PHYSICS

BOOKS - MTG GUIDE

ATOMS AND NUCLEI

Illustration

1. In a geiger - marsden experiment. Find the distance of closest approach to the nucleus of a 7.7 me v α- particle before it comes momentarily to rest and reverses its direction. (z for gold nucleus = 79) .

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2. Answer the following questions, which help you understand the difference between Thomson's model and Rutherford's model better.

(a) Is the average angle of deflection of -particles by a thin gold foil predicted by Thomson's model much less, about the same, or much greater than that predicted by Rutherford's model?

(b) Is the probability of backward scattering (i.e., scattering of α-particles at angles greater than 90°) predicted by Thomson's model much less, about the same, or much greater than that predicted by Rutherford's model?

(c) Keeping other factors fixed, it is found experimentally that for small thickness t, the number of α-particles scattered at moderate angles is proportional to t. What clue does this linear dependence on t provide?

(d) In which model is it completely wrong to ignore multiple scattering for the calculation of average angle of scattering of α -particles by a thin foil?

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6. A single electron orbits around a stationary nucleus of charge $+Ze$ where Z is a constant and e is the magnitude of electronic charge. It requires 47.2 eV to excite the electron from the second bohr orbit to the third bohr orbit

a. Find the value of Z

b. Find the energy required to excite the electron from $n = 3 \text{ to } n = 4$

c. Find the wavelength of radiation required to remove the electron from the second bohr orbit to infinity

d. Find the kinetic energy, potential energy and angular momentum of the electron in the first orbit

e. Find the ionisation energy of above electron system in electron-volt.

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7. In atension from state n to a state of excitation energy $10.19eV$, hydrogen atom emits a 4890Å photon. Etermine the binding energy of the initial state.

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8. Given the mass of iron nucleus as $55.85u$ and $A = 56$, the nuclear density is

$(u = 1.66 \times 10^{-27}kg, r = 1.2 \times 10^{-15}m)$

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9. Two stable isotopes of lithium ${}_{3}^{6}Li$ and ${}_{3}^{7}Li$ have respective abundances of 7.5% and 92.5% . These isotopes have masses 6.0152 u and 7.016004 u respectively. Find the atomic weight of lithium

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10. 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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11. Radioisotopes of phosphorus p^{32} and p^{35} are mixed in the ratio of $2:1$ of atoms. The activity of the sample is 2 Ci. Find the activity of the sample after 30 days. $T_{1/2}$ of P^{32} is 14 days and $T_{1/2}$ of P^{35} is 25 days.

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12. The count rate meter is used to measure that activity of a given amount of a radio active element. At one instant, the meter shows 475 counts/minute. Exactly 5 minutes later, is shown 270 counts/minute then The decay constant is

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Neet Cafe Topicwise Practice Questions Alpha Particle Scattering Experiment And Rutherford S Model Of Atom

1. An α-particle of kinetic energy 7.68 MeV is projected towards the nucleus of copper (Z=29). Calculate its distance of nearest approach.

A. $8.4 \times 10^{-15} cm$

B. $8.4 \times 10^{-15} m$

C. $4.2 \times 10^{-15} m$

D. $4.2 \times 10^{-15} cm$

Answer: B

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2. A beam of beryllium nucleus (z = 4) of kinetic energy 5.3 MeV is headed towards the nucleus of gold atom (Z = 79). What is the distance of closest approach?

A. $10.32 \times 10^{-14} m$

B. $8.58 \times 10^{-14} m$

C. $3.56 \times 10^{-14} m$

D. $1.25 \times 10^{-14} m$

Answer: B

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Neet Cafe Topicwise Practice Questions Bohr Model

1. According to Bohr's theory the moment of momentum of an electron revolving in second orbit of hydrogen atom will be

A. $\frac{h}{\pi}$

B. $2\pi h$

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

D. $\frac{\pi}{h}$

Answer: A

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2. The angular speed of the electron in the n^{th} Bohr orbit of the hydrogen atom is proportional to

A. directly proportional to n

B. inversely proportional to $\sqrt{n}$

C. inversely proportional to n^2

D. inversely proportional to n^3

Answer: D

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3. The angular momentum of an electron in the hydrogen atom is $\frac{3h}{2\pi}$ Here. h is Planck's constant. The kinetic energy of this electron is

A. 4.35 eV

B. 1.51 eV

C. 3.4 eV

D. 6.8 eV

Answer: B

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4. Which of the following statements are not true for hydrogen ?

A. Angular momentum $\propto \frac{1}{n}$

B. Linear momentum $\propto \frac{1}{n}$

C. Radius $\propto \frac{1}{n}$

D. Energy $\propto \frac{1}{n}$

Answer: B

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5. which of the following postulates of the Bohr model led to the quantization of energy of the hydrogen atom ?

A. The electron goes around the nucleus in circular orbits.

B. The angular momentum of the electron can only be an integral multiple of $h/2\pi$.

C. The magnitude of the linear momentum of the electron is quantized.

D. Quantization of energy is itself a postulate of the Bohr model.

Answer: B

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6. The magnitude of angular momentum, orbit radius and frequency of revolution of elctron in hydrogen atom corresponding to quantum number n are L, r and f respectively. Then accoding to Bohr's theory of hydrogen atom

A. vr^2L

B. vrL

C. v^2rL

D. vrL^2

Answer: B

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7. What is orbital angular momentum of an electron in $3d$ orbital.

A. $\sqrt{2}\left(\frac{h}{2\pi}\right)$

B. $\sqrt{3}\left(\frac{h}{2\pi}\right)$

C. $\sqrt{6}\left(\frac{h}{2\pi}\right)$

D. $\sqrt{12}\left(\frac{h}{2\pi}\right)$

Answer: C

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8. The ratio of the speed of the electrons in the ground state of hydrogen to the speed of light in vacuum is

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

B. $\frac{2}{237}$

C. $\frac{1}{137}$

D. $\frac{1}{237}$

Answer: C

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9. The electric potential between a proton and as electron is given by $V = V_0 \frac{\ln(r)}{r_0}$, wherer_0 is a constant . Assuming Bohr's model to be applicable , write variation of r_n with n, n being the principal quantum number ?

A. $r_n \propto n$

B. $r_n = \frac{1}{n}$

C. $r_n \propto n^2$

D. $r_n \propto \frac{1}{n^2}$

Answer: A

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10. If the atom$(_ 100)Fm^{257}$ follows the Bohr model the radius of $\_ (100)Fm^{257}$ is n time the Bohr radius , then find n .

A. 100

B. 200

C. 4

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

Answer: D

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11. To explain his theory, Bohr used

A. Conservation of energy

B. Quantization of angular momentum

C. Quantization of linear momentum

D. Quantization of moment of inertia

Answer: B

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12. In the Bohr's model of hydrogen atom, the ratio of the kinetic energy to the total energy of the electron in n^{th} quantum state is:

A. -1

B. $+1$

C. -2

D. $+2$

Answer: A

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13. In hydrogen atom, the total energy of an electron in a given orbit is -1.5eV. The potential energy in the same orbit is

A. $1.5eV$

B. $-1.5eV$

C. $3.0eV$

D. $-3.0eV$

Answer: D

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14. The radius of hydrogen atom in its ground state is $5.3 \times 10^{-11}m$. After collision with an electron it is found to have a radius of $21.2 \times 10^{-11}m$. What is the principle quantum number of n of the final state of the atom ?

