# SHORT QUESTIONS

**20.1 Bohr's theory of hydrogen atom is based upon several assumptions. Do any of these assumptions contradict classical physics?**

**Ans.** Yes, Bohr's first postulate contradict with classical physics. According to classical physics every moving particle radiate energy continuously therefore, accelerated electron must radiate energy but according to Bohr's theory an electron does not radiate energy when moving around the nucleus.

**20.2 What is meant by a line spectrum? Explain, how line spectrum can be used for the identification of elements?**

**Ans.** When atoms of an element are excited by absorbing the energy from the incident photon, the excited atoms returns to the ground state by the emission of energy forms a spectrum of definite spectral lines, such a spectrum is called a line spectrum. A spectrum consists of discrete lines. Thus we can identify different elements because each element has characteristic lines of definite wavelength.

**20.3 Can the electron in the ground state of hydrogen atom absorb a photon of energy 13.6 eV and greater than 13.6 eV?**

**Ans.** Yes, photon of energy 13.6 eV will be absorbed by the electron in the ground state of hydrogen atom for ionization because ionization energy of hydrogen atom is 13.6 eV. But if energy of photon is greater than 13.6 eV then surplus energy is changed into kinetic energy of electron.

**20.4 How can the spectrum of hydrogen contain so many lines when hydrogen contains one electron?**

**Ans.** Because in an excited hydrogen atom, electron falls back to ground state in different steps, emitting lines of different wavelength. (For each orbit, photon of different wavelength emits).

**20.5 Is energy conserved when an atom emits a photon of light?**

**Ans.** Yes, during excitation atom receives energy from some external source and during de-excitation same energy is emitted in the form of photon. This means that energy absorbed by atom, during excitation is equal to the energy emitted during de-excitation.

**20.6 Explain why a glowing gas gives only certain wavelength of light and why that gas is capable of absorbing the same wavelengths? Give a reason why it is transparent to other wavelengths?**

**Ans.** A glowing gas gives only certain wavelengths because in an atom there are only certain energy states and transition between these states gives light of certain wavelengths. Similarly an atom can absorb only those photons which have energy equal to energy difference between these two states and gas atoms are transparent to other wavelengths.

**20.7 What do we mean when say that the atom is excited?**

**Ans.** When electron jumps from lower energy level to high energy level by providing some energy, the atom is said to be in excited state.

**20.8 Can X-rays be reflected, refracted, diffracted and polarized just like any other waves? Explain.**

**Ans.** Yes, X-rays are electromagnetic waves and they can be diffracted, reflected, refracted and polarized but their conditions may be different from that of ordinary light e.g. light can be diffracted by diffraction grating but X-rays cannot be diffracted by grating.

**20.9 What are the advantages of lasers over ordinary light?**

**Ans.** Laser light has following advantages over ordinary light:

(i) It is mono-chromatic i.e., single wavelength while ordinary light has many wavelength.

(ii) It is phase-coherent while ordinary light has no phase coherent.

(iii) It is uni-directional while ordinary light spreads in all direction.

(iv) It is much more intense than ordinary light.

**20.10 Explain why laser action could not occur without population inversion between atomic levels?**

**Ans.** Population inversion means number of atoms in the metastable state are greater than number of atoms in ground state. Laser light is produced due to stimulated emission. For this most of electrons should be in the excited state. So population inversion is necessary for laser action.