PHYSICS

BOOKS - AAKASH SERIES

NUCLEI

Exercise I

1. The distance of closest approach of α particle to the nucleus was taken as a measure of

A. Atomic radius

B. Diameter of the nucleus

C. Nuclear radius

D. Size of atom

Answer: C

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2. The mass number of a nucleus is equal to

A. always less than its atomic number

B. always more than its atomic number

C. equal to its atomic number

D. some times more than and some times equal to atomic number

Answer: D

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3. The graph of on (R/R_0) versus ln A (R=radius of nuccleus and A= its mass number) is

A. straight line

B. parabola

C. ellipse

D. hyperbola

Answer: A

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4. The mass density of a nucleus varies with mass number A as:

A. $D \propto A^3$

B. $D \propto A^2$

C. $D \propto A$

D. $D \propto A^0$

Answer: D

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5. Observe the following statements regarding isotones :

a. $.^{39}K$ and $.^{40}Ca$ are isotones.

$b.$ Nucleides having different atomic number (Z) and mass numbers (a) but same number of neutrons (n) are called isotones.

$c.$ $.^{19}F$ and $.^{23}Na$ are isotones.

The correct answer is —

A. i,ii and iii are correct

B. Only (i) and (ii) are correct

C. Only i and iii are correct

D. Only ii and iii are correct

Answer: B

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6. The ratio of the volume fo the atom to the volume of the nucleus is of the order of

A. 10^{15}

B. 10^{10}

C. 10^{5}

D. 10^{7}

Answer: A

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7. Which of the forces are considered as shortest ranged ?

A. attractive

B. repulsive

C. 1 or 2

D. always attractive

Answer: C

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8. The origin of nuclear force between nucleons is due to the exchange of

A. Mesons

B. Photons

C. Positrons

D. Electrons

Answer: A

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9. Nuclear forces are

A. Non-central forces

B. saturated

C. Spin dependent

D. All the above

Answer: D

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10. If the nuclear force between two protons, two neutrons and between proton and neutron is denoted by F_{pp}, F_{nn} and F_{pn} respectively, then

A. $F_{p-p} < F_{p-n} < F_{n-n}$

B. $F_{p-p} = F_{p-n} = F_{n-n}$

C. $F_{p-p} < F_{p-n} = F_{n-n}$

D. $F_{p-p} > F_{p-n} = F_{n-n}$

Answer: B

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11. One requires energy E_n to remove a nucleon from a nucleus and an energy E_e to remove an electron from the orbit of an atom. Then

A. $E_n = E_c$

B. $E_n < E_c$

C. $E_n > E_c$

D. $E_n \frac{>}{<} E_c$

Answer: C

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12. Two nucleons are at a separation of $1 \times 10^{-15} m$. The net force between them is F_1 if both are neutrons F_2 if both are protons and F_3 if one is a proton and other is a neutron. In such a case

A. $F_2 > F_1 > F_3$

B. $F_1 = F_2 > F_3$

C. $F_1 = F_2 = F_3$

D. $F_1 = F_3 > F_2$

Answer: D

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13. The binding energy per nucleon is maximum at A=56 and its value is around ____ Mev/ Nucleon

A. 8.4

B. 8.7

C. 9

D. 7.8

Answer: B

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14. As the mass number A increases, the binding energy per nucleon in a nucleus.

A. increases

B. decreases

C. first increases and then decreases

D. remains same

Answer: C

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15. The stability of a nucleus can be measured by

A. Average binding energy

B. Packing fraction

C. Ratio of number of neutrons and protons

D. All the above

Answer: D

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16. In nuclear reaction $._2He^4 + ._ZX^A \rightarrow ._{Z+2}Y^{A+3} + R$,R denotes

A. electron

B. positron

C. proton

D. neutron

Answer: D

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17. The penetrating powers of α and β and γ radiations, in decreasing order, are

A. γ, α, β

B. γ, β, α

C. α, β, γ

D. β, γ, α

Answer: B

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18. When α, β and γ radiation pass through a gas, their ionizing powers, in decreasing order, are

A. γ, α, β

B. γ, β, α

C. α, β, γ

D. β, γ, α

Answer: C

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19. The half-life period of a radioactive element x is same as the mean life time of another radioactive element y. Initially, both of them have the same number of atoms. Then,

(a) x and y have the same decay rate initially

(b) x and y decay at the same rate always

(c) y will decay at a faster rate than x

(d) x will decay at a faster rate than y

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: A

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20. A fraction f_1 of a radioactive sample decays in one mean life, and a fraction f_2 decays in one half life. Then

A. $f_1 > f_2$

B. $f_1 < f_2$

C. $f_1 = f_2$

D. May be (a), (b) or (c) depending on the values of the mean life and half-life.

Answer: A

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21. The half life period of a radioactive sample depends upon

A. temperature

B. pressure

C. Nature of substance

D. All the above

Answer: C

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22. Half life period of lead is

A. zero

B. infinite

C. 1590 years

D. 1230 years

Answer: B

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23. Which of the following radioactive substance used in archeological survey?

A. $._{6} C^{14}$

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

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

D. $._{2} HC^{3}$

Answer: A

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24. The process of producing a new stable nucleus from the other stable nucleus is called

A. Nuclear reaction

B. Artificial transmutation

C. Nuclear fusion

D. Nuclear fission

Answer: B

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25. Which of the following changes in the artificial transmutation of elements?

A. number of neutrons

B. number of electrons

C. atomic weight

D. nucleus

Answer: D

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26. A free neutron decays spontaneously into

A. a proton, an electron and an anti neutrino

B. a proton, an electron and a neutrino

C. a proton and electron

D. a proton, an electron, a neutrino and an anti neutrino

Answer: A

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27. Neutron was discovered by the experiment of

A. Artificial transmutation of $\left(._{4} Be^{9}\right)$ by α - particles

B. Artificial transmutation of $\left(._{7} N^{11}\right)$ by alpha particles

C. Rutherford scattering of alpha particles by heavy nuclei

D. Becquerel with radio activity

Answer: A

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28. The average life of an isolated neutron

A. 1500 sec

B. 1000 sec

C. 1200 sec

D. 3 minutes

Answer: B

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29. A radioactive substance X decays into another radioactive substance Y Initially only X was present. λ_x and λy_y are the disnttegration constants of Xa nd Y N_x and N_y are the number of nuclie of X and Y at any time t. Number of nuclei N_y will be maximum when

A. $\dfrac{N_y}{N_x - N_y} = \dfrac{\lambda_y}{\lambda_x - \lambda_y}$

B. $\dfrac{N_x}{N_x - N_y} = \dfrac{\lambda_x}{\lambda_x - \lambda_y}$

C. $\lambda_y N_y = \lambda_x N_x$

D. $\lambda_y N_x = \lambda_x N_y$

Answer: C

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30. Thermal neutrons energy is

A. $<$ 1 eV

B. $>$ 1 eV

C. $= 2$ MeV

D. $= 4$ MeV

Answer: A

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31. Which of the following projectiles is the best for bombarding the nuclide? a)α-particle b)Proton c)Deuteron d)Neutron

A. Neutron

B. Proton

C. α- particle

D. β- particle

Answer: A

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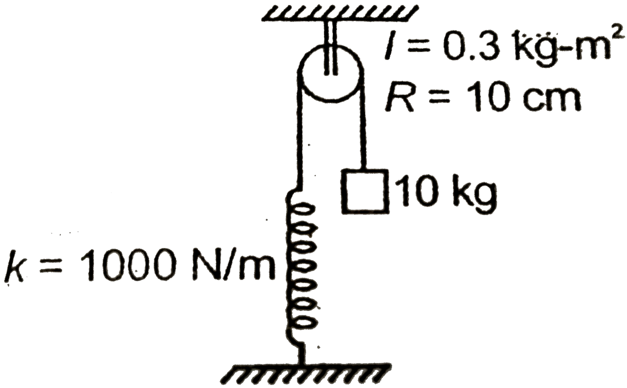
32. In the given arrangement the block is released from the position where the spring is unstretched. The speed of the block when it has descended through $2cm$ is $\frac{x}{10}$. Find the value of x.



A. 7

B. 3.5

C. 1.5

D. 2.5

Answer: D

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33. The fission of uranium nuclide

A. always leads to the same pair of fission produce say barium and krypton

B. doesn.t always produce barium and krypton but different pair of fission produces

C. produce barium and any other fission product

D. always produces at last one radioactive fission product

Answer: B

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34. Most of energy released in the fission is carried by

A. neutrons

B. fission fragments

C. neutrons and fragments carry equally

D. positrons

Answer: B

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35. Regarding Prompt neutrons

A. They are highly energetic

B. They constitute 99%

C. Cannot initiate chain reaction

D. 1,2,3 are correct

Answer: D

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36. Nuclear reactions obey the law of conservation of

A. Mass and energy

B. Charge

C. Momentum

D. All the above

Answer: D

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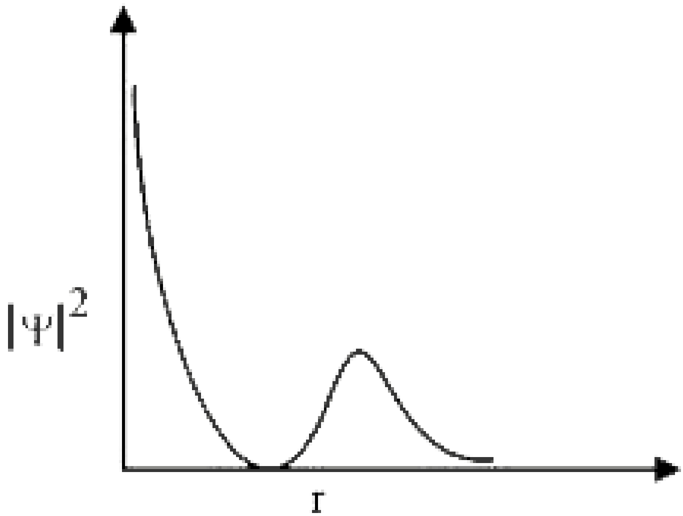
37. The graph for an orbital between $|\varphi|^2$ and r(radial distance) is shown below. The sum of principle quantum number, azimuthal, quantum number and magnetic quantum number of this orbital is __________.



A. under-critical chain reaction

B. Critical chain reaction

C. super-critical chain reaction

D. All the above

Answer: C

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38. In a critical chain reaction

A. energy is released at increasing rate

B. energy is released at steady rate

C. energy is released at decreasing rate

D. energy is not released

Answer: B

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39. Compreshension-II

In non-ideal solutions, at one of the intermediate compostions, the total vapour pressure is highest and the boiling point is lowest. At this point, the composition of the liquid and vapour phase is same. So, if liquid mixture vapouriese at this point and vapours are condensed, teh condensate contains same compositon as present in original liquid mixture. it means at this point liquid behaves like a pure liquid and is called an Azeotropic mixture.

