Lorentz Force: Magnetism and Charged Particles (SwiftStudy Printable)

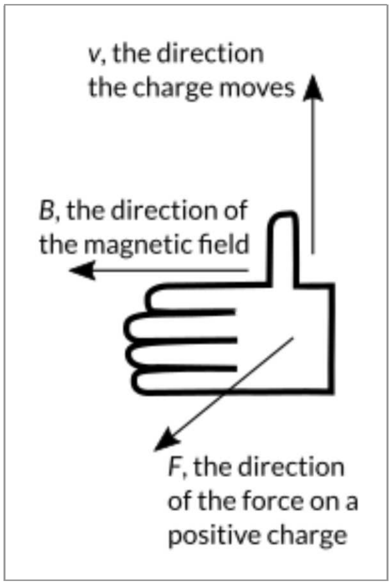
Key Formula

$$F = qvBsin\theta$$

F	force	newtons (N)
q	charge	coulombs (C)
v	velocity	m/s
B	magnetic field strength	tesla (T)
θ	angle between velocity and magnetic field vectors	degrees or radians

Tips to Remember

- When the velocity and the magnetic field are perpendicular, e.g., a proton moves north in a westbound magnetic field, then the angle θ between them is 90°. Since sin(90°) = 1, the Lorentz formula then simplifies to $F = qvB$.
- If the particle is moving in the same direction as the magnetic field, then θ is zero, and there is no force at all since sin(0) = 0. The same is true if the particles are moving in exactly opposite directions, since sin(180°) is also 0.
- Often problems about the Lorentz force will refer to forces on specific particles such as protons. In this case, you will need to know that the charge on a proton is 1.6×10^{-19} C.
- If you need to know the direction of the Lorentz force, use the right hand rule. Hold your **right** hand with its palm outstretched. Point your thumb in the direction the charge is moving, and point your fingers in the direction of the magnetic field. The force on a **positive** charge will be in the direction outward from your palm, while the force on a negative charge would be the opposite direction. (Another version of this rule uses the thumb for F, the index finger for v, and the middle finger for B. Both versions produce the same results.)



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