doubtnut
India's Number 1 Education App

PHYSICS

BOOKS - D MUKHERJEE PHYSICS (HINGLISH)

MODERN PHYSICS

Type 1

1. The peneting power of α, β and γ 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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2. Identify the correct ascending order of α, β and γ with reference to their ioninzing power

(I) α-ray (II) γ-ray (III) β-ray

A. γ, α, β

B. γ, β, α

C. α, β, γ

D. β, γ, α

Answer: c

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3. If a beam consisiting of α, β and γ radiation is passed through an electric field perpendicular to the beam, the deflections suffered by the components, in decreasing ordre are,

A. α, β, γ

B. α, γ, β

C. β, α, γ

D. β, γ, α

Answer: c

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4. In a radioactive serries , ${}^{238}_{92}$ U change to ${}^{206}_{82}$ pb though $n_1\alpha$ -decay processses and $n_2\beta -$ decay processes.

A. $n_1 = 8, n_2 = 8$

B. $n_1 = 6, n_2 = 6$

C. $n_1 = 8, n_2 = 6$

D. $n_1 = 6, n_2 = 8$

Answer: c

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5. Let u denote one atomic unit .one atom of an element of mass number A has mass exactly equal A u

A. For any value ofA

B. only for A=1

C. Only for A=12

D. For any value of A provided the atom is stable

Answer: c

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6. 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. $F_1 > F_2 > F_3$

B. $F_2 > F_1 > F_3$

C. $F_1 = F_3 > F_2$

D. $F_1 = F_2 > F_3$

Answer: c

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7. 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. mN_Ae^{λ}

Answer: c

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8. In the previous question , the activity of the sample after time t will be

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

Answer: b

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

A. $A_1 t_1 = A_2 t_2$

B. $\dfrac{A_1 - A_2}{t_2 - t_1} = \text{constant}$

C. $A_2 = A_1 e^{(t_1 - t_2 / T)}$

D. $A_2 = A_1 e^{(t_2 / T t_2)}$

Answer: c

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10. Let T be the mean life of a radioactive sample. 75% of the active nuclei present in th sample initially will deacy in time

A. 2T

B. $\frac{1}{2}(In2)T$

C. 4T

D. $2(In2)T$

Answer: d

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

A. 37%

B. 50%

C. 63%

D. 69.3%

Answer: c

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12. In a sample of radioactive material, what fraction of initial number of active nuclei will remain undistintegrated after half of a

half0life 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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13. Three fourth of the active decays in a radioactive sample in $3/4\,\text{sec}$. The half-life of the sample is

A. 1 s

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

C. $\frac{3}{4}s$

D. $\frac{3}{8}s$

Answer: d

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14. 90% of the active nuclei present in a radioactive sample are found to remain undecyayed after 1 day. The precentage of undecayed nuclei left after two days will be

A. 85%

B. 81%

C. 80%

D. 79%

Answer: b

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15. 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 oof the mean life and half - life .

Answer: a

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16. A radioactive nuclide can decay simultaneously by two different processes which have decay constant λ_1 and λ_2. The effective decay constant of the nucleide 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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17. A sample of radioactive material is used to provide desired doses of radiation for medical purposes. The total time for which the sample can be used will depend

A. only on the munber ot times radiation is drwn from it

B. only on the intersity of does drqwn from it

C. on both (a) and (b)

D. neither on (a)nor on(b)

Answer: d

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18. An orbit electron in the ground state of hydrogen has an angular momentum L_1, and an orbital electron in the first orbit in the ground state of lithium (dounle ionised positively) has an angular momentum L_2. Then :

A. $L_1 = L_2$

B. $L_1 = 3L_2$

C. $L_2 = 3L_1$

D. $L_2 = 9L_1$

Answer: a

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19. When white light (violet to red) is passed thouogh hydrogen gas at room temparature , absorption lines will be observed in the

A. Lyman series

B. Balmer series

C. both (a) and(b)

D. neither (a) nor (b)

Answer: d

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20. If radiation of all wavelangths from ultavoilet to infraed is passed through hydrogen gas at room temperature , absorption lines will be observed in the

A. Lyman series

B. Balmer series

C. both (a) and(b)

D. neither (a) nor (b)

Answer: a

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21. A photon of energy 10.2 eV corresponds to light of wavelength λ_0. Due to an electron transition from n=2 to n=1 in a hydrogen atom, light of wavelength λ is emitted. If we take into account the recoil of the atom when the photon is emitted.

