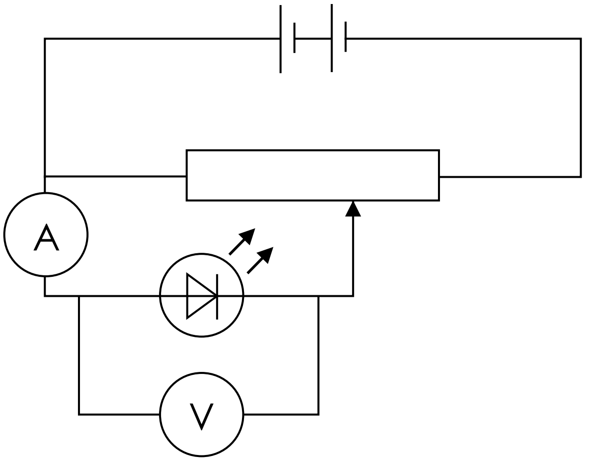
14th May



1. A circuit is constructed where a variable potential difference is applied across a light emitting diode (LED). When the PD equals the activation voltage, V_A , the LED lights up. As each electron moves through the diode, a photon is emitted, and the work done on each electron by the PD determines the photon energy $E = hf = hc/\lambda$.

   a. Calculate how much **energy**, in eV and J, an electron would gain passing through a PD of V_A = 2.30 V

      i. eV

      ii. J

Different colour LEDs of known wavelength are used in the circuit and the activation PD measured.

Colour	λ / nm	V_A / V	Planck constant / x 10^{-34} J s
Violet	415	3.00	
Blue	465	2.60	
Green	550	2.26	
Yellow	600	2.33	
Red	650	1.92	

   b. Using the equation $eV_A = hc/\lambda$, calculate a value for **Planck constant**, h, for each colour

   c. Ignoring the anomaly, calculate a **mean** value for h, including its **uncertainty**

   d. Using the accepted value for ‘h’, calculate the expected **activation PD** you would expect for the yellow LED

16th May

1 2 3

1. A student with mass 60 kg runs up a ramp 10 m long at 30° to the horizontal in 6.0 s. They then do 4 pull-ups, raising their body 0.50 m each time, in a total time of 10 seconds.

   Calculate the **ratio** of their leg power to arm power.

2. The EMF of a battery is 6.0 V. When the battery provides a current of 1.4 A, its terminal PD drops to 4.1 V. Calculate the **internal resistance** of the battery.

3. A uniform beam of length 4.0 m and mass 48 kg hangs on two wires A and B. Wire A is 1.0 m from the centre and wire B is 1.5 m from the centre.

   Calculate the **tension** in each wire.