Choose the correct answer :

A. prompt neutrons

B. delayed neutrons

C. stray neutrons

D. sustained neutrons

Answer: B

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40. A hydrogen like atom of atomic number Z is in and excited state of quantum number 2n. It can emit a maximum energy photon of 204 eV. If it makes a transition to quantum state n, photon of energy 40.8 eV is emitted. Find n , Z and the gound state energy (in eV) for this atom, Also calculate the minimum energy (in eV) that can be emitted by this atom during de-exitation, Ground state energy of hydrogen atom is $13.6eV$

A. prompt nevtrons

B. delayed neutrons

C. slowed prompt neutrons

D. 2 or 3

Answer: D

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41. At a specific instant emission of radioactive compound is deflected in magnetic field. The compound can emit

A. I,ii,iii

B. I,ii,iii,iv

C. iv

D. ii,iii

Answer: A

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42. Cadmium and Boron rods are used in a nuclear reactor to

A. Slow down the neutrons

B. Absorb.excess number of thermal neutrons

C. speed up neutrons

D. absorb fast neutrons

Answer: B

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43. Heavy water is used as moderator in a nuclear reactor. The function of the moderator is

A. To control the energy released in the reactor

B. To slow down the neutrons to thermal energies

C. To cool the reactor faster

D. To absorb neutrons and stop chain reaction

Answer: B

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44. In fission,the percentage of mass converted into energy is about

A. 0.1%

B. 0.25%

C. 0.01%

D. 2%

Answer: A

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45. Study of the seed is called

A. breeder reactor

B. Pressurized reactor

C. Heterogeneous reactor

D. Homogeneous reactor

Answer: A

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46. A nucleus with Z =92 emits the following in a sequence:

$\alpha, \beta^{-}, \beta^{-}, \alpha, \alpha, \alpha, \alpha, \alpha, \beta^{-}, \beta^{-}, \alpha, \beta^{+}, \beta^{+}, \alpha$

. The Z of the resulting nucleus is

A. 76

B. 78

C. 82

D. 74

Answer: B

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47. Enthalpy change of a reaction with be equal to

A. less than the critical mass

B. equal to critical mass

C. less than or equal to critical mass

D. greater than critical mass

Answer: D

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48. Nuclear - Fission is best explained by:

A. Optical model of the nucleus

B. Shell model of nucleus

C. Collective model of the nucleus

D. Liquid drop model of the nucleus

Answer: D

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49. The operation of a nuclear rector is said to be critical, if the multiplication factor (x) as a value

A. 1

B. 1.5

C. 2.1

D. 2.5

Answer: A

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50. The main source of sun.s energy is

A. Nuclear fusion

B. Nuclear fission

C. Gravitational contraction

D. Combustion

Answer: A

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51. Fusion reaction takes place at high tamperature because

A. Atoms are ionized at high temperature

B. Molecules break up at high temperature

C. Nuclei break up at high temperature

D. Kinetic energy is high enough to over come coulomb repulsion between nuclei

Answer: D

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52. Nuclear fusion is possible

A. only between light nuclei

B. only between heavy nuclei

C. between both light and heavy nuclei

D. only between nuclei which are stable against β-decay

Answer: A

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53. In sun, the important source of energy is,

A. Proton-Proton cycle

B. Carbon-nitrogen cycle

C. Carbon-carbon cycle

D. nitrogen-nitrogen cycle

Answer: A

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54. In carbon-nitrogen nuclear fusion cycle, protons are fused to form a helium nucleus, positrons and release some energy. The number of protons fused and the number of positrons released in this process respectively are

A. 4,4

B. 4,2

C. 2,4

D. 4,6

Answer: B

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55. When two deuterium nuclei fuse together to form a tritium nuclei, we get a

A. Neutron

B. Deuteron

C. $\propto$ -particle

D. proton

Answer: D

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56. Particles and their anti-particles have,

A. The same masses but opposite spins

B. The same masses but opposite magnetic moment

C. The same masses and same magnetic moment

D. Opposite spins and same magnetic moment

Answer: B

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57. The particles that possesses half integral spin is

A. Photon

B. Pion

C. Proton

D. K-meson

Answer: C

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58. The half life period of the radioactive is $\_\ 15P^{30}$ is

A. 6.5 minutes

B. 3.25 minutes

C. 10 minutes

D. 8.4 minutes

Answer: B

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59. In a gamma ray emission from nucleus:

A. only the neutron number changes

B. only the proton number changes

C. both the neutron and the proton number change

D. there is no change in the proton number and the neutron number

Answer: D

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60. $\cdot_{+1}e^{\circ} + \cdot_{-1}e^{\circ} \rightarrow 2\gamma$ The above equation satisfies the law of conservation of

A. A) Charge

B. B) energy and mass

C. C) momentum

D. D) All the above

Answer: D

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61. If a radioactive nucleus decay according to the following reaction

$$\cdot_{72} X^{180} \xrightarrow{\alpha} X_1 \xrightarrow{\beta} X_2 \xrightarrow{\alpha} X_3 \xrightarrow{\gamma} X_4$$

then the mass number and atomic number of X_4 will be respectively

A. 172,70

B. 172,69

C. 172,68

D. 171,69

Answer: B

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62. Which of the following particles is most unstable?

A. Neutron

B. Proton

C. Electron

D. α particle

Answer: A

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63. The products of combustion of an aliphatic thiol (RSH) at $298K$ are

A. Ba^{141} and Kr^{92} and 3 neutron always

B. Xe^{140}, Sr^{94} and $2._{0}\,n^{1}$ always

C. can be different in each fission

D. should have same mass number

Answer: C

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64. As the age of star increases

A. Helium quantity increases

B. Helium quantity decreases

C. Helium quantity doesn.t change

D. Helium, Hydrogen both quantities increases

Answer: A

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65. A particle having no charge and almost no rest mass

A. neutrino

B. neutron

C. electron

D. positron

Answer: A

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66. In the nuclear process $\cdot_6 C^{11} \rightarrow \cdot_2 B^{11} + \beta^+ + X, X$ stands for _____ .

A. An electron

B. A proton

C. A neutron

D. A neutrino

Answer: D

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67. Two identical nuclei A and B of the same radioactive element undergo β decay. A emits a β-particle and changes to A'. B emits a β-particle and then a γ-photon immediately afterwards, and changes to B'

A. A. and B. have the same atomic number and mass number

B. A and B. have the same atomic number and different mass numbers

C. A. and B. have different atomic numbers

but the same mass number

D. A and B are isotopes

Answer: A

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68. During β-decay (beta minus), the emission of antineutrino particle is supported by which of the following statement (s)?

A. A, B and D are correct

B. A, B and C are correct

C. A, C and D are correct

D. B and D are correct

Answer: B

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69. A nuclide A undergoes α - decay and another nuclide B undergoes β-decay

(a) All the α-particle emitted by A will have almost the same speed

(b) The α- particle emitted by A may have widely different speeds

(c) All the β-particle emitted by B will have almost the same speed

(d) The β-particle emitted by B may have widely different speeds

A. a, b are true

B. b, c are true

C. b, d are true

D. a, d are true

Answer: D

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70. In the fission of U^{235}

(i) Slow neutron is absorbed by U^{235}

(ii) The products in the process are not same always, their atomic number varies from 34 to 58

(iii) About 200 Mev energy is released per fission

(iv) The product are always Ba and Kr

A. Only i, ii & iii are true

B. Only ii & iii are true

C. All are true

D. Only i, ii & iv are true

Answer: A

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71. Which of the following statements are correct

(i) Positron is predicted by Dirac and

discovered by Anderson

(ii) Liquid drop model of nucleus by Bohr and Wheeler is developed

(iii) Carbon cycle was proposed by Bethe

(iv) Fission reaction is first observed Otto Hahn and Strass man

A. All are true

B. Only i, ii & iv are true

C. Only i, iii & iv are true

D. Only iii & iv are true

Answer: A

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72. Consider the following two statements A and B and identify the correct answer given below.

A. Nuclear density is same for all nuclei.

B.Radius of the nucleus R and its mass number A are related as $\sqrt{A} \alpha R^{\frac{1}{6}}$.

A. A and B are true

B. A and B are false

C. A is true but B is false

D. A is false but B is true

Answer: C

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73. Consider the following statements. A, B and identify the correct choice in the given answers

(A) Density of a nucleus is independent of its mass number

(B) Beryllium is used as moderator in nuclear reactors

A. A and B are correct

B. A and B are wrong

C. A is correct, B is wrong

D. A is wrong, B is correct

Answer: A

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74. Consider the following statements (A) and (B) and identify the correct answer given below.

Statement (A): Positive values of packing fraction implies a large value of binding energy.

Statement (B): The difference between the mass of the nucleus and the mass number of the nucleus is called packing fraction

A. A and B are correct

B. (A) and (B) are false

C. (A) is true (B) is false

D. A is false, B is true

Answer: B

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75. Assertion: Free Neutron decays into proton, electron and antineutrino

Reason : Neutron is unstable outside the nucleus

A. Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is true .

Answer: A

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76. Assertion : Nuclear forces arise from strong coulombic interactions between protons and neutrons

Reason : Nuclear forces are independent of charge of the nucleons

A. Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is true .

Answer: D

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77. This question contains Statement - 1 and Statement -2 Of the four choice given after the Statements , choose the one that best decribes the two Statements

Statement- 1:

Energy is released when heavy nuclei undergo fission or light nuclei undergo fusion and

Statement- 2:

for nuclei , Binding energy nucleon increases with increasing Z while for light nuclei it decreases with increasing Z

A. Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is true .

Answer: C

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78. Statement-1 : Electron capture occurs more often than positron emission in heavy elements.

and

Statement-2 : Heavy element generally exhibit radioactivity.

A. Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is true .

Answer: B

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79. Match the following

Match list I (Type of ore) with list II.

List I (Type of ore)	List II (Example)
(*i*) Oxide ore	(*a*) Feldspar
(*ii*) Sulfide ore	(*b*) Barytes
(*iii*) Sulfate ore	(*c*) Fluorspar
(*iv*) Halide ore	(*d*) Galena
	(*e*) Corrundum

A. a-e,b-g,c-h,d-f

B. a-g,b-e,c-f,d-h

C. a-g,b-e,c-h,d-f

D. a-f,b-e,c-g,d-h

Answer: C

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Exercise Ii

1. Atomic number of Iodine is 53 and its mass number is 125. Radius of iodine is approximately. $\left(R_0 = 1.2 \times 10^{-15} m\right)$

A. 6×10^{-5} m

B. 6×10^{-11} m

C. 6×10^{-15} m

D. 6×10^{-18} m

Answer: C

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2. Compare the radii of two nuclei with mass number 8 and 64 respectively.

