5 A charged particle passes through a region of uniform magnetic field of flux density 0.74 T, as shown in Fig. 5.1.

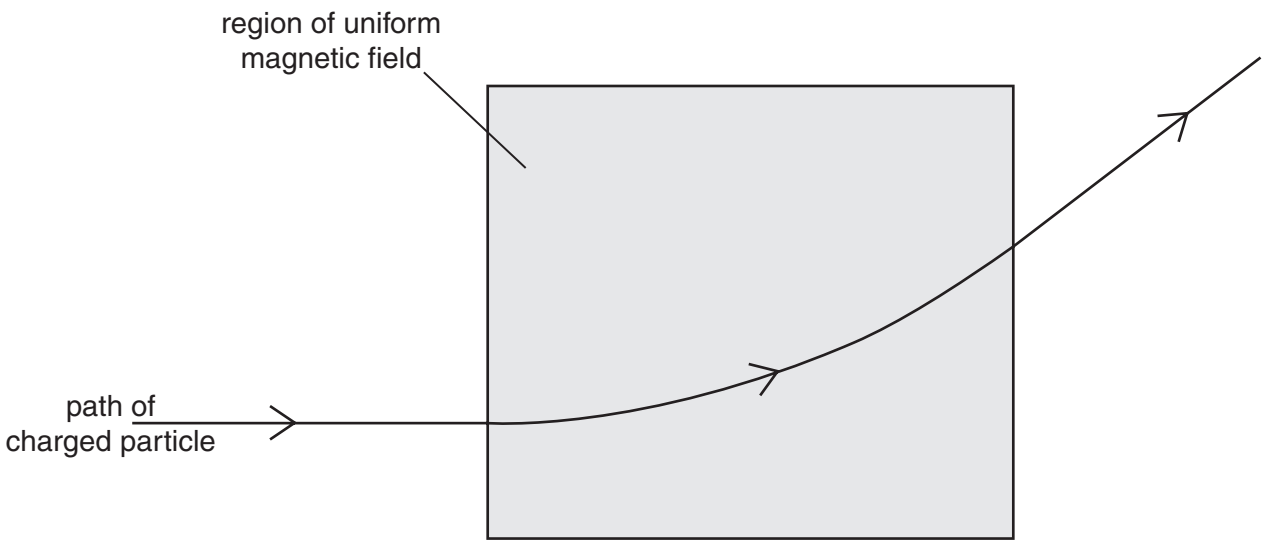

Fig. 5.1

The radius r of the path of the particle in the magnetic field is 23 cm.

(a) The particle is positively charged. State the direction of the magnetic field.

.....[1]

(b) **(i)** Show that the specific charge of the particle (the ratio $\frac{q}{m}$ of its charge to its mass) is given by the expression

$$\frac{q}{m} = \frac{v}{rB},$$

where v is the speed of the particle and B is the flux density of the field.

[2]

(ii) The speed v of the particle is $8.2 \times 10^6\,\text{m s}^{-1}$. Calculate the specific charge of the particle.

specific charge = ... C kg^{-1} [2]

(c) (i) The particle in **(b)** has charge $1.6 \times 10^{-19}\,\text{C}$. Using your answer to **(b)(ii)**, determine the mass of the particle in terms of the unified atomic mass constant u.

mass = ... u [2]

(ii) The particle is the nucleus of an atom. Suggest the composition of this nucleus.

.....

.....[1]

[Turn over