

- 5 Positive ions are travelling through a vacuum in a narrow beam. The ions enter a region of uniform magnetic field of flux density B and are deflected in a semi-circular arc, as shown in Fig. 5.1.

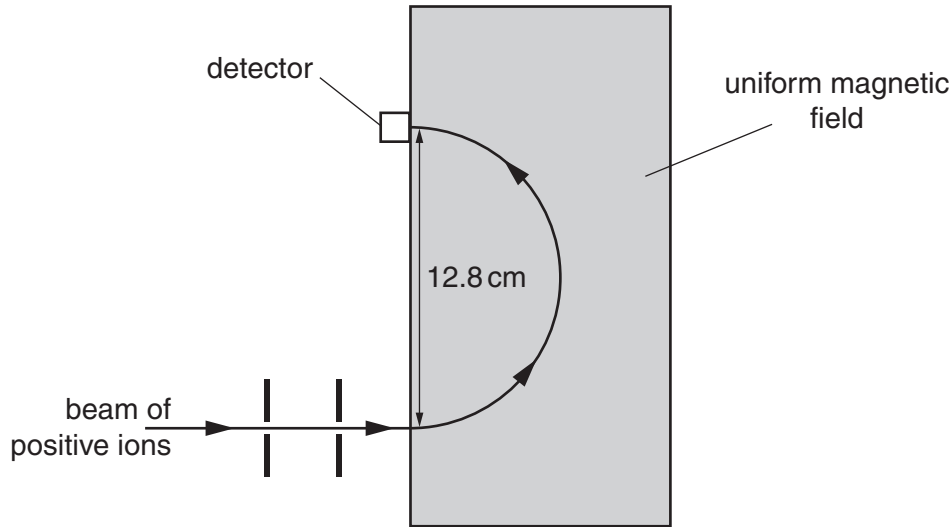


Fig. 5.1

The ions, travelling with speed $1.40 \times 10^5 \text{ ms}^{-1}$, are detected at a fixed detector when the diameter of the arc in the magnetic field is 12.8 cm.

- (a) By reference to Fig. 5.1, state the direction of the magnetic field.

.....[1]

- (b) The ions have mass 20 u and charge $+1.6 \times 10^{-19} \text{ C}$. Show that the magnetic flux density is 0.454 T . Explain your working.

[3]

(c) Ions of mass 22 u with the same charge and speed as those in (b) are also present in the beam.

(i) On Fig. 5.1, sketch the path of these ions in the magnetic field of magnetic flux density 0.454 T . [1]

(ii) In order to detect these ions at the fixed detector, the magnetic flux density is changed.
Calculate this new magnetic flux density.

magnetic flux density = T [2]