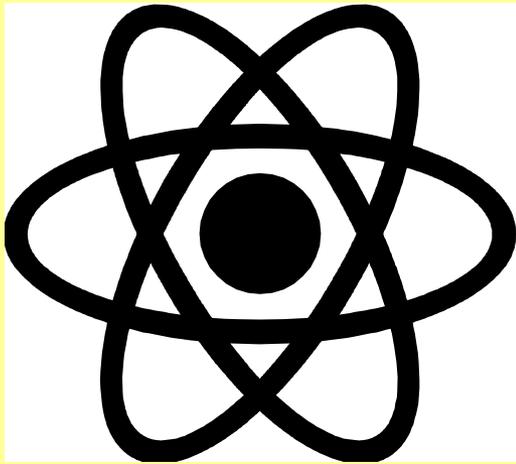


Magnetism

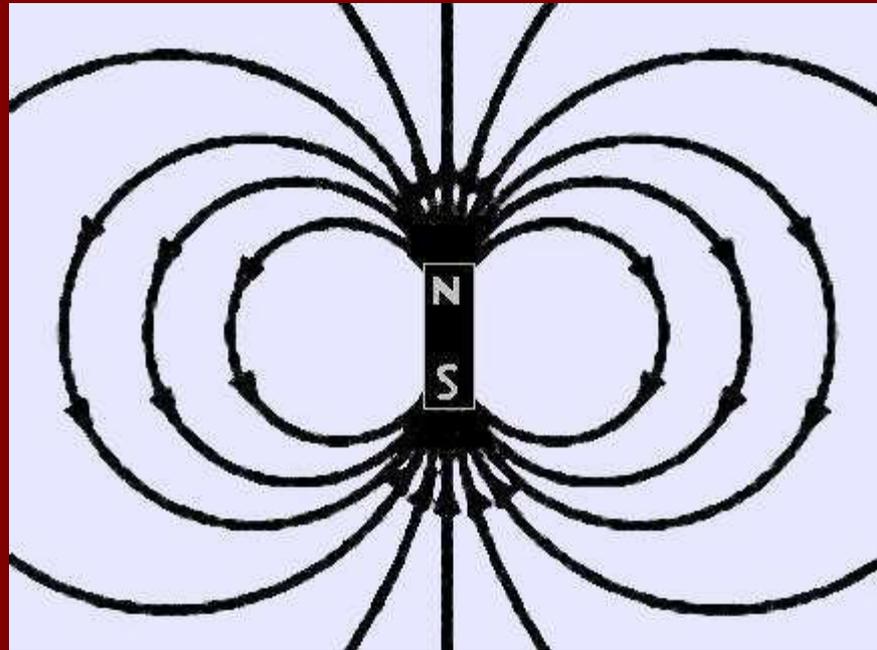


WHAT IS MAGNETISM?



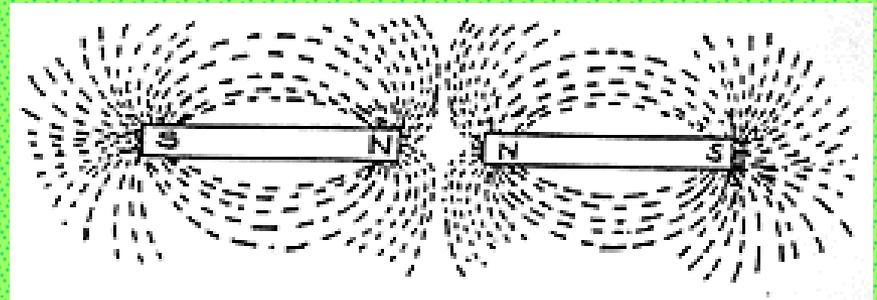
MAGNETISM IS THE FORCE OF ATTRACTION OR REPULSION OF A MAGNETIC MATERIAL DUE TO THE ARRANGEMENT OF ITS ATOMS, PARTICULARLY ITS ELECTRONS.

The ends of a magnet are where the magnetic effect is the strongest. These are called “poles.” Each magnet has 2 poles – 1 north, 1 south.

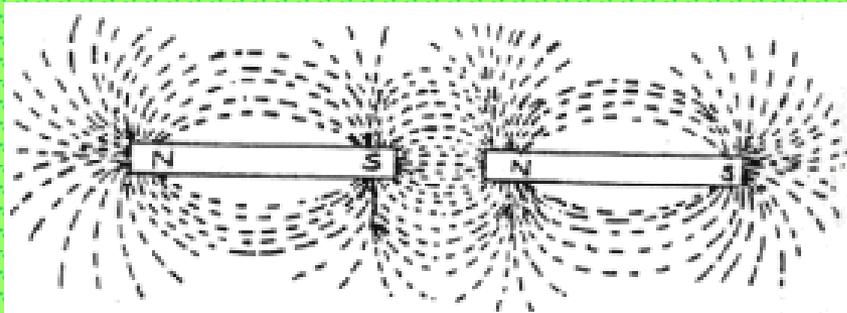




Like repels like...

