Notes for:
B.Sc. Part-II
Paper-4th
(Modern P)

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H.O.D Physics

Photo-electric (effect) Emission:

In 1987, Hertz discovered that a metallic surface is capable of emitting electrons when light of very short wavelengths falls on it. He noted that the air in the spark gap become a better conducter when it was illuminated by ultraviolet from arc lamp. Hallwachs in 1988 found that :—

(1) when ultraviolet light was incident on a neutral zinc plate, the plate became positively charged.

(2) when ultraviolet light was incident on a negatively charged zinc plate, it lost its charge rapidly, and

(3) when ultraviolet light was incident on a posetively charged zinc plate, it became more positively charged.

He came to the conclusion that only negatively charged particles can be emitted by the surface under the action of the ultraviolet light. Thomson in 1898 showed that the e/m value of the particles was the same as that for cathod rays.

~~Einstein~~ Eienstein in 1916 studied ~~that~~ the effect of visible light of a range of frequencies on sodium, potassium, cesium, rubidium and lithium and found that the electrons were rejected out of these metals.

The electrons ejected out of the metal under the action of light is known photoelectrons ~~effect~~ and this phenomena is known as photo electric effect or photo electric emission. Since the flow of electrons constitutes electric current, hence the current flowing in the circuit →

(P.T.O)

→ due to flow of electrons is known as "Photo electricity".

Photo-electric emission :—

" The Phenomenon of ejection of electrons from a metal under the action of light of suitable wavelength or frequency) is called the Photoelectric emission (or effect).

When Ultraviolet light is incident on the negatively charged zinc plate, it loses its charge slowly. The loss of charge is due to the ejection of electrons from the surface of the zinc plate under the effect of light. All substances, metals as well as non metals, give out slow moving electrons when illuminated with light of suitable wavelength.

The electrons emitted are called "Photoelectrons" to indicate their mode of production. The value of e/m of these electrons is the same as that for electrons produced by other methods.

The alkali metals like sodium, Potassium and cesium are sensitive to rays from the visible part of the ~~spectrum~~ spectrum, whereas zinc, cadmium etc, are sensitive to only ultraviolet light. Light of shorter wavelength has more energy and is thus more effective in producing the Photo electrons.

The effect is also observed in non-mets but they are highly electromagnetic waves of very shorter wavelength which are required. Photo electric effect is also observed in liquids and in gases. In gases the phenomenon results in ionisation. An electron escaping just from the surface of a plate has the maximum velocity.

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