A. $\lambda = \lambda_0$

B. $\lambda < \lambda_0$

C. $\lambda > \lambda_0$

D. the data is not suffcient to reach a cnclusion

Answer: c

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22. White X-rays are called 'white' due to the fact that:

A. they are produced most abunantly in X-ray tubes

B. they are electromagnetic waves and hence have a nature similar to ehite light

C. thet can be converted to light using coated screens, and they affect photographic plates , just like light

D. they havea continuous range of wavelengths

Answer: d

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23. The mimmum wevelength of X-ray that can be produced in a Coolisge tube depends on

A. the metal used as the target

B. the intensity of the electron beam striking the target

C. the current flowing though the filament

D. the potential difference between the cathode and the anode

Answer: d

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24. If a potential difference of 20,000 volts is applied across X-ray tube , the cut -off wavelength will be

A. $6.21 \times 10^{-10} m$

B. $6.21 \times 10^{-11} m$

C. $6.21 \times 10^{-12} m$

D. $3.1 \times 10^{-11} m$

Answer: b

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25. If the potential difference applied across a Collidage tube is increased,

A. the wavelength of the K_α line will increase

B. the wavelength of the K_β line will decrease

C. the difference in wavelegth between the K_α and K_β lines will decrease

D. none of the above

Answer: d

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26. The K_α X-ray emission line of lungsten accurs at $\lambda = 0.021 nm$. What is the energy difference between $K$and L levels in the atom?

A. $051 MeV$

B. $1.2 MeV$

C. $59 keV$

D. $13.6eV$

Answer: c

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Type 2

1. When a nucleus with atomic number Z and mass number A undergoes a radioactive decay process,

(i) Both Z and A will decrease, if the process is

α decay

(ii) Z will decrease but A will not change, if the process is $\beta^{+} -$ decay

(iii) Z will increase but A will not change, if the process is $\beta -$ decay

(iv) Z and a will remain uncharged, if the prices is γ decay

A. both Z and A will decrease , if the process is α decay

B. Z will dcrease but A will not change , if the process is β^{+} decay

C. Z will increase but A will not change , if the process is $B\eta^{-}$ decay

D. Z and A will remain unchanged , if the process is γ decay

Answer: a,b,c,d

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2. When the nucleus o fan eletrically neutral atom undergoes a radioactive decay process , it will remain after he decay if the process is

A. anα decay

B. aβ^{-} decay

C. a γ decay

D. a k-capture process

Answer: c,d

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3. Which of the following assertions are correct?

(i) A neutron can decay to a proton only inside a nucleus

(ii) A proton can change to a neutron only inside a nucleus

(iii) An isolated neutron can change into a proton

(iv) An isolated proton can change into a neutron

A. A neutron can decay to aprotion only inside a nucleus .

B. Aproton can change to a neutron only inside a nucleus.

C. An isolated neutron can change into a proton .

D. An isolated proton can change into a neutron.

Answer: b,c

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4. 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 and mass number.

B. A' and b' have the same atomic munber but different mass munbers

C. A ' and B' have different atomic number but the same mass number.

D. A' and B' ae isotopes.

Answer: a

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5. A and B are isotopes. B and C are isobars. All three are radioactive. Which one of the following is true.

A. A,b and C must belong to the same element.

B. A,B and C may belong to the same element .

C. It is possible that A will change to B though a radioactive-decay process.

D. It is possible that B will change to C through a radioactive -decay process.

Answer: d

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6. A nuclide A undergoes α-decay and another nuclides B undergoes β-decay

A. All the α -particles emitted by A will have almost the same speed.

B. The α -particles emitted by A amay have widely different speeds.

C. All the β-particles emitted by B may have widely different speeds.

D.

Answer: a,d

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7. The decay constant of a radioactive sample is λ. Its half -life is $T_{1/2}$ and mean life is T.

A. $T_{1/2}=\frac{1}{\lambda}, T=\frac{In2}{\lambda}$

B. $T_{1/2}=\frac{In2}{\lambda}, T=\frac{1}{\lambda}$

C. $T_{1/2}=\lambda \text{in} 2, T=\frac{1}{\lambda}$

D. $T_{1/2}=\frac{\lambda}{In2}, T=\frac{In2}{\lambda}$

Answer: b

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8. The count rate from $100cm^3$ 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

A. 20

B. 40

C. 60

D. 80

Answer: d

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9. In Bohr model of the hydrogen atom, let R,v and E represent the radius of the orbit, speed of the electron and the total energy respectively. Which of the following quantities are directly proportional to the quantum number n?

A. VR

B. RE

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

D. $\frac{R}{E}$

Answer: a,c

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10. Let v_1 be the frequency of series limit of Lyman series, v_2 the frequency of the first line of Lyman series and v_3 the frequency of series limit of Balmer series. Then which of the following is correct ?

A. $v_1 - v_2 = v_3$

B. $v_2 - v_1 = v_3$

C. $v_3 = \frac{1}{2}(v_1 + v_2)$

D. $v_1 + v_2 = v_3$

Answer: a

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11. In an e^- transition inside a hydrogen atom, orbital angular momentum may change by (h=Planck's constant)

A. h

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

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

D. $\frac{h}{4\pi}$

Answer: b,c

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12. If a hydrogen atom emit a photon of energy $12.1eV$, its orbital angular momentum changes by $\Delta L. then$Delta L` equals

A. $1.05 \times 10^{-34} Js$

B. $2.11 \times 10^{-34} Js$

C. $3.16 \times 10^{-34} Js$

D. $4.22 \times 10^{-34} Js$

Answer: b

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13. An electron with kinetic energy =E eV collides with a hydrogen atom in the ground state. The collision will be elastic

A. for all values of E

B. for $E < 10.2eV$

C. For $E < 13.6eV$

D. only for$e < 3.4eV$

Answer: d

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14. 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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15. Let the potential energy of the hydrogen atom in the ground state be zero . Then its energy in the excited state will be

A. 10.2eV

B. $13.6eV$

C. $23.8eV$

D. $27.2eV$

Answer: a

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16. When a hydrogen atom emits a photon in going from n=5 to n=1, its recoil speed is almost

A. $10^{-4} m / s$

B. $2 \times 10^{-2} m / s$

C. $4 m / s$

D. $8 \times 10^{2} m / s$

Answer: c

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17. The electron in a hydrogen atom makes a transition $n_1 \to n_2$, where n_1 and n_2 are the principle quantum numbers of the two states. Assume the Bohr model to be valid. The time period of the electron in the initial state is eight times that in the final state. 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. $n_1 = 6, n_2 = 3$

Answer: a,d

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18. A beam of ultraviolet light of all wavelength passes through hydrogen gas at room temperature, in the x-direction. Assume that all photons emitted due to electron transitions inside the gas emerge in the y-direction. Let A and B denote the lights emerging from the gas in the x-and y-directions respectively.

(i) Some of the incident wavelengths will be absent in A

(ii) Only those wavelengths will be present in B which are absent in A

(iii) B will contain some visible light

(iv) B will contain some infrared light

A. Some of the incident wavelengths will be absent inA

B. Only those wavelengths will be present in B which are absent in A

C. B willcontainSome viible light .

D. B will contain Some infrared light.

Answer: a,c,d

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19. Whenever a hydrogen atom emits a photon in the Balmer series

A. it may emit another photon in the Balmer series

B. it must emit another photon in the Lyman series

C. the second photon ,if emitted ,will have a wavelength of about 122 nm

D. it may emit a second photon , but the wavelength of this photon cannot be predicted

Answer: b,c

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20. Which of the following pairs constitute very similar rediations?

(i) Hard ultraviolet rays and soft X-rays

(ii) Soft ultraviolet rays and hard X-rays

(iii) Very hard X-rays and low-frequency γ-rays

(iv) Soft X-rays and γ-rays

A. Hard ultraviolet rays and soft X-rays

B. Soft ultraviolet rays and soft X-rays

C. very hard X-rays and low - frequency

$\gamma - \text{rays}$

D. Doft X-rays and $\gamma - \text{rays}$

Answer: a,c

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21. Let $\lambda_{\alpha}{'}, \lambda_{\beta}, \text{ and } \lambda'_{\alpha}$ denote the wavelength of the X-ray of the $K_{\alpha}, K_{\beta}, \text{ and } L_{\alpha}$ lines in the characteristic X-rays for a metal. Then.

A. $\lambda'_{\alpha} > \lambda_{\alpha} > \lambda_{\beta}$

B. $\lambda'_{\alpha} > \lambda_{\beta} > \lambda_{\alpha}$

C. $\dfrac{1}{\lambda_{\beta}} = \dfrac{1}{\lambda_{\alpha}} + \dfrac{1}{\lambda'_{\alpha}}$

D. $\dfrac{1}{\lambda_{\alpha}} + \dfrac{1}{\lambda_{\beta}} = \dfrac{1}{\lambda'_{\alpha}}$

Answer: a,c

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22. The potential different across the Coolidge tube is $20kV$ and $10mA$ current flows through the voltage supply. Only 0.5% of the energy carried by the electrons striking the largest is converted into X-ray. The power carried by the X-ray beam is p. Then

A. $0.1W$

B. $1W$

C. $2W$

D. $10W$

Answer: b

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23. When an electron moving at a high speed strikes a metal surface, which of the following are possible?

(i) The entire energy of the electron may be converted into an X-ray photon

(ii) Any fraction of energy of the electron may be converted into an X-ray photon

(iii) The entire energy of the electron may get converted to heat

(iv) The electron may undergo elastic collision with the metal surface

A. The entire energy of the electron may be converted into an X-ray photon .

B. Any fraction of the energy of the electron may be converted into an X-ray phopton.

C. The entire energy of the electron may get converted to heat.

D. The electron may undergo elastic collision with the metal surface.

Answer: a,b,c,d

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24. In Coolidge tube, if f and λ represent the frequency and wavelength of K_{α} -line for a metal of atomic number Z, then identify the statement which represents a straight line

A. V against Z

B. $\frac{1}{v}$ against Z

C. $\sqrt{v}$ against Z

D. v against $\sqrt{Z}$

Answer: c

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