Table of Contents

Section 1: Life Systems

Basic Science Concepts

Unit 1
Biodiversity p. 10

Unit 2
Classification p. 16

Unit 3
Biodiversity and Communities p. 22

Unit 4
Biodiversity: Connections p. 28

Unit 5
Human Activities and Biodiversity p. 34

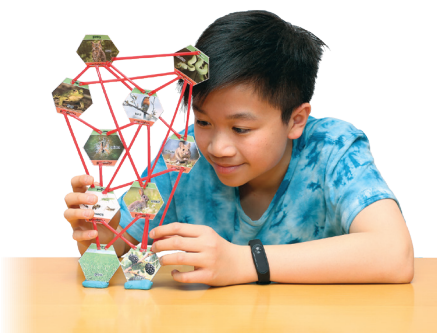
Unit 6
Biodiversity: Threats and Solutions p. 40

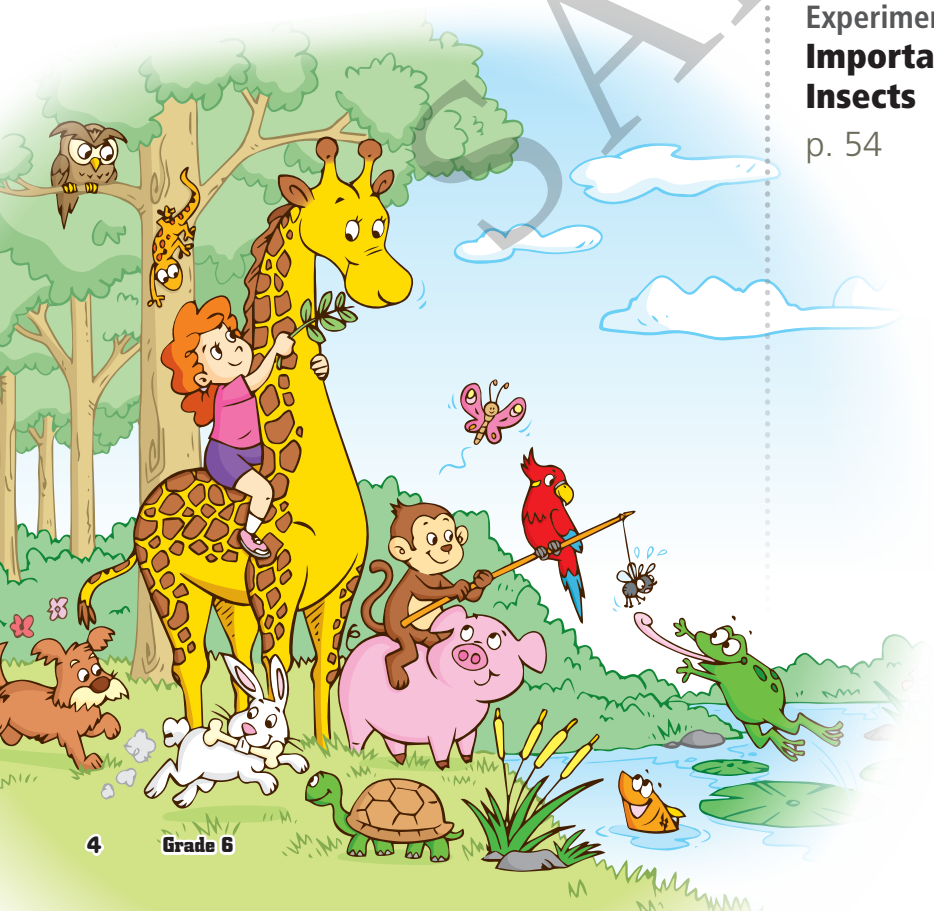
STEM Experiments

Experiment 1:
A Miniature Ecosystem
p. 46

Experiment 2:
Fighting for Space
p. 50

Experiment 3:
Important Insects
p. 54





Basic Science Concepts

Unit 1
Properties of Air p. 60

Unit 2
Four Forces of Flight p. 66

Unit 3
Flight: Moving Through Air p. 72

Unit 4
Bernoulli's Principle p. 78

Unit 5
Living Things and Flight p. 84

Unit 6
Flight and Society p. 90

STEM Experiments

Experiment 1:
A Balloon in a Bottle
p. 96

Experiment 2:
The Weight of Air
p. 100

