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# Dual nature of radiation
# Photoelectric effect, Hertz and Lenard's Observations

CLASS-XII

**SUBJECT : PHYSICS**
**CHAPTER NUMBER: 11**
**CHAPTER NAME : Dual Nature of Radiation and Matter**



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# LEARNING OUTCOME

- Understand the concept of electron emission and types.
- Understand the concept of work function.
- Describe the photoelectric effect.
- To study the conclusions obtained from experimental study of photoelectric effect.
- Discuss the effect of intensity and frequency on the photoelectric effect.

# Electron Emission

**Electron Emission:-**

The phenomenon of emission of electrons from the surface of a metal with a supply of energy is known as electron emission.

Different types of emission are

(a) Thermionic emission

(b) Photo ionic emission

(c) Field emission

(d) Secondary emission

# Work Function

**Work Function:-**

The minimum amount of energy required by the free electron to just leave the metal surface without imparting any kinetic energy to the electron is known as work function.

Work function depends upon

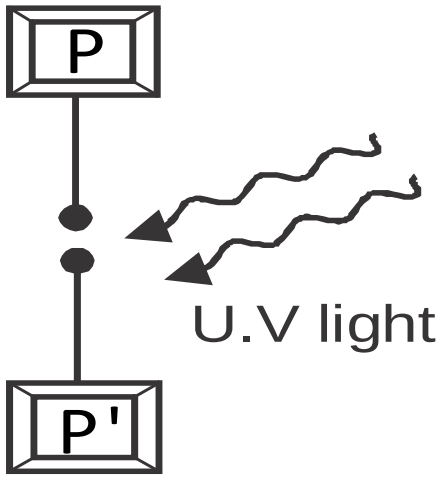
(i) property of material (ii) Nature of surface (iii) Nature of impurity.

The practical unit of work function  is eV

Note:- Max K.E of electrons emitted decreases with an increase in work function.

