Determination of Planck's constant and work function. According to Einstein's photoelectron equation, the maximum K.E. of a photoelectron is given by

$$K_{max} = h\nu - W_0$$

If V_0 is the stopping potential, then

$$K_{max} = eV_0$$

$$\therefore \quad eV_0 = h\nu - W_0$$

or

$$V_0 = \left(\frac{h}{e}\right)\nu - \frac{W_0}{e} \quad ...(1)$$

We compare this equation with the straight line equation,

$$y = mx + c$$

It follows from equation (1) that V_0 versus ν graph is a straight line, as shown in Fig. 11.9.

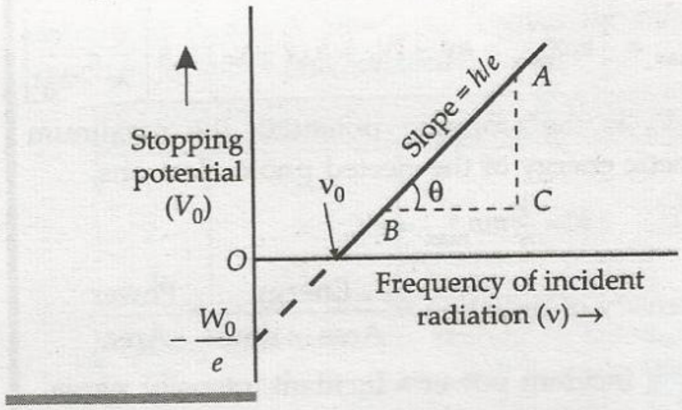

Fig. 11.9 V_0 versus ν graph for a photo-sensitive material.

Clearly, slope of V_0- ν graph $= \frac{h}{e}$

To determine the slope, take two points *A* and *B* on the straight line graph. Then

$$m = \tan\theta = \frac{AC}{BC} = \frac{h}{e}$$

$$\therefore \quad h = e \times \frac{AC}{BC} = e \times \text{slope of } V_0\text{- }\nu \text{ graph}$$

Thus, the Planck's constant *h* can be determined.

Moreover, the intercept on vertical axis $= -\frac{W_0}{e}$

$\therefore$ $W_0 = e \times$ Magnitude of the intercept on vertical axis.

In this way, the work function W_0 can be determined.

By measuring the slope of V_0- ν graph for sodium and using the known value of *e*, *R.A. Millikan* precisely determined the values of *h* and W_0 (for sodium). These values agreed well with the values known from other experiments. This led to the acceptance of Einstein's particle or photon picture of electromagnetic radiation. *R.A. Millikan* was awarded the Noble Prize in 1923 for his work on the determination of *e* and photoelectric effect.