ETERNAL CAREER CLASSES

SUBJECT : PHYSICS | CLASS : XII | FULL MARKS : 40

NAME : …….. | BOARD TEST : 23 | DATE : 3.01.2025

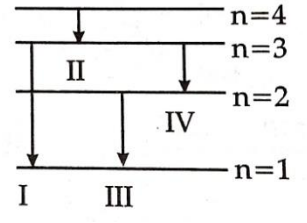
SECTION - A

Single answer type question. Attempt any Fourteen question :- **Marks : 1**× 14 = 14

1. A metallic plate exposed to white light emits electrons. For which of the following colours of light, the stopping potential will be maximum ?
   (a) Blue (b) Yellow (c) Red (d) Violet
2. Lenard observed that no electrons are emitted when frequency of light is less than a certain minimum frequency . This minimum frequency depends on
   (a) potential difference of emitter and collector plates
   (b) distance between collector and the emitter plate
   (c) size (area) of the emitter plate
   (d) material of the emitter plate
3. Matter have a dual nature, that is, it has both particle and wave properties. The wave properties of macroscopic objects are not generally observed. This is because
   (a) the speeds are too small
   (b) the dual nature applies only at the atomic scale
   (c) the wavelengths are too large
   (d) the moments are too small
4. Whose results are used by de Broglie's to prove his hypothesis ?
   (a) Einstein and Plank
   (b) Einstein and Maxwell
   (c) Plank and Maxwell
   (d) None of these
5. The energy of a photon of wavelength λ is
   (a) hc λ (b) hc/ λ (c) λ/hc (d) λh/c
6. Which one of the following metals does not exhibit emission of electrons from its surface when irradiated by visible light ?
   (a) Rubidium (b) Sodium (c) Cadmium (d) Caesium
7. E, c and v represent the energy , velocity and frequency of a photon. Which of the following represents its wavelength ?
   (a) $\frac{hv}{c^2}$ (b) hv (c) $\frac{hc}{E}$ (d) $\frac{hc}{c}$
8. A photon of wavelengths 663 nm is incident on a metal surface. The work function of the metal is 1.50 eV. The maximum kinetic energy of the emitted photo electrons is
   (a) 3.0×10^{-20} J (b) 6.0×10^{-20} J (c) 4.5×10^{-20} J (d) 9.0×10^{-20} J
9. A particle is dropped from a height H. The de – Broglie wavelength of the particle as a function of height is proportional to
   (a) H (b) $H^{1/2}$ (c) H^0 (d) $H^{-1/2}$
10. Two particles A_1 and A_2 of masses m_1, $m_2(m_1 > m_2)$ have the same de – Broglie wavelength. Then,
    (a) their momenta are the same
    (b) their energies are the same
    (c) energy of $A_1$is less than the energy of A_2
    (d) energy of A_1 is more than the energy of A_2
11. When alpha particles are sent through a thin gold foil, most of them go straight through the foil, because

(a) alpha particles are positively charged
(b) the mass of an alpha particle is more than the mass of an electron
(c) most of the part of an atom is empty space
(d) alpha particles move with high velocity

12. A photon beam of energy 12.1 eV is incident on a hydrogen atom. The orbit to which electron of H – atom be excited is
(a) 2^{nd} (b) 3^{rd} (c) 4^{th} (d) 5^{th}
13. Two H atoms in the ground state collide inelastically. The maximum amount by which their combined kinetic energy is reduced, is
(a) 10.20 eV. (b) 20.40 eV (c) 13.6 eV (d) 27.2 eV
14. The diagram shows four energy level of an electron in Bohr model of hydrogen atom. Identify the transition in which the emitted photon will have the highest energy



