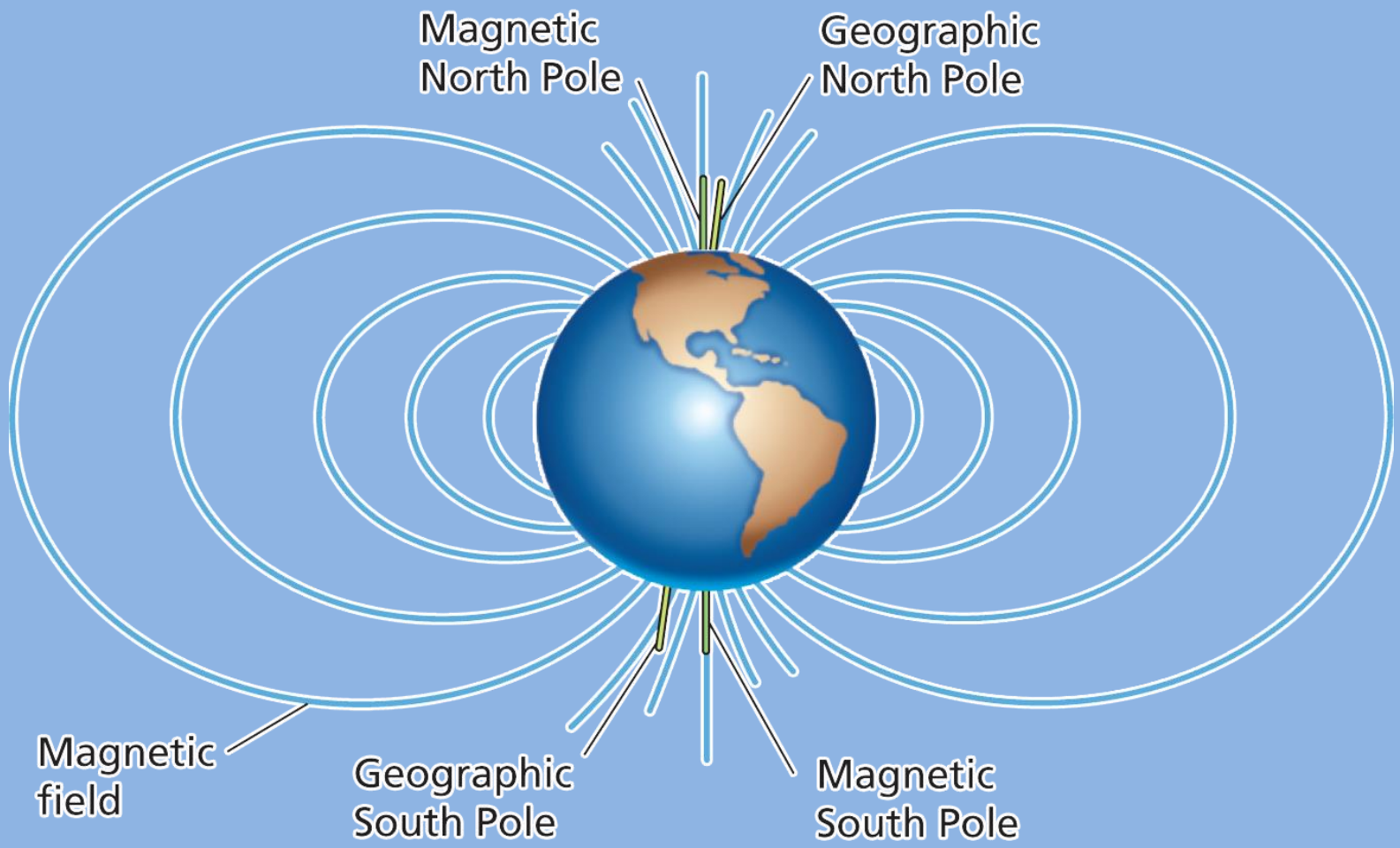
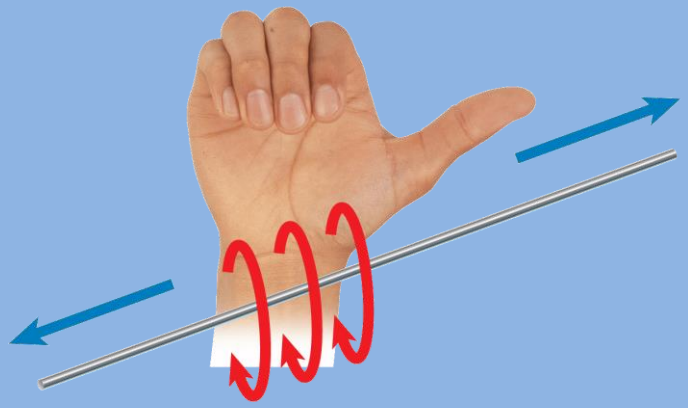


Chapter 21
Magnetism



Focus Questions

LESSON QUESTION

1. Explain the nature of magnetic force.
2. Interpret magnetic field diagrams.
3. Explain how materials are magnetized.
4. Explain how electromagnets are produced.
5. Explain how electricity is generated.
6. Describe how a transformer operates.

WARM-UP

Electricity

Name and describe the two types of electricity.

WARM-UP

Electricity

Static Electricity vs. Electric Current

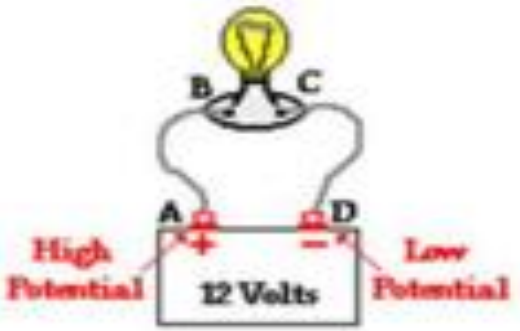
Positive & negative charges build up, allowing electrons to jump from atom to atom, releasing energy in a one time event.

Static electricity is a one time event.

Lightning, scuffing one's feet and touching metal

Alternating or Direct current (usually electrons) that flows constantly.

Electric current is a constant flow.



Current is broken up by a gap in the circuit (e.g. switch).

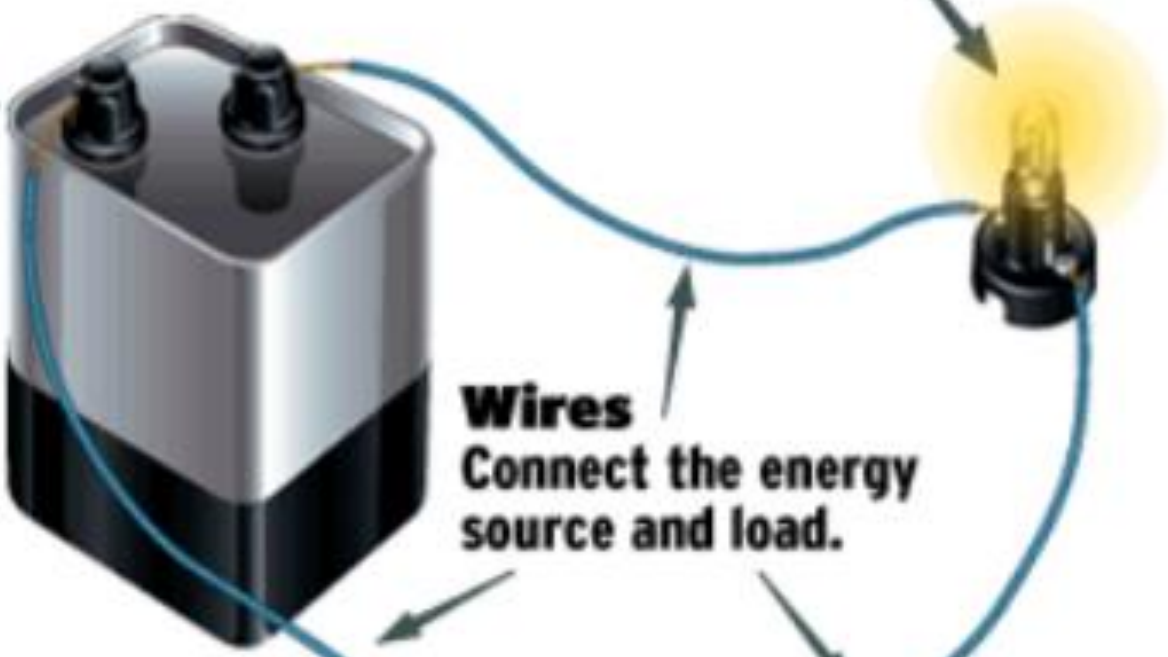
Name Four Major Parts of Circuits

WARM-UP

Four Parts of the Circuit

Energy Source
Provides the "push" that makes current move around a circuit.