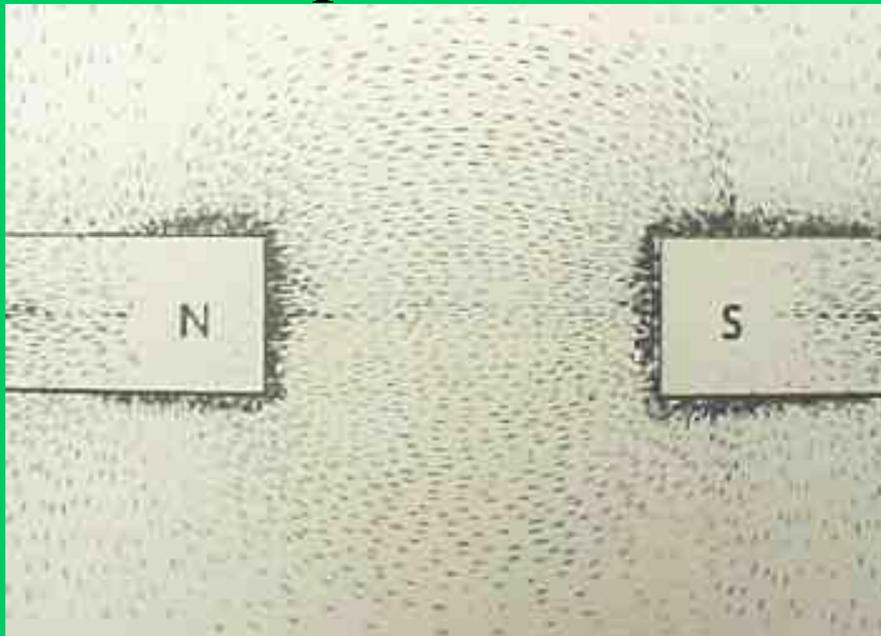


Opposites attract!

