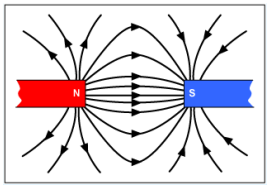
Chapter 11

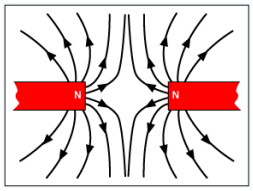
Magnetism & Electromagnetism

Magnets

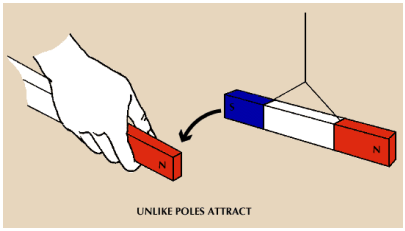
- A special stone first discovered <2000 years ago in Greece, in a region called "**Magnesia**", attracted iron, they called it "**magnetite**" hence the "magnet" name.
- 2. About 1000 years ago they noticed that a hanging magnet always pointed to the North Star A.K.A "**Lodestar**". Hence the other name for naturally occurring magnets – "**lodestone**"



Magnetic Poles

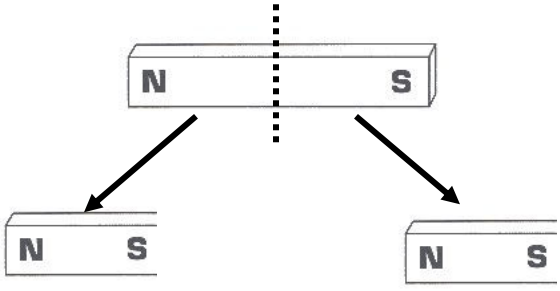


- **Magnetic Poles** – the ends of the magnet, area where the magnetic effect is the **strongest**.
- If a bar magnet is suspended by a thread or string, it will align itself so that one strong end points north and the other points south, hence the names for the "North" and "South" poles of the magnet.
- **Like poles of separate magnets repel** – push away from – each other
- **Unlike poles attract each other**



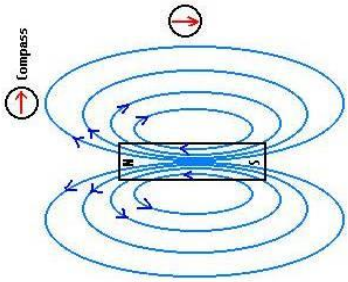
Magnets

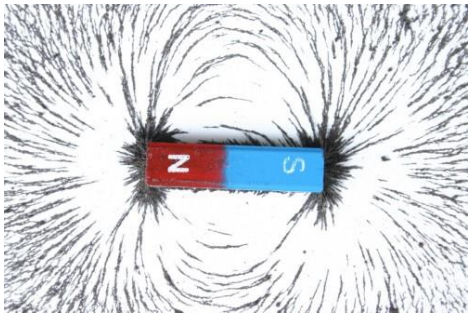
- If you snap a magnet in half, the inside pieces become the opposite poles:



Magnetic Fields

- that region around a magnet that is affected by the magnet. Strongest at the poles, the Force forms lines that go out of the North Pole and wrap back around to enter in at the South Pole.

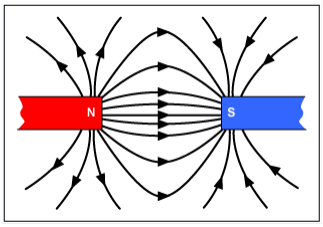




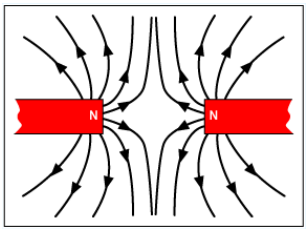
Attract & Repel

- Magnets attract because force comes out of North Pole and goes into the South Pole

Attraction



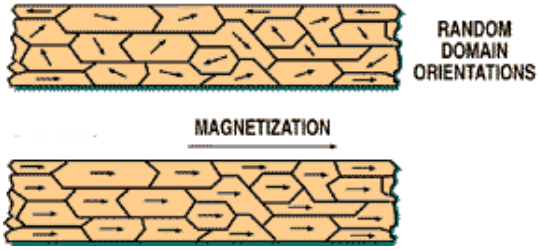
Repulsion



- Magnets repel because the forces are pushing away from each other

Inside a Magnet

- At the atomic level, there are **protons** (+ charge) & **neutrons** (neutral charge) in the nucleus, and **electrons** (- charge) spinning in orbits around the nucleus. The moving electron acts as a mini electrical charge and therefore has a magnetic field associated w/ it.
- In ferrous materials clusters of atoms align there atoms w/ one another. A cluster of billions of atoms w/ magnetic fields aligned is called a **domain**.



Inside a Magnet

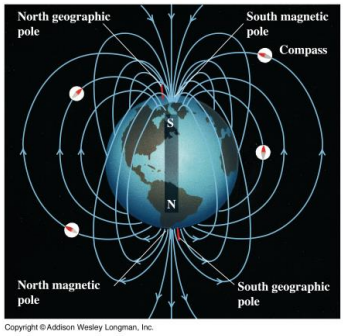
- When domains are randomly arranged – forces cancel each other out. – no net magnetic affect
- When domains have their magnetic affect in alignment - forces are additive and create a strong magnetic affect

Making Magnets

- Since Magnetism and electricity are so closely related, it is relatively easy to make magnets
- **Temporary magnets** – materials that become magnetized while in contact w/ strong magnets – ie a paperclip is able to pick up more paper clips when stuck to a strong magnet
- **Permanent magnets** – materials that maintain their magnetism when the magnet is removed from it.

Magnetic Earth

- **Earth's core is Iron** – Earth is a giant magnet
- Earth's magnetic north pole is not the same as Earth's axis north pole. It is about 1250 km (776 miles) away from the **true north** pole
- The angle between true north and magnetic north is **the magnetic declination**.



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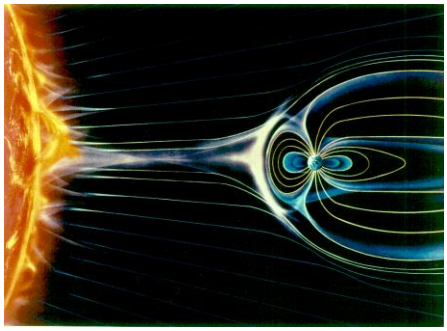
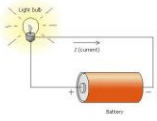
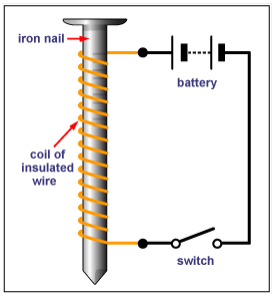


Electric Current & Magnetic Fields

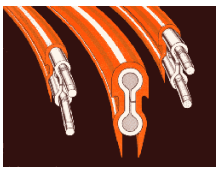
- When electric charges run thru a wire they create an electric current – a flow of charge thru a material
- An electric current produces a magnetic field
- An electric current through a coil of wire around a nail produces a magnet
- Electric circuit – a complete path through which electric current can flow
  - Each circuit has a source of electrical energy
  - Have devices that are run by the electric current
  - Connected by conducting wires and a switch





Conductors & Insulators

- Conductors allow current to flow easily
  - Their electrons are loosely bound to their atoms
  - Metals – copper, silver, iron, superconductors
- Insulator – do not allow current to flow easily
  - Electrons are tightly bound to atom
  - Plastic, wood, rubber, sand, glass



That's All Folks!!

- No mas Chapter 11!!