

JEE MAIN NUCLEI — PYQS

Max. Marks: 156

Questions: 39

Section A (MCQ) — 30 questions

- Q.1** 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 _____.

[JEE Main 2026 (Online) 8th April Evening Shift]

- (1) $\frac{2548}{2650}$ (2) $\frac{2706}{2646}$ (3) $\frac{2597}{2600}$ (4) $\frac{2862}{2499}$

Scan or tap for the full solution



- Q.2** The energy released if hydrogen atoms are combined to form ${}^4_2\text{He}$ is _____ MeV. (Take binding energies per nucleon of ${}^1_1\text{H}$ and ${}^4_2\text{He}$ as 1.1 MeV and 7.2 MeV, respectively)

[JEE Main 2026 (Online) 6th April Evening Shift]

- (1) 6.1 (2) 24.4 (3) 26.6 (4) 5

Scan or tap for the full solution



- Q.3** Assuming the experimental mass of ${}^{12}_6\text{C}$ as 12 u, the mass defect of ${}^{12}_6\text{C}$ 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).

[JEE Main 2026 (Online) 5th April Evening Shift]

- (1) 127.5 (2) 89.03 (3) 272.0 (4) 92.0

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- Q.4** 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, $\Delta mc^2 =$ _____ MeV.

[JEE Main 2026 (Online) 4th April Morning Shift]

- (1) 6.9 (2) 7.9 (3) 2.2 (4) 4.3

Scan or tap for the full solution



- Q.5** The binding energy per nucleon of ${}^{209}_{83}\text{Bi}$ is _____ MeV. [Take $m({}^{209}_{83}\text{Bi}) = 208.980388$ u, $m_p = 1.007825$ u, $m_n = 1.008665$ u, 1 u = 931 MeV/ c^2]

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 7.48 (2) 7.84 (3) 8.79 (4) 6.94

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- Q.6** An atom ${}^8_3\text{X}$ 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 nucleus is recorded by :

[JEE Main 2026 (Online) 28th January Morning Shift]

- (1) 150% (2) 900% (3) 125% (4) 225%

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- Q.7** 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 :

[JEE Main 2026 (Online) 28th January Evening Shift]

- (1) 1 (2) 2 (3) 8 (4) 0.5

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- Q.8** 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 transform to nuclei with greater binding energy per nucleon.

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

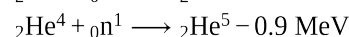
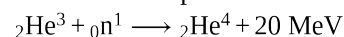
[JEE Main 2026 (Online) 24th January Morning Shift]

- (1) Statement-I is false but Statement-II is true
(2) Both Statement-I and Statement-II are true
(3) Both Statement-I and Statement-II are false
(4) Statement-I is true but Statement-II is false

Scan or tap for the full solution



- Q.9** The binding energies for the following nuclear reactions are expressed in MeV.



If X_3 , X_4 , X_5 denote the stability of ${}^2_1\text{He}^3$, ${}^2_1\text{He}^4$ and ${}^2_1\text{He}^5$, respectively, then the correct order is :

[JEE Main 2026 (Online) 24th January Evening Shift]

- (1) $X_4 > X_5 > X_3$ (2) $X_4 < X_5 < X_3$
 (3) $X_4 > X_5 < X_3$ (4) $X_4 = X_5 = X_3$

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Q.10 Which of the following pair of nuclei are isobars of the element?

[JEE Main 2026 (Online) 23rd January Evening Shift]

- (1) ${}^3_1\text{H}$ and ${}^3_2\text{He}$ (2) ${}^{198}_{80}\text{Hg}$ and ${}^{197}_{79}\text{Au}$
 (3) ${}^2_1\text{H}$ and ${}^3_1\text{H}$ (4) ${}^{236}_{92}\text{U}$ and ${}^{238}_{92}\text{U}$

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Q.11 The minimum frequency of photon required to break a particle of mass 15.348 amu into 4α particles is _____ kHz.

