

# Magnetic Force Model

## • Properties

- Electromotive force (emf)
- Magnetic field
- Magnetic force
- Electric field
- Charge
- Velocity
- Current
- number of turns per unit length
- magnetic dipole
- radius
- length

• Equations:

$$- \quad \vec{F} = q\vec{v} \times \vec{B}$$

$$- \quad \vec{F} = \int I d\vec{\ell} \times \vec{B}$$

$$- \quad B_s = \mu_0 n I$$

$$- \quad \vec{\tau} = \vec{\mu} \times \vec{B}$$

$$- \quad \vec{F} = q\vec{E} + q\vec{v} \times \vec{B}$$

$$- \quad \mu = n I A$$

$$- \quad B = \frac{\mu_0}{4\pi} \frac{2I}{a}$$

$$- \quad \vec{\tau} = \vec{r} \times \vec{F}$$

$$- \quad |\vec{\tau}| = |\vec{\mu}| |\vec{B}| \sin \theta$$

$$- \quad |\vec{\tau}| = |\vec{r}| |\vec{F}| \sin \theta$$

- Diagrammatic
  - FBD
  - Right-hand rule(s)
  - Magnetic field of solenoid

#### Rules of Behavior

- Force is exerted on a charge moving in a magnetic field.
- Directions of force, charge/current, and magnetic field can be found with the right-hand rule.
- Energy can be stored as a magnetic field in a solenoid.
- A current-carrying coil or magnetic dipole experiences torque in a magnetic field and twists to align with the applied magnetic field.