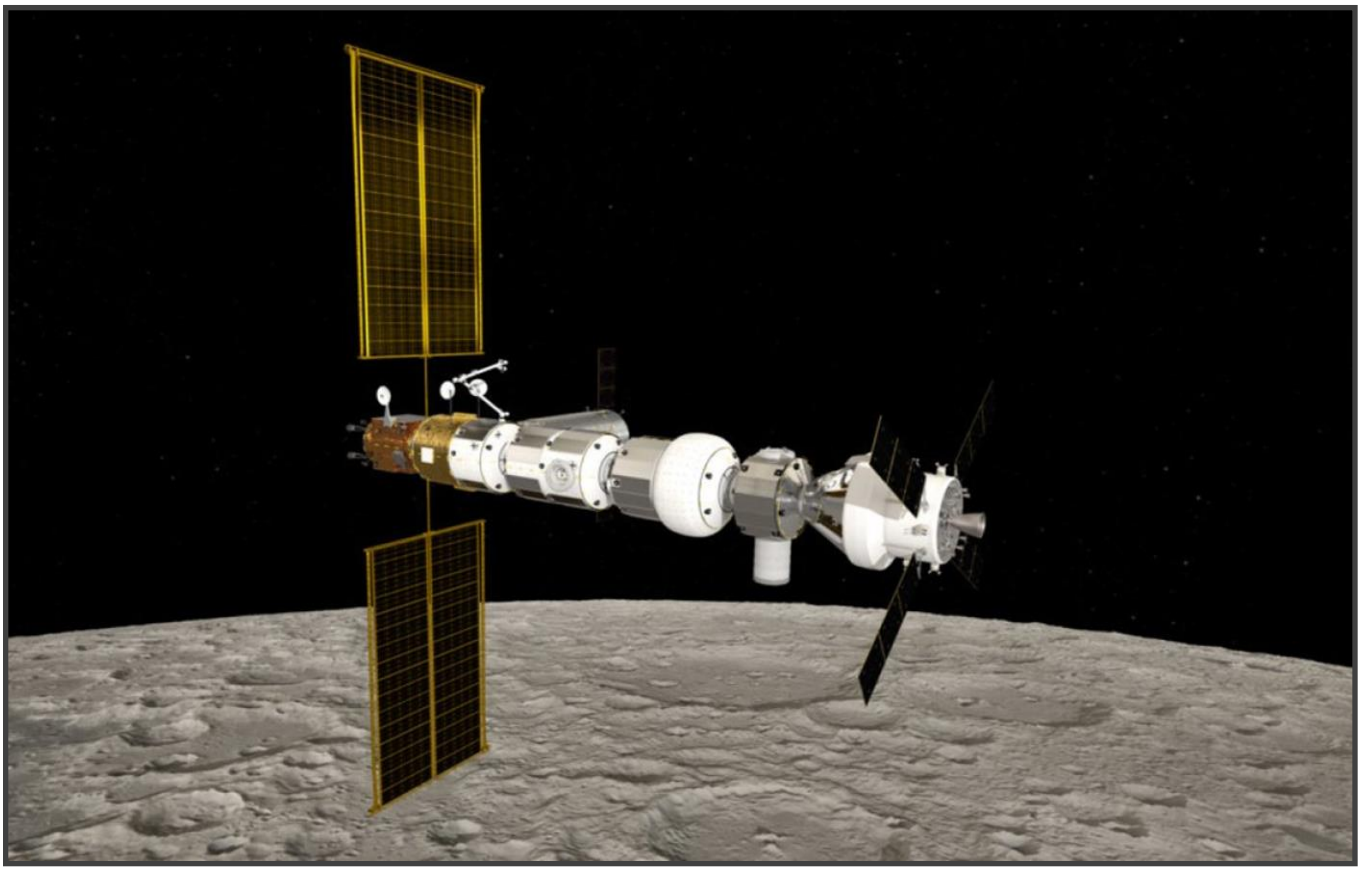
Spacegate Station Season 2

Episode 3 Resources



Resource Contents

- Guided Notes
- Electrical Conduction Activity
- Worksheets on Circuits and Conduction
- Next Generation Sunshine State Standards

This program was designed specifically to be used as part of science subject instruction, science remediation and science enrichment. The determination of the appropriate science standards that correlate to this program was established by a board of Science Specialists and teachers in Duval County Public Schools, Jacksonville, FL.

