $\mathrm{b_c} = -\mathrm{a_2}\frac{Z(Z-1)}{A^{\frac{4}{3}}}$.
C. The volume energy $b_v = a_3 A$
D. Decrease in the binding energy is proportional to surface area.
E. While estimating the surface energy, it is assumed that each nucleon interacts with 12 nucleons. (a_1, a_2 and a_3 are constants)
Choose the most appropriate answer from the options given below:

(A) B, C, E only
(B) C, D only
(C) A, B, C, D only
(D) B, C only

Answer: (B) C, D only · Key from source paper

Q49 JEE Main 2023 · 8 Apr · Shift 1 Numerical

A nucleus with mass number 242 and binding energy per nucleon as $7.6\ \mathrm{MeV}$ breaks into two fragment each with mass number 121. If each fragment nucleus has binding energy per nucleon as $8.1\ \mathrm{MeV}$, the total gain in binding energy is _____ MeV.

Numerical value type: the answer is a number.

Answer: 121. · Key from source paper

Q50 JEE Main 2023 · 8 Apr · Shift 2 MCQ

A radio active material is reduced to $\frac{1}{8}$ of its original amount in 3 days. If $8 \times 10^{-3}\ \mathrm{kg}$ of the material is left after 5 days the initial amount of the material is

(A) $40\ \mathrm{g}$
(B) $32\ \mathrm{g}$
(C) $64\ \mathrm{g}$
(D) $256\ \mathrm{g}$

Answer: (D) $256\ \mathrm{g}$ · Key from source paper

Q51 JEE Main 2023 · 1 Feb · Shift 1 MCQ

The mass of proton, neutron and helium nucleus are respectively 1.0073 u, 1.0087 u and 4.0015u. The binding energy of helium nucleus is:

(A) 14.2 MeV
(B) 28.4 MeV
(C) 56.8 MeV
(D) 7.1 MeV

Answer: (B) 28.4 MeV · Key from source paper

Q52 JEE Main 2023 · 1 Feb · Shift 2 Numerical

Nucleus A having Z = 17 and equal number of protons and neutrons has 1.2 MeV binding energy per nucleon. Another nucleus B of Z = 12 has total 26 nucleons and 1.8 MeV binding energy per nucleons. The difference of binding energy of B and A will be _____ MeV.

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Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

Q53 JEE Main 2023 · 31 Jan · Shift 1 MCQ

A free neutron decays into a proton but a free proton does not decay into neutron. This is because

(A) neutron is an uncharged particle
(B) proton is a charged particle
(C) neutron is a composite particle made of a proton and an electron
(D) neutron has larger rest mass than proton

Answer: (D) neutron has larger rest mass than proton · Key from source paper

Q54 JEE Main 2023 · 30 Jan · Shift 2 MCQ

Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R

Assertion A : The nuclear density of nuclides ${}^{10}_{5}B$, ${}^{6}_{3}Li$, ${}^{56}_{26}Fe$, ${}^{20}_{10}Ne$ and ${}^{209}_{83}Bi$ can be arranged as $\rho^N_{Bi} > \rho^N_{Fe} > \rho^N_{Ne} > \rho^N_B > \rho^N_{Li}$.

Reason R : The radius R of nucleus is related to its mass number A as $R = R_0 A^{\frac{1}{3}}$, where R_0 is a constant.

In the light of the above statement, choose the correct answer from the options given below :

(A) Both A and R are true and R is the correct explanation of A
(B) A is false but R is true
(C) A is true but R is false
(D) Both A and R are true but R is NOT the correct explanation of A

Answer: (B) A is false but R is true · Key from source paper

Q55 JEE Main 2023 · 30 Jan · Shift 2 Numerical

A radioactive nucleus decays by two different process. The half life of the first process is 5 minutes and that of the second process is 30 s. The effective half-life of the nucleus is calculated to be $\frac{\alpha}{11}$ s. The value of α is _____.

Numerical value type: the answer is a number.

Answer: 300. · Key from source paper

Q56 JEE Main 2023 · 29 Jan · Shift 1 MCQ

If a radioactive element having half-life of $30\ \text{min}$ is undergoing beta decay, the fraction of radioactive element remains undecayed after $90\ \text{min}$ will be :

(A) $\frac{1}{8}$
(B) $\frac{1}{16}$
(C) $\frac{1}{4}$
(D) $\frac{1}{2}$

Answer: (A) $\frac{1}{8}$ · Key from source paper

Q57 JEE Main 2023 · 29 Jan · Shift 1 Numerical

A radioactive element $^{242}_{92}\mathrm{X}$ emits two α-particles, one electron and two positrons. The product nucleus is represented by $^{234}_{\mathrm{P}}\mathrm{Y}$. The value of P is _____.

Numerical value type: the answer is a number.

Answer: 87. · Key from source paper

Q58 JEE Main 2023 · 29 Jan · Shift 2 MCQ

Substance A has atomic mass number 16 and half life of 1 day. Another substance B has atomic mass number 32 and half life of $\frac{1}{2}$ day. If both A and B simultaneously start undergo radio activity at the same time with initial mass 320 g each, how many total atoms of A and B combined would be left after 2 days

(A) 3.38×10^{24}
(B) 6.76×10^{24}
(C) 6.76×10^{23}
(D) 1.69×10^{24}

Answer: (A) 3.38×10^{24} · Key from source paper

Q59 JEE Main 2023 · 25 Jan · Shift 1 MCQ

The ratio of the density of oxygen nucleus $\left(^{16}_{8}\mathrm{O}\right)$ and helium nucleus $\left(^{4}_{2}\mathrm{He}\right)$ is

(A) 4 : 1
(B) 8 : 1
(C) 1 : 1
(D) 2 : 1

Answer: (C) 1 : 1 · Key from source paper

Q60 JEE Main 2023 · 25 Jan · Shift 2 Numerical

A nucleus disintegrates into two smaller parts, which have their velocities in the ratio 3 : 2. The ratio of their nuclear sizes will be $\left(\frac{x}{3}\right)^{\frac{1}{3}}$. The value of 'x' is:

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

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Q61 JEE Main 2023 · 24 Jan · Shift 1 MCQ

Consider the following radioactive decay process:

$${}^{218}_{84}A \xrightarrow{\alpha} A_1 \xrightarrow{\beta^-} A_2 \xrightarrow{\gamma} A_3 \xrightarrow{\alpha} A_4 \xrightarrow{\beta^+} A_5 \xrightarrow{\gamma} A_6$$

The mass number and the atomic number of A_6 are given by:

(A) 210 and 82
(B) 210 and 84
(C) 210 and 80
(D) 211 and 80

Answer: (C) 210 and 80 · Key from source paper

Q62 JEE Main 2023 · 24 Jan · Shift 1 Numerical

Assume that protons and neutrons have equal masses. Mass of a nucleon is 1.6×10^{-27} kg and radius of nucleus is $1.5 \times 10^{-15} A^{\frac{1}{3}}$ m. The approximate ratio of the nuclear density and water density is $n \times 10^{13}$. The value of n is _____.

Numerical value type: the answer is a number.

Answer: 11. · Key from source paper

Q63 JEE Main 2023 · 24 Jan · Shift 2 Numerical

The energy released per fission of nucleus of $^{240}\mathrm{X}$ is 200 MeV. The energy released if all the atoms in 120 g of pure $^{240}\mathrm{X}$ undergo fission is _____$\times 10^{25}$ MeV.

(Given $N_A = 6 \times 10^{23}$)

Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

Q64 JEE Main 2022 · 29 Jul · Shift 2 MCQ

Read the following statements:
(A) Volume of the nucleus is directly proportional to the mass number.
(B) Volume of the nucleus is independent of mass number.
(C) Density of the nucleus is directly proportional to the mass number.
(D) Density of the nucleus is directly proportional to the cube root of the mass number.
(E) Density of the nucleus is independent of the mass number.
Choose the correct option from the following options.