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

[JEE Main 2026 (Online) 22nd January Morning Shift]

- (1) 14.94×10^{20} (2) 9×10^{19}
 (3) 9×10^{20} (4) 14.94×10^{19}

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Q.12 For a nucleus of mass number A and radius R, the mass density of nucleus can be represented as

[JEE Main 2025 (Online) 8th April Evening Shift]

- (1) $A^{\frac{2}{3}}$ (2) Independent of A
 (3) A^3 (4) $A^{\frac{1}{3}}$

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Q.13 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 (${}^{64}_{29}\text{Cu}$) nucleus is greater than that of the carbon (${}^{12}_6\text{C}$) 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 :

[JEE Main 2025 (Online) 7th April Evening Shift]

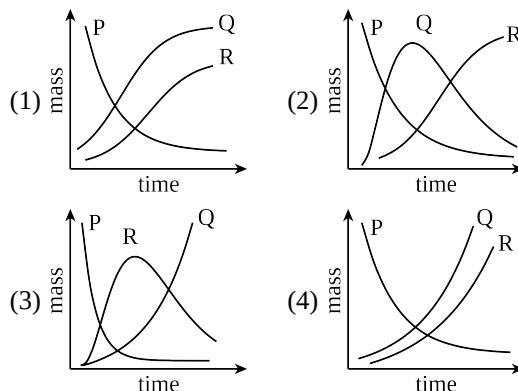
- (1) (A) is correct but (R) is not correct
 (2) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
 (3) (A) is not correct but (R) is correct
 (4) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Scan or tap for the full solution



Q.14 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 ?

[JEE Main 2025 (Online) 4th April Evening Shift]



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Q.15 Match the **LIST-I** with **LIST-II**

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

Choose the correct answer from the options given below: [JEE Main 2025 (Online) 3rd April Morning Shift]

- (1) A-II, B-I, C-III, D-IV
 (2) A-III, B-I, C-II, D-IV
 (3) A-III, B-I, C-IV, D-II
 (4) A-II, B-I, C-IV, D-III



Solution

Q.16 Energy released when two deuterons (${}_1\text{H}^2$) fuse to form a helium nucleus (${}_2\text{He}^4$) is : (Given : Binding energy per nucleon of ${}_1\text{H}^2 = 1.1$ MeV and binding energy per nucleon of ${}_2\text{He}^4 = 7.0$ MeV)

[JEE Main 2025 (Online) 2nd April Evening Shift]

- (1) 26.8 MeV (2) 8.1 MeV
 (3) 23.6 MeV (4) 5.9 MeV

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Q.17 Choose the correct nuclear process from the below options [p : proton, n : neutron, e^- : electron, e^+ : positron, ν : neutrino, $\bar{\nu}$: antineutrino]

[JEE Main 2025 (Online) 28th January Morning Shift]

- (1) $n \longrightarrow p + e^- + \bar{\nu}$ (2) $n \longrightarrow p + e^- + \nu$
 (3) $n \longrightarrow p + e^+ + \bar{\nu}$ (4) $n \longrightarrow p + e^+ + \nu$

Scan or tap for the full solution



- Q.18** 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 ?

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $1/4$ (2) $1/8$ (3) 4 (4) 8

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- Q.19** 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 :

[JEE Main 2025 (Online) 23rd January Evening Shift]

- (1) (A) is true but (R) is false
 (2) Both (A) and (R) are true and (R) is the correct explanation of (A)
 (3) (A) is false but (R) is true
 (4) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

Scan or tap for the full solution 

- Q.20** The energy equivalent of 1 g of substance is :

[JEE Main 2024 (Online) 9th April Morning Shift]

- (1) 5.6×10^{26} MeV (2) 5.6×10^{12} MeV
 (3) 5.6 eV (4) 11.2×10^{24} MeV

Scan or tap for the full solution 

- Q.21** 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}U is E_U . The ratio $\frac{E_H}{E_U}$ is approximately: (Consider the fusion reaction as

$4\text{}^1_1\text{H} + 2\text{}^0_{-1}\text{e}^- \longrightarrow \text{}^4_2\text{He} + 2\nu + 6\gamma + 26.7\text{ MeV}$, energy released in the fission reaction of ^{235}U is 200 MeV per fission nucleus and $N_A = 6.023 \times 10^{23}$)