Spacegate Station Episode 3

Word Bank

Amperes	**Atoms**	**Battery**	**Closed-loop**	**Coal**	**Conductor**	**Electrons**
Energy	**Generator**	**Glass**	**Hydroelectric**	**Insulator**	**Lights**	**Nuclear**
Oil	**Parallel**	**Plastic**	**Rubber**	**Series**	**Solar**	**Switches**
Voltage	**Wind**	**Wood**				

Electricity

1. Electricity is a form of _____energy.

2. Electrical energy is caused by the movement of _____ which are particles of an _____.

3. Electricity can be produced through natural energy sources such as:
   - _____ dams
   - _____or ___ _____ power plants
   - _____ power plants
   - _____ turbines
   - _____ solar panels.

   This is energy can be used to power items such as toasters, microwaves, televisions, and computer tablets

Circuits

1. A circuit is the _____ path through which electrical current flows.

2. A circuit has an electrical source such as a _____ and a wire for the electricity to pass through.

3. A circuit may have other parts as well, such as _____ and _____. A circuit system may consist of either one loop or two loops.

4. A circuit that consists of one loop is called a _____circuit. It is a closed loop through which electricity can flow. If its single loop is interrupted at any point, no current can flow through the circuit.

5. A circuit that consists of two loops in which electricity can flow is called a _____ circuit. If one loop of a parallel circuit is interrupted, current can still flow through the other loop.

Electrical Measurement

1. The term _____ is the name given for the measurement of the electric force that causes electrons to flow. Just like water needs pressure to force it through a hose, electrical current needs some force to make it flow.

2. Voltage is usually supplied by an electrical source like a _____ or a _____.

3. Electrical _____is the number of electrons that can flow through material like a metallic wire. It is just like the amount of water flowing through a hose within a certain amount of time.

4. The current is the amount of electricity flowing through a wire. Electrical current is measured in_____, or "amps" for short.

Conductors and Insulators

1. A _____is any item or material that provides a path for energy to flow. This means that electricity and electrical current can move freely around through a conductor.

2. A wire is a good example because it is made from _____.

3. An _____is any item or material that does not let electricity or electrical current flow thought it. Their atoms hold onto their electrons tightly, so electric current cannot flow freely through them. They are important as they prevent electricity from leaving the wire and causing damage or hurting people.

4. Examples include most nonmetallic solids such as:
    - _____
    - _____
    - _____
    - _____

Spacegate Station Episode 3

Electrical Conduction Activity

Introduction: Atoms are small particles that make up all matter. They are so small that it takes billions and billions of them just to make something useful like a pencil. Inside the atom are even smaller objects called electrons, protons, and neutrons. Electrons have a negative charge (-) and the protons have a positive charge (+). The protons and neutrons stick to together in the center of the atom, called the nucleus. The electrons spin fast around the outside. The positive charge of the protons keeps the electrons from flying off and leaving the atom. The electrons in the atom are where electricity gets its name. In some elements, there are electrons on the outside of the atom that, when a force is applied, can come loose and move to another atom. When a bunch of atoms are together and electrons are moving from one atom to the other in the same direction, this is called electricity. Electricity is the "flow" of electrons.

Electrical Conduction

Electrical conductors allow electric current to flow easily because of the make-up of their atoms. In a conductor, the outer electrons of the atom are loosely bound and can freely move through the material when an electric charge is applied.

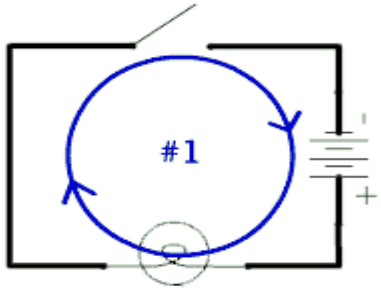
Conductive Materials

In general, the best electrical conductors are metals. Metals tend to have electrons in the outer layer of their atoms that are freely shared. The most conductive of all the elements is silver. Unfortunately, silver is too rare and expensive to use in most electrical equipment. Today, the most used electrical conductor is copper. Copper is used in electrical wiring and electrical circuits throughout the world.

Insulators

The opposite of a conductor is an insulator. An insulator opposes the flow of electricity. Insulators are important to keep us safe from electricity. The wire that carries electricity to your computer or television is covered with a rubber-like insulator that protects you from getting electrocuted. Good insulators include such material as glass or air.

How do we make electrons move to make electricity?