(A) (A) and (D) only.
(B) (A) and (E) only.
(C) (B) and (E) only.
(D) (A) and (C) only

Answer: (B) (A) and (E) only. · Key from source paper

Q65 JEE Main 2022 · 29 Jul · Shift 2 Numerical

Two radioactive materials A and B have decay constants 25λ and 16λ respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of B to that of A will be "e" after a time $\frac{1}{a\lambda}$. The value of a is _____.

Numerical value type: the answer is a number.

Answer: 9. · Key from source paper

Q66 JEE Main 2022 · 28 Jul · Shift 1 MCQ

The half life period of a radioactive substance is 60 days. The time taken for $\frac{7}{8}$th of its original mass to disintegrate will be :

(A) 120 days
(B) 130 days
(C) 180 days
(D) 20 days

Answer: (C) 180 days · Key from source paper

Q67 JEE Main 2022 · 28 Jul · Shift 1 Numerical

A freshly prepared radioactive source of half life 2 hours 30 minutes emits radiation which is 64 times the permissible safe level. The minimum time, after which it would be possible to work safely with source, will be _____ hours.

Numerical value type: the answer is a number.

Answer: 15. · Key from source paper

Q68 JEE Main 2022 · 28 Jul · Shift 2 MCQ

A radioactive sample decays $\frac{7}{8}$ times its original quantity in 15 minutes. The half-life of the sample is

(A) 5 min
(B) 7.5 min
(C) 15 min
(D) 30 min

Answer: (A) 5 min · Key from source paper

EdLoop JEE

Q69 JEE Main 2022 · 27 Jul · Shift 1 MCQ

What is the half-life period of a radioactive material if its activity drops to $\frac{1}{16^{\text{th}}}$ of its initial value of 30 years ?

(A) 9.5 years
(B) 8.5 years
(C) 7.5 years
(D) 10.5 years

Answer: (C) 7.5 years · Key from source paper

Q70 JEE Main 2022 · 27 Jul · Shift 2 MCQ

The activity of a radioactive material is 6.4×10^{-4} curie. Its half life is 5 days. The activity will become 5×10^{-6} curie after

(A) 7 days
(B) 15 days
(C) 25 days
(D) 35 days

Answer: (D) 35 days · Key from source paper

Q71 JEE Main 2022 · 26 Jul · Shift 1 MCQ

The disintegration rate of a certain radioactive sample at any instant is 4250 disintegrations per minute. 10 minutes later, the rate becomes 2250 disintegrations per minute. The approximate decay constant is
(Take $\log_e 1.88 = 0.63$)

(A) $0.02\ \text{min}^{-1}$
(B) $2.7\ \text{min}^{-1}$
(C) $0.063\ \text{min}^{-1}$
(D) $6.3\ \text{min}^{-1}$

Answer: (C) $0.063\ \text{min}^{-1}$ · Key from source paper

Q72 JEE Main 2022 · 26 Jul · Shift 2 MCQ

Mass numbers of two nuclei are in the ratio of $4 : 3$. Their nuclear densities will be in the ratio of

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(A) $4:3$
(B) $\frac{3}{4}^{\frac{1}{3}}$
(C) $1:1$
(D) $\frac{4}{3}^{\frac{1}{3}}$

Answer: (C) $1:1$ · Key from source paper

Q73 JEE Main 2022 · 26 Jul · Shift 2 Numerical

Two lighter nuclei combine to form a comparatively heavier nucleus by the relation given below:
${}_1^2X + {}_1^2X = {}_2^4Y$
The binding energies per nucleon of ${}_1^2X$ and ${}_2^4Y$ are 1.1MeV and 7.6MeV respectively. The energy released in this process is _____ MeV.

Numerical value type: the answer is a number.

Answer: 26. · Key from source paper

Q74 JEE Main 2022 · 29 Jun · Shift 1 MCQ

The activity of a radioactive material is 2.56×10^{-3} Ci. If the half life of the material is 5 days, after how many days the activity will become 2×10^{-5} Ci?

(A) 30 days
(B) 35 days
(C) 40 days
(D) 25 days

Answer: (B) 35 days · Key from source paper

Q75 JEE Main 2022 · 29 Jun · Shift 2 MCQ

In the following nuclear reaction,
$D \xrightarrow{\alpha} D_1 \xrightarrow{\beta^-} D_2 \xrightarrow{\alpha} D_3 \xrightarrow{\gamma} D_4$
Mass number of D is 182 and atomic number is 74 . Mass number and atomic number of D_4 respectively will be

(A) 174 and 71
(B) 174 and 69
(C) 172 and 69
(D) 172 and 71

Answer: (A) 174 and 71 · Key from source paper

Q76 JEE Main 2022 · 29 Jun · Shift 2 Numerical

The half life of a radioactive substance is 5 years. After x years a given sample of the radioactive substance gets reduced to 6.25% of its initial value. The value of x is _____

Numerical value type: the answer is a number.

Answer: 20. · Key from source paper

Q77 JEE Main 2022 · 28 Jun · Shift 1 MCQ

The Q-value of a nuclear reaction and kinetic energy of the projectile particle, K_p are related as

(A) $Q = K_p$
(B) $(K_p + Q) < 0$
(C) $Q < K_p$
(D) $(K_p + Q) > 0$

Answer: (D) $(K_p + Q) > 0$ · Key from source paper

Q78 JEE Main 2022 · 28 Jun · Shift 2 MCQ

Following statements related to radioactivity are given below :
(A) Radioactivity is a random and spontaneous process and is dependent on physical and chemical conditions.
(B) The number of undecayed nuclei in the radioactive sample decays exponentially with time.
(C) Slope of the graph of $\log_e$ (no. of undecayed nuclei) vs. time represents the reciprocal of mean life time (τ)
(D) Product of decay constant (λ) and half-life time $\left(T_{\frac{1}{2}}\right)$ is not constant.
Choose the most appropriate answer from the options given below:

(A) (A) and (B) only
(B) (B) and (D) only
(C) (B) and (C) only
(D) (C) and (D) only

Answer: (C) (B) and (C) only · Key from source paper

Q79 JEE Main 2022 · 26 Jun · Shift 1 MCQ

How many alpha and beta particles are emitted when Uranium ${}_{92}\mathrm{U}^{238}$ decays to lead ${}_{82}\mathrm{Pb}^{206}$?

(A) 3 alpha particles and 5 beta particles
(B) 6 alpha particles and 4 beta particles
(C) 4 alpha particles and 5 beta particles
(D) 8 alpha particles and 6 beta particles

Answer: (D) 8 alpha particles and 6 beta particles · Key from source paper

Q80 JEE Main 2022 · 26 Jun · Shift 2 MCQ

A radioactive nucleus can decay by two different processes. Half-life for the first process is 3.0 hours while it is 4.5 hours for the second process. The effective halflife of the nucleus will be

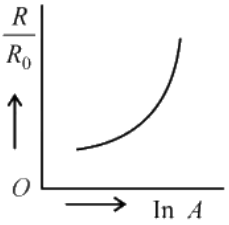
(A) 3.75 hours
(B) 0.56 hours
(C) 0.26 hours
(D) 1.80 hours

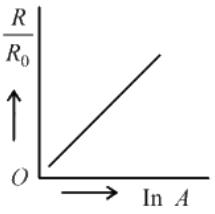
Answer: (D) 1.80 hours · Key from source paper

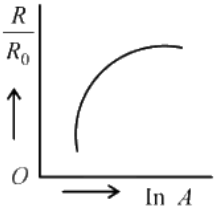
Q81 JEE Main 2022 · 25 Jun · Shift 2 MCQ

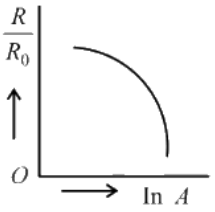
Which of the following figure represents the variation of $\ln \frac{R}{R_0}$ with $\ln A$ (if $R =$ radius of a nucleus and $A =$ its mass number)

Q18. Which of the following figure represents the variation of $\ln\frac{R}{R_0}$ with $\ln A$ (if $R =$ radius of a nucleus and $A =$ its mass number)

(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (B) · Key from source paper

Q82 JEE Main 2022 · 24 Jun · Shift 1 MCQ

Nucleus A is having mass number 220 and its binding energy per nucleon is 5.6 MeV. It splits in two fragments B and C of mass numbers 105 and 115. The binding energy of nucleons in B and C is 6.4 MeV per nucleon. The energy Q released per fission will be:

(A) 0.8 MeV
(B) 275 MeV
(C) 220 MeV
(D) 176 MeV

Answer: (D) 176 MeV · Key from source paper

Q83 JEE Main 2022 · 24 Jun · Shift 2 Numerical

A sample contains 10^{-2} kg each of two substances A and B with half lives 4 s and 8 s respectively. The ratio of their atomic weights is $1:2$. The ratio of the amounts of A and B after 16 s is $\frac{x}{100}$. The value of x is _____ .

