Chapter-11

Dual Nature of Matter and Radiation

1. Define work function.

Ans: The minimum energy of incident radiation, required to eject the electrons from metallic surface is defined as work function of that surface.

2. Define threshold wavelength.

Ans: The minimum frequency of incident radiation, required to eject the electrons from metallic surface is defined as work function of that surface.

3. What do you mean by electron-volt (eV)?

Ans: It is a unit of energy. The energy acquired by an electron when accelerated through a potential difference of 1 V is called eV. Work function of a metal surface is measured in this unit.

4. Which metal has the minimum work function and how much?

Ans: Caesium has minimum work function. It is 2.14 eV.

5. Which metal has the maximum work function and how much?

Ans: Platinum has the maximum work function. It is 5.65 eV.

6. On what factors work function of a metal surface depends?

Ans: Work function of a metal surface depends on the structure and chemical composition of a surface.

7. What do you mean by electron emission?

Ans: The phenomenon of ejection of an electron from a metal surface when sufficient energy is supplied to the metal surface is called electron emission.

8. What are the main types of electron emission?

Ans: There are three main types of electron emission-

(i) Thermionic emission (ii) Field emission and (iii) Photoelectric emission

9. Who discovered the phenomenon of photoelectric effect?

Ans: It was discovered by Heinrich Hertz in 1887.

10. Who investigated the phenomenon of photoelectric effect in detail?

Ans: Wilhelm Hallwachs and Philipp Lenard investigated the phenomenon of photoelectric effect in detail during 1886 to 1902.

11. Define stopping potential.

Ans: The minimum retarding potential at which photocurrent becomes zero is called stopping potential. At this situation, no electron is able to reach the collector plate.

12. How photocurrent depends on intensity of radiation?

Ans: Photocurrent is directly proportional to intensity of radiation.

13. How stopping potential depends on frequency of radiation?

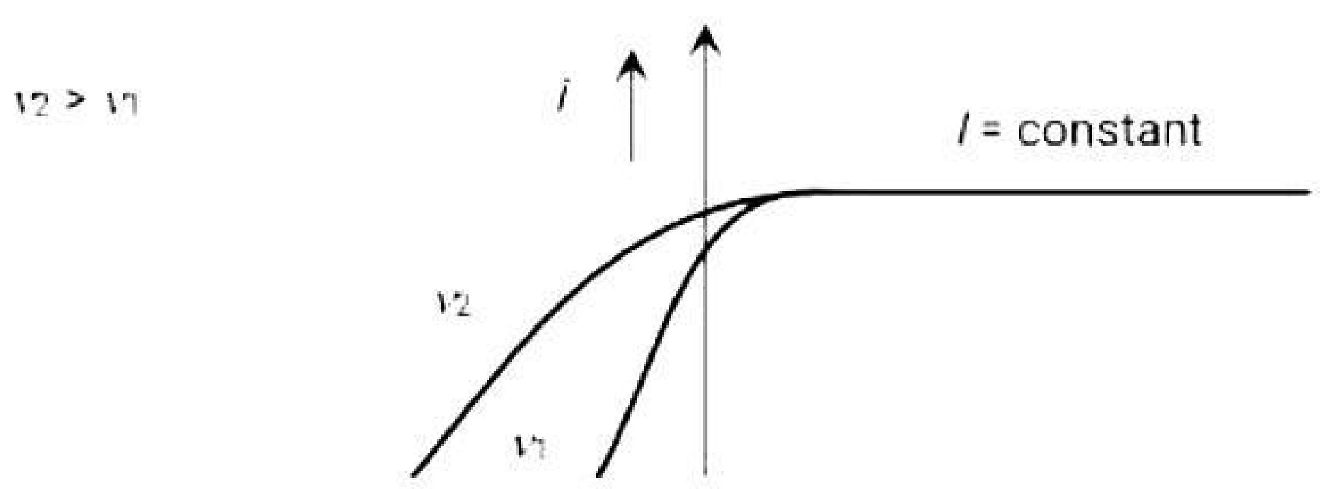
Ans: stopping potential is directly proportional to frequency of radiation.