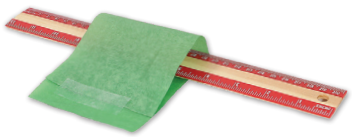
Experiment 3:
Expanding Air
p. 104

Experiment 4:
An Air Cannon
p. 108

Experiment 5:
Curving Air
p. 112

Experiment 6:
Flying Forward
p. 116

Experiment 7:
Lifting High
p. 120



Experiment 8:
Streamlined Wings
p. 124

Basic Science Concepts

Unit 1
Current and Static Electricity p. 130

Unit 2
Simple Electrical Circuits p. 134

Unit 3
Parallel and Series Circuits p. 138

Unit 4
Insulators and Conductors p. 142

Unit 5
Transformation of Energy p. 146

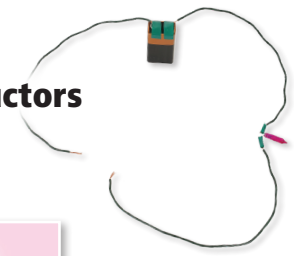
Unit 6
Electricity and Us p. 150

STEM Experiments

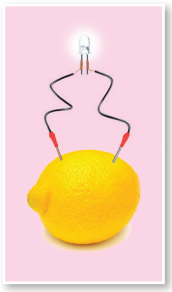
Experiment 1:
Bending Water
p. 154

Experiment 2:
Tiny Lightning
p. 158

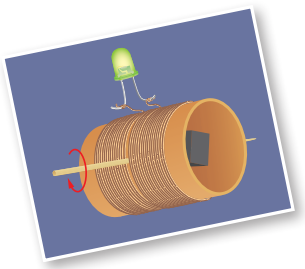
Experiment 3:
A Static Detector
p. 162



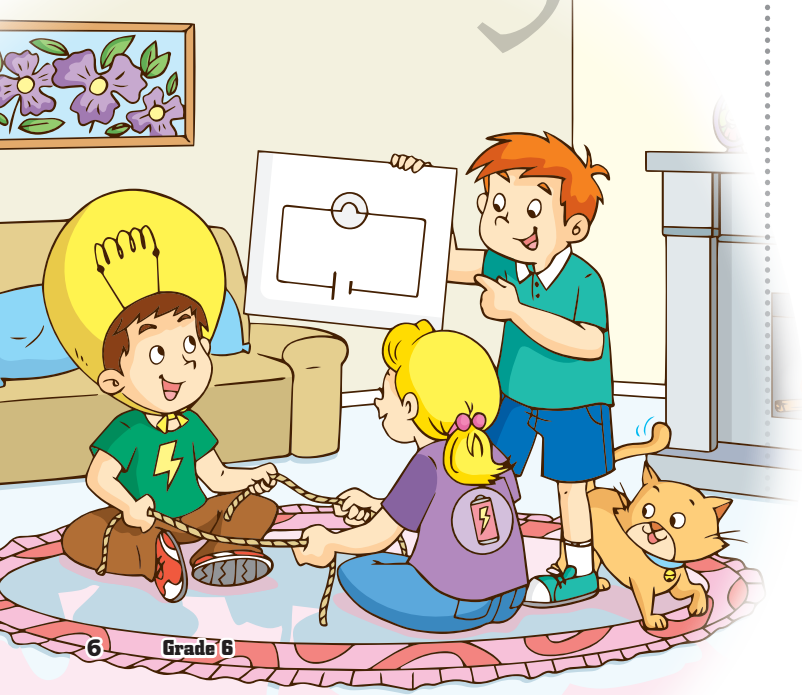
Experiment 4:
Insulators and Conductors
p. 166