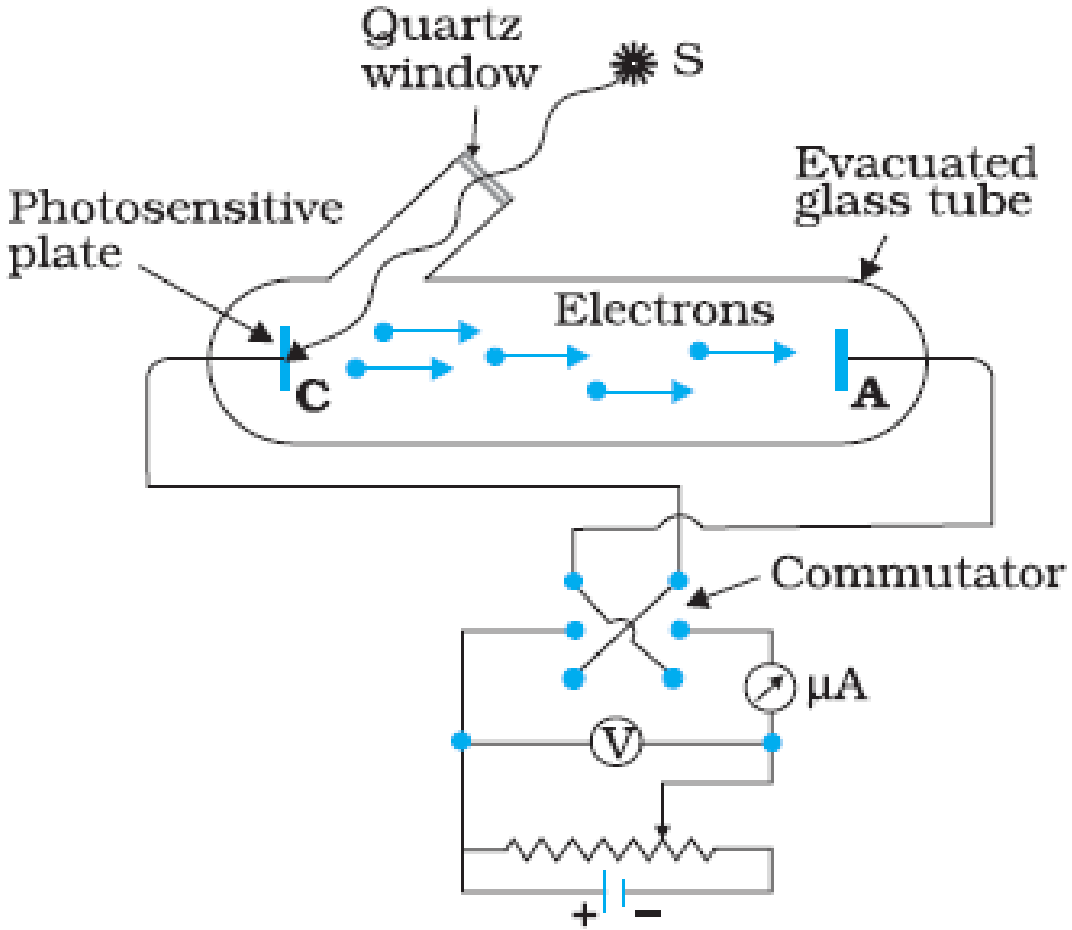
# Photoelectric Emission

**Hertz's Observation**



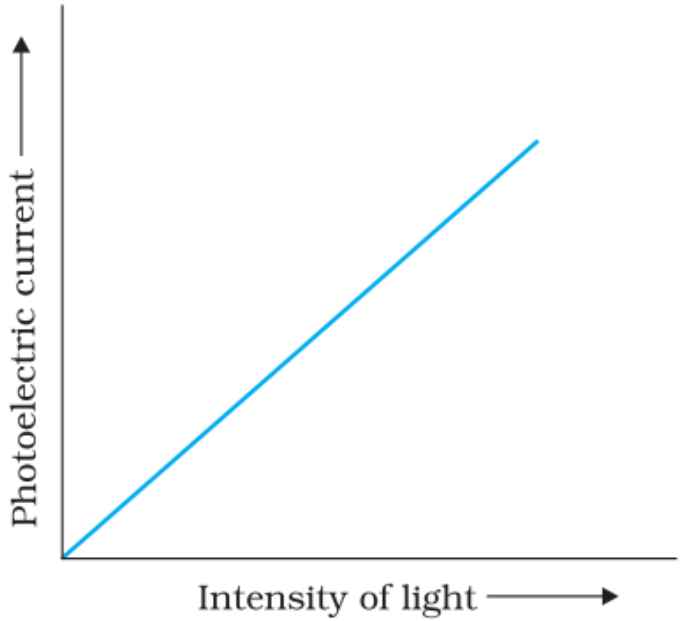

**Hallwachs' and Lenard observation**

# Experimental study of photoelectric effect:-



# Experimental study of photoelectric effect:-

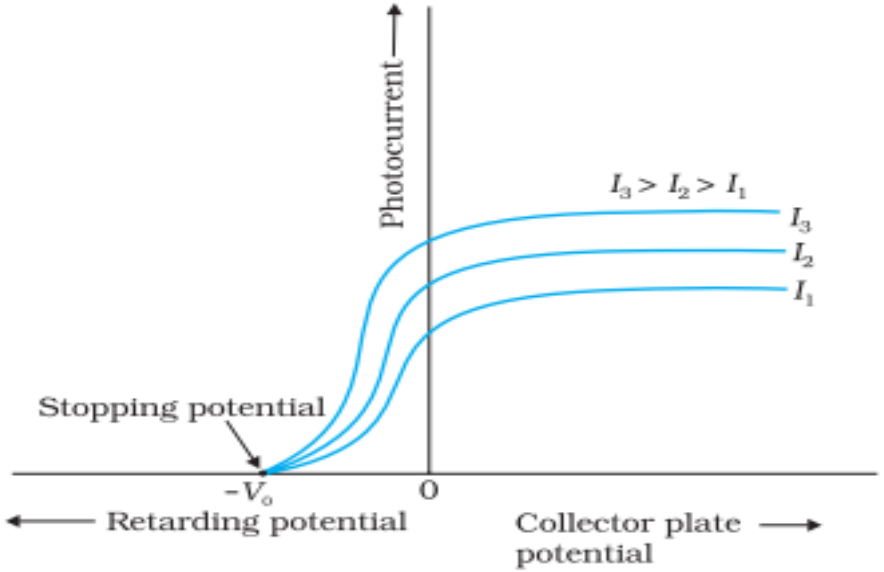
**Effect of intensity of light on photocurrent**:-