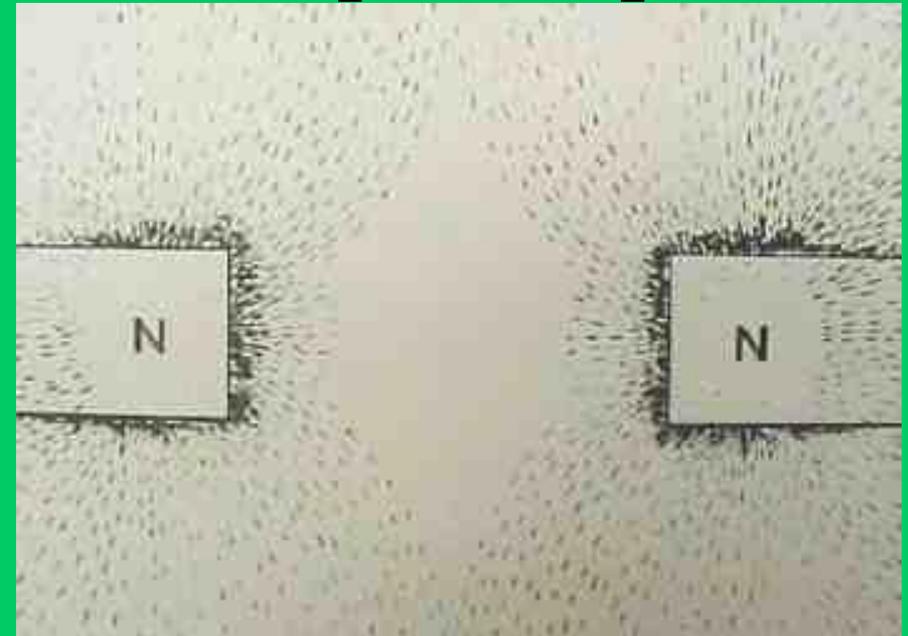


Laws of magnets shown by *flux lines*

Unlike poles attract



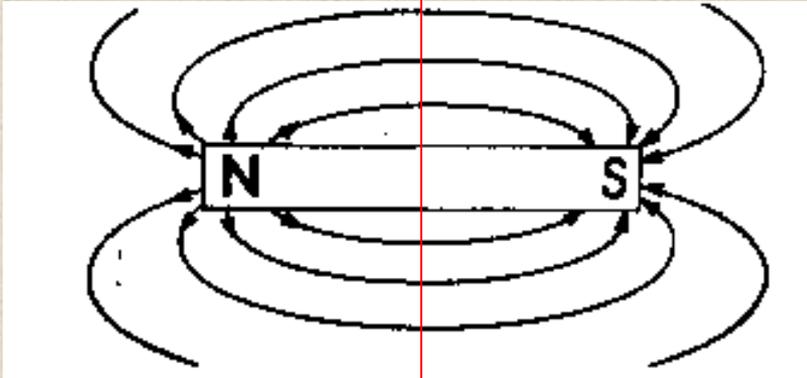
Like poles repel



**Poles of a magnet
always
Come in pairs!**

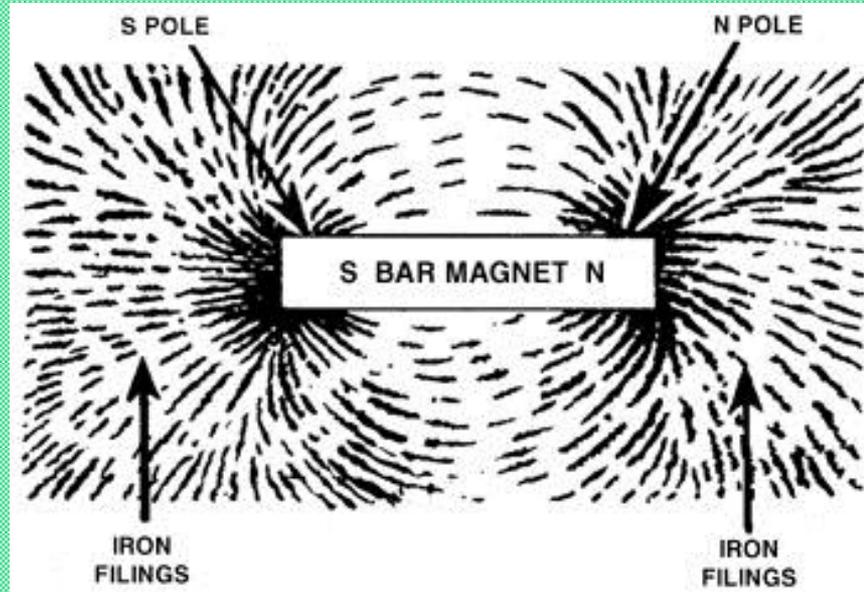


If you cut a magnet in half,

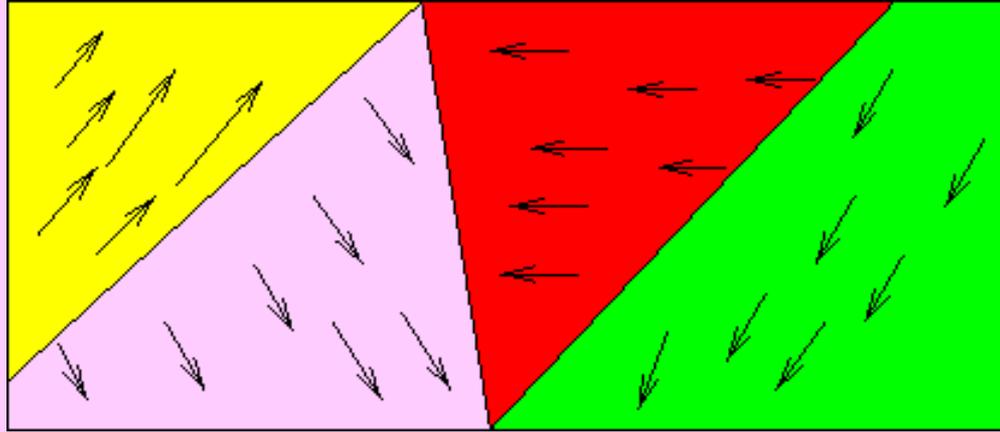


you get 2 magnets!

Magnetic Fields



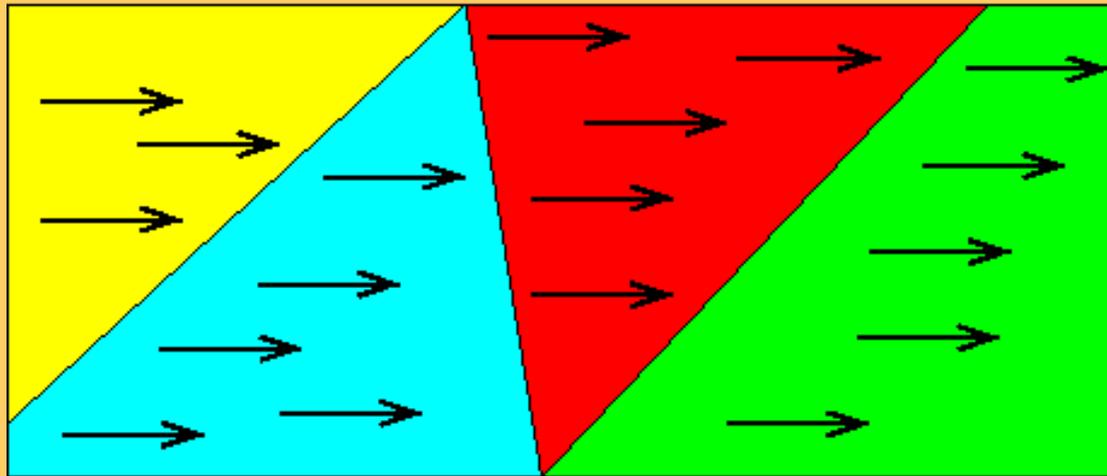
The region where the magnetic forces act is called the "magnetic field"



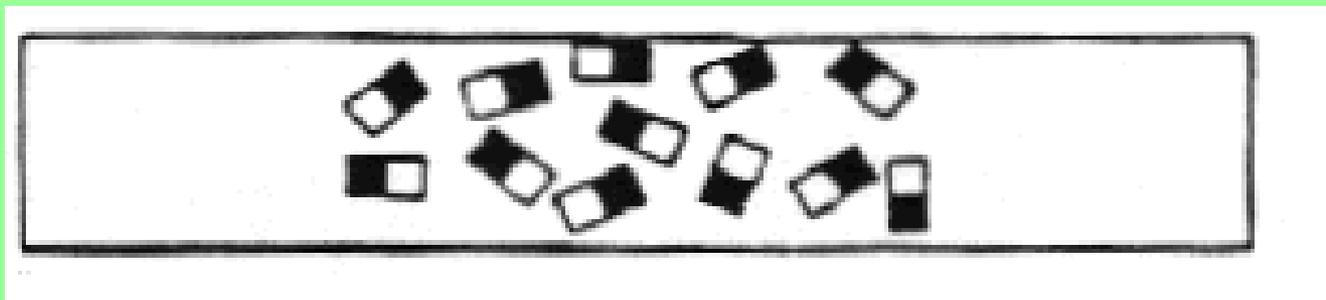
☆ **Atoms themselves have magnetic properties due to the spin of the atom's electrons. Groups of atoms join so that their magnetic fields are all going in the same direction These areas of atoms are called "domains"**

When an unmagnetized substance is placed in a magnetic field, the substance can become magnetized. This happens when the spinning electrons line up in the same direction.

