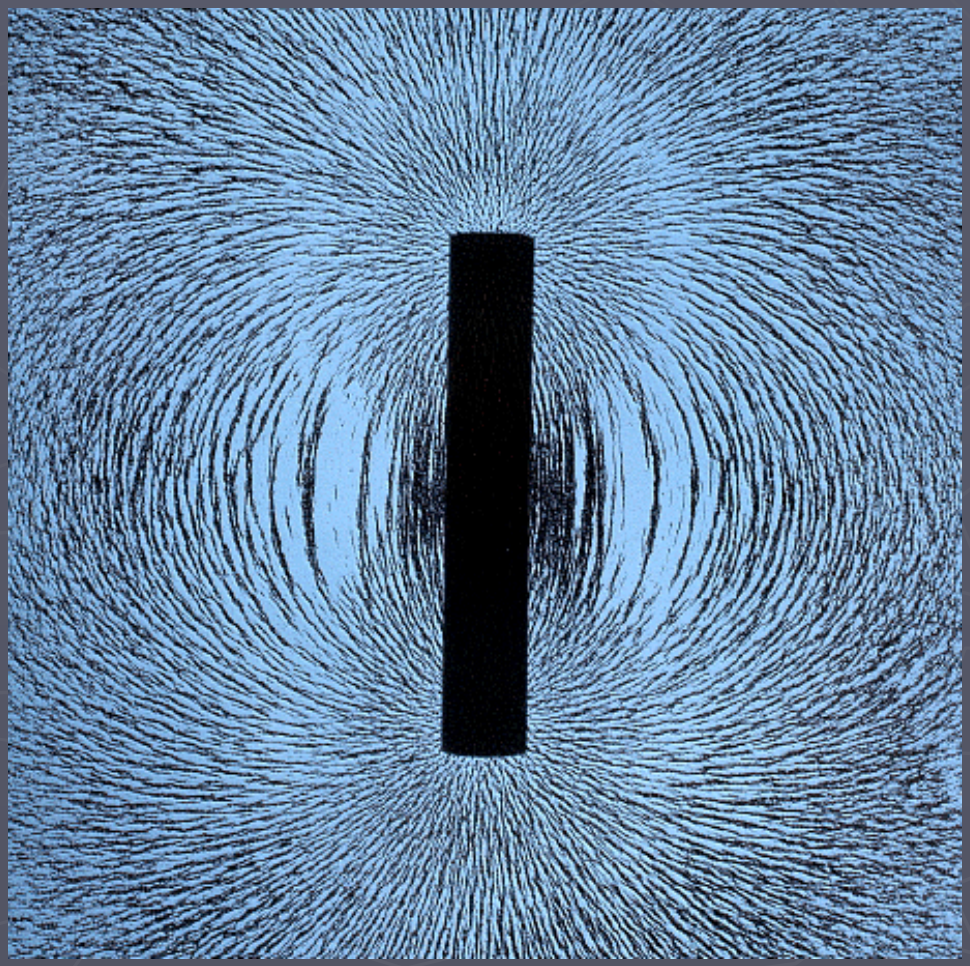
ELECTRICITY & MAGNETISM

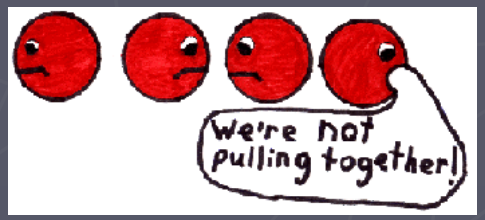


MAGNETISM

Invisible force of "push" or "pull" by an object with this property

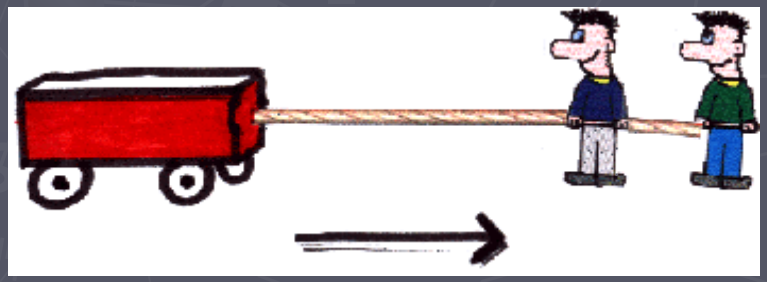
Wagon does not move;
forces are not lined up