Numerical value type: the answer is a number.

Accepted answers: 25 or 50. · Key from source paper

Q84 JEE Main 2021 · 1 Sep · Shift 2 MCQ

The half life period of a radioactive element x is same as the mean life time of another radioactive element y. Initially they have the same number of atoms. Then:

(A) x and y decay at the same rate always.

(B) x-will decay faster than y.

(C) y-will decay faster than x.

(D) x and y have same decay rate initially and later on different decay rate.

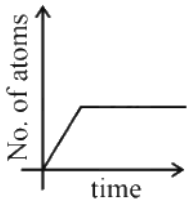
Answer: (C) y-will decay faster than x. · Key from source paper

Q85 JEE Main 2021 · 31 Aug · Shift 1 MCQ

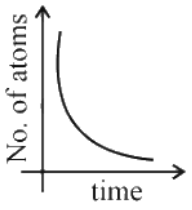
A sample of a radioactive nucleus A disintegrates to another radioactive nucleus B, which in turn disintegrates to some other stable nucleus C. Plot of a graph showing the variation of number of atoms of nucleus B vesus time is : (Assume that at $t = 0$, there are no B atoms in the sample)

Q18. A sample of a radioactive nucleus A disintegrates to another radioactive nucleus B, which in turn disintegrates to some other stable nucleus C. Plot of a graph showing the variation of number of atoms of nucleus B vesus time is : (Assume that at $t = 0$, there are no B atoms in the sample)

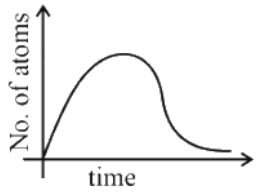
(1)



(2)



(3)



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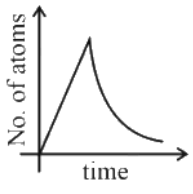

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (C) · Key from source paper

Q86 JEE Main 2021 · 27 Aug · Shift 1 MCQ

There are 10^{10} radioactive nuclei in a given radioactive element. Its half-life time is 1 min. How many nuclei will remain after 30 s? ($\sqrt{2} = 1.414$)

(A) 7×10^9
(B) 10^5
(C) 2×10^{10}
(D) 4×10^{10}

Answer: (A) 7×10^9 · Key from source paper

Q87 JEE Main 2021 · 26 Aug · Shift 2 MCQ

At time $t = 0$, a material is composed of two radioactive atoms A and B, where $N_A(0) = 2N_B(0)$ The decay constant of both kind of radioactive atoms is λ. However, A disintegrates to B and B disintegrates to C. Which of the following figures represents the evolution of $\frac{N_B(t)}{N_B(0)}$ with respect to time t?

(see the figure above)

Q18. At time $t = 0$, a material is composed of two radioactive atoms A and B, where $N_A(0) = 2N_B(0)$ The decay constant of both kind of radioactive atoms is λ. However, A disintegrates to B and B disintegrates to C. Which of the following figures represents the evolution of $\frac{N_B(t)}{N_B(0)}$ with respect to time t?

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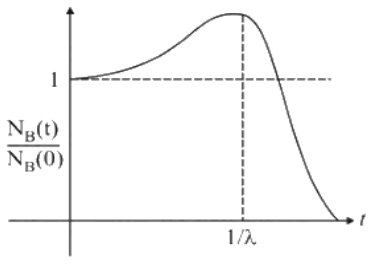

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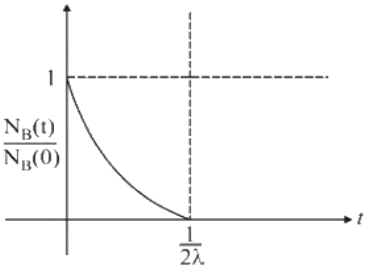

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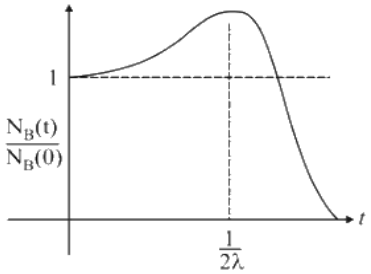

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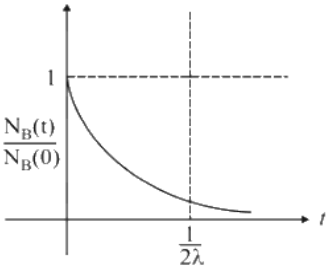

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (C) · Key from source paper

Q88 JEE Main 2021 · 27 Jul · Shift 1 MCQ

If f denotes the ratio of the number of nuclei decayed (N_d) to the number of nuclei at $t = 0$, (N_0) then for a collection of radioactive nuclei, the rate of change of f with respect to time is given as: [λ is the radioactive decay constant]

(A) $-\lambda\left(1 - e^{-\lambda t}\right)$
(B) $\lambda\left(1 - \mathrm{e}^{-\lambda t}\right)$
(C) $\lambda \mathrm{e}^{-\lambda t}$
(D) $-\lambda \mathrm{e}^{-\lambda t}$

Answer: (C) $\lambda \mathrm{e}^{-\lambda t}$ · Key from source paper

Q89 JEE Main 2021 · 27 Jul · Shift 2 MCQ

Consider the following statements:
A. Atoms of each element emit characteristics spectrum.
B. According to Bohr's Postulate, an electron in a hydrogen atom revolves in a certain stationary orbit.
C. The density of nuclear matter depends on the size of the nucleus.
D. A free neutron is stable but a free proton decay is possible.
E. Radioactivity is an indication of the instability of nuclei. Choose the correct answer from the options given below.

(A) A, B, C, D and E
(B) A, B and E only.
(C) B and D only
(D) A, C and E only

Answer: (B) A, B and E only. · Key from source paper

Q90 JEE Main 2021 · 25 Jul · Shift 1 MCQ

Some nuclei of a radioactive material are undergoing radioactive decay. The time gap between the instances when a quarter of the nuclei have decayed and when half of the nuclei have decayed is given as: (where λ is the decay constant)

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(A) $\frac{1}{2}\frac{\ln 2}{\lambda}$
(B) $\frac{\ln 2}{\lambda}$
(C) $\frac{2\ln 2}{\lambda}$
(D) $\frac{\ln \frac{3}{2}}{\lambda}$

Answer: (D) $\frac{\ln \frac{3}{2}}{\lambda}$ · Key from source paper

Q91 JEE Main 2021 · 25 Jul · Shift 1 MCQ

The half-life of $^{198}\mathrm{Au}$ is 3 days. If atomic weight of $^{198}\mathrm{Au}$ is $198\ \mathrm{g\ mol^{-1}}$, then the activity of $2\ \mathrm{mg}$ of $^{198}\mathrm{Au}$ is [in disintegration $\mathrm{second^{-1}}$]:

(A) 2.67×10^{12}
(B) 6.06×10^{18}
(C) 32.36×10^{12}
(D) 16.18×10^{12}

Answer: (D) 16.18×10^{12} · Key from source paper

Q92 JEE Main 2021 · 25 Jul · Shift 2 Numerical

From the given data, the amount of energy required to break the nucleus of aluminium $^{27}_{13}\mathrm{Al}$ is _____ $x \times 10^{-3}$ J

Mass of neutron $= 1.00866$ u
Mass of proton $= 1.00726$ u
Mass of Aluminium nucleus $= 27.18846$ u
(Assume 1 u corresponds to x J of energy)
(Round off to the nearest integer)

Numerical value type: the answer is a number.