Load
Converts electrical energy to another form (in this case, light and heat).



Wires
Connect the energy source and load.

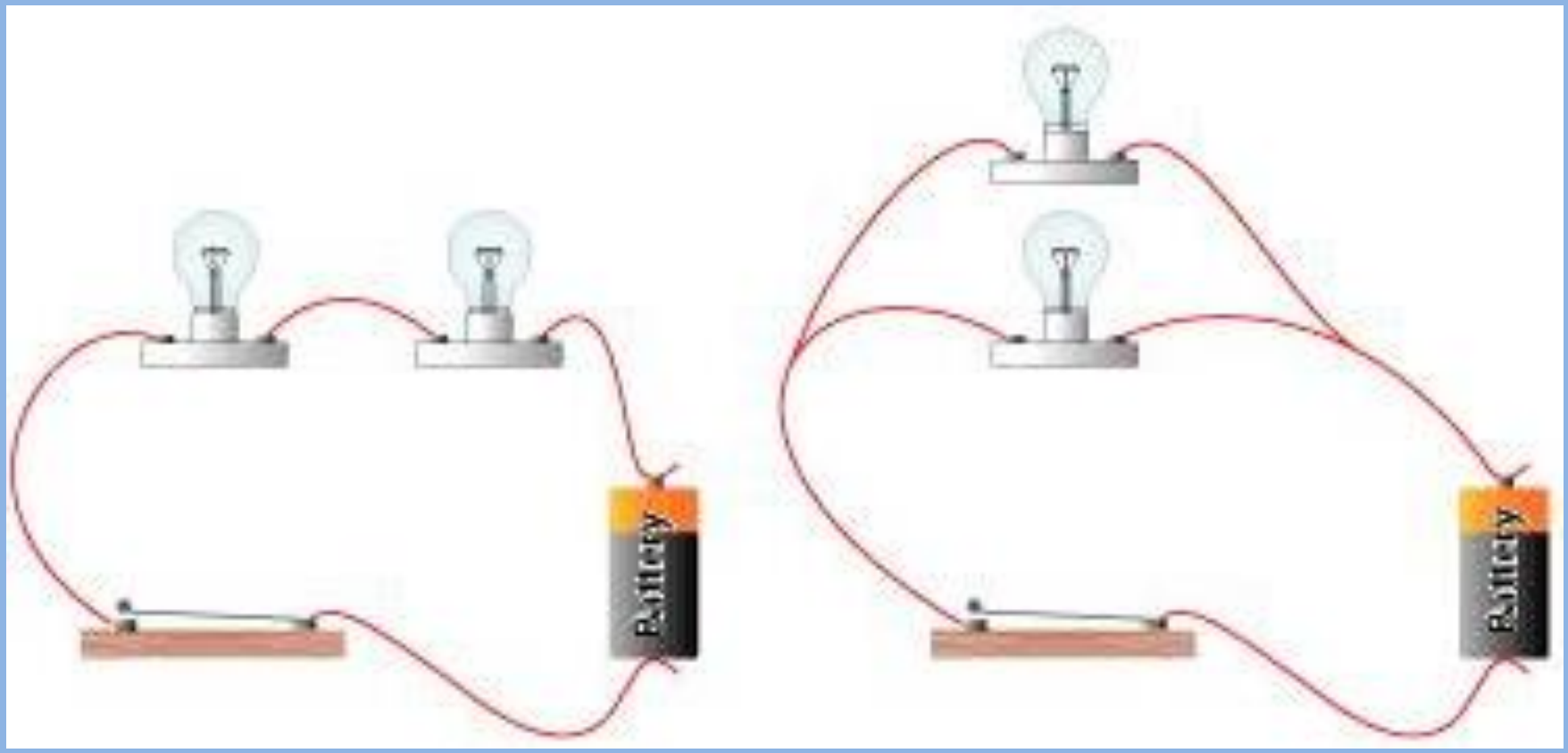
Switch
Opens and closes the circuit.

WARM-UP

Types of Circuits

THINK ABOUT IT

Name and describe two types of circuits.

