6 A charged particle of mass m and charge $-q$ is travelling through a vacuum at constant speed v.
It enters a uniform magnetic field of flux density B. The initial angle between the direction of motion of the particle and the direction of the magnetic field is 90°.

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

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.....

.....

..... [3]

(b) The radius of the arc in **(a)** is r.

Show that the ratio $\frac{q}{m}$ for the particle is given by the expression

$$\frac{q}{m} = \frac{v}{Br}.$$

[1]

(c) The initial speed v of the particle is $2.0 \times 10^7\,\text{m s}^{-1}$. The magnetic flux density B is $2.5 \times 10^{-3}\,\text{T}$.
The radius r of the arc in the magnetic field is 4.5 cm.

(i) Use these data to calculate the ratio $\frac{q}{m}$.

ratio = ... C kg^{-1} [2]

(ii) The path of the negatively-charged particle before it enters the magnetic field is shown in Fig. 6.1.

For Examiner's Use

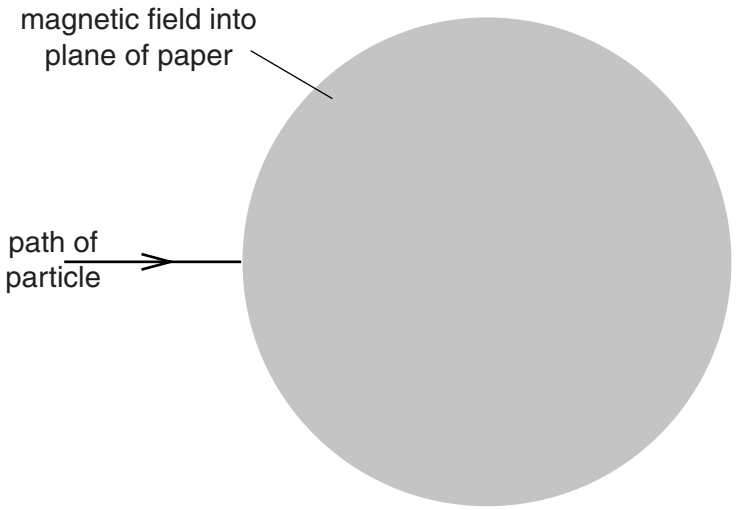

Fig. 6.1

The direction of the magnetic field is into the plane of the paper.

On Fig. 6.1, sketch the path of the particle in the magnetic field and as it emerges from the field. [2]