

- 6 (a) There are two situations in which a charged particle in a magnetic field does not experience a magnetic force.

State these two situations.

1. ....

.....

2. ....

[2]

- (b) A beam of particles of charge  $+3.2 \times 10^{-19}$  C travels in a vacuum at  $4.7 \times 10^5$  m s<sup>-1</sup>. The particles enter a region of uniform magnetic field of flux density 0.12 T at an angle of  $20^\circ$  to the direction of magnetic field as shown in Fig. 6.1.

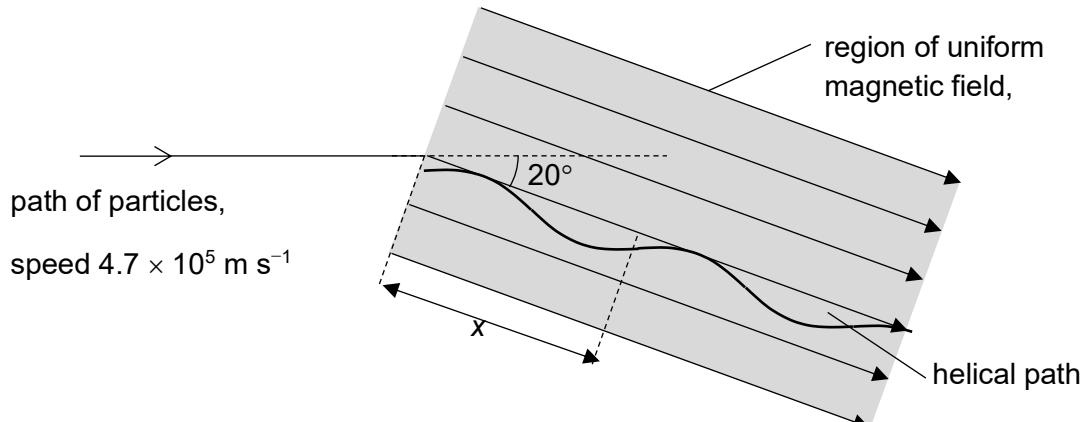


Fig. 6.1

The path of the particles in the magnetic field is a helix with a diameter of 5.6 cm.

In the time taken for the particles to complete one revolution in the helix, the particles travel a displacement  $x$  along the direction of the magnetic field.

- (i) Calculate the component of the velocity of the particles in the direction normal to the magnetic field.

component of velocity = .....  $\text{m s}^{-1}$  [1]

- (ii) Determine the mass of each particle.

mass = ..... kg [2]

- (iii) Determine the displacement  $x$ .

$x$  = ..... m [3]

- (iv) Electrons with the same speed of  $4.7 \times 10^5 \text{ m s}^{-1}$  enter the magnetic field at the same angle of  $20^\circ$ .

Without further calculation, state **two** differences between the path of the electrons and the path of the particles in the magnetic field.

1.

.....

2.

.....

[2]