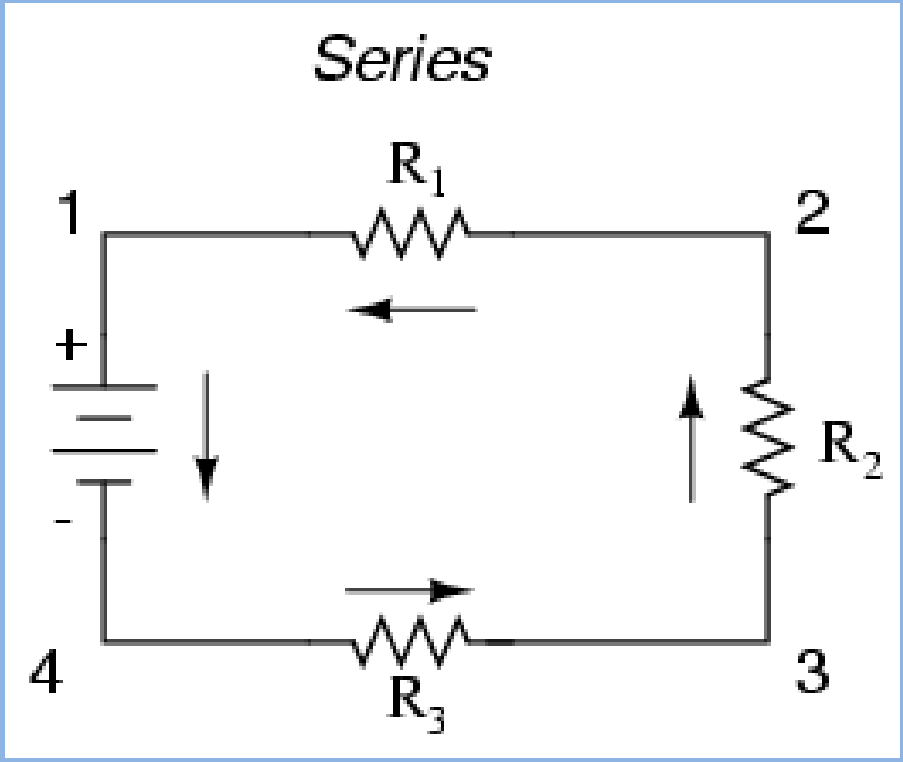


Series & Parallel

Same current across resistors

ONE loop of current

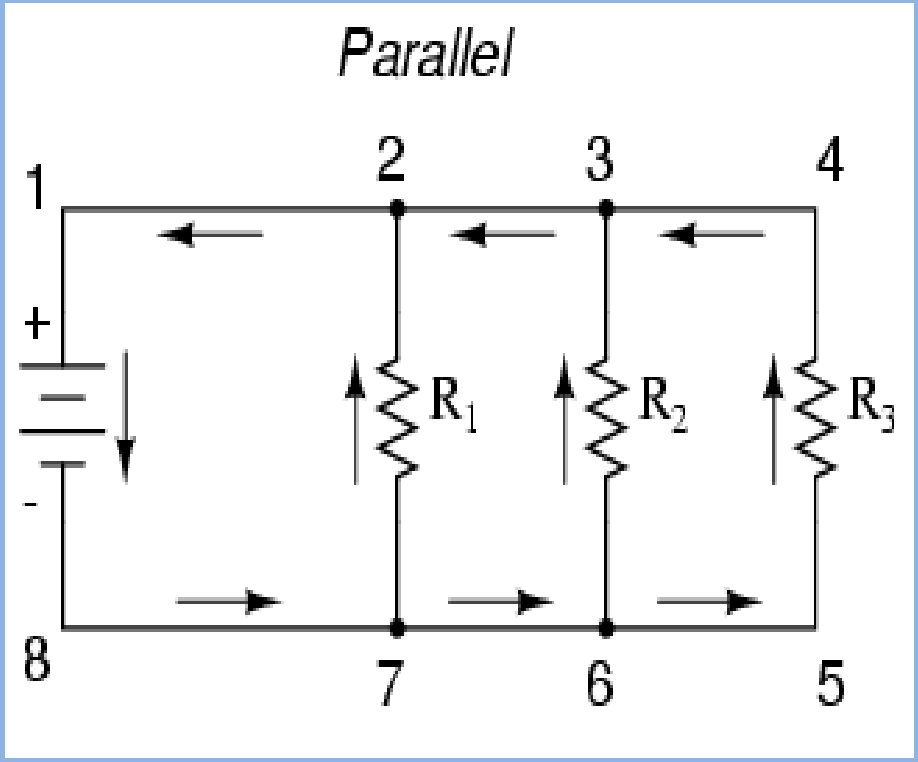
E.g. flashlights



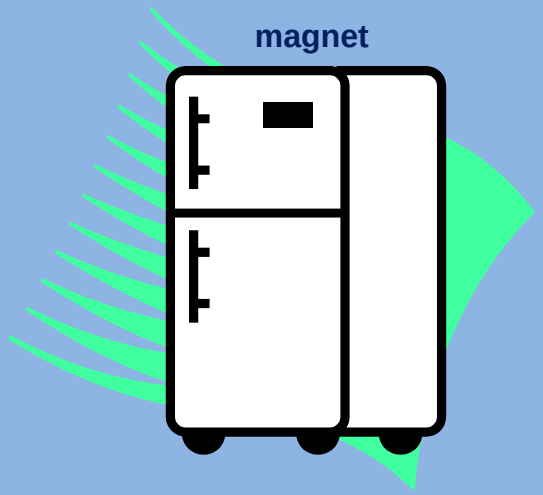
Same voltage across devices

Multiples loops of current.

E.g. house, industry

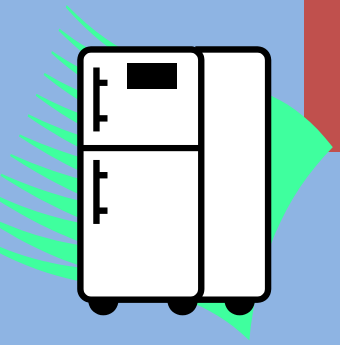


Electromagnetism



– Make a list of other magnetic effects you have observed

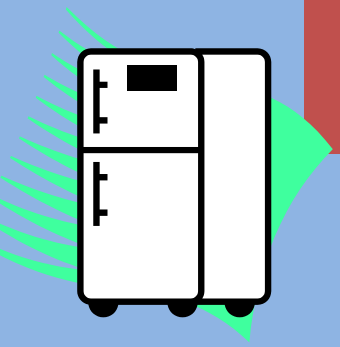
– Make a list of static electricity effects you have observed



Electromagnetism

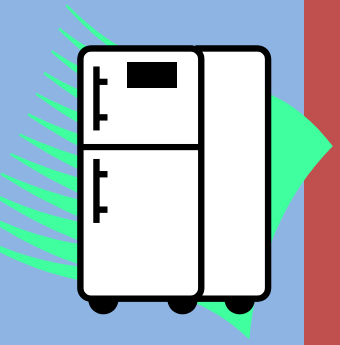
– Make a list of similarities between magnetism and static electricity

– Make a list of differences between magnetism and static electricity



Electromagnetism

	Examples	Similarities
Magnetism	Engines; stick up magnets; MRI; credit cards; generators; Detectors	Attraction Repulsion Force Fields Energy Induction Conduction
Static Electricity	Lightning; static cling; Van der Graaf machine; static shocks	



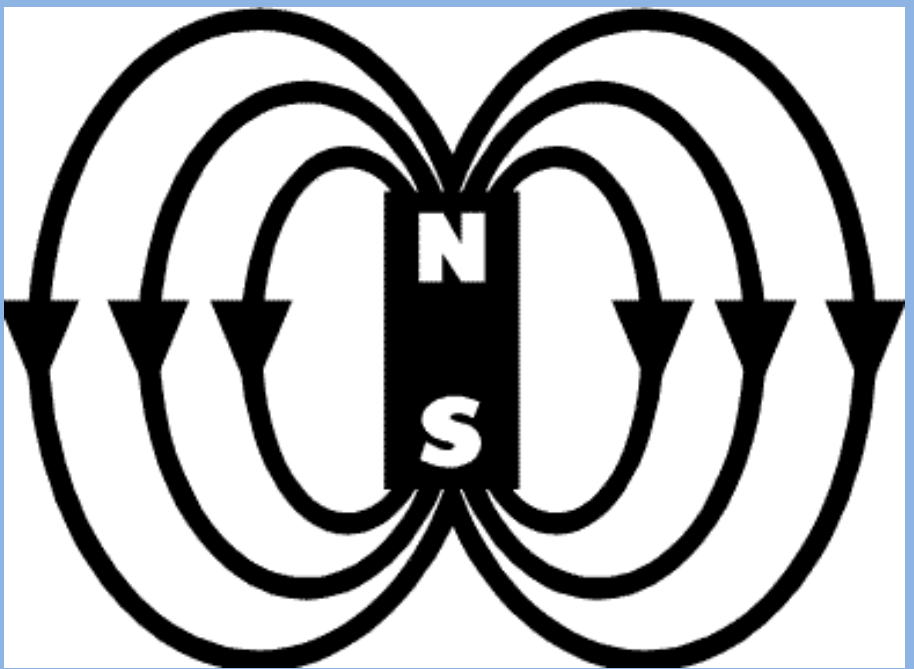
Electromagnetism
DIFFERENCES

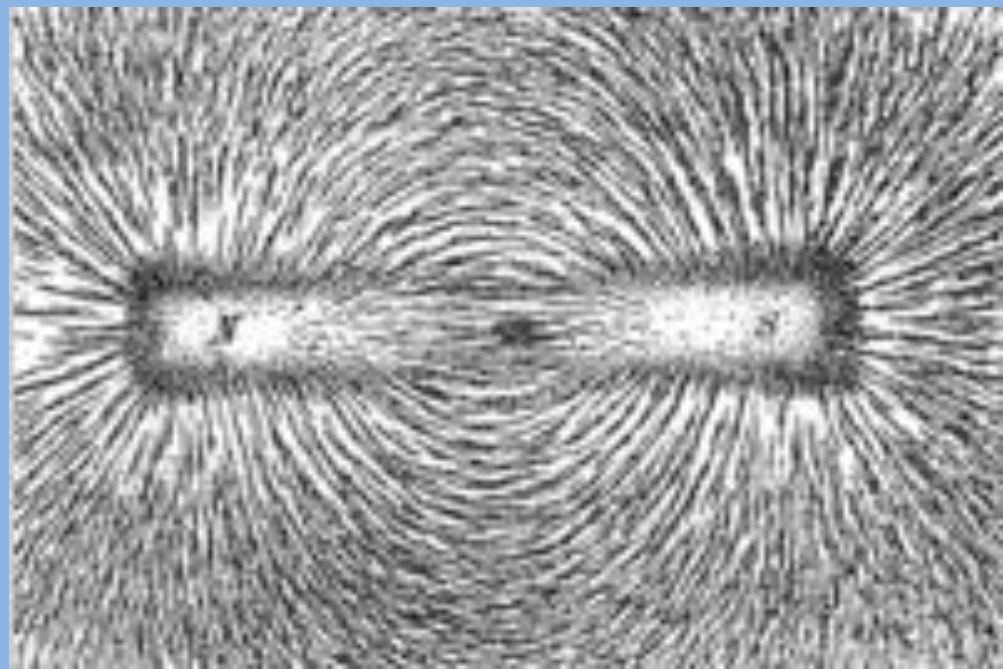
THINK ABOUT IT

Magnetism	Static Electricity
1. N – S 2. Magnetic force 3. Magnetic field 4. Alignment of “domains” 5. No friction 6. Any conditions	1. + & - 2. Electric Force 3. Electric Field 4. Transfer of charge (usually electron) 5. Friction 6. Dry conditions