14. How stopping potential depends on intensity of radiation?

Ans: Stopping potential does not depend on intensity of radiation.

15. Show graphically how stopping potential for a given photosensitive material varies with the frequency of incident radiation.

Ans: If frequency of incident light increases, (keeping intensity is constant) stopping potential increases but their is no change in saturation photoelectric current



16. Show graphically how photocurrent for a given photosensitive material varies with the applied potential.

Ans: Higher the intensity, higher is the saturation current but stopping potential remains the same as frequency of radiation is same.

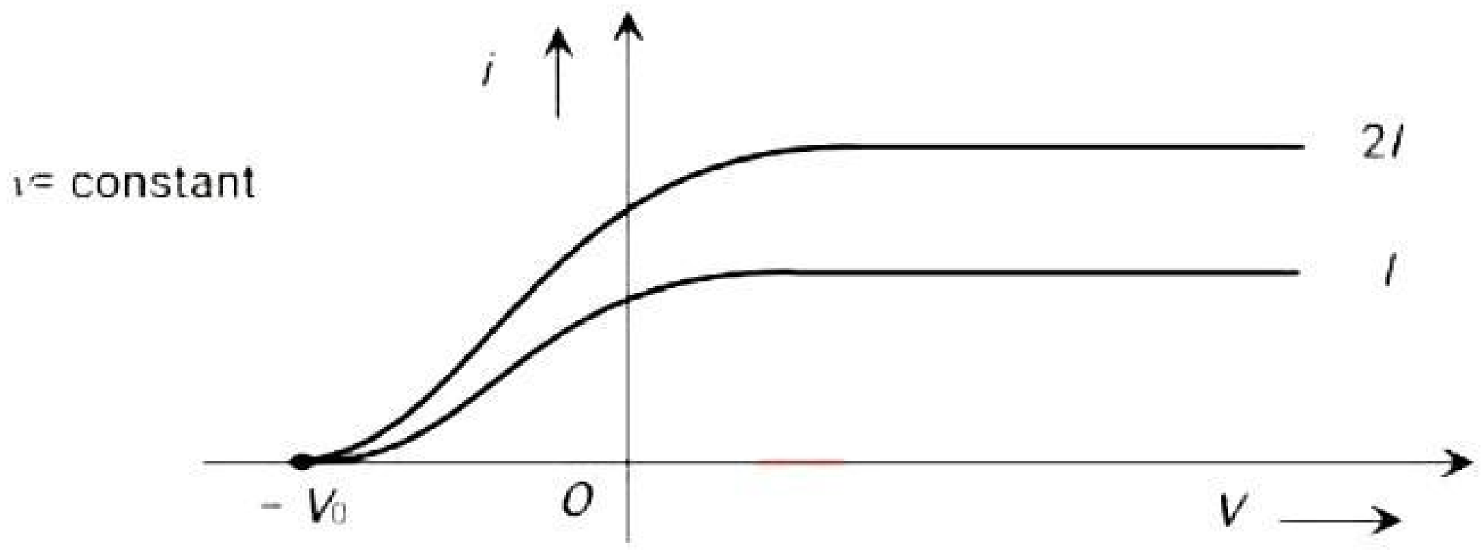


Fig. 25.19

17. Write De Broglie hypothesis.

Ans: According to de-Broglie a moving material particle sometimes acts as a wave and sometimes as a particle.

The wave associated with moving particle is called matter wave or de-Broglie wave and it propagates in the form of wave packets with group velocity.

18. Give the formula for de Broglie wavelength.

Ans: According to de-Broglie theory, the wavelength of de-Broglie wave is given by

$$\lambda = \frac{h}{p} = \frac{h}{mv} = \frac{h}{\sqrt{2mE}} \Rightarrow \lambda \propto \frac{1}{p} \propto \frac{1}{v} \propto \frac{1}{\sqrt{E}}$$

Where h = Plank's constant, m = Mass of the particle, v = Speed of the particle, E = Energy of the particle.