[JEE Main 2024 (Online) 9th April Evening Shift]

- (1) 7.62 (2) 25.6 (3) 9.13 (4) 15.04

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- Q.22** 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: [JEE Main 2024 (Online) 8th April Morning Shift]

- (1) 20 μg (2) 2 μg (3) 10 μg (4) 0.2 μg

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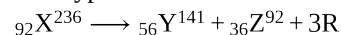
- Q.23** If M_0 is the mass of isotope $^{12}_5\text{B}$, M_p and M_n are the masses of proton and neutron, then nuclear binding energy of isotope is:

[JEE Main 2024 (Online) 8th April Evening Shift]

- (1) $(5M_p + 7M_n - M_0)C^2$
 (2) $(M_0 - 5M_p - 7M_n)C^2$
 (3) $(M_0 - 5M_p)C^2$
 (4) $(M_0 - 12M_n)C^2$


Solution

- Q.24** In a hypothetical fission reaction



The identity of emitted particles (R) is :

[JEE Main 2024 (Online) 8th April Evening Shift]

- (1) Proton (2) Neutron
 (3) Electron (4) γ -radiations

Scan or tap for the full solution 

- Q.25** Which of the following nuclear fragments corresponding to nuclear fission between neutron (${}^1_0\text{n}$) and uranium isotope (${}^{235}_{92}\text{U}$) is correct :

[JEE Main 2024 (Online) 4th April Morning Shift]

- (1) ${}_{56}^{140}\text{Xe} + {}_{38}^{94}\text{Sr} + 3{}^1_0\text{n}$
 (2) ${}_{51}^{153}\text{Sb} + {}_{41}^{99}\text{Nb} + 3{}^1_0\text{n}$
 (3) ${}_{56}^{144}\text{Ba} + {}_{36}^{89}\text{Kr} + 4{}^1_0\text{n}$
 (4) ${}_{56}^{144}\text{Ba} + {}_{36}^{89}\text{Kr} + 3{}^1_0\text{n}$


Solution

- Q.26** From the statements given below :

- A. The angular momentum of an electron in n^{th} orbit is an integral multiple of $\hbar$.
 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 :

[JEE Main 2024 (Online) 1st February Evening Shift]

- (1) (B), (C), (D), (E) only
 (2) (A), (C), (D), (E) only
 (3) (A), (B), (C), (E) only
 (4) (A), (B), (C), (D) only


Solution

- Q.27** The mass number of nucleus having radius equal to half of the radius of nucleus with mass number 192 is : [JEE Main 2024 (Online) 31st January Evening Shift]

- (1) 32 (2) 24 (3) 20 (4) 40

Scan or tap for the full solution 

- Q.28** 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 nucleus in terms of mass defect ΔM will be :

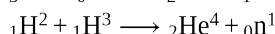
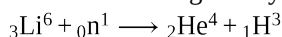
[JEE Main 2024 (Online) 30th January Evening Shift]

- (1) $c\sqrt{\frac{3\Delta M}{M}}$ (2) $\frac{\Delta Mc^2}{3}$
 (3) $c\sqrt{\frac{2\Delta M}{M}}$ (4) $\sqrt{\frac{2c\Delta M}{M}}$

Scan or tap for the full solution



- Q.29** The explosive in a Hydrogen bomb is a mixture of ${}_1\text{H}^2$, ${}_1\text{H}^3$ and ${}_3\text{Li}^6$ in some condensed form. The chain reaction is given by



During the explosion the energy released is approximately

[Given ; $M(\text{Li}) = 6.01690$ amu, $M({}_1\text{H}^2) = 2.01471$ amu, $M({}_2\text{He}^4) = 4.00388$ amu,and $1 \text{ amu} = 931.5 \text{ MeV}$]

[JEE Main 2024 (Online) 29th January Morning Shift]

- (1) 22.22 MeV (2) 28.12 MeV
 (3) 16.48 MeV (4) 12.64 MeV

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- Q.30** The atomic mass of ${}_6\text{C}^{12}$ is 12.000000 u and that of ${}_6\text{C}^{13}$ is 13.003354 u. The required energy to remove a neutron from ${}_6\text{C}^{13}$, if mass of neutron is 1.008665 u, will be :

