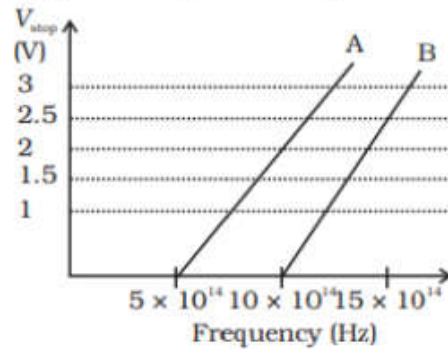


Q 02. A student performs an experiment on the photoelectric effect, using two materials A and B. A plot of V_{stop} vs ν is given in Figure.



- Which material A or B has a higher work function?
- Given the electric charge of an electron = 1.6×10^{-19} C, find the value of h obtained from the experiment for both A and B. Comment on whether it is consistent with Einstein's theory:

Sol.

a. Here threshold frequency of, $\nu_{0A} = 5 \times 10^{14}$ Hz and of B, is given by

$$\nu_{0B} = 10 \times 10^{14} \text{ Hz}$$

The work function is given by $\phi_0 = h\nu_0$ or $\phi_0 \propto \nu_0$

$$\therefore \frac{\phi_{0A}}{\phi_{0B}} = \frac{5 \times 10^{14}}{10 \times 10^{14}} < 1 \text{ or } \phi_{0A} < \phi_{0B}$$

Therefore, the work function is higher for material B than A.

b. For metal A,

$$\text{slope} = \frac{h}{e} = \frac{2}{(10-5) \times 10^{14}} \text{ or } h = \frac{2 \times e}{5 \times 10^{14}} = \frac{2 \times 1.6 \times 10^{-19}}{5 \times 10^{14}} = 6.4 \times 10^{-34} \text{ Js}$$

For metal B,

$$\text{Slope} = \frac{h}{e} = \frac{2}{(15-10) \times 10^{14}} \text{ or } h = \frac{2.5 \times e}{5 \times 10^{14}} = \frac{2.5 \times 1.6 \times 10^{-19}}{5 \times 10^{14}} = 8 \times 10^{-34} \text{ Js}$$

Since the value of h from the experiment for metals A and B is different. Hence, the experiment is not consistent with the theory.