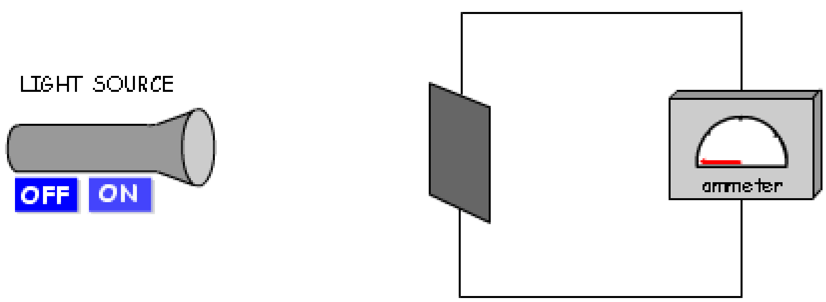
Photo electric effect:



The photoelectric effect was originally observed in 1939 and was documented by Heinrich Hertz in 1887. Initially, it was termed as the Hertz effect but later it was called the photoelectric effect.

In 1880 Hertz and Lenard observed that **when a clean metallic surface is irradiated by monochromatic light of proper frequency, electrons are emitted from it.** This phenomenon of ejection of the electrons from metal surface was called as **Photoelectric Effect**. The electrons thus ejected were called as photoelectrons. For photoemission to take place, energy of incident light photons should be greater than or equal to the work function of the metal.

Or $E \geq W$

$hf \geq W$ [Where h is plank's constant]

$f \geq W/h$

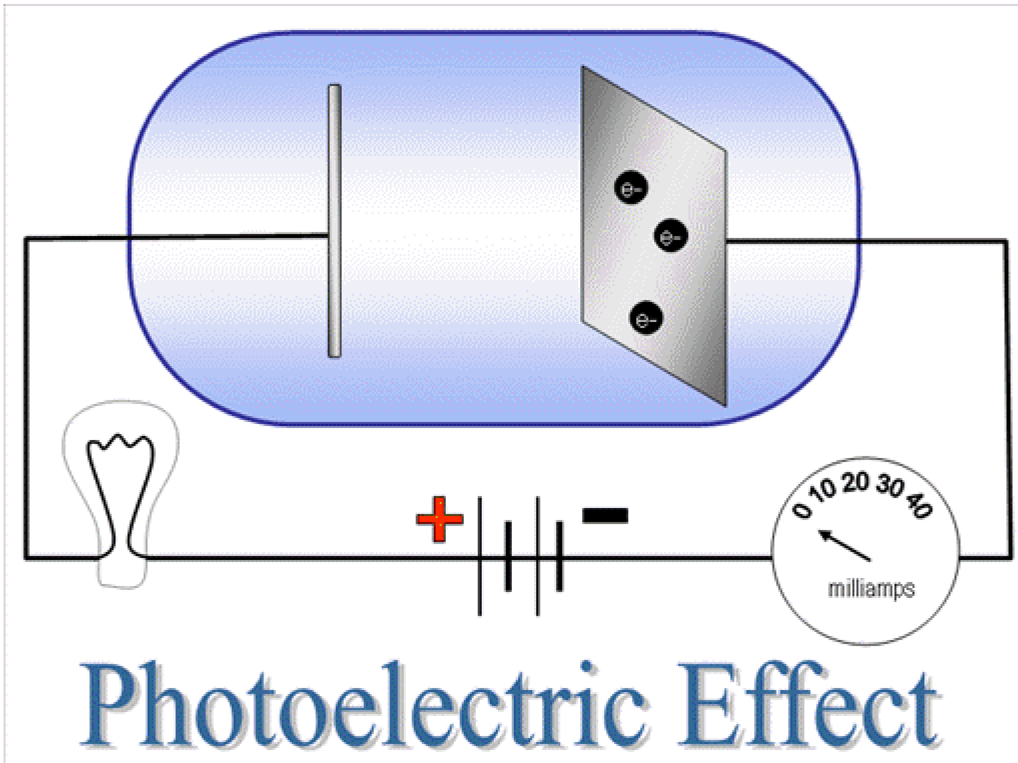
Here W/h is the minimum frequency required for the emission of electrons. This is known as the threshold frequency f.

Let us discuss the photoelectric effect

On exposing a surface to a tremendous amount of energetic electromagnetic energy, it emits electrons and absorbs light. The value of threshold frequency varies according to the type of material as:

The photoelectric effect crops up with photons whose energy varies from a few electron volts to over 1 MeV. Compton scattering may also happen at high proton energies comparable to electron rest energy of 511 keV.

When a light source or some electromagnetic radiation is incident upon a metallic surface, the surface can emit electrons. The electrons released in this manner are termed as photoelectrons. This is depicted in the figure given below:



Einstein and the Photoelectric Effect

It was Einstein who first suggested that light consists of quanta which are generally known as photons. He proposed that the energy in each quantum of light was equal to the frequency multiplied by a constant (Planck's constant). He also suggested that a photon with frequency above a certain threshold would have adequate essential for emission of single electron thus resulting in the photoelectric effect.

Einstein's analysis of this effect has introduced various equations which hold true for both visible as well as ultraviolet light. We discuss some of these equations:

Energy of photon = energy needed to remove an electron + kinetic energy of the emitted electron

$$h\nu = W + E$$

Here,

h is Planck's constant.

ν is the frequency of the incident photon.

W is the work function, which is the minimum energy required to remove an electron from the surface of a given metal: hv_0.

E is the maximum kinetic energy of ejected electrons: $1/2\ mv^2$

ν_0 is the threshold frequency for the photoelectric effect.

m is the rest mass of the ejected electron.

v is the speed of the ejected electron.