Wiring Barbie s House

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Electricity and Magnetism
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How can you make a complete circuit that will light a bulb?

Concept

An electric circuit is a closed path for electricity to flow.

Skill

Students will learn about open or closed circuits by trying to light a bulb using a battery, a bulb, and wires.

Activity

1. Give students a battery, a bulb, and a wire. Challenge them to come up with as many ways as they can to light a bulb. Record discoveries in their science notebooks.

2. Have students show and explain what they did to light the bulb. (An overhead transparency of a bulb and battery helped with a string as a wire)

3. Identify the contact points to complete a circuit.

4. Give students a second wire. Challenge them to add the second wire to the circuit to light the bulb. (They may not combine the 2 wires to make one.)

5. Show how to represent the circuit by using symbols.

Discussion

1. How can you make a complete electric circuit that will light a bulb?
2. What are the contact points to complete a circuit?
   Bulb:
   Battery:
3. Is electricity flowing through the whole circuit? How do you know?
4. In order to have a complete circuit, what do you need?

Practice

In your notebooks, design two new ways to light a bulb.
Design two new ways where the bulb will not light.

Adding a Switch

Concept

An electric current will flow only if it has a complete path through which it can travel. A switch is added to the circuit to complete or interrupt that path.

Skill
Students will control the flow of electricity in a circuit by adding a switch to the circuit.

Activity

1. Give students a bulb, a battery, and wires to complete the circuit.
2. Ask: How can you turn the current on and off in an electric current?
3. Give them another wire and a switch.
4. Have students show and explain what they did to include the switch to the circuit.
5. Share different types of switches. (knife switch, slide switch, normally on button switch, normally off button switch)

Discussion

1. Why are switches important?
2. How do they work?
3. What are some examples of circuits in the classroom that have switches?
4. Are all switches alike?

How can you turn a light on from two different parts of a room?

Concept
Some electrical circuits are controlled by more than one switch. A double pole switch allows the light to be turned on or off from either switch.

Skill
The students will make a switch that will open or close a circuit at two different parts of a room.

Activity

1. Give students two double pole switches, a bulb, a battery, and wires.
2. Challenge them to make a complete circuit where the light can be turned on/off with either switch.

3. Have students show and explain what they did.

4. Have them trace the path(s) of current with colored markers.

Discussion

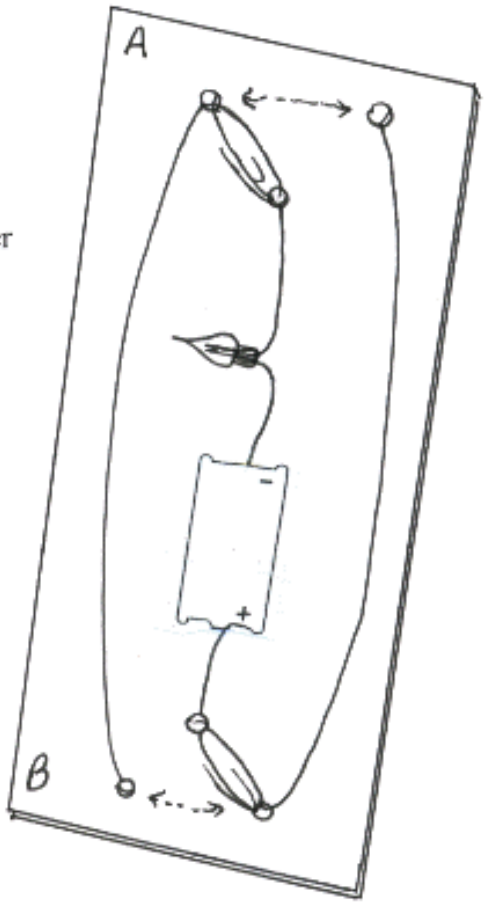
1. What are the advantages of using double pole switches?

2. Where do you see double pole switches being used at home?

Make a staircase switch

Materials

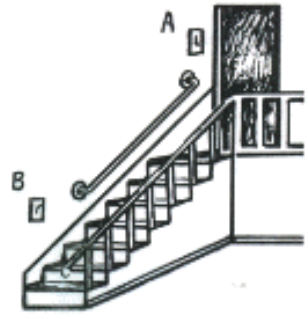
1 – 5cm by 15cm piece of construction paper
2 – paper clips
6 – brad fasteners
1 – battery
3 – pieces of wires
1 – Xmas bulb
masking tape
colored pencils



1. Build the circuit as shown above.
2. Light the bulb with both positions.
3. Trace the path(s) of current.

Discussion

Explain how your double pole switches work in your science notebooks.



