

- 9 Electrons in a vacuum are accelerated from rest through a potential difference (p.d.) V to form a beam. The electrons each have mass m and charge q .

The beam is incident on a graphite crystal that acts as a diffraction grating. After passing through the crystal, the beam reaches a fluorescent screen. An interference pattern is observed on this screen.

- (a) Explain what this observation shows about the nature of electrons.

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..... [1]

- (b) Determine an expression, in terms of m , q and V , for the momentum p of an electron in the beam.

$p =$ [3]

- (c) The p.d. through which the electrons are accelerated is now increased to a greater value.

Describe and explain the effect of this change on the interference pattern observed.

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..... [2]



- (d) The electrons are now accelerated through different values of V , resulting in pairs of corresponding values for p and the de Broglie wavelength λ .

- (i) On Fig. 9.1, sketch the variation of p with $\frac{1}{\lambda}$.

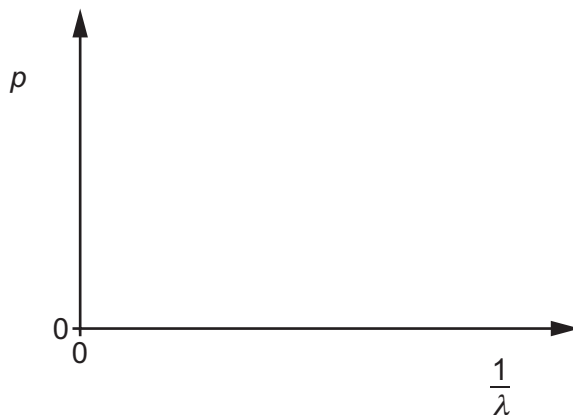


Fig. 9.1

- (ii) State the name of the quantity represented by the gradient of the line in Fig. 9.1.

..... [1]