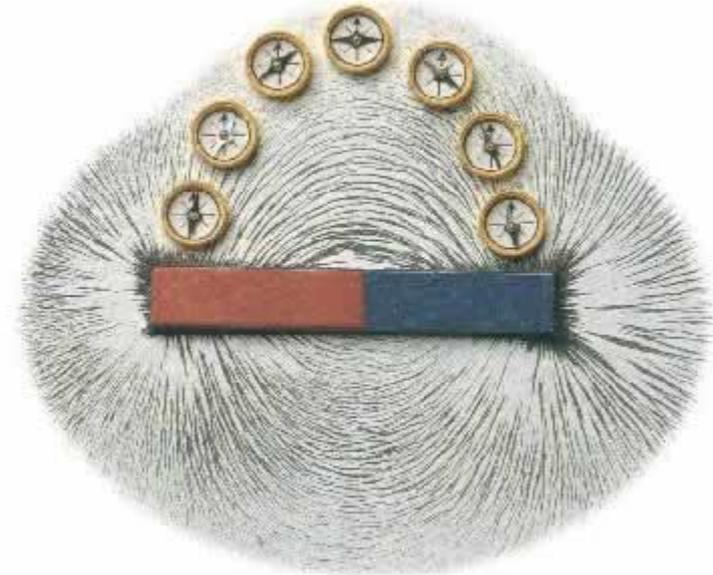
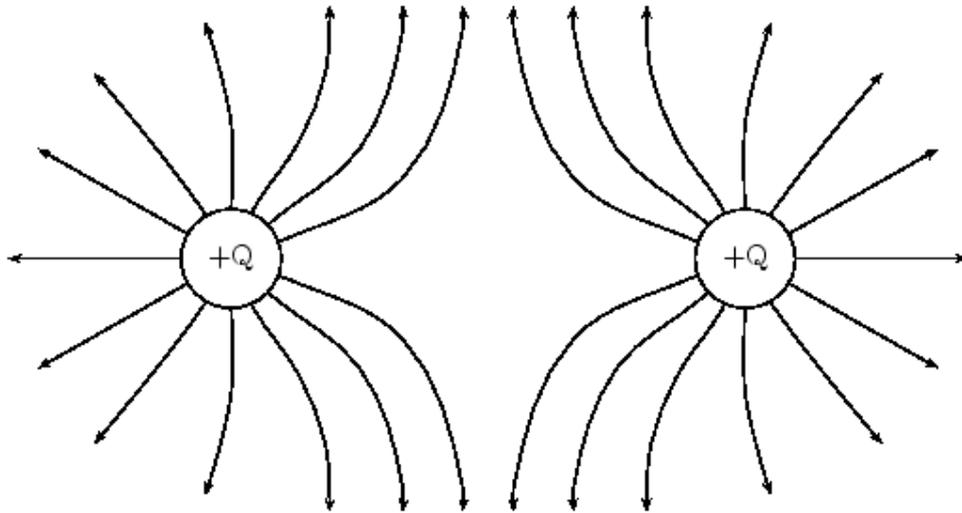
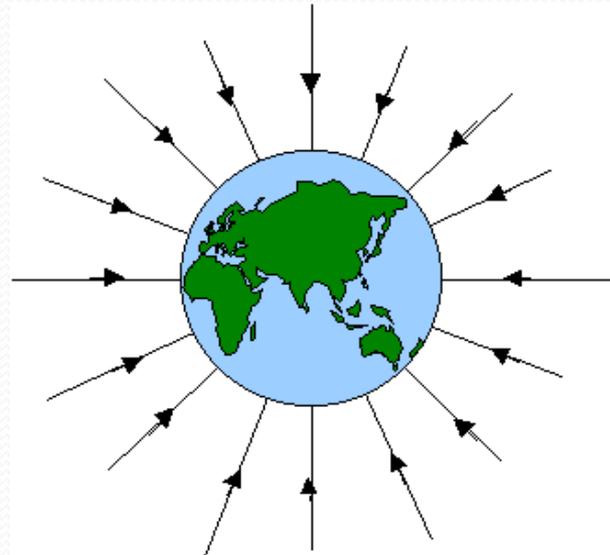


Magnetic Fields

Review: Fields

- Gravitational
- Electric
- Magnetic



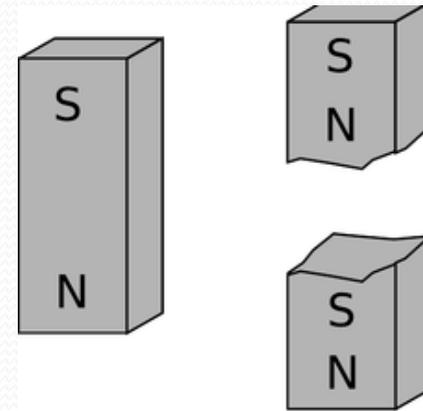
Where do we use magnetic fields?