A. $1:3, 1:1$

B. $3:2, 1:1$

C. $1:2, 1:1$

D. $1:2, 1:2$

Answer: C

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3. The radius of the oxygen nucleus $\left({}_{8}^{16}O\right)$ is 2.8×10^{-15}m. Find the radius of the lead nucleus $\left({}_{82}^{205}Pb\right)$.

A. 8.55×10^{-15} m

B. 6.55×10^{-15} m

C. 6.55×10^{-13} m

D. 4.55×10^{-12} m

Answer: B

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4. Two stable isotopes $._3^6 Li$ and $._3^7 Li$ have respective abundances of 7.5% and 92.5% . These isotopes have masses 6.01512 u and 7.01600 u respectively. The atomic weight of lithium is

A. 5.941 u

B. 6.491 u

C. 6.941 u

D. 6.149 u

Answer: C

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5. A heavy nucleus at rest breaks into two fragments which fly off with velocities in the ratio 8:1 The ratio of radii of the fragments is

A. $1:2$

B. $1:4$

C. $4:1$

D. $2:1$

Answer: A

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6. The energy equivalent to 1 amu is?

A. 1.67×10^{-27} g, 9.30 Mev

B. 1.67×10^{-27} kg, 931.5 Mev

C. 1.67×10^{-27} kg , 1 Mev

D. 1.67×10^{-34} kg ,1 Mev

Answer: B

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7. 1g ofhydrogen is converted into 0.993 g of helium in a thermonucleart reaction . The energy released is

A. 63×10^{7} J

B. 63×10^{10} J

C. 63×10^{13} J

D. 63×10^{20} J

Answer: B

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8. If one microgram of $._{92}^{235}U$ is completely destroyed in an atom bomb, the energy released will be ?

A. 9×10^6 J

B. 9×10^7 J

C. 9×10^8 J

D. 9×10^5 J

Answer: B

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9. What is the approximate energy released by the complete annihilation of an alpha particle?

A. 931 J

B. 372 J

C. 931 MeV

D. 3724 MeV

Answer: D

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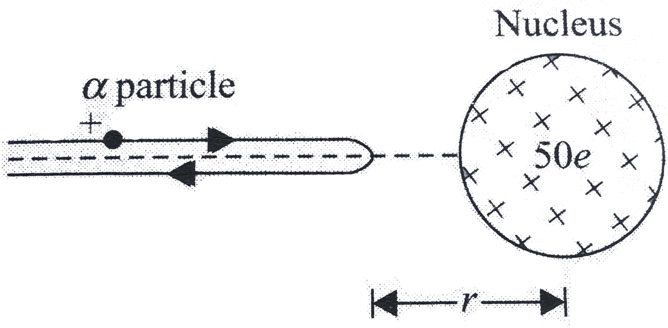
10. An alpha particle with kinetic energy $10MeV$ is heading toward a stationary tin nucleus of atomic number 50. Calculate the distance of closest approach (Fig . 3.23).



A. 14.4×10^{-16} m

B. 1.7×10^{-7} m

C. 1.5×10^{-12} m

D. 14.4×10^{-15} m

Answer: D

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11. The mass defect for the nucleus of helium is 0.0303 a,m,u,. What is the binding energy per nucleon for helium in MeV?

A. 28

B. 7

C. 4

D. 1

Answer: B

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12. If the binding energy per nucleon in $._3 Li^7$ and $._2 He^4$ nuclei are respectively 5.60 MeV and 7.06 MeV, then the ebergy of proton in the reaction $._3 Li^7 + p \rightarrow 2._2 He^4$ is

A. 1.728 MeV

B. 17.28 MeV

C. 172.8 MeV

D. 1728 MeV

Answer: B

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13. Calculate the binding energy per nucleon of $._{17}^{35}Cl$ nucleus. Given that mass of $._{17}^{35}Cl$ nucleus = 34.98000 u, mass of proton = 1.007825 u, mass of neutron = 1.008665 u and 1 u is equivalent to 931 Mev.

A. 6.2 MeV

B. 7.2 Mev

C. 4.2 Mev

D. 8.2 Mev

Answer: D

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14. Binding energies of $._1 H^2, ._2 He^4, ._{26} Fe^{56}$ and $._{92} U^{235}$ nuclei are 2.22Mev, 28.4Mev, 492Mev and 1786MeV respectively which one of the following is more stable?

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

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

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

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

Answer: C

Watch Video Solution

15. How much energy is required to separate a typical nucleus $_{50}Sn^{120}$ into its constituent nucleons ?

Given atomic masses are

$$m\left(Sn^{120}\right) = 119.902199u$$

$$m\left(H^{1}\right) = 1.007825u$$

$$m\left({}_0n^{1}\right) = 1.008665u$$

(b) what is the binding energy per nuclon for this nuclide ?

A. 1021 Mev

B. 921 Mev

C. 1121 Mev

D. 821 Mev

Answer: A

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16. Calculate the binding energy of an α-particle in MeV Given : m_p (mass of proton) = 1.007825 amu, m_n (mass of neutron) = 1.008665 amu Mass of the nucleus `=4.002800 amu, 1 amu = 931 MeV.

A. 26.4 Mev

B. 28.4 Mev

C. 24.4 Mev

D. 23.4 Mev

Answer: B

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17. The distance of the closest approach of an alpha particle fired at a nucleus with kinetic of an alpha particle fired at a nucleus with kinetic energy K is r_0. The distance of the closest approach when the α particle is fired at the same nucleus with kinetic energy 2K will be

A. $2r_0$

B. $4r_0$

C. $\frac{r_0}{2}$

D. $\frac{r_0}{4}$

Answer: C

Watch Video Solution

18. A free neutron has half life of 14 minutes. Its decay constant is

A. $8.25 \times 10^{-2} S^{-1}$

B. $8.25 \times 10^{-3} S^{-1}$

C. $8.25 \times 10^{-4} S^{-1}$

D. $8.25 \times 10^{1} S^{-1}$

Answer: C

Watch Video Solution

19. The half-life of ^{215}At is $100\mu s$. Find the time taken for the radioactivity of a sample of ^{215} At to decay to $\frac{1}{16}th$ of its initial value:

A. $400\mu s$

B. $6.3\mu s$

C. $40\mu s$

D. $300\mu s$

Answer: A

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20. Plutonium decays with half life of 24000 years. If plutonium is stored for 72000 years, the fraction of it that remains is

A. $1/8$

B. $3/8$

C. $7/8$

D. $1/4$

Answer: A

Watch Video Solution

21. Half-life of a radioactive substance is $12.5h$ and its mass is $256g$. After what time the amount of remaining substance is $1g$?

A. 75

B. 100

C. 125

D. 150

Answer: B

Watch Video Solution

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

A. $\frac{1}{2\lambda}s$

B. $\frac{1}{10\lambda}s$

C. $\frac{1}{5\lambda}s$

D. $\frac{1}{8\lambda}$s

Answer: A

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23. In order to dcrease radioactive nuclei to one million of its initial number, number of half - lives required is

A. 20

B. 40

C. 30

D. 10

Answer: A

Watch Video Solution

24. The half life of radium is 1600 years. The mean life of radium is

A. 800 years

B. 2309 years

C. 3209 years

D. 2903 years

Answer: B

Watch Video Solution

25. The activity of a radioactive element decreased to one - third of original activity I_0 in 9 yr. After further 9 yr, its activity will be

A. I_0

B. $\frac{2}{3}I_0$

C. $\frac{I_0}{9}$

D. $\frac{I_0}{6}$

Answer: C

Watch Video Solution

26. The half-life of a radioactive substance is 100 years, Calculate in how many years the activity will decay to 1/10th of its initial value.

A. 332.3 years

B. 232.3 years

C. 432.3 years

D. 532.3 years

Answer: A

Watch Video Solution

27. The counting rate observed from a radioactive source at t=0 second was 1600 counts per second and t =8 seconds it was 100 counts per second. The counting rate observed as counts per second t = 6 seconds will be

A. 250

B. 300

C. 250

D. 200

Answer: D

Watch Video Solution

28. Two nuclei P, Q have equal no.of atoms at t= 0. Their half-life are 3 hours, 9 hours. Compare their rates of disintegration after 18 hrs from the start.

A. $3 : 16$

B. $16 : 3$

C. $1 : 3$

D. $3 : 1$

Answer: A

Watch Video Solution

29. The sample of a radioactive substance has 10^6 nucei. Its half life is 20 s . The number of nuclei that will be left after 10 s is neary .

A. 7×10^5

B. 8.5×10^5

C. 8×10^5

D. 7.5×10^5

Answer: A

Watch Video Solution

30. One mole of radium has an activity of 1/3.7 kilo curie. Its decay constant will be

A. $\frac{1}{6} \times 10^{-10} s^{-1}$

B. $10^{-10} s^{-1}$

C. $10^{-11} s^{-1}$

D. $10^{-8} s^{-1}$

Answer: A

Watch Video Solution

31. A radioactive nucleus undergoes a series of decays according to the sequence

$X \xrightarrow{\beta} X_1 \xrightarrow{\alpha} X_2 \xrightarrow{\alpha} X_3.$

f the mass number and atomic number of X_3 are 172 and 69 respectively. what is the mass numberand atomic number of X ?

A. 180,72

B. 180,74

C. 176,72

D. 170,70

Answer: A

Watch Video Solution

32. Tritium has a half-life of 12.5 y undergoing beta decay. What fraction of a sample of pure tritium will remain undecayed after 25 y.

A. $\frac{1}{2}$

B. $\frac{1}{4}$

C. $\frac{1}{8}$

D. $\frac{1}{16}$

Answer: B

Watch Video Solution

33. A freshly prepared radioactive source of half-life 2 h emits radiation of intensity which is 64 times the permissible safe level. The minimum time after which it would be passible to work safely with this source is

A. 6 Hrs

B. 12 Hrs

C. 24 Hrs

D. 128 Hrs

Answer: B

Watch Video Solution

34. If 10% of a radioactive material decays in 5 days, then the amount of orginal material left after 20 days is approximately

A. 90%

B. 80%

C. 65.6%

D. 50%

Answer: C

Watch Video Solution

35. A certain radioactive substance has a half life of 5 years. Thus for a nucleus in a sample of the element, probability of decay in 10 years is

A. $50\ \%$

B. $75\ \%$

C. $60\ \%$

D. $100\ \%$

Answer: B

Watch Video Solution

36. 200 Mev energy is released when one nucleus of $.^{235}U$ undergoes fission. Find the number of fissions per second required for producing a power of 1 mega watt.

A. 3.125×10^{14}

B. 3.125×10^{15}

C. 3.125×10^{16}

D. 3.125×10^{13}

Answer: C

Watch Video Solution

37. In each fission of U^{235}, 200 MeV of energy is released. If a reactor produces 100MW power the rate of fission in it will be

A. 3.125×10^{18} per min

B. 1.9×10^{19} per min

C. 3.125×10^{17} per min

D. 1.9×10^{20} per min

Answer: D

Watch Video Solution

38. In a nuclear fission 0.1% of mass is converted into energy. The energy released by the fission of 1kg mass is

A. 2.5×10^{7} KWH

B. 2.5×10^7 J

C. 2.5×10^7 eV

D. 2.5×10^7 MeV

Answer: A

Watch Video Solution

39. Calculate the energy released by fission from 2 g of $._{92}^{235}U$ in k Wh. Given that the energy released per fission is 200 Mev.

