5 **(a)** State what is meant by a *magnetic field*.

.....

.....

.....[2]

(b) A charged particle of mass m and charge $+q$ is travelling with velocity v in a vacuum. It enters a region of uniform magnetic field of flux density B, as shown in Fig. 5.1.

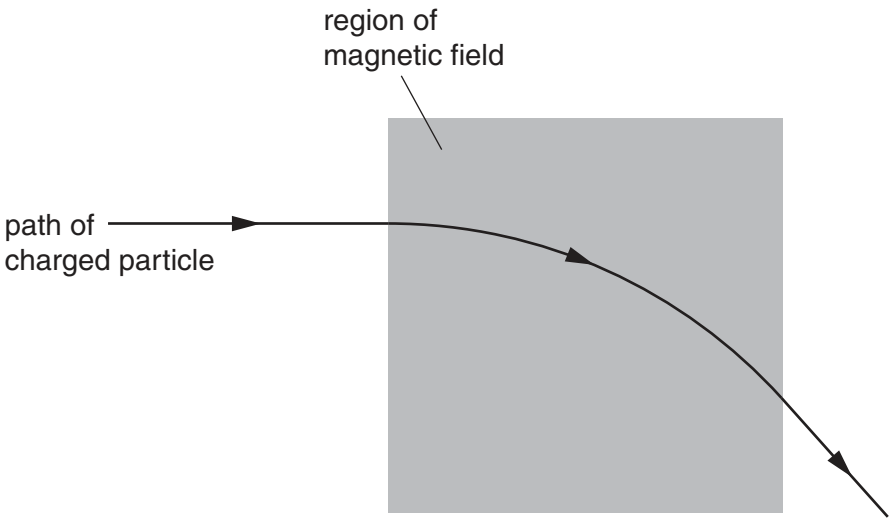

Fig. 5.1

The magnetic field is normal to the direction of motion of the particle. The path of the particle in the field is the arc of a circle of radius r.

(i) Explain why the path of the particle in the field is the arc of a circle.

.....

.....

.....

.....[2]

(ii) Show that the radius r is given by the expression

$$r = \frac{mv}{Bq}.$$

[2]

(c) A thin metal foil is placed in the magnetic field in **(b)**.
A second charged particle enters the region of the magnetic field. It loses kinetic energy as it passes through the foil. The particle follows the path shown in Fig. 5.2.

For Examiner's Use

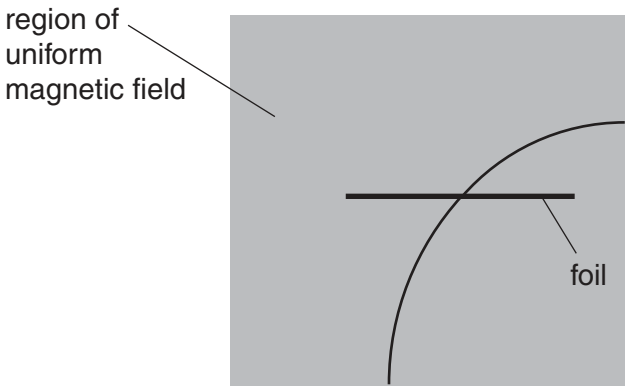

Fig. 5.2

(i) On Fig. 5.2, mark with an arrow the direction of travel of the particle. [1]

(ii) The path of the particle has different radii on each side of the foil.
The radii are 7.4 cm and 5.7 cm.
Determine the ratio

$$\frac{\text{final momentum of particle}}{\text{initial momentum of particle}}$$

for the particle as it passes through the foil.

ratio = ... [2]