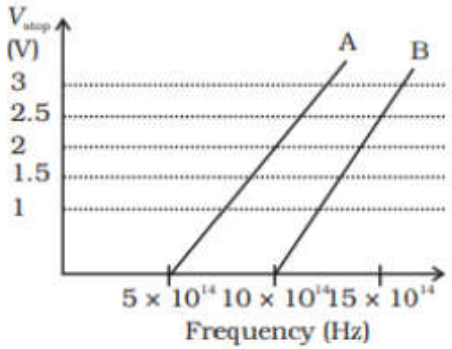
Q 02 A student performs an experiment on the photoelectric effect, using two materials A and B. A plot of V_{stop} vs ν is given in Figure.



a. Which material A or B has a higher work function?

b. 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, ν_{0A} = 5×10^{14}Hz and of B, is given by

$\nu_{OB} = 10 \times 10^{14} Hz$

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

$\therefore \frac{\phi_{0A}}{\phi_{0B}} = \frac{5\times10^{14}}{10\times10^{14}} < 1$ or $\phi_{0A} < \phi_{0B}$

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

b. For metal A,

slope $= \frac{h}{e} = \frac{2}{(10-5)\times10^{14}}$ or $h = \frac{2\times e}{5\times10^{14}} = \frac{2\times1.6\times10^{-19}}{5\times10^{14}} = 6.4 \times 10^{-34}$Js

For metal B,

Slope $= \frac{h}{e} = \frac{2}{(15-10)\times10^{14}}$ or $h = \frac{2.5\times e}{5\times10^{14}} = \frac{2.5\times1.6\times10^{19}}{5\times10^{14}} = 8 \times 10^{-34} Js$

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