9 **(a)** An electron is travelling at speed v in a straight line in a vacuum. It enters a uniform magnetic field of flux density 8.0×10^{-4} T. Initially, the electron is travelling at right angles to the magnetic field, as illustrated in Fig. 9.1.

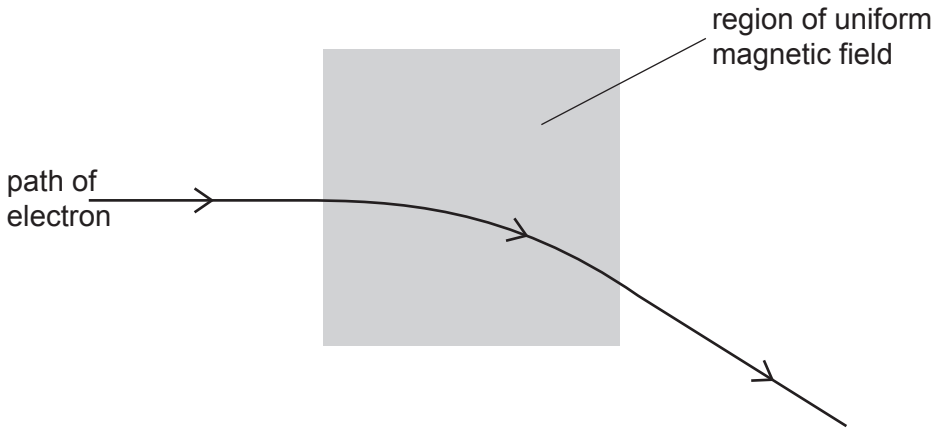

Fig. 9.1

The path of the electron in the magnetic field is an arc of a circle of radius 6.4 cm.

(i) State and explain the direction of the magnetic field.

.....

.....

..... [2]

(ii) Show that the speed v of the electron is $9.0 \times 10^{6}\,\text{m s}^{-1}$.

[3]

(b) A uniform electric field is now applied in the same region as the magnetic field.

The electron passes undeviated through the region of the two fields, as illustrated in Fig. 9.2.

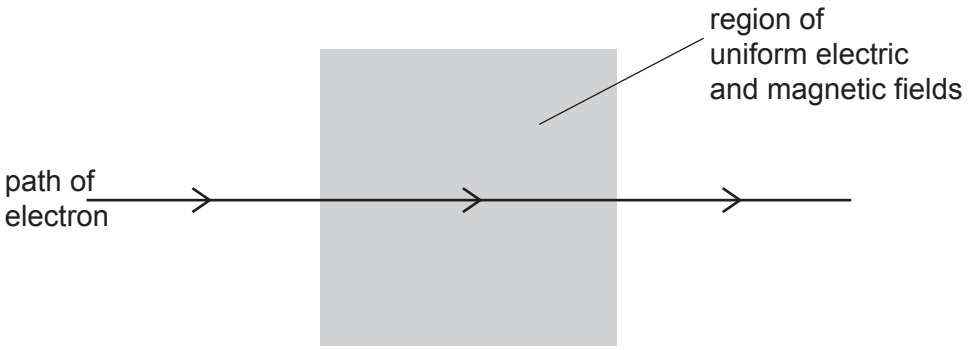

Fig. 9.2

(i) On Fig. 9.2, mark with an arrow the direction of the uniform electric field. [1]

(ii) Use data from **(a)** to calculate the magnitude of the electric field strength.

field strength = ... NC^{-1} [2]

(c) The electron in **(b)** is now replaced by an α-particle travelling at the same speed v along the same initial path as the electron.

Describe and explain the shape of the path in the region of the magnetic and electric fields.

.....

.....

..... [2]

[Total: 10]