Magnetism

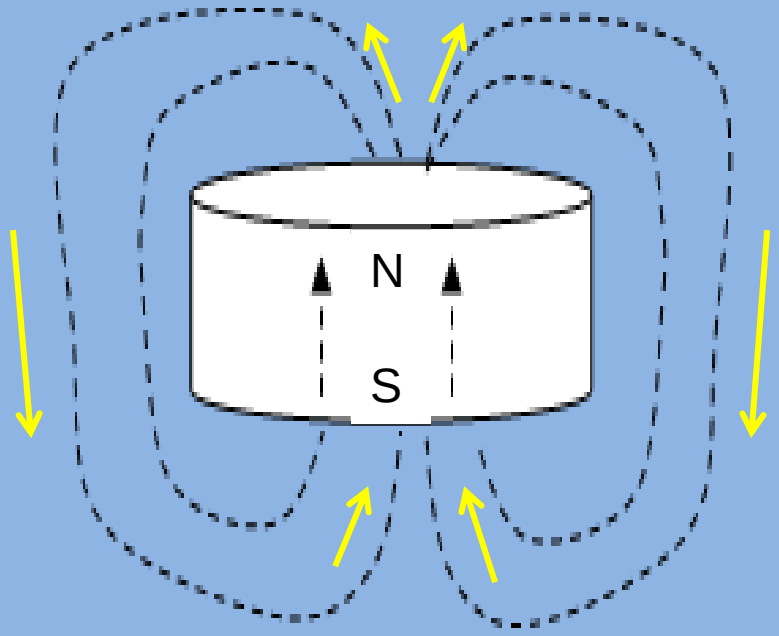
A force that can attract (pull closer) or repel (push away) objects that have a magnetic material like iron inside them (*magnetic objects*).

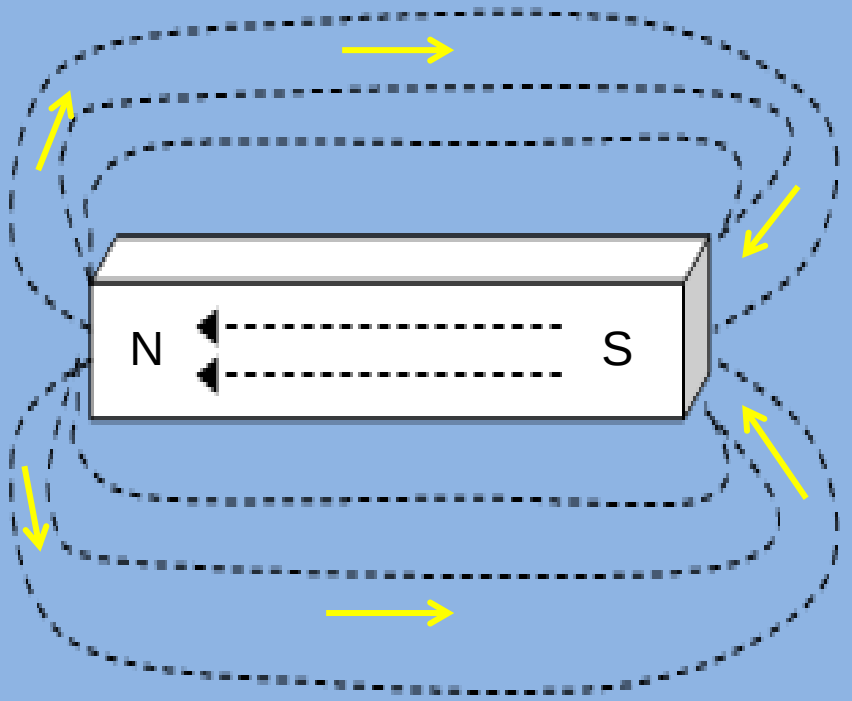




Magnetism

Magnetic field lines go from N to S outside a magnet and S to N within the magnet.

