PHYSICS

BOOKS - DISHA PHYSICS (HINGLISH)

NUCLEI

Physics

1. The mass of a $a_3^7 Li$ nucleus is $0.042u$ less than the sum of the masses of all its nucleons.

The binding energy per nucleon of $._{3}^{7}Li$

nucleus is nearly.

A. 46 MeV

B. $5.6 MeV$

C. $3.9 MeV$

D. 23 MeV

Answer:

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2. In the given reaction

$$\cdot_{z} X^{A} \rightarrow \cdot_{z+1} Y^{A} \rightarrow \cdot_{z-1} K^{A-4} \rightarrow \cdot_{z-1} K^{A-4}$$

Radioactive radiations are emitted in the sequence.

A. γ, β, α

B. β, γ, α

C. α, β, γ

D. β, α, γ

Answer:

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3. If the nuclear radius of $.^{27}A1$ is 3.6 Fermi, the approximate nuclear radius of $64Cu$ in Fermi is :

A. 2.4

B. 1.2

C. 4.8

D. 3.6

Answer:

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4. Which of the following statements is incorrect for nuclear forces?

A. they obey the inverse square law of distance

B. they obey the inverse third power law of distance

C. they are short range forces

D. they are equal in strength to electromagnetic forces.

Answer:

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

A. $0.4 \ln 2$

B. $0.1 \ln 2$

C. $0.1 \ln 2$

D. $0.8 \ln 2$

Answer:

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6. The radioactivity of a sample is R_1 at a time T_1 and R_2 at time T_2. If the half-life of the specimen is T, the number of atoms that have disintegrated in the time $(T_2 - T_1)$ is proporational to

A. $(R_1 T_1 - R_2 T_2)$

B. $(R_1 - R_2)$

C. $(R_1 - R_2)/T$

D. $(R_1 - R_2)T$

Answer:

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

A. a+b+c

B. a+b-c

C. c-a-b

D. c+a-b

Answer:

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8. If $M(A, Z), M_p$ and M_n denote the masses of the nucleus $._Z X^A$, proton and neutron respectively in units of U (where $1U = 931MeV/c^2$) and B.E. represents its B.E. in MeV, then

A. M(A,Z)=$ZM_p + (A - Z)M_n - BE/c^2$

B. M(A,Z)=$ZM_p + (A - Z)M_n + BE$

C. M(A,Z) $= ZM_p + (A - Z)M_n - BE$

D.

$$M(A, Z) = ZM_p + (A - Z)M_n + BE/c^2$$

Answer:

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9. When the number of nucleons in a nuclues increases the binding energy per nucleon

A. Increases continuously with mass number

B. Decreases continuously with mass number

C. First decreases and then increases with increase in mass number

D. First increases and then decreases with increase in mass number

Answer:

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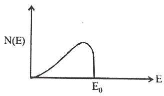
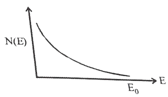
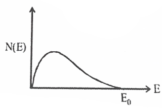
10. The energy spectrum of β - particle [number $N€$ as a function of β - energy E] emitted from a radioactive source is

A. 

B. 

C. 

D.

Answer:

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11. A radioactive nucleus undergoes a series of deacy according to the scheme.

$$A \xrightarrow{\alpha} A_1 \xrightarrow{\beta^-} A_2 \xrightarrow{\alpha} A_3 \xrightarrow{\gamma} A_4$$

If the mass number and atomic number of A are 180 and 172 respectively, what are these numbers for A_4.

A. 172 and 69

B. 174 and 70

C. 176 and 69

D. 176 and 70

Answer:

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12. The activity of a radioactive sample is measured as 9750 counts per minute at $t = 0$ and as 975 counts per minute at $t = 5$ minutes. The decay constant is approximately

A. 0.922 per minute

B. 0.691 per mintue

C. 0.461 per mintue

D. 0.230 per minute

Answer:

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13. Actinium 231,.$^{231}AC_{89}$, emit in succession two β particles, four α-particles, one β and one α plus several λ rays. What is the resltant isotope?

A. $.^{221}Au_{79}$

B. $.^{211}Au_{79}$

C. $.^{221}Pb_{82}$

D. $.^{211}Pb_{82}$

Answer:

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14. Fusion reaction takes place at high temperature because

A. atoms are ionised at high temperature

B. molecules break up at high temperature

C. nuclei break up at high temperature

D. kinetic energy is high enough to overcome repulsion between nuclei

Answer:

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15. If M_O is the mass of an oxygen is otpe $\_(8)O^{17}$, M_p and M_N are the mases of a proton and a neutron respectively , the nuclear binding energy of the isotope is

A. $(M_O - 17M_N)c^2$

B. $(M_O - 8M_p)c^2$

C. $(M_O - 8M_p - 9M_N)c^2$

D. M_Oc^2

Answer:

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16. Which of the following nuclear reaction is not possible?

