2019 Ph H1 Q12

Section: Particles and Waves

Topic: Forces on Charged Particles

Brief summary of the question

An electron enters uniform magnetic field out of the page. Find direction of force.

Worked solution

Magnetic force: $F = q(v \times B)$.

For positive charges: right-hand rule.

For electrons (negative), force is opposite to right-hand rule result.

If velocity is to the right and B is out of page: right-hand rule ⇒ up for positive charge; for electron ⇒ down.

Final answer

B — towards the bottom of the page.

Revision tips

- **Reverse direction for negative charges.**
- **Magnetic force always perpendicular to velocity.**
- **No work done by magnetic fields — speed unchanged.**