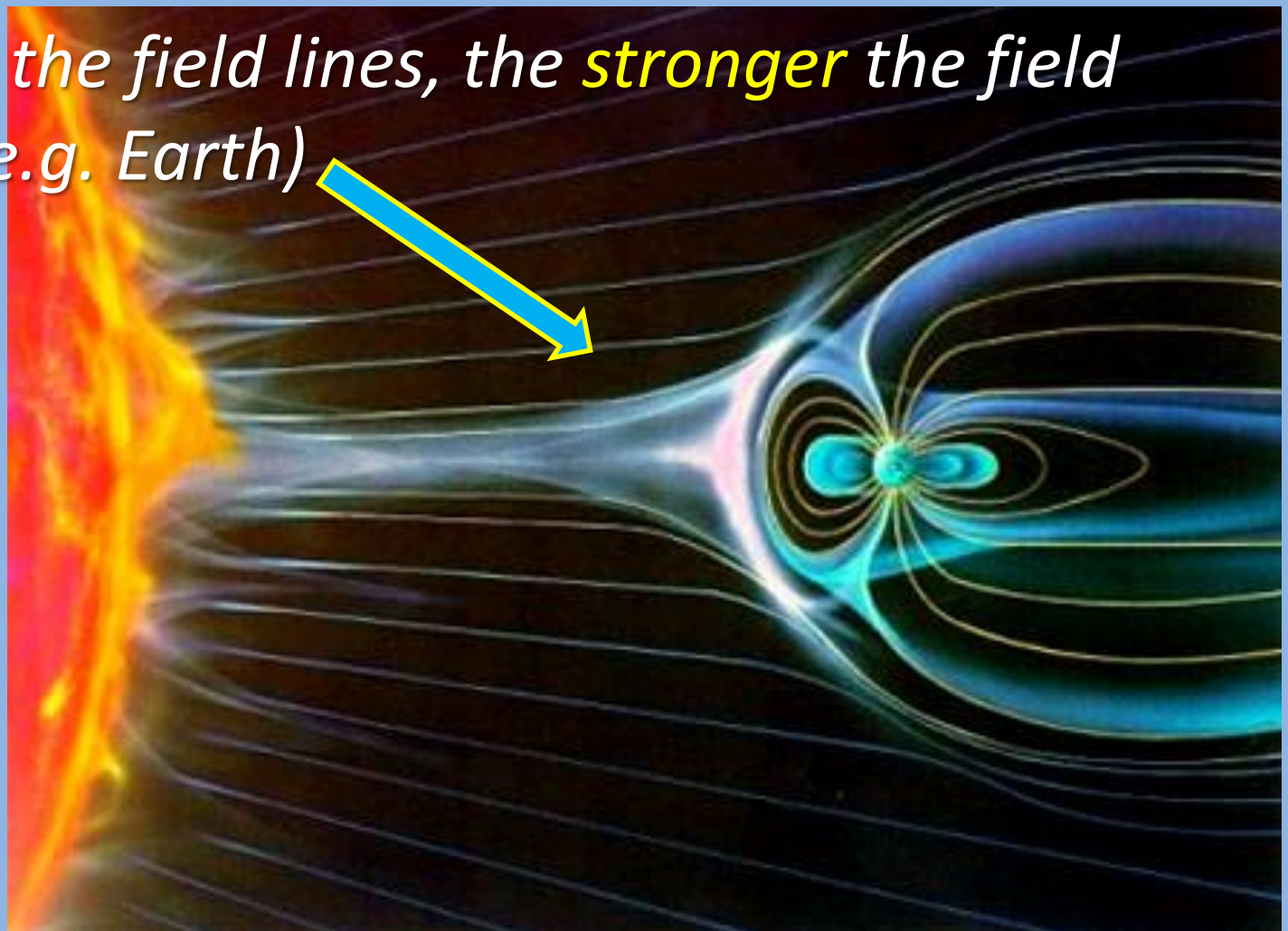




Magnetic Field Strength

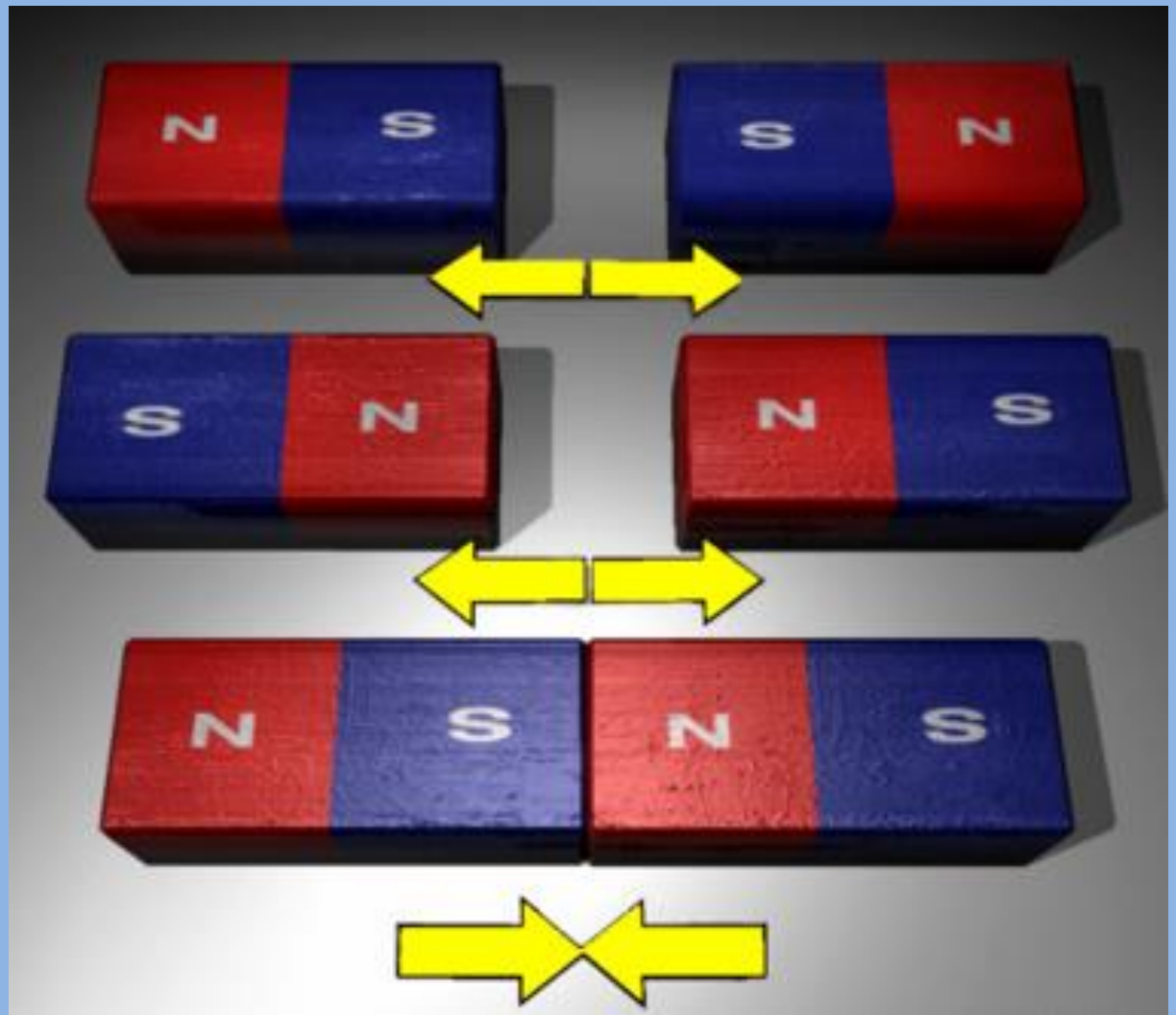
*The **farther apart** the field lines, the **weaker** the field strength (e.g. sun to Earth)*

*The **closer** the field lines, the **stronger** the field strength (e.g. Earth)*



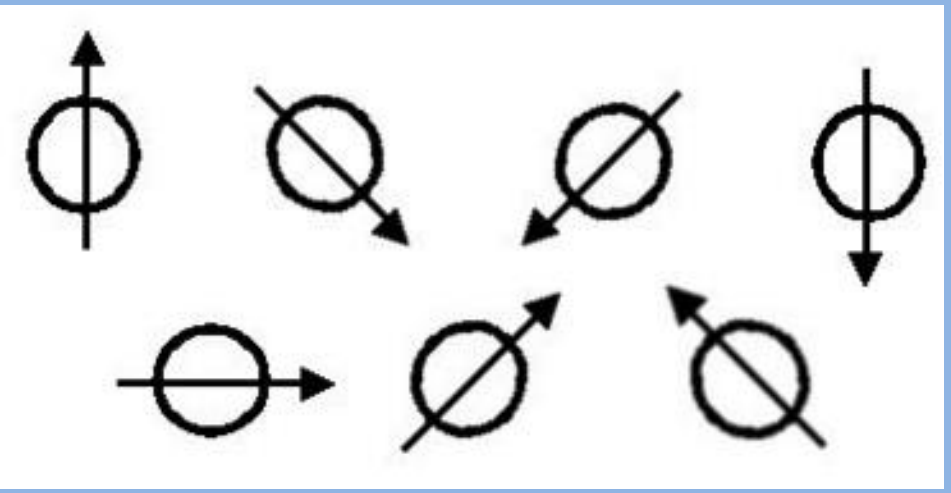
Magnetism

Opposite poles ATTRACT; Like poles REPEL.

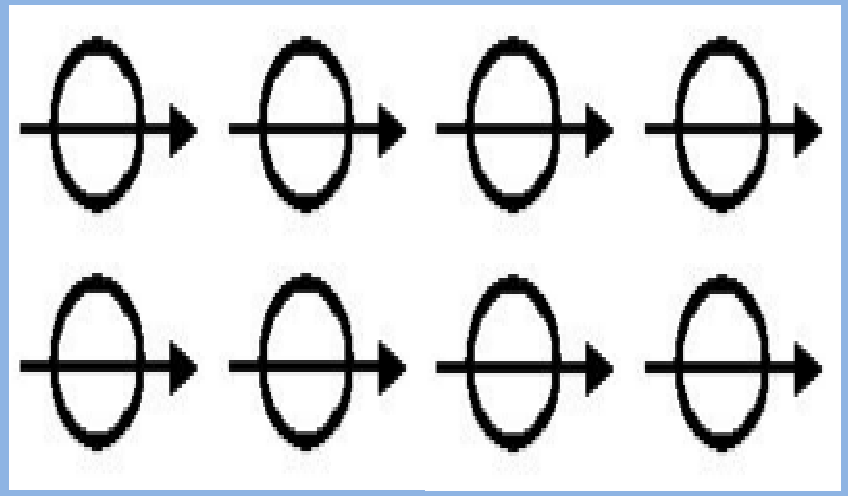


Magnetism

Unmagnetized objects have no alignment or "polarization" in their "domains"