We make electricity by creating an electric circuit. Let's take the case where you are turning on a light in your house: when you flip the switch "on" you are completing the electric circuit and causing electricity and electrons to flow through the light bulb, turning the light "ON."

Here are some key elements to a circuit:

- Power source: Could be a battery or your wall outlet
- Conductor: The wires that carry the electricity from place to place
- Load: what the electricity is powering, like the light bulb in the example above
- Switch: The device that connects the circuit together to start the electricity flowing

Your Task: Construct a flashlight. Use several materials to determine the levels of conduction of each material provided and determine the best conductor to complete the circuit.

Conduction Materials used

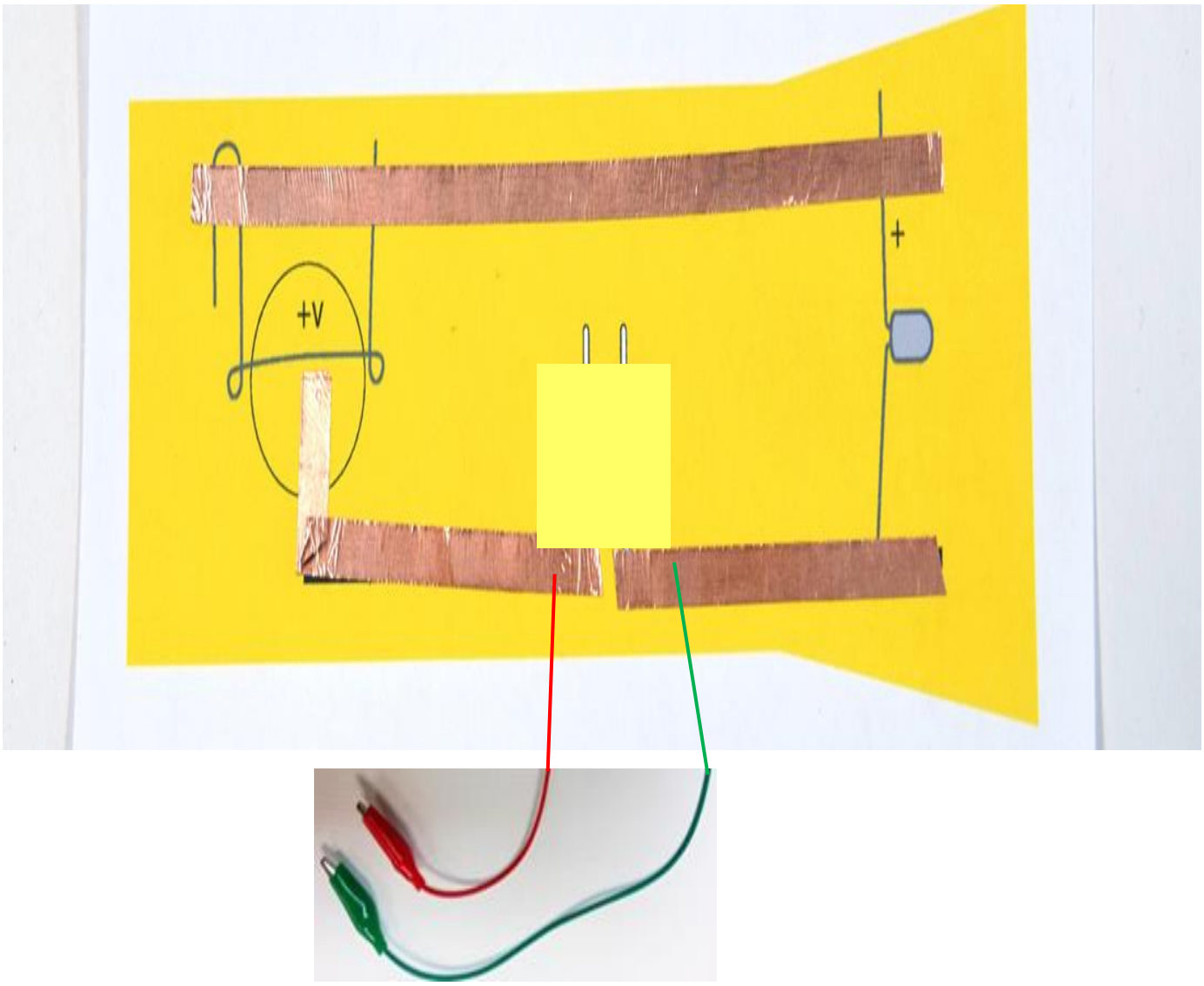
1. Wood stick
2. Wood stick (saturated with distilled water)
3. Wood stick (saturated with Sodium Chloride solution)
4. String
5. Aluminum
6. Zinc
7. Copper
8. Paper

