WJEC (Wales) Physics A-level

SP2.7 - Determination of h using LEDs

Practical Flashcards

Describe the I-V characteristic for an LED.

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An LED is a light-emitting diode and so current can only pass through it in one direction. It also requires a minimum voltage (threshold voltage) before current can flow.

What is a threshold voltage?

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A threshold voltage is the minimum potential difference across a diode that is required before any current is allowed to flow.

How can the threshold voltage be obtained experimentally?

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Slowly increase the potential difference across the LED until it just begins to emit light. If it emits light then current must be flowing through it. Therefore, the potential difference at which this occurs is the threshold voltage.

How can you determine the point at which the LED begins to glow more precisely?

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The LED can be viewed through a matt black paper tube to help prevent external light interfering with you view.

How could you vary the potential difference across the LED without altering the power supply?

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The LED can be placed in a potential divider circuit with a rheostat. As the resistance of the rheostat decreases, the potential difference across the LED will increase.

What device can be used to measure the potential difference across the LED?

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A voltmeter, connected in parallel to the LED, will measure the potential difference across it.

How can the energy of a photon be obtained from its frequency?

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Energy = Planck's Constant x Frequency

$$E = hf$$

How can the energy of a photon be obtained from its wavelength?

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Energy = (Planck's Constant x Speed of Light) / Wavelength

$$E = hc/\lambda$$

What is the minimum energy of an electron moving through a potential difference?

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Energy = Charge of Electron x Potential Difference

$$E = eV$$

What equation can be formed by equating the electron energy and photon energy?

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$$eV = hc/\lambda$$

Is the wavelength of a green photon larger or smaller than the wavelength of a red photon?

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Red photons have a larger wavelength than green photons. This means the red photons have a smaller energy.

How can the Planck constant be determined from a graph of threshold voltage against 1/λ?

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The gradient of the graph will be Vλ.

Vλ = hc/e (rearranged energy balance)

Therefore Planck's constant should be given by e/c multiplied by the gradient.

How can the percentage difference in your experimental value and accepted value be calculated?

How can the percentage difference in your experimental value and accepted value be calculated?

[(Your Value - Accepted Value)/Accepted Value] x 100%

What is the accepted value for Planck's constant?

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6.63×10^{-34} m² kg s^{-1}

What safety precautions should be taken when carrying out this experiment?

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Ensure that the current passing through the LEDs does not exceed the LEDs' current ratings. Avoid touching any bare metal contacts and handle all components with care, since they may become hot.