Einstein's photoelectric equation:

According to Einstein, any electromagnetic radiation has a quantized concentrated packet of energy called as photon. The photon travel with the speed of the electromagnetic wave. He proposed that, when a photon incident on a surface, it interacts with an election on the surface. The photon is either reflected back with no reduction of its energy or it must give up all its energy to the electron, *but cannot be shared among the electrons*.

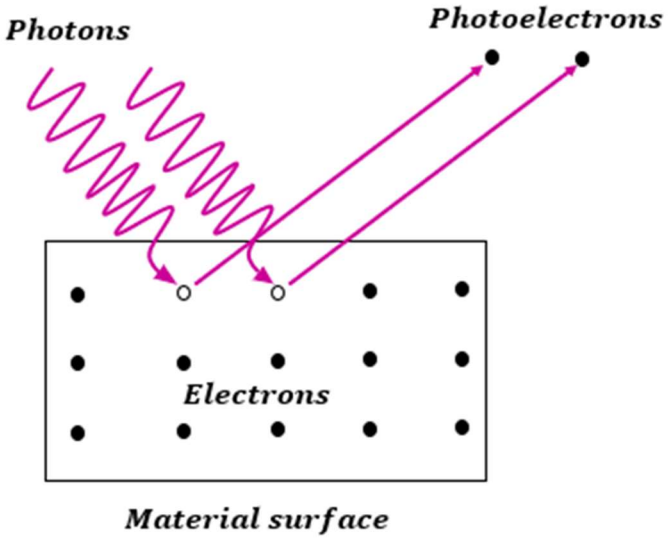

Figure: Emission of photoelectrons from a surface.

As a photon incident on a surface, its energy is absorbed in two steps.

- First, some energy of photon (***equal to work function***) is used to release (eject) an election from surface.
- Second, the remaining energy of the photon is used to impart (provide) Kinetic Energy to the emitted electron (photoelectron).

Thus, obeying the principle of conservation of energy,

$$Energy\ of\ incident\ photon\ =\ work\ function\ +\ Maximum\ KE\ of\ photo\ electron$$

Or $$E = \phi + KE_{max} \quad \ldots\ldots\ldots\ldots\ldots\ (1)$$

This is the Einstein's photoelectric equation.

If 'f' be the frequency of incident photon (and 'λ' be its wavelength), then

$$E = hf = h\frac{c}{\lambda}$$

If 'f_o' be the threshold Frequency (and 'λ_o' to be the threshold wavelength, then

$$\phi = hf_o = h\frac{c}{\lambda_o}$$

Then equation (1) can be simplified as:

$$hf = hf_o + KE_{max} \quad \ldots\ldots\ldots\ldots\ldots\ (2)$$

And $$h\frac{c}{\lambda} = h\frac{c}{\lambda_o} + KE_{max} \quad \ldots\ldots\ldots\ldots\ldots\ (3)$$

Equations, (1), (2), and (3) are the different forms of Einstein's photo electric equation.