- TV screens, MRIs, speakers, microphones, motors, generators, compasses, burglar alarms, transportation..
- Northern Lights – Solar wind (charged particles) can get caught in the Earth's magnetic field, and when they collide with the atoms in the atmosphere, light is produced.
- <https://www.wAYKBBSc>



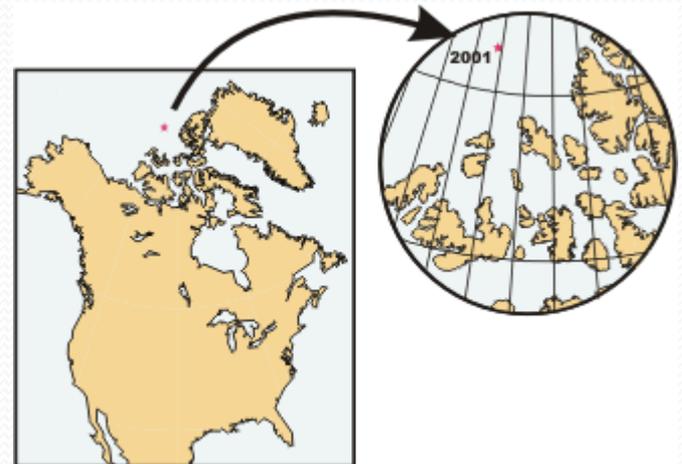
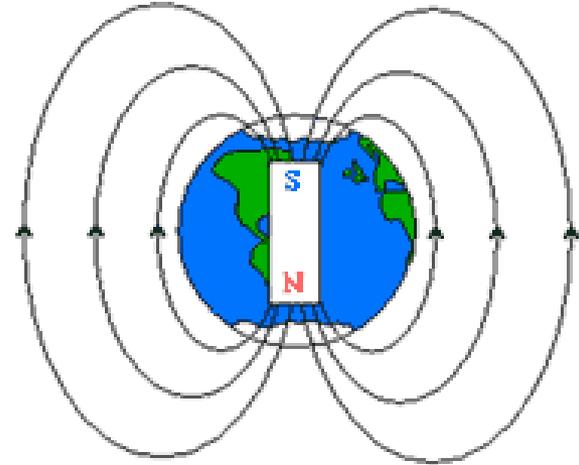
Magnets

- Humans have known about magnets for 200 years. The first use of magnets as a compass was in China.
- Magnetism is caused by poles – north and south
- Opposite poles attract, like poles repel
- If you break a magnet in half, you get 2 smaller magnets. It is impossible to get a monopole (as far as we know). (See Big Bang video)



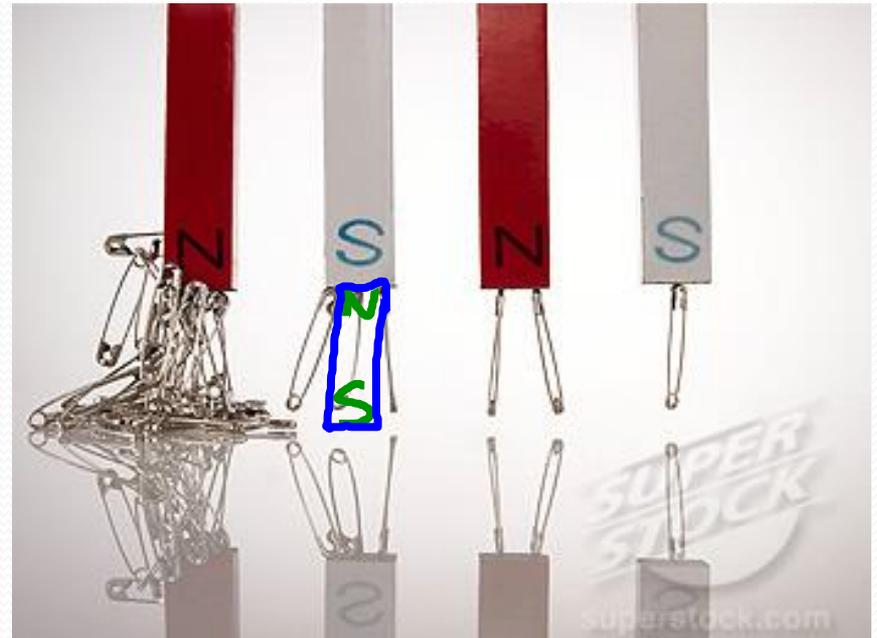
Earth's Magnetic Field

- The north and south geographic poles mark the positions where the lines of longitude meet.
- The north and south magnetic poles are reversed, and in different locations than the geographic poles. (South Magnetic Pole is actually in northern Canada)