Answer: 27. · Key from source paper

Q93 JEE Main 2021 · 25 Jul · Shift 2 Numerical

The nuclear activity of a radioactive element becomes $\left(\frac{1}{8}\right)^{\text{th}}$ of its initial value in 30 years. The half-life of radioactive element is _____ years.

Numerical value type: the answer is a number.

Answer: 10. · Key from source paper

Q94 JEE Main 2021 · 22 Jul · Shift 1 MCQ

A nucleus with mass number 184 initially at rest emits an α-particle. If the Q value of the reaction is $5.5\ \mathrm{MeV}$, calculate the kinetic energy of the $\alpha-$ particle.

(A) $5.0\ \text{MeV}$
(B) $5.5\ \text{MeV}$
(C) $0.12\ \text{MeV}$
(D) $5.38\ \text{MeV}$

Answer: (D) $5.38\ \text{MeV}$ · Key from source paper

Q95 JEE Main 2021 · 20 Jul · Shift 1 MCQ

A radioactive material decays by simultaneous emissions of two particles with half lives of 1400 years and 700 years, respectively. What will be the time after the which one third of the material remains ? (Take $\ln 3 = 1.1$)

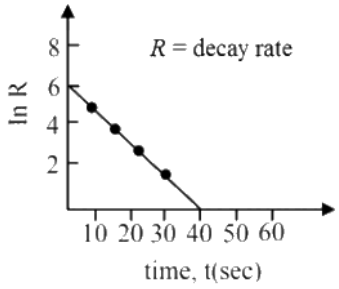
(A) 1110 years
(B) 700 years
(C) 340 years
(D) 740 years

Answer: (D) 740 years · Key from source paper

Q96 JEE Main 2021 · 20 Jul · Shift 2 MCQ

For a certain radioactive process, the graph between $\ln R$ and t(sec) is obtained as shown in the figure. Then the value of half life for the unknown radioactive material is approximately:
(see the figure above)

Q20. For a certain radioactive process, the graph between $\ln R$ and $t(\text{sec})$ is obtained as shown in the figure. Then the value of half life for the unknown radioactive material is approximately:



(1) 9.15 sec
(2) 6.93 sec
(3) 2.62 sec
(4) 4.62 sec

(A) 9.15 sec
(B) 6.93 sec
(C) 2.62 sec
(D) 4.62 sec

Answer: (D) 4.62 sec · Key from source paper

Q97 JEE Main 2021 · 20 Jul · Shift 2 Numerical

A radioactive substance decays to $\left(\frac{1}{16}\right)^{\text{th}}$ of its initial activity in 80 days. The half life of the radioactive substance expressed in days is _____ .

Numerical value type: the answer is a number.

Answer: 20. · Key from source paper

Q98 JEE Main 2021 · 18 Mar · Shift 1 MCQ

A radioactive sample disintegrates via two independent decay processes having half lives $T_{1/2}^{(1)}$ and $T_{1/2}^{(2)}$ respectively. The effective half- life $T_{1/2}$ of the nuclei is :-

(A) $T_{1/2} = \frac{T_{1/2}^{(1)} + T_{1/2}^{(2)}}{T_{1/2}^{(1)} - T_{1/2}^{(2)}}$

(B) $T_{1/2} = T_{1/2}^{(1)} + T_{1/2}^{(2)}$

(C) $T_{1/2} = \frac{T_{1/2}^{(1)} T_{1/2}^{(2)}}{T_{1/2}^{(1)} + T_{1/2}^{(2)}}$

(D) None of the above

Answer: (C) $T_{1/2} = \frac{T_{1/2}^{(1)} T_{1/2}^{(2)}}{T_{1/2}^{(1)} + T_{1/2}^{(2)}}$ · Key from source paper

Q99 JEE Main 2021 · 18 Mar · Shift 2 MCQ

The decay of a proton to neutron is :

(A) not possible as proton mass is less than the neutron mass

(B) possible only inside the nucleus

(C) not possible but neutron to proton conversion is possible

(D) always possible as it is associated only with β^+ decay

Answer: (B) possible only inside the nucleus · Key from source paper

Q100 JEE Main 2021 · 16 Mar · Shift 2 MCQ

The half-life of Au^{198} is 2.7 days. The activity of $1.50\ \mathrm{mg}$ of Au^{198}, if its atomic weight is $198\ \mathrm{g\ mol}^{-1}$ is, $(N_A = 6 \times 10^{23}\ \mathrm{mol}^{-1})$

(A) $240\ \mathrm{Ci}$

(B) $357\ \mathrm{Ci}$

(C) $535\ \mathrm{Ci}$

(D) $252\ \mathrm{Ci}$

Answer: (B) $357\ \mathrm{Ci}$ · Key from source paper

Q101 JEE Main 2021 · 16 Mar · Shift 2 MCQ

Calculate the time interval between 33% decay and 67% decay if half-life of a substance is $20\ \mathrm{min}$.

(A) $60\ \text{min}$
(B) $20\ \text{min}$
(C) $40\ \text{min}$
(D) $13\ \text{min}$

Answer: (B) $20\ \text{min}$ · Key from source paper

Q102 JEE Main 2021 · 26 Feb · Shift 2 MCQ

A radioactive sample is undergoing α decay, At any time t_1, its activity is A and another time t_2, the activity is $\frac{A}{5}$. What is the average life time for the sample ?

(A) $\frac{\ln 5}{t_2 - t_1}$
(B) $\frac{\ln(t_2+t_1)}{2}$
(C) $\frac{t_2-t_1}{\ln 5}$
(D) $\frac{t_1-t_2}{\ln 5}$

Answer: (C) $\frac{t_2-t_1}{\ln 5}$ · Key from source paper

Q103 JEE Main 2021 · 25 Feb · Shift 1 MCQ

Two radioactive substances X and Y originally have N_1 and N_2 nuclei respectively. Half life of X is half of the half life of Y. After three half lives of Y, number of nuclei of both are equal. The ratio $\frac{N_1}{N_2}$ will be equal to :

(A) $\frac{1}{3}$
(B) $\frac{8}{1}$
(C) $\frac{3}{1}$
(D) $\frac{1}{8}$

Answer: (B) $\frac{8}{1}$ · Key from source paper

Q104 JEE Main 2020 · 6 Sep · Shift 1 MCQ

You are given that $^{7}_{3}\text{Li} = 7.0160\text{u}$,Mass of Mass of $^{4}_{2}\text{He} = 4.0026\text{u}$ and Mass of $^{1}_{1}\text{He} = 1.0079\text{H}$ When 20g of $^{7}_{3}\text{Li}$ is converted into $^{4}_{2}$ He by proton capture, the energy liberated, (in kWh), is : [Mass of nucleon $= 1\ \text{GeV}/c^2$]

(A) 4.5×10^5
(B) 8×10^6
(C) 6.82×10^5
(D) 1.33×10^6

Answer: (D) 1.33×10^6 · Key from source paper

Q105 JEE Main 2020 · 6 Sep · Shift 2 MCQ

Given the masses of various atomic particles $m_P = 1,0072$ u, $m_n = 1,0087$ u, $m_e = 0.000548$ u, $m_{\overline{\nu}} = 0$, $m_d = 2.0141$ u, where p =proton, n ≡neutron, e ≡electron, $\overline{\nu}$ ≡antineutrino and $\overline{d} \equiv$ deuteron. Which of the following process is allowed by momentum and energy conservation :

(A) $n + n \rightarrow$ deuterium atom (electron bound to the nucleus)