A. $n = 4$

B. $n = 2$

C. $n = 16$

D. $n = 3$

Answer: B

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15. In the Bohr model of the hydrogen atom, let R, v and E represent the radius of the orbit, the speed of electron and the total energy of the electron respectively. Which of the following quantity is proportional to the equantum number n

A. vr

B. rE

C. $\frac{r}{E}$

D. $\frac{r}{v}$

Answer: A

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16. According to Bohr's theory, the time averaged magnetic field at the centre (i.e. nucleus) of a hydrogen atom due to the motion of electrons in

the n^{th} orbit is proportional to :

(n = principal quantum number)

A. $\frac{1}{n^3}$

B. $\frac{1}{n^5}$

C. n^5

D. n^2

Answer: B

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17. Suppose an electron is attracted toward the origin by a force $\frac{k}{r}$ where k is a constant and r is the distance of the electron from the origin .By applying Bohr model to this system the radius of the n^{th} orbital of the electron is found to be r_n and the kinetic energy of the electron to be T_n , Then which of the following is true ?

A. $T_n \propto \frac{1}{n^2}$

B. T_n is independent of $n, r_n \propto n$

C. $T_n \propto \frac{1}{n}, r_n \propto n$

D. $T_n \propto \frac{1}{n}$ and $r_n \propto n^2$

Answer: B

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18. Which state of triply ionised Beryllium $\left(Be^{+++}\right)$ the same orbital radius as that of the ground state hydrogen ?

A. $n = 1$

B. $n = 2$

C. $n = 3$

D. $n = 4$

Answer: B

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19. If n is the orbit number of the electron in a hydrogen atom, the correct statement among the following is

A. electron energy increases as n increases.

B. hydrogen emits infrared rays for the electron transition from $n = \infty$ to $n = 1$

C. electron energy is zero for $n = 1$

D. electron energy varies as n^2.

Answer: A

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Neet Cafe Topicwise Practice Questions Energy Levels And Hydrogen Spectrum

1. In which transition of a hydrogen atom, photons of lowest frequency are emitted ?

A. $n = 2 \text{ to} n = 1$

B. $n = 4 \text{ to } n = 4$

C. $n = 4 \text{ to } n = 1$

D. $n = 4 \text{ to } n = 3$

Answer: D

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2. In hydrogen spectrum, the shortest wavelength in Balmer series is the λ. The shortest wavelength in the Brackett series will be

A. 2λ

B. 4λ

C. 9λ

D. 16λ

Answer: B

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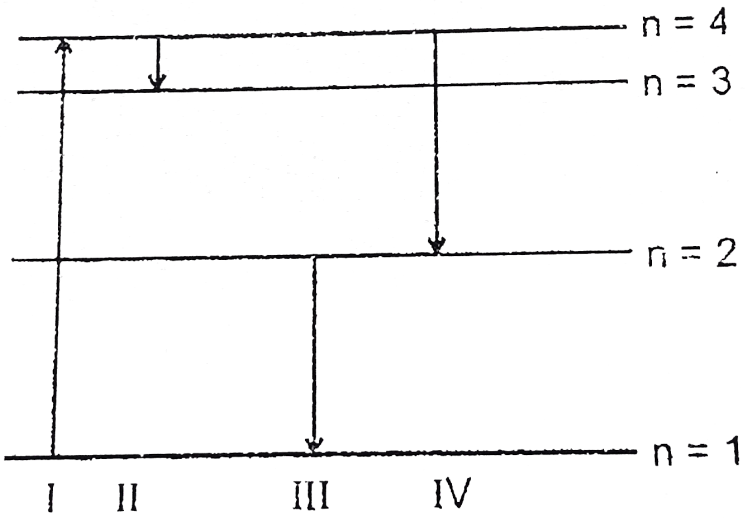
3. The diagram shows the energy levels for an electron in a certain atom. Which transition shown represents the emission of photon with the most enegy ?



A. I

B. II

C. III

D. IV

Answer: C

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4. If the binding energy of the electron in a hydrogen atom is $13.6eV$, the energy required to remove the electron from the first excited state of Li^{++} is

A. $+122.4eV$

B. $-30.6eV$

C. $-13.6eV$

D. $+30.6eV$

Answer: B

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5. The ratio of the energies of the hydrogen atom in its first to second excited state is

A. $1/4$

B. $4/9$

C. $9/4$

D. 4

Answer: C

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6. If the wavelength of the first line of the Balmer series of hydrogen is 6561Å, the wavelngth of the second line of the series should be

A. 1312Å

B. 3280Å

C. 4860Å

D. 2187Å

Answer: C

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7. According to bohr's theory, the wave number of last line of balmer series is $\left(R = 1.1 \times 10^7 m^{-1}\right)$

A. $5.5 \times 10^5 m^{-1}$

B. $4.4 \times 10^7 m^{-1}$

C. $2.75 \times 10^6 m^{-1}$

D. $2.75 \times 10^8 m^{-1}$

Answer: C

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8. The first line of the lyman series in a hydrogen spectrum has a wavelength of 1210 Å. The corresponding line of a hydrogen like atom of $Z = 11$ is equal to

A. $4000Å$

B. $100Å$

C. $40Å$

D. $10Å$

Answer: D

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9. The frequency of the H_β-line of the Balmer series for hydrogen is

A. $2v_0 Hz$

B. $4v_0 Hz$

C. $(v_0/2) Hz$

D. $(v_0/4)Hz$

Answer: B

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10. the wavelength of radiation emitted is λ_0 when an electron jumps. From the third to second orbit of hydrogen atom. For the electron jumping from the fourth to the second orbit of the hydrogen atom, the wavelength of radiation emitted will be

A. $(16/25)\lambda_0$

B. $(20/27)\lambda_0$

C. $(27/20)\lambda_0$

D. $(25/16)\lambda_0$

Answer: B

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11. The total energy of a hydrogen atom in its ground state is $-13.6eV$. If the potential energy in the first excited state is taken as zero then the total energy in the ground state will be

A. $-3.4eV$

B. $3.4eV$

C. $-6.8eV$

D. $6.8eV$

Answer: C

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12. In an excited state of hydrogen like atom an electron has total energy of $-3.4eV$. If the kinetic energy of the electron is E and its de-Broglie wavelength is λ, then

A. $E = 6.8eV, \lambda = 6.6 \times 10^{-10}m$

B. $E = 3.4eV, \lambda = 6.6 \times 10^{-10}m$

C. $E = 3.4eV, \lambda = 6.6 \times 10^{-11}m$

D. $E = 6.8eV, \lambda = 6.6 \times 10^{-11}m$

Answer: B

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13. The electron in a hydrogen atom makes a transition from $n = n_1$ to $n = n_2$ state. The time period of the electron in the initial state (n_1) is eigh times that in the final state (n_2). The possible values of n_1 and n_2 are

A. $n_1 = 4, n_2 = 2$

B. $n_1 = 8, n_2 = 2$

C. $n_1 = 8, n_2 = 1$

D. $n_1 = 6, n_2 = 2$

Answer: A

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14. Which energy state of doubly ionized lithium Li^{++} has the same energy as that of the ground state of hydrogen?