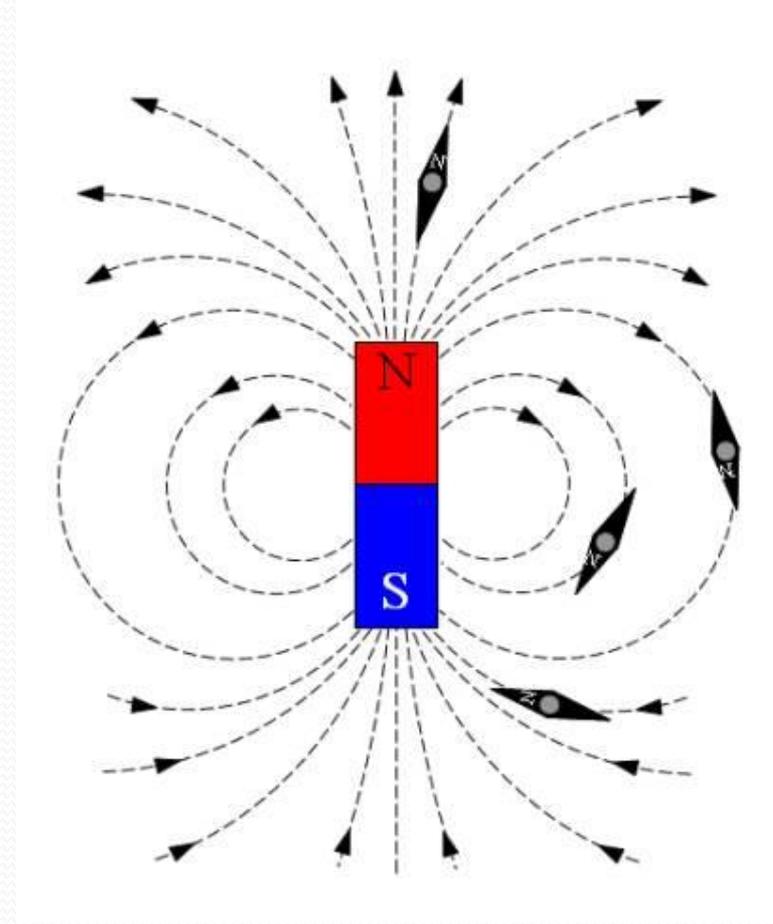
Why are metal objects attracted to both poles of a magnet?

- Some metals are have magnetic properties, and can be made into permanent or temporary magnets.
- Iron, nickel, cobalt, and neodymium*.



Magnetic Field Lines

- Remember – magnetic field lines are not real, they help us visualize what the field ‘looks’ like.
- Same rules as for electric field lines, but lines start on north poles and end on south poles (they show the direction a north pole would experience a force)



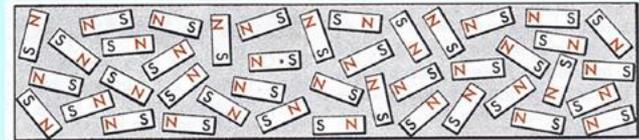
Domain Theory

- All materials are made up of tiny regions called domains.
- Domains are like little magnets.
- When domains are random – magnetic effect cancels.
- When domains are aligned – material is magnetized.

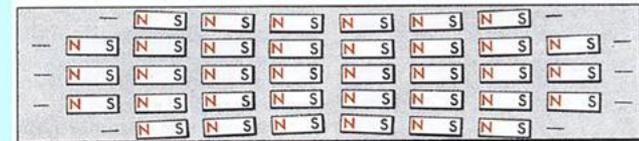
Magnetic Domains Theory

Groups of atoms acting like tiny bar magnets.

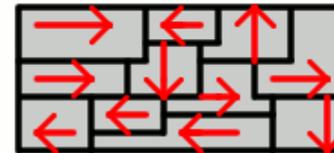
Unmagnetized.



