A Level · OCR · Physics

🕐 11 mins   ❓ 1 question

Structured Questions

Photons & Wave-Particle Duality

The Photon / The Electronvolt / Determining the Planck Constant / Electron Diffraction / The de Broglie Equation

Total Marks   **/11**

1 (a) The Planck constant h is an important fundamental constant in quantum physics.

Determine the S.I. base units for h.

base units = ...

....

....

(2 marks)

**(b)** A researcher is investigating the de Broglie wavelength of charged particles.

The charged particles are accelerated through a potential difference V. The de Broglie wavelength λ of these particles is then determined by the researcher.

Each particle has mass m and charge q.

i) Show that the de Broglie wavelength λ is given by the expression $\lambda^2 = \dfrac{h^2}{2mq} \times \dfrac{1}{V}$

[2]

ii) The researcher plots data points on a λ^2 against $\dfrac{1}{V}$ grid, as shown below.
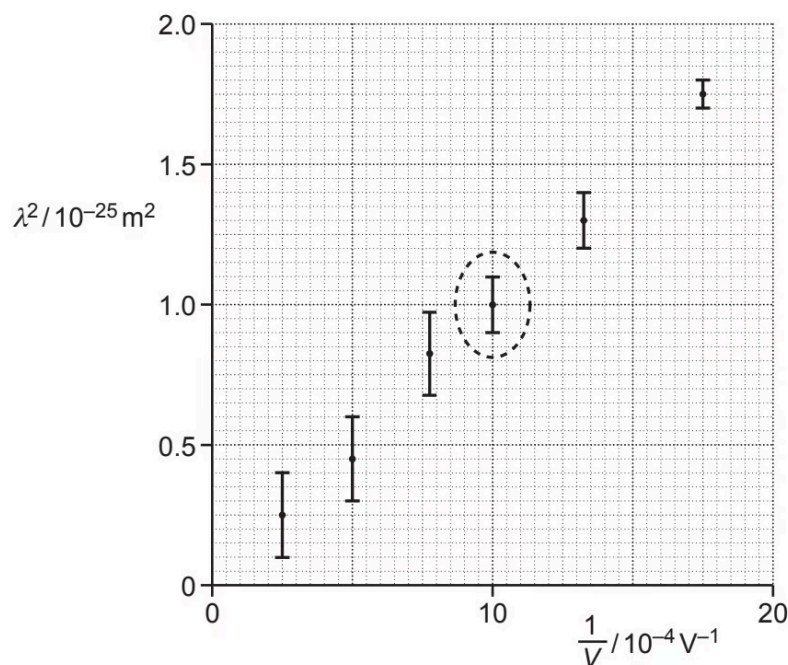
1. Calculate the percentage uncertainty in λ for the data point circled on the grid.

percentage uncertainty = ... % **[2]**

2. Draw a straight line of best fit through the data points.

[1]

3. The charge q on the particle is $2e$, where e is the elementary charge.

Use your best fit straight line to show that the mass m of the particle is about 10^{-26} kg.

[4]

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(9 marks)