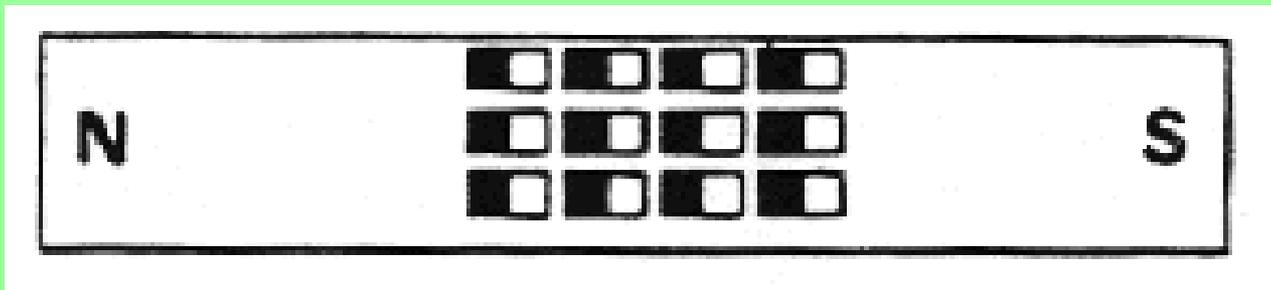
External Magnetic Field



**AN UNMAGNETIZED
SUBSTANCE LOOKS
LIKE
THIS...**



**WHILE A MAGNETIZED SUBSTANCE
LOOKS
LIKE THIS...**



How to break a magnet:

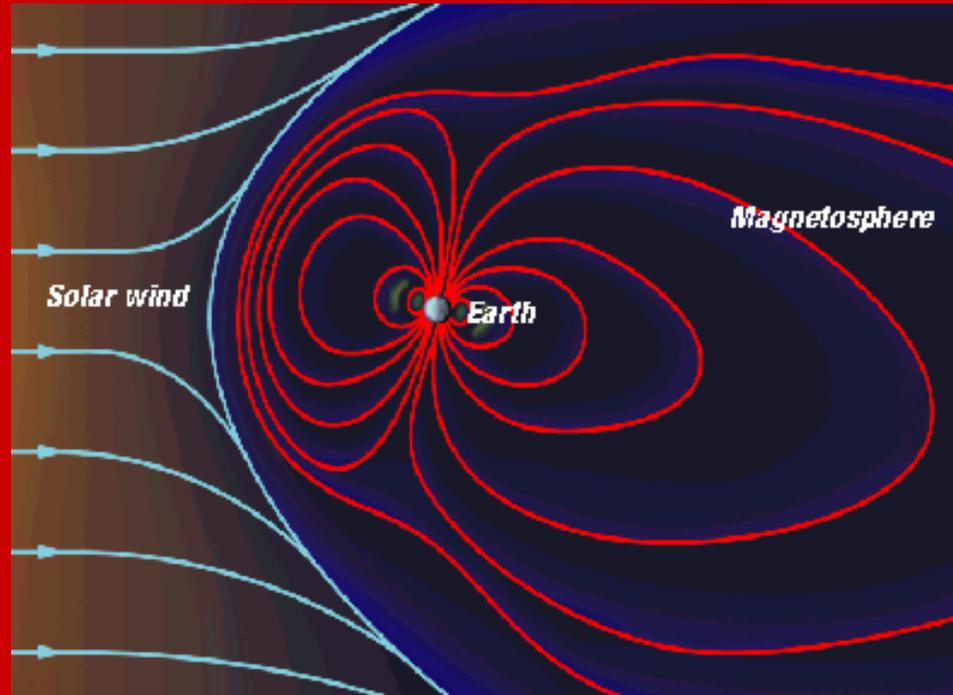
1. Drop it

2. Heat it



This causes the domains to become random again!

The Earth's magnetic field extends far into space. It is called the "magnetosphere."



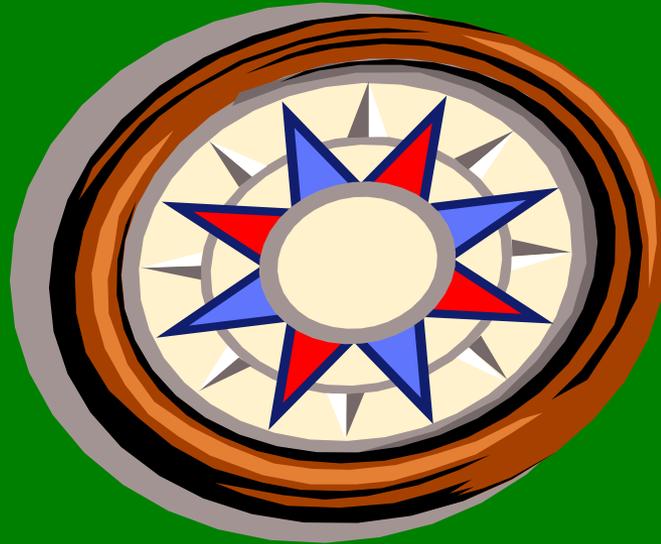
When the magnetic particles from the sun, called "solar wind", strike this magnetosphere, we see a phenomenon called...

The Aurora Borealis in the Northern Hemisphere



And the Aurora Australis in the Southern Hemisphere

We use the Earth's magnetic field to find direction.



The needle of a compass always points toward the magnetic south pole.

We call this direction “North” (remember, opposites attract)

