6 **(a)** Define the *tesla*.

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..... [3]

(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. 6.1.

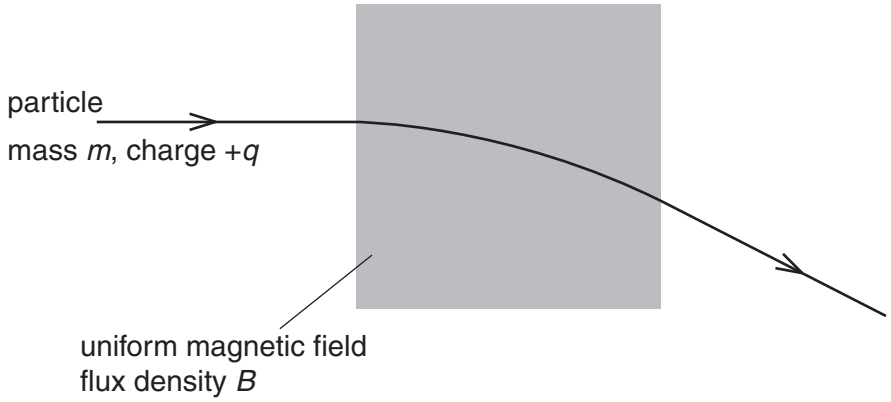

Fig. 6.1

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.

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..... [2]

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

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

[1]

(c) A uniform magnetic field is produced in the region PQRS, as shown in Fig. 6.2.

For Examiner's Use

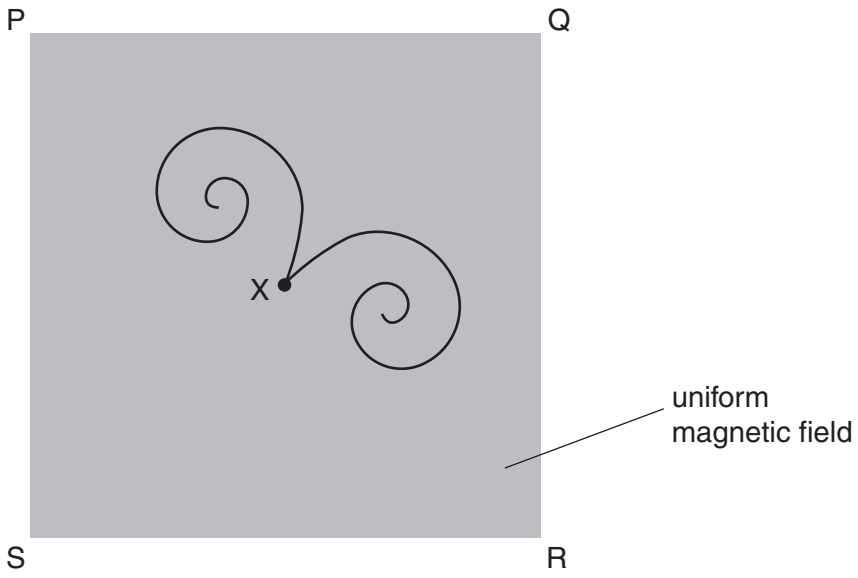

Fig. 6.2

The magnetic field is normal to the page.
At point X, a gamma-ray photon interaction causes two particles to be formed. The paths of these particles are shown in Fig. 6.2.

(i) Suggest, with a reason, why each of the paths is a spiral, rather than the arc of a circle.

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..... [2]

(ii) State and explain what can be deduced from the paths about

1. the charges on the two particles,

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..... [2]

2. the initial speeds of the two particles.

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..... [2]