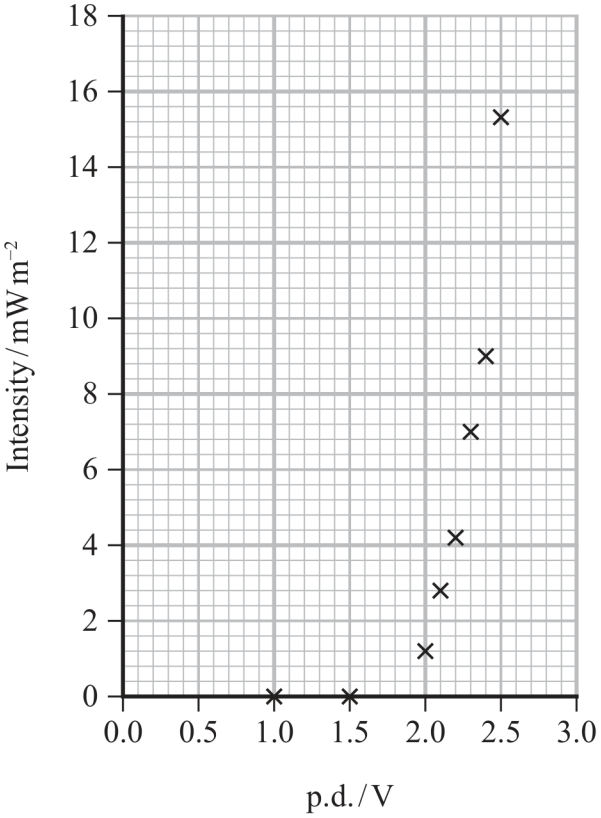
2 A student investigated how the intensity of light emitted by a light emitting diode (LED) varied with the potential difference (p.d.) applied across the LED. She measured the intensity of the light using a lightmeter which was shielded from external light sources.

She plotted her results on a graph as shown.



(a) Add a line of best fit to the graph.

(1)

(b) (i) Give the value of the p.d. at which the LED starts to conduct.

(1)

.....

(ii) Calculate the minimum energy that must be transferred to an electron in the LED for light to be emitted.

(2)

.....

.....

.....

Minimum electron energy = ... J

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(c) Light is emitted when the electron releases energy as a photon.

The student tested a second LED which emitted light of wavelength 625 nm.

From her results she determined the minimum electron energy to be 3.1×10^{-19} J.

Calculate the value of the Planck constant from this data.

(3)

The Planck constant = ...

(d) The LED does not produce monochromatic light.

Explain how this would affect the value of the Planck constant calculated.

(3)

(e) The accuracy of the value of the Planck constant calculated depends on the minimum p.d. determined from the graph.

Explain how the student could reduce the uncertainty in her value of the minimum p.d.

(2)

(Total for Question 2 = 12 marks)