A. 4.54×10^4 kWh

B. 4.54×10^3 kWh

C. 4.54×10^5 kWh

D. 4.54×10^6 kWh

Answer: A

Watch Video Solution

40. An explosion of atomic bomb release an energy of 7.6×10^{13}J. If 200 Mev energy is released on fission of one $.^{235}U$ atom calculate (i) the number of uranium atoms undergoing fission, (ii) the mass of uranium used in the bomb.

A. 4.375×10^{24}, 926.66 g

B. 2.375×10^{24} , 826.66 g

C. 3.375×10^{24} , 926.66 g

D. 2.375×10^{24} , 926.66 g

Answer: D

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Practice Exercise

1. Radius of the nucleus of the atom with A=216 is (R_0 =1.3fm)

A. 7.2 fm

B. 7.8 fm

C. 280 fm

D. 19 fm

Answer: B

Watch Video Solution

2. The ratio of the radii of the nuclei $._{13}Al^{27}$ and $._{52}Te^{125}$ is approximately

A. $5:3$

B. $9:25$

C. $25:9$

D. $3:5$

Answer: D

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3. If the radius of a nucleus with a mass number 7 is 2 fermi then the radius of the nucleus with mass number 189 is

A. 27 fm

B. 25 fm

C. 6 fm

D. 3 fm

Answer: C

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4. A heavy nucleus at rest breaks into two fragments which fly off with velocities in the ratio 27:1. The ratio of the radii of the fragments (assumed spherical) is

A. $1:3$

B. $1:4$

C. $4:1$

D. $2:1$

Answer: A

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5. One milligram of matter converted into energy will give

A. 9×10^{10} J

B. 9×10^{3} J

C. 9×10^{7} J

D. 9×10^{5} J

Answer: A

Watch Video Solution

6. The energy in MeV released due to transformation of 1 kg mass completely into energy, is ($c = 3 \times 10^8$ m/s)

A. 7.625×10^9 MeV

B. 29×10^5 MeV

C. 2.8×10^{-28} MeV

D. 5.625×10^{29} MeV

Answer: D

Watch Video Solution

7. Binding energy of deuterium is 2.23MeV. Mass defect in amu is

A. 0.0012

B. 0.0024

C. 0.0036

D. -0.0012

Answer: B

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8. Distance of closest approach when a 5.0MeV proton approaches a gold nucleus is (Z=79)

A. 16 fermi

B. 23 fermi

C. 39 fermi

D. 47 fermi

Answer: B

Watch Video Solution

9. the mas defect in a particular nuclear reaction is 0.3g the emount of energy liberated in ilowatt hours is(velocity of light $= 3 \times 10^8 ms^{-1}$)

A. 1.5×10^6

B. 2.5×10^6

C. 3×10^6

D. 7.5×10^6

Answer: D

Watch Video Solution

10. The value of binding energy per nucleon of $._{20}^{40}Ca$ nucleus is Given :

Mass of $._{20}^{40}Ca$ nucleus $= 39.962589u$

$\text{Mass of proton} \quad = 1.007825u$

$\text{Mass of neutron} \quad = 1.008665u$

and $1u = 931 \text{ MeV C}^{-2}$

A. 4.55 Mev

B. 8.55 Mev

C. 6.55 Mev

D. 7.55 Mev

Answer: B

Watch Video Solution

11. Calculate the energy required to separate $\cdot_{50} Sn^{120}$ into its constituents if m_p =1.007825amu, m_{sn}=119.902199amu, m_n =1.008665amu

A. 1.02 MeV

B. 1021 MeV

C. 102.1 MeV

D. 0.1021 MeV

Answer: B

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12. Find the energy required to split $._{8}^{16}O$ nucleus into four αparticles. The mass of an α -particle is 4.002603 u and that of oxygen is 15.994915 u.

A. 14.43 Mev

B. 12.43 Mev

C. 10.43 Mev

D. 16.43 Mev

Answer: A

Watch Video Solution

13. Bombardment of lithium with protons gives rise to the following reaction :

$._3 Li^7 + ._1 H^1 \rightarrow 2(._2 He^4) + Q$. Find the Q-value of the reaction. The atomic masses of lithium, proton and helium are 7.016 u, 1.008 u and 4.004 u respectively.

A. 12.904 Mev

B. 14.904 Mev

C. 10.904 Mev

D. 16.904 Mev

Answer: B

Watch Video Solution

14. The distance of closest approach of an α-particle fired at nucleus with momentum p is d. The distance of closest approach when the α-particle is fired at same nucleus with momentum 3p will be

A. $2r_0$

B. $4r_0$

C. $\frac{r_0}{2}$

D. $\frac{r_0}{4}$

Answer: D

Watch Video Solution

15. Atomic mass of $._{6}^{13}C$ is 13.00335 amu and its mass number is 13.0. If 1 amu = 931 MeV. binding energy of the neutrons present in the nucleus is

A. 0.24 MeV

B. 1.44 MeV

C. 1.68 MeV

D. 3.12 MeV

Answer: C

Watch Video Solution

16. Three $\propto$ -particles ($m_{\propto}$ = 4.0026) amu are combined to form a C^{12} nucleus. The energy released will be

A. 4.02 Mev

B. 5.57 Mev

C. 3.39 Mev

D. 7.26 Mev

Answer: D

Watch Video Solution

17. If the rate of emission of energy from a star is 2.7×10^{36} J/ sec, the rate of loss of mass in the star will be

A. 3×10^{18} kg/s

B. 3×10^{19} kg/s

C. 3×10^{20} kg/s

D. 3×10^{21} kg/s

Answer: B

Watch Video Solution

18. The half life of a radioactive substance is 13 years. The decay constant is

A. $1.69 \times 10^{-10} S^{-1}$

B. $1.96 \times 10^{-9} S^{-1}$

C. $1.69 \times 10^{-9} S^{-1}$

D. $1.29 \times 10^{-7} S^{-1}$

Answer: C

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

A. 5 min

B. $7\frac{1}{2}$ min

C. 10 min

D. 14 min

Answer: A

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20. A certain substance decays to 1/32 of its initial activity in 25 days. Calculate its half-life.

A. 4 days

B. 5 days

C. 3 days

D. 6 days

Answer: B

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21. Half life period of a radio active element A is 10 hours. In certain time 2g of A has become 0.25g. In the same time 4g of B reduced to 0.5g. Half life period of B is

A. 10 hrs

B. 5hrs

C. 2hrs

D. 6 hrs

Answer: A

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

A. $\frac{1}{10\lambda}$

B. $\frac{1}{11\lambda}$

C. $\frac{11}{10\lambda}$

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

Answer: D

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23. A radioactive sample at any instant has its disintegration rate 5000 disintegrations per minute.

After 5 minute, the rate 1250 disintegration per minute. The decay constant (per minute) is

A. 0.4 ln2

B. 0.2 ln2

C. 0.1 ln2

D. 0.8 ln2

Answer: A

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24. The half life of Co^{58} is 72 days its average life is

A. 103.9 days

B. 50 days

C. 200 days

D. 320 days

Answer: A

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25. After 280 days, the activity of a radioactive sample is 6000 dps. The activity reduces to 3000 dps after another 140 days. The initial activity of the sample in dps is

A. 6000

B. 9000

C. 3000

D. 24000

Answer: D

26. The half-life of a radioactive substance is 5000 years. In how many years, its activity will decay to 0.2 times of its initial value ? Given $\log_{10}5$ = 0.6990.

A. 1.16×10^5 years

B. 1.16×10^4 years

C. 1.16×10^3 years

D. 1.16×10^6 years

Answer: B

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27. At time $t = 0$, activity of a radioactive substance is $1600Bq$, at $t = 8s$ activity remains $100Bq$. Find the activity at $t = 2s$.

A. 200 Bq

B. 400 Bq

C. 600 Bq

D. 800 Bq

Answer: D

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28. Two radiactive sources A and B initially contain equal number of radioactive atoms. Source A has half-life of 1 hour and source B has a half-life 2 hours. At the end of 2 hours, the ratio of the rate of disintergration of A to that of B is :

A. $1:1$

B. $1:2$

C. $2:1$

D. $1 : 3$

Answer: A

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29. 1 g of a radiactive substance disintegrates at the rate of 3.7×10^{10} dps , the atomic mass of the substance is 22.6 , calculate its means life .

A. 7.2×10^{10} sec

B. 8×10^{10} sec

C. 9×10^{10} sec

D. 10^{10} sec

Answer: A

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30. The isotope $._{92}U^{238}$ decays successively to form $._{90}Th^{234}, ._{91}Pa^{234}, ._{92}U^{234}, ._{90}Th^{230}$ and $._{88}Ra^{226}$. What are the radiations emitted in these five steps?

A. $\alpha, \alpha, \alpha, \beta, \beta$

B. $\alpha, \beta, \beta, \alpha, \beta$

C. $\alpha, \beta, \alpha, \alpha, \alpha$

D. $\alpha, \beta, \beta, \alpha, \alpha$

Answer: D

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31. A radioactive isotope has a half-life of T years. The time required for its activity reduced to 6.25% of its original activity

A. 4T years

B. T years

C. 3T years

D. 2T years

Answer: A

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32. A certain particle has a half life of 60 seconds. The fraction of the particles that will decay at the end of 10 seconds is

A. $2^{1/6}$

B. $\left(1-2^{1/6}\right)$

C. $\left(2^{6}-1\right)$

D. $\left(1-2^{-1/6}\right)$

Answer: D

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33. A nuclear reactor has a power of 16 kW. If the energy released per fission is 200 MeV, the number of fissions per second is

A. 5×10^{16}

B. 5×10^{17}

C. 5×10^{14}

D. 5×10^{15}

Answer: C

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34. If 200 MeV of energy is released in the fission of one nucleus of $._{92}U^{235}$, The number of nuclei that must undergo fission to produce

energy of 1000J in 1 sec is

A. 3.125×10^{13}

B. 6.25×10^{13}

C. 12.5×10^{13}

D. 3.125×10^{14}

Answer: A

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35. When U-235 undergoes fission, 0.1% of its mass is converted into energy. Then amount of energy released during the fission of 1kg of uranium-235 will be

A. 9×10^{13} J

B. 9×10^{14} J

C. 9×10^{15} J

D. 9×10^{21} J

Answer: A

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36. Energy released during the fission of one Uranium-235 nucleus is 200MeV. Energy released by the fission of 500gm of U-235 nuclei will be about