(B) $p \rightarrow n + e^+ + \overline{\nu}$

(C) $n + p \rightarrow d + \gamma$

(D) $e^+ + e^- \rightarrow \gamma$

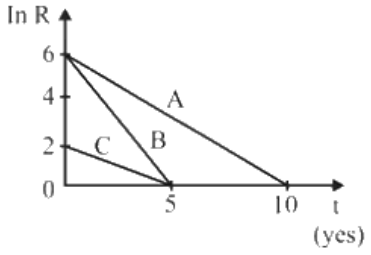
Answer: (C) $n + p \rightarrow d + \gamma$ · Key from source paper

Q106 JEE Main 2020 · 5 Sep · Shift 1 MCQ

Activities of three radioactive substances A, B and C are represented by the curves A, B and C, in the figure. Then their half-lives $T_{\frac{1}{2}}(A) : T_{\frac{1}{2}}(B) : T_{\frac{1}{2}}(C)$ are in the ratio:

(see the figure above)

Q19. Activities of three radioactive substances A, B and C are represented by the curves A, B and C, in the figure. Then their half-lives $T_{\frac{1}{2}}(A) : T_{\frac{1}{2}}(B) : T_{\frac{1}{2}}(C)$ are in the ratio:



(1) 2 : 1 : 1 (2) 3 : 2 : 1

(3) 2 : 1 : 3 (4) 4 : 3 : 1

(A) 2 : 1 : 1

(B) 3 : 2 : 1

(C) 2 : 1 : 3

(D) 4 : 3 : 1

Answer: (C) 2 : 1 : 3 · Key from source paper

Q107 JEE Main 2020 · 5 Sep · Shift 2 MCQ

A radioactive nucleus decays by two different processes. The half-life for the first process is 10 s and that for the second is 100 s. The effective half-life of the nucleus is close to:

(A) 9 s
(B) 6 s
(C) 55 s
(D) 12 s

Answer: (A) 9 s · Key from source paper

Q108 JEE Main 2020 · 4 Sep · Shift 2 MCQ

Find the Binding energy per nucleon for $^{120}_{50}\mathrm{Sn}$. Mass of proton $m_p = 1.00783\ U$, mass of neutron $m_n = 1.00867\ U$ and mass of tin nucleus $m_{\mathrm{sn}} = 119.902199\ U$. (take $1U\ =\ 931\ MeV$)

(A) $7.5\ MeV$
(B) $9.0 MeV$
(C) $8.0 MeV$
(D) $8.5\ MeV$

Answer: (D) $8.5\ MeV$ · Key from source paper

Q109 JEE Main 2020 · 3 Sep · Shift 1 MCQ

In a radioactive material, a fraction of active material remaining after the time t is $\frac{9}{16}$. The fraction that was remaining after the time $\frac{t}{2}$ is :

(A) $\frac{4}{5}$
(B) $\frac{3}{5}$
(C) $\frac{3}{4}$
(D) $\frac{7}{8}$

Answer: (C) $\frac{3}{4}$ · Key from source paper

Q110 JEE Main 2020 · 3 Sep · Shift 2 MCQ

The radius R of a nucleus of mass number A can be estimated by the formula $R = (1.3 \times 10^{-15})A^{1/3}\mathrm{m}$. It follows that the mass density of n nucleus is of the order of: $(M_{prot} \cong M_{neut} \simeq 1.67 \times 10^{-27}\ \mathrm{kg})$

(A) $10^{3}\ \mathrm{kg\,m^{-3}}$
(B) $10^{10}\ \mathrm{kg\,m^{-3}}$
(C) $10^{24}\ \mathrm{kg\,m^{-3}}$
(D) $10^{17}\ \mathrm{kg\,m^{-3}}$

Answer: (D) $10^{17}\ \mathrm{kg\,m^{-3}}$ · Key from source paper

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Q111 JEE Main 2020 · 2 Sep · Shift 1 MCQ

In a reactor, 2 kg of $_{92}\mathrm{U}^{235}$ fuel is fully used up in 30 days. The energy released fission is 200 MeV. Given that the Avogadro number, $\mathrm{N} = 6.023 \times 10^{26}$ per kilo mole and $1\ \mathrm{eV} = 1.6 \times 10^{-19}\ \mathrm{J}$. The

power output of the reactor is close to:

(A) $35\ \mathrm{MW}$
(B) $60\ \mathrm{MW}$
(C) $125\ \mathrm{MW}$
(D) $54\ \mathrm{MW}$

Answer: (B) $60\ \mathrm{MW}$ · Key from source paper

Q112 JEE Main 2020 · 7 Jan · Shift 2 MCQ

The activity of a radioactive sample falls from $700\mathrm{s}^{-1}$ to $500\mathrm{s}^{-1}$ in 30 minutes. Its half life is close to:

(A) $72\mathrm{min}$
(B) $62\mathrm{min}$
(C) $66\mathrm{min}$
(D) $52\mathrm{min}$

Answer: (B) $62\mathrm{min}$ · Key from source paper

Q113 JEE Main 2019 · 12 Apr · Shift 2 MCQ

Half lives of two radioactive nuclei A and B are 10 minutes and 20 minutes, respectively. If, initially a sample has equal number of nuclei, then after 60 minutes, the ratio of decayed numbers of nuclei A and B will be:

(A) 3 : 8
(B) 8 : 1
(C) 1 : 8
(D) 9 : 8

Answer: (D) 9 : 8 · Key from source paper

Q114 JEE Main 2019 · 10 Apr · Shift 1 MCQ

Two radioactive materials A and B have decay constants 10λ and λ, respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of A to that of B will be 1/e after a time:

(A) $\frac{1}{10\lambda}$
(B) $\frac{1}{9\lambda}$
(C) $\frac{1}{11\lambda}$
(D) $\frac{11}{10\lambda}$

Answer: (B) $\frac{1}{9\lambda}$ · Key from source paper

Q115 JEE Main 2019 · 10 Apr · Shift 2 MCQ

Two radioactive substances A and B have decay constants 5λ and λ respectively. At $t = 0$, a sample has the same number of the two nuclei. The time taken for the ratio of the number of nuclei to become $\frac{1}{e}^2$ will be

(A) $\frac{1}{\lambda}$
(B) $\frac{1}{2\lambda}$
(C) $\frac{2}{\lambda}$
(D) $\frac{1}{4\lambda}$

Answer: (B) $\frac{1}{2\lambda}$ · Key from source paper

Q116 JEE Main 2019 · 8 Apr · Shift 2 MCQ

The ratio of mass densities of nuclei of ^{40}Ca and ^{16}O is close to:

(A) 1
(B) 0.1
(C) 2
(D) 5

Answer: (A) 1 · Key from source paper

Q117 JEE Main 2019 · 12 Jan · Shift 2 MCQ

In a radioactive decay chain, the initial nucleus is $^{232}_{90}\mathrm{Th}$. At the end, there are 6 α-particles and 4β-particles which are emitted. If the end nucleus is $^{A}_{Z}\mathrm{X}$, A and Z are given by:

(A) $A = 208;\ Z = 82$
(B) $A = 208;\ Z = 80$
(C) $A = 200;\ Z = 81$
(D) $A = 202;\ Z = 80$

Answer: (A) $A = 208;\ Z = 82$ · Key from source paper

Q118 JEE Main 2019 · 10 Jan · Shift 1 MCQ

Using a nuclear counter the count rate of emitted particles from a radioactive source is measured. At $t = 0$ it was 1600 counts per second and $t = 8$ seconds it was 100 counts per second. The count rate observed, as counts per second, at $t = 6$ seconds is close to:

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(A) 400
(B) 200
(C) 150
(D) 360

Answer: (B) 200 · Key from source paper

Q119 JEE Main 2019 · 9 Jan · Shift 1 MCQ

A Sample of radioactive material A, that has an activity of $10\ m\ Ci\ 1\ Ci = 3.7 \times 10^{10}\ \text{decays s}^{-1}$, has twice the number of nuclei as another sample of a different radioactive material B which has an activity of $20\ m\ Ci$. The correct choices for half-lives of A and B would then be, respectively:

(A) 5 days and 10 days
(B) 10 days and 40 days
(C) 20 days and 10 days
(D) 20 days and 5 days

Answer: (D) 20 days and 5 days · Key from source paper

Q120 JEE Main 2019 · 9 Jan · Shift 2 MCQ

At a given instant, say $t = 0$, two radioactive substance A and B have equal activities. The ratio $\frac{R_B}{R_A}$ of their activities after time t itself decays with time t as e^{-3t}. If the half-life of A is $ln2$, the half-life of B is:

(A) $2ln2$
(B) $4ln2$
(C) $\frac{ln2}{4}$
(D) $\frac{ln2}{2}$

Answer: (C) $\frac{ln2}{4}$ · Key from source paper

Q121 JEE Main 2018 · 16 Apr · Online MCQ

Both the nucleus and the atom of some element are in their respective first excited states. They get de-excited by emitting photons of wavelengths λ_N, λ_A respectively. The ratio $\frac{\lambda_N}{\lambda_A}$ is closest to:

(A) 10^{-1}
(B) 10^{-6}
(C) 10
(D) 10^{-10}

Answer: (B) 10^{-6} · Key from source paper

EdLoop JEE

Q122 JEE Main 2018 · 16 Apr · Online MCQ

At some instant, a radioactive sample S_1 having an activity $5\mu\text{Ci}$ has twice the number of nuclei as another sample S_2 which has an activity of $10\mu\text{Ci}$. The half lives of S_1 and S_2 are :

(A) $4:1$
(B) $1:4$
(C) $1:2$
(D) $2:1$

Answer: (A) $4:1$ · Key from source paper

Q123 JEE Main 2018 · 15 Apr · Shift 1 MCQ

A solution containing active cobalt ${}^{60}_{27}\text{Co}$ having activity of $0.8\mu\text{Ci}$ and decay constant λ is injected in an animal's body. If $1\ \text{cm}^3$ of blood is drawn from the animal's body after 10hrs of injection, the activity found was 300 decays per minute. What is the volume of blood that is flowing in the body? ($1\text{Ci} = 3.7 \times 10^{10}$ decay per second and at $t = 10\text{hrs}\ e^{-\lambda t} = 0.84$)

(A) 6 litres
(B) 7 litres
(C) 4 litres
(D) 5 litres

Answer: (D) 5 litres · Key from source paper

Q124 JEE Main 2018 · 15 Apr · Shift 2 MCQ

An unstable heavy nucleus at rest breaks into two nuclei which move away with velocities in the ratio of $8:27$. The ratio of the radii of the nuclei (assumed to be spherical) is:

(A) $8:27$
(B) $2:3$
(C) $3:2$
(D) $4:9$

Answer: (C) $3:2$ · Key from source paper

Q125 JEE Main 2017 · 9 Apr · Online MCQ

Imagine that a reactor converts all the given mass into energy and that it operates at a power level of 10^9 Watt. The mass of the fuel consumed per hour, in the reactor, will be:
(velocity of light, c is $3 \times 10^8\ \text{m s}^{-1}$)

EdLoop JEE

(A) 6.6×10^{-5} g
(B) 0.96 g
(C) 4×10^{-2} g
(D) 0.8 g

Answer: (C) 4×10^{-2} g · Key from source paper

Q126 JEE Main 2017 · 8 Apr · Online MCQ

Two deuterons undergo nuclear fusion to form a Helium nucleus. The energy released in this process is (given binding energy per nucleon for deuteron= 1.1 MeV and for helium= 7.0 MeV)

(A) 23.6 MeV
(B) 30.2 MeV
(C) 25.8 MeV
(D) 32.4 MeV

Answer: (A) 23.6 MeV · Key from source paper

Q127 JEE Main 2017 · 2 Apr · Offline MCQ

A radioactive nucleus A with a half-life T, decays into a nucleus B. At $t = 0$, there is no nucleus B. At some time t, the ratio of the number of B to that of A is 0.3. Then, t is given by: Consider $\log_e x = \log x$

(A) $t = \frac{T}{\log 1.3}$
(B) $t = \frac{T \log 2}{2 \log 1.3}$
(C) $t = T\frac{\log 1.3}{\log 2}$
(D) $t = T \log 1.3$

Answer: (C) $t = T\frac{\log 1.3}{\log 2}$ · Key from source paper

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Q128 JEE Main 2016 · 3 Apr · Offline MCQ

Half-lives of two radioactive elements A and B are 20 minutes and 40 minutes, respectively. Initially, the samples have an equal number of nuclei. After 80 minutes, the ratio of decayed numbers of A and B nuclei will be:

(A) $1 : 4$
(B) $5 : 4$
(C) $1 : 16$
(D) $4 : 1$

Answer: (B) $5 : 4$ · Key from source paper

Q129 JEE Main 2015 · 11 Apr · Online MCQ

Let N_β be the number of β particle emitted by 1 gram of Na^{24} radioactive nuclei having a half life of 15 h. In 7.5 h, the number N_β is close to $\left[N_A = 6.023 \times 10^{23}\ \mathrm{mole}^{-1}\right]$

(A) 1.75×10^{22}
(B) 6.2×10^{21}
(C) 7.5×10^{21}
(D) 1.25×10^{22}

Answer: (C) 7.5×10^{21} · Key from source paper

Q130 JEE Main 2014 · 19 Apr · Online MCQ

A piece of wood from a recently cut tree shows 20 decays per minute. A wooden piece of the same size placed in a museum (obtained from a tree cut many years back) shows 2 decays per minute. If the half-life of C^{14} is 5730 years, then the age of the wooden piece placed in the museum is approximately

(A) 10439 years
(B) 39049 years
(C) 19042 years
(D) 13094 years

Answer: (C) 19042 years · Key from source paper

Q131 JEE Main 2014 · 12 Apr · Online MCQ

A piece of bone of an animal from a ruin is found to have $^{14}\mathrm{C}$ activity of 12 disintegrations per minute per gm of its carbon content. The $^{14}\mathrm{C}$ activity of a living animal is 16 disintegrations per minute per gm. How long ago nearly did the animal die? (Given half life of $^{14}\mathrm{C}$ is $\mathrm{t}_{1/2} = 5760$ years)

(A) 1672 years
(B) 2391 years
(C) 3291 years
(D) 4453 years

Answer: (B) 2391 years · Key from source paper

Q132 JEE Main 2014 · 11 Apr · Online MCQ

A radioactive nuclei with decay constant $0.5/\mathrm{s}$ is being produced at a constant rate of 100 nuclei/s. If at $t = 0$ there were no nuclei, the time when there are 50 nuclei is:

(A) $1\ \text{s}$
(B) $2\ln\left(\frac{4}{3}\right)\ \text{s}$
(C) $\ln 2\ \text{s}$
(D) $\ln\left(\frac{4}{3}\right)\ \text{s}$

Answer: (B) $2\ln\left(\frac{4}{3}\right)\ \text{s}$ · Key from source paper

Q133 JEE Main 2013 · 22 Apr · Online MCQ

The half-life of a radioactive element A is the same as the mean-life of another radioactive element B. Initially both substances have the same number of atoms, then :

(A) A and B decay at the same rate always.
(B) A and B decay at the same rate initially.
(C) A will decay at a faster rate than B.
(D) B will decay at a faster rate than A.

Answer: (D) B will decay at a faster rate than A. · Key from source paper

Q134 JEE Main 2013 · 9 Apr · Online MCQ

When Uranium is bombarded with neutrons, it undergoes fission. The fission reaction can be written as : ${}_{92}\mathrm{U}^{235} + {}_{0}n^{1} \rightarrow {}_{56}\mathrm{Ba}^{141} + {}_{36}\mathrm{Kr}^{92} + 3x + Q(\text{ energy})$ where three particles named x are produced and energy Q is released. What is the name of the particle x ?