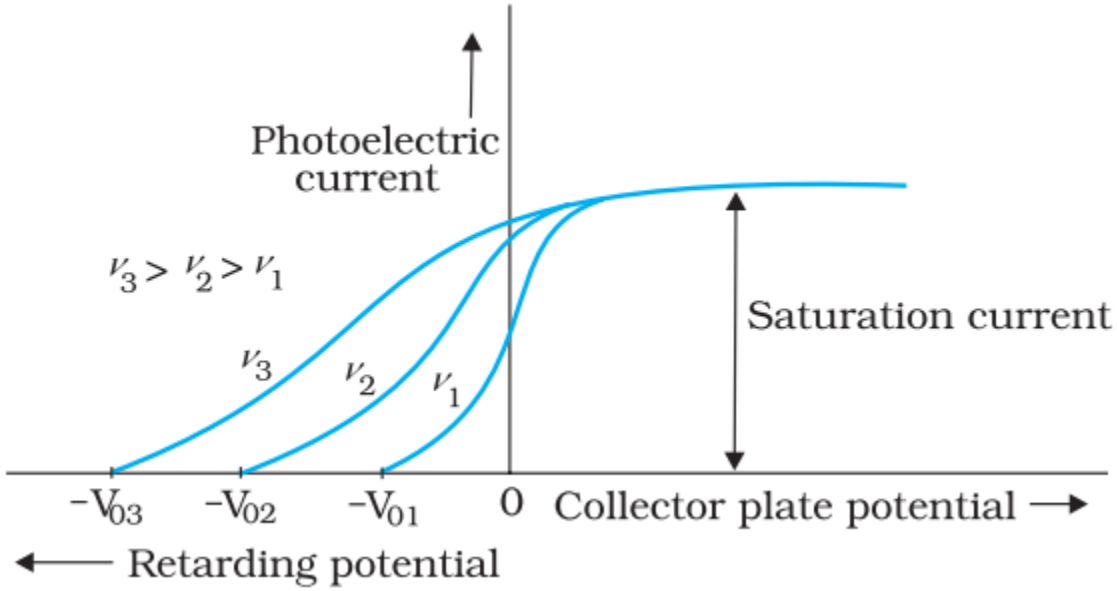



**Conclusion:** The number of photoelectrons emitted per second is proportional to the intensity of incident radiation.

# Experimental study of photoelectric effect:-

**Effect of potential on photocurrent**:-




**Conclusion**: Above the threshold frequency, the stopping potential or equivalently the maximum kinetic energy of the photoelectrons is directly proportional to the frequency of incident radiation, but is independent of its intensity.

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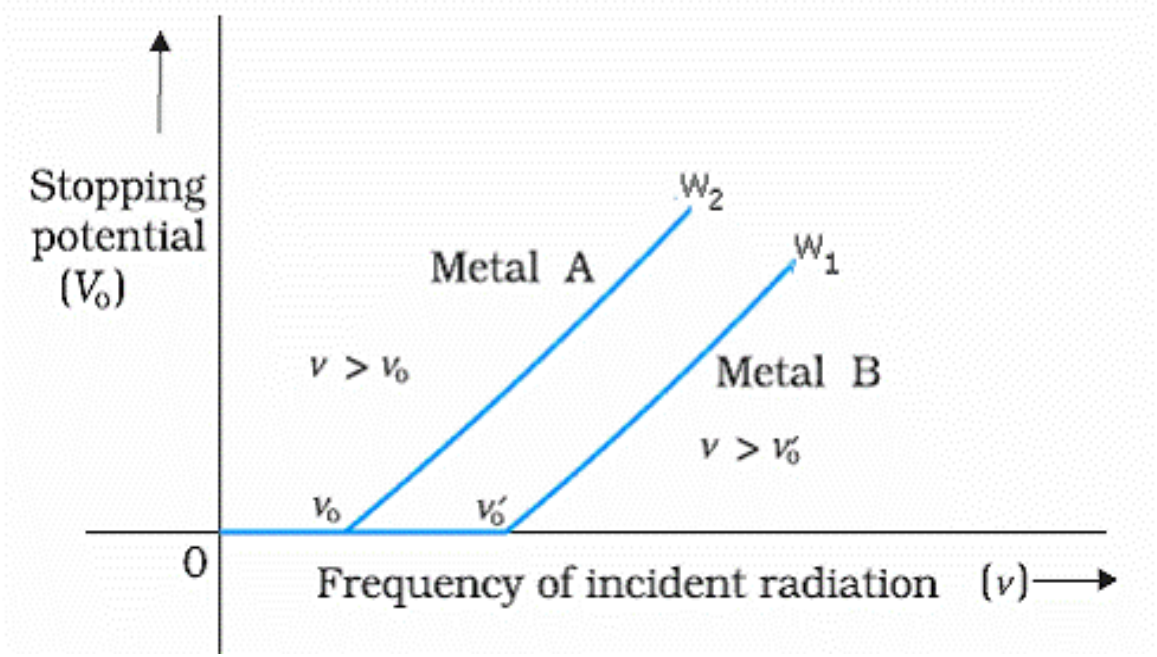
# Experimental study of photoelectric effect:-




**Conclusion:** Above the threshold frequency, the stopping potential is directly proportional to the frequency of incident radiation.

# Numerical

1.Two monochromatic radiations of frequencies $v_1$ and $v_2$ ($v_1 > v_2$) and having the same intensity are, in turn, incident on a photosensitive surface to cause photoelectric emission. Explain, giving reason, in which case (i) more number of electrons will be emitted and (ii) maximum kinetic energy of the emitted photoelectrons will be more.

2.For a photosensitive surface, threshold wavelength is $\lambda_0$. Does photo-emission occur if the wavelength ($\lambda$) of the incident radiation is (i) more than $\lambda_0$, (ii) less than $\lambda_0$ ? Justify your answer

# THANKING YOU

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