Hi! We're e⁻ (electrons)!!!
We usually speed around the outside of the nucleus

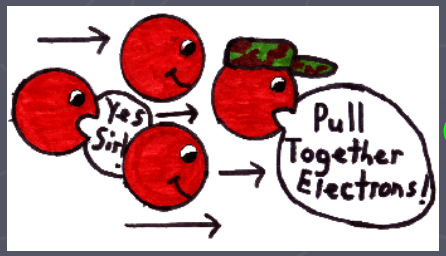


In these atoms, each e⁻ is going its own way

Wagon moves;
forces are lined up



But in a magnet or a metal, we can line up to become magnetic



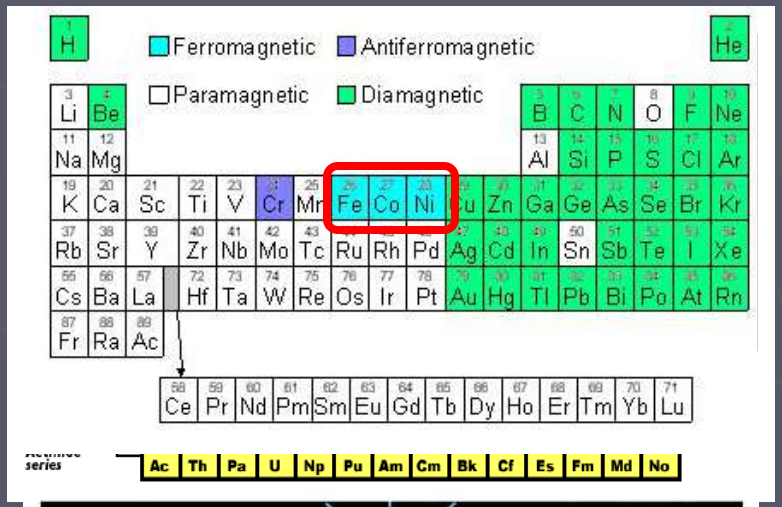
Lined up atoms/ electrons=Domain

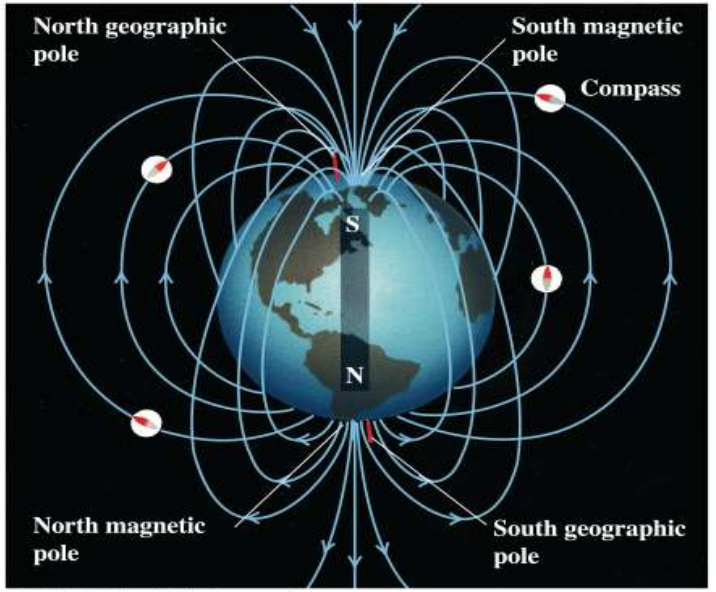
MAGNETS

Materials whose atoms can be aligned

Elements that can be magnetic

1. Fe: Iron
   soft iron loses magnetism easily
2. Co: Cobalt
   used to harden tools
3. Ni: Nickel
   used to make jewelry





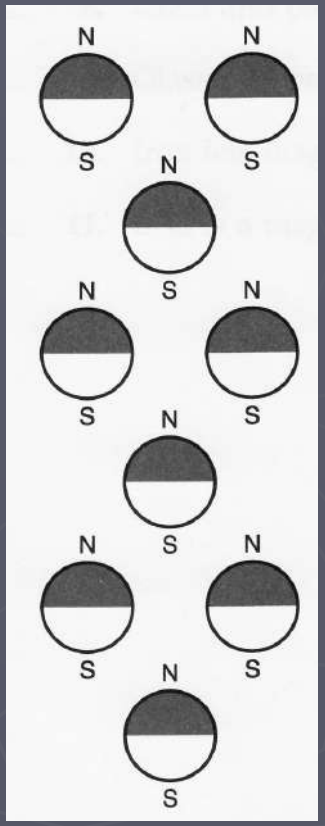
Other magnets:

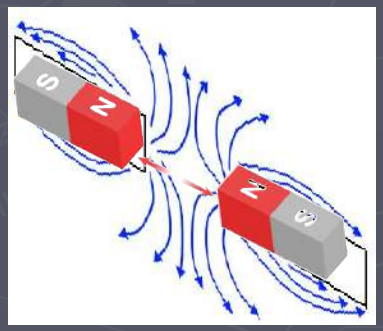
1. Compass
2. Earth

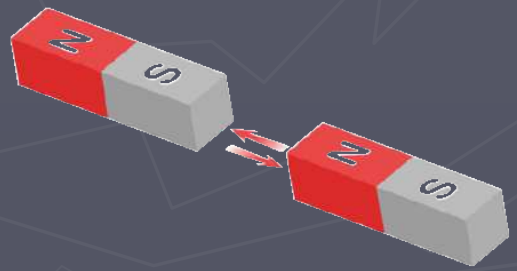
MAGNETS

Properties

1. Have domain (lined up atoms)
2. Have polarity (characteristic of magnetism)
   North-seeking pole ("normal")
   South-seeking pole ("reversed")
3. Cannot have only 1 pole
   *** magnetic poles cannot be isolated***
4. Like poles repel; Opposite poles attract