(A) electron
(B) α-particle
(C) neutron
(D) neutrino

Answer: (C) neutron · Key from source paper

Q135 AIEEE 2012 · 26 May · Online MCQ

The counting rate observed from a radioactive source at $t = 0$ was 1600 counts s^{-1}, and $t = 8$ s, it was 100 counts s^{-1}. The counting rate observed as counts s^{-1} at $t = 6$ s will be

(A) 250
(B) 400
(C) 300
(D) 200

Answer: (D) 200 · Key from source paper

Q136 AIEEE 2012 · 19 May · Online MCQ

The decay constants of a radioactive substance for α and β emission are λ_α and λ_β respectively. If the substance emits α and β simultaneously, then the average half life of the material will be

(A) $\frac{2T_\alpha T_\beta}{T_\alpha+T_\beta}$
(B) $T_\alpha + T_\beta$
(C) $\frac{T_\alpha T_\beta}{T_\alpha+T_\beta}$
(D) $\frac{1}{2}(T_\alpha + T_\beta)$

Answer: (C) $\frac{T_\alpha T_\beta}{T_\alpha+T_\beta}$ · Key from source paper

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Q137 AIEEE 2012 · 12 May · Online MCQ

Which of the following Statements is correct?

(A) The rate of radioactive decay cannot be controlled but that of nuclear fission can be controlled.
(B) Nuclear forces are short range, attractive and charge dependent.
(C) Nuclei of atoms having same number of neutrons are known as isobars.
(D) Wavelength of matter waves is given by de Broglie formula but that of photons is not given by the same formula

Answer: (A) The rate of radioactive decay cannot be controlled but that of nuclear fission can be controlled. · Key from source paper

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Q138 AIEEE 2012 · 7 May · Online MCQ

A sample originally contained 10^{20} radioactive atoms, which emit α-particles. The ratio of α particles emitted in the third year to that emitted during the second year is 0.3. How many α particles were emitted in the first year?

(A) 3×10^{18}
(B) 3×10^{19}
(C) 5×10^{18}
(D) 7×10^{19}

Answer: (D) 7×10^{19} · Checked by our team

Q139 AIEEE 2011 MCQ

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 and $\frac{1}{3}$ of it had decayed is :

(A) 14 min
(B) 20 min
(C) 28 min
(D) 7 min

Answer: (B) 20 min · Key from source paper

Q140 AIEEE 2010 MCQ

A nucleus of mass $M + \Delta m$ is at rest and decays into two daughter nuclei of equal mass $\frac{M}{2}$ each. Speed of light is c. 40. The binding energy per nucleon for the parent nucleus is E_1 and that for the daughter nuclei is E_2. Then

(A) $\mathrm{E}_2 = 2\mathrm{E}_1$
(B) $E_1 > E_2$
(C) $\mathrm{E}_2 > \mathrm{E}_1$
(D) $\mathrm{E}_1 = 2\mathrm{E}_2$

Answer: (C) $\mathrm{E}_2 > \mathrm{E}_1$ · Key from source paper

Q141 AIEEE 2010 MCQ

A nucleus of mass $M + \Delta m$ is at rest and decays into two daughter nuclei of equal mass $\frac{M}{2}$ each. Speed of light is C. The speed of daughter nuclei is

(A) $c\frac{\Delta m}{M+\Delta m}$
(B) $c\sqrt{\frac{2\Delta m}{M}}$
(C) $c\sqrt{\frac{\Delta m}{M}}$
(D) $c\sqrt{\frac{\Delta m}{M+\Delta m}}$

Answer: (B) $c\sqrt{\frac{2\Delta m}{M}}$ · Key from source paper

Q142 AIEEE 2010 MCQ

A radioactive nucleus (initial mass number A and atomic number Z) emits 3α-particles and 2 positrons. The ratio of number of neutrons to that of protons in the final nucleus will be

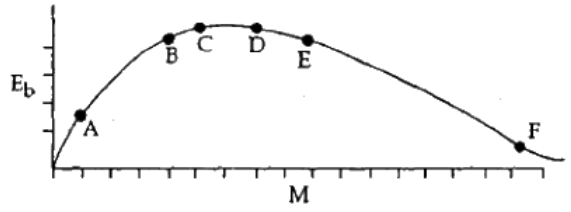
(A) $\frac{A-Z-8}{Z-4}$
(B) $\frac{A-Z-4}{Z-8}$
(C) $\frac{A-Z-12}{Z-4}$
(D) $\frac{A-Z-4}{Z-2}$

Answer: (B) $\frac{A-Z-4}{Z-8}$ · Key from source paper

Q143 AIEEE 2009 MCQ

The above is a plot of binding energy per nucleon E_b, against the nuclear mass M; A, B, C, D, E, F correspond to different nuclei. Consider four reactions: (i) $A + B \rightarrow C + \varepsilon$ (ii) C $\rightarrow$ A + B $+\varepsilon$ (iii) D + E $\rightarrow$ F $+\varepsilon$ and (iv) $F \rightarrow D + E + \varepsilon$ where ε is the energy released? In which reactions is ε positive? *(see the figure above)*

Q27. The above is a plot of binding energy per nucleon E_b, against the nuclear mass M; A, B, C, D, E, F correspond to different nuclei. Consider four reactions: (i) $A + B \rightarrow C + \varepsilon$ (ii) $\mathrm{C} \rightarrow \mathrm{A} + \mathrm{B} + \varepsilon$ (iii) $\mathrm{D} + \mathrm{E} \rightarrow \mathrm{F} + \varepsilon$ and (iv) $F \rightarrow D + E + \varepsilon$ where ε is the energy released? In which reactions is ε positive?



(1) (i) and (iv)
(2) (i) and (iii)
(3) (ii) and (iv)
(4) (ii) and (iii)

(A) (i) and (iv)
(B) (i) and (iii)
(C) (ii) and (iv)
(D) (ii) and (iii)

Answer: (A) (i) and (iv) · Key from source paper

Q144 AIEEE 2008 MCQ

This question contains Statement -1 and Statement-2. Of the four choices given after the statements, choose the one that best describes the two statements. Statement - I: Energy is released when heavy nuclei undergo fission or light nuclei undergo fusion. and Statement - II For heavy nuclei, binding energy per nucleon increases with increasing Z while for light nuclei it decrease with increasing Z.

(A) Statement -1 is false, Statement -2 is true.
(B) Statement - 1is true, Statement -2 is true; Statement -2 is correct explanation for Statement-1.
(C) Statement -1 is true, Statement -2 is true; Statement -2 is not a correct explanation for Statement-1.
(D) Statement -1 is true, Statement -2 is False.

Answer: (D) Statement -1 is true, Statement -2 is False. · Key from source paper

Q145 AIEEE 2007 MCQ

If $\mathrm{M_o}$ is the mass of an oxygen isotope ${}_8\mathrm{O}^{17}$, $\mathrm{M_P}$ and $\mathrm{M_N}$ are the masses of a proton and a neutron respectively, the nuclear binding energy of the isotope is

(A) $(\mathrm{M_o} - 8\mathrm{M_p})\mathrm{C}^2$
(B) $(\mathrm{M_o} - 8\mathrm{M_p} - 9\mathrm{M_N})\mathrm{C}^2$
(C) $\mathrm{M_o C}^2$
(D) $(\mathrm{M_o} - 17\mathrm{M_N})\mathrm{C}^2$

Answer: (B) $(\mathrm{M_o} - 8\mathrm{M_p} - 9\mathrm{M_N})\mathrm{C}^2$ · Key from source paper

Q146 AIEEE 2007 MCQ

In gamma ray emission from a nucleus

(A) both the neutron number and the proton number change
(B) there is no change in the proton number and the neutron number.
(C) only the neutron number changes
(D) only the proton number changes

Answer: (B) there is no change in the proton number and the neutron number. · Key from source paper

Q147 AIEEE 2007 MCQ

The half-life period of a radio-active element X is same as the mean life time of another radioactive element Y . Initially they have the same number of atoms. Then

(A) X will decay faster than Y
(B) Y will decay faster than X
(C) X and Y have same decay rate initially
(D) X and Y decay at same rate always.