Electromagnets

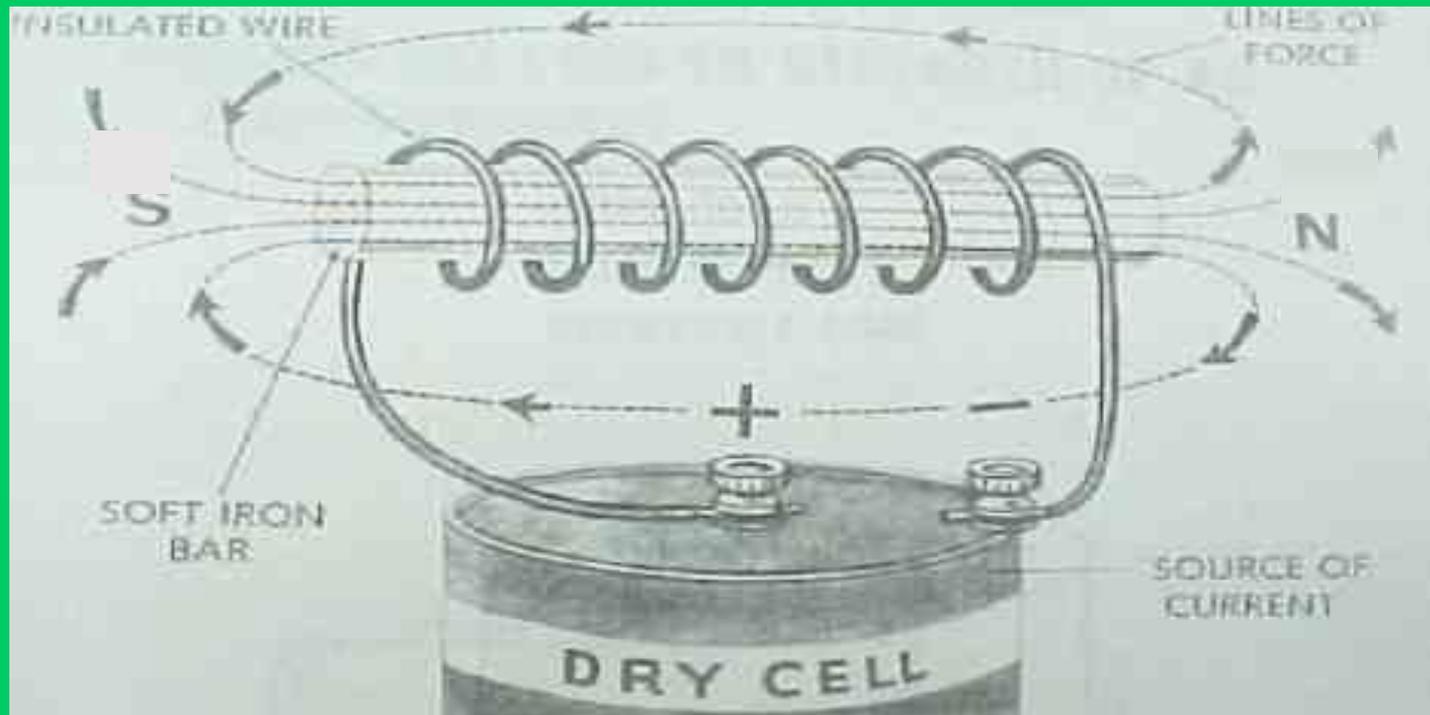
A large electromagnet used to lift scrap metal



A 30-foot diameter electromagnet used in research for a superconductor

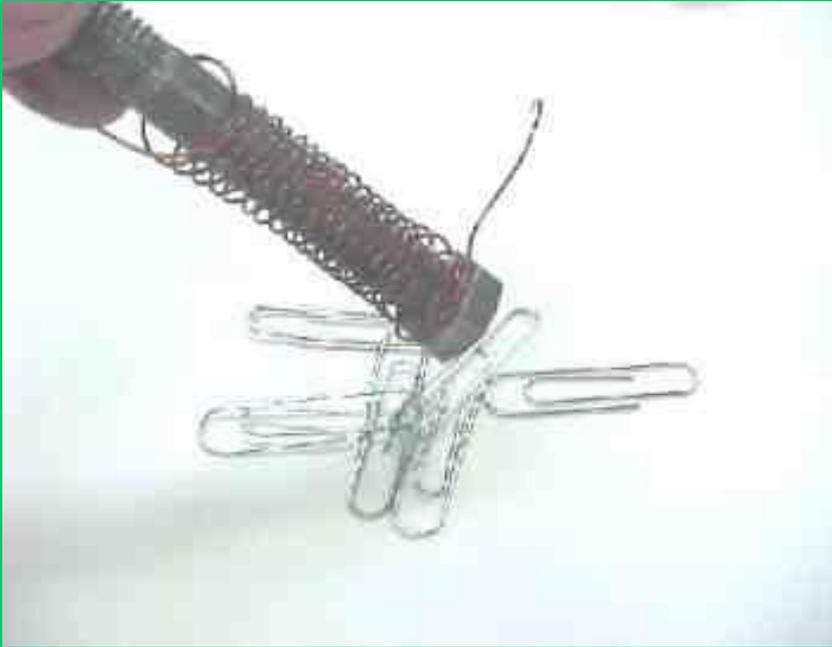
Electromagnets

- The source of electromagnetism is electricity (*current*) flowing through a coil of wire.
- A current flowing through a coiled wire creates a magnetic field

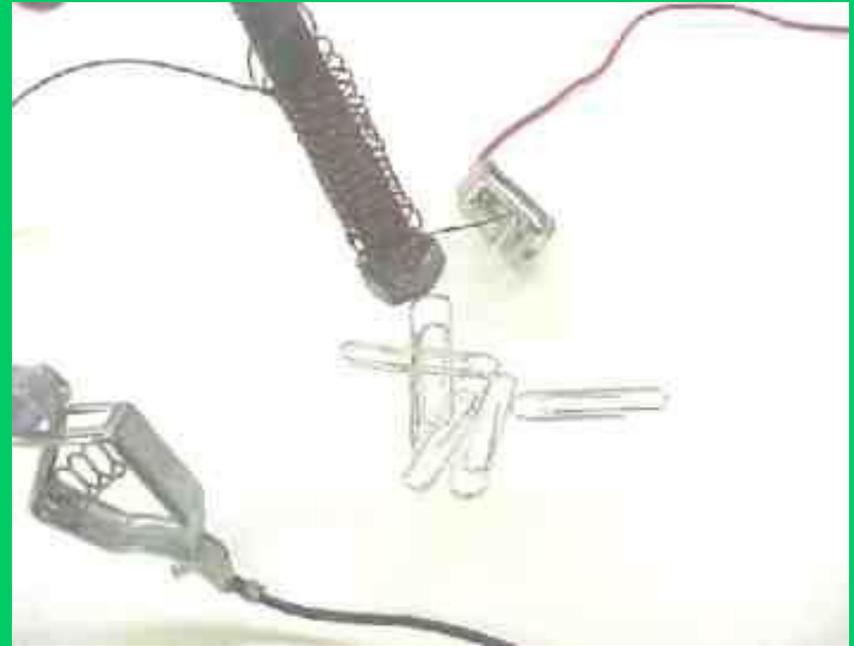


Electromagnets

A coil of wire can be made into a magnet by passing an electric current through it.