A. $._{6}^{12}C + ._{6}^{12}C \rightarrow ._{10}^{20}Ne + ._{4}^{2}He$

B. $._{4}^{9}Be + ._{1}^{1}H \rightarrow ._{3}^{6}Li + ._{2}^{4}He$

C. $._{5}^{11}Be + ._{1}^{1}H \rightarrow ._{4}^{9}Be + ._{2}^{4}He$

D. $._{3}^{7}Li + ._{2}^{4}He \rightarrow ._{1}^{1}H + ._{4}^{10}B$

Answer:

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17. The ratio of half-life times of two elements A and B is $\frac{T_A}{T_B}$. The ratio of respective decay constant $\frac{\lambda_A}{\lambda_B}$,is

A. T_B / T_A

B. T_A / T_B

C. $\frac{T_A + T_B}{T_A}$

D. $\frac{T_A - T_B}{T_A}$

Answer:

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18. Two radioactive X_1 and X_2 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 X_1 to that of X_2will be $1/e$ after a time .

A. $1/10\lambda$

B. $1/11\lambda$

C. $11/10\lambda$

D. $1/9\lambda$

Answer:

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19. In a radioactive material the activity at time t_1 is R_1 and at a later time t_2, it is R_2. If the decay constant of the material is λ, then

A. $R_1 = R_2 e^{\lambda(t_1 - t_2)}$

B. $R_1 = R_2 e^{(t_1 / t_2)}$

C. $R_1 = R_2$

D. $R_1 = R_2 e^{-\lambda(t_1 - t_2)}$

Answer:

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20. The correct relation between t_{av}=average life and $t_{1/2} =$ half life for a radioactive nuclei.

A. $t_{av} = t_{1/2}$

B. $t_{av} = \frac{1}{2} t_{1/2}$

C. $0.693 t_{av} = t_{1/2}$

D. $t_{av} = 0.693 t_{1/2}$

Answer:

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21. Assertion: Forces acting between proton-proton (f_{pp}), proton -neutron (f_{pn}) and neutron -neutron (f_{nn}) are such that $f_{pp} < f_{pn} = f_{nn}$.

Reason: Electrostatic force of repulsion between two proton reduces net nuclear forces between them.

A. $F_{pp} \approx F_{nn} \approx F_{pn}$

B. $F_{pp} \neq F_{nn}$ and $F_{pp} = F_{nn}$

C. $F_{pp} = F_{nn} = F_{pn}$

D. $F_{pp} \neq F_{nn} \neq F_{pn}$

Answer:

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22. Which one is correct about fission?

A. Approx. 0.1% mass converts into energy

B. Most of energy of fission is in the form of heat

C. In a fission of U^{235} about 200 eV energy is released

D. On an average, one neutron is released per fission of U^{235}

Answer:

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23. If $200 MeV$ energy is released in the fission of a single U^{235} nucleus, the number of fissions required per second to produce 1 kilowatt power shall be (Given $1eV = 1.6 \times 10^{-19} J$).

A. 3.125×10^{13}

B. 3.125×10^{14}

C. 3.125×10^{15}

D. 3.152×10^{16}

Answer:

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24. In any fission the ratio

$$\frac{\text{mass of fission produts}}{\text{mass of parent nucleus}}$$ is

A. equal to 1

B. greater than 1

C. less than 1

D. depends on the mass of the parent nucleus

Answer:

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25. In an α -decay, the kinetic energy of α-particles is $48MeV$ and Q value of the reaction is $50MeV$. The mass number of the mother nucleus is (assume that daughter nucleus is in ground state)

A. 2

B. 4

C. 6

D. 8

Answer:

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26. A sample of a radioactive element has a mass of $10g$ at an instant $t = 0$. The approxiamte mass of this element in the sample after two mean lives is .

A. 6.30 gm

B. 1.35 gm

C. 2.50 gm

D. 3.70 gm

Answer:

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27. Consider a radioactive material of half-life 1.0 minute. If one of the nuclei decays now, the next one will decay

A. after 1 minute

B. after $\frac{1}{\log_e 2}$ minute

C. after $\frac{1}{N}$ minute, where N is the number of nuclei present at that moment

D. after any time

Answer:

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28. The mass of an $\alpha-$ particle is.

