Magnetism

What is it?
And
How does it work?

Magnetic Materials

- Ferromagnetic
  - Strongly attracted to magnetic materials (ex:iron, steel, cobalt)
- Diamagnetic
  - Feebly repelled by magnetic materials (ex:gold, zinc, sodium chloride)
- Paramagnetic
  - Very slightly attracted to strong magnetic materials (ex:wood, aluminum, platinum)

Domain Theory

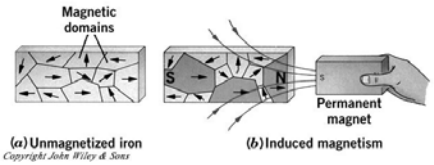
- Magnetism is caused by a charge in motion
- Electrons in motion
  - Revolving around the nucleus
  - Spinning around it own axis
  - Usually occur in pairs, neutralizing each other
- Magnetic materials have an imbalance in the electron in orbits and spins.

Domain Theory

- Atoms are grouped in microscopic magnetic regions called domains.
- Domains are oriented in random directions neutralizing any overall magnetic field.

Domain Theory

- When a ferromagnetic material is placed in an external magnetic field, the domains align, creating a magnetic field of its own.



Permanent Magnets

- Domains align in the direction of the magnet field. These domains may also enlarge.
- If the domains remain enlarged after the external field in removed, the material is said to be "permanently magnetized"

"Neutralizing" Magnets

- Heating a ferromagnetic material to a specific temperature breaks down the domain regions resulting in a paramagnetic material.
- This temperature is known as the Curie point.

Magnetic Poles

- All magnets have two poles, mono poles do not exist.
- North pole points toward to the north, south towards the south.
- Like poles repel, unlike attract.

Coulomb's Law of Magnetism

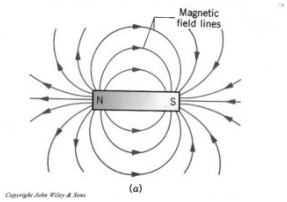
- The force between two magnetic poles is directly proportional to the product of the strengths of the poles and inversely proportional to the square of the distance between them

$$F = k\frac{M_1 M_2}{d^2}$$

Where k = 1×10^{-7} N/A^2

Magnetic Fields

- Similar to electric fields, the lines of magnetic flux are drawn away from North and toward South



Magnetic Field Strength

- The strength of a magnetic field can be found by determining the number of magnetic flux lines occur in a certain area.
- The magnetic flux density is the number of flux lines per unit area that permeates the magnetic field.
- The magnetic flux density determines the magnetic force present at a given point in the magnetic field

Magnetic Field Strength

- Determine the magnetic field density

$$B = \frac{\Phi}{A}$$

Where

B = Magnetic Field Density
Φ = number of flux lines
A = Area being observed

Magnetic Permeability

- The amount a material changes the magnetic field compared to air.

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