6 **(a)** A particle has mass m, charge $+q$ and speed v.

State the magnitude and direction of the force, if any, on the particle when the particle is travelling along the direction of

(i) a uniform gravitational field of field strength g,

.....

.....[2]

(ii) a uniform magnetic field of flux density B.

.....

.....[1]

(b) Two charged horizontal metal plates, situated in a vacuum, produce a uniform electric field of field strength E between the plates. The field strength outside the region between the plates is zero.

The particle in **(a)** enters the region of the electric field at right-angles to the direction of the field, as illustrated in Fig. 6.1.

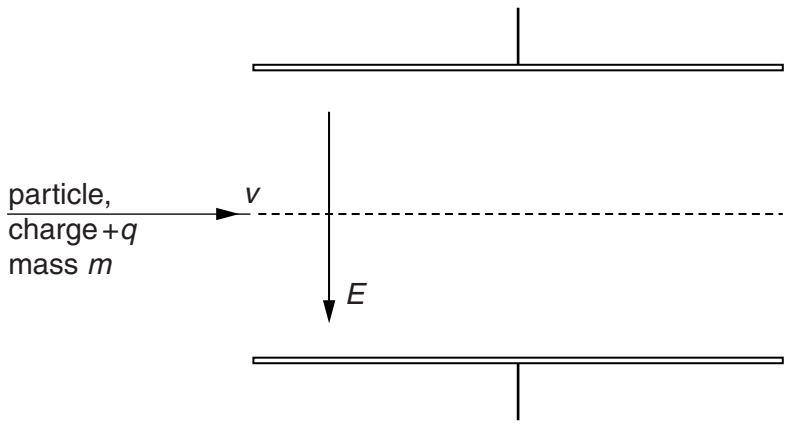

Fig. 6.1

A uniform magnetic field is to be applied in the same region as the electric field so that the particle passes undeviated through the region between the plates.

(i) State and explain the direction of the magnetic field.

.....

.....[2]

(ii) Derive, with explanation, the relation between the speed v and the magnitudes of the electric field strength E and the magnetic flux density B.

[3]

(c) A second particle has the same mass m and charge $+q$ as that in **(b)** but its speed is $2v$. This particle enters the region between the plates along the same direction as the particle in **(b)**.

On Fig. 6.1, sketch the path of this particle in the region between the plates. [2]