Magnetized objects have alignment or "polarization" in their "domains" (*groups of atoms get aligned … like miniature magnets inside a material*)

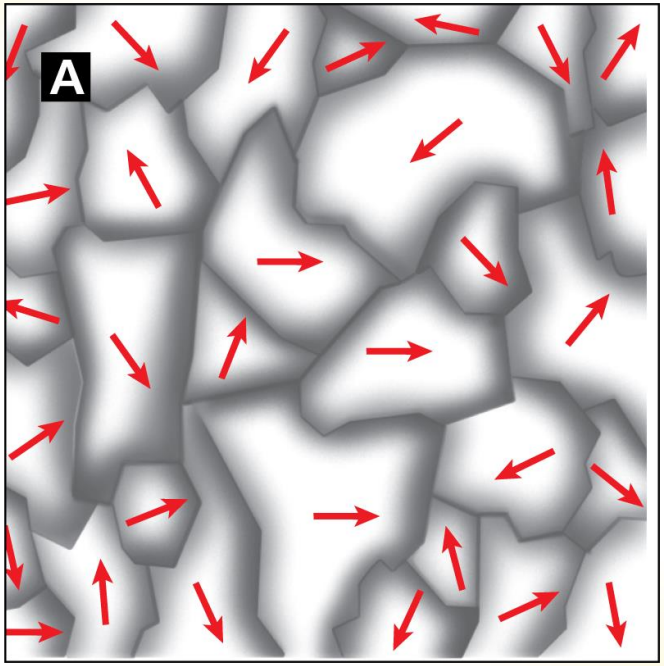


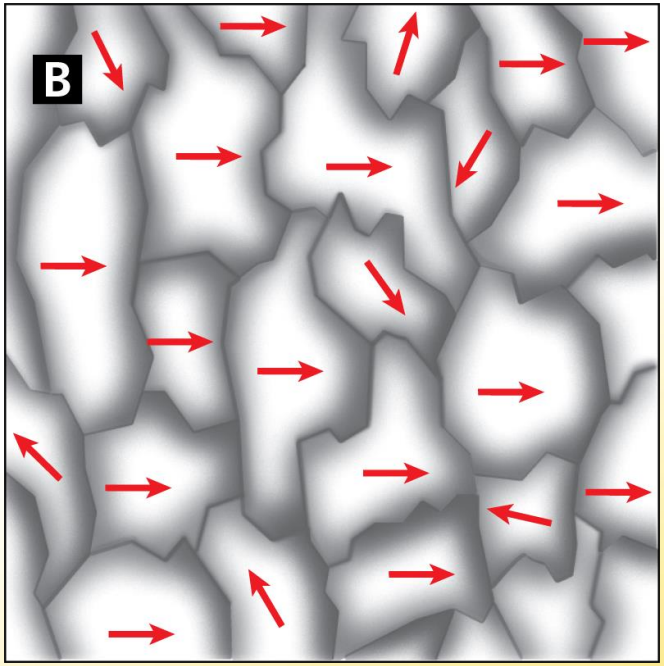
Magnetic Materials

A magnetic field can magnetize ferromagnetic materials.

A. Before magnetization, domains are random.

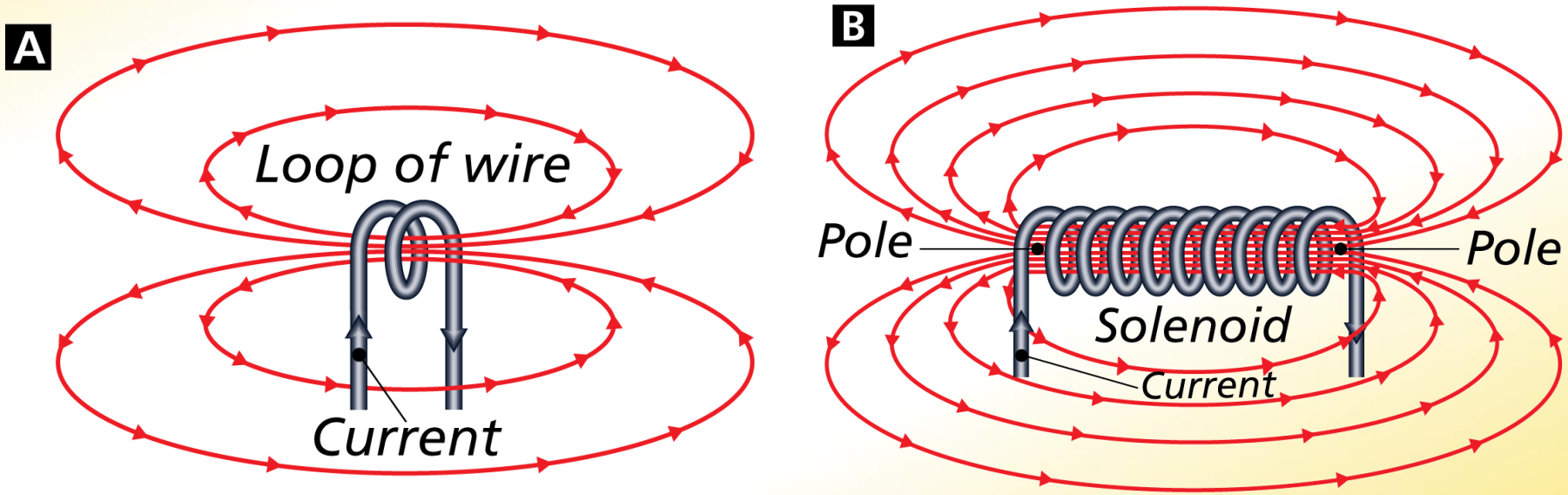
B. Domains aligned with the field grow during magnetization. Unaligned domains can shrink.





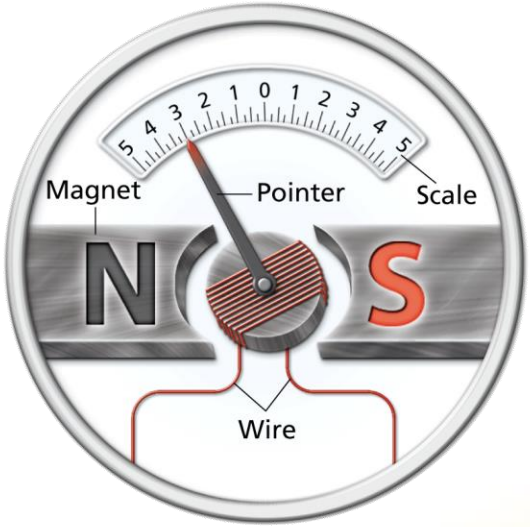
Solenoids and Electromagnets

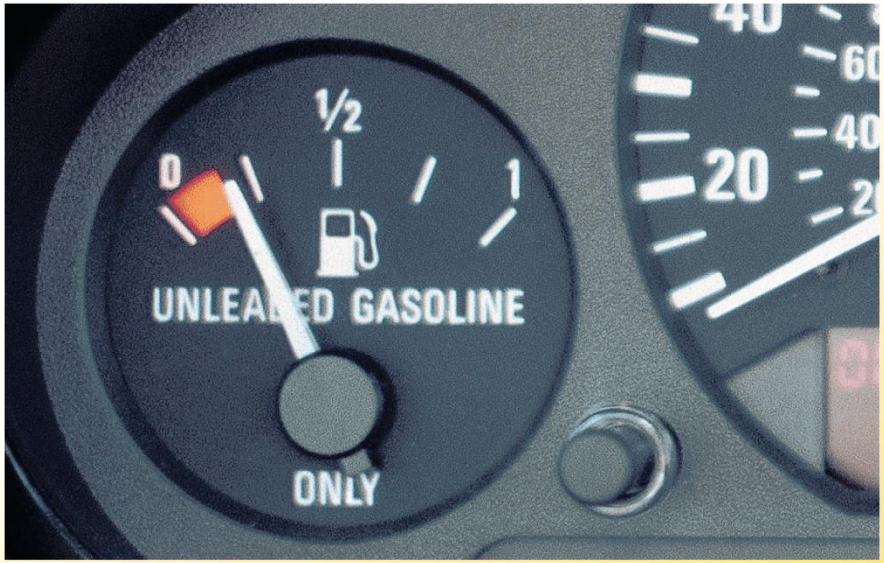
The magnetic field lines around a solenoid are like those of a bar magnet.



