2022 Ph H1 Q10

Section: Particles and Waves

Topic: Forces on Charged Particles

Brief summary of the question

A proton enters a magnetic field directed from left to right. (The proton travels downwards in the diagram.) Find the direction of the force on the proton.

Worked solution

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

Proton is positive, so use the right-hand rule.

Thumb = velocity direction (downwards in the diagram).

Index finger = magnetic field direction (left → right).

Curl from v to B ⇒ middle finger points out of the page.

Final answer

A — out of the page.

Revision tips

- **Positive charge ⇒ use right hand; negative ⇒ reverse.**
- **Magnetic force always perpendicular to both velocity and B.**
- **If v is parallel to B, force is zero.**