Flashlight Construction Materials

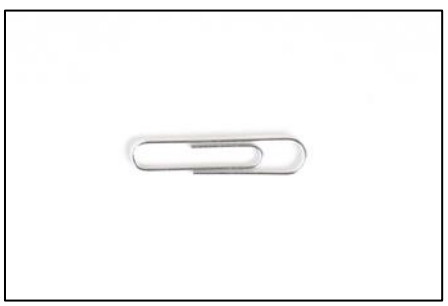
1. Flashlight diagram
2. 1-coin cell battery
3. 1 LED light
4. 1 paper clip
5. 2 strips of copper tape
6. Various types of conductive and non-conductive material.

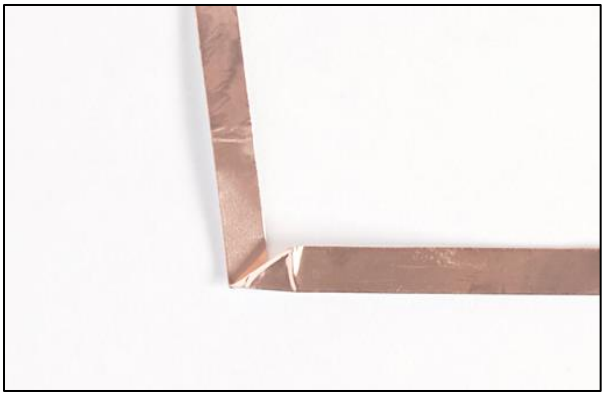
Flashlight Motor Building Instructions

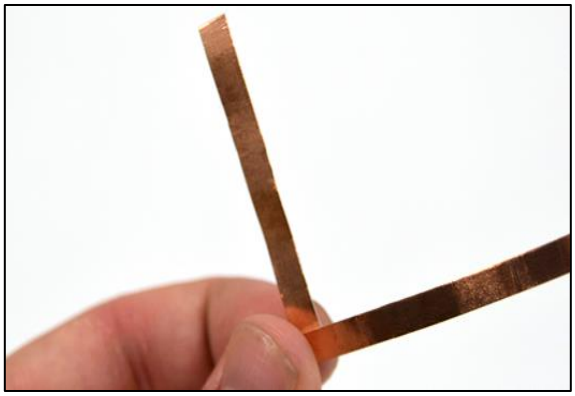
1. Lay down the copper tape on the flashlight diagram along the dark lines. Be careful not wrinkle the copper tape too much or it may obstruct the connection. Leave a small space where a switch would normally be in the circuit
2. Place the paper clip on your circuit diagram (see picture).
3. Tape down the ends with copper tape.
4. Bend the legs of the LED apart and place on circuit diagram. Connect the longer leg of the LED to the positive (+) side of the circuit.
5. Tape down the LED with copper tape.
6. Place the battery under the paper clip.
7. Place two pin style alligator clip wires, one on either side of the gap between the copper tape on the negative side.
8. Tape down the pins with copper tape and reinforce with clear plastic tape.
9. Test your circuit by connecting the alligator clips together.
10. Place the various conductive material between the alligator clips to determine the level of conductivity.



Bend the paperclip upwards as shown in the photos above. This will give your battery a secure connection.



- The key to making successful circuits with copper tape has a lot to with how good the connections are between LEDs, paperclips, and switch contacts with the tape. Folding the tape is the best way to do this rather than laying on multiple strands of tape to make the turn.

Evaluate your conductive material

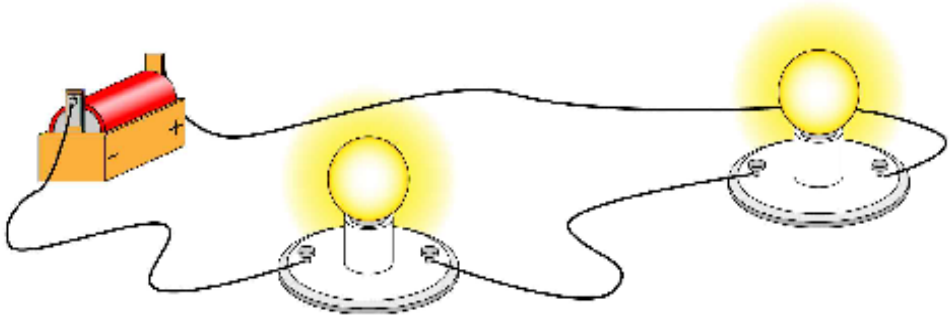
Once you have created your flashlight, you must carry out a planned test to determine which is the most conductive. You must create a method to measure or observe your tests in the space below. Use the results of your tests to determine which materials are the most and least conductive.

