

A horseshoe magnet is shown with a large pile of metal nails attracted to its poles. The magnet is dark and has a U-shaped opening. The nails are clustered together, with some pointing towards the magnet and others hanging down. The background is plain white.

Magnetism & Induction Review

With Max and Zoe

Magnets

Poles

- Every magnet has a north and south pole
- Opposite poles attract and like poles repel

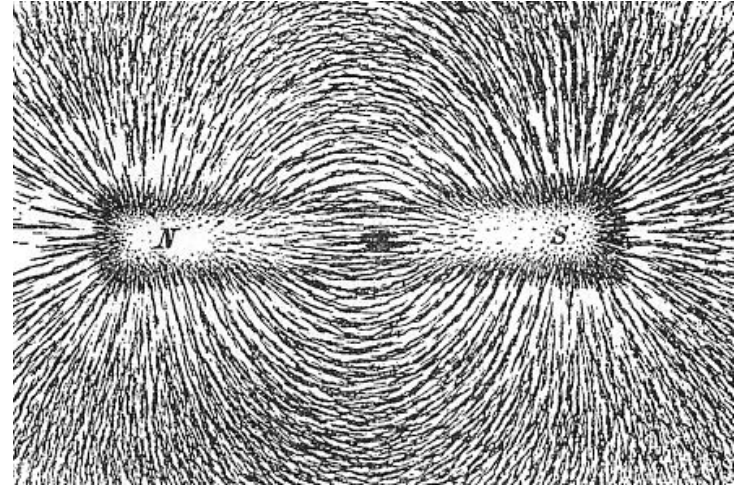


Magnetic Domains-

- clusters of aligned atoms
- Difference between materials being magnetic and nonmagnets, whether or not it contains magnetic domains

Magnetic Fields

- Magnetic fields are produced by charges in motion
- First discovered by Hans Christian Oersted in 1820
- A stationary charge does not produce a magnetic field at all



Magnetic Fields Equations

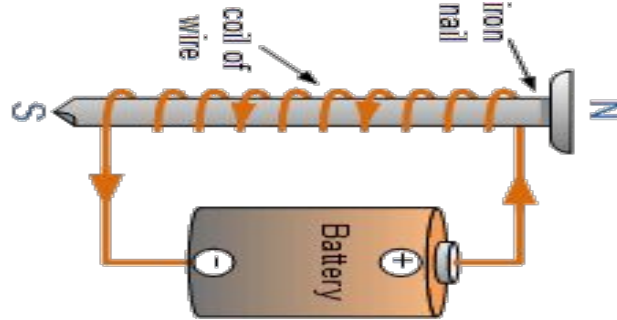
$F_B = I\ell B \sin\theta$ - for calculating the amount of the force applied on an electric current

$F_B = qvB \sin\theta$ - for calculating the charge of a moving particle due to magnetic field

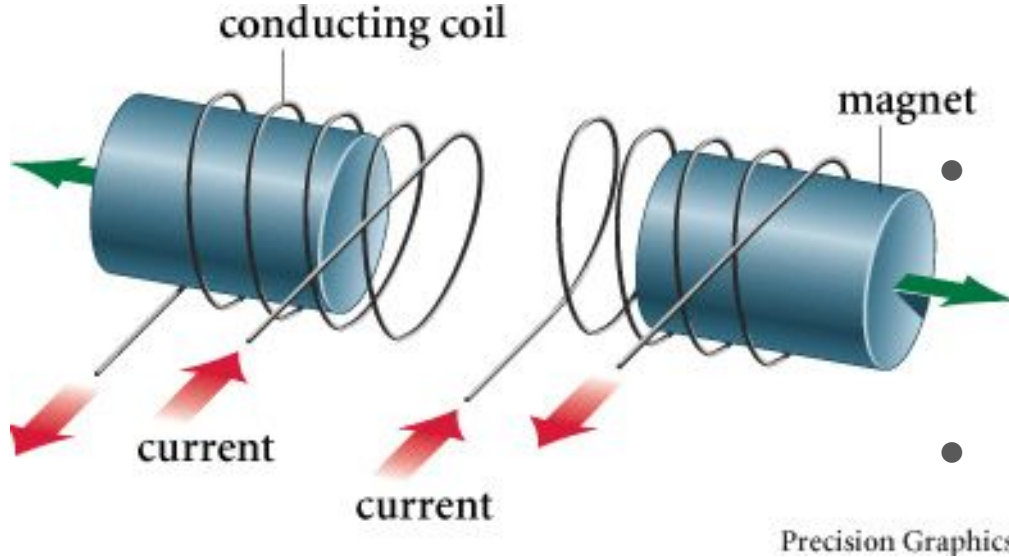
Electromagnets

A soft metal core made into magnet by the by the passage of electric current through a coil surrounding it

- Electromagnetic induction- voltage that is produced by a changing a magnetic field
- What are ways to pick up more things with your electromagnet?



Electromagnetic Induction



- A changing magnetic field will produce a voltage
- The faster the motion and the more coils, the higher voltage
- The current induced on the wire will create a magnetic field that resists the motion of the magnet

Electromagnetic Induction Equations

- $\Phi = BA = BA \sin\theta$
 - Measured in Wb (Weber)
 - This finds magnetic flux
- $V = -N\Delta\Phi/\Delta t$ -Faraday's Law
 - Measured in V (Volts)
 - Finds the voltage induced by the changing magnetic field onto the wire
- Lenz's Law
 - Induced voltage will have a current that opposes the magnetic field which it produces



Motors and Generators and Transformers, OH MY!

Generators- Basic generators include a mechanical motion that involves moving a magnet through a coil of wire and back out again

- This produces an AC current

Motors- Generators in reverse

Transformers- Changes voltage by having a differing number of coils on the primary and secondary

$$V_P/N_P = V_S/N_S$$

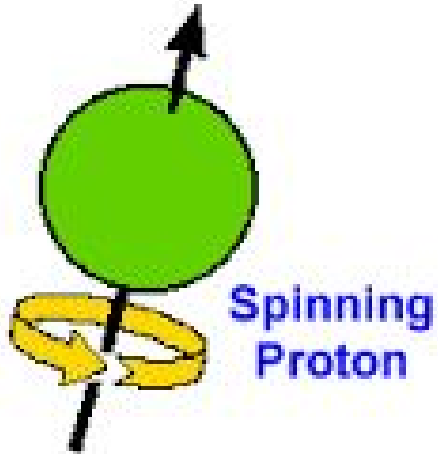
Common Misconceptions

- Using the right hand for the negative charge
- Transformers create energy
- Energy is free



Example #1

A proton going 3.4×10^6 m/s in a magnetic field, it feels the force of 1.0×10^{-18} N east when it moves down. What is the magnitude and direction of the magnetic field?



Example #2

In this step down transformer, the primary coil is 3600 turn and the primary voltage is 5400V and the secondary voltage is 2700V. What is the secondary coil turn count?

