

What makes a magnet a magnet?

# Magnetism

# Papers From Yesterday

- Objectives Sheet
- Magnetism Study Sheet (graded, due Tuesday February 28<sup>th</sup>)
- What is a Magnet? Sheet
- Warning: we are using magnets and electricity in this unit so any and all electronic devices are strongly discouraged to bring to class!

# Magnetic Field Lines

- Magnetic fields are generated by Magnets.
- Magnetic field lines are drawn from North Pole to South Pole (All known magnets have two poles to my knowledge).

# Nails and Paper Clips

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- Chain paper clips together without linking them!
- Magnets know which nails to pick up!?

# Temporary Versus Permanent

- Temporary Magnets behave as magnets when put inside a magnetic field.
- Permanent Magnets are magnets that retain their poles in the absence of outside magnets.

# Three Types of Temporary Magnets

- Ferromagnetism
  - Magnets strongly attract
    - Steel, Iron, Nickel, Cobalt, Gadolinium
- Paramagnetic
  - Magnets slightly attract
    - Liquid oxygen, and other materials
- Diamagnetism
  - Magnets slightly repel
    - Water, carbon and boron

# Elements that make good magnets

- Fe
- Co
- Ni
- Gd
- Nature stone (not an element)
  - Lodestone

# Magnetic Domains

- This is the lining up of electrons spin (unpaired electrons) such that a magnetic field is produced.
- A region that has the atoms lining up the spin in the same direction produce a stronger magnetic field.





# Ruining a Magnet

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- Temperature
- Mechanical Shock
- Moisture
- Demagnetizing fields

# Earth as a Magnet

- Earth is a giant magnet with the North Pole actually being a magnetic south pole and the South Pole is actually a magnetic north pole.

# Monopole

- Experiment in College!
- Mathematically possible!
  - Monopoles obey the four Maxwell equations.
- Still elusive
- <http://phet.colorado.edu/en/simulation/magnet-and-compass>

# Electromagnets

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- Another type of temporary magnets.
- Tightly wound helical coil of wire usually with a core that acts like a permanent magnet when current is flowing.

# Core Movie!!

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