4

Two positively charged particles, P and Q, are projected with speed v at right angles to a magnetic field of magnetic flux density B. Particle P and Q strike the wall at a distance of L and $2L$ respectively from the point of entry, as shown in Fig. 4.1.

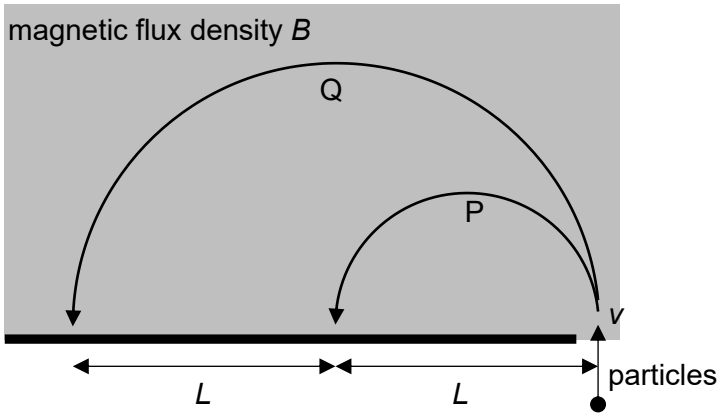

Fig. 4.1

(a)

Define *magnetic flux density*.

……

……

……

……

……

……

……

……[2]

(b)

A velocity selector can be used to ensure that the initial speeds of P and Q are the same.

Explain how an electric and magnetic field is used in a velocity selector. You may wish to include a diagram.

....

....

....

....

....

....

....

....

....

......[3]

(c)

(i)

The charge-to-mass ratio of an object is

$$\frac{\text{charge of object}}{\text{mass of object}}$$

Determine the charge-to-mass ratio of P relative to Q i.e.

$$\frac{\text{charge-to-mass ratio of P}}{\text{charge-to-mass ratio of Q}}$$

ratio = …… [2]

(ii)

Fig. 4.2 shows the mass and charge of different particles.

particle	mass / *u*	charge / *e*
protium	1	+1
tritium	3	+1
alpha particle	4	+2

Fig. 4.2

Using Fig. 4.2, identify particles P and Q.

P : ……

Q : …… [1]

(iii)

Both P and Q enter the magnetic field at the same time. P strikes the wall after time *T*.

Determine the time taken for Q to strike the wall in terms of *T*.

time = …… *T* [2]

[Total: 10]