Experiment 5:
A Lemon Battery
p. 170



Experiment 6:
An Electric Generator
p. 174



Basic Science Concepts

Unit 1
The Solar System p. 180

Unit 2
Bodies in Motion p. 184

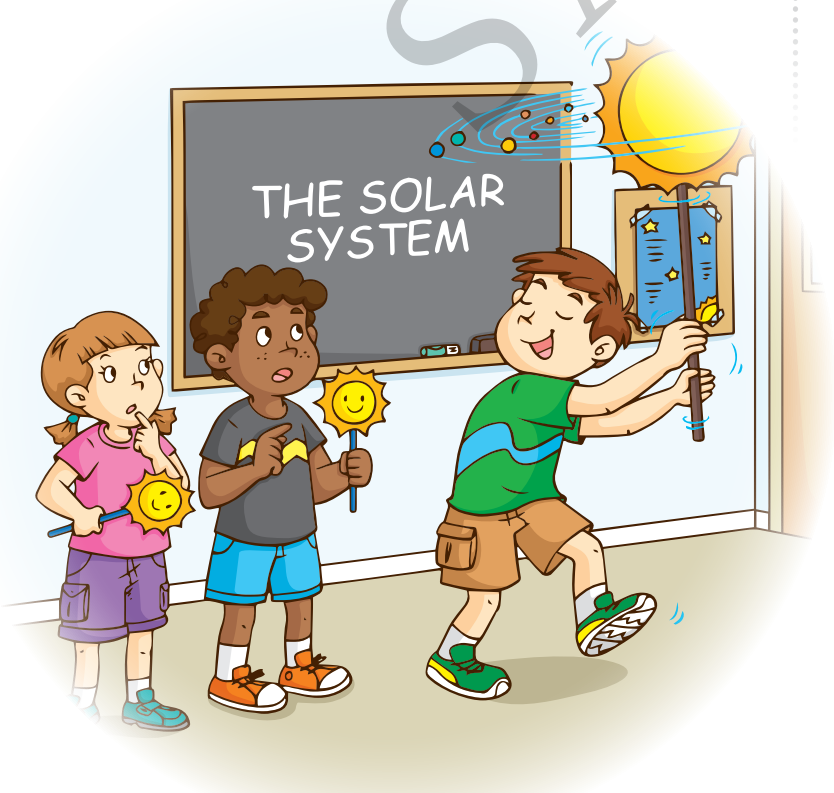
Unit 3
Lights in the Sky p. 188

Unit 4
Humans in Space p. 192

Unit 5
Technology and Space p. 196

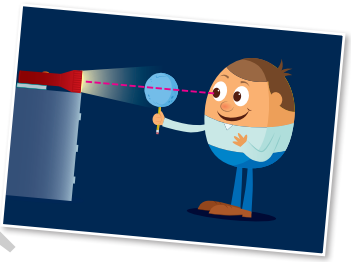
Unit 6
Space Exploration and Society p. 200

Answer p. 218

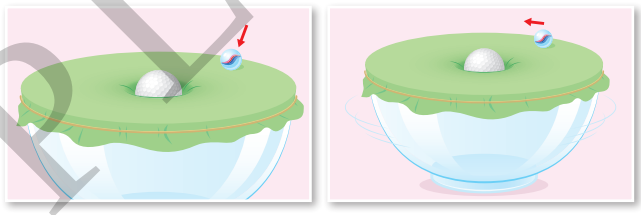


STEM Experiments

Experiment 1:
Phases of the Moon
p. 204



Experiment 2:
A Continuous Tug-of-war
p. 208



Experiment 3:
Feeling Weightless
p. 212

3 Parallel and Series Circuits

Have you ever plugged in a set of patio lights to find that none of the bulbs lit up? The set is probably a series circuit. However, if your set allows other bulbs to stay lit when one is burned out, then it is a parallel circuit. In this unit, you will study series and parallel circuits.

Daddy, can you see that the other lights are working even though two lights are burned out? The chandelier must be a parallel circuit.

After completing this unit, you will

- understand how parallel and series circuits work and how they are different from each other.

