7 **(a)** A beam of electrons is accelerated through a potential difference of 130 V and is then incident on a thin silicon crystal.

(i) State what is meant by *de Broglie wavelength*.

.....

.....[1]

(ii) Show that the de Broglie wavelength of the electrons is 1.08×10^{-10} m.

[3]

(b) A fluorescent screen is positioned 12 cm away from the silicon crystal as shown in Fig. 7.1. The separation of silicon atoms in a silicon crystal is 0.235 nm.

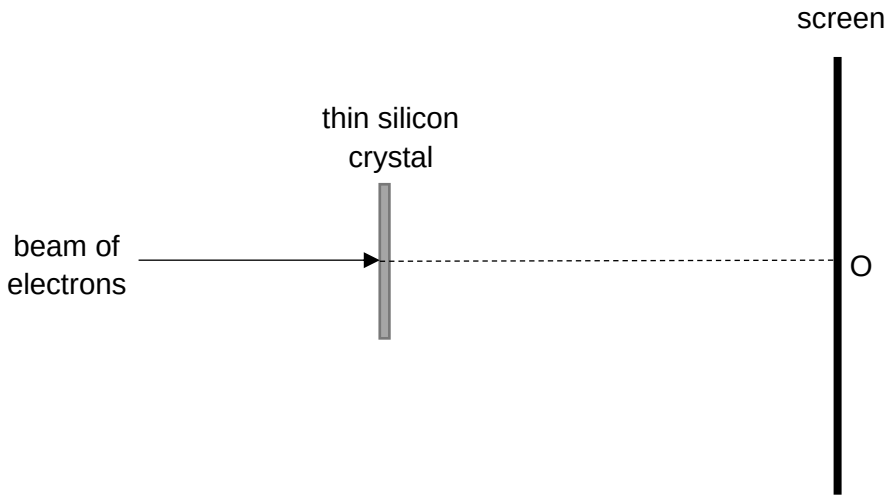

Fig. 7.1

(i) Explain why electron diffraction will be observed on the fluorescent screen.

.....

.....[1]

(ii) Electrons are observed in the straight-through direction at position O as shown in Fig. 7.1 and Fig. 7.2. Assume that the silicon crystal acts as a diffraction grating.

Draw to scale, on Fig. 7.2, the resulting diffraction pattern for the 1st order maxima. Show your working.

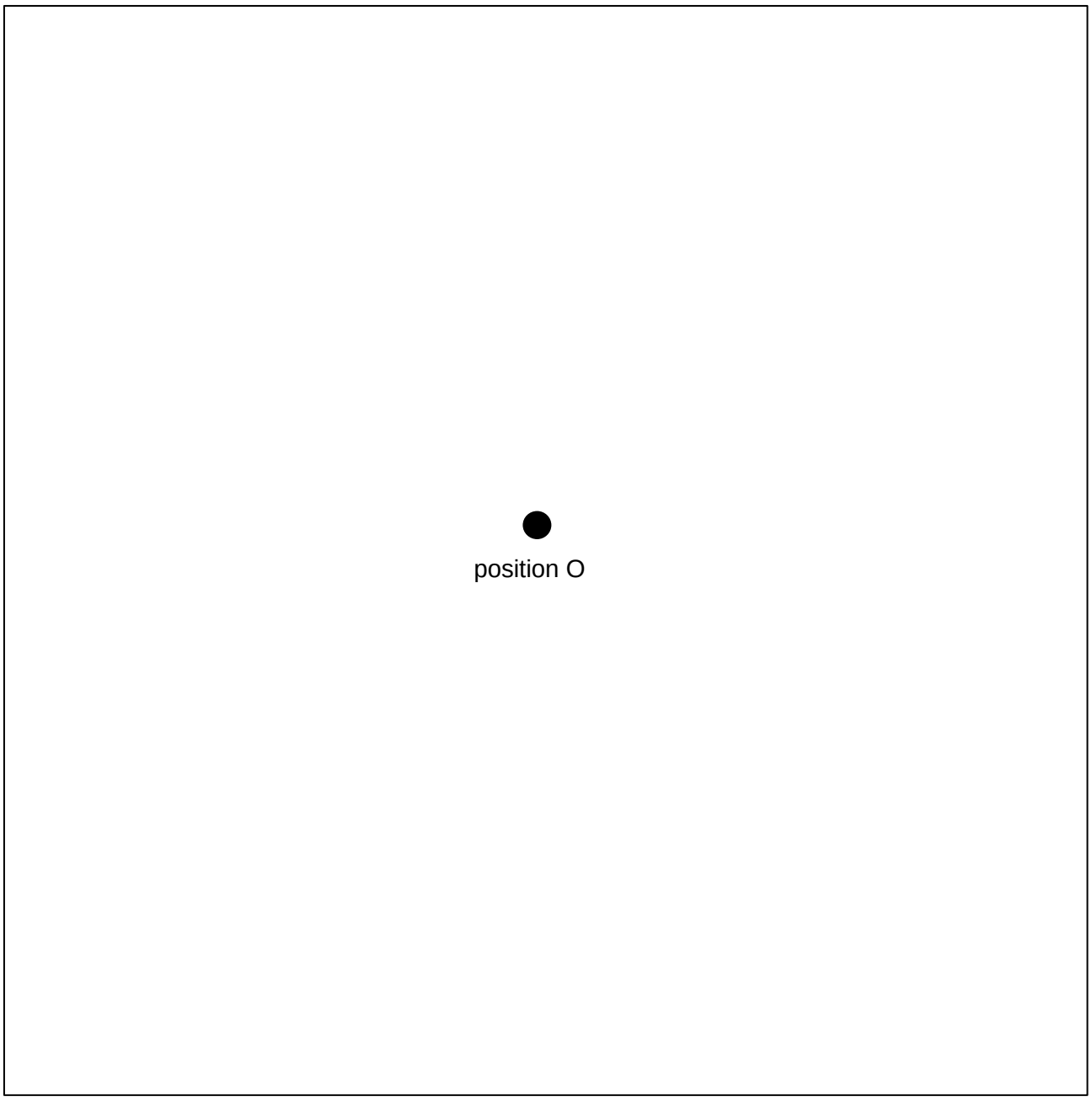

Fig. 7.2

[3]

[Total: 8]