Answer: (B) Y will decay faster than X · Key from source paper

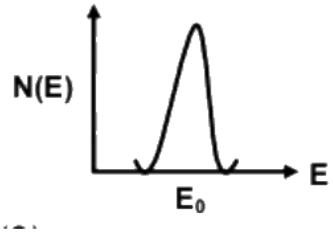
Q148 AIEEE 2006 MCQ

The energy spectrum of β-particles [number $N(E)$ as a function of β-energy E] emitted from a radioactive source is

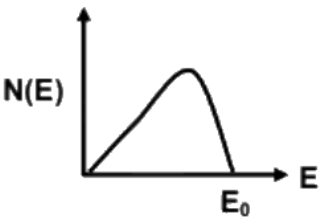
(see the figure above)

Q47. The energy spectrum of β-particles [number $N(E)$ as a function of β-energy E] emitted from a radioactive source is

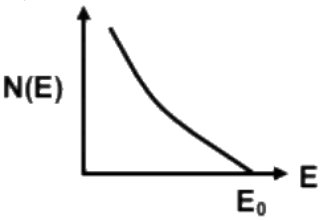
(1)



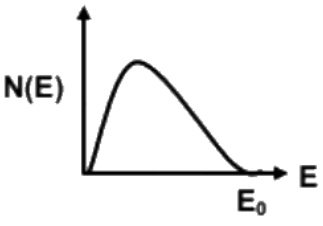
(2)



(3)



(4)



(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (D) · Key from source paper

Q149 AIEEE 2006 MCQ

When ${}_3\mathrm{Li}'$ nuclei are bombarded by protons, and the resultant nuclei are ${}_4\mathrm{Be}^8$, the emitted particles will be

(A) neutrons
(B) alpha particles
(C) beta particles
(D) gamma photons

Answer: (D) gamma photons · Key from source paper

Q150 AIEEE 2006 MCQ

The 'rad' is the correct unit used to report the measurement of

(A) the rate of decay of radioactive source
(B) the ability of a beam of gamma ray photons to produce ions in a target
(C) the energy delivered by radiation to a target.
(D) the biological effect of radiation

Answer: (C) the energy delivered by radiation to a target. · Checked by our team

Q151 AIEEE 2006 MCQ

If the binding energy per nucleon in ${}^7_3\mathrm{Li}$ and ${}^4_2\mathrm{He}$ nuclei are 5.60MeV and 7.06MeV respectively, then in the reaction $\mathrm{p} + {}^7_3\mathrm{Li} \rightarrow 2\,{}^4_2\mathrm{He}$ energy of proton must be

(A) 39.2MeV
(B) 28.24MeV
(C) 17.28MeV
(D) 1.46MeV

Answer: (C) 17.28MeV · Key from source paper

Q152 AIEEE 2005 MCQ

The intensity of gamma radiation from a given source is I. On passing through 36 mm of lead, it is reduced to $\frac{I}{8}$. The thickness of lead which will reduce the intensity to $\frac{I}{2}$ will be

(A) 6 mm
(B) 9 mm
(C) 18 mm
(D) 12 mm

Answer: (D) 12 mm · Key from source paper

Q153 AIEEE 2005 MCQ

Starting with a sample of pure $^{66}\mathrm{Cu}$, 7/8 of it decays into Zn in 15 minutes. The corresponding half-life is

(A) 10 minutes
(B) 15 minutes
(C) 5 minutes
(D) $7\frac{1}{2}$ minutes

Answer: (C) 5 minutes · Key from source paper

Q154 AIEEE 2005 MCQ

If radius of $^{27}_{13}\mathrm{Al}$ nucleus is estimated to be 3.6 Fermi then the radius $^{125}_{52}\mathrm{Te}$ nucleus be nearly

(A) 6 fermi
(B) 8 fermi
(C) 4 fermi
(D) 5 fermi

Answer: (A) 6 fermi · Key from source paper

Q155 AIEEE 2005 MCQ

A nuclear transformation is denoted by $X(n,\alpha)^{7}_{3}\mathrm{Li}$. Which of the following is the nucleus of element X ?

(A) $^{12}\mathrm{C}_{6}$
(B) $^{10}_{5}\mathrm{B}$
(C) $^{9}_{5}\mathrm{B}$
(D) $^{11}_{4}\mathrm{Be}$

Answer: (B) $^{10}_{5}\mathrm{B}$ · Key from source paper

Q156 AIEEE 2004 MCQ

A nucleus disintegrates into two nuclear parts which have their velocities in the ratio 2 : 1. The ratio of their nuclear sizes will be

(A) $2^{1/3} : 1$
(B) $1 : 3^{1/2}$
(C) $3^{1/2} : 1$
(D) $1 : 2^{1/3}$

Answer: (D) $1 : 2^{1/3}$ · Checked by our team

Q157 AIEEE 2004 MCQ

The binding energy per nucleon of deuteron ($_1^2$H) and helium nucleus ($_2^4$He) is 1.1MeV and 7MeV respectively. If two deuteron nuclei react to form a single helium nucleus, then the energy released is

(A) 13.9MeV
(B) 26.9MeV
(C) 23.6MeV
(D) 19.2MeV

Answer: (C) 23.6MeV · Key from source paper

Q158 AIEEE 2003 MCQ

When a U^{238} nucleus originally at rest, decays by emitting an alpha particle having a speed ' u ', the recoil speed of the residual nucleus is

(A) $\frac{4u}{238}$
(B) $-\frac{4u}{234}$
(C) $\frac{4u}{234}$
(D) $-\frac{4u}{238}$

Answer: (C) $\frac{4u}{234}$ · Checked by our team

Q159 AIEEE 2003 MCQ

A radioactive sample at any instant has its disintegration rate 5000 disintegrations per minute. After 5 minutes, the rate is 1250 disintegrations per minute. Then, the decay constant (per minute) is

(A) 0.4 ln 2
(B) 0.2 ln 2
(C) 0.1 ln 2
(D) None of these

Answer: (A) 0.4 ln 2 · Checked by our team

Q160 AIEEE 2003 MCQ

A nucleus with Z = 92 emits the following in a sequence: $\alpha, \beta^-, \beta^-\alpha, \alpha, \alpha, \alpha, \alpha, \beta^-, \beta^-, \alpha, \beta^+, \beta^+, \alpha$. Then Z of the resulting nucleus is

(A) 76
(B) 78
(C) 82
(D) 74

Answer: (B) 78 · Key from source paper

Q161 AIEEE 2003 MCQ

Which of the following cannot be emitted by radioactive substances during their decay?

(A) Protons
(B) Neutrinoes
(C) Helium nuclei
(D) Electrons

Answer: (A) Protons · Key from source paper

Q162 AIEEE 2002 MCQ

At a specific instant emission of radioactive compound is deflected in a magnetic field. The compound can emit (i) electrons (ii) protons (iii) He^{2+} (iv) neutrons The emission at instant can be

(A) i, ii, iii
(B) i, ii, iii, iv
(C) iv
(D) ii, iii

Answer: (A) i, ii, iii · Key from source paper

Q163 AIEEE 2002 MCQ

If N_0 is the original mass of the substance of half- life period $\mathrm{t}_{1/2}$ = 5 years, then the amount of substance left after 15 years is

(A) $\mathrm{N}_0/8$
(B) $\mathrm{N}_0/16$
(C) $\mathrm{N}_0/2$
(D) $\mathrm{N}_0/4$

Answer: (A) $\mathrm{N}_0/8$ · Key from source paper

Q164 AIEEE 2002 MCQ

If mass-energy equivalence is taken into account, when water is cooled to form ice, the mass of water should

(A) increase
(B) remain unchanged
(C) decrease
(D) first increase then decrease

Answer: (C) decrease · Checked by our team

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