GHraisoni INTERNATIONAL SKILL TECH UNIVERSITY Pune

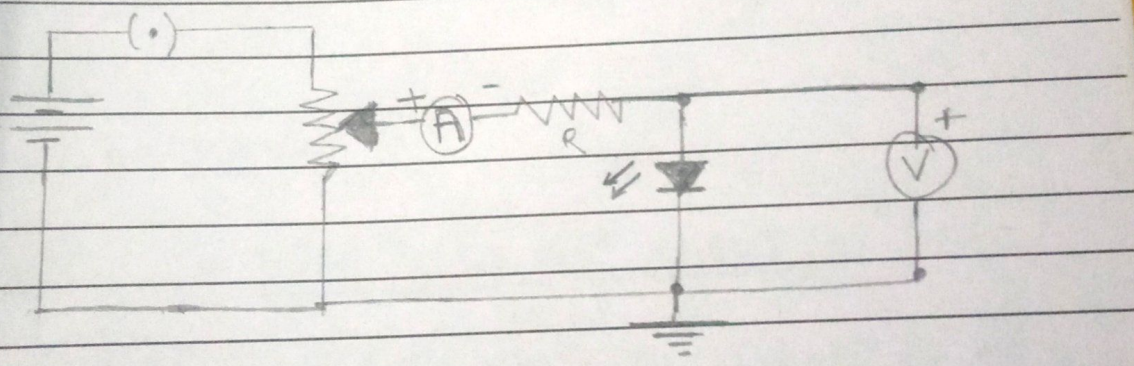
PRACTICAL - 2

Determination of Planck's Constant (Virtual)

Aim: To determine Planck's Constant using photoelectric effect.

Apparatus: 0-10V power supply, a one way key, a rheostat, a digital milimeter, a digital voltmeter, a 1k resistor and different known wavelength LEDs

Diagram:



Formula: Planck's constant 'h' is given by

$$h = \frac{e}{c} \lambda V$$

h = Planck's constant
e = charge on $e^- = 1.6 \times 10^{-19} C$
λ = Wavelength of incident light
V = Knee voltage.

Observation table:

Obs no.	Color of LED	Wavelength (nm)	(V) knee voltage
1	Red	650	1.948
2	Green	510	2.448
3	Yellow	570	2.196
4	Blue	475	2.628

Calculation

Red : $h = \frac{e\lambda V}{c}$

$= \frac{1.6 \times 10^{-19} \times 650 \times 10^{-9} \times 1.948}{3 \times 10^{8}}$

$= 6.75 \times 10^{-34}$ JS

Green -

$h = \frac{e\lambda V}{c}$

$= \frac{1.6 \times 10^{-19} \times 510 \times 10^{-9} \times 2.448}{3 \times 10^{8}}$

$= 6.65 \times 10^{-34}$ JS

Yellow -

$h = \frac{e\lambda V}{c}$

$= \frac{1.6 \times 10^{-19} \times 570 \times 10^{-9} \times 2.196}{3 \times 10^{8}}$

$= 6.68 \times 10^{-34}$ JS

Blue:

$$h = \frac{e\lambda V}{c}$$

$$= \frac{1.6\times10^{-19} \times 47\times10^{-9} \times 2.628}{3\times10^{8}}$$

$= 6.65 \times 10^{-34}$ JS

Result. The value of planck's constant is

Red = 6.75×10^{-34}

Green = 6.65×10^{-34}

Yellow = 6.68×10^{-34} JS

Blue: 6.65×10^{-34} JS

Procedure:

1. Start the virtual lab simulation ~~using~~
2. Choose a photocell or photo~~electric~~ detector and connect it to the ammeter or voltmeter in the ckt.
3. Connect the LED light source to an adjustable power supply. Use the power supply to change the current.
4. Choose LED's color. Different color means different wavelength.
5. Gradually increase the voltage supplied to the LED and monitor the voltage across the photocell. The knee voltage is the point where measurable photocurrent is detected.

Note the knee voltage for each LED wavelength when photoelectrons are ejected from the photocell.
Repeat the process ~~of~~ for different LED colors (wavelengths). Record the knee voltage for each color to gather data for multiple wavelengths
Determine the Planck's constant for each wavelength.

Theory:

The experiment aims to determine Planck's constant (h) by studying the photoelectric effect using LED's of different colors (wavelengths). When light of a certain wavelength strikes a photocell, it can eject electrons if the energy of the photons is greater than the work function of the material. The knee voltage is the minimum voltage at which photoelectrons are ejected, marking the threshold energy needed

Planck's constant using the eqn $eV = \frac{hc}{\lambda}$

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