A. less than the sum of masses of two protons and two neutrons

B. equal to mass of four protons

C. equal to mass of four neutrons

D. equal to sum of masses of two protons and two neutron

Answer:

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29. 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. $\dfrac{2T_\alpha T_\beta}{T_\alpha + T_\beta}$

B. $T_\alpha + T_\beta$

C. $\dfrac{T_\alpha T_\beta}{T_\alpha + T_\beta}$

D. $\frac{1}{2}(T_{\alpha}+T_{\beta})$

Answer:

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30. If the end A of a wire is irradiated with α-rays and the other end B is irradiated with β-rays. Then

A. a current will flow from A to B

B. a current will flow from B to A

C. there will be no current in the wire

D. a current will flow from each end to the mid-point of the wire

Answer:

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31. A radioactive nucleus of mass M emits a photon of frequency v and the nucleus recoils. The recoil energy will be

A. $Mc^2 - hv$

B. $h^2v^2 / 2Mc^2$

C. zero

D. hv

Answer:

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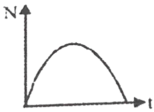
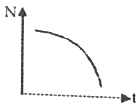
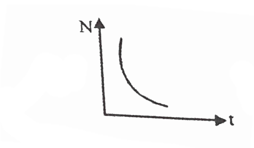
32. Radioactive element decays to form a stable nuclide, then the rate of decay of reactant $\left(\frac{dN}{dt}\right)$ will vary with time (t) as shown in figure.

A. 

B. 

C. 

D. 

Answer:

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33. A nuclear of mass $M + \delta m$ is at rest and decay into two daughter nuclei of equal mass $\frac{M}{2}$ each speed 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:

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34. Atomic weight of boron is 10.81 and it has two isotopes $._5 B^{10}$ and $._5 B^{11}$. Then ratio of $._5 B^{10}$ in nature would be.

A. $19:81$

B. $10:11$

C. $15:16$

D. $81:19$

Answer:

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35. A nucleus desintegrated into two nucleus which have their velocities in the ratio of $2:1$. The ratio of their nuiclear sizes will be

A. $2^{1/3}:1$

B. $1:2^{1/3}$

C. $3^{1/2}:1$

D. $1:3^{1/2}$

Answer:

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36. A nucleus of uranium decays at rest into nuclei of thorium and helium. Then :

A. the helium nucleus has less momentum than the thorium nucleus.

B. the helium nucleus has more momentum than the thorium nucleus.

C. the helium nucleus has less kinetic energy than the thorium nucleus.

D. the helium nucleus has more kinetic energy than the thorium nucleus.

Answer:

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37. If radius of the $._{13}^{27}A1$ nucleus is taken to be R_{A1} then the radius of $._{53}^{125}Te$ nucleus is nearly.

A. $\frac{5}{3}R_{Al}$

B. $\frac{3}{5}R_{Al}$

C. $\left(\frac{13}{53}\right)^{1/3}R_{Al}$

D. $\left(\frac{53}{13}\right)^{1/3}R_{Al}$

Answer:

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38. M_n and M_p represent mass of neutron and proton respectively. If an element having atomic mass M has $N-$ neutron and Z-proton, then the correct relation will be :

A. $M < [NM_n + ZM_p]$

B. $M > [NM_n + ZM_p]$

C. $M = [NM_n + ZM_p]$

D. $M = N[M_n + M_p]$

Answer:

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39. After 300 days, the activity of a radioactive sample is 5000 dps (disintegrations per sec). The activity becomes 2500 dps after another

150 days. The initial activity of the sample in dps is

A. $20,000$

B. $10,000$

C. $7,000$

D. $25,000$

Answer:

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40. Order of magnitude of density of uranium nucleus is , [m = 1.67 xx 10^(-27 kg]`

A. $10^{20} kg/m^3$

B. $10^{17} kg/m^3$

C. $10^{14} kg/m^3$

D. $10^{11} kg/m^3$

Answer:

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41. The electrons cannot exist inside the nucleus because

A. de-Broglie wavelength associated with electron in β- decay is much less than the size of nucleus

B. de-Broglie wavelength associated with electron in β- decay is much greater than the size of nucleus

C. de-Broglie wavelength associated with electron in β- decay is equal to the size of nucleus

D. negative charge cannot exist in the nucleus

Answer:

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42. If the total binding energies of $._1 H^2, ._2 He^4, ._{26} Fe^{56}$ and $._{92} U^{235}$ nuclei are $2.22, 28.3, 492$ and $1786 MeV$ respectively, identify the most stable nucleus out of the following

A. $._{26}^{56} Fe$

B. $._{1}^{2} H$

C. $._{92}^{235} U$

D. $._{2}^{4} He$

Answer:

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43. At a specific instant emission of radioactive compound is deflected in a magnetic field. The compound cannot emit

A. electrons

B. protons

C. He^{2+}

D. neutrons

Answer:

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44. A nuclear reaction given by

$$1_Z X^A \rightarrow .(Z+1)Y^A + ._{-1}e^0 + \overrightarrow{p}$$

represents.

A. fission

B. β-decay

C. $\propto$ -decay

D. fusion

Answer:

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45. Radioactive material 'A' has decay constant '8λ' and material 'B' has decay constant 'lamda'. Initial they have same number of nuclei. After what time, the ratio of number of nuclei of material 'B' to that 'A' will be $\frac{1}{e}$?

A. $\frac{1}{7\lambda}$

B. $\frac{1}{8\lambda}$

C. $\frac{1}{9\lambda}$

D. $\frac{1}{\lambda}$

Answer:

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