A. 3.5×10^{20} MeV

B. 6.6×10^{24} MeV

C. 2.8×10^{26} MeV

D. 1.6×10^{31} MeV

Answer: C

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37. It is estimated that the energy released in the explosion of atomic bomb at Hiroshima was 9×10^{13}J. If an average 200MeV of energy is released in the fission of one , $._{92}U^{235}$. The mass of uranium used for the bomb is nearly

A. 1.1 kg

B. 2.5 kg

C. 3.6 kg

D. 4 kg

Answer: A

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38. The binding energy of deuteron is 2.2 MeV and that of $._2^4He$ is 28 MeV. If two deuterons are fused to form one $._2^4He$, th n the energy released is

A. 30.2 MeV

B. 25.8 MeV

C. 23.6 MeV

D. 19.2 MeV

Answer: C

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39. In the reaction ${}_1^2H + {}_1^3H \rightarrow {}_2^4He + {}_0^1n$. If the binding energies of ${}_1^2H, {}_1^3H$ and ${}_2^4He$ are respectively a, b and c (in MeV), then the energy (in MeV) released in this reaction is

A. c+a-b

B. c-a-b

C. a+b+c

D. a+b-c

Answer: B

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40. Assume that a neutron breaks into a proton and an electron. The energy released during this process is (Mass of neutron = 1.6725×10^{-27} kg, mass of proton = 1.6725×10^{-27} kg, mass of electron = 9×10^{-31} kg)

A. -0.51 MeV

B. -7.10 MeV

C. -6.30 MeV

D. -5.4 MeV

Answer: A

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Problem

1. Compare the radii of two nuclei with mass number 27 and 64 respectively.

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2. How many electrons protons, and neutrons are there in $12g$ of $._6 C^{12}$ and in $14g$ of $._6 C^{14}$?.

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3. Calculate the mass defect and binding energy per nucleon for an alpha particle (containing two protons and two neutrons) whose actual mass is 4.0028 amu (mass of proton = 1.00759 amu, mass of nuetron = 1.00898 amu).

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4. Calculate the binding energy of an α-particle in MeV Given : m_p (mass of proton) = 1.007825 amu, m_n (mass of neutron) = 1.008665 amu Mass of the nucleus `=4.002800 amu, 1 amu = 931 MeV.

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5. Find the average binding energy per nucleon of $._7 N^{14}$ and $._8 O^{16}$. Their atomic masses are 14.008 u and 16.000 u. The mass of $._1 H^1$atom is 1.007825 u and the mass of neutron is 1.008665 u. Which is more stable?

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

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7. Find the Q value of the reaction $P + .^7 Li \rightarrow .^4 He + .^4 He$. Determine whether the reaction is exothermic or endothermic. The atomic masses of $.^1 H, .^4 He$ and $.^7 Li$ are $1.007825u, 4.002603u,$ and $7.016004u,$ respectively.

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8. Calculate the average energy required to extract a nucleon from the nucleus of an α - particle. the mass of 'alpha' -particle , proton and neutron are 4.00150 a.m.u 1.00728 a.m.u and 1.00867 amu respectively .

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9. Find the energy required to split $._{8}^{16}O$ nucleus into four α - particles. The mass of an

α- particle is 4.002603u and that of oxygen is 15.994915u.

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10. The kinetic energy of an α-particle which flies out of the nucleus of a Ra^{226} atom in radioactive disintergration is $4.78 MeV$. Find the total energy evolved during the eascape of the α-particle

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11. How many alpha and β^{-} decays does U^{238} experiences before turning finally into stable Pb^{206} isotope ?

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12. Neon-23 decays in the following way,

$._{10}^{23} Ne \rightarrow_{11}^{23} Na +_{-1}^{0} e + \bar{v}$

Find the minimum and maximum kinetic energy that the beta particle$\left(._{-1}^{0} e\right)$can have. The atomic masses of $.^{23} Ne$ and $.^{23} Na$ are $22.9945u$ and $22.9898u$, respectively.

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13. A radioactive sample has an activity of 4×10^7 Ci. Express its activity in .becqueral. and .rutherford..

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14. The probaility that a certaun radioactive atom would get disintefrated in a time equal to the mean life fo the radioactive sample is

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15. The radioactivity of given sample of whisky due to tritium (Half life=12 yrs) was found to be only 3.125% of that measured in a recently purchased bottle marked "10 years old". By how many years ago the sample must have been prepared?

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16. The half life of a substance is 20 minutes. E The time interval between 33% decay and 67% decay.

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17. Find the number of half lives elapsed, before which, 93.75% of a radioactive sample has decayed.

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18. Calculate the number of half lives elapsed, the end of which, the activity of a radioactive sample decrease by 90%.

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19. Estimate the number of mean lives elapsed, when the number of atoms in a radioactive sample decrease to 5% of the original value.

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20. The mean lives of a radioactive substance are 1620 years and 405 years of α-emission and β-emission respectively. Find out the time during which three-fourth of a sample will decay if it is decaying both by α-emission and β-emission simultaneously.

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21. A radioactive isotope X has a half-life of 3s. At t = 0 s, a given sample of this isotope X contains 8000 atoms. Find the time t_1, when

1000 atoms of isotope X remains in the sample.

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22. n alpha particles per second are emitted from N atoms of a radioactive element. Then find the half life of radioactive element ?

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23. Four vessels A,B,C and D contain respectively 20g atom ($T_{1/2}$ = 5h) 2g atom ($T_{1/2}$=1h) 5g atom ($T_{1/2}$ = 2h) and 10g atom ($T_{1/2}$ = 3h) of different radio nuclides in the 12 beginning, the maximum activity would be exhibited by the vessel is

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24. At time $t = 0$, number of nuclei of a radioactive substance are $100.$ At $t = 1$ s these numbers become 90. Find the number of nuclei at $t = 2s$.

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25. The activity of a sample of radioactive material is A_1 at time t_1 and A_2 at time $t_2 (t_2 > t_1)$. It mean life is T .

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26. The half-life of $_{-}^{238}U_{92}$ against alpha decay is 4.5×10^9 year. How much disintegration per second occurs in 1 g of $_{-}^{238}U_{92}$?

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27. A radioactive substance has 6.0×10^{18} active nuclei initially. What time is required for the active nuclei o the same substance to become 1.0×10^{18} if its half-life is 40 s.

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Watch Video Solution

28. Two radioactive substances X and Y initially contain equal number of atoms. Their half-lives are 1 hour and 2 hours respectively. Calculate the ratio of their rates of disintegration after four hours.

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29. A radioactive nucleus can decay by two different processes. The half-life for the first process is t_1 and that for the second process is t_2. Show that the effective half-life t of the nucleus is given by

$$\frac{1}{t} = \frac{1}{t_1} + \frac{1}{t_2}.$$

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30. The count rate from 100 cm^3 of a radioactive liquid is c.Some of this liquid is now discarded. The count rate of the remaining liquid is found to be c/10 after three half-lives. The volume of the remaining liquid, in cm^3, is

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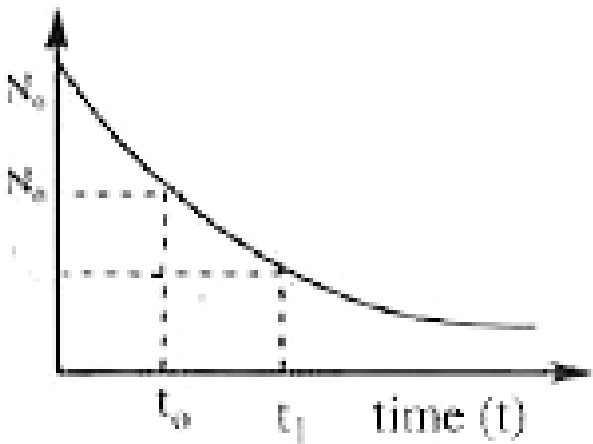
31. Graph shows the variation of the number of radioactive atoms left undecayed with time. Find the time corresponding to $N = N_0/3$?



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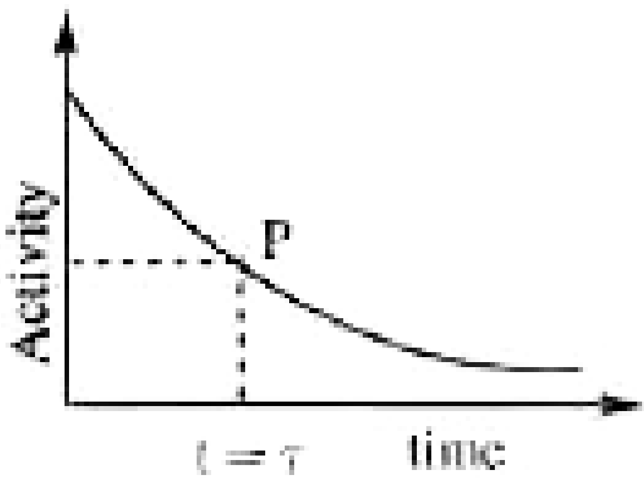
32. The activity of a certain radioactive sample is plotted against time in graph. If the initial slope of the curve is m, then find the slope of the curve at point P ?



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33. A nuclear power reactor generates electric power of 100 MW. How many number of fissions occur per second if nuclear fuel used in the reactor is uranium ?

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34. How much U^{235} is consumed in a day in an atomic power house operating at 400 MW, provided the whole of the mass of U^{235} is converted into energy?

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35. If the speed of light were 2/3 of its present value, what would be fractional decrease in the energy released in a given atomic explosion

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36. Calculate the energy released by the fission 1 g of $.^{235}U$ in joule, given that the energy released per fission is 200 MeV. (Avogadro.s number $=6.023 \times 10^{23}$)

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37. Calculate the energy released by fission from 2 gm of $._{92}U^{235}$ in KWH. Given that the energy released per fission is 200 Mev.

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38. A reactor is developing nuclear energy at a rate of 32,000 kilowatt. How many kg of U^{235} undergo fission per second? How many kg of U^{235} would be used up in 1000 hour of operation? Assume an average energy of 200 MeV released per fission? Take Avogadro.s number as 6×10^{23} and 1 MeV $=1.6 \times 10^{-13}$ joule

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39. In the process of nuclear fission of $1g$ uranium, the mass lost is $0.92mg$. The efficiency of power house run by the fission reactor is 10% .To obtain 400 megawatt power from the power house, how much uranium will be required per hour? $\left(c = 3 \times 10^{8} ms^{-1}\right)$.

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40. If both the number of protons and the number of neutrons are conserved in each nuclear reaction, in what way is mass converted into energy (or vice-versa) in a nuclear reaction ? Explain.

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41. An electron-positron pair is produced when a γ-ray photon of energy 2.36MeV passes close to a heavy nucleus. Find the kinetic energy carried by each particle produced, as well as the total energy with each.

