ఈనాడు
ప్రతిభ
గురువారం 16 ఏప్రిల్ 2020 ■ email: help@eenadupratibha.net

The speed of the electron..?

JEE MAIN

Physics

Modern Physics

1. If K_1 and K_2 are the maximum kinetic energies of the photo electrons emitted by a light of wavelength λ_1 and λ_2 respectively. If $\lambda_1 = 2\lambda_2$, then

1) $K_1 = K_2$ 2) $K_1 = \frac{K_2}{2}$
3) $K_1 > \frac{K_2}{2}$ 4) $K_1 < \frac{K_2}{2}$

2. The quantum number of Bohr orbit in Hydrogen atom whose radius is 0.01 nm is..
1) 235 2) 435 3) 123 4) 498

3. The electron in a Hydrogen atom makes transition from M shell to L Shell. The ratio of magnitudes of initial to final centripetal acceleration of the electron is..
1) 4 : 9 2) 9 : 4
3) 81 : 16 4) 16 : 81

Writer
K.S.S Rajasekhar
Subject Expert

4. In a hypothetical system, a particle of mass m and charge –3q moving around a heavy particle having charge q. Assuming Bohr's model holds good to this system, the orbital velocity of mass m when it is nearest to the heavy particle is..
1) $\frac{3q}{2\varepsilon_0 h}$ 2) $\frac{3q^2}{2\varepsilon_0 h}$ 3) $\frac{3q}{4\varepsilon_0 h}$ 4) $\frac{3q^2}{4\varepsilon_0 h}$

5. A Hydrogen atom is in an excited state of principal quantum number n. It emits a photon of wavelength λ while returning to the ground state. Then the value of n is..

1) $\sqrt{\lambda(\lambda R - 1)}$ 2) $\sqrt{\frac{(\lambda R - 1)}{\lambda R}}$

3) $\sqrt{\frac{\lambda R}{(\lambda R - 1)}}$ 4) $\sqrt{\lambda(R - 1)}$

6. Electrons with de–Broglie wavelength λ fall on the target in a X–ray tube. Then the cut off wavelength(λ_0) of the emitted X–rays is..
1) $\frac{2mc\lambda^2}{h}$ 2) $\frac{2h}{mc}$
3) $\frac{2m^2c^2\lambda^2}{h^2}$ 4) λ

7. The potential difference applied to an X–ray tube is 5kV and the current through it is 3.2 mA. Then the number of electrons striking the target per second is..
1) 10^{16} 2) 2×10^{16}
3) 10^{17} 4) 2×10^{17}

8. Two radioactive substances have decay constants $10\lambda_0$ and λ_0. If initially they have the same number of nuclei, the ratio of number of their undecayed nuclei will be $\left(\frac{1}{e}\right)$ after a time..
1) $\frac{1}{\lambda_0}$ 2) $\frac{1}{3\lambda_0}$ 3) $\frac{1}{10\lambda_0}$ 4) $\frac{1}{9\lambda_0}$

9. A radioactive sample has 3.2×10^{16} active nuclei at certain instant. How many of these nuclei will still be in the same active state after four half– lives?
1) 10^{15} 2) 2×10^{15}
3) 10^{16} 4) 2×10^{16}

10. If elements of quantum number grater than n were not allowed, then the number of possible elements in the nature would be..
1) $\frac{1}{2}n(n + 1)$ 2) $\frac{n^2(n + 1)^2}{4}$
3) $\frac{1}{3}n(n + 1)(2n + 1)$ 4) $\frac{1}{6}n(n + 1)(2n + 1)$

11. When a certain photosensitive surface is illuminated with monochromatic light of frequency υ, the stopping potential for photo electric current is $\frac{V_0}{2}$. When the same surface is illuminated by monochromatic light of frequency $\frac{\upsilon}{2}$, the stopping potential is V_0. What is the threshold frequency for photoelectric emission?
1) $\frac{\upsilon}{3}$ 2) $\frac{3\upsilon}{2}$ 3) 3υ 4) $\frac{3\upsilon}{4}$