A. 4

B. 3

C. 2

D. 1

Answer: B

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15. when an electron jumps from the fourth orbit to the second orbit, one gets the

A. second line of Paschen series

B. second lline of Balmer series

C. first line of Pfund series

D. second line of Lyman series

Answer: B

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16. The ratio of minimum to maximum wavelength in Balmer series is

A. $5:9$

B. $5:36$

C. $1:4$

D. $3:4$

Answer: A

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17. What is the ratio of shortest wavelength of the Balmer series ot the shortest waelength of the Lyman series?

A. $4:1$

B. $4:3$

C. $4:9$

D. $5:9$

Answer: A

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18. Hydrogen atom from excited state comes to the ground state by emitting a photon of wavelength λ. If R is the Rydberg constant, then the principal quatum number n of the excited state is

A. $\sqrt{\frac{\lambda R}{\lambda R - 1}}$

B. $\sqrt{\frac{\lambda}{\lambda R-1}}$

C. $\sqrt{\frac{\lambda R^2}{\lambda R-1}}$

D. $\sqrt{\frac{\lambda R}{\lambda-1}}$

Answer: A

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19. According to Bolir's theory, the energy of an electron in hydrogen atom starts corresponding to $n=1,2,3,4$ is $-13.6eV,\ -3.4eV,\ -1.51eV$ and $-0.85eV$ respectively. In order to obtain emission of H_β line of Balmer series, the energy that has to be given to a normal hydrogen atom is

A. $12.75eV$

B. $14.45eV$

C. $2.55eV$

D. $4.25eV$

Answer: A

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20. An electron is moving in an orbit of a hydrogen atom from which there can be a maximum of six transition. An which there can be a maximum of three transition. Find ratio of the velocities of the electron in these two orbits.

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

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

C. $\frac{5}{4}$

D. $\frac{3}{4}$

Answer: D

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21. Which of the following transition in He^+ ion will give rise to a spectral line which has the same wavelength as some spectral line in the hydrogen atom ?

A. $n = 3 \text{ to } n = 1$

B. $n = 43 \text{ to } n = 2$

C. $n = 4 \text{ to } n = 2$

D. $n = 4 \text{ to } n = 3$

Answer: C

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22. Let ν_1 be the frequency of the series limit of the lyman series ν_2 be the frequency of the first line of th lyman series and ν_3 be the frequency of the series limit of the Balmer series. Then

A. $\upsilon_1 - \upsilon P_2 = \upsilon_3$

B. $v_1 = v_2 - v_3$

C. $\frac{1}{v_1} = \frac{1}{v_1} + \frac{1}{v_3}$

D. $\frac{1}{v_1} = \frac{1}{v_2} = \frac{1}{v_2} + \frac{1}{v_3}$

Answer: A

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23. In Bohr model of the hydrogen atom, the lowest orbit corresponds to

A. infinite energy

B. maximum energy

C. minimum energy

D. zero energy

Answer: C

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24. Calculate the highest frequency of the emitted photon in the Paschen series of spectral lines of the hydrogen atom.

A. $3.7 \times 10^{14} Hz$

B. $9.1 \times 10^{15} Hz$

C. $10.23 \times 10^{14} Hz$

D. $29.7 \times 10^{15} Hz$

Answer: A

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Neet Cafe Topicwise Practice Questions Composition And Size Of Nucleus

1. In $._{88} Ra^{226}$ nucleus there are

A. 138 protons and 88 neutrons

B. 138 neutrons and 88 protons

C. 138 neutrons and 88 protons

D. none of these

Answer: B

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2. A nucleus splits into two nuclear parts having radii in the ratio $1:2$ Their velocities are in the ratio

A. 226 protons and 88 electrons

B. 226 neutrons and 138 electrons

C.

D.

Answer: A

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3. A triton contains (neutron /proton)

A. $8:1$

B. $6:1$

C. $4:1$

D. $2:1$

Answer: A

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4. The radius of a spherical nucleus as measured by electron scattering is 3.6 fm. What is the mass number of the nucleus most likely to be ?

A. $1\text{ proton }+2\text{ neutrons}$

B. $1\text{ proton }+1\text{ neutrons}$

C. $2\text{ protons }+1\text{ neutron}$

D. $2\text{ protons }+2\text{ neutrons}$

Answer: A

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5. The stable nucleus that has a radius $1/3$ that of Os^{189} is-

A. Be^9

B. Li^7

C. F^{19}

D. C^{12}

Answer: B

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1. The three stable isotopes of neon $._{10}Ne^{20}$, $._{10}Ne^{21}$ and $._{10}Ne^{22}$ have respective abundances of $90.51\,\%$, $0.27\,\%$ and $9.22\,\%$. The atomic masses of the three isotopes are $19.99u$, $20.99u$ and $21.99u$ respectively. Obtain the average atomic mass of neon.

A. 11.18 y

B. 15.18 u

C. 20.18 u

D. 10.18 u

Answer: C

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2. The natural boron of atomic weight 10.81 is found to have two isotopes $._{}^{10}B$ and $._{}^{11}B$ .The ratio of abundance of isotopes of natural boron should be

A. $11:10$

B. $81:19$

C. $10:11$

D. $19:81$

Answer: D

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3. The set which represents the isotope, isobar and isotone respectively is

A. $\left({}_1H_2, {}_1H^3\right)$, $\left({}_{79}Ay^{197}, {}_{80}Hg^{198}\right)$ and $\left({}_2He^3, {}_1H^2\right)$

B. `("" _(2)He^(3),"" _(1)H^(1))

C. `

D.

Answer: D

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Neet Cafe Topicwise Practice Questions Mass Energy Relation Mass Defect And Nuclear Binding Energy

1. Consider the following statements.

SI : The nuclear force is independent of the charge of nucleons.

S2 : The number of nucleons in the nucleus of an atom is equal to the number of electrons in the atom.

S3 : All nuclei have masses that are less than the sum of the masses of constituent nucleons.

S4 : Nucleons belong to the family of leptons while electrons are members of the family of hadrons.

Choose the correct statement/statements from these.

A. S1 only

B. S1 and S4

C. S2, S3 and S4

D. S1 and S3

Answer: D

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2. The binding energies of a deutron and an α-particle are $1.125, 7.2 MeV / \text{nucleon}$ respectively. The more stable of the two, is

A. deuteron

B. alpha particle

C. both (a) and (b)

D. sometimes deuteron and sometimes alpha particle

Answer: B

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3. If M_O is the mass of an oxygen isotope ${}_8O^{17}$, M_p and M_n are the masses 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. $(8M_P + 9M_N - M_O)c^2$

D. M_Oc^2

Answer: C

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4. Li nucleus has three protons and four neutrons. Mass of Li nucleus is 7.016005 amu. Mass of proton is 1.007277 amu and mass of neutron is 1.008665 amu. Mass defect of lithium nucleus in amu is

A. 0.04048 amu

B. 0.04050 amu

C. 0.04052 amu

D. 0.04055 amu

Answer: A

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5. One milligram of matter is converted into energy. The energy released will be

A. $9 \times 10^{14} J$

B. $9 \times 10^{10} J$

C. $9 \times 10^{7} J$

D. $9 \times 10^{4} J$

Answer: C

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6. 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. 2.52 MeV

C. 4.95 MeV

D. 2.75 MeV

Answer: C

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7. If the binding energy per nucleon of deuterium is 1.115 MeV, its mass defect in atomic mass unit is