MAGNETIC FIELDS

An area where the force exists; area where force is felt

Magnetic field lines

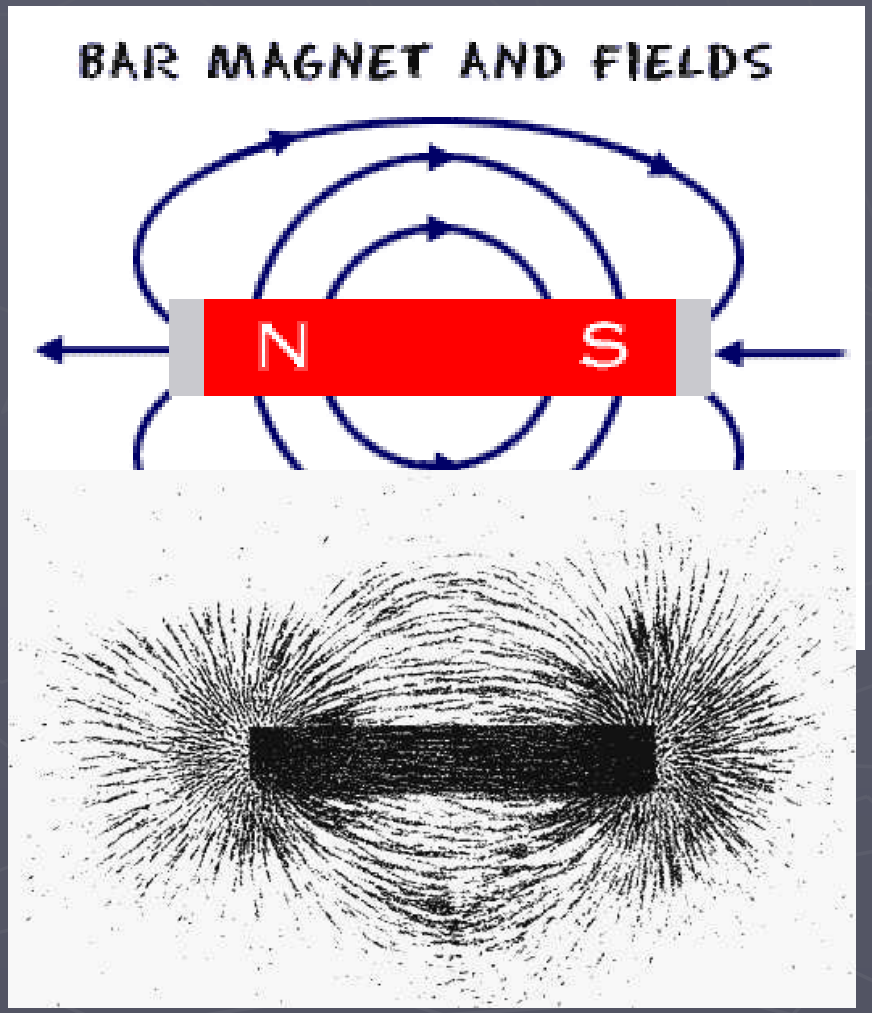
1. Leaves north pole & enters south pole

2. Lines closer together = stronger field

NOTICE

1. Strongest at the poles

2. Field lines start at the NORTH pole and travel towards the SOUTH pole

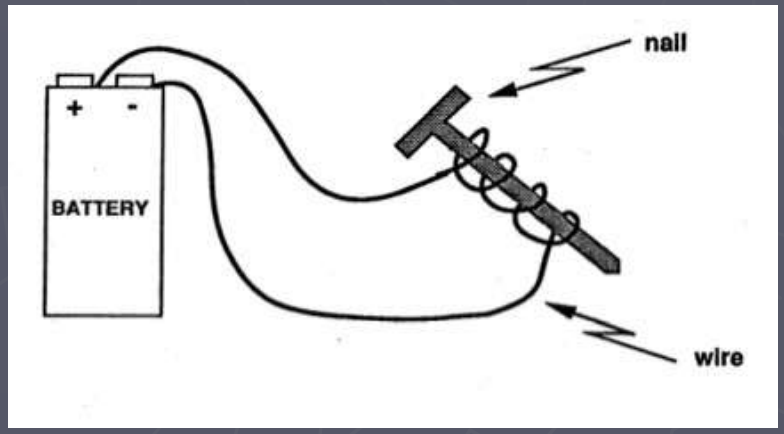


ELECTROMAGNET

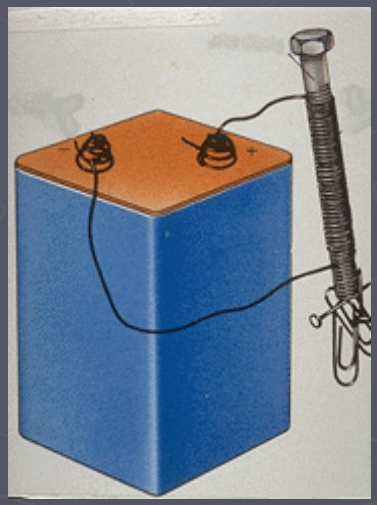
A magnet with a field produced by an electric current

Electromagnetism

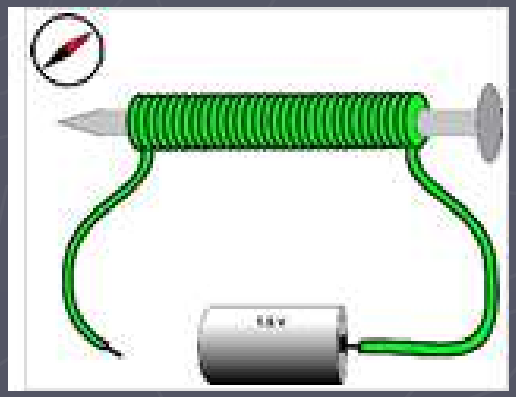
a moving charge (electricity) produces a magnetic field