**Without electricity,
there is no
magnetic force**



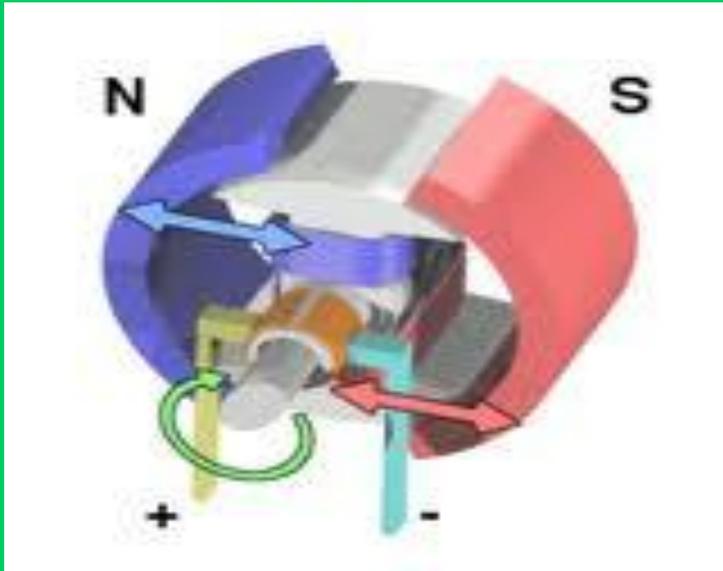
**Electric current applied to a coil
creates a magnetic field**

Electromagnetic Strength

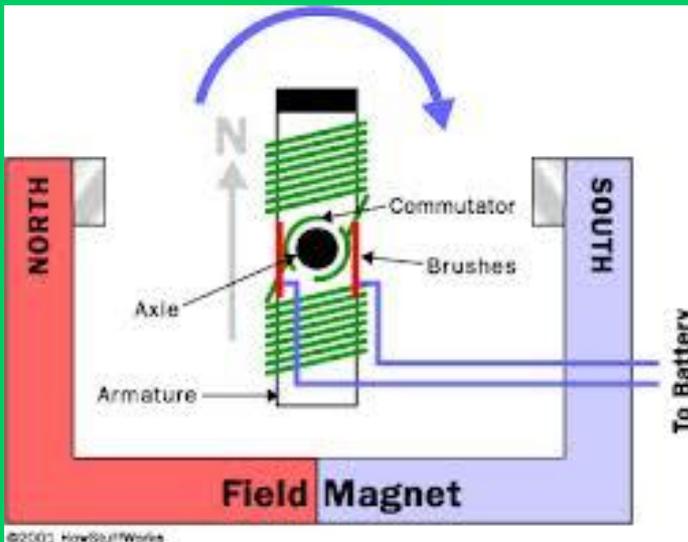
How can an electromagnet be made stronger?

- Increase the number of coils.
- Increase the electric current
flowing through the coil.

