Magnets and Electromagnets

Objective/EQ

- Objective: Students will be able to describe the basic properties of magnets and electromagnets and they can produce an electric current.
- EQ: Can I describe the basic properties of magnets and the effects of earth's magnetic field?

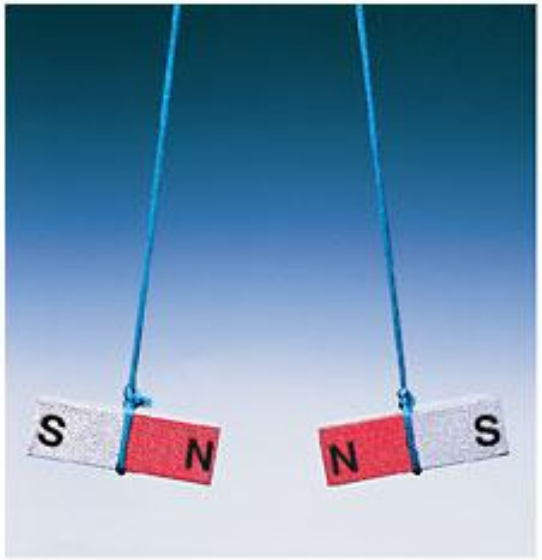
Properties of Magnets

- Magnet: any material that affects iron or material containing iron.
- 3 Properties of magnets

1. All magnets have 2 poles N/S
2. Exert forces on each other
3. Surrounded by a magnetic field

Magnetic Forces

- Magnetic Poles: points on a magnet that have opposite magnetic properties. (*north and south)* Poles are always in pairs
- Magnetic forces: force of attraction or repulsion generated by moving or spinning electric charges.
- N to N or S to S together repel each other
- N to S attract each other



▲ If you hold the north poles of two magnets close together, the magnetic force will push the magnets apart. The same is true if you hold the south poles close together.

▲ If you hold the north pole of one magnet close to the south pole of another magnet, the magnetic force will pull the magnets together.

Causes of Magnetism

- Whether a material is magnetic or not depends on the material's atoms.
- In material such as iron, nickel, and colbalt, groups of atoms are in tiny areas called domains.
- The arrangement of domains in an object determines whether the object is magnetic.
- When domains move the magnet is demagnetized or looses its magnetic properties.

How to lose Magnetic Properties

1. Dropping or Hitting it HARD
2. Putting it in a strong magnetic field opposite its own
3. Increasing the temperature.

Kinds of magnets

- Some magnets, called ferromagnets, are made of iron, nickel, cobalt, or mixtures of those metals.
- Another kind of magnet is the electromagnet. This is a magnet made by an electric current.
- Temporary magnets are made from materials that are easy to magnetize. But they tend to lose their magnetization easily.
- Permanent magnets are difficult to magnetize, but tend to keep their magnetic properties longer.

Earth's Magnetic Field

- The Earth behaves as if it has a bar magnet running through its center.
- The point of a compass needle is attracted to the south pole of a magnet. Opposite poles of magnets attract each other.
- A compass needle points north because the magnetic pole of Earth that is closest to the geographic North Pole is a magnetic south pole.

Earth's Magnetic Field

- Scientists think that the Earth's magnetic field is made by the movement of electric charges in the Earth's core.
- Earth's magnetic field plays a part in making auroras. An aurora is formed when charged particles from the sun hit oxygen and nitrogen atoms in the air.

Bell work

- A battery manufacturing plant is having problems with a robotic arm in the assembly line. The engineers need to design a new arm. Look at the steps below. What belongs in step #4?

1	Clearly identify the problem or need.
2	Search for and evaluate possible solutions.
3	Select the best possible solution.
4	?
5	Test and evaluate the prototype.
6	Communicate the results.
7	Redesign and retest as necessary.

- a. Develop a pilot plant.
- b. Create a one-half scale model of the best solution.
- c. Develop a prototype.
- d. Perform experiments on the different solutions.

