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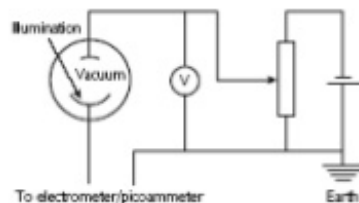
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TAP502- 3: Measuring threshold frequency

Use a white light source and a set of coloured filters to find the threshold frequency, and hence the work function, of the photosensitive material in a photocell. This may well be a standard piece of kit in your school or college. Use a spreadsheet to plot and analyse a graph of your results.

This experiment uses a photocell to investigate the photoelectric effect. Light of various frequencies is incident on the cell and photoelectrons are emitted and then form an electric current. A white light source is shone through various coloured filters to produce a series of different frequencies of light falling on the photocell. The current of photoelectrons produced in the cell maybe amplified internally and is measurable on the ammeter. Otherwise an amplifying picoammeter is needed.



The potential divider provides an adjustable voltage. The incident frequency, threshold frequency, and stopping potential are related by the following equation:

$$hf = eV + hf_0$$

Procedure

For each coloured filter, adjust the potential divider until the stopping potential has been reached.

Record the stopping potential and the wavelength of light transmitted by the filter. Select the middle of the range as the transmitted frequency.

NB: the filter might have written on it the range of wavelengths it transmits measured in

Ångstroms, Å , $1 \text{ Å} = 10^{-10} \text{ m}$.

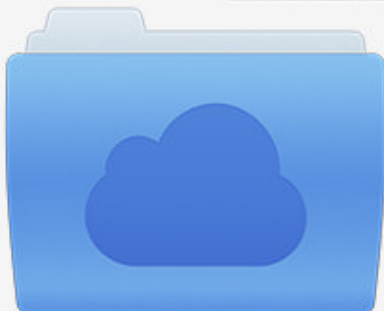
Enter your results of frequency and stopping potential on a spreadsheet and plot a graph of frequency f versus stopping potential V .

Use your graph to determine the value of the threshold frequency f and hence calculate the work function ϕ . Express your result in J and in eV.

Estimate the uncertainties in your measurements of V and in the values of f that you have used. Use these estimates to add error bars to your graph and hence estimate the uncertainty in your values of f_0 and ϕ .


Decide how you could use your graph to determine the value of Planck's constant if you knew only the value of e and not h .

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