ONE PHOTON OF LIGHT

OF FREQUENCY U

PHOTOSENSITIVE METAL

SURFACE

The energy of the photon (E = hv) is spent in two ways –

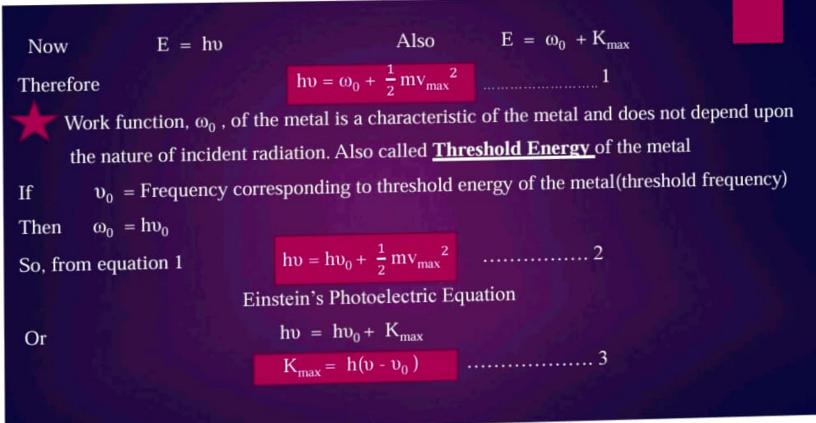
- A part of the energy of the photon used in liberating the electron from the metal surface, equal to the work function, ω₀, of the metal
- Rest of energy of photon used in imparting maximum kinetic energy K_{max}, to the emitted photoelectron

i.e. $E = \omega_0 + K_{max}$

If v_{max =} maximum velocity of the emitted photoelectron

m = mass of the photoelectron

Then
$$K_{max} = \frac{1}{2} m v_{max}$$



Explanation / Deduction of laws of Photoelectric Emission from Einstein's Photoelectric Equation

- Ī
- One photon ejects one photoelectron from a metal surface
- Number of photoelectrons emitted per second depends upon the number of photons falling on the metal surface per second ,which in turn depends on the intensity of the incident light
- If intensity of light is increased, the number of incident photons increases, resulting in increase in the number of photoelectrons ejected. This is the <u>First law of photoelectric emission</u>.

Ш

- * From equation 3, IF $v < v_0$, maximum kinetic energy is negative, which is impossible
- Photoelectric emission does not take place for the incident radiation below threshold frequency. This is <u>Second law of photoelectric emission</u>.

ш

- From equation 3, IF $v > v_0$ maximum kinetic energy directly proportional to frequency
- Maximum kinetic energy of photoelectron depends only on the frequency or wavelength of incident light
- Increase in intensity of incident light radiation leads to increase in the number of incident photons falling per second on the metal surface. This is <u>Third law of photoelectric</u> <u>emission.</u>

IV

- Phenomenon of photoelectric emission has been conceived as an effect of an elastic collision between a photon and an electron inside the metal
- Absorption of energy by the electron of metal from the incident photon is a single event involving transfer of energy at once
- There is no time lag between the incidence of photon and the ejection of photoelectron. This is Fourth law of photoelectric emission.