4 A positively-charged particle, travelling in a vacuum, enters a region of uniform magnetic field. Initially, the path of the particle is normal to the direction of the magnetic field.

The path of the particle through, and beyond, the region of the magnetic field is shown in Fig. 4.1.

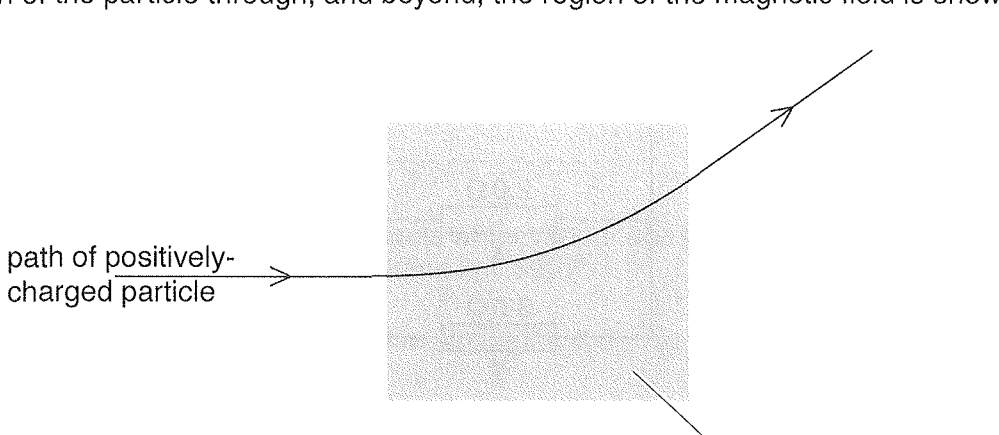

Fig. 4.1

The magnetic flux density of the magnetic field is 3.2×10^{-3} T and it is directed into the plane of the paper.

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

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.....

..... [3]

(b) A uniform electric field is now applied in the region of the magnetic field so that the particle continues undeviated through the two fields.
The speed of the particle is $4.7 \times 10^{5}\,\text{m s}^{-1}$.

(i) Calculate the magnitude E of the electric field strength. Explain your working.

E = ... V m^{-1} [2]

(ii) The charged particle is a proton.

State and explain the effect, if any, on the deviation when the initial speed of the proton is increased.

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..... [2]