

- 9 (a) Two parallel metal plates in a vacuum are separated by a distance of 15 mm, as shown in Fig. 9.1.

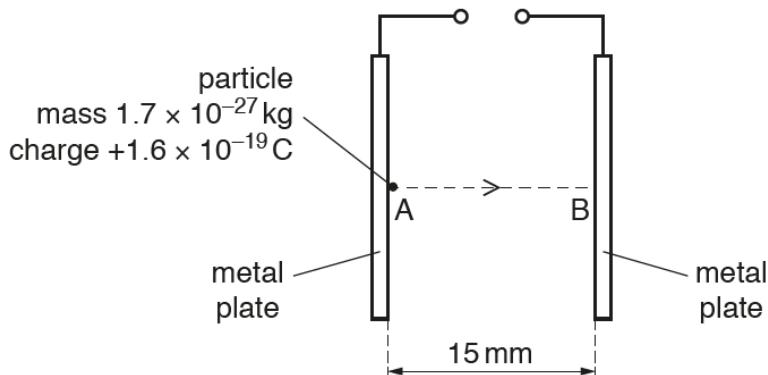


Fig 9.1

A uniform electric field is produced between the plates by applying a potential difference between them.

A particle of mass $1.7 \times 10^{-27} \text{ kg}$ and charge $+1.6 \times 10^{-19} \text{ C}$ is initially at rest at point A on one plate. The particle is moved by the electric field to point B on the other plate. The particle reaches point B with kinetic energy $2.4 \times 10^{-16} \text{ J}$.

- (i) Define electric field strength.

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[2]

- (ii) 1. State whether A or B is at higher potential.

higher potential at [1]

2. Determine the work done by the electric field to move the particle from A to B.

work done = J [1]

3. Use your answer in (a)(ii)2. to determine the force on the particle.

force = N [2]

4. Determine the potential difference between the plates.

potential difference = V [3]

- (iii) On Fig. 9.2, sketch a graph to show the variation of the kinetic energy of the particle with the distance x from point A along the line AB.

Numerical values for the kinetic energy are not required. [1]

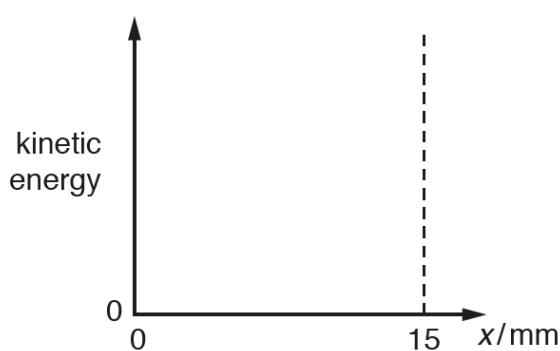
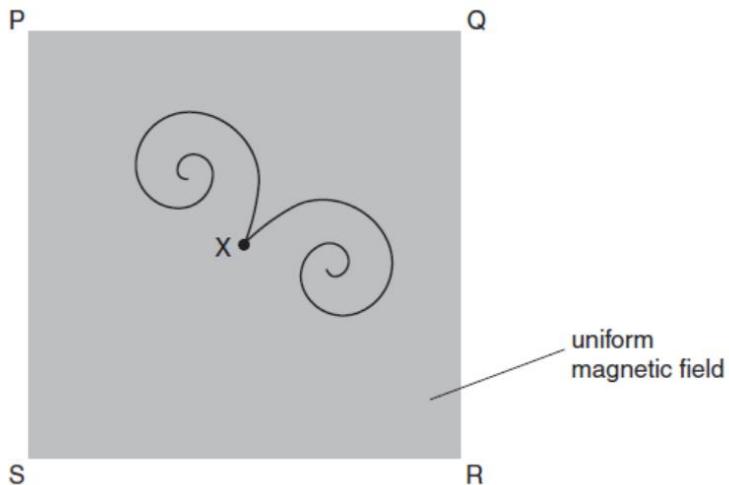


Fig. 9.2

- (iv) An electron is placed at A and projected along the direction AB with a kinetic energy less than 2.4×10^{-16} J. Describe the motion of the electron.
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[2]

- (b) A uniform magnetic field normal to the page is produced in the region PQRS. At point X, a gamma-ray photon interaction causes two particles to be formed. The paths of these particles are shown in Fig. 9.3.

**Fig. 9.3**

- (i) State the condition for a charged particle to experience a force in a magnetic field.
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[2]

- (ii) Suggest with a reason, why each of the paths is a spiral, rather than the arc of a circle.
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[2]

(iii) State and explain what can be deduced from the paths about

- 1.** the charges on the two particles

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[2]

- 2.** the initial speeds of the two particles.

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[2]

[End of Paper]