4 A proton of mass m and charge $+q$ is travelling through a vacuum in a straight line with speed v.
It enters a region of uniform magnetic field of magnetic flux density B, as shown in Fig. 4.1.

For Examiner's Use

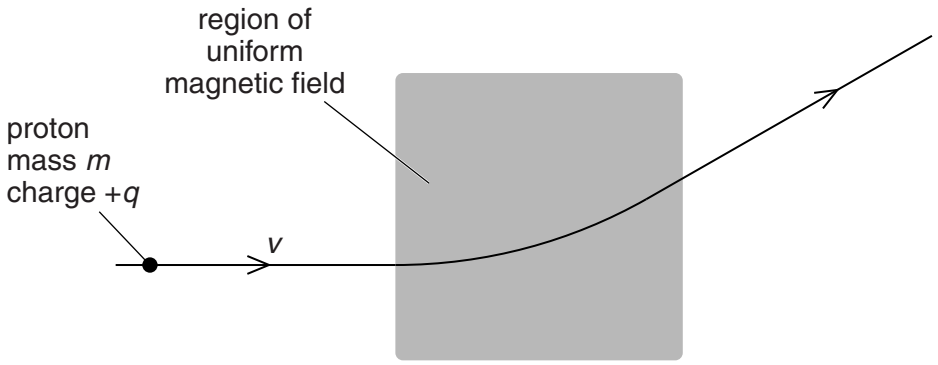

Fig. 4.1

The magnetic field is normal to the direction of motion of the proton.

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

.....

.....

.....[2]

(b) The angular speed of the proton in the magnetic field is ω.
Derive an expression for ω in terms of B, q and m.

[4]