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42. A gamma ray photon of energy 1896 MeV annihilates to produce a proton-antiproton pair. If the rest mass of each of the particles involved be 1.007276 a.m.u approximately, find how much K.E these will carry?

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43. The ratio of the radii of the nuclei $._{13}Al^{27}$ and $._{52}Te^{125}$ is approximately

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44. How many electrons , protons and neutrons are there in 12g of ${}_6C^{12}$ and in 14g of ${}_6C^{14}$ (Take Avogadro number N $= 6 \times 10^{23}$)

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

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46. Calculate the mass defect, binding energy and building energy per nucleon of an alpha particle (An α - particle is nothing but helium nucleus. Hence its symbol is ${}_2He^4$. It contains 2 protons , 2 neutrons with a mass number 4. Mass hydrogen atom $m_H = 1.007825$ u : Mass of neutron $m_n = 1.008665$ u : Atomic number of helium Z = 2 , Mass number of helium A = 4 , Mass of helium atom $m_a = 4.00260u$)

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47. Find the average binding energy per nucleon of $._7 N^{14}$ and $._8 O^{16}$. Their atomic masses are 14.008 u and 16.000 u. The mass of $._1 H^1$atom is 1.007825 u and the mass of neutron is 1.008665 u. Which is more stable?

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48. Find the Q value of the reaction $P + .^7 Li \rightarrow .^4 He + .^4 He.$ Determine whether the reaction is exothermic or endothermic. The atomic masses of $.^1 H, .^4 He$ and $.^7 Li$ are $1.007825u, 4.002603u,$ and $7.016004u,$ respectively.

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49. Calculate the average energy required to extract a nucleon from the nucleus of an α - particle ,proton and neutron are 4.00150 a.m.u 1.00728 a.m.u and 1.00867 amu respectively .

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50. The atomic mass of an alpha particles 4.002603 amu and that of oxygen is 15.99415 amu. Find the energy required to split up the oxygen - 16 nucleus into 4 alpha particles .

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51. The kinetic energy of an α-particle which flies out of the nucleus of a Ra^{226} atom in radioactive disintergration is $4.78 MeV$. Find the total energy evolved during the eascape of the α-particle

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52. How many α and β - particles are emitted when uranium nucleus $\left({ }_{92}^{238} U\right)$ decay to ${ }_{82}^{214} Pb$?

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53. Neon-23 decays in the following way,

$.{ }_{10}^{23} Ne \rightarrow{ }_{11}^{23} Na+{ }^{0}{ }_{-1} e+\bar{v}$

Find the minimum and maximum kinetic energy that the beta particle$\left(.^{0}_{-1}e\right)$can have. The atomic masses of $.^{23}Ne$ and $.^{23}Na$ are $22.9945u$ and $22.9898u$, respectively.

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54. A radioactive sample has an activity of $4 \times 10^7 Ci$, Expross its activity in .becqueral. and .rutherford..

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55. The probaility that a certaun radioactive atom would get disintefrated in a time equal to the mean life fo the radioactive sample is

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56. The radioactivity of given sample of whiskey due to tritium (Half life= 12 yrs) was found to be only 3.125% that measured in a recently purchased bottle marked " 10 years old", By how many years age the sample must have been prepared ?

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57. The half life of a substance is 20 minutes The time interval between 33% decay and 67% decay

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58. Find the number of half lives elapsed , before which , 93.75% of a radioactive sample has decayed .

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59. Calculate the number of half lives elapsed , at the end of which , the activity of a radioactive sample decrease by 90% .

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60. Estimate the number of mean lives clasped , when the number of atoms in a radioactive sample decrease to 5% of the original value.

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61. The mean lives of a radioactive substance are 1620 year and 405 year for α - emission and β -emission respectively . Find the time during which three-fourth of sample will decay if it is decayed both by α -emission and β -emission simultaneously.

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62. A radioactive isotope X has a half-life of 3s. At t = 0 s, a given sample of this isotope X contains 8000 atoms. Find the time t_1, when 1000 atoms of isotope X remains in the sample.

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63. n alpha particles per second are emitted from N atoms of a radioactive element. Find the half-life of radioactive element?

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View Text Solution

64. Four vessels A,B,C and D contain respectively 20g atom $\left(T_{1/2} = 5h\right)$ 2g atom $\left(T_{1/2} = 1h\right)$ 5g atom $\left(T_{1/2} = 2h\right)$ and 10g atom $\left(T_{1/2} = 3h\right)$ of different radio nuclides in the beginning , the maximum activity would be exhibited by the vessel is

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65. At time $t = 0$, number of nuclei of a radioactive substance are $100.$ At $t = 1$ s these numbers become $90.$ Find the number of nuclei at $t = 2s.$

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66. The activity of a sample of radioactive material is A_1 at time t_1 and A_2 at time $t_2(t_2 > t_1)$. It mean life is T .

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67. The half-life of $_{-}^{238}U_{92}$ against alpha decay is 4.5×10^9 year. How much disintegration per second occurs in 1 g of $_{-}^{238}U_{92}$?

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68. A radioactive sample can decay by two different processes. The half-life for the first process is T_1 and that for the second process is T_2 Find the effective half - life T of the radioactive sample.

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69. A radioactive substance has 6.0×10^{18} active nuclei initially . What time required for the active nuclei of the same substance to become 1.0×10^{18} if it.s half-life is 40 s.

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70. Two radioactive substances X and Y initially contain equal number of atoms . Their half-lives are 1 hour and 2 hours respectively . Calculate the ratio of their rates of disintegrations after four hours.

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71. The count rate from 100 cm^3 of a radioactive liquid is c.Some of this liquid is now discarded. The count rate of the remaining liquid is found to be c/10 after three half-lives. The volume of the remaining liquid, in cm^3 , is

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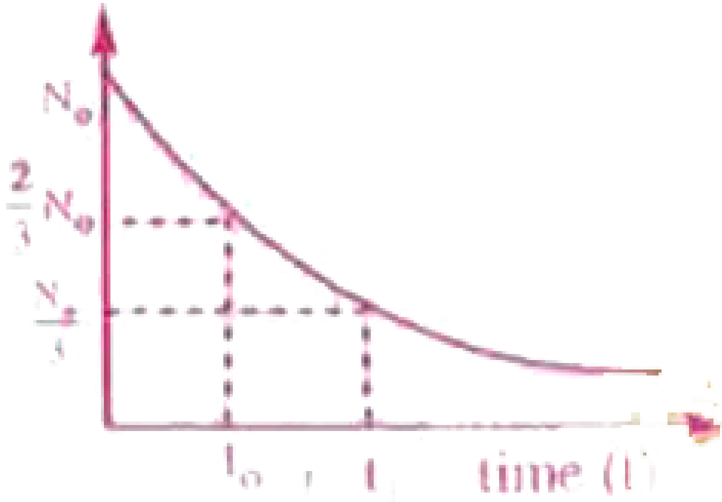
72. Graph shows the variation of the number of radioactive atoms left undecayed with time.

Find the time corresponding to $N = N_0/3$?



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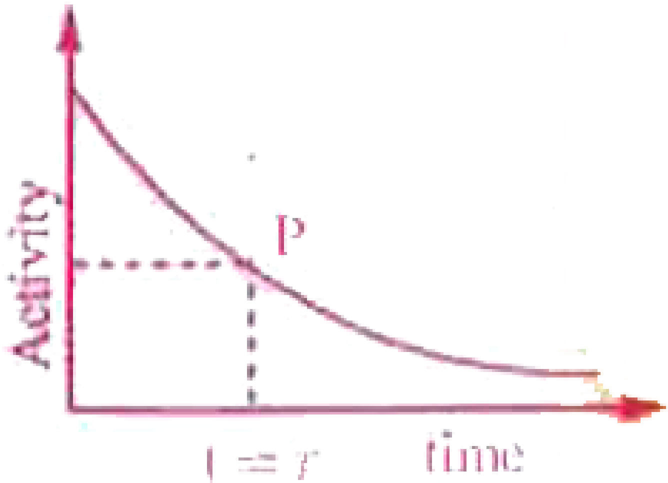

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79. If the speed of light were 2/3 of its present value , what would be fractional decrease in the energy released in a given atomic explosion

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80. a) Are the equations of nuclear reactions .balanced. in the sense a chemical reaction ?

b) If both the number of protons and the number of neutrons are conserved in each nuclear reaction, in what way is mass converted into energy (or vice- versa) in a nuclear reaction?

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81. An electron-positron pair is produced when a γ -ray photon of energy 2.36MeV passes close to a heavy nuclens . Find the kinetic energy carried by each particle produced , as well as the total energy with each.

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Exercise I

1. The mass number of a nucleus is

A. always less than its atomic number

B. always more than its atomic number

C. equal to its atomic number

D. some times more than and some times equal to atomic number

Answer: D

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2. The gravitational force between a H-atom and another particle of mass m will be given by Newton's law

$F = G\frac{M.m}{r^2}$, where r is in km and

A. $M = m_{\text{proton}} + M_{\text{electron}}$

B. $M = M_{\text{proton}} + M_{\text{electron}} - \frac{B}{C^2}$ (Here B = 13.6ev)

C. M is not related to mass of hydrogen atom

D. $M = m_{\text{proton}} + M_{\text{electron}} - \frac{V}{C^2}$ (Here V is magnitude of P.E of electron in H atom)

Answer: B

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3. Two nucleons are at a separation of $1 \times 10^{-15} m$. The net force between them is F_1 if both are neutrons F_2 if both are protons and F_3 if one is a proton and other is a neutron. In such a case

A. $F_2 > F_1 > F_3$

B. $F_1 = F_2 > F_3$

C. $F_1 = F_2 = F_3$

D. $F_1 = F_3 > F_2$

Answer: D

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4. One requires energy E_n to remove a nucleon from a nucleus and an energy E_e to remove an electron from the orbit of an atom. Then

A. E_n

B. $E_n < E_c$

C. $E_n > E_c$

D. $E_n \begin{matrix} \geq \\ < \end{matrix} E_c$

Answer: C

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5. Which of the following is correct about nuclear forces?

A. They are short range attractive forces

B. They are independent of charge

C. They change to repulsion at very close distance

D. They obey inverse square law

Answer: D

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6. As the mass number A increases, the binding energy per nucleon in a nucleus.