12. Photoelectrons with a maximum speed of 7×10^5 m/s are emitted from a metal surface when a light of frequency 8×10^{14} Hz falls on it. What is the threshold frequency of the surface?
1) 4.6×10^{14} Hz 2) 3.6×10^{14} Hz
3) 4.6×10^{15} Hz 4) 3.6×10^{15} Hz

13. Radiation of two photon energies twice and five times the work function of metal are incident successively on the metal surface. The ratio of the maximum velocity of the photoelectrons emitted in the two cases is..
1) 1 : 2 2) 2 : 1
3) 1 : 4 4) 4 : 1

14. What is the de–Broglie wavelength associated with an electron accelerated through a potential difference of 30 KV?
1) 1.24 Å 2) 2.24 Å
3) 1.84 Å 4) 3.84 Å

15. The speed of the electron in the first Bohr orbit of Hydrogen atom is (c = speed of light in Vacuum)
1) c 2) 137c 3) $\frac{c}{137}$ 4) 13.7c

16. The angular momentum of an electron in the Hydrogen atom is $\frac{3h}{2\pi}$ (h represents Plank's constant). The kinetic energy of this electron is..
1) 2 eV 2) 4.5 eV
3) 3 eV 4) 1.51 eV

17. The first ionisation potential of hydrogen like Bohr atom is x. Then the value of the first excitation potential for this atom is
1) x 2) $\frac{3x}{4}$ 3) $\frac{4x}{3}$ 4) $\frac{x}{4}$

18. The wavelength of D_1 and D_2 lines of sodium are 5890 Å and 5896 Å respectively. If their mean wavelength is 6000 Å, find the difference of excited energy states.
1) 10^{-3} eV 2) 2×10^{-3} eV
3) 3×10^{-3} eV 4) 4×10^{-3} eV

19. If the wavelength of the first member of the Balmer series of Hydrogen spectrum is 6562 Å, then the wavelength of the first member of Lyman series in the same spectrum is (approx)..
1) 1215 Å 2) 6000 Å
3) 1315 Å 4) 6315 Å

20. The electric field associated with a light wave is $E = E_0 \sin[1.57 \times 10^7 (x - ct)]$, where x is in meter and t is in second. If this light is used to produce photoelectric emission, from the surface of a metal whose work function is 1.9 eV, then the stopping potential is
1) 1 Volt 2) 1.2 V 3) 2 V 4) 2.2 V

21. Two identical photo cathodes receive light of frequencies f_1 and f_2. If the velocities of the photo electrons (of mass m) coming out are v_1 and v_2 respectively, then
1) $v_1 - v_2 = \frac{2h}{m}(f_1 - f_2)$
2) $v_1^2 - v_2^2 = \frac{2h}{m}(f_1 - f_2)$
3) $v_1 + v_2 = \frac{2h}{m}(f_1 - f_2)$
4) $v_1^2 + v_2^2 = \frac{2h}{m}(f_1 - f_2)$

22. If 5% of the energy supplied to a bulb is irradiated as visible light, how many quanta are emitted per second by a 100W lamp? (Assume wave length of visible light as 5.6×10^{-5} cm)
1) 3×10^4 2) 3×10^3
3) 1.4×10^{-19} 4) 1.4×10^{19}

23. Let ν_1 be the frequency of series limit of Lyman series, ν_2 the frequency of the first line of Lyman series, and ν_3 the frequency of series limit of Balmer series. Then which of the following is correct?
1) $\nu_1 + \nu_2 = \nu_3$ 2) $\nu_1 - \nu_2 = \nu_3$
3) $\nu_1 = \frac{\nu_2}{\nu_3}$ 4) $\nu_3 = \frac{1}{2}(\nu_1 + \nu_2)$

24. A stationary hydrogen atom of mass M emits a photon corresponding to the first line of Lyman series. If R is the Rydberg's constant, the velocity that the atom acquires is
1) $\frac{hR}{M}$ 2) $\frac{3hR}{M}$
3) $\frac{hR}{4M}$ 4) $\frac{3hR}{4M}$

