

Magnetic Fields

Physics

The force on a current and on a moving charge, and the hand rules.

The force on a current-carrying conductor is perpendicular to both the current and the field.

$$\mathbf{F} = BIL \sin \theta \cdot \mathbf{F} = Bqv \sin \theta$$

Current perpendicular to field

$\sin 90^\circ = 1.$

$$\mathbf{F} = BIL$$

Current parallel to field

$\sin 0^\circ = 0.$

$$\mathbf{F} = 0$$

Charge in a field

Circular path, $r = mv/Bq$

THE COMMON MISTAKE

✗ **Using the left hand for induction**

✓ **Fleming's left hand is for the motor effect only**

Left hand: force from a current. Right hand: current from motion. Using the wrong one reverses every direction.

A magnetic force does no work: it is always perpendicular to velocity, so it changes direction and never speed.