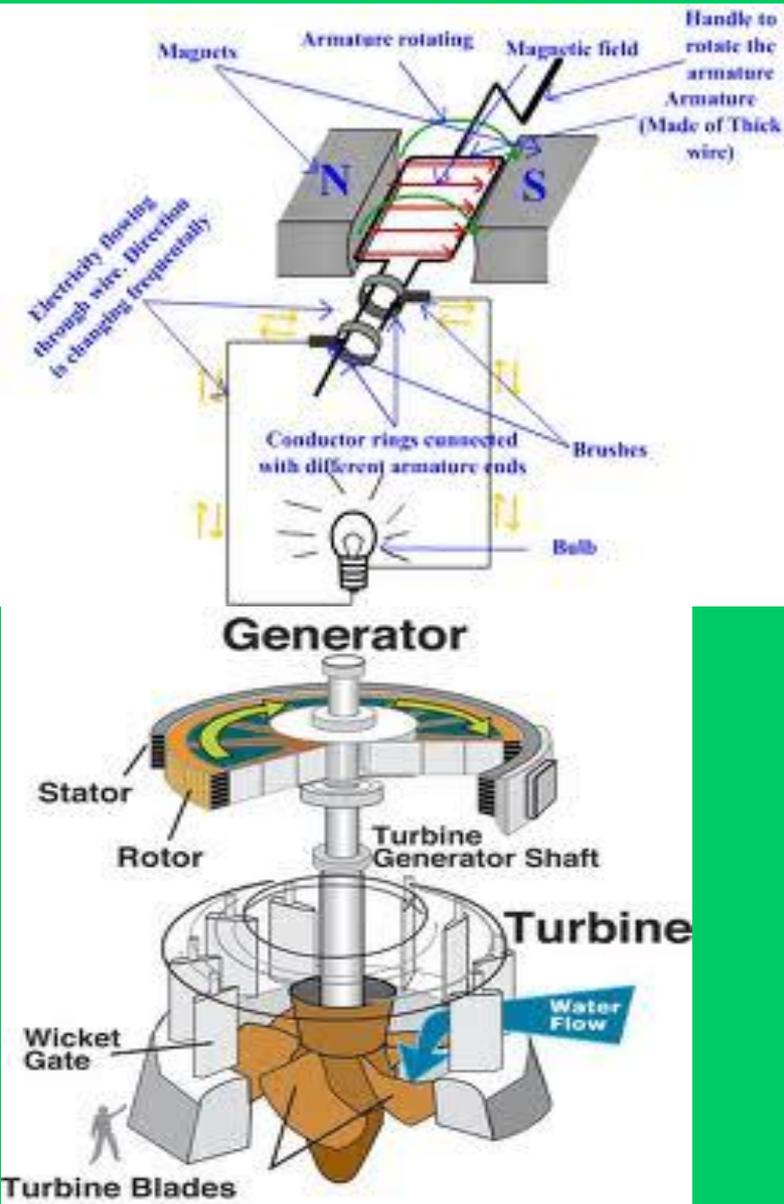
Electric Motors



- Permanent Magnets on the outside
- Electromagnet on the inside
- When power runs to the electromagnet it is repelled and attracted to the poles of the permanent magnet
- When it makes a half turn, the polarity of the electromagnet is reversed so that it keeps spinning



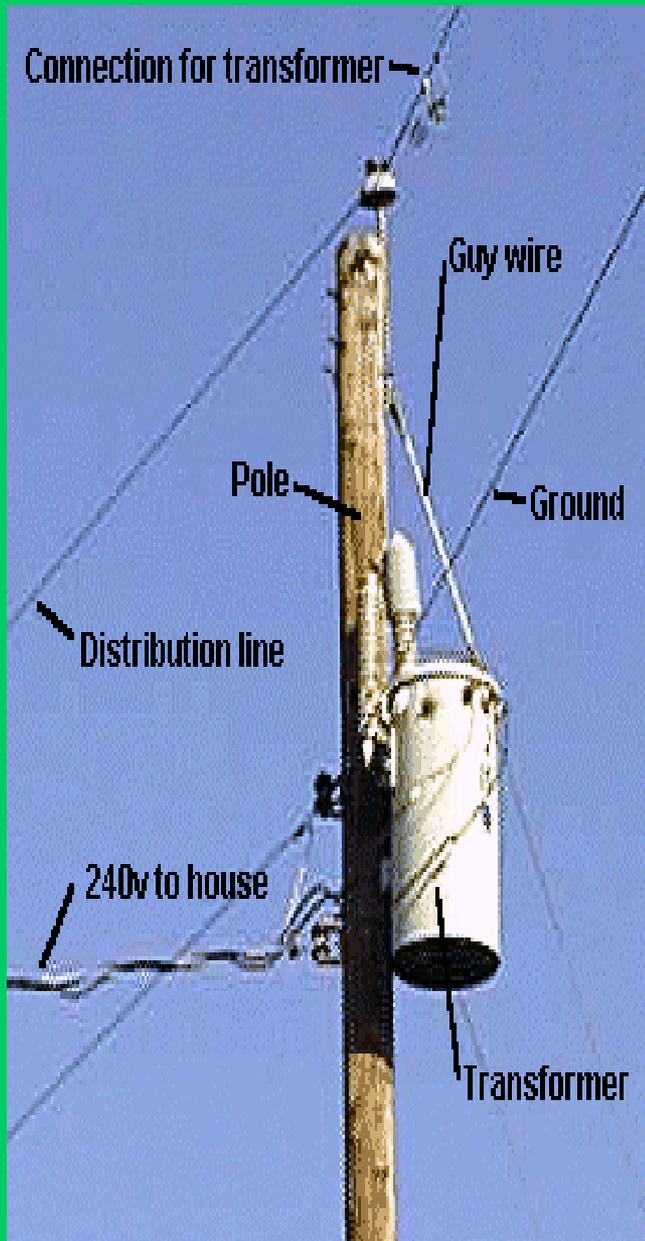
Electric Generators



- Opposite of electric motor
- A conductor (usually wound copper wire) is turned inside of a magnet
- When the wire moves through the magnetic field of the magnet, it creates electric current
- The current can be transferred to a load

Induced Current in a Generator

- The effect of inducing a current in a coil by moving a magnet inside it is used for the generation of electricity in power plants
- There are two types of generator or dynamo. Both turn rotational energy into electrical energy.
 1. One type involves rotating a coil inside a magnet.
 2. The other type involves rotating a magnet inside a coilBoth types produce **ALTERNATING CURRENT**.
- gcsescience.com



A transformer can change electrical energy of a given voltage into electrical energy at a different voltage level. It consists of two coils arranged in such a way that the magnetic field surrounding one coil cuts through the other coil

This transformer's job is to reduce the 4160 volts down to the 240 volts that makes up normal household electrical service. It is a step down transformer

