6 A particle has mass m and charge $+q$ and is travelling with speed v through a vacuum. The initial direction of travel is parallel to the plane of two charged horizontal metal plates, as shown in Fig. 6.1.

For Examiner's Use

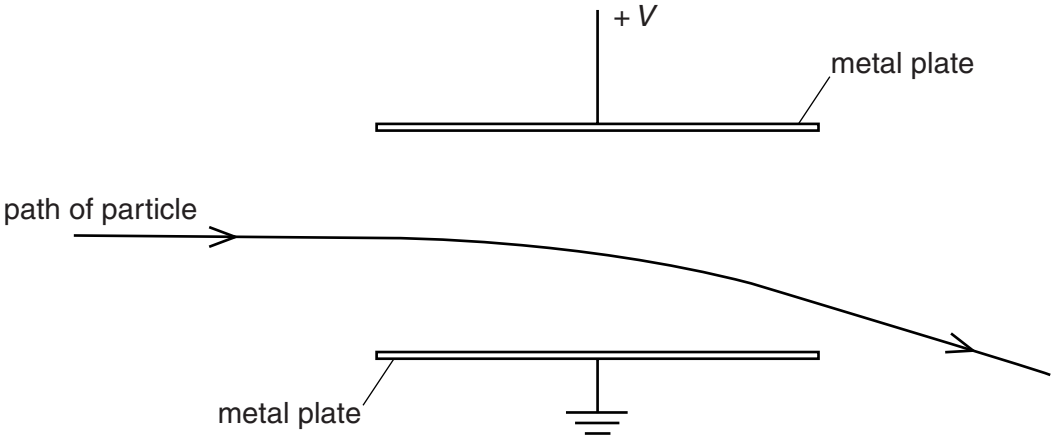

Fig. 6.1

The uniform electric field between the plates has magnitude $2.8 \times 10^4 \text{V m}^{-1}$ and is zero outside the plates.
The particle passes between the plates and emerges beyond them, as illustrated in Fig. 6.1.

(a) Explain why the path of the particle in the electric field is not an arc of a circle.

.....

.....

.....[1]

(b) A uniform magnetic field is now formed in the region between the metal plates. The magnetic field strength is adjusted so that the positively charged particle passes undeviated between the plates, as shown in Fig. 6.2.

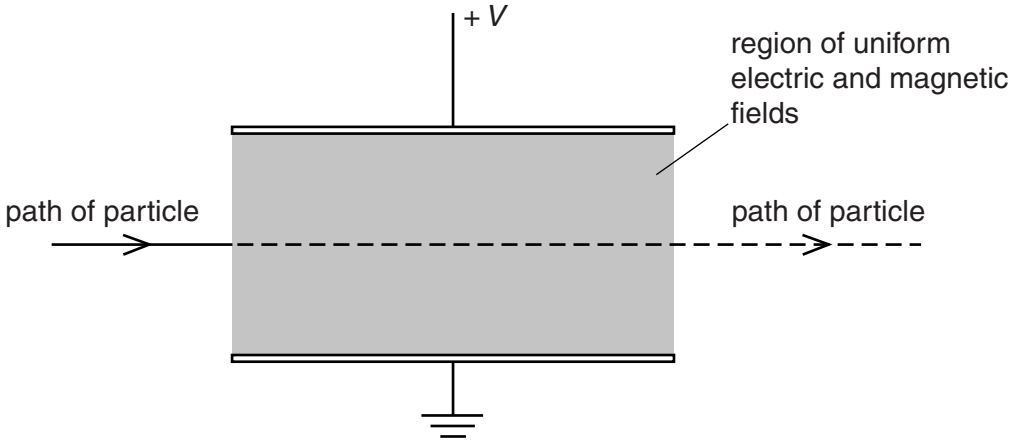

Fig. 6.2

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

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.....

.....

.....[2]

(ii) The particle has speed $4.7 \times 10^5\,\text{m}\,\text{s}^{-1}$.
Calculate the magnitude of the magnetic flux density.
Explain your working.

magnetic flux density = ... T [3]

(c) The particle in **(b)** has mass m, charge $+q$ and speed v.
Without any further calculation, state the effect, if any, on the path of a particle that has

(i) mass m, charge $-q$ and speed v,

.....[1]

(ii) mass m, charge $+q$ and speed $2v$,

.....[1]

(iii) mass $2m$, charge $+q$ and speed v.

.....[1]