What are the differences between a series and a parallel circuit?

Concept

In a series circuit, the current has only one path. If there is a break in that path, then the current will stop. A parallel circuit, on the other hand, has more than one path. If there is a break in any path, then the current will still go through the other paths. The brightness of the bulbs, due to the electrical resistance, will also be different between the two types of circuits.

Skill

The students will build and observe series and parallel circuits.

Activity

1. Give students a battery and two bulbs.

2. Challenge them to build a circuit where
   a. if one bulb is removed, then the other will go out
   b. if one bulb is removed, then the other will stay lit

   For each:

   Observe the brightness of the bulbs
   Have kids trace the path of current

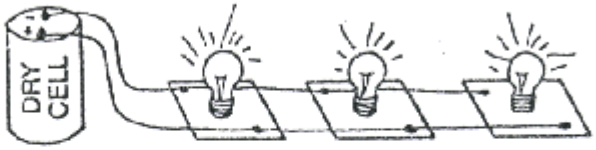
3. Have kids label circuits as series or parallel.

Discussion

1. In a series circuit, what happened to the second bulb when the first one was removed? Why?
2. In a parallel circuit, what happened to the second bulb when the first one was removed? Why?
3. Which circuit had the brighter bulbs? Why?
4. What are the advantages and disadvantages of a series and parallel circuit?

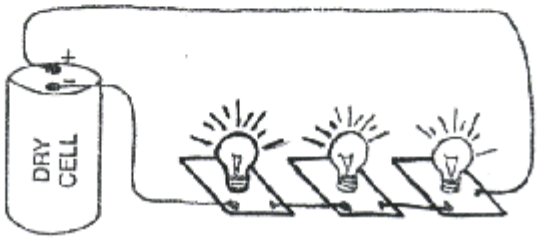
SERIES & PARALLEL CIRCUIT PRACTICE SHEET Name_____

Circuit 1



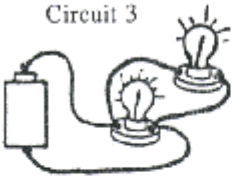
1. What kind of circuit is pictured above? (series or parallel)
2. Would the other bulbs stay lit if one bulb was removed? _____

Circuit 2

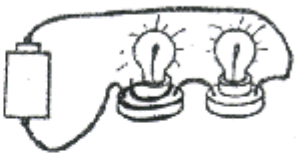


3. What type of circuit is pictured above? (series or parallel)
4. Would the other bulbs stay lit if one bulb was removed? _____

Circuit 3



Circuit 4



5. Is circuit 3 a series or a parallel circuit? _____
6. Would all the bulbs in circuit 3 go out if one bulb was removed?_____
7. Is circuit 4 a series or a parallel circuit? _____
8. Would all the bulbs in circuit 4 go out if one bulb was removed?_____
9. What is one advantage of having parallel circuits in your house?

_____

Measuring Voltage

Concept

Variations of Ohm s Law Ł **V = IR**

(V = voltage , I = current , R = resistance)

Skill

The students will compare the amount of voltage across a bulb in a series and a parallel circuit.

Activity

1. Give students a battery, two bulbs, and a multimeter.
2. Have students build a series circuit.
3. Have students measure with the multimeter the voltage across each bulb and across both bulbs. Record results in notebooks.
4. Have students build a parallel circuit. Do the same measurement as the series. Record results.

Discussion

1. How are the voltages compared between a series and a parallel circuit?
2. Why are the bulbs in a parallel circuit brighter than the bulbs in a series circuit?
3. What do you predict will happen if you add another bulb to the series circuit? Parallel circuit?
4. Try it.

Do the following in science notebooks:

1. Calculate the voltage of a bulb if it has a current of 1 amps and a resistance of 3 ohms.
2. In a series circuit of 2 bulbs:
   Each bulb has a voltage of 4 volts and a resistance of 2 ohms. Calculate the current through each bulb.
3. The voltage of a car headlight is 12 volts and it has a power of 40 watts. Calculate its resistance.
4. An electric heater draws 10 amps on a 110 volts line. How much power does it use?

EXTRA: For upper grades kids, they can calculate the amount of energy being used by various appliances around their homes.