- More coils of wire= more current = stronger magnet

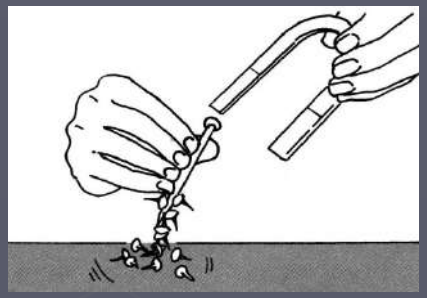


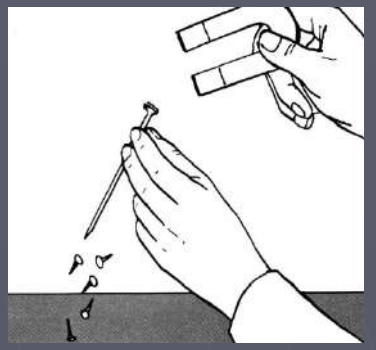
- Bigger battery = stronger magnet



INDUCTION

Causes a response

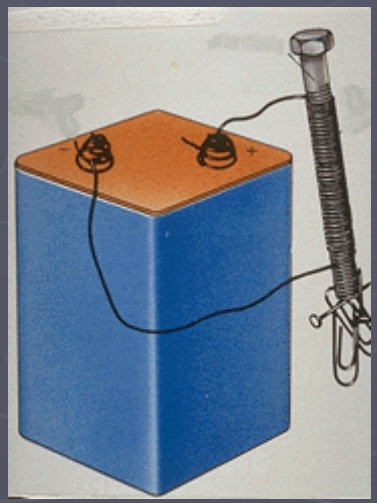




Example of induction:
Making something magnetic

- Induction by proximity:
  putting a magnet on an iron nail
  induces the nail to become magnetic

- Electromagnetic Induction:
  a moving charge (electricity) through
  coils around a nail induces the nail to
  become magnetic

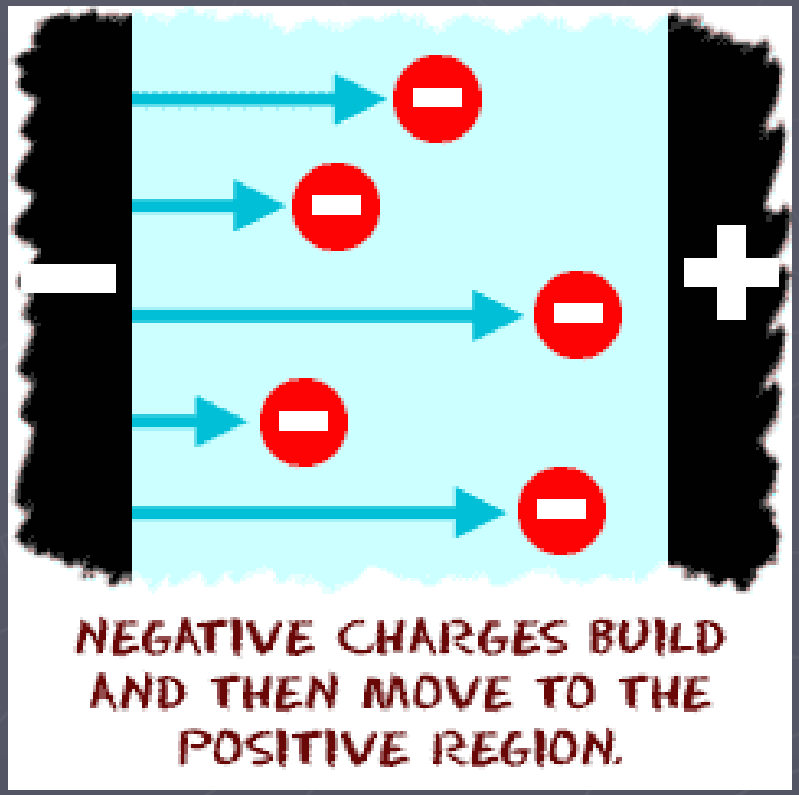


ELECTRICITY

The movement of electrons from one place to another

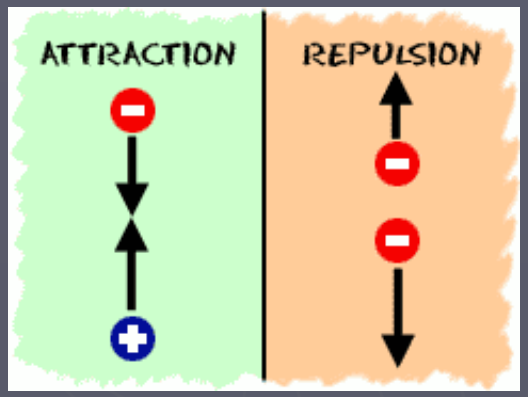
- **e^- movement**

  negatively charged area → positively charged area

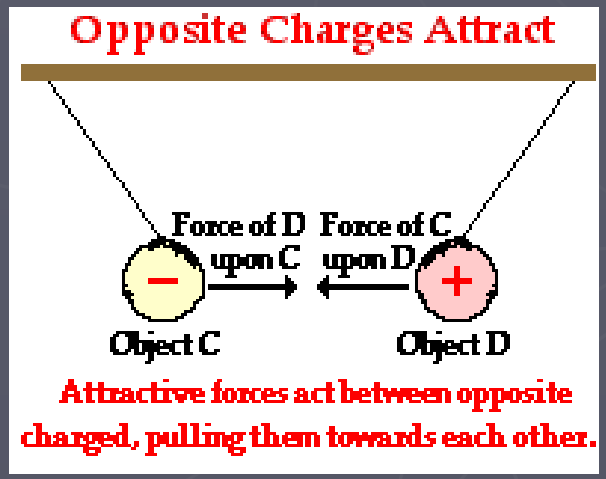


ELECTRICAL FORCES

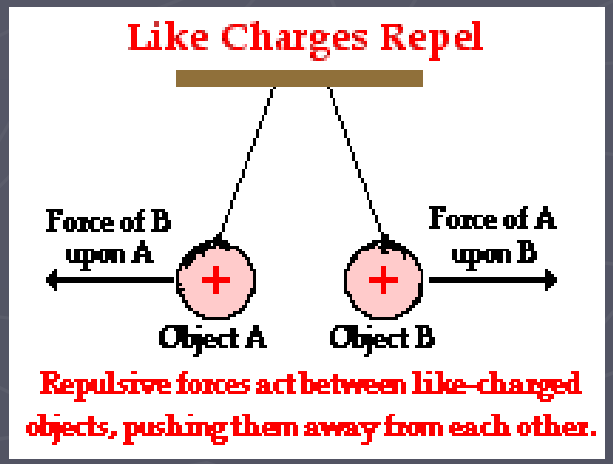
A force that one charge exerts on another



