# 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.

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.



# Magnitude of Magnetic Force



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

#### Single charge:



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

#### Many charges (current):



- 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 <u>v towards B</u>
  - The direction your thumb points is the direction of 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

