Magnetism

What is it and how does it work?

1

Magnetic Poles

- All magnets have two poles
  - _____ do not exist.
- North pole points toward to the north, south towards the south.
- Like poles _____, unlike _____.
- Earth's magnetic North is actually geographic _____.

2

Magnetic Materials

- Ferromagnetic
  - Strongly _____ to magnetic materials (ex: iron, steel, cobalt)
- Paramagnetic
  - Very slightly _____ to magnetic materials (ex: wood, aluminum, platinum)
- Diamagnetic
  - Weakly _____ by magnetic materials (ex: gold, zinc, sodium chloride)
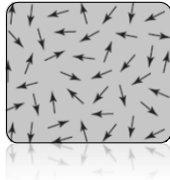
3

Cause of Magnetism

- Magnetism is caused by a _____ in motion
- Electrons in motion
  - Revolving around the _____
  - _____ around it own axis
  - Usually occur in pairs, _____ each other
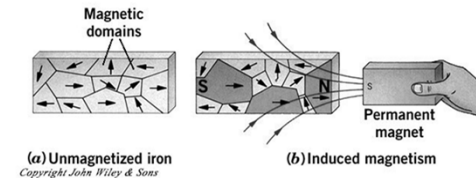- Magnetic materials have an _____ of electrons in orbits and spins.

4

Magnetic Domains

- Electron motion occurs in microscopic magnetic regions called_____.
- Domains are oriented in _____ directions neutralizing any overall magnetic field.

Creating Magnets

- When a _____ material is placed in an magnetic field, the domains _____, magnetizing the material.

Magnetic domains

(a) Unmagnetized iron
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Permanent magnet

(b) Induced magnetism

Types of Magnets

- Permanent magnets
  - If the domains _____ _____ after the magnetic field in removed, the material is said to be permanently magnetized.
- Temporary magnets
  - If the domains _____ after the magnetic field in removed, the material is said to be a temporary magnet.
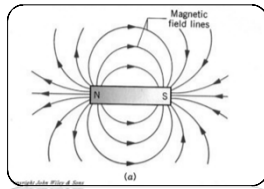
"Neutralizing" Magnets

- Heating a ferromagnetic material to a specific temperature _____ _____ the domain regions resulting in a paramagnetic material.
  - This temperature is known as the _____ point.
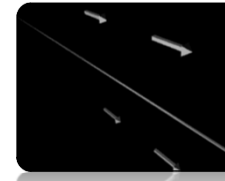
Magnetic Fields

- The lines of magnetic flux are drawn away from _____ and towards the _____
- The strength of a magnetic field is shown by the _____ of magnetic field lines in a certain area.
- More Magnetic Field Lines = Stronger Magnetic Field

Electromagnetism

- Current passing through a wire _____ a magnetic field.
- Discovered by Oersted, when a _____ was placed by a current carrying wire.

Magnetic Field Strength

- To determine the magnetic field strength (B) along a wire, we use:

Where
$k = 1 \times 10^{-7} \text{ N/A}^2$
I = current in the wire (A)
r = distance from wire (m)
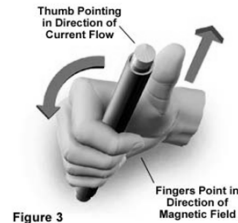B = magnetic field strength (T)

Example Problem

- Calculate the current passing through a wire if a magnetic field strength of 8.89 x 10^{-5} T occurs at a distance of 0.135 m from the wire?

Answer: I = 60 A
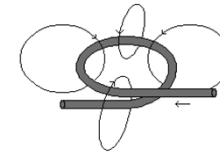
3

First Right Hand Rule

- Used to determine the _____ of the magnetic field in a current carrying wire.
- Grasp the conductor with your right hand with your _____ pointing in the direction of the current. Your fingers will circle in the direction of the magnetic field.

Thumb Pointing in Direction of Current Flow

Fingers Point in Direction of Magnetic Field
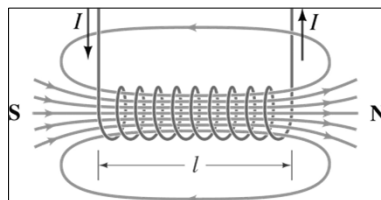
Figure 3

Loops of Wire

- If we bend a current carrying wire into a loop, we find that the magnetic field along the _____ of the loop faces in one direction, producing a magnetic field pointed in that direction.
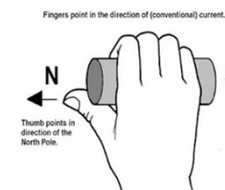
Multiple Loops

- By _____ the number of loops, the magnetic field can be increased.

Second Right Hand Rule

- Grasp the coil with your right hand with your _____ circling the coil in the direction of the current. The extended thumb will point in the direction of the north pole of the core.

Fingers point in the direction of (conventional) current.

N   S

Thumb points in direction of the North Pole.