Switches

Electricity All Around Us
Learner Activity Instructions
Grade Level: 5-8

What you will learn:

In this activity, you will learn the difference between series and parallel circuits. Have you ever used Christmas lights and found that if one light burns out, the rest no longer works? This is an example of a series circuit. The electricity flows from one light to the next. For the string to work, all the lights must be able to conduct electricity. A parallel circuit is very different. In parallel circuits, several bulbs (or other appliances) have their own connection to the power supply. Each one can receive a supply of electricity, regardless of what happens to the others.

What you will need:

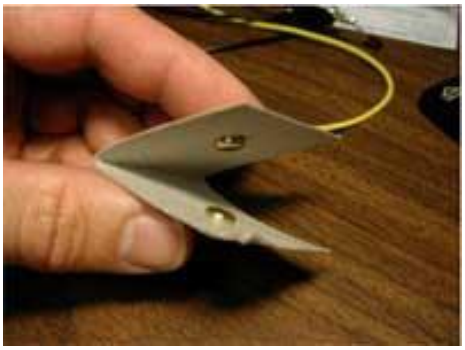
Switches Learner Worksheet
3 Insulated copper wires (each piece 10 to 20 cm long, ends stripped)
3-Volt battery
Battery holder
Light
Light holder
Wire strippers and cutters
3 Paper clips
2-4 Paper fasteners
Small pieces of cardboard
Clothespin
Pieces of string
Glue or glue gun
Tape

Background

Switches are generally designed to do one thing, which is to open and close circuits. To do this, they need to have contacts, some kind of button or lever to operate and connectors that allow wires to be attached. The contacts can be opened or closed. When closed, they permit electricity to flow. When open, the gap between the contacts prevents the flow of electricity. Switches are used in almost all circuits in our homes or schools. Switches can be very simple or quite complex, depending on what the switch is needed for. Switches can also be manual (e.g. something needs to touch the switch to make it operate) or automatic (e.g. sensors). There are many different types of switches. Listed below are samples of various switches with examples of their uses in everyday life.

Momentary Switch

A momentary switch closes a circuit for as long as someone pushes or holds the button down. A spring inside the switch causes the switch to open as soon as the pressure is released. An example most people are familiar with is a doorbell switch.



Sliding Switch

A sliding switch closes a circuit when someone slides the slider to touch the contact button. The switch will remain closed until someone moves the slider so it no longer is touching the contact button. You can often find examples of sliding switches on small appliances such as flashlights, electric shavers and battery-powered children's toys.

Clothespin Switch

The clothespin switch is often used in various types of alarms, such as the alarms in elevators, burglar alarms, and fire alarms. The principle behind this switch is simple: thumbtacks will be used as contacts between the two main pieces of a wooden clothespin. A small piece of boxboard (cardboard) will be used to keep the switch open. Anything that pulls the paper out from between the contacts will cause the circuit to close, and the alarm to be activated. In this case, the alarm could consist of a small light or a buzzer

How to do it

1. Your group will build two of the three switch designs below. First, choose the two switches you will build. Then follow the instructions for building your switch. Complete your observation sheet after you have built the first switch before beginning to build the second switch. Have fun!

Momentary Switch

- Cut a piece of cardboard 5 cm wide and 10 cm in length. Fold the cardboard in half so it measures 5 cm wide and 5 cm in length.
- Using two paper fasteners, push the pointed ends through the cardboard ensuring the round tops are on the inside part of the folded cardboard (ensure that when you press the folded cardboard halves together that the two fastener tops touch one another). Fold the fastener ends (on the outside of the cardboard) flat to secure the paper fastener in place.
- Attach an insulated copper wire to each of the paper fasteners. Wrap one of the stripped ends around the flattened fastener ends (on the outside of the folded cardboard).
- Place the battery in the battery holder.
- Attach one end of one of the insulated copper wires to the light bulb. Attach the other insulated copper wire to the battery holder.
- Using a third insulated copper wire, attach one end to the light bulb and the other to the battery holder.
- Take turns pressing the folded cardboard together.
- Draw your switch on your observation sheet and answer the questions.

Sliding Switch

- Cut a piece of cardboard 5 cm wide and 10 cm in length.
- Place the paper clip on the cardboard and trace an outline of the paper clip.
- Using two paper fasteners, push the pointed ends through the ends of the traced paper clip on the cardboard.
- Remove one of the paper fasteners. Take the paper clip and slide one end of the paper clip over the pointed ends of the fastener. Push the paper fastener back through the hole already on the cardboard.
- Secure the paper fasteners by flattening the ends of the fasteners on the other side of the cardboard.
- Ensure that you can slide the paper clip to touch the second paper fastener.
- Place the battery in the battery holder.
- Attach one piece of insulated copper wire to the flattened end of one of the paper fasteners. Wrap the stripped end around the fastener. Attach the other end of the insulated copper wire to the battery holder.

- Attach another piece of insulated copper wire to the flattened end of the other paper fastener. Attach the other end of the insulated copper wire to the light bulb.
- Using the third insulated copper wire, attach it to the light bulb and the battery holder.
- Take turns sliding the paper clip to touch the other fastener.

Clothespin Switch

- Twist the metal clasps (pointed ends) from two paper fasteners until they detach from the round top.
- Use glue to fasten the round tops from the paper fasteners to the inside of the closed ends of the clothespin. If you are using insulated copper wire with stripped ends, take two pieces of the insulated copper wire and glue one end of each of the wires to one of the round tops. Ensure the round tops touch when the clothespin is closed.
- Place the battery in the battery holder.
- If using alligator clips, use two pieces of copper wire and attach one end of each of the wires to the two-round tops.
- Using one of the wires attached to a round top, attach the other end of the insulated copper wire to the light bulb.
- Using the other wire attached to a round top, attach the other end to the battery holder.
- Using the third insulated copper wire, attach it to the light bulb and the battery holder.
- Cut a piece of boxboard 5 cm in width and 5 cm in length.
- Tape a piece of string to one side of the boxboard strip.
- Open the clothespin and place the boxboard strip in between the two contact points. Close the clothespin with the boxboard pinched between the two contact points.
- Take turns removing the boxboard.

As you explore and complete this activity think about these questions:

1. What are the differences between an open and closed circuit?
2. What were some of the different designs of switches that were made or tested?
3. What were some common design elements? How were they different?
4. What materials were used to make the switches?