

Experiment - I

Title of the experiment:

Determination of Planck's constant by photoelectric effect.

Objective:

Determination of Planck's constant.

Laboratory report:-

S/No	Filters used (Wave length)	ν (Hz)	Stopping Voltage (V)
1.	Red (635nm)	4.72×10^{14}	- 0.29
2.	Yellow-I (570nm)	5.26×10^{14}	- 0.42
3.	Yellow-II (540nm)	5.55×10^{14}	- 0.61
4.	Green (500nm)	6.00×10^{14}	- 0.76
5.	Blue (460nm)	6.52×10^{14}	- 1.02

Frequency calculation:-

Formulae :- $\nu = c/\lambda$

Red light (635nm), $\nu = \frac{3 \times 10^8}{635 \times 10^{-9}} = 4.72 \times 10^{14} \text{ Hz}$

Yellow light (I) (570nm), $\nu = \frac{3 \times 10^8}{570 \times 10^{-9}} = 5.26 \times 10^{14} \text{ Hz}$

Yellow light (II) (540nm), $\nu = \frac{3 \times 10^8}{540 \times 10^{-9}} = 5.55 \times 10^{14}$

Green light (500nm), $\nu = \frac{3 \times 10^8}{500 \times 10^{-9}} = 6.00 \times 10^{14}$

Blue light (460nm), $\nu = \frac{3 \times 10^8}{460 \times 10^{-9}} = 6.52 \times 10^{14}$

Calculations :-

Planck's constant : $h = e \frac{\Delta V_s}{\Delta \nu}$

$$h = (1.602 \times 10^{-19}) \left(\frac{(-0.29 + 1.02)}{(6.52 \times 10^{14}) - (4.72 \times 10^{14})} \right)$$

$$h = 6.62 \times 10^{-34} \text{ Js}$$

Where e is the charge of electron

The value of $\frac{\Delta V_s}{\Delta \nu}$ can be obtained from the graph and can be substituted to calculate Planck's Constant

Graphs:-

Plot a Graph of V_s versus ν . The slope of the graph will give the value of $\frac{\Delta V_s}{\Delta \nu}$. In addition find the y -intercept of the plot to give the value of work function.

Result:-

The value of Planck's Constant is $6.62 \times 10^{-34} \text{ Js}$

Scale:-

for x-axis

$$1 \text{ unit} = 1 \times 10^{-4} \text{ A}$$

for y-axis

$$1 \text{ unit} = 0.25 \text{ V}$$