- **e^- and p^+**
  - attract one another
  - Opposite charges **attract**
    (+ and - charges)



- **e^- and e^- or p^+ and p^+**
  - repel one another
  - Like charges **repel**
    (- and - charges)



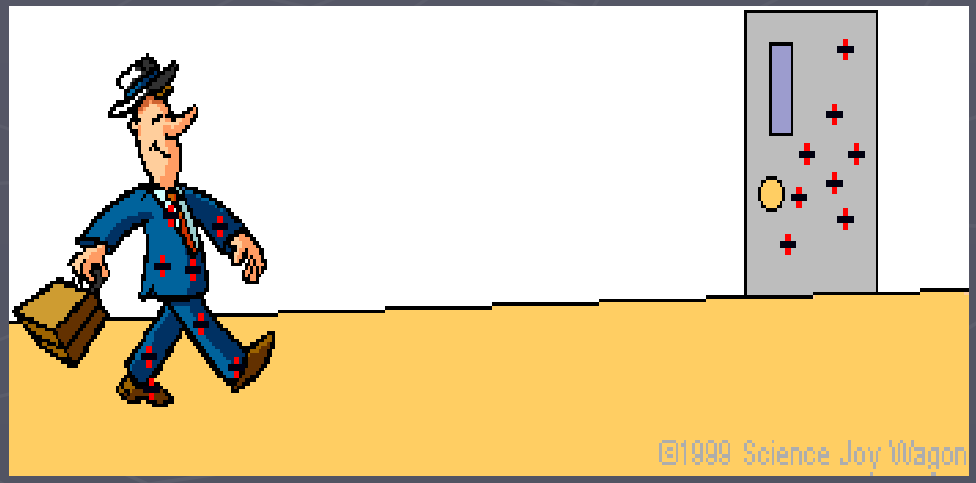
STATIC ELECTRICITY

Electrons are displaced WITHOUT moving through a conductor

e^- displaced & builds charge
(not moving through a conductor)
Eventually electrons "jump" to a positively charged object

Examples

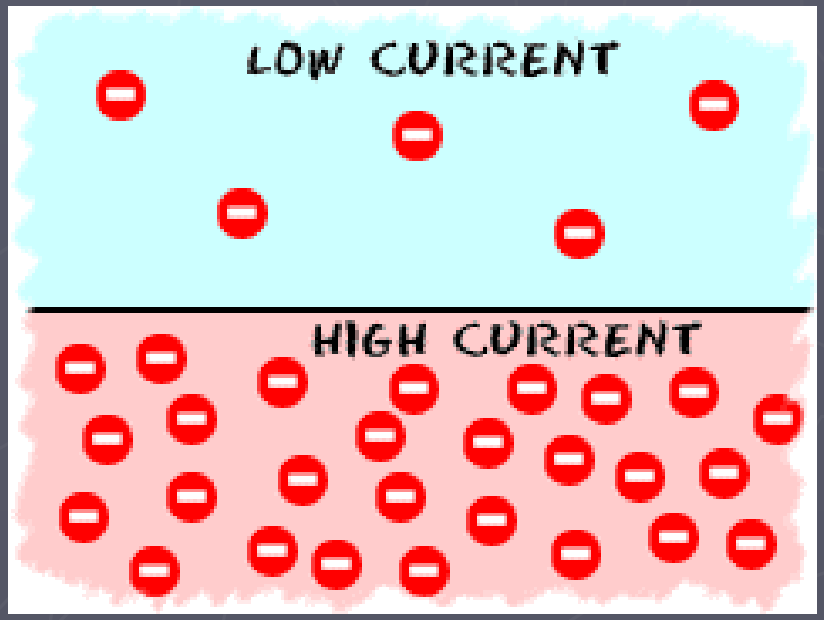
- Plastic sheet & hair
- Walking on carpet &
- Touching a metal doorknob



CURRENT ELECTRICITY

The flow of electrons

- **Flow from negative to positive**
- **Electric current: I**
  unit = amp (electrons/second)
- **Current occurs when charges at the ends of a conductor are different**



