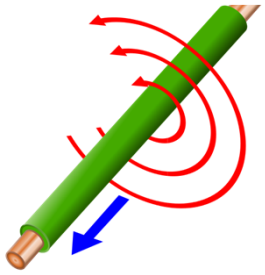
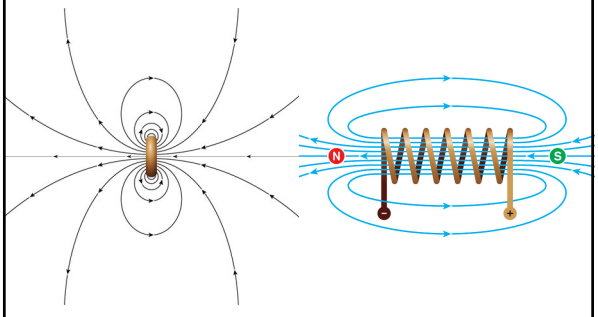
Electromagnetism

- In 1820, physicist Hans Christian Ørsted (Danish) showed that an electric current flowing in a wire produces a magnetic field.



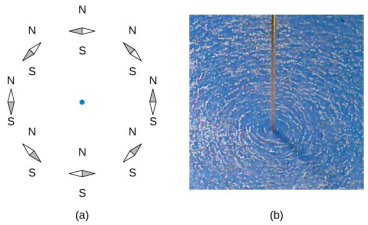
Single Loop

Solenoid (Coil)



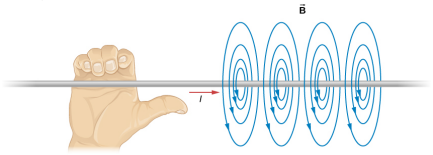
Direction of Magnetic Fields

- The direction of the magnetic field at a point in space is the direction a compass points

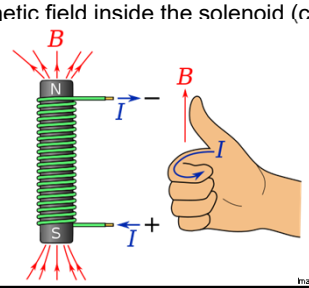


"Right-hand Rule"

- For a wire
  - Grip wire with hand such that the thumb points in the direction of the current
  - The fingers curl in the direction of the magnetic field

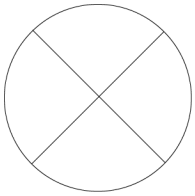


- For a solenoid (coil)
  - Wrap your fingers in the direction of the current
  - Your thumb will point in the direction of the magnetic field inside the solenoid (coil)



Directional Notations

- Into the page



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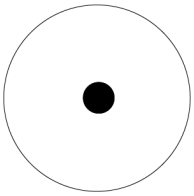

Magnetic Force on Current

- A moving charge experiences a force when it is in a magnetic field
- A wire carrying current therefore also experiences a force when it is placed in a magnetic field

- The magnitude of the force is proportional to the current, *I*, the magnetic field magnitude, *B*, and the length *L* of the wire that is in the magnetic field.

$$\boxed{F = BIL\sin\theta}$$

(*θ* is the angle between the current and the direction of the magnetic field)

Direction of Magnetic Force On a Wire

- Using the **right** hand, place the thumb in the direction of the current and the fingers in the direction of the magnetic field.
- The direction *away* from the palm is the direction of the magnetic force.