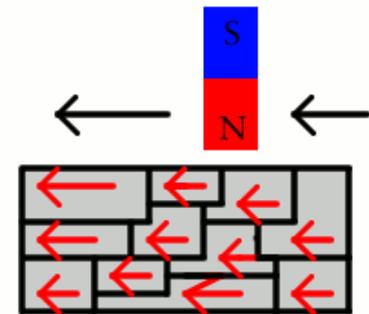
Magnetized.



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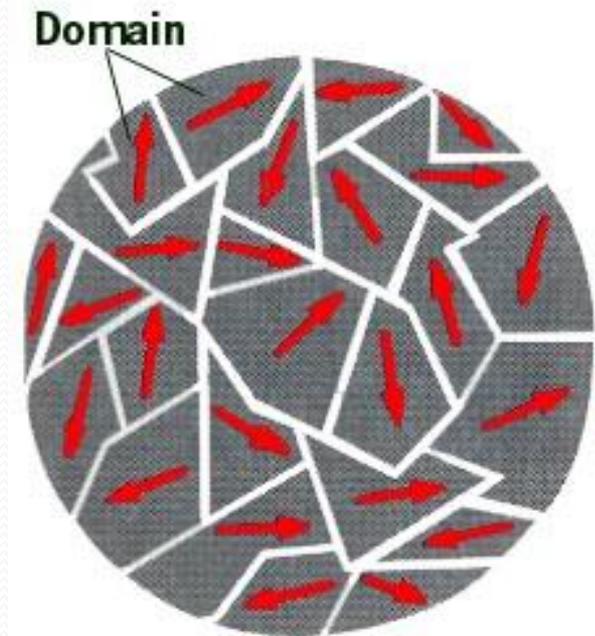
UNMAGNETIZED



MAGNETIZED

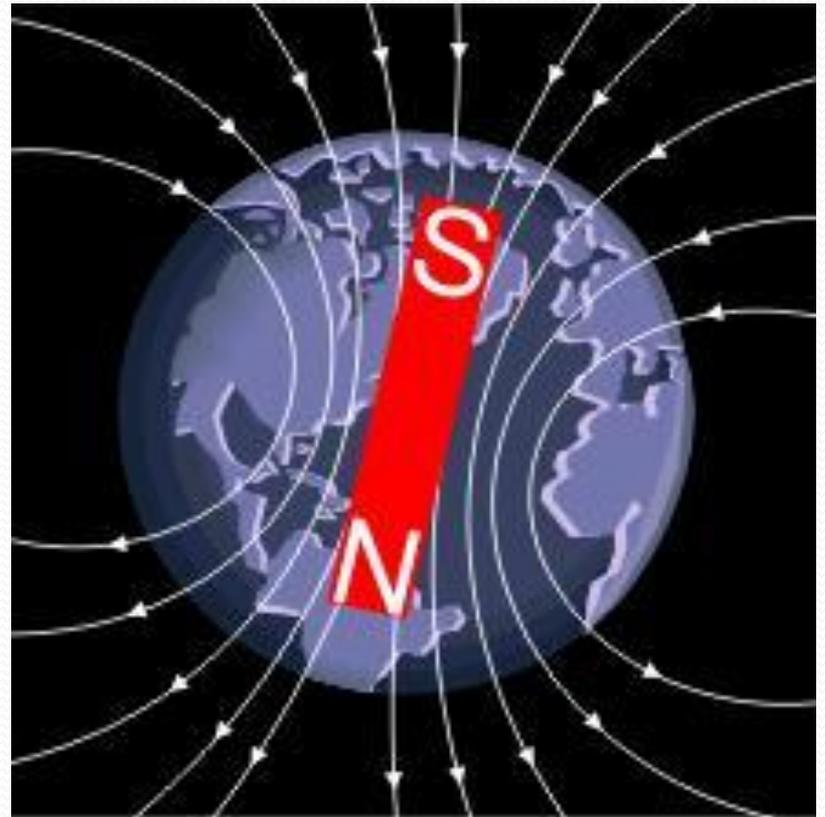
Domain Theory

- The polarity of each domain is determined by the direction of the electron spins.
- Repeatedly dropping, banging, or heating a magnet disturbs the alignment and weakens the magnet.
- <https://www.youtube.com/watch?v=hFAOXdXZ5TM>
- <https://www.youtube.com/watch?v=IlnZKSR73So>



