5 **(a)** Force-fields may be represented using lines that have direction.

State

(i) what is meant by a *field of force,*

…… [1]

(ii) how, using lines of force, changes in the strength of a force-field are represented.

……

…… [1]

(b) A large horseshoe magnet produces a uniform magnetic field of flux density *B* between its poles. Outside the region of the poles, the flux density is zero.

The magnet is placed on a top-pan balance and a stiff wire *XY* is situated between its poles as shown in Fig. 5.1.

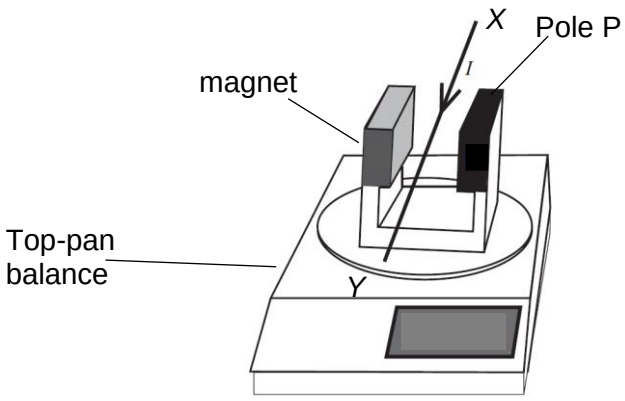

Fig. 5.1

The wire *XY* is horizontal and normal to the magnetic field.

A direct current is now passed through the wires in the direction from *X* to *Y.*
The reading on the top-pan balance increased.

State and explain the polarity of the pole P of the magnet.

……

……

……

……

……

…… [3]

(c) A charged particle of mass *m* and charge +*q* travelling with velocity *v* in a vacuum.
It enters a region of uniform magnetic field of flux density *B* as shown in Fig. 5.2.

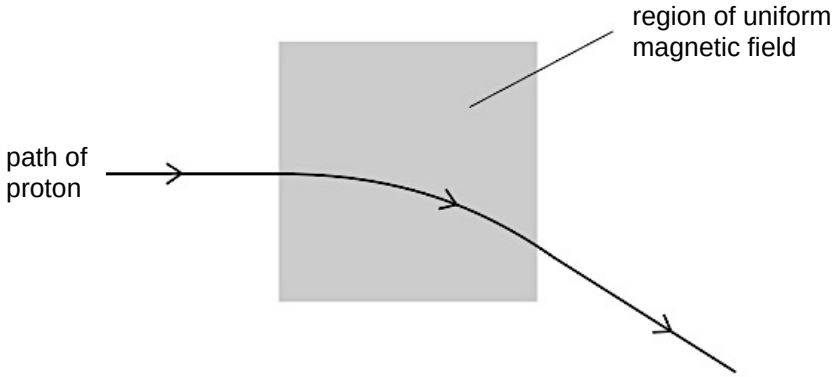

Fig. 5.2

A thin metal foil is placed in the magnetic field in **(c).**
A second charged particle enters the region of the magnetic field. It loses kinetic energy as it passes through the foil.

The particle follows the path as shown in Fig. 5.3.

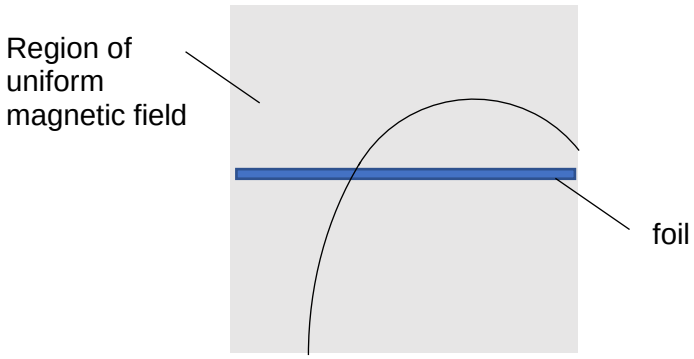

Fig. 5.3

(i) On Fig. 5.3, mark with an arrow the direction of travel of particle. [1]

(ii) The path of the particle has different radii on each side of the foil.
The radii are 7.4 cm and 5.7 cm.

Determine the ratio

$$\frac{\text{final momentum of particle}}{\text{initial momentum of particle}}$$

for the particle as it passes through the foil.

ratio = …….…….. [2]

[Total: 8]