[JEE Main 2024 (Online) 27th January Evening Shift]

- (1) 62.5 MeV (2) 6.25 MeV
 (3) 4.95 MeV (4) 49.5 MeV

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Section B (Numerical) — 9 questions

- Q.31** The energy released when $\frac{7}{17.13}$ kg of ${}_3\text{Li}^7$ is converted into ${}_2\text{He}^4$ by proton bombardment is $\alpha \times 10^{32}$ eV. The value of α is _____. (Nearest integer)
 (Mass of ${}_3\text{Li}^7 = 7.0183$ u, mass of ${}_2\text{He}^4 = 4.004$ u, mass of proton = 1.008 u and $1 \text{ u} = 931 \text{ MeV}/c^2$ and Avogadro number = 6.0×10^{23})

[JEE Main 2026 (Online) 6th April Morning Shift]

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- Q.32** The average energy released per fission for the nucleus of ${}^{235}_{92}\text{U}$ is 190 MeV. When all the atoms of 47 g pure ${}^{235}_{92}\text{U}$ undergo fission process, the energy released is $\alpha \times 10^{23}$ MeV. The value of α is _____. (Avogadro Number = 6×10^{23} per mole)

[JEE Main 2026 (Online) 23rd January Evening Shift]

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- Q.33** A star has 100% helium composition. It starts to convert three ${}^4\text{He}$ into one ${}^{12}\text{C}$ via triple alpha process as ${}^4\text{He} + {}^4\text{He} + {}^4\text{He} \longrightarrow {}^{12}\text{C} + \text{Q}$. 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 ${}^4\text{He}$ to ${}^{12}\text{C}$ is $n \times 10^{42} \text{ s}^{-1}$, where n is _____. [Take, mass of ${}^4\text{He} = 4.0026$ u, mass of ${}^{12}\text{C} = 12$ u]

[JEE Main 2024 (Online) 9th April Morning Shift]

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- Q.34** If three helium nuclei combine to form a carbon nucleus then the energy released in this reaction is _____ $\times 10^{-2}$ MeV. (Given $1 \text{ u} = 931 \text{ MeV}/c^2$, atomic mass of helium = 4.002603 u)

[JEE Main 2024 (Online) 5th April Morning Shift]

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- Q.35** The disintegration energy Q for the nuclear fission of ${}^{235}\text{U} \longrightarrow {}^{140}\text{Ce} + {}^{94}\text{Zr} + \text{n}$ is _____ MeV. Given atomic masses of ${}^{235}\text{U}$: 235.0439 u; ${}^{140}\text{Ce}$: 139.9054 u, ${}^{94}\text{Zr}$: 93.9063 u; n : 1.0086 u, Value of $c^2 = 931 \text{ MeV}/\text{u}$.

[JEE Main 2024 (Online) 4th April Evening Shift]

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- Q.36** 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 _____.

[JEE Main 2024 (Online) 1st February Morning Shift]

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- Q.37** The mass defect in a particular reaction is 0.4 g. The amount of energy liberated is $n \times 10^7$ kWh, where $n =$ _____. (speed of light = $3 \times 10^8 \text{ m/s}$)

[JEE Main 2024 (Online) 31st January Morning Shift]

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- Q.38** 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 $\frac{V_2}{V_1} = \underline{\hspace{2cm}}$.

[JEE Main 2024 (Online) 31st January Evening Shift]

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full solution



- Q.39** In a nuclear fission process, a high mass nuclide ($A \approx 236$) with binding energy 7.6 MeV/Nucleon dissociated into middle mass nuclides ($A \approx 118$), having binding energy of 8.6 MeV/Nucleon. The energy released in the process would be _____ MeV.

[JEE Main 2024 (Online) 27th January Morning Shift]

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ANSWER KEY

Section A (MCQ) — 30 questions

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

Section B (Numerical) — 9 questions

Ques.	31	32	33	34	35	36	37
Ans.	6	228	15	727	208	27	1
Ques.	38	39					
Ans.	4	236					