Magnetic Force
When moving electric charges are placed in magnetic fields, they feel a **FORCE**.

- Force is **greatest** when the particle moves **perpendicular** to the magnetic field.
- Force becomes less at angles less than 90 and **zero** when the particle moves **parallel** to the field lines.
Magnetic Force on a POINT CHARGE

- The **force** that acts on a moving charged particle depends on the particle’s **charge**, its **velocity**, and the strength of the **magnetic field**.

\[ F_B = qvB \]

- \( B \) = magnetic field [T]
- \( v \) = charge velocity [m/s]
- \( F \) = force [N]
- \( q \) = charge [C]
• A charged particle moving through a magnetic field experiences a deflecting force.

• So...a **current of charged particles** moving through a magnetic field also experiences a deflecting force.

\[
F_B = qvB
\]

\[
F_B = ILB
\]

- F = force (N)
- I = current (A)
- L = length of wire (m)
- B = magnetic field (T)
Magnitude of Magnetic Force

When an electric charge moves in a magnetic field, it feels a force.

Single charge:

\[ F_B = qvB \]

- \( F \) = force (N)
- \( q \) = charge (C)
- \( v \) = velocity (m/s)
- \( B \) = magnetic field (T)

Many charges (current):

\[ F_B = ILB \]

- \( F \) = force (N)
- \( I \) = current (A)
- \( L \) = length of wire (m)
- \( B \) = magnetic field (T)
The Right Hand Rule (Part III)

• Force is a vector. It was magnitude (size) and direction. We can calculate the magnitude of the magnetic force with the equations.

• To find the direction of the magnetic force on a charge
  • Take two pens
  • Hold them perpendicular to each other as in the picture
  • Take your RIGHT hand
  • Place your RIGHT hand at the point where the two pens meet
  • Push \( \mathbf{v} \) towards \( \mathbf{B} \)
  • The direction your thumb points is the direction of \( \mathbf{F} \)
Right Hand Rule Practice
Earth’s B Field

• A compass points northward because Earth itself is a huge magnet
• The compass aligns with the magnetic field of the earth
• Most geologists think that moving charges looping around within Earth create its magnetic field
• The magnetic field of Earth is not stable
  • It has flip-flopped throughout geologic time
  • Studies of deep-sea sediments indicate that the field was virtually switched off for 10,000 to 20,000 years just over 1 million years ago