Vocabulary

parallel: side by side

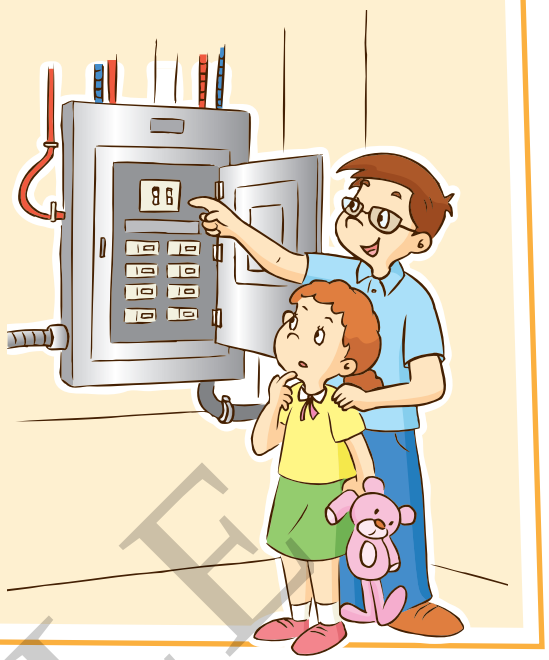
series: one after the other

parallel circuit

Most lights work even though some are burned out.

Extension

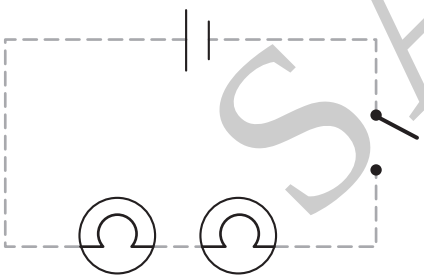
There are many electrical circuits in your house. There are also many things that can keep you safe from the electrical currents. In your house, electrical wires, like the ones connecting a lamp to an outlet, are covered in plastic or rubber. Houses also have circuit breakers. A circuit breaker is a switch that breaks its circuit if the circuit becomes unsafe. Ask an adult to show you the circuit breaker panel in your house to see just how many circuits there are in your house.



A. Trace the dotted lines to complete the circuits. Then fill in the blanks.

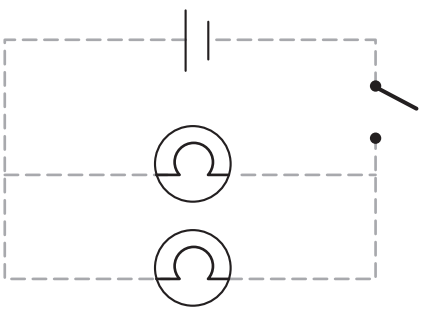
keep parallel chain-like one series stop branches

1. S_____ Circuit



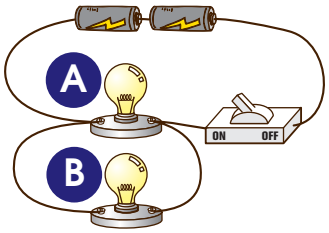
- allows electrons to follow only _____ path
- components (e.g. light bulbs) are connected in a _____ order
- all the components _____ working if one component fails

2. P_____ Circuit



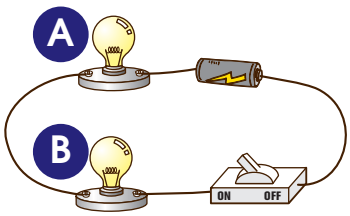
- different components are connected on different _____ of the wires
- the other components _____ working even if one fails

B. Decide whether each circuit is a "parallel" or "series" circuit and fill in the blanks.

1. 

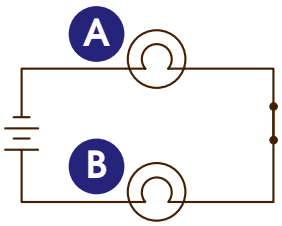
a _____ circuit

If **A** is burned out, **B** _____ working.
stops/keeps

2. 

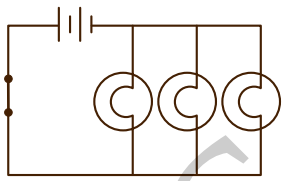
a _____ circuit

If **A** is burned out, **B** _____ working.
stops/keeps

3. 

a _____ circuit

If **A** is burned out, **B** _____ working.
stops/keeps

4. 

a _____ circuit

If one of the light bulbs is burned out, the rest _____ working.
stop/keep

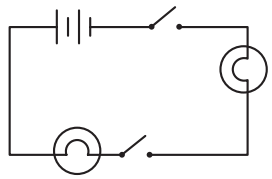
C. Draw one series circuit and one parallel circuit with each of the items provided.