A. 0.0048

B. 0.0024

C. 0.0012

D. 0.0006

Answer: B

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8. The neutron separation energy is defined to be the energy required to remove a neutron form nucleus. Obtain the neutron separation energy of the nuclei $._{20}Ca^{41}$ and $._{13}Al^{27}$ from the following data : $m\left(._{20}Ca^{40}\right) = 39.962591u$ and $m\left(._{20}Ca^{41}\right) = 40.962278u$

$m\left(._{13}Al^{26}\right) = 25.986895u$ and $m\left(._{13}Al^{27}\right) = 26.981541u$

A. 7.57 MeV

B. 8.36 MeV

C. 9.12 MeV

D. 9.56 MeV

Answer: B

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Neet Cafe Topicwise Practice Questions Nuclear Force

1. 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. $f_{\mathrm{pn}} < f_{\mathrm{pp}} < f_{\mathrm{nm}}$

B. $f_{\mathrm{pp}} = f_{\mathrm{nm}} = f_{\mathrm{pn}}$

C. $f_{\mathrm{pp}} < f_{\mathrm{pn}} < f_{\mathrm{nm}}$

D. $f_{\mathrm{pp}} > f_{\mathrm{pn}} < f_{\mathrm{nm}}$

Answer: B

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2. Which one of the following statements is true 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: C

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Neet Cafe Topicwise Practice Questions Radioactivity

1. The half - life of $\hat{}(215)At$ is $100\mu, s$. The time taken for the radioactivity of a sample of $\hat{}(215)At$ to decay to $1/16^{th}$ of its initially 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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2. 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. $0.2\ln 2$

B. $0.2\ln 2$

C. $0.1\ln 2$

D. $0.8\ln 2$

Answer: A

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3. A nucleus of ${}_{84}^{210}Po$ originally at rest emits α particle with speed v. What will be the recoil speed of the daughter nucleus ?

A. $4v/206$

B. $4v/214$

C. $v/206$

D. $v/214$

Answer: A

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4. At any instant, the ratio of the amounts of two radioactive substance is $2:1$. If their half-lives be, respectively, $12h$ and $16h$, then after two days, what will be the ratio of the substances?

A. $1:1$

B. $2:1$

C. $1:2$

D. $1:4$

Answer: A

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5. What percentage of radioactive substance is left after 5 half lives?

A. $31\ \%$

B. $3.125\ \%$

C. $0.3\ \%$

D. $1\ \%$

Answer: B

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6. Which of the following particle can be deflected by electric and magnetic field?

A. $\gamma -$ rays

B. Neutron

C. X - rays

D. Proton

Answer: D

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7. In the following radioactive decay, ${}_{92}X^{232} \rightarrow (89)Y^{220}$, how many α and β particles are ejected from X to form Y ?

A. 10, 6

B. 8, 8

C. 12, 6

D. 8, 6

Answer: D

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8. A radioactive substance has a half life of 60 minutes. After 3 hours, the fraction of atom that have decayed would be.

A. $12.5\ \%$

B. $87.5\ \%$

C. $8.5\ \%$

D. $25.1\ \%$

Answer: B

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9. If N_0 is the original mass of the substance of half - life period $t_{1/2} = 5year$ then the amount of substance left after 15 year is

A. $N_0/2$

B. $N_0/3$

C. $N_0/4$

D. $N_0/8$

Answer: D

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10. In the reaction represented by,

$$_Z{}^A X \to \cdot\, _{Z-2}{}^{A-4} Y \to \cdot\, _{Z-2}{}^{A-4} Y \to \cdot\, _{Z-1}{}^{A-4} K$$

the decays in the sequence are a)α, β, γ b)β, γ, α c)γ, α, β d)α, γ, β

A. α, β, γ

B. β, γ, α

C. γ, α, β

D. α, γ, β

Answer: D

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11. Half life of a radioactive substance A is two times the half life of another radioactive substance B. Initially, the number of nuclei of A and B are N_A and N_B respectively. After three half lives of A, number of nuclei of both are equal. Then the ratio $\frac{N_A}{N_B}$ is

A. $\frac{1}{3}$

B. $\frac{1}{6}$

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

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

Answer: C

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12. A radioactive substance decays to $\left(\frac{1}{16}\right)^{th}$ of its initial activity in 40 days. The half-life of the radioacctive substance expressed in days is

A. 10

B. 20

C. 5

D. 2.5

Answer: A

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

A. 400 Bq

B. 800 Bq

C. 200 Bq

D. 600 Bq

Answer: B

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14. There are two radio nuceli A and B. A is an α emitter and B a β emitter. Their disintegration constant are in the ratio of $1:2$ What should be the ratio of number of atoms of A and B at any time t so that probabilities of getting alpha and beta particles are same at that instant?

A. $1:2$

B. $2:1$

C. $e:1$

D. $1:e$

Answer: B

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15. The fraction of atoms of radioactive element that decays in 6 days is 7/8. the fraction that decays in 10 days will be

A. $77/80$

B. $91/80$

C. $31/32$

D. $15/16$

Answer: C

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16. A 280 day old radioactive substances shows an activity of 6000 dps, 140 days later its activity becomes 3000 dps. What was its initial activity ?

A. 20000 dps

B. 24000 dps

C. 12000 dps

D. 6000 dps

Answer: B

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17. The half life of radon is 3.8 days . After how many days will only one twentieth of radon sample be left over ?

A. 5

B. 10

C. 15

D. 17

Answer: D

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18. The mean lives of a radioactive substance are 1620 years and 405 years for 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. $(\log_e 4 = 1.386)$.

A. 339 years

B. 449 years

C. 559 years

D. 669 years

Answer: B

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

A. $63\ \%$

B. $69.3\ \%$

C. $37\ \%$

D. $50\ \%$

Answer: A

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20. Masses of two isobars $._{29}Cu^{64}$ and $._{30}Zn^{64}$ are $63.9298u$ and $63.9292u$, respectively. It can be concluded from these data that .

A. Zn^{64} is radioactive, decaying to Cu^{64} through $\beta-$ decay

B. Cu^{64} is radioactive, decaying to Zn^{64} through $\gamma-$ decay

C. Cu^{64} is radioactive, decaying to Zn^{64} through $\beta-$ decay

D. both the isobars are stable

Answer: C

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21. The half life of $._{38}^{90}Sr$ is 28 years. The disintegration rate of 15 mg of this isotope is of the order of

A. $7.88 \times 10^{10} Bq$

B. $8.88 \times 10^{10} Bq$

C. $9.88 \times 10^{10} Bq$

D. $6.88 \times 10^{10} Bq$

Answer: A

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22. A radioactive sample has half-life of 5 years. Probability of decay in 10 years will be.

A. $50\ \%$

B. $75\ \%$

C. $100\ \%$

D. $60\ \%$

Answer: B

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

A. λm

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

C. $\frac{\lambda m N_A}{M}$

D. $m N_A \lambda$

Answer: C

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24. In gamma ray emission from a nucleus

A. only the proton number changes

B. both, the proton number and neutron number change

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

D. only the neutron number changes

Answer: C

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25. 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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26. The peneting power of $\alpha, \beta \text{ and } \gamma$ rediations ,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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27. A nucleus with mass number 220 initially at rest emits an α-particle. If the Q-value of the reaction is $5.5MeV$, calculate the kinetic energy of the α-particle.