Objective/EQ

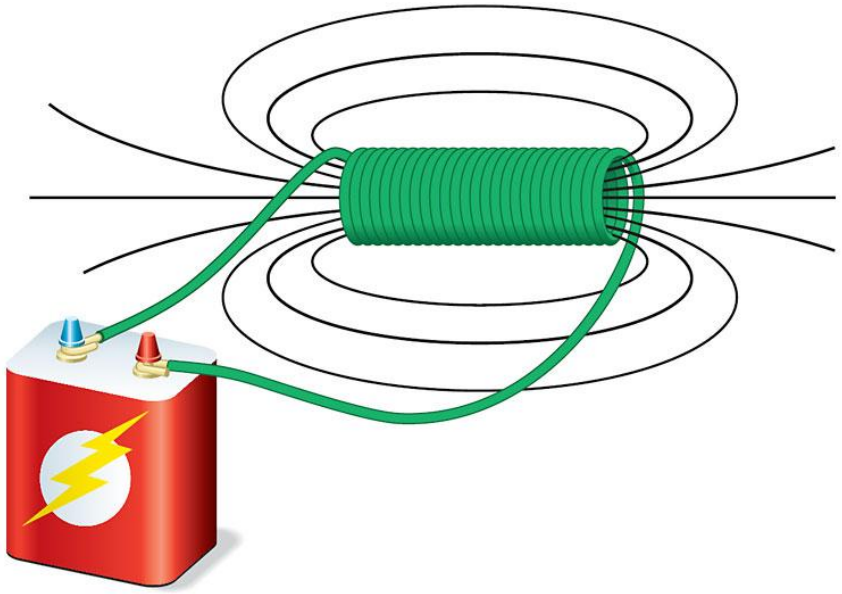
- Objective: Students will be able to describe the basic properties of magnets and electromagnets and they can produce an electric current.
- EQ: Can I identify the relationship between an electric current and a magnetic field.

Electromagnetism

- Physicist Hans Oersted discovered that electric current produces a magnetic field.
- Also discovered that direction of field depends on direction of current.
- Electromagnetism—the interaction between electricity and magnetism.

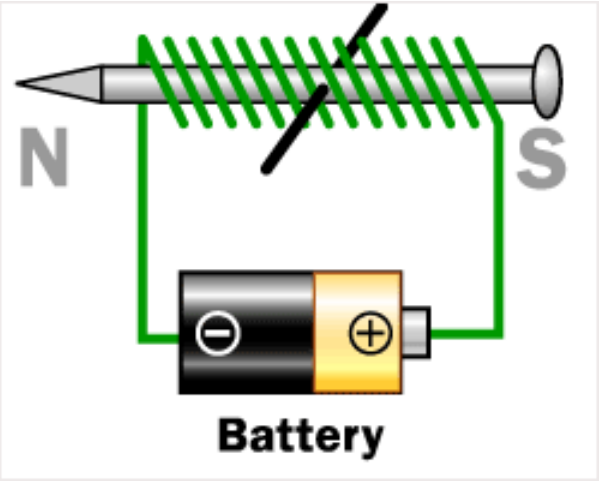
Using Electromagnetism

- A solenoid is a coil of wire that produces a magnetic field when carrying an electric current.
- The strength of the magnetic field increases as more loops per meter are used and increasing the electric current.



Electromagnets

- An electromagnet is made up of a solenoid wrapped around an iron core.
- Electromagnets are very useful because they can be turned on and off as needed. The solenoid has a field only when there is electric current in it.



