CHAPTER

7

Modern Physics

Cathode Rays

- If the gas pressure in a discharge tube is 10^{-2} to 10^{-3} mm of Hg and a potential difference of 10^4 V is applied between the electrode, then a beam of electrons emerges from the cathode which is called **cathode rays**.
- Cathode rays are invisible and travel in straight line.
- These rays are deflected by electric and magnetic fields.
- These rays can ionise gases.
- They can produce chemical change and thus affect a photographic plate.
- When they strike a target of heavy metal such as tungsten, they produce X-rays.

X-rays

- X rays are electromagnetic waves.
- X-rays were discovered by scientist Roentgen.
- X-rays travels in a straight line with speed of light.
- X-rays ionise gases.
- They show all the important properties of light rays like, reflection, refraction, interference, diffraction and polarization etc.
- They produce photoelectric effect.

Uses of X-rays

- In radiography
- In engineering
- In laboratories

Positive or Canal Rays

- These rays are positively charged particles and are called positive rays or canal ray. These rays were discovered by Goldstein.
- These rays are capable of producing physical and chemical changes.
- These rays are deflected by electric and magnetic fields.

Photoelectric Effect

- When the ultraviolet rays (or the visible light of low wavelength or any other kind of electromagnetic radiation) are made incident on a metal, the electrons are emitted from it. This phenomenon is called the photoelectric emission or photoelectric effect. Photoelectric cell is based on photoelectric effect. It is a device by which light energy is converted into the electrical energy.

Fluorescence

- Some substance absorb the light of higher frequency or shorter wavelength and emits a light having lower frequency or higher wavelength in the presence of light source. This phenomenon of emission of light is called fluorescence. Such substance are called fluorescence substance.
- Fluoresphor, petral, uranium oxide, and barium platino cyanide are examples of fluorescence substance.
- Barium plantino cyanide is used in search of X-rays.

Phosphorescence

- Some substance can emit light even after removing the light source such substance are called phosphorescence substance and the phenomenon is called phosphorescence.
- Zinc sulphide, calcium sulphide and barium sulphide are examples of phosphorescence.

Semiconductor

- Semiconductor are those materials whose electrical conductivity at room temperature lies in between that of insulator and conductor. A semiconductor in an extremely pure form is known as intrinsic semiconductor.
- If a measured and small amount of chemical impurity is added to intrinsic semiconductor, it is called extrinsic semiconductor or doped semiconductor. External semiconductor are of two types.
- An extrinsic semiconductor in which electrons are majority charge carrier is called ***n*-type semiconductor**.

- An extrinsic semiconductor in which holes are the majority charge carrier is called ***p*-type semiconductor.**

LASER

- The word LASER is the short form of Light Amplification by Stimulated Emission of Radiation.

User of LASER Beam

- telecommunication
- In surgery
- In chemistry

Points to be Remember

- LED or semiconducting laser is used to convert electrical energy into optical energy.
- Microwaves are used in radar communication, satellite communication, etc.
- The remote control is a technique which performs the function from a distance.
- Co-axial cables are used for long distance high frequency transmission. *e.g.*, TV channel transmission.
- Diode valve acts as a rectifier. Rectifier is a device which converts alternating voltage into direct voltage.
- Triode valve can be used as amplifier oscillator and detector.

Exercise

1. The television sets receives
   (a) magnetic waves (b) radio waves
   (c) micro waves (d) None of these
2. An ordinary tube light used for lighting purposes contains
   (a) fluorescent material and an inert gas
   (b) one filament, reflective material and mercury vapour
   (c) fluorescent material and mercury vapour
   (d) two filaments, fluorescent material and mercury vapour
3. X-rays were discovered by
   (a) Johnson (b) Milikan
   (c) Roentgen (d) Thomson
4. Which of the following is the correct combination of the inventors and the inventions?
   (a) Elisha G Otis—Windmill (b) Galileo Galilei—Transistor
   (c) Sir Frank Whittle—Laser (d) J L Baird—Television
5. If the temperature of a semiconductor is raised, its resistivity will
   (a) increase (b) decrease
   (c) remain same (d) reduce to zero
6. Optical fibres are mainly used for which of the following?
   (a) Communication (b) Eye surgery
   (c) Weaving (d) Food industry
7. Which is not true with respect to the cathode rays?
   (a) A stream of electrons
   (b) Charged particles
   (c) Move with speed same as that of light
   (d) Can be deflected by magnetic fields
8. Positive rays was discovered by
   (a) Thomson (b) Goldsten
   (c) W. Crookes (d) Ratherford
9. X-ray beam can be deflected by
   (a) magnetic field (b) electric field
   (c) both (a) and (b) (d) None of these
10. X-ray will travel minimum distance in
    (a) air (b) iron
    (c) wood (d) water
11. The majority charge carriers in *p*-type semiconductor are
    (a) electrons (b) protons
    (c) holes (d) neutrons
12. Photoelectric cell is a device of
    (a) collecting the photons
    (b) measuring the intensity of light
    (c) changing the photo energy to mechanical energy
    (d) substituting the accumulators by storing the electrical energy
13. Fire fly gives us cold light by virtue of the phenomenon of **(CDS 2011 I)**
    (a) fluorescence (b) phosphorescence
    (c) chemiluminescence (d) effervescence
14. Laser is a device to produce **(CDS 2009 I)**
    (a) a beam of white light (b) coherent light
    (c) microwaves (d) X-rays
15. Consider the following statements
    X-rays
    1. can pass through aluminium.
    2. can be deflected by magnetic field.
    3. move with a velocity less than the velocity of ultraviolet ray in vacuum.

    Which of the statements given above is/are correct?
    (a) 1, 2, and 3 (b) Only 1 **(CDS 2009 I)**
    (c) 2 and 3 (d) 1 and 2

Answers

1. (c) 2. (d) 3. (c) 4. (d) 5. (b) 6. (a) 7. (c) 8. (b) 9. (d) 10. (b)
11. (c) 12. (b) 13. (c) 14. (b) 15. (b)