Assessment

One of the ways to assess the students understanding of circuits is for them to wire a house. The number and type of circuits required will depend on the grade level of your students. Each house should have at least the following:

3 simple circuits (resistors can be bulbs, motors, and/or buzzers)
1 circuit using double pole switches
1 series circuit
1 parallel circuit

Other possible circuits for kids who want more challenges: drawbridge, front/back door buzzer, burglar alarm, fan with more than one speed, a bulb with different amount of brightness)

Staircase switch

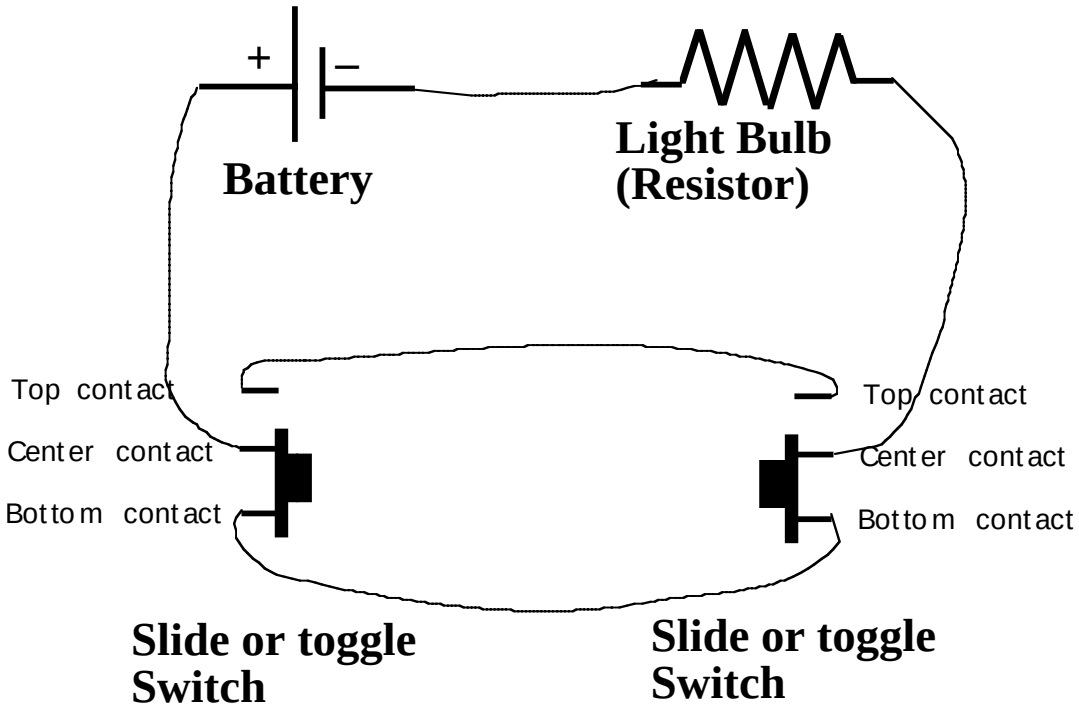
Materials

A cardboard shoe box; a string of three Christmas light bulbs; Two slide or toggle switches with wires soldered on; 9 V battery with connectors; wires; twist on connectors.

Activity

In this activity you will continue your job as an electrician: you will wire up a pretend "house" (a cardboard box) so that you can turn on the lights using one switch and turn them off using the other switch. Such circuits are used for lights in a stairwell or in a room with two doors. You will use toggle switches in this activity.

1. Cut two rectangular holes large enough to fit the back of the switch on two sides of the box.
2. Push the switches into holes the box, with the wires on the inside of the box.
3. Connect the circuit in the picture. Note how the top contact of one switch connects to the top contact of the other. The same is true for the bottom contact. The circuit is connected between the center contacts.
4. What happens when you operate the switches?



Materials List

Item	Price	Source
AA battery holder	$0.75	Digikey
2 AA battery holder	$0.75	Circuit Specialist
String of Xmas bulbs	$2.99	Wal-mart
Buzzer	$1.50	Hosfelt
LED	$0.70	Jameco/Kelvin
Motor	$0.70	Kelvin
Push button switch (normally on)	$50	Hosfelt
Push button switch (normally off)	$50	Hosfelt
Solar cell	$4.45	Kelvin
SPDT rocker switch	$.75	Hosfelt
SPDT toggle switch	$.75	Hosfelt

Comments:
* The kids can make their own switches using paper clips and brad fasteners if the switches are not available.
* Other additional supplies:
    - extra pieces of cardboard
    - wire strippers
    - scissors
    - tape