REVISION TEST -07 **Total Marks -30**

12th Physics – Atom Physics

Multiple Choice Questions 5x1 =5

1. Emission line spectrum of atoms contains
   a. Only a few colors in the form of isolated sharp parallel lines generally produced by heated gases
   b. All colors of visible light without sharp boundaries
   c. All colors in the form of isolated sharp parallel lines generally produced by heated resistances
   d. Only a few colors in the form of isolated sharp parallel lines generally produced by chilled gases
2. Find the kinetic, potential, and total energies of the hydrogen atom in the first excited level, and find the wavelength of the photon emitted in a transition from that level to the ground level.
   a. K_2 = 3.90 eV, U_2 = -6.80 eV and E_2 = -3.40 eV. For the ground level (n = 1) E_1 = -13.6 eV, λ = 142 nm
   b. K_2 = 3.80 eV, U_2 =-6.80 eV and E_2 = -3.40 eV. For the ground level (n = 1) E_1 = -13.6 eV, λ = 132 nm
   c. K_2 = 3.40 eV, U_2 =-6.80 eV and E_2 = -3.40 eV. For the ground level (n = 1) E_1 = -13.6 eV, λ = 122 nm
   d. K_2 = 3.60 eV, U_2 = -6.80 eV and E_2 = -3.40 eV. For the ground level (n = 1) E_1 = -13.6 eV, λ = 129 nm
3. A triply ionized beryllium ion Be^{3+}, (a beryllium atom with three electrons removed), behaves very much like a hydrogen atom except that the nuclear charge is four times as great. For a given value of n, how does the radius of an orbit in Be^{3+} compare to that for hydrogen?
   a. $\frac{1}{7}$ th of hydrogen radius
   b. $\frac{1}{4}$ th of hydrogen radius
   c. $\frac{1}{6}$ th of hydrogen radius
   d. $\frac{1}{5}$ th of hydrogen radius
4. The energy of the electron revolving in the orbit of Bohr radius is
   a. 13.6 MeV

b. -13.6 eV
c. -13.6 MeV
d. 13.6 eV

5. Which of these statements about Bohr model is correct?
   a. Bohr model is pure quantum mechanical theory
   b. Bohr model is based classical electromagnetic theory
   c. Bohr model combines classical and early quantum concepts
   d. Bohr model postulates wavy paths around the nucleus

Short Type 1 Questions 4 x2 =8

6. What is the maximum number of spectral lines emitted by a hydrogen atom when it is in the third excited state?

7. State Bohr's quantisation condition for defining stationary orbits.

8. Write the expression for Bohr's radius in hydrogen atom.

9. In the ground state of hydrogen atom, its Bohr radius is given as 5.3 $\times 10^{-11}$ m.The atom is excited such that the radius becomes 21.2 $\times 10^{-11}$ m. Find (i) the value of the principal quantum number and (ii) the total energy of the atom in this excited state.

Short Type 2 Questions 3 x3 =9

10. Using Bohr's postulates of the atomic model, derive the expression for radius of nth electron orbit. Hence, obtain the expression for Bohr's radius.

11. State any two postulates of Bohr's theory of hydrogen atom. What is the maximum possible number of spectral lines observed when the hydrogen atom is in its second excited state? Justify your answer.
    Calculate the ratio of the maximum and minimum wavelengths of the radiations emitted in this process.

12. The energy of the electron, the hydrogen atom, is known to be expressible in the form $E_n = \frac{-13.6eV}{n^2}$ (n = 1, 2, 3, . . .)

Use this expression to show that the

i. Electron in the hydrogen atom can not have an energy of -2V.
ii. Spacing between the lines (consecutive energy levels) within the given set of the observed hydrogen atom spectrum decreases as n increases.

Long Type Questions 2 x4 =8

13. Prove that the ionization energy of hydrogen atom is 13.6 eV.

14. Using Bohr's formula for energy quantization determine:
    i. the longest wavelength in the Lyman series of hydrogen atom spectrum.
    ii. the excitation energy of the n =3 level of He^{+} atom
    iii. the ionization potential of the ground state of Li^{++} atom.