

## Electric Circuits Notes

Electrical energy can be changed into light, sound, heat and mechanical motion in an electric circuit.

**Circuit:** a path through which electricity flows.

**Conductor:** a material that allows electricity to flow through. (all metal and coins)

**Insulator:** a material that does not allow electricity to flow through. (glass, wood, plastic, rubber)

**Volt:** a unit used to measure electric potential. The number of volts of an electric charge equals the charge's voltage.

### The parts of a circuit:

- a **source** of electrical energy (battery)
- a **conductor** of electrical energy (wires, aluminum foil)
- a **device** that uses and transforms the electrical energy (light bulb)
- a **switch**- open switch- produces a gap and charge cannot flow through, closed switch- electricity can flow through

All of these parts must be connected in a complete, unbroken path in order for an energy transformation to occur.

### Where does our electrical energy come from?

1) Battery – stored chemical  $\Rightarrow$  electrical

2) Solar Cell – solar  $\Rightarrow$  electrical ex. streetlights that come on when it gets dark

3) Wall outlets – from power plants with generators

$\Rightarrow$  Appliances change electrical energy into heat, light, sound, and mechanical energy.

- **Light**- light bulb added to circuit, chemical energy in a battery is changed into electrical energy in the circuit then changed into light and heat energy in light.
- **Sound**- bell, buzzer, radio or TV added to the circuit, chemical energy in a battery is transformed into electrical energy in the circuit which is transformed into sound energy by the buzzer.
- **Heat**- toaster, stove, or heater is added to a circuit, chemical energy from the fuel at the power plant is transformed into heat energy which is transformed into mechanical energy to turn a generator. The generator changes the mechanical energy into electrical energy, then the electrical energy in the circuit is changed into heat energy.
- **Mechanical motion**- fan or motor is added to a circuit, chemical energy in a battery is changed into electrical energy in a circuit which is changed into energy of mechanical motion by the fan or motor.

## Electricity & Magnetism

Did you know that electricity can create magnetism?

### Magnets

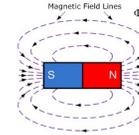
- have poles (North and South)



- attract and repel to other magnets
  - like poles repel (N-N and S-S)
  - opposite poles attract (N-S)
- objects made of iron and steel will attract to a magnet
- the Earth is a large magnet – its core is made of iron and nickel, we can use a compass because the Earth is a magnet.

**Magnetism:** the force of attraction or repulsion of magnetic materials

**Magnetic field:** the area around a magnet in which the magnet exerts force, a push or a pull, without actually touching the object



We made electromagnets using the following materials:

Electromagnets

1. Iron Core (nail or bolt)
2. Source of Electricity (battery)
3. Path for electricity to flow (wire)

### Electromagnets:

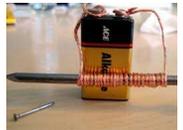
**Electromagnet:** a coil of wire (with electricity) wrapped around a steel or iron core, producing a magnetic field. Hans Christian Oersted discovered electromagnetism in his physics classroom.

Step 1. Gather all materials.

Step 2. Place the battery in the battery holder.

Step 3. Wrap the wire in tight coils around the nail or bolt.

Step 4. Clip both sides of the wire to the battery holder.



What is the best thing about an electromagnet? They can be turned ON or OFF.

### Electromagnet Uses

- cranes
- motors (all different kinds)
- computer hard drive
- ATM cards
- cassette tapes
- cell phones
- televisions

**Generator:** device that converts kinetic (motion) into electrical energy.

## MOTORS and GENERATORS

### Simple Motor

uses electricity to produce motion

The like poles of the magnet and electromagnet repel while the unlike poles attract. This makes the motor spin.

made up of: an electromagnet, a magnet, a shaft, and a power source

Examples: fan, blender, hair dryer, heater, remote controlled car

How it works:

1. Turn on the battery.
2. Current travels down the shaft to the electromagnet. The electromagnet gets a N and a S pole.
3. The electromagnet begins to spin as it attracts and repels with the other magnet.
4. Turn off the current? The motor stops.

Transformation: Electrical  $\Rightarrow$  Mechanical = MOTOR

### Generator

uses motion to produce electricity

made up of a coil of wire, a magnet, and a shaft, (object to receive the electricity)

Examples: found in power plants such as hydroelectric (dams), nuclear, geothermal, and solar power plants.

Transformation: Mechanical  $\Rightarrow$  Electrical = GENERATOR

They are made with the same materials, but work in an opposite way!!