Electric Motors/Galvanometer

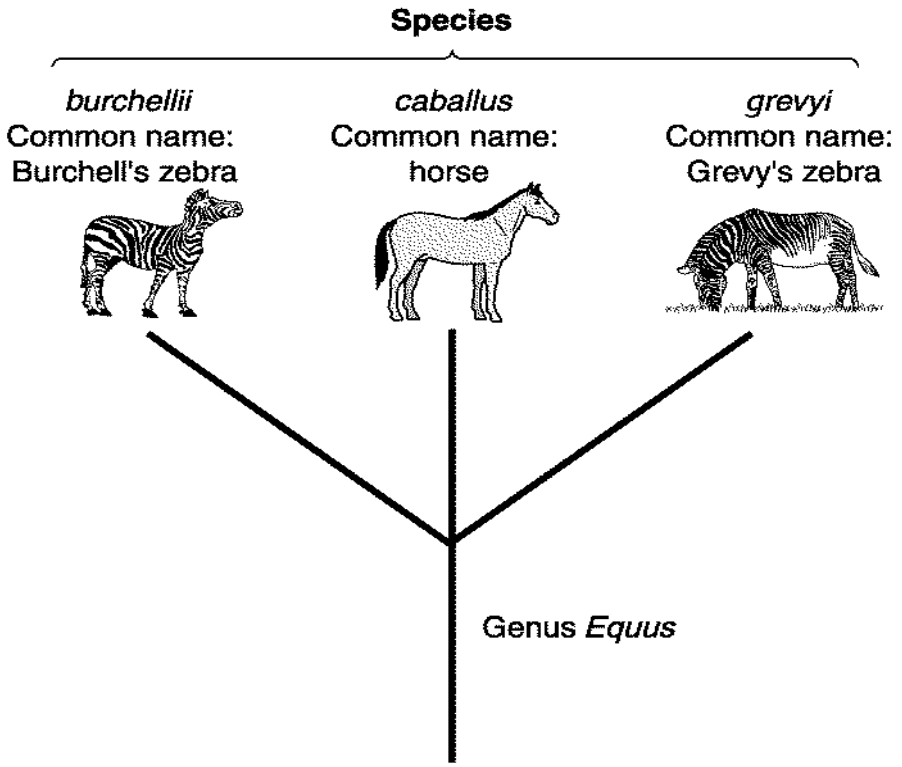
- Electric Motor: a device that converts electrical energy into mechanical energy.
- Galvanometer: measures current, it has an electromagnet and needle on a pivot b/t the poles of permanent magnet.

EXIT TICKET

1. The interaction between electricity and magnetism is called?
2. What increases the strength of a magnetic field in a solenoid?

Bell Work

- What is the scientific name for a Burchell’s zebra?



- a. *Equus caballus*
- b. *Equus burchellii*
- c. *Equus grevyi*
- d. *Caballus zebra*

Obective/EQ

- Objective: Students will be able to describe the basic properties of magnets and electromagnets and they can produce an electric current.
- EQ: Can I explain how a magnetic field can make an electric current.

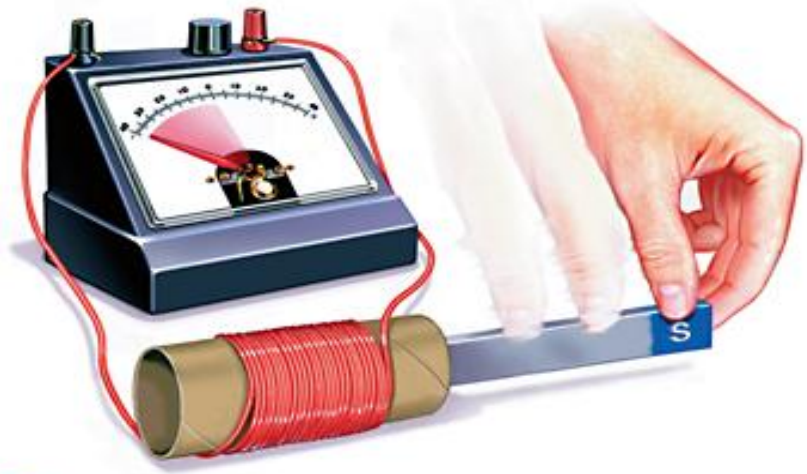
Electromagnetic Induction

- The process by which an electric current is made is by changing a magnetic field is called electromagnetic induction.
- An electric generator:uses electromagnetic induction to change mechanical energy into electrical energy.

a An electric current is induced when you move a magnet through a coil of wire because the magnetic field is changing relative to the coil of wire.

b A greater electric current is induced if you move the magnet faster through the coil because the magnetic field is changing faster.

c A greater electric current is induced if you add more loops of wire. This magnet is moving at the same speed as the magnet in **b.**



d The induced electric current reverses direction if the magnet is pulled out rather than pushed in.

Alternating Current

- The electric current produced by the generator changes direction each time the coil makes a half turn. Because the electric current changes direction, it is an alternating current.
- The energy that generators convert into electrical energy comes from different sources such as fossil fuels and nuclear energy.

Transformers

- A transformer increases or decreases the voltage of alternating current.
- The number of loops in the primary and secondary coils of a transformer determines whether it increases or decreases the voltage.
- The electric current that brings electrical energy to your home is usually transformed three times.