6 **(a)** Negative ions are travelling through a vacuum in a narrow beam. The ions enter a region of uniform magnetic field and are deflected in a semi-circular arc, as shown in Fig. 6.1.

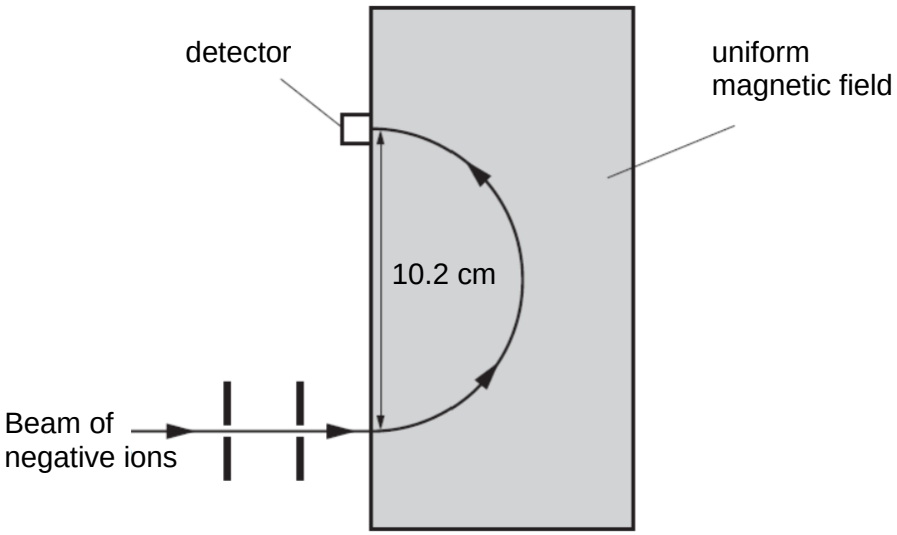

Fig. 6.1

The ions, travelling at a constant speed 5.6×10^5 m s^{-1}, are detected at a detector when the diameter of the arc in the magnetic field is 10.2 cm.

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

……..

……..

……..

……..… [2]

(ii) With reference to Fig. 6.1, state the direction of the magnetic field.

……..… [1]

(iii) The ions have mass $20u$ and charge of magnitude 1.60×10^{-19} C (where u is the unified atomic mass unit).

Determine the value of magnetic flux density. Explain your working.

magnetic flux density = ... T [3]

(b) A uniform electric field is now switched on in the same region as the magnetic field in **(a).** The magnitude of the electric field is adjusted so that the ion moves undeviated through the two fields.

(i) On Fig 6.1, draw an arrow to show the direction of the electric field. [1]

(ii) Determine the magnitude of the electric field strength.

electric field strength = ... V m^{-1} [2]

[Total: 9]