A. increases

B. decreases

C. first increases and then decreases

D. remains same

Answer: C

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7. A fraction f_1 of a radioactive sample decays in one mean life, and a fraction f_2 decays in one half life. Then

A. $f_1 > f_2$

B. $f_1 < f_2$

C. $f_1 = f_2$

D. May be (1), (2) or (3) depending on the values of the mean life and half-life.

Answer: A

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8. 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 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

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9. Suppose we consider a large number of containers each containing initially 10000 atoms of a radioactive material with a half life of 1 yr. After 1 yr

A. All containers will have 5000 atoms of material

B. All containers will contain same number of atoms and number will be approximately 5000.

C. Containers will have different numbers of atoms of material, but their average will be close to 5000.

D. None of containers can have more than 5000 atoms.

Answer: C

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10. When a nucleus in an atom undergoes a radioactive decay the electronic energy levels of the atom

A. Do not change for any type of radioactivity

B. Change for α and β radioactivity but not for γ -radioactivity.

C. Change for - radioactivity but not for others.

D. Change for radioactivity but not for others.

Answer: B

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11. A radioactive substance X decays into another radioactive substance Y Initially only X was present. λ_x and λy_y are the disnttegration constants of Xa nd Y N_x and N_y are the number of nuclie of X and Y at any time t. Number of nuclei N_y will be maximum when

A. $\dfrac{N_y}{N_x - N_y} = \dfrac{\lambda_y}{\lambda_x - \lambda_y}$

B. $\dfrac{N_x}{N_x - N_y} = \dfrac{\lambda_x}{\lambda_x - \lambda_y}$

C. $\lambda_y N_y = \lambda_x N_x$

D. $\lambda_y N_x = \lambda_x N_y$

Answer: C

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12. Which one of the following is a possible nuclear reaction ?

A. ${}_{5}^{10}B + {}_{2}^{4}He \rightarrow {}_{7}^{13}N + {}_{1}^{1}H$

B. ${}_{11}^{20}Na + {}_{1}^{1}H \rightarrow {}_{10}^{20}Ne + {}_{2}^{4}He$

C. ${}_{93}^{239}Np + {}_{94}^{239}Pu + \beta^{-} + \overrightarrow{v}$

D. ${}_{7}^{11}N + {}_{1}^{1}H \rightarrow {}_{6}^{12}C + \beta^{-} + \overrightarrow{v}$

Answer: C

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13. N_1 atoms of a radioactive element emit N_2 "beta" particles per second The decay constant of the element is (ins^{-1})

A. N_1 / N_2

B. N_2 / N_1

C. $N_1(In2)$

D. $N_2(In2)$

Answer: B

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14. Radioactive nuclei that are injected into a patient collect at certain sites within its body, undergoing radioactive decay and emiting electromagnetic radiation can then be recorded by a detector. This procedure provides an important diagnostic tool called

A. Gamma camera

B. CAT scan

C. Radiotracer technique

D. Gamma ray spectroscopy

Answer: C

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15. In fission,the percentage of mass converted into energy is about

A. 0.1%

B. 0.25%

C. 0.01%

D. 2%

Answer: A

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16. Nuclear - Fission is best explained by:

A. Optical model of the nucleus

B. Shell model of nucleus

C. Collective model of the nucleus

D. Liquid drop model of the nucleus

Answer: D

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17. Nuclear fusion is possible

A. only between light nuclei

B. only between heavy nuclei

C. between both light and heavy nuclei

D. only between nuclei which are stable against β - decay

Answer: A

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18. Nuclear energy is released in fusion reaction, since binding energy per nucleon is

A. Greater for fission fragments than for parent nucleus

B. Smaller for fission fragments than for parent nucleus

C. Same for fission fragments and nucleus

D. None of the above

Answer: A

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19. Observe the following statements regarding isotones :

$a.\ .^{39}K$ and $.^{40}Ca$ are isotones.

$b.$ Nucleides having different atomic number (Z) and mass numbers (a) but same number of neutrons (n) are called isotones.

$c.\ .^{19}F$ and $.^{23}Na$ are isotones.

The correct answer is $-$

A. i,ii and iii are correct

B. only (i) and (ii) are correct

C. only i and iii are correct

D. only ii and iii are correct

Answer: B

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Exercise Ib

1. Assertion: Activity of 10^8 undecayed radioactive nuclei of half life 50 days is equal to that of 1.2×10^8 number of undecayed nuclei of same other material with half life 60 days.

Reason :Activity is proportional to half life

A. Both .A. and .R. are true and .R. is the correct explanation of .A.

B. Both .A. and .R. are true and .R. is not the correct explanation of .A.

C. A. is true and .R. is false

D. A. is false and .R. is false

Answer: C

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2. Statement-1 : Electron capture occurs more often than positron emission in heavy elements.

and

Statement-2 : Heavy element generally exhibit radioactivity.

A. Both .A. and .R. are true and .R. is the correct explanation of .A.

B. Both .A. and .R. are true and .R. is not the correct explanation of .A.

C. A. is true and .R. is false

D. A. is false and .R. is false

Answer: B

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3. Statement-1:isotopes of an element can be separated using a mass-spectrometer.

Statement-2:Separation of isotopes is possible because of the difference in electron numbers of isotopes.

A. Both .A. and .R. are true and .R. is the correct explanation of .A.

B. Both .A. and .R. are true and .R. is not the correct explanation of .A.

C. A. is true and .R. is false

D. A. is false and .R. is false

Answer: C

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4. Assertion A beam of charged particles is employed in the treatment of cancer

Reson Charged particles on passing through a material medium lose their energy by causing ionization of the atoms along their path.

A. Both .A. and .R. are true and .R. is the correct explanation of .A.

B. Both .A. and .R. are true and .R. is not the correct explanation of .A.

C. A. is true and .R. is false

D. A. is false and .R. is false

Answer: A

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5. Assertion: In the process of nuclear fission, the fragments emit two or three neutrons as soon as they are formed and subsequently emit particles.

Reason : As the fragments contain an excess of neutrons over protons, emission of neutrons and particles bring their neutron/proton ratio the to stable values

A. Statement-1 is True , Statement-2 is True ,Statement-2 is a correct explanation for

Statement-1

B. Statement-1 is True , Statement-2 is True ,Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False, Statement-2 is True

A. Both .A. and .R. are true and .R. is the correct explanation of .A.

B. Both .A. and .R. are true and .R. is not the correct explanation of .A.

C. A. is true and .R. is false

D. A. is false and .R. is false

Answer: A

Watch Video Solution

6. Assertion The binding energy per nucleon, for nuclei with atomic mass number $A > 100$, decreases with A.

Reason The nuclear forces are weak for heavier nuclei.

A. Both .A. and .R. are true and .R. is the correct explanation of .A.

B. Both .A. and .R. are true and .R. is not the correct explanation of .A.

C. A. is true and .R. is false

D. A. is false and .R. is false

Answer: B

Watch Video Solution

7. Assertion : X-ray can essential that all the flash but not through the bones .

Reason The penctrating power of X- rays depends on voltage .

A. Both .A. and .R. are true and .R. is the correct explanation of .A.

B. Both .A. and .R. are true and .R. is not the correct explanation of .A.

C. A. is true and .R. is false

D. A. is false and .R. is false

Answer: B

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8. Assertion : Nuclei having number about 60 are most stable.

Reason : When two or more light nuclei are combined into a heavier nucleus, then the binding energy per nucleon will increase.

A. Both .A. and .R. are true and .R. is the correct explanation of .A.

B. Both .A. and .R. are true and .R. is not the correct explanation of .A.

C. A. is true and .R. is false

D. A. is false and .R. is false

Answer: B

Watch Video Solution

9. Assertion : At rest, radium is decayed into Radon and an α- particle. They both moves back to back of each other.

Reason : Splitting of radioactive particle is based on conservation of linear momentum.

A. Both .A. and .R. are true and .R. is the correct explanation of .A.

B. Both .A. and .R. are true and .R. is not the correct explanation of .A.

C. A. is true and .R. is false

D. A. is false and .R. is false

Answer: A

Watch Video Solution

10. Assertion : γ - radiation emission occurs after α and β decay.

Reason : Energy levels occur in nucleus.

A. Both .A. and .R. are true and .R. is the correct explanation of .A.

B. Both .A. and .R. are true and .R. is not the correct explanation of .A.

C. A. is true and .R. is false

D. A. is false and .R. is false

Answer: A

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11. Assertion : A laser beam of 0.2 watt power can drill holes through a metal sheet whereas a 1000 watt torch light cannot

Reason The frequency of laser light

A. Both .A. and .R. are true and .R. is the correct explanation of .A.

B. Both .A. and .R. are true and .R. is not the correct explanation of .A.

C. A. is true and .R. is false

D. A. is false and .R. is false

Answer: C

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Exercise Ii

1. Compare the radii of two nuclei with mass number 8 and 64 respectively.

A. $1:3, 1:1$

B. $3:2, 1:1$

C. $1:2, 1:1$

D. $1:2, 1:2$

Answer: C

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2. Two stable isotopes $._{3}^{6}Li$ and $._{3}^{7}Li$ have respective abundances of 7.5% and 92.5% . These isotopes have masses 6.01512 u and 7.01600 u respectively. The atomic weight of lithium is

A. 5.941 u

B. 6.491 u

C. 6.941 u

D. 6.149 u

Answer: C

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3. A heavy nucleus at rest breaks into two fragments which fly off with velocities in the ratio 8:1 The ratio of radii of the fragments is

A. $1:2$

B. $1:4$

C. $4:1$

D. $2:1$

Answer: A

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4. 1g ofhydrogen is converted into 0.993 g of helium in a thermonucleart reaction . The energy released is

A. $63 \times 10^{7} J$

B. $63 \times 10^{10} J$

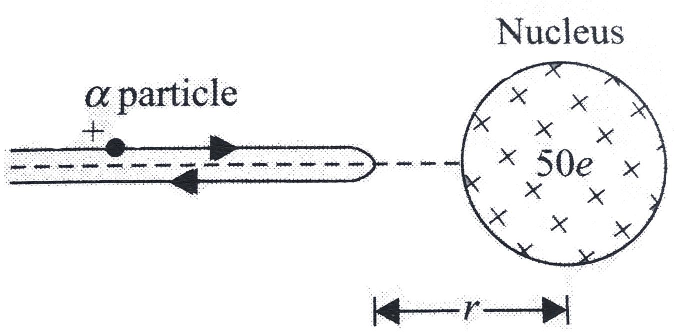
C. $63 \times 10^{13} J$

D. $63 \times 10^{20} J$

Answer: B

Watch Video Solution

5. An alpha particle with kinetic energy $10MeV$ is heading toward a stationary tin nucleus of atomic number 50. Calculate the distance of closest approach (Fig . 3.23).



.

