CHAPTER-12
Atoms
ASSIGNMENT-3

Multiple Choice Questions (1 Mark)

Q.1 What is the ratio of radii of orbits corresponding to 1^{st} excited state and ground state of hydrogen atm?

(a) 2:1 (b)1:4 (c)4:1 (d)1:2

Q.2 The ratio between Bohr radii is

(a) 1: 2: 3 (b) 2 : 4 : 6 (c) 1 : 4 : 9 (d) 1 : 3 : 5

Q3. An alpha particle of energy 5 Mega eV is scattered through 180 degree by a fixed uranium nucleus. The distance of closest approach is of the order of

(a)1 ^{0}A (b)10^{-10} cm (c)10^{-12} cm (d)10^{-15} cm

Q.4 The total energy of the electron in the ground state of hydrogen atom is -13.6 eV. The kinetic energy of the electron in the first excited state will be

(a) 1.7 eV (b) 3.4 eV (c) 6.8 eV (d)13.6 eV

Q.5 When an electron jumps from 4^{th} orbit to 2^{nd} orbit,one gets the

(a) second line of paschen series (b) second line of lyman series

(c)second line of balmer series (d) first line of pfund series

Q.6 If P.E and K.E represent potential and kinetic energies of the orbital electron then

(a) K.E=-P.E/2 (b) K.E=-P.E (c) K.E=-2P.E (d) none of the above

Assertion –Reason Type Questions (1 Mark each)

Answer: A Both are correct and reason is correct explanation of assertion.

Answer: B Both are correct but reason is not the correct explanation of assertion.

Answer: C Reason is wrong.

Answer: D Both are wrong.

Q7. **Assertion:** Electrons in the atom are held due to coulomb forces

Reason: The atom is stable only because the centripetal force due to Coulomb's law is balanced by the centrifugal force.

Q8. **Assertion:** Rydberg's constant varies with the mass number of given element.

Reason: The reduced mass of electron is dependent on the mass of nucleus only.

Q9. **Assertion:** In Lyman series, the ratio of minimum and maximum wavelength is ¾

Reason: Lyman series constitute spectral lines corresponding to transition from higher energy to ground state of hydrogen atom.

Case study based question (5 marks)

Q10. ENERGY OF ELECTRON FOR HYDROGEN ATOM

Electrons are revolving around the nucleus in particular stable orbits. The energy of the electron is increasing as we go from the orbit closer to nucleus to outer side. The ground state energy is the lowest energy and it is -13.6 eV for hydrogen atom. Thus, the minimum amount of energy required to remove or free the electron from the ground state is the ionisation energy and it has value +13.6 eV. When electrons jumps from higher energy orbit to lower energy orbit emits energy in the form of photons which are in the form of spectral lines and called as emission lines. The light emitted by the ordinary source of light consist of different wavelength. But the laser light is the monochromatic one which emits light of single wavelength. In case of hydrogen atom, the ground state energy is that energy state for which n = 1. And the states for which n > 1, all are the excited states. Where n shows the principal quantum number.

(I) In hydrogen atom, the energy corresponding to principal quantum number n =2 is

(a) -13.6 eV (b) -3.4 Ev (c) +13.6 eV (d) +3.4 eV

(II) For ground state of hydrogen atom the value of principal quantum number is

(a) n = 2 (b) n = 0 (c) n = 1 (d) n = infinity

(III) The minimum energy required to remove the electron from the ground state of the hydrogen atom is called as____

(a) excitation energy (b) ionisation energy

(c) ground state energy (d) excited state energy

(IV) The acronym LASER stands for?

(V) If n = infinity then what is the energy of the state and what does it means?

Short answer type questions (2 marks each)

Q 11. What is the maximum number of spectral lines emitted by a hydrogen atom when it is in the third excited state? Which one will have lowest wavelength?

Q 12. The wavelength of the second line of Balmer series in Hydrogen atom is 4861Angstrom. Calculate the wave length of the first line.

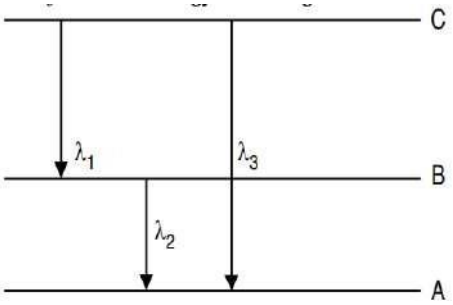
Q13. Calculate the shortest wavelength in the Balmer series of hydrogen atom. In which region (infra-red, visible, ultraviolet) of hydrogen spectrum does this wavelength lie?

Q14 The ground state energy of hydrogen atom is – 13.6 eV. If an electron makes a transition from an energy level – 1.51 eV to – 3.4 eV, calculate the wavelength of the spectral line emitted and the series of hydrogen spectrum to which it belongs. (CBSE 2017)

Q15 Energy of electron in first excited state in Hydrogen atom is -3.4eV. Find KE and PE of electron in the ground state. (CBSE SQP 2019-20)

Short answer type questions (3 marks each)

Q16. (i) State Bohr's quantization condition for defining stationary orbits. How does de-Broglie hypothesis explain the stationary orbits? (ii) Find the relation between the three wavelengths λ_1, λ_2 and λ_3 from the energy level diagram shown below. (2016)



Long answer type questions (5 marks each)

Q.17 (i) Write two important limitations of Rutherford model which could not explain the observed features of atomic spectra. How were these explained in Bohr's model of hydrogen atom ? Use the Rydberg formula to calculate thewavelength of the H_a line. (Take R = 1.1×10^7 m^{-1}).

(CBSE 2015)

(ii) Using Bohr's postulates, obtain the expression for the radius of the n^{th} orbit in hydrogen atom.