Electromagnetic Devices

A galvanometer uses an electromagnet to move a pointer. One common application is in an automobile gas gauge. The pointer indicates the current in the wire. The wire is connected to a sensor in the gas tank.



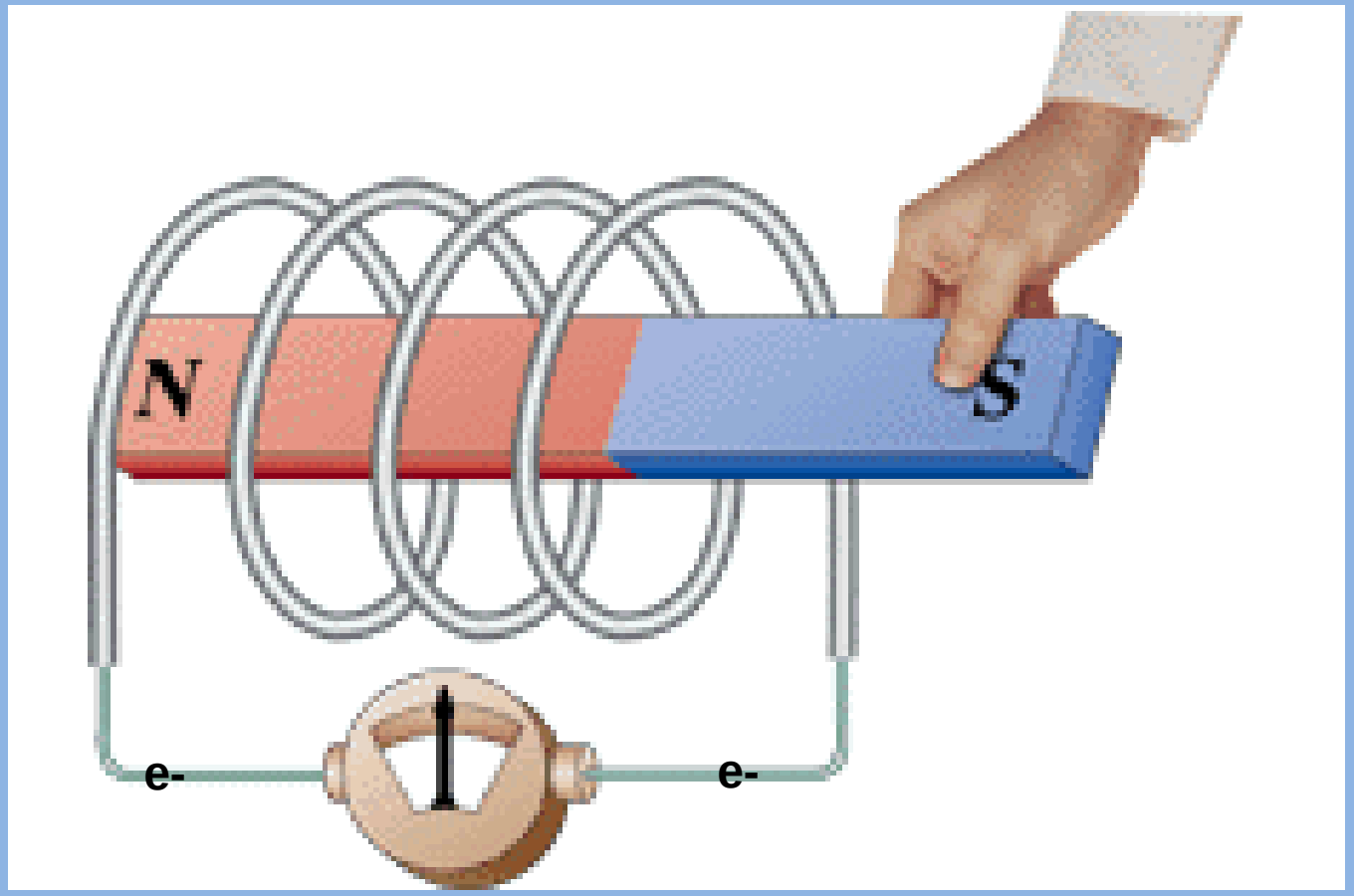


ELECTROmagnetic INDUCTION

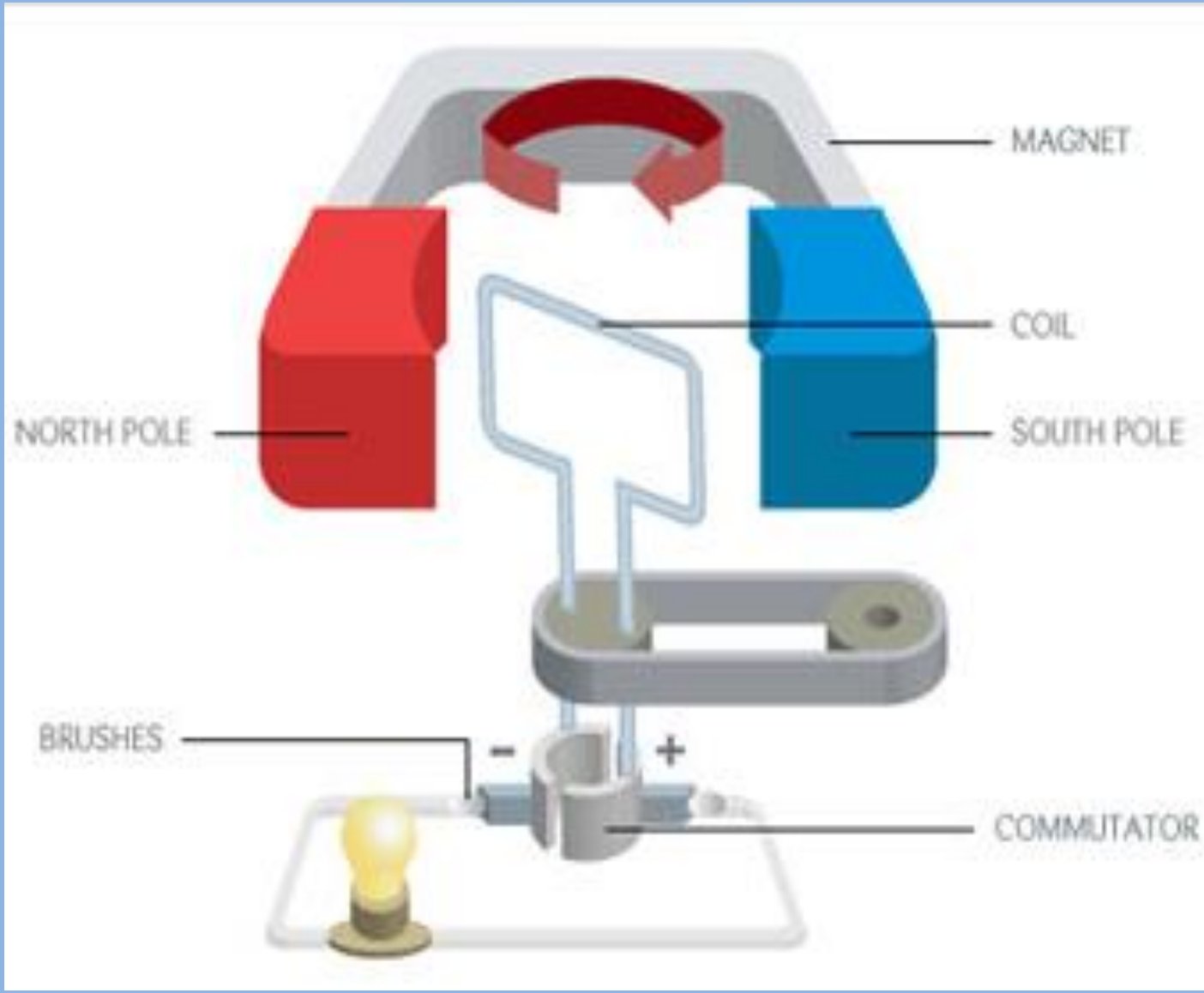
Passing electricity through a wire INDUCES a magnetic field around the wire.

