

- 7 Electrons are often used in diffraction experiments to study the regularly repeating atomic structure in crystals. In such experiments, an electron gun is used to direct a beam of electrons towards a thin slice of crystal. The scattered electrons form scintillations when they impinge on a phosphor-coated screen.

(a) In one experiment, electrons are accelerated from rest through a potential difference of 45 V.

(i) Show that the electrons reach a speed of  $4.0 \times 10^6 \text{ m s}^{-1}$ .

[1]

(ii) Determine the wavelength associated with the moving electron.

wavelength = ..... m [2]

- (b) Fig. 7.1 below shows a hypothetical one-dimensional crystal consisting of a single row of atoms with regular spacing of  $d = 2.0 \times 10^{-10}$  m.

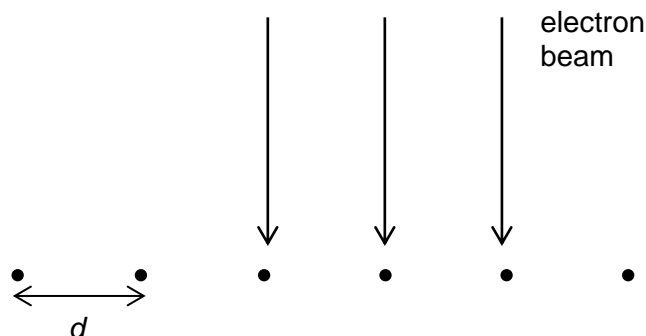


Fig. 7.1

- (i) Explain why the electrons scattered by the crystal form a line of bright spots on the screen.

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..... [3]

- (ii) Explain how the spacing between the bright spots will vary as the accelerating potential of the electron gun increases.

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..... [2]

[Total: 8]