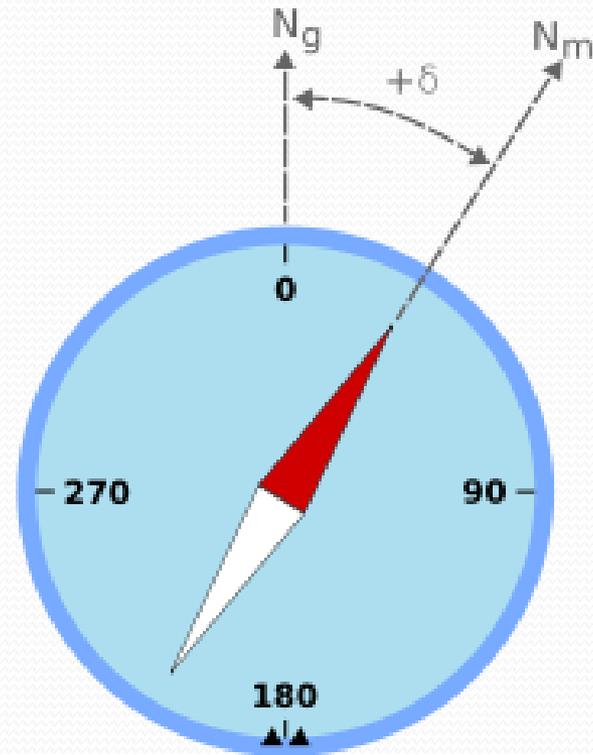
Earth's Magnetic Field

- Earth is like a giant magnet.
- The magnetic field is caused by the rotation of Earth's outer core (which contains Fe and Ni). This creates a current, which produces a magnetic field.



Angle of Declination

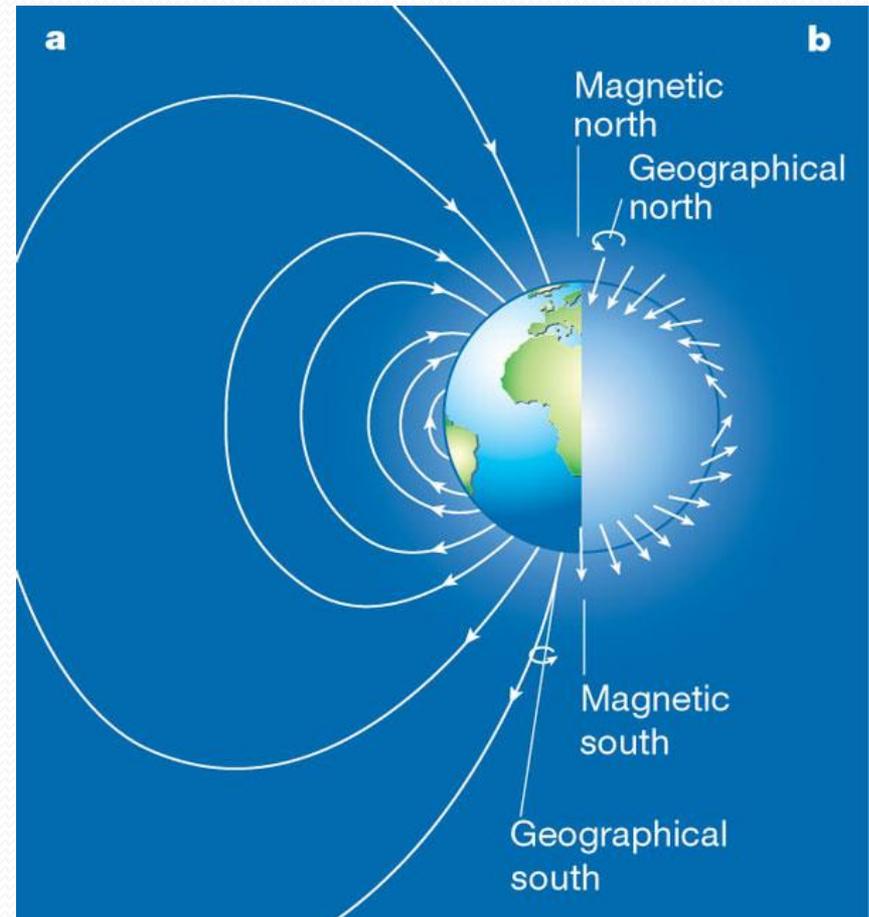
- Difference between true north and magnetic north.





Angle of Inclination

- Angle created between the Earth's magnetic field and the Earth's surface.
- Equator – parallel - 0°
- Magnetic Poles – perpendicular - 90°
- Some animals can detect this and use it for migration.
- <https://www.youtube.com/watch?v=EbHskZySTBw>



Paleomagnetism

- Rock magnetic data on ocean floors led scientists to plate tectonics and continental drift.