(a) 4.4 MeV (b) 5.4 MeV (c) 5.6 MeV (d) 6.5 MeV

A. 4.4 MeV

B. 5.4 MeV

C. 5.6 MeV

D. 6.5 MeV

Answer: B

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28. A radioactive sample S_1 having an acitivity of $5\mu Ci$ has twice the number of nuclei as another sample S_2 which has a activity of $10\mu Ci$. The half lives of S_1 and S_2 can be

A. 20 years and 5 years, respectively

B. 20 years and 10 years, respectively

C. 10 years each

D. 5 years each

Answer: A

Watch Video Solution

29. In a sample of radioactive material , what fraction of the initial number of active nuclei will remain undisintegrated after half of the half life of the sample ?

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

B. $\frac{1}{2\sqrt{2}}$

C. $\frac{1}{\sqrt{2}}$

D. $\sqrt{2}-1$

Answer: C

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

A. X and Y decay at same rate always

B. X will decay faster than Y

C. Y will decay faster than X

D. X and Y have same decay rate initially

Answer: C

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31. During negative B decay, an anti- neutrino is also emmited along with the ejected electron. Then

A. only linear momentum will be conserved

B. total linear momentum and total angular momentum but not total energy will be conserved

C. total linear momentum and total energy but not total angular momentum will be conserved

D. total linear monientum, total angular momentum and total energy will be conserved

Answer: D

Watch Video Solution

32. A radiaocatice isotope is being produced at a constant rate X. Half-life of the radioactive substance is Y. After some time, the number of

radioactive nuceli become constant. The value of this constant is .

A. $\frac{X}{Y}$

B. XY

C. $XY\ln(2)$

D. $\frac{XY}{\ln(2)}$

Answer: D

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33. 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. $1/3$

C. $1/4$

D. $1/2$

Answer: A

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34. A fraction f_1 of a radioactive sample decays in one mean lie and a fraction f_2 decays in one half-life

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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35. An element A decays into element C by a two-step process :

$A \rightarrow B + {}_{2}He^{4}$

$B \rightarrow C + 2e^{-}$

Then.

A. A and C are isotopes

B. A and C are isobars

C. B and C are isotopes

D. A and B are isobars

Answer: A

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

A. $\frac{A-Z-4}{Z-2}$

B. $\frac{A-Z-8}{Z-4}$

C. $\frac{A-Z-4}{Z-8}$

D. $\frac{A-Z-12}{Z-4}$

Answer: C

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37. A radioactive nuclide can decay simultaneously by two different processes which have decay constants λ_1 and λ_2. The effective decay constant of the nuclides is λ.

A. $\lambda = \lambda_1 + \lambda_2$

B. $\lambda = \frac{1}{2}(\lambda_1 + \lambda_2)$

C. $\frac{1}{\lambda} + \frac{1}{\lambda_1} + \frac{1}{\lambda_2}$

D. $\lambda = \sqrt{\lambda_1 \lambda_2}$

Answer: A

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38. The intensity of gamma radiation from a given source is I

On passing through $36mm$ of lead , it is reduced to $\frac{1}{8}$. The thickness of lead which will reduce the intensity to $\frac{1}{2}$ will be

A. 12 mm

B. 18 mm

C. 9 mm

D. 6 mm

Answer: A

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39. Number of nuclei of a radioactive substance are 1000 and 900 at times $t = 0$ and time $t = 2s$. Then, number of nuclei at time $t = 4s$ will be

A. 800

B. 790

C. 700

D. 810

Answer: D

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40. A radioactive isotope has h half-life of 2 yr. how long will itt take the activity to reduce to 3.125% of its original value

A. 4.8 years

B. 7 years

C. 10 years

D. 9.6 years

Answer: C

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41. 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. 0.8 ln 2

B. 0.4 ln 2

C. 0.2 ln 2

D. 0.1 ln 2

Answer: B

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42. Two samples X and Y contain equal amounts of radioactive substances. If $\frac{1}{16}th$ of a sample X and $\frac{1}{256}th$ of sample Y remain after 8h, then the ratio of half periods of X and Y is

A. $2:1$

B. $1:2$

C. $1:4$

D. $4:1$

Answer: A

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43. Radioactive $._{27}^{60}Co$ is transformed into stable $._{28}^{60}$ Ni by emitting two γ-rays of energies

A. 1.33 MeV and 1.17 MeV in succession

B. 1.17 MeV and 1.33 MeV in succession

C. 1.37 MeV and 1.13 MeV in succession

D. 1.13 MeV and 1.37 MeV in succession

Answer: B

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44. A uranium nucleus $._{92}U^{238}$ emits and α-particle and a β-particle in succession. The atomic number and mass number of the final nucleus will be

A. 90, 233

B. 90, 238

C. 91, 234

D. 93, 238

Answer: C

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45. Pick out the incorrect statement from the following .

A. β^- emission from the nucleus is always accompanied by a neutrino.

B. The energy of the $\alpha-$ particle emitted from a given nucleus is always constant.

C. $\gamma-$ ray emission makes the nucleus more stable.

D. Nuclear force is charge-independent.

Answer: A

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46. A radioactive element X with half life 2 h decays giving a stable element Y. After a time t, ratio of X and Y atoms is 1:16 .Time t is

A. 6 h

B. 4 h

C. 8 h

D. 16 h

Answer: C

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47. Which of the following statements are true?

(I) All radioactive element decay exponentially with time.

(II) Half life time of a radioactive element is the time required for one half of the radioactive atoms to distintegrate.

(III) Age of the earth can be determined by radioactive dating.

(IV) Half life time of a radioactive element is fifty percent of its average life period.

Select the correct answer using the codes given below.

A. I and II

B. I, III and IV

C. I, II and III

D. II and III

Answer: C

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48. A radioactive substance with decay constant of $0.5s^{-1}$ is being produced at a constant rate of 50 nuclei per second. If there are no nuclei present initially, the time in second) after which 25 nuclei will be present is

A. 1

B. $2\ln\left(\frac{4}{3}\right)$

C. $\ln 2$

D. $\ln\left(\frac{4}{3}\right)$

Answer: B

View Text Solution

49. Half-life of a radioactive substance is 20 minutes. Difference between points of time when it is $33\,\%$ disintegrated and $67\,\%$ disintegrated is approximate.

A. 10 minutes

B. 20 minutes

C. 30 minutes

D. 40 minutes

Answer: B

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50. A freshly prepared radioactive sample of half-life 4 hours emits radiation of intensity which is 64 times the safe level. The minimum hours after which it would be safe to work with it is

A. 4

B. 6

C. 12

D. 24

Answer: D

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51. A radioactive decay can form an isotope of the original nucleus with the emission of particles

A. one α and four β

B. one α and two β

C. one α and one β

D. four α and one β

Answer: B

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52. A radioactive sample emit $n\beta$ - particles is 2 sec , In next 2 sec it emits $0.75n\beta$- particle , what is the mean life of the sample?

A. 4s

B. 2s

C. $\frac{2}{(\ln 2)}s$

D. $2(\ln 2)s$

Answer: C

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Neet Cafe Topicwise Practice Questions Nuclear Reaction

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

A. ${}_{5}^{9}B$

B. ${}_{4}^{11}Be$

C. ${}_{6}^{12}C$

D. ${}_{5}^{10}B$

Answer: D

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2. In the following reaction.