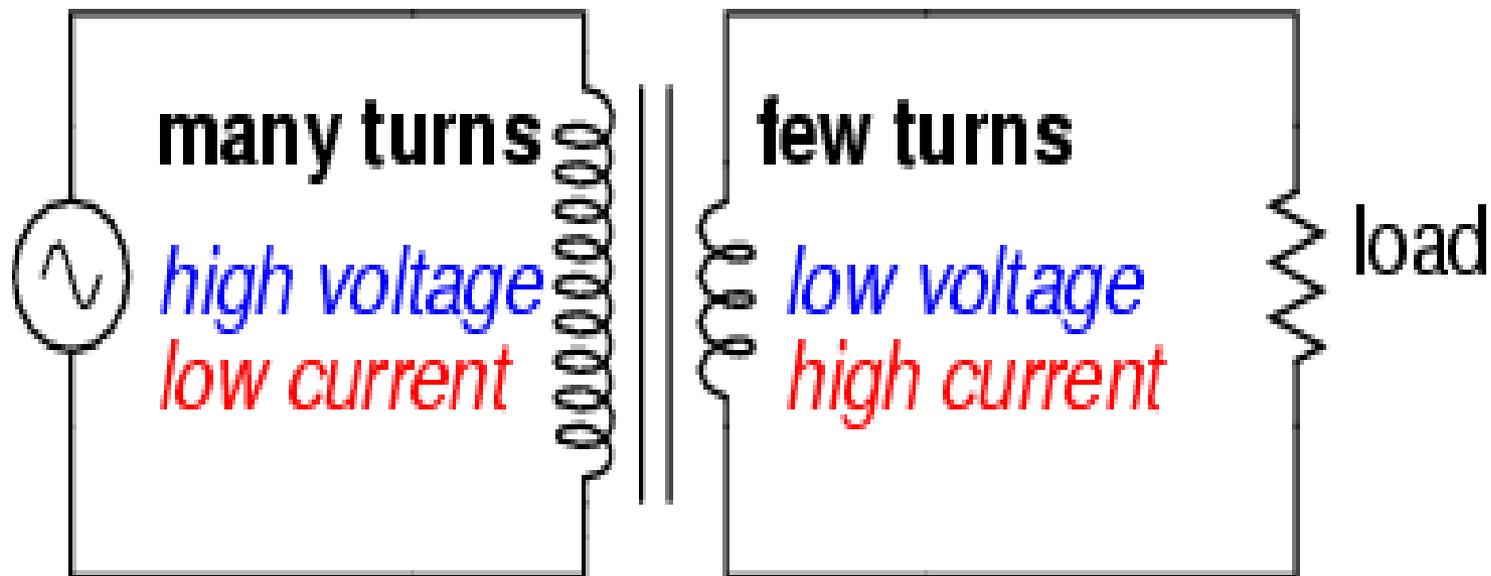


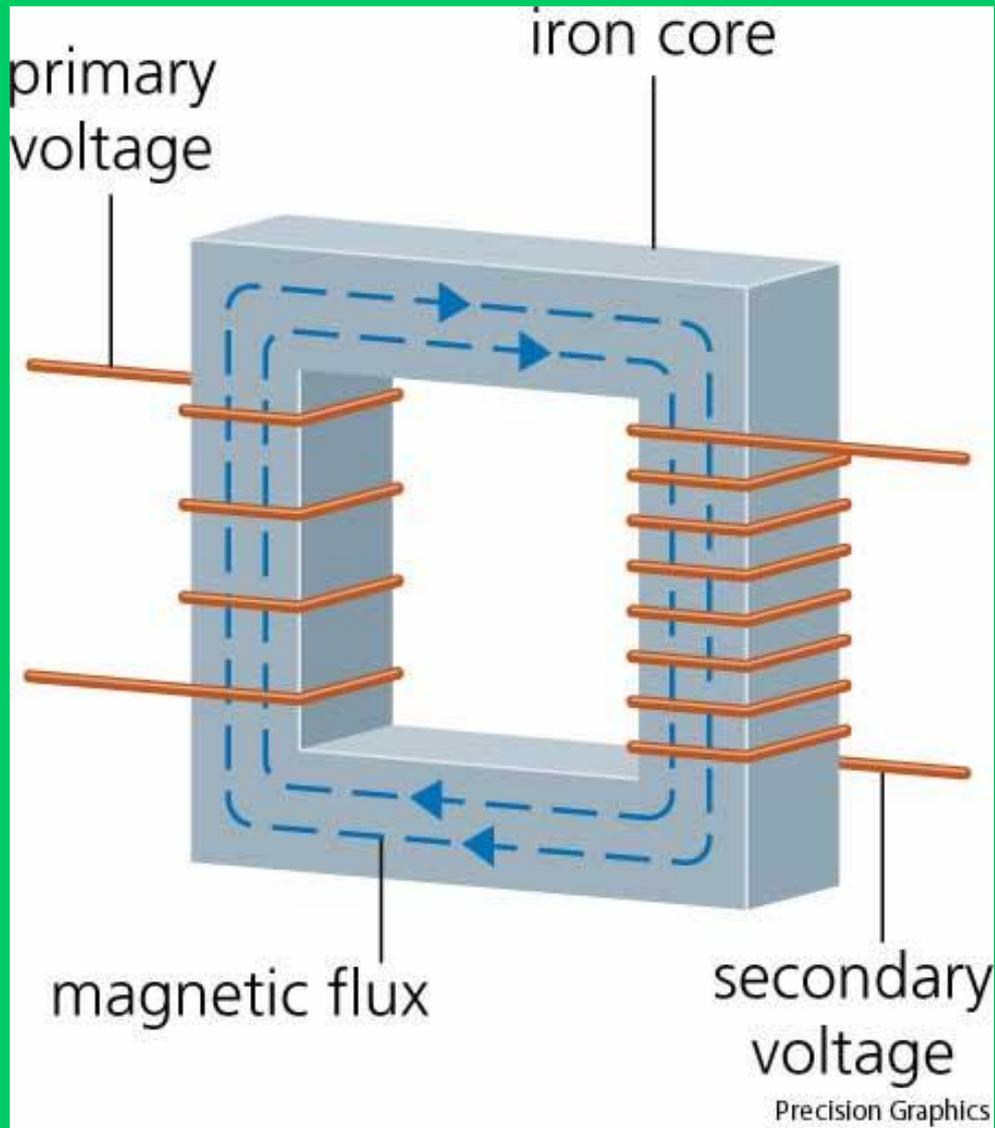
Step Up Transformer at Power Plant

TRANSFORMER

- The factor which determines whether a transformer is a step up(increasing the voltage) or step down (decreasing the voltage) type is the "turns" ratio. The turns ratio is the ratio of the number of turns in the primary coil to the number of turns in the secondary coil.

Step-down transformer





- An electric motor converts electric energy into mechanical/kinetic energy
- An electric generator converts mechanical/kinetic energy into electric energy