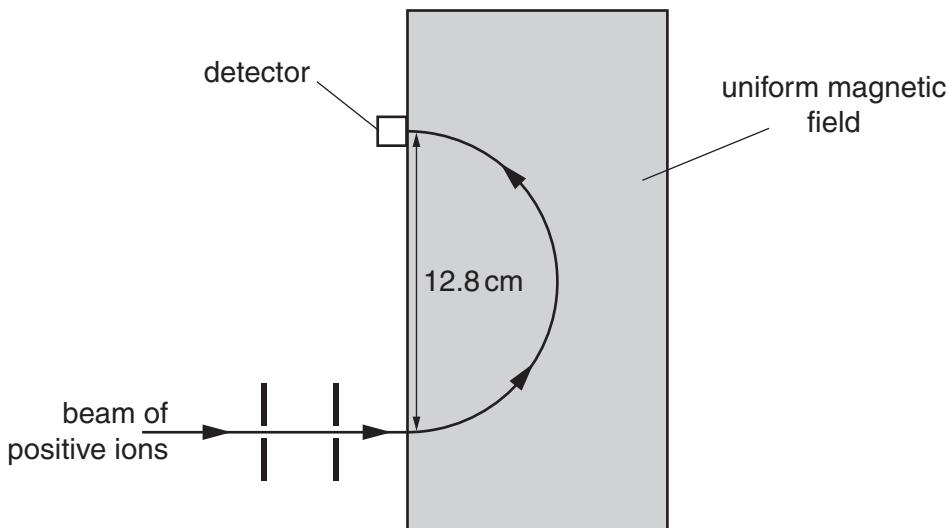


- 5 Positive ions are travelling through a vacuum in a narrow beam. The ions enter a region of uniform magnetic field of flux density  $B$  and are deflected in a semi-circular arc, as shown in Fig. 5.1.



**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  $20 \text{ u}$  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]