$._{12}Mg^{24} + ._{2}He^{4} \rightarrow ._{14}Si^{X} + ._{0}n^{1}$, X is.

A. 28

B. 27

C.

D. 26

Answer: B

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3. Consider the nuclear reaction $X^{200} \rightarrow A^{110} + B^{80} + 10n^1$. If the binding energy per nucleon for X, A and B are 7.4 MeV, 8.2 MeV and 8.1 MeV respectively, then the energy released in the reaction:

A. 70 MeV

B. 200 MeV

C. 190 MeV

D. 1480 MeV

Answer: A

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4. An atom of mass number 15 and atomic number 7 captures an $\alpha -$ particle and then emits a proton. The mass number and atomic number of the resulting product will respectively be.

A. 14 and 2

B. 15 and 3

C. 16 and 4

D. 18 and 8

Answer: D

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5. Calculate the energy of the following nuclear reaction:

$._1H^2 + ._1H^3 \rightarrow ._2He^4 + ._0n^1 + Q$

Given:

$m\left(._1H^2\right) = 2.014102u, m\left(._1H^3\right) = 3.016049u, m\left(._2He^4\right) = 4.002603u, r$

A. -4.03 MeV

B. -2.01 MeV

C. 2.01 MeV

D. 4.03 MeV

Answer: A

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6. 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. ${}_{11}^{24}Na + {}_{1}^{1}H \rightarrow {}_{10}^{20}Ne + {}_{2}^{4}He$

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

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

Answer: C

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Neet Cafe Topicwise Practice Questions Nuclear Fission And Fusion

1. Energy generation in starts is mainly due to

A. chemical reactions

B. fission of heavy nuclei

C. fusion of light nuclei

D. fusion of heavy nuclei

Answer: C

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2. Energy is the sun is generated mainly by

A. fusion of radioactive material

B. fusion of helium atoms

C. chemical reaction

D. fusion of hydrogen atoms

Answer: D

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3. In a nuclear reactor

A. cadmium rods are used to slow down the neutrons

B. moderator is used to slow down the neutrons

C. coolant is used to slow down the neutrons

D. moderator is used to control the neutrons

Answer: B

View Text Solution

4. A reactor is developing energy at the rate of 3000 kW. How many atoms of U^{235} undergo fission per second, if 200 MeV energy is released per fission?

A. 6.5×10^{22}

B. 5.15×10^{21}

C. 3.384×10^{23}

D. 9.4×10^{16}

Answer: D

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5. Calculate the energy released by the fission $1g$ of $.^{235} U$ in joule, given that the energy released per fission is $200MeV$.

(Avogadro's number $= 6.023 \times 10^{23}$)

A. $5.1 \times 10^{26} eV$

B. $5.1 \times 10^{26} J$

C. $8.2 \times 10^{13} J$

D. 8.2×10^{13} MeV

Answer: C

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6. A U^{235} atom undergoes fission by thermal neutrons according to the following reaction

$U^{235} + n \rightarrow {}^{140}_{54}Xe + {}^{94}_{38}Sr + 2n$

Then Xenon undergoes four and Strontium undergoes two consecutive B decays and six electrons are detected. What is the atomic number of the two decay products of Xenon and Strontium?

A. 50, 36

B. 58, 40

C. 56, 42

D. 57, 41

Answer: B

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7. Heavy water is used in nuclear reactors as

A. to absorb neutrons to sustain controlled reaction

B. to absorb neutrons to stop the chain reaction

C. to reduce hazardous radiation from nuclear reaction

D. to slow down the neutrons to thermal energies

Answer: D

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8. The following fusion reaction take place $2_1^2A \rightarrow_2^3 B + n + 3.27$ MeV. If 2 kg of $._1^2 A$ is subjected to the above reaction, the energy released is used to light a 100 W light a lamp, how long will the lamp glow ?

A. 2×10^6 years

B. 3×10^5 years

C. 5×10^4 years

D. 7×10^3 years

Answer: C

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9. In proton-proton cycle, four hydrogen atoms combine to release energy

A. 26.7 MeV

B. 216 MeV

C. 3.27 MeV

D. 1 MeV

Answer: A

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Check Your Neet Vitals

1. In Rutherford scattering experiment, what will b ethe correct angle for α scattering for an impact parameter $b = 0$?

A. 0°

B. 90°

C. 180°

D. 270°

Answer: C

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2. The total energy of an electron in the second excited state of the hydrogen atom is about -1.5 eV. The kinetic energy and potential energy of the electron in this state are:

A. $1.51eV, \ -3.02eV$

B. $-1.51eV, 3.02eV$

C. $3.02eV, \ -1.51eV$

D. $-3.02eV, 1.51eV$

Answer: A

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3. The angular momentum of an electron in a hydrogen atom is proportional to

A. $\frac{1}{\sqrt{r}}$

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

C. r^2

D. $\sqrt{r}$

Answer: D

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4. de-Broglie wavelength of electron in 2^{nd} excited state of hydrogen atom is: [where r_0 is the radius of 1^{st} orbit in H-atom]

A. $2\pi a_0$

B. $4\pi a_0$

C. $8\pi a_0$

D. $16\pi a_0$

Answer: B

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5. The minimum energy that must be given to a H atom in ground state so that it can emit an H, line in balmer series is

A. 13.06 eV

B. 12.75 eV

C. 10.2 eV

D. 2.86 eV

Answer: A

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6. Find the radius of Li^{++} ions in its ground state assuming Bohr's model to be valid.

A. a_0

B. $\frac{a_0}{3}$

C. $2a_0$

D. $3a_0$

Answer: B

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7. For which one one of the following bohr model is not valid

A. H

B. He

C. Li^+

D. He^+

Answer: B

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8. Two H atoms in the ground state collide in elastically. The maximum amount by which their combined kinetic energy is reduced is

A. 10.2 eV

B. 20.4 eV

C. 13.6 eV

D. 27.2 eV

Answer: A

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9. The simple Bohr model cannot be directly ap-plied to calculate the energy level of an atom with many electrons . This is because.

A. of the electrons not being subject to a central force

B. of the electrons colliding with each other

C. of screening effects

D. the force between the nuclcus and an clectron will no longer be given by Coulomb's law.

Answer: A

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10. What is the wavelength of ligth for the least energetic photon emitted in the Lyman series of the hydrogen spectrum. (Take , hc =1240 eV -nm)

A. 82 nm

B. 102 nm

C. 122 nm

D. 150 nm

Answer: C

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11. The radius of the orbit of an electron in a Hydrogen-like atom is $4.5a_0$, where a_0 is the Bohr radius. Its orbital angular momemtum is $\frac{3h}{2\pi}$. It is given that h is Plank constant and R si Rydberg constant. The possible wavelength (s), when the atom-de-excites. is (are):

A. 2

B. 3

C. 4

D. 5

Answer: A

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12. In the Bohr model of the hydrogen atom, let R, v and E represent the radius of the orbit, the speed of electron and the total energy of the electron respectively. Which of the following quantity is proportional to the equantum number n

A. vr

B. rE

C. $\frac{r}{E}$

D. $\frac{r}{v}$

Answer: B

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13. A nucleus ${}_{n}X^{M}$ emits one α particle and one β-particle. What are the mass number and atomic number of the product nucleus?