- 1 battery (|ı)
- 1 switch (✓•)
- 3 light bulbs ( )

Series	*Parallel*

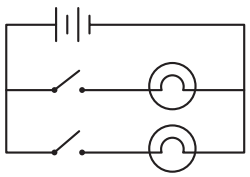
D. Identify each circuit as a "series" or "parallel" circuit. Then match the circuits with the correct descriptions. Write the letters.

1. A



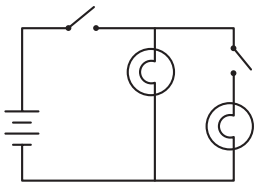
_____ circuit

B



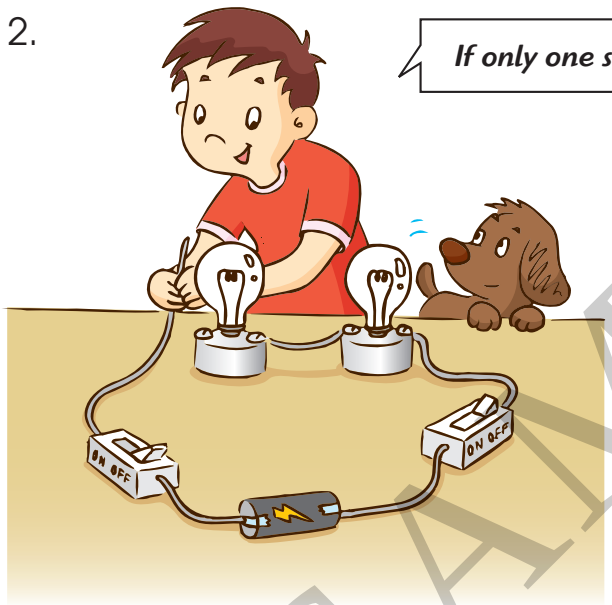
_____ circuit

C



_____ circuit

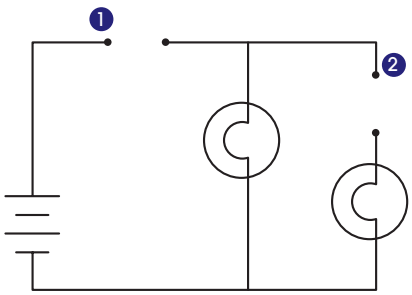
2.



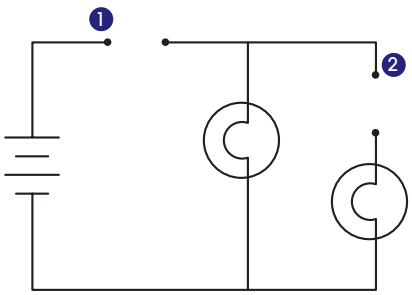
- ◯ you may or may not have one lit light bulb.
- ◯ only one light bulb is on.
- ◯ neither light bulb is on.

E. Draw the switches in the schematic diagrams so that they match the descriptions. Then color the lit light bulbs yellow.

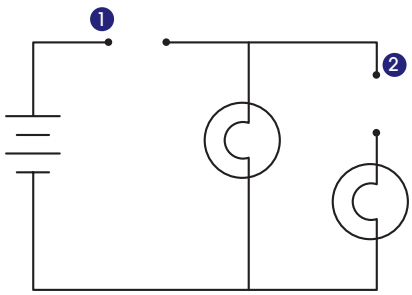
Case 1 ❶: off ❷: on



Case 2 ❶: on ❷: off



Case 3 ❶ & ❷: on



A STATIC DETECTOR

building an electroscope to detect static electricity

Static electricity lurks in the environment and likes surprising people. The buildup of negative charges jump and shock you unexpectedly and unpleasantly when you shake hands with people, pet animals, or remove a sweater, especially on a cold, dry day. Since no one likes being shocked or zapped, are there ways to detect static electricity so that we can "see" its presence?

What you need:

- a clear jar with a lid
- a