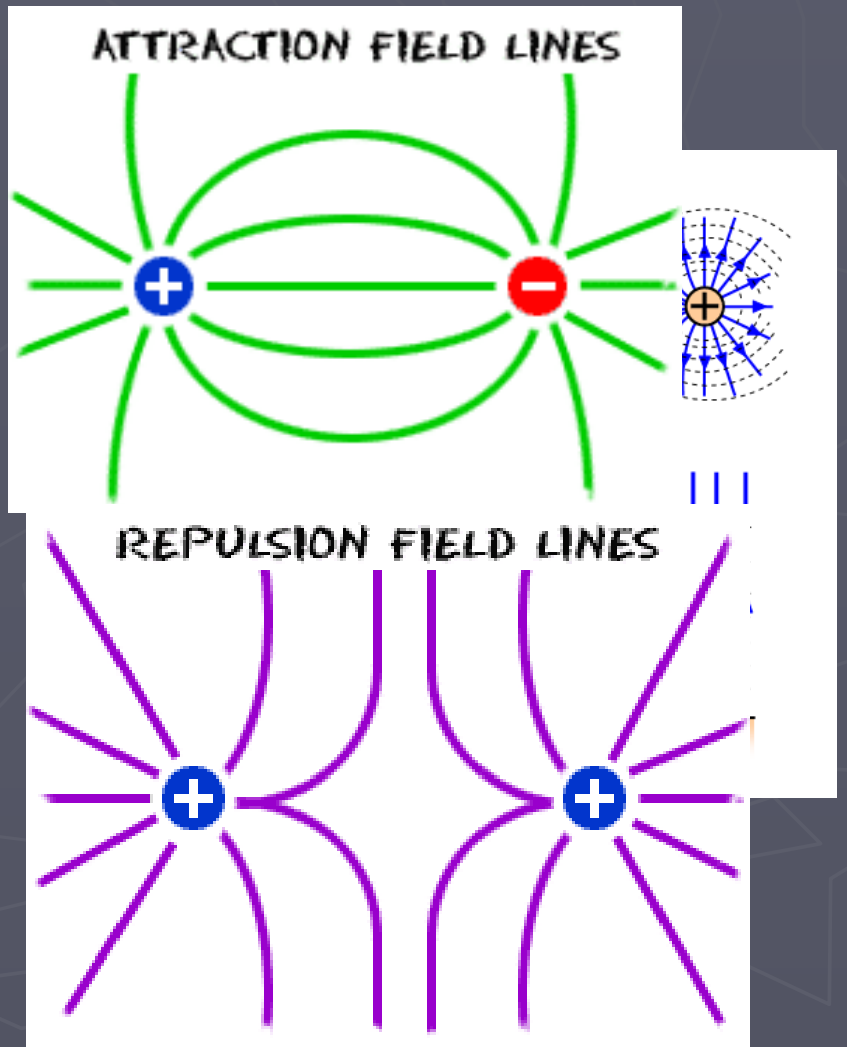
ELECTRIC FIELDS

A force field that fills the space around electrical charges

Electrical field

two charges are separated

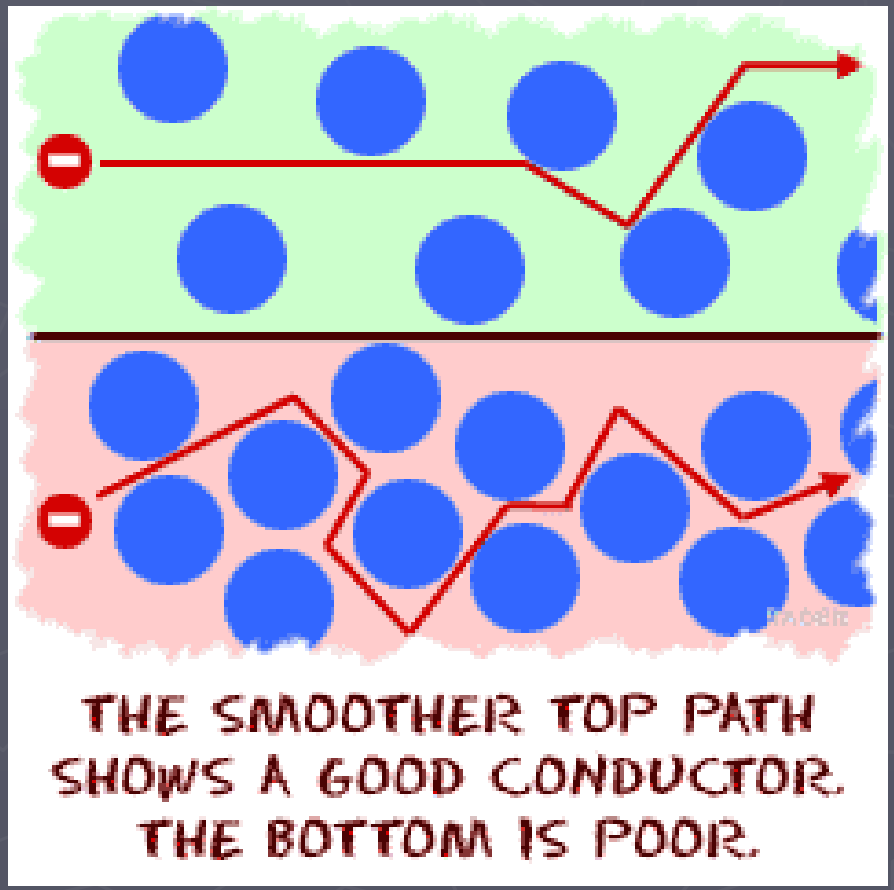
- vectors (lines of force) point towards negative charges and away from positive charges
- strength of field (magnitude)= distance between two charges
- closer particles = stronger field



