Chemistry Question Paper

Section – A (Very Short Answer, 1 Mark Each)

1. How many electrons have n + l = 4 in the ground state of an atom?

2. Which of the following sets of quantum numbers is not possible? Give reason.
(a) n=3, l=2, m_l=+3, m_s=+1/2
(b) n=2, l=1, m_l=0, m_s=-1/2

3. The maximum number of emission lines possible when an electron in hydrogen jumps from n=5 to ground state is ___.

4. Which is more penetrating – Lyman α or Balmer α radiation? Justify.

5. Write the electronic configuration of Fe^{3+}.

Section – B (2 Marks Each)

1. Calculate the wavelength associated with an electron accelerated through a potential difference of 100 V.

2. The frequency of a line in the Lyman series of hydrogen is 2.47 × 10^15 Hz. Identify the transition. (R = 1.097 × 10^7 m^{-1})

3. Why is the ionization enthalpy of He much higher than that of H?

4. How many electrons in an atom can have the following set of quantum numbers? n=3, l=1.

5. A metal surface has a work function of 2 eV. Find the maximum wavelength of light capable of producing photoelectrons.

Section – C (3 Marks Each)

1. Calculate the energy required to excite an electron in hydrogen atom from ground state to n=3. Express your answer in joules and kJ/mol.

2. A particle of mass 1×10^{-27} kg is moving with velocity 1×10^{3} m/s. Calculate its de Broglie wavelength.

3. Which transition in the hydrogen spectrum would have the same wavelength as the Balmer transition n=4 → n=2 in the He^{+} spectrum?

4. The uncertainty in position of an electron is 1×10^{-10} m. Calculate the minimum uncertainty in its velocity. (m_e = 9.1×10^{-31} kg)

5. Write short notes on:
(a) Hund's rule of maximum multiplicity
(b) Screening effect and its influence on orbital energy.

Section – D (5 Marks Each)

1. An electron in a hydrogen atom makes a transition from n=6 to n=2. Calculate:
(a) Energy released (in eV)
(b) Wavelength of emitted radiation
(c) Name of spectral series.

2. A photon of wavelength 150 nm ejects electrons from a metal surface. If the maximum kinetic energy of photoelectrons is 3.3 eV, calculate:
(a) The work function of the metal
(b) The threshold frequency.

3. A beam of electrons has a kinetic energy of 150 eV. Calculate its de Broglie wavelength. Compare it with the wavelength of yellow light of 589 nm.

4. A sample of hydrogen atoms in ground state is irradiated with photons of energy 12.1 eV. Calculate:
(a) The principal quantum number to which the electrons are excited
(b) The total number of spectral lines possible.

5. A bullet of mass 10 g is moving with a velocity of 500 m/s. Calculate its de Broglie wavelength. Compare the result with that of an electron moving with the same speed. Comment on the result.