(a) I (b) II (c) III (d) IV
15. The radius of the n^{th} orbit in Bohr model of hydrogen atom is proportional
(a) n^2 (b) $\frac{1}{n^2}$ (c) n (d) $\frac{1}{n}$
16. Specify the transition of electron in the wavelength of the line in the Bohr model of hydrogen atom which gives rise to the spectral line of highest wavelength .
(a) n = 3 to n = 1 (b) n = 3 to n = 2 (c) n = 4 to n = 1 (d) n = 4 to n = 2
17. A proton and an alpha particle move in circular orbits in a uniform magnetic field. Their speeds are in the ratio of 9 : 4. The ratio of radii of their circular orbits $\left(\frac{r_p}{r_\alpha}\right)$ is
(a) $\frac{3}{4}$ (b) $\frac{4}{3}$ (c) $\frac{8}{9}$ (d) $\frac{9}{8}$
18. An element with an unstable nucleus decays by emitting an α particle and two β −particles to become a stable atom.
Which of the following is true about the new stable atom ?
(a) it is an isobar of the original element.
(b) it is an isotone of the original element
(c)it is an isotope of the original element
(d)it has the same proton and neutron number as the original atom.
19. The angular momentum of a hydrogen atom in the excited state is $8.28/\pi \times 10^{-15}$ eVs. What should be the minimum energy of light which can excite the electron from the ground state to this excited state ? (h = 4.14×10^{-15} eVs)
(a) 0.85 eV (b) 12.75 eV (c) 13.6 eV (d) 14.45 eV
20. Taking the Bohr radius as r_0 = 53 pm, the radius of Li^{++} ion in its ground state, on the basis of Bohr's model, will be about
(a) 53 pm (b) 27 pm (c) 18 pm (d) 13 pm

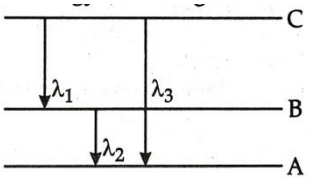
SECTION - B

Short answer type question. Attempt any two question :- **Marks : 2× 3 = 6**

21. Light wavelength 2000 Å falls on a metal surface of work function 4.2 eV.
    (a) What is the kinetic energy (in eV) of the faster electrons emitted from the surface ?
    (b) What will be the change in the energy of the emitted electrons if the intensity of light with same wavelength is doubled ?
    (c) If the same light falls on another surface of work function 6.5 eV, what will be the energy of emitted electrons ?
22. **(i)** Derive the expression for de – Broglie wavelength of an electron moving under a potential difference of V volts .
    (ii) An electron and a proton have the same Kinetic Energy. Which of these particles has the shorter de – Broglie wavelength ?
23. An electron excites from first orbit to the second orbit of a hydrogen atom. By what factor will the magnetic dipole moment of the revolving electron change? Show calculations .
24. A difference of 2.3 eV is the separates two energy levels in a atom. What is the frequency of radiation emitted when the atom make a transition form the upper level to the lower level ?

Long answer type question. Attempt any four question :- **Marks : 4 × 5 = 20**

25. Sketch the graphs showing variation of stopping potential with frequencies of incident radiations for two photosensitive materials A and B having threshold frequencies $v_A > v_B$.
    (i) In which case is the stopping potential more and why ?
    (ii) Does the slope of the graph on the nature of the material used ? Explain .
26. Find the
    (a) Maximum frequency, and
    (b) Minimum wavelength of X –rays produced by 30 kV electrons.
27. The work function of caesium metal is 3.14 eV. Ehen light of frequency 6×10^{14} Hz is incident on the metal surface, photoemission of electrons occurs. What is the
    (a) Maximum kinetic energy of the emitted electrons,
    (b) Stopping potential, and
    (c) Maximum speed of he emitted photoelectrons ?
28. (a) State the postulates of Bohr model of Hydrogen atom.
    (b)Find the ratio of the longest and the shortest wavelengths of Bolmer series spectrum of Hydrogen atom.
    (c) What are the longest and shortest wavelengths of Lyman spectral series ?
29. (a) in Rutherford scattering experiment, draw a plot to show the variation number of α −particles scattered with scattering angle.
    (b) Find the relation between the three wavelengths from the energy level diagram shown below.



    (c) Find the ratio between the wavelengths of the " most energetic" spectral lines in Balmer and paschen series of Hydrogen spectrum .
30. A 12.5 eV electron beam is used to bombard gaseous hydrogen at room temperature. What series of wavelengths will be emitted ?