CONDUCTORS

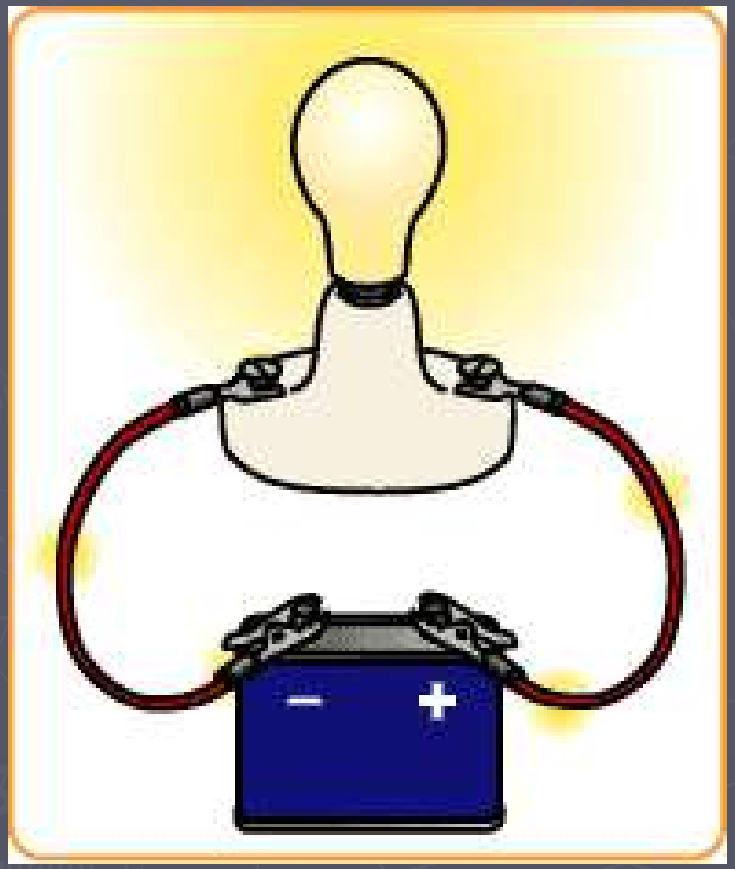
A material, usually a metal, through which electrons can flow

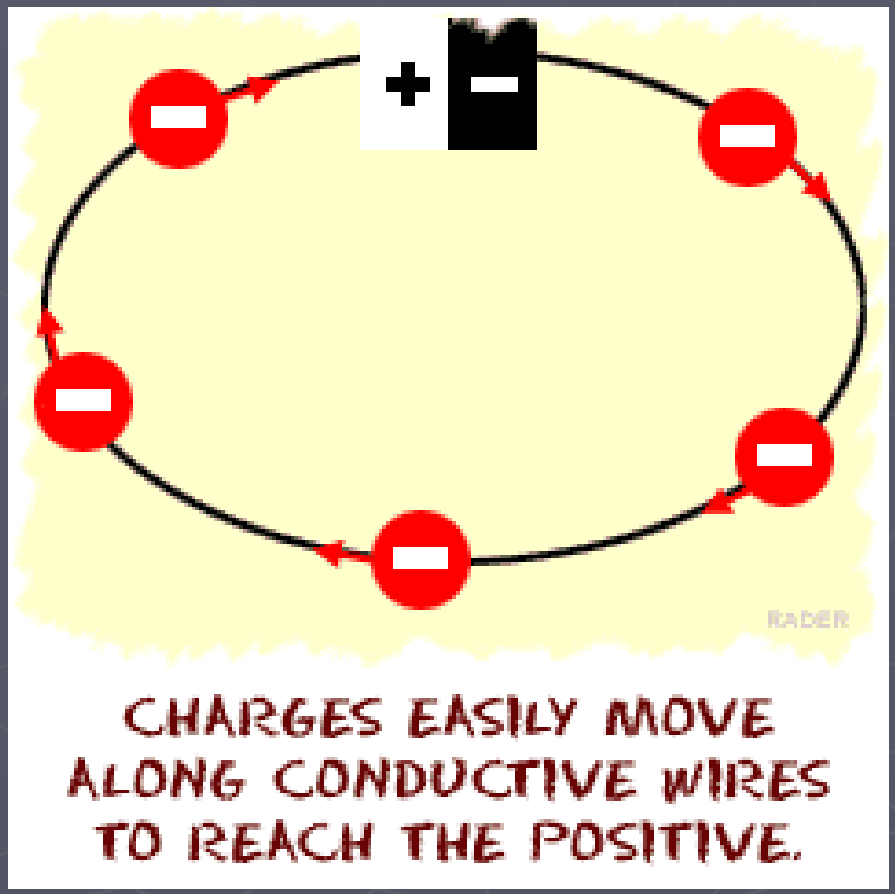
- good conductor
  electrons able to move freely within the atoms of the material
- poor conductor or insulator
  electrons are not free to move about the atoms of the other material