ElectroMAGNETIC Induction

Moving a magnet through a coil of wire INDUCES an electric current.



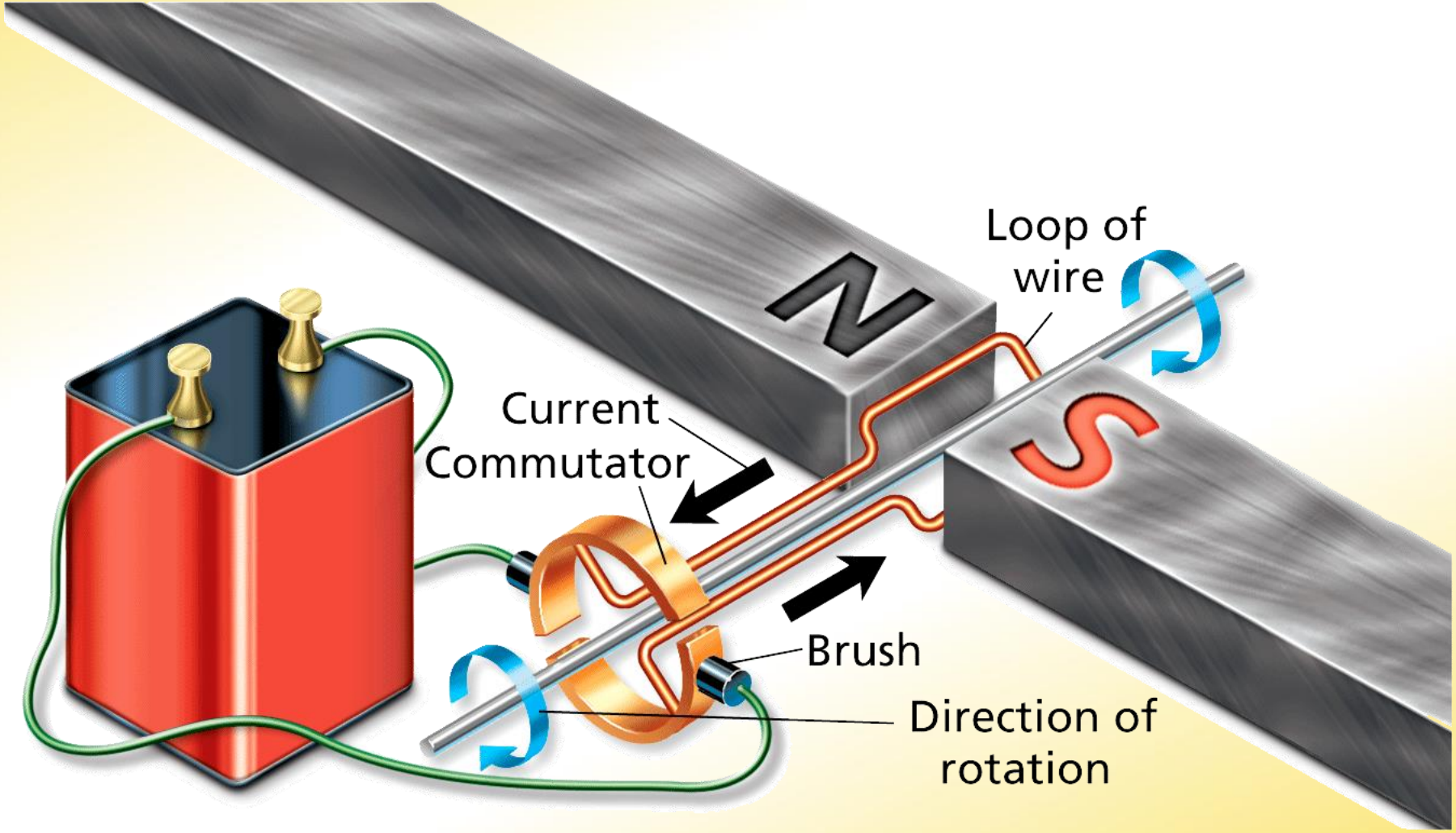
Electromagnetic INDUCTION



AC (alternating current)
Generator

Spinning a wire coil inside a magnetic field.

Electromagnetic Devices



Module 12B Worksheets

- Download the Electric Circuits (Lab)
- Download the Electricity Review worksheet
- Download the Electricity Review 2 worksheet
- Download the Electromagnetism PHET Lab

Assessment Questions

1. Where does the magnetic field of a magnet have the strongest effect on another magnet?
   a. the north pole
   b. the south pole
   c. both poles equally
   d. midway between the two poles

Assessment Questions

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   a. the north pole
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   d. midway between the two poles

   ANS: C

Assessment Questions

2. How are the magnetic field lines drawn to show the interaction of two bar magnets that are lined up with their north poles near one another?
   a. Field lines begin at the north pole of each magnet and extend to the south pole of the other magnet.
   b. Field lines begin at each magnet's north pole and extend toward its south pole.
   c. Field lines extend from the north pole of one magnet to the north pole of the other magnet.
   d. Field lines cannot be drawn because the magnetic forces cancel one another.

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   ANS: B

Assessment Questions

3. Why does a compass not point exactly toward the geographic north pole?
   a. Earth's magnetic field is constantly changing due to effects of the solar wind.
   b. The magnetic pole is near but not exactly at the geographic pole.
   c. Earth's magnetic field lines are too broad for a compass point exactly toward the pole.
   d. Daily variations in the magnetic field mean that compasses are not very accurate.

Assessment Questions

3. Why does a compass not point exactly toward the geographic north pole?
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   ANS: B

Assessment Questions

4. What happens to a permanent magnet if its magnetic domains lose their alignment?
   a. The magnetic field reverses direction.
   b. It loses its magnetic field.
   c. It has several north poles and several south poles.
   d. It is no longer a ferromagnetic material.

Assessment Questions

4. What happens to a permanent magnet if its magnetic domains lose their alignment?
   a. The magnetic field reverses direction.
   b. It loses its magnetic field.
   c. It has several north poles and several south poles.
   d. It is no longer a ferromagnetic material.

   ANS: B

Assessment Questions

2. Which change will increase the strength of an electromagnet made by wrapping a conductive wire around an iron nail?
   a. reversing the direction of current flow
   b. replacing the nail with a wooden dowel
   c. increasing the number of coils of wire around the nail
   d. using a longer nail

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   ANS: C

Assessment Questions

3. A loudspeaker uses a magnet to cause which energy conversion?
   a. mechanical energy to magnetic energy
   b. electrical energy to mechanical energy
   c. electrical energy to magnetic energy
   d. mechanical energy to electrical energy

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   c. electrical energy to magnetic energy
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   ANS: B

Assessment Questions

1. The motion of an electric charge creates an electrical field.

   True
   False

Assessment Questions

1. The motion of an electric charge creates an electrical field.

   True
   False

   ANS: F, a magnetic