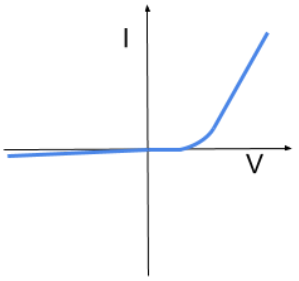
# OCR A Physics A-Level

## PAG 6.1

## Determining the Planck Constant using LEDs

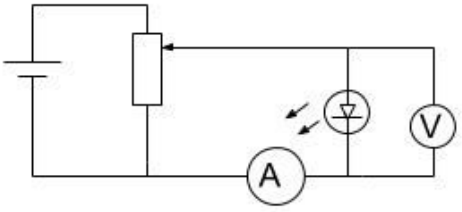
**Equipment**

- Light emitting diodes of varying colours
- Ammeter
- Voltmeter
- Leads
- Cell
- Resistor




LEDs are a type of diode hence their I-V characteristic is such that they have a threshold voltage which is a certain point where current begins to flow.

**Method**




1. Set up the circuit as shown in the diagram.
2. Find the wavelength of light the LED is emitting, this will either be on the packaging or you can find it online depending on the colour of the LED.
3. Find the threshold voltage of the LED by recording the potential difference across it at which it lights up/current is shown to be flowing by the ammeter.
4. Find the threshold voltage for a range of LEDs of different wavelengths and record these in a table of wavelength against threshold voltage.

**Calculations**

- Plot a graph of threshold voltage (V) against 1/wavelength (1/λ) and calculate the gradient.

  The energy of the photons emitted by the LED have energy (E) equal to:
  $E = hf = hc/\lambda$ they also have energy $E = eV$ where e is the charge on an electron and V is the potential difference applied, we can equate these to get:

  $$\frac{hc}{\lambda} = eV$$

  Multiply both sides by λ and divide both sides by e to find:

  $$\frac{hc}{e} = V\lambda$$

  Vλ is the gradient (m) of the graph so planck's constant (h) can be found by calculating the product of gradient and e/c (where e is the charge on an electron and c is the speed of light in a vacuum).

**Notes**

- Use a wide range of wavelength LEDs and take repeats to draw the most accurate line of best fit.
- Make sure the wavelength is in metres and the voltage is in volts.