Name: _____

Series and Parallel Circuits

In a **series circuit** electricity has only one path to follow. All parts are connected one after another. Electrons flow from the negative side of the battery around in a loop to the positive side.

Draw arrows to show the path of the electricity in this series circuit.



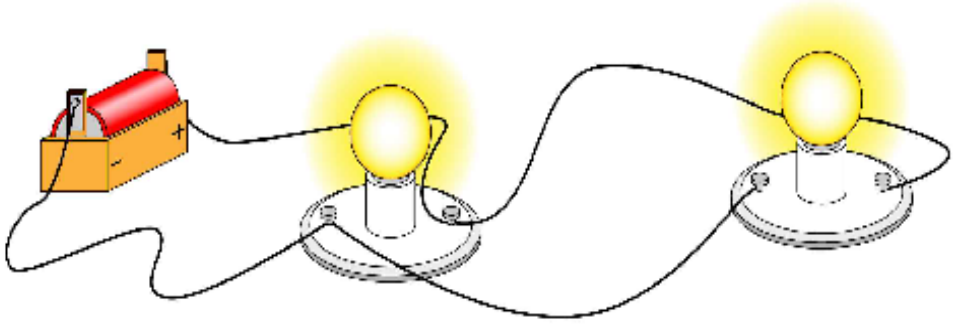
If a light bulb is missing or broken in a series circuit, will the other bulb light? Explain.

_____

_____

In a **parallel circuit**, electricity has more than one path to follow. Electrons can follow different paths as they flow from the negative side of the battery to the positive side.

Draw arrows to show the different paths electrons can travel in this parallel circuit.



If a light bulb is missing or broken in a parallel circuit, will the other bulb light? Explain.

_____

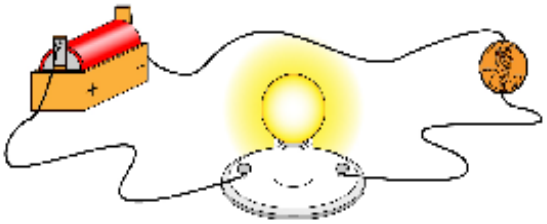
_____

Name: _____

Conductors and Insulators

A **conductor** is a material that allows electricity to flow through it.
An **insulator** is a material that electricity cannot flow through.

To determine whether an object is a conductor or insulator, you can build a simple circuit with a battery, light bulb, and three pieces of wire.



Touch the free ends of the wire to the object you are testing. If the light bulb lights up, the object is made from a conductor. if it does not, the object is made from an insulator.

Complete the table. Predict whether each item is made from a material that is a conductor or insulator. Then test each item to determine if it is made from a conductor or insulator.

Object	Prediction: Conductor or Insulator?	Result: Conductor or Insulator?
rubber band		
penny		
nickel		
toothpick		
key		
paper clip		
brass paper fastener		
glass microscope slide		
(your choice)		
(your choice)		

Next Generation Sunshine State Standards (Florida)

SC.3.P.10.1Identify some basic forms of energy such as light, heat, sound, electrical, and mechanical.

SC.4.P.10.1: Identify forms of energy, such as light, heat, electrical, and energy of motion.

SC.4.P.10.4 - Describe how moving water and air are sources of energy and can be used to move things

SC.5.P.11.1 Investigate and illustrate the fact that the flow of electricity requires a closed circuit (a complete loop).

SC.5.P.11.2 Identify and classify materials that conduct electricity and materials that do not.

SC.6.P.13.1 Investigate and describe types of forces, including contact forces and forces acting at a distance, such as electrical, magnetic, and gravitational.

SC.7.P.11.2 Investigate and describe the transformation of energy from one form to another.

SC.8.P.8.7 Explore the scientific theory of atoms (also known as atomic theory) by recognizing that atoms are the smallest unit of an element and are composed of subatomic particles (electrons surrounding a nucleus containing protons and neutrons).