A. $(P-2)(Q+1)$

B. $(P-3)(Q-1)$

C. $(P-4)(Q-1)$

D. $(P+4)(Q-1)$

Answer: C

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14. Half lives of two isotopes X and Y of a material are known to be 2×10^9 years and 4×10^9 years respectively if a planet was formed with

equal number of these isotopes, then the current age of planet, given that currently the material has 20% of X and 80% of Y by number, will be:

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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15. The ratio of the longest to shortest wavelength in Brackett series of hydrogen spectra is

A. $\frac{25}{9}$

B. $\frac{17}{6}$

C. $\frac{9}{5}$

D. $\frac{4}{3}$

Answer: A

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16. A nucleus of Ux_1 has a half life of 24.1 days. How long a sample of Ux_1 will take to change to 90% of Ux_1.

A. 80 days

B. 40 days

C. 20 days

D. 10 days

Answer: A

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17. A nuclide 1 is said to be the mirror isobar of nuclide 2 if $Z_1 = N_2$ and $Z_2 = N_1$. (a) What nuclide is a mirror isobar of ${}^{23}_{11}Na$? (b) Which nuclide out of the two mirror isobars has greater binding energy and why?

A. ${}_{10}Ne^{23}$

B. ${}_{12}Mg^{23}$

C. ${}_{13}Al^{25}$

D. ${}_{13}Mg^{23}$

Answer: B

Watch Video Solution

18. The radius of the hydrogen atom in its ground state is a_0. The radius of a muonic hydrogen atom in which the electron is replaced by an identically charged muon with mass 207 times that of an electron, is a_μ equal to

A. 207 a_0

B. $\frac{a_0}{207}$

C. $\frac{a_0}{\sqrt{207}}$

D. $a_0\sqrt{207}$

Answer: B

View Text Solution

19. A heavy nucleus X of mass number 240 and binding energy per nucleon $7.6MeV$ is split into two fragments Y and Z of mass numbers 110 and 130. The binding energy of nucleons in Y and Z is $8.5MeV$ per nucleon. Calculate the energy Q released per fission in MeV.

A. 116 MeV

B. 216 MeV

C. 306 MeV

D. 340 MeV

Answer: B

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20. A nuclear reactor delivers a power of 10 W. Find fuel consumed by the reactor per hour, if its efficiency is $20\ \%$. (Given, $c = 3 \times 10^8 ms^{-1}$)

A. $2 \times 10^{-6} gh^{-1}$

B. $9 \times 10^{-12} gh^{-1}$

C. $8 \times 10^{-9} gh^{-1}$

D. $2 \times 10^{-9_g h^{-1}}$

Answer: D

View Text Solution

21. In a fission reaction $._{92}^{236} U \rightarrow^{117} X +^{117} Y + n + n$, the binding energy per nucleon of X and Y is $8.5 MeV$ whereas of $.^{236} U$ is $7.6 MeV$.

The total energy liberated will be about.

A. 200 keV

B. 2 MeV

C. 200 MeV

D. 2000 MeV

Answer: C

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22. The half lives of a radioactive sample are 30 years and 60 years from α - emission and β- emission respectively If the sample decays both by alpha-emission and β-emission simultaneously, the time after which, only one-fourth of the sample remain is

A. 18 years

B. 20 years and 10 years, respectively

C. 28 years

D. 45 years

Answer: C

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23. A radio isotope X with a half-life 1.4×10^9 years 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. 9.6×10^{10} years

B. 4.2×10^{10} years

C. 5×10^{10} years

D. 1.95×10^{10} years

Answer: C

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24. Two radioactive substance A and B have decay constants 5λ and λ respectively. At $t = 0$ they have the same number of nuclei. The ratio of number of nuclei of nuclei of A to those of B will be $\left(\frac{1}{e}\right)^2$ after a time interval

A. 4λ

B. 2λ

C. $1/2\lambda$

D. $1/4\lambda$

Answer: C

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25. The activity of a radioactive sample is measured as N_0 counts per minute at t= 0 and N/e_0 counts per minute at t = 5 minutes. The time (in minutes) at which the activity reduces to one fourth of its value is

A. $\log_3 \frac{4}{5}$

B. $\frac{5}{\log_e 2}$

C. $5\log_{10} 4$

D. $5\log_3 4$

Answer: D

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Aipmt Neet Mcqs

1. The mass of 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. The activity of a radioactive sample is measures as N_0 counts per minute at $t = 0$ and N_0 / e counts per minute at $t = 5 \text{ min}$. The time (in minute) at which the activity reduces to half its value is.

A. $\log_2 \frac{2}{5}$

B. $\frac{5}{\log_e 2}$

C. $\log_{10} 2$

D. $5 \log_e 2$

Answer:

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3. The energy of a hydrogen atom in the ground state is $-13.6eV$. The eneergy of a He^+ ion in the first excited state will be

A. $-13.6eV$

B. $-27.2eV$

C. $-54.4eV$

D. $-6.8eV$

Answer:

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4. An alpha nucleus of energy $\frac{1}{2}mv^2$ bombards a heavy nucleus of charge Ze . Then the distance of closed 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:

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5. The decay constant of radio isotope is λ. If A_1 and A_2 are its activities at times t_1 and t_2 respectively, the number of nuclei which have decayed during the time $(t_1 - t_2)$

A. $A_1 t_1 - A_2 t_2$

B. $A_1 - A_2$

C. $(A_1 - A_2)/\lambda$

D. $\lambda(A_1 - A_2)$

Answer:

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6. The binding energy per nucleon of deuterium and helium nuclei are 1.1 MeV and 7.0 MeV respectively. When two deuterium nuclei fuse to form a helium nucleus the energy released in the fusion is

A. 23.6 MeV

B. 2.2 MeV

C. 28.0 MeV

D. 30.2 MeV

Answer:

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7. The wavelength of the first line of Lyman series for hydrogen atom is equal to that of the second line of Balmer series for a hydrogen-like ion. The atomic number Z of hydrogen-like ion is

A. 3

B. 4

C. 1

D. 2

Answer:

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8. The half-life of a radioactive isotope X is 50 years. It decays to another element Y which is stable. The two elements X and Y were found to be in the ratio of $1:15$ in a sample of a given rock. The age of the rock was estimated to be

A. 150 years

B. 200 years

C. 250 years

D. 100 years

Answer:

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9. The power obtained in a reactor using U^{235} disintergration is $1000kW$. The mass decay of U^{235} per hour is

A. 10 microgram

B. 20 microgram

C. 40 microgram

D. 1 microgram

Answer:

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10. 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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11. A nucleus ${}_{n}^{m}X$ emits one $\alpha -$ particle and two $\beta -$ particles. The resulting nucleus is

A. ${}_{n-4}^{m-6}Z$

B. ${}_{n}^{m-6}Z$

C. ${}_{n}^{m-4}X$

D. ${}_{n-2}^{m-4}Y$

Answer:

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12. Fusion reaction takes place at high temperature because

A. nuclei break up at high temperature

B. atoms get ionised at high temperature

C. kinetic energy is high enough to overcome the coulomb repulsion between nuclei

D. molecules break up at high temperature

Answer:

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13. Two radioactive nuclei P and Q in a given sample decay into a stable nucleus R. At time t=0, number of P species are $4N_0$ and that of Q are N_0. Half-life of P (for conversion to R) is 1 min whereas that of Q is 2min. Initially there are no nuclei of R present in the sample. When number of

nuclei of P and Q are equal, the number of nuclei of R present in the sample would be -

(A) $2N_0$

(B) $3N_0$

(C) $\frac{9N_0}{2}$

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

A. $2N_0$

B. $3N_0$

C. $\frac{9N_0}{2}$

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

Answer:

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14. Out of the following which one is not a possible energy for a photon to be emitted by hydrogen atom according to Bohr's atomic model?

