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

.....

.....

.....[2]

(b) A particle of charge $+q$ and mass m is travelling in a vacuum with speed v. The particle enters, at a right angle, a uniform magnetic field of flux density B, as shown in Fig. 8.1.

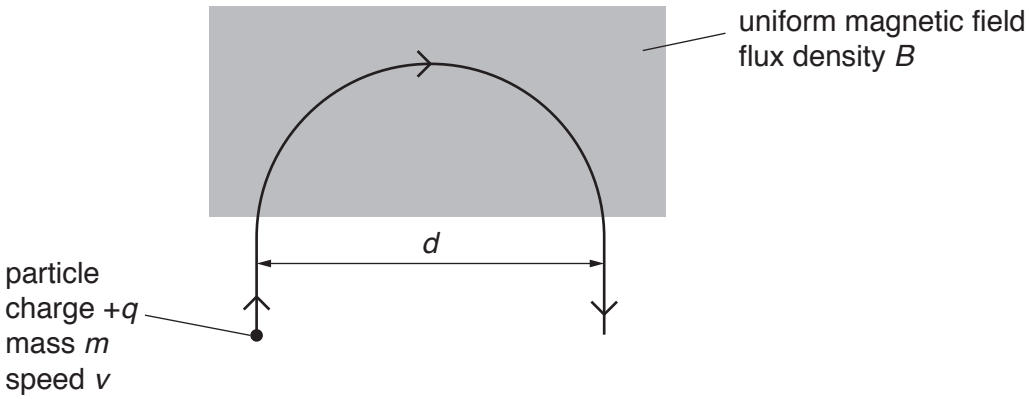

Fig. 8.1

The particle leaves the field after following a semi-circular path of diameter d.

(i) State the direction of the magnetic field.

.....[1]

(ii) Explain why the speed of the particle is not affected by the magnetic field.

.....

.....

.....[2]

(iii) Show that the diameter d of the semi-circular path is given by the expression

$$d = \frac{2mv}{Bq}.$$

[2]

(iv) Use the expression in **(b)(iii)** to show that the time T_F spent in the field by the particle is independent of its speed v.

[2]

[Total: 9]