ELECTRIC CIRCUIT

A path that allows electrons to flow from negative to positive

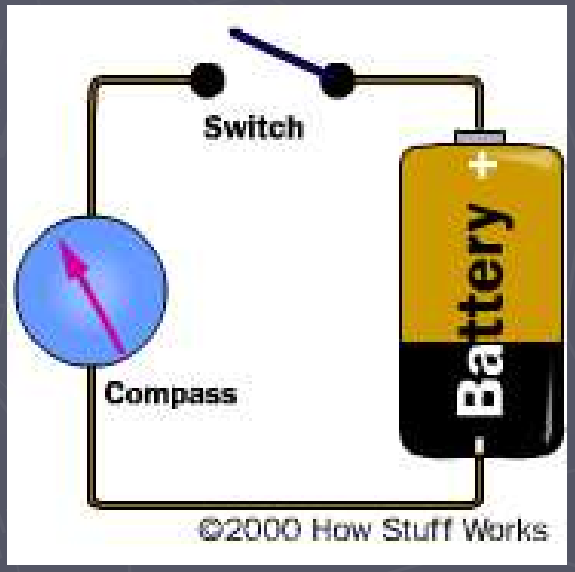


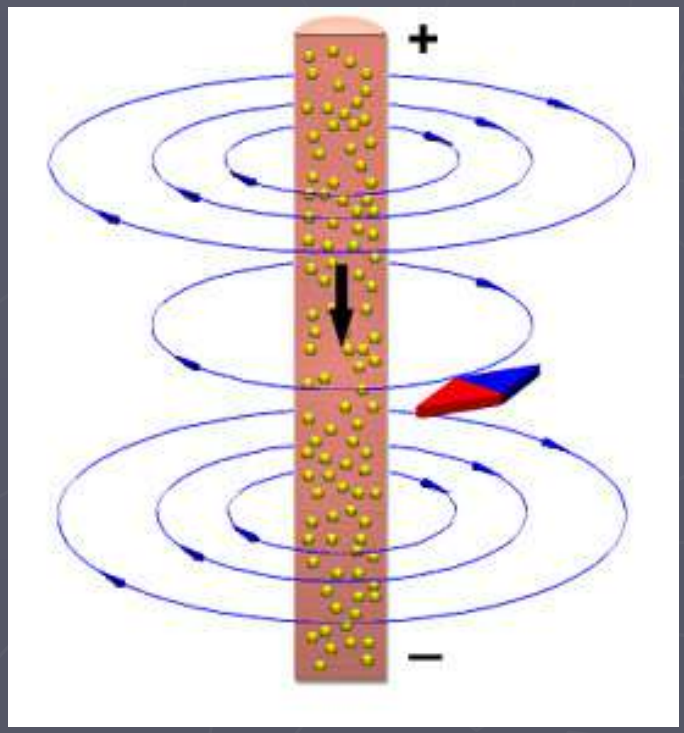


ELECTRICITY → MAGNETISM

Electric currents cause magnetism

- **How can you tell?**
  Compass needle moves when near electrical current - creating an magnetic field





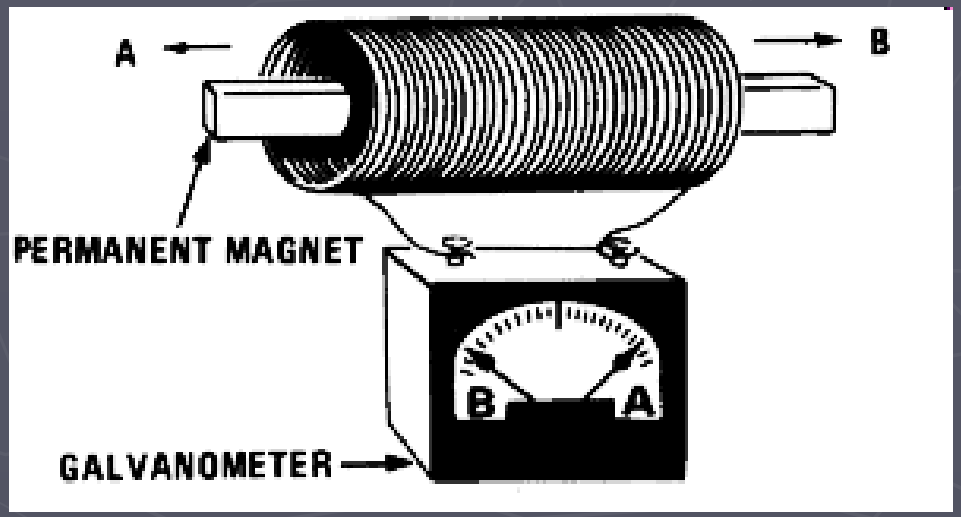
MAGNETISM → ELECTRICITY

Moving magnet can generate electricity

- **How can you tell?**

Electromagnetic induction

moving a magnet in and out of a coiled wire created an electrical current without a battery

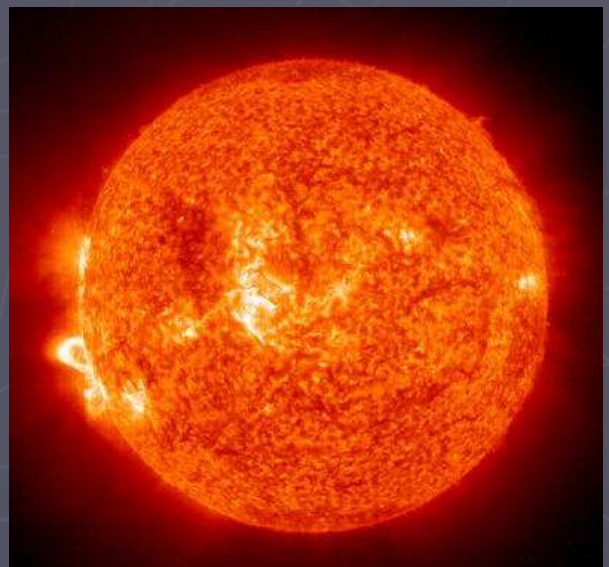


PLASMA

Superheated m
bound to nu

Plasma

- **4th state of matter**
- **Highly conductive**
- **Highly magnetic**
- **On Earth = Northern(Southern)lights**
- **On Sun causes**
  sun spots, flares, prominences &
  Coronal Mass Ejections
  (CME – where plasma escapes to earth)



SUMMARY OF E & M

E = Electricity and M = Magnetism are related!!

ELECTRICITY

- Can be + or -
- Can flow (current)
- Can jump (static)

MAGNETISM

- Both can cause each other
- Can NOT have only 1 pole
- Can be Normal (N) or Reversed (S) pole
  - Likes repel
- Can move through field
  - Opposites attract
- Causes sun spots, flares, CME