A. 0.65eV

B. 1.9 eV

C. 11.1 eV

D. 13.6 eV

Answer:

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15. Electron in hydrogen atom first jumps from third excited state to second excited state and then form second excited state to first excited state. The ratio of wavelength $\lambda_1 : \lambda_2$ emitted in two cases is

A. $\frac{7}{5}$

B. $\frac{27}{20}$

C. $\frac{27}{5}$

D. $\frac{20}{7}$

Answer:

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16. 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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17. A mixture consists of two radioactive materials A_1 and A_2 with half-lives of $20s$ and $10s$ respectively. Initially the mixture has $40g$ of A_1 and

$160g$ of a_2. The amount the two in the mixture will become equal after

A. 60 s

B. 80 s

C. 20 s

D. 40 s

Answer:

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18. An electrons of a stationary hydrogen aton passes form the fifth enegry level to the ground level. The velocity that the atom acquired as a result of photon emission will be

(m is the mass of the electron, R, Rydberg constanrt and h, Planck's constant)

A. $\frac{24hR}{25m}$

B. $\frac{25hR}{24m}$

C. $\frac{25m}{24hr}$

D. $\frac{24m}{25hR}$

Answer:

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19. The transition form the state $n = 3$ to $n = 1$ in a hydrogen-like atom results in ultraviolet radiation. Infared radiation will be obtained in the transition from

A. $2 \to 1$

B. $3 \to 2$

C. $4 \to 2$

D. $4 \to 3$

Answer:

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20. The half-life of a radioactive nucleus is 50 days. The time interval $(t_2 - t_1)$ between the time t_2 when $\frac{2}{3}$ of it has decayed and the time t_1 when $\frac{1}{3}$ of it had decayed is

A. 30 dyas

B. 50 days

C. 60 days

D. 15 days

Answer:

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21. Ratio of longest wavelengths corresponding to Lyman and Balmer series in hydrogen spectrum is

A. $\frac{7}{29}$

B. $\frac{9}{31}$

C. $\frac{5}{27}$

D. $\frac{3}{23}$

Answer:

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22. A certain mass of hydrogen is changes to helium by the process of fusion. The mass defect in fusion reaction is $0.02866u$. The energy liberated per u is (given $1u = 931MeV$)

A. 6.675 MeV

B. 13.35 MeV

C. 2.67 MeV

D. 26.7MeV

Answer:

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23. The half-life of a radioactive isotope X is 20 years. It decays to another element Y which is stable. The two elements X and Y were found to be in the ratio of $1:7$ in a sample of a given rock. The age of the rock was estimated to be.

A. 80 years

B. 100 years

C. 40 years

D. 60 years

Answer:

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24. Hydrogen atom in ground state is excited by a monochromatic radiation of $\lambda = 975\text{Å}$. Number of spectral lines in the resulting

spectrum emitted will be

A. 3

B. 2

C. 6

D. 10

Answer:

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25. 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. 19.6 MeV

B. -2.4 MeV

C. 8.4 MeV

D. 17.3 MeV

Answer:

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26. A radio isotope X with a half-life 1.4×10^9 years 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. 1.96×10^9 years

B. 3.92×10^9 years

C. 4.20×10^9 years

D. 8.40×10^9 years

Answer:

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

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

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

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

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

Answer:

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28. Consider $3rd$ orbit of He^{+} (Helium) using nonrelativistic approach the speed of electron in this orbit will be (given $K = 9 \times 10^{9}$ constant $Z = 2$ and h (Planck's constant) $= 6.6 \times 10^{-34} Js$.)

A. $0.73 \times 10^{6} m/s$

B. $3.0 \times 10^{8} m/s$

C. $2.92 \times 10^6 m/s$

D. $1.46 \times 10^6 m/s$

Answer:

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

A. The helium nucleus has more momentum than the thorium nucleus.

B. The helium nucleus has less kinetic energy than the thorium nucleus.

C. The helium nucleus has more kinetic energy than the thorium nucleus.

D. The helium nucleus has less momentum than the thorium nucleus.

Answer:

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30. In the spectrum of hydrogen atom, the ratio of the longest wavelength in Lyman series to the longest wavelength in the Balmer series is

A. $\frac{27}{5}$

B. $\frac{5}{27}$

C. $\frac{4}{9}$

D. $\frac{9}{4}$

Answer:

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31. Given the value of Rydberg constant is $10^7 m^{-1}$, the waves number of the lest line of the Balmer series in hydrogen spectrum will be:

A. $0.25 \times 10^7 m^{-1}$

B. $2.5 \times 10^7 m^{-1}$

C. $0.025 \times 10^4 m^{-1}$

D. $0.5 \times 10^7 m^{-1}$

Answer:

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32. When an $\alpha -$ particle of mass 'm' moving with velocity 'v' bombards on a heavy nucleus of charge 'Ze' its distance of closest approach from the nucleus depends on m as :

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

B. m

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

D. $\frac{1}{\sqrt{m}}$

Answer:

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33. If an electron in a hydrogen atom jumps from the $3rd$ orbit to the $2nd$ orbit, it emits a photon of wavelength λ. When it jumps form the $4th$ orbit to the $3dr$ orbit, the corresponding wavelength of the photon will be

A. $\frac{16}{25}\lambda$

B. $\frac{9}{16}\lambda$

C. $\frac{20}{7}\lambda$

D. $\frac{20}{13}\lambda$

Answer:

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34. The half-life of a radioactive substance is 30 minutes, The time (in minutes) taken between $40\,\%$ decay and $85\,\%$ decay of the same radioactive substance is.

A. 15

B. 30

C. 45

D. 60

Answer:

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35. Radioactive material 'A' has decay constant $'8\lambda'$ 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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36. The ratio of wavelength of the lest line of Balmer series and the last line Lyman series is:

A. 1

B. 4

C. 0.5

D. 2

Answer:

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37. For a radioactive material, half-life is 10 minutes. If initially there are 600 number of nuclei, the time taken for the disintegratiom of 450 nuclei is.

A. 20

B. 10

C. 30

D. 15

Answer:

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38. The ratio of kinetic energy to the total energy of an electron in a Bohr orbit of the hydrogen atom, is

A. $1:1$

B. $1:-1$

C. $2:-1$

D. $1:-2$

Answer:

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39. The total energy of an electron in an atom in an orbit is $-3.4eV$. Its kinetic and potential energies are, respectively:

A. 3.4 eV, 3.4 eV

B. $-3.4eV,\ -3.4eV$

C. $-3.4eV,\ -6.8eV$

D. $3.4eV,\ -6.8eV$

Answer:

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40. α-particle consists of

A. 2 protons only

B. 2 protons and 2 neutrons only

C. 2 electrons, 2 protons and 2 neutrons

D. 2 electrons and 4 protons only

Answer:

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