Millikan's Experiment:

VERIFICATION OF EINSTEIN'S PHOTOELECTRIC EQUATION

[Determination of value of plank's constant]

Einstein's Theoretical Part:

According to Einstein, any electromagnetic radiation has a packet of energy called as photon. When a photon is incident on a surface, it interacts with an election on the surface, the photon gives up all its energy to the electron, and the electron is emitted out from the surface (obeying principle of conservation of energy).

The Einstein's photoelectric equation is:

$$E = \phi + KE_{max}$$

Or $$hf = hf_o + eV_s \qquad [\because \text{at stopping potential}, KE_{max} = eV_s]$$

Or $$\boxed{V_s = \frac{h}{e}f - \frac{h}{e}f_o \ \ldots\ldots (1)} \qquad [\text{Here}, \frac{h}{e}f_o = \frac{\phi}{e}]$$

This equation suggests that the stopping potential (V_s) along y-axis and frequency of radiation (f) along x-axis gives a straight line (in the form of $y = mx + C$)

Where, **slope**, $m = \frac{h}{e}$, **and**

$$y - intercept, C = -\frac{h}{e}f_o = -\frac{\phi}{e}$$

Millikan's Experimental Part:

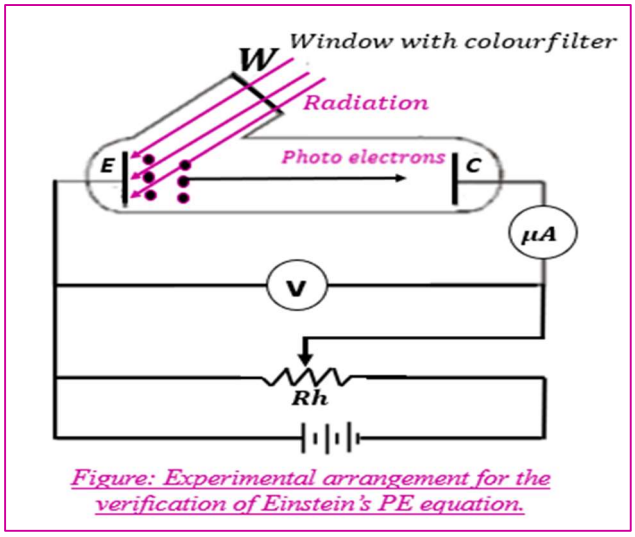
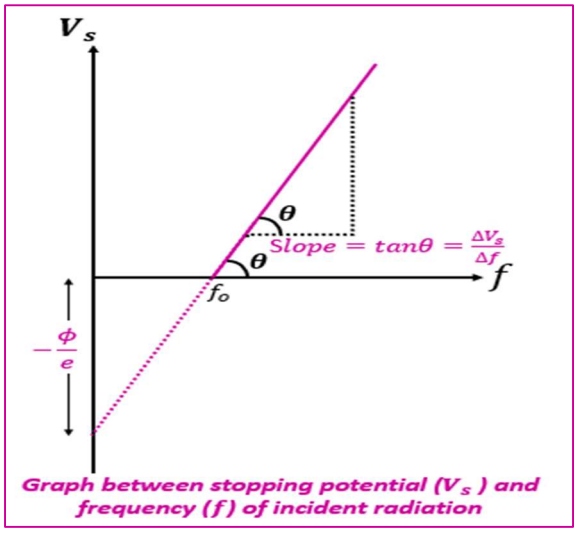


Figure: Experimental arrangement for the verification of Einstein's PE equation.



Graph between stopping potential (V_s) and frequency (f) of incident radiation

The simple Millikan's experimental arrangement for the verification of Einstein's Photoelectric equation is as shown in figure.

The plate E is photosensitive in nature (*Alkali metals: Na. Li, K, etc.*). The quartz bulb has a window with color filter to adjust the frequency of the incident radiation.

Radiation (photon) of different frequencies (different colors) are incident on the emitter plate E (say Sodium Plate) and the corresponding stopping potentials are recorded. And, a graph: stopping potential (V_s) along y-axis and frequency of radiation (f) along x-axis is obtained as shown [as suggested (predicted) by Einstein's equation (1)].