A. $14.4 \times 10^{-16}m$

B. $1.7 \times 10^{-7} m$

C. $1.5 \times 10^{-12} m$

D. $14.4 \times 10^{-15} m$

Answer: D

Watch Video Solution

6. The mass defect for the nucleus of helium is 0.0303 a,m,u,. What is the binding energy per nucleon for helium in MeV?

A. 28

B. 7

C. 4

D. 1

Answer: B

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7. A certain mass of hydrogen is changed to helium by the process of fusion. The mass defect in fusion reaction is $0.02866u$. The energy liberated per u is

$(\text{given} \quad 1u = 931 MeV)$

(1.) 2.67 MeV

(2.)26.7 MeV

(3.)6.675 MeV

(4.)13.35 MeV

A. 12.67 MeV

B. 26.7 MeV

C. 6.675 MeV

D. 13.35 MeV

Answer: C

8. The distance of the closest approach of an alpha particle fired at a nucleus with kinetic of an alpha particle fired at a nucleus with kinetic energy K is r_0. The distance of the closest approach when the α particle is fired at the same nucleus with kinetic energy 2K will be

A. $2r_0$

B. $4r_0$

C. $\frac{r_0}{2}$

D. $\frac{r_0}{4}$

Answer: C

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9. The half - life of $.^{215} At$ is $100 \mu s$. The time taken for the radioactivity of a sample of $.^{215} At$ to decay to $\left(\frac{1}{16}\right)^{\text{th}}$ of its initial value is

A. $400\mu s$

B. $6.3\mu s$

C. $40\mu s$

D. $300\mu s$

Answer: A

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10. Plutonium decays with half life of 24000 years. If plutonium is stored for 72000 years, the fraction of it that remains is

A. 1/8

B. 3/8

C. $7/8$

D. $1/4$

Answer: A

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11. Half-life of a radioactive substance is $12.5h$ and its mass is $256g$. After what time the amount of remaining substance is $1g$?

A. 75

B. 100

C. 125

D. 150

Answer: B

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12. The activity of a radioactive element decreased to one - third of original activity I_0 in 9 yr. After further 9 yr, its activity will be

A. I_0

B. $\frac{2}{3}I_0$

C. $\frac{I_0}{9}$

D. $\frac{I_0}{6}$

Answer: C

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13. The sample of a radioactive substance has 10^6 nucei. Its half life is 20 s . The number of nuclei that will be left after 10 s is neary .

A. 7×10^5

B. 8.5×10^5

C. 8×10^5

D. 7.5×10^5

Answer: A

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14. A radioactive nucleus undergoes a series of decays according to the sequence

$$X \xrightarrow{\beta} X_1 \xrightarrow{\alpha} X_2 \xrightarrow{\alpha} X_3.$$

f the mass number and atomic number of X_3 are 172 and 69 respectively. what is the mass numberand atomic number of X ?

A. 180, 72

B. 180, 74

C. 176, 72

D. 170, 70

Answer: A

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15. Tritium has a half-life of 12.5 y undergoing beta decay. What fraction of a sample of pure tritium will remain undecayed after 25 y.

A. $\frac{1}{2}$

B. $\frac{1}{4}$

C. $\frac{1}{8}$

D. $\frac{1}{16}$

Answer: B

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16. A freshly prepared radioactive source of half-life 2 h emits radiation of intensity which is 64 times the permissible safe level. The minimum time after which it would be passible to work safely with this source is

A. 6 Hrs

B. 12 Hrs

C. 24 Hrs

D. 128 Hrs

Answer: B

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17. If 10% of a radioactive material decays in 5 days, then the amount of orginal material left after 20 days is approximately

A. 90%

B. 80%

C. 65.6%

D. 50%

Answer: C

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18. A sample of radioactive material decays simultaneously by two processes A and B with half-lives $\frac{1}{2}$ and $\frac{1}{4}$ hours respectively . For first half-hour, it decays with process A, next one hour with process B and for a further half and hour with both A and B. If originally there were N_0 nuclei, find the number of nuclei after 2 hours of such decay-

A. $\frac{N_0}{2^8}$

B. $\frac{N_0}{2^4}$

C. $\frac{N_0}{2^6}$

D. $\frac{N_0}{2^5}$

Answer: A

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19. A radio isotope X with a half life 1.4×10^9 yr decays of Y which is stable. A sample of the rock from a cave was found to contain X and Y in the ratio $1:7$. The age of the rock is

A. 3.92×10^9 years

B. 4.20×10^9 years

C. 8.40×10^9 years

D. 1.96×10^9 years

Answer: B

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20. For a radioactive material, half-life is 10 minutes. If initially there are 600 number of nuclei, the time taken (in minutes) for the disintegration of 450 nuclei is

A. 20

B. 10

C. 15

D. 30

Answer: A

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Exercise Iii

1. The binding energy per nucleon of $._3^7 Li$ and $._2^4 He$ nuclei are 5.60 MeV and 7.06 MeV, respectively. In the nuclear reaction $._3^7 Li + ._1^1 H \rightarrow ._2^4 He + ._2^4 He + Q$, the value of energy Q released is

A. -2.4 MeV

B. 8.4 Mev

C. 17.3 MeV

D. 19.6 MeV

Answer: C

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

A. 1.1 MeV

B. 7 MeV

C. 23.6 MeV

D. 6 MeV

Answer: C

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3. The binding energy per nucleon for C^{12} is $7.68 MeV$ and that for C^{13} is $7.5 MeV$ The energy required to remove a neutron from C^{13} is

A. 0.21 MeV

B. 2.52MeV

C. 4.95MeV

D. 2.75 MeV

Answer: C

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4. An alpha nucleus of energy $\frac{1}{2}mv^2$ bomobards a heavy nuclear target of charge

Ze. Then the distance of closest approach for the alpha nucleus will be proportional to

A. $\frac{1}{Ze}$

B. v^2

C. $\frac{1}{m}$

D. $\frac{1}{v^4}$

Answer: C

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5. In a sample of radioactive material, what percentage of the initial number of radioactive nuclei with decay during one mean life ?

A. 37%

B. 50%

C. 63%

D. 69.3%

Answer: C

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6. There are two radioactive nuclei A and B A is an alpha emitter and B a beta emitter. Their disintegration constants are in the ratio of atoms of A and B at any time t so that probilities of getting alpha and beta particles are same at that instant?

A. $2:1$

B. $1:2$

C. e

D. e^{-1}

Answer: A

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7. A radioactive material decays by simultaneous emission of two particle from the with respective half - lives 1620 and 810 year . The time , in year , after which one - fourth of the material remains is

A. 1080 years

B. 2000 years

C. 1500 years

D. 1200 years

Answer: A

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8. A charged capacitor of capacitance C is discharged through a resistance $R. A.$ Radiacvtive sample decays with an average life τ. Find the value of R for which the ratio of the electrostatic field energy stored in the capacitor to the activity of the radioactive sample is independent of time.

A. $\frac{2t}{C}$

B. $\frac{C}{2t}$

C. $2tC$

D. t C

Answer: A

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9. A sample of radioactive material has mass m, decay constant λ, and molecular weight M. Avogadro consatant $=N_A$. The initial activity of the sample is

A. $\left(\frac{mN_A}{M}\right)e^{-\lambda t}$

B. $\left(\frac{mN_A\lambda}{M}\right)e^{-\lambda t}$

C. $\left(\frac{mN_A}{M\lambda}\right)e^{-\lambda t}$

D. $\frac{m}{\lambda}\left(1-e^{-\lambda t}\right)$

Answer: B

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10. $200 MeV$ of energy may be obtained per fission of U^{235} A reactor is generating $1000 KV$ of power. The rate of nuclear fission in the ractor is

A. 1000

B. 2×10^{8}

C. 3.125×10^{16}

D. 931

Answer: C

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11. Half lives of two isotpers X and Y are know to be 2×10^9 years and 4×10^9 years of these isotopes and currntly the meterical has 20% of X and Y 80% by number on the plabnet. The current age of the planet is

A. 2×10^9 years

B. 4×10^9 years

C. 6×10^9 years

D. 8×10^9 years

Answer: D

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12. A sample of radioactive material decays simultaneously by two processes A and B with half-lives $\frac{1}{2}$ and $\frac{1}{4}$ hours respectively . For first half-hour, it decays with process A, next one hour with process B and for a further half and hour with both A and B. If originally there were N_0 nuclei, find the number of nuclei after 2 hours of such decay-

A. $\frac{N_0}{(2)^8}$

B. $\frac{N_0}{(2)^4}$

C. $\frac{N_0}{(2)^6}$

D. $\frac{N_0}{(2)^5}$

Answer: A

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13. Let N_β be the number of β particle emitted by 1 gram of Na^{24} radioactive nuclei hving a half life of $15h$. In 7.5h, the number N_β is close to

$$\left[N_A = 6.023 \times 10^{23}\text{mole}^{-1}\right]$$

A. 1.75×10^{22}

B. 1.25×10^{22}

C. 7.5×10^{21}

D. 6.2×10^{21}

Answer: A

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14. Consider a hypothetical annihilation of a stationary electron with a stationary positron. What is the wavelength of the resulting radiation?

A. $\frac{h}{2m_0c}$

B. $\frac{h}{m_0c}$

C. $\frac{2h}{m_0c}$

D. $\frac{h}{m_0c^2}$

Answer: B

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15. The binding energy per nucleon are 5.3 Mev, 6.2 MeV and 7.4 MeV for the nucleus with mass number ,3,4 and 5 respectively . If one nucleus of mass number 3 combines with one nucleus of mass number 5 to give two nuclei of mass number 4, then

A. 0.3 MeV of energy absorbed

B. 0.3 MeV of energy released

C. 2.81 MeV of energy absorbed

D. 3.3 MeV of energy absorbed

Answer: D

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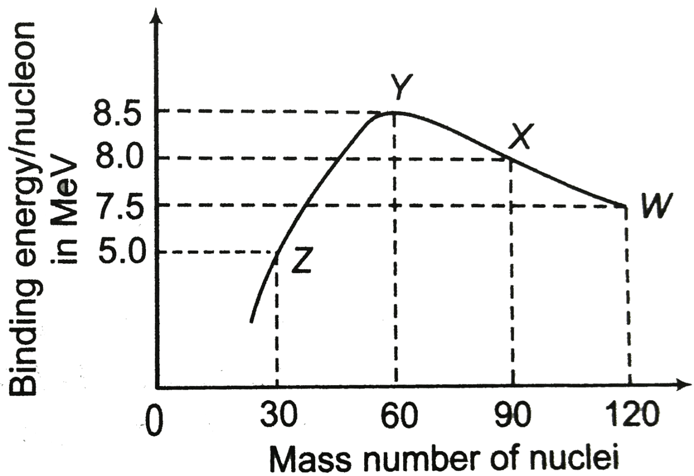
16. Binding energy per nucleon versus mass number curve for nuclei is shown in figure. W, X, Y, and Z are four nuclei indicated on the curve. The process that would release energy is

(a) $Y \rightarrow 2Z$

(b) $W \rightarrow X+Z$

(c) $W \rightarrow 2Y$

(d) $X \rightarrow Y+Z$



A. $Y \rightarrow 2Z$

B. $W \rightarrow X+Z$

C. $X \rightarrow Y + Z$

D. $W \rightarrow 2Y$

Answer: D

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17. Radioactive material A has decay constant 8λ and material B has decay constant λ .Initially,They have same number of nulei.After what time,the ratio of number of nuclei of material B to that A will be $\frac{1}{e}$?

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

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

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

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

Answer: C

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