Photo Electric Effect

Hertz: Light incident on a metal surface ejects electrons.

(Observation by Heinrich Hertz) (PHOTOELECTRONS)

1/. Metals contain a large number of "free" electrons (free within the metal).

2/. Light is like a particle (photon) which on striking an ~~photon~~ electron transfers enough energy to escape the metal. (Einstein).

Observations: (Contradicts electromagnetic theory)

1/. Increasing the intensity of the incident light increased the current, but not the kinetic energy of the electrons.

2/. No current flows below a critical frequency of light, however intense.

Einstein : Energy in a beam of light is not distributed continuously through space, but is localised at points (in quanta). These quanta cannot be subdivided, and are emitted and absorbed as whole unit.

(THE PHOTON) | Beyond Planck.

i/. Energy of an incident photon is $h\nu$.

ii/. Minimum Energy needed to eject an electron, when a single photon strikes it, is $\boxed{h\nu_0 = W_0}$ (Work function)

$\nu_0 \rightarrow$ Threshold frequency

iii/. If $\nu > \nu_0$, then the electrons will flow with a maximum kinetic energy, $\boxed{\frac{1}{2}mv^2 = h\nu - h\nu_0.}$

$\therefore \quad h\nu = h\nu_0 + \frac{1}{2}mv^2.$

$\Rightarrow \boxed{h\nu = w_0 + \frac{1}{2}mv^2}$

Einstein's Photo-electric Equation

Experimental Evidence

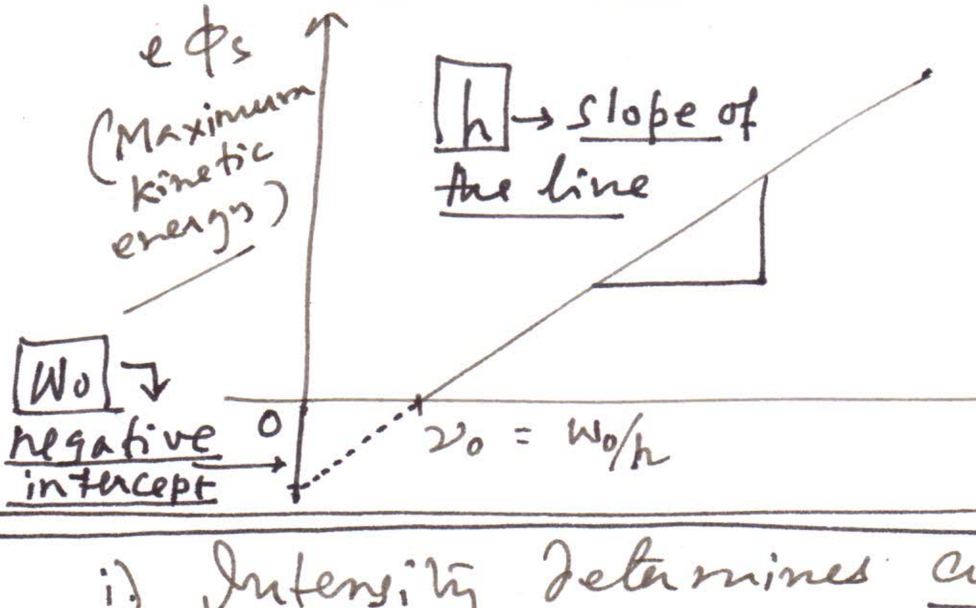
Apply a negative potential against the current flow, to work against the flow. When current stops completely, $\boxed{\frac{1}{2}mv^2 = e\phi_s}$ > 0 Why?

Where $\phi_s \to$ Stopping (extinction) potential.

$\therefore$ $\boxed{e\phi_s = h\nu - W_0}$

$\Rightarrow$ $\boxed{|\phi_s| = \frac{h}{|e|}\nu - \frac{W_0}{|e|}}$

$y = mx + c$.
$W_0 > 0$



Millikan's experiment (Robert Millikan)

i) Intensity determines current (no. of charges/time)

ii) Frequency determines the stopping potential.

iii) Effective only for visible and ultraviolet radiation.