25. If potential energy between a proton and an electron is given by $|U| = \frac{ke^2}{2R^3}$, where 'e' is the charge of electron and R is the radius of atom, then radius of bohr's orbit is given by
1) $\frac{ke^2m}{n^2h^2}$ 2) $\frac{6\pi^2ke^2m}{n^2h^2}$
3) $\frac{6\pi^2ke^2m}{nh}$ 4) $\frac{\pi^2ke^2m}{n^2h^2}$

26. The approximate value of quantum number n for the circular orbit of hydrogen of 0.0001 mm in diameter is..
1) 20 2) 31 3) 1000 4) 10

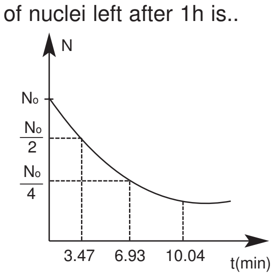
27. Magnetic field at the centre (at nucleus) of the hydrogen like atoms (atomic number = z) due to the motion of electron in n^{th} orbit is proportional to
1) $\frac{z^3}{n^5}$ 2) $\frac{z^5}{n^3}$ 3) $\frac{z^3}{n^3}$ 4) $\frac{z^5}{n^5}$

28. A sample of radioactive material decays simultaneously by two processes A and B with half–lives $\frac{1}{2}$ and $\frac{1}{4}$ hr respectively. For first half an hour it delays with the process A, next one hour with the process B, and for further half an hour with both A and B. If originally there were N_0 nuclei, the number of nuclei after 2 hr of such decay is..
1) $N_0\left(\frac{1}{2^3}\right)$ 2) $N_0\left(\frac{1}{2^5}\right)$
3) $N_0\left(\frac{1}{2^{10}}\right)$ 4) $N_0\left(\frac{1}{2^8}\right)$

29. The activity of a radioactive element decreases to one–third of the original activity A_o in a period of 9 years. After a further lapse of 9 years, its activity will be..
1) A_o 2) $9A_o$ 3) $3A_o$ 4) $\frac{A_o}{9}$

30. At any instant, the ratio of the amounts of two radio active substances is 2 : 1. If their half–lives be, respectively, 12h and 16h, then after two days what will be the ratio of the substances?
1) 1 : 1 2) 1 : 2 3) 2 : 1 4) 3 : 4

31. A radioactive sample undergoes decay as per the following graph. At time t = 0, the number of undecayed nuclei is N_o. Then the number of nuclei left after 1h is..
1) $\frac{N_o}{e^4}$
2) $\frac{N_o}{e^6}$
3) $\frac{N_o}{e^8}$
4) $\frac{N_o}{e^{12}}$



32. A proton of mass 'm' moving with a speed V_o approaches a stationary proton that is free to move. Assume impact parameter to be zero, i.e., head–on collision. How close will the incident proton go to other proton?
1) $\frac{e^2}{\pi\varepsilon_o m v_o^2}$ 2) $\frac{e^2}{m v_o^2}$
3) $\frac{e^4}{\pi\varepsilon_o m v_o^2}$ 4) $\frac{e^4}{m v_o^2}$

33. If 10,000 V are applied across an X–ray tube, the ratio of wavelength of the incident electrons and the shortest wavelength of X–ray coming out of the X–ray tube is (e/m of electron = 1.8×10^{11}C kg^{-1})
1) 1 : 5 2) 5 : 1 3) 1 : 10 4) 10 : 1

34. At a certain instant, a radioactive sample has a decay rate of 5000 disintigrations per minute. After 5 minutes, the decay rate is 1250 disintigrations per minute. Then the decay constant (per minute) is..
1) 0.4 ln (2) 2) 0.2 ln (2)
3) 0.1 *l*n (2) 4) 0.8 ln 2

ANSWERS

1-4; 2-2; 3-4; 4-2; 5-3; 6-1; 7-2; 8-4; 9-2; 10-3; 11-2; 12-1; 13-1; 14-2; 15-3; 16-4; 17-2; 18-2; 19-1; 20-2; 21-2; 22-4; 23-2; 24-4; 25-2; 26-2; 27-1; 28-4; 29-4; 30-1; 31-4; 32-1; 33-3; 34-1.