CHAPTER-12
Atoms
ASSIGNMENT-1
Multiple Choice Questions (1 Mark each)

Q.1 In Bohr's theory of model of hydrogen atom, name the physical quantity which equals to an integral multiple of $h/2\pi$?

(a) Momentum (b) Angular momentum

(c)Angular frequency (d) Angular velocity

Q.2 What is the relation between 'n' and radius 'r' of the orbit of electron in hydrogen atom according to Bohr's theory?

(a) 'r' is directly proportional to n (b) 'r' is directly proportional to n^2

(c) 'n^2' is directly proportional to r (d) 'r' is inversely proportional to n^2

Q.3 What is Bohr's frequency condition?

(a) $hv=E_i-E_f$ (b) $hv= E_f -E_i$ (c) $hv=E-E_f$ (d) $h=E_i-E_f$

Q.4 Write the expression for Bohr's radius in hydrogen atom?

(a) $r=4\Pi E_0 \times h^2 / 4\pi^2 me$ (b) $r=4\Pi E_0 \times h^2 / 4\pi^2 me^2$

(c) $r=4\Pi E_0 \times h^2 / 4\pi me^2$ (d)) $r=4\Pi E_0 \times h/ 4\pi^2 me^2$

Q.5 Name the spectral series of hydrogen atom lying in visible region?

(a) Paschen series (b)Pfund series (c)Bracket series (d) Balmer series

Q.6 The total energy of an electron in 1st excited state of hydrogen atom is about -3.4eV. What is the kinetic energy of electron in this state?

(a) -3.4 eV (b) 3.4 eV (c) 0.34 eV (d) -0.34 eV

Q7. Which of the following spectral series in hydrogen atom gives spectral line of 4860 ^{0}A?

(a)Lyman (b) Balmer (c) Paschen (d) Brackett

Q.8 When hydrogen atom is in first excited level, its radius is

(a)same (b) half (c) twice (d) 4 times

Q.9 Rutherford model of atom was unstable because

(a)nuclei will break down (b)electron move in circular orbit

(c)orbiting electrons radiate energy (d) electrons are repelled by the nucleus

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.

Q10. **Assertion:** According to Bohr's atomic model the ratio of angular momenta of an electron in first excited state and in ground state is 2:1.

Reason: In a Bohr's atom the angular momentum of the electron is directly proportional to the principal quantum number.

Q11. **Assertion:** The positively charged nucleus of an atom has a radius of almost 10^{-15}m.

Reason: In a-particle scattering experiment, the distance of closest approach for particles is $\simeq 10^{-15}$m.

Q12. **Assertion:** For the scattering of a-particles at a large angles, only the nucleus of the atom is responsible.

Reason: Nucleus is very heavy in comparison to α particle.

Q13.**Assertion**: Bohr had postulated that the electrons in stationary orbits around the nucleus do not radiate

Reason: According to classical physics all moving electrons radiate.

Q14. **Assertion:** Atoms are not electrically neutral.

Reason: Number of protons and electrons are different.

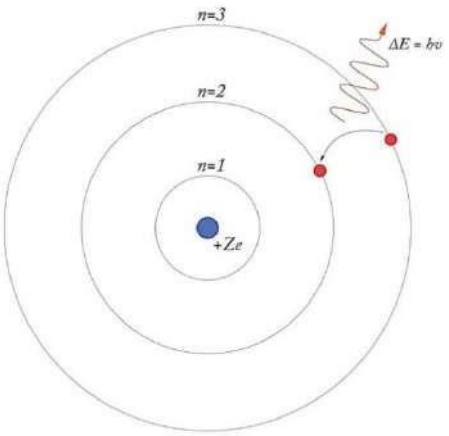
Case study based questions (4 marks)

Q 15. BOHR ATOM MODEL

Rutherford gives Rutherford's model of the atom after performing an Alpha particle scattering experiment.

This model is a modification of the earlier Rutherford Model. According to this model, an atom consists of a small, positively-charged nucleus and negatively-charged electrons orbiting around it in an orbital. These orbital can have different sizes, energy, etc. And the energy of the orbit is also related to its size. The lowest energy is found in the smallest orbit. So if the electron is orbiting in nth orbit then we will study about its Velocity in nth orbital, Radius of nth orbital, Energy of

electron in nth orbit, etc. Energy is also emitted due to the transition of electrons from one orbit to another orbit. This energy is emitted in the form of photons with different wavelengths. This wavelength is given by the Rydberg formula. When electrons make transitions between two energy levels in an atom various spectral lines are obtained. The emission spectrum of the hydrogen atom has been divided into various spectral series like Lyman series, Balmer series, Paschen series etc.



Bohr model

(I). The formula which gives the wavelength of emitted photon when electron jumps from higher energy state to lower was given by

(a) Balmer (b) Paschen (c) Lyman (d) Rydberg

(II). What is true about Bohr's atomic Model?

(a) His model was unique totally different from other

(b) His model is a modification of Rutherford atomic model.

(c) His model is a modification of Thomson atomic model.

(d) None of the above

(III). Bohr's atomic model is applicable for

(a) All types of atoms (b) Only for hydrogen atom

(c) For hydrogen like atoms (d) For H2 gas.

(IV). The cause of rejection of Rutherford atomic model was

(a) It was totally wrong (b) It could not justify its stability

(c) Rutherford was unable to explain it (d) none of the above.

Short Answer type questions (2 marks each)

Q16.The ground state energy of hydrogen atom is -13.6eV. What is the kinetic energies and potential Energies of the electron in the ground state and second excited state.

Q17. Define impact parameter. Represent diagrammatically the shape of trajectory of alpha particles.

Q18. Show graphically the variation of radius of orbit with principal quantum number n.

Q19. The radius of innermost electron orbit of a hydrogen atom is 5.3×10^{-11} m. What is the radiusof orbit in the second excited state?

Q20. Define ionization energy. How would the ionization energy change when electron in hydrogen atom is replaced by the particle of mass 200 times that of the electron but having the same charge? [Given Rydberg constant, $R = 10^7\ m^{-1}$] (2016)

Q21.Write two important limitations of Rutherford nuclear model of the atom. (2017)

Q22. Calculate the de-Broglie wavelength of the electron orbiting in the n = 2 state of hydrogen atom. (2016)

Q23. Derive an expression for the radius of nth Bohr's orbit in Hydrogen atom.

Short answer type questions. (3 marks each)

Q24. In a Geiger-Marsden experiment, calculate the distance of the closest approach to the nucleus of Z= 80, when an α-particle of 8 MeV energy impinges on it before it comes momentarily to rest and reverses its direction. How will the distance of the closest approach be affected when the kinetic energy of the a-particle is doubled?

Q25. Derive an expression for the frequency of radiation emitted when a hydrogen atom de-excitesfrom level n to level (n – 1). Also show that for large values of n, this frequency equals to classicalfrequency of revolution of an electron. (CBSE SQP 2020-21)

Long answer type questions. (5 marks each)

Q26. (i) Using Bohr's postulates, derive an expression for the total energy of the electron in the stationary states of the hydrogen atom. (CBSE 2013)

(ii) Using Rydberg formula, calculate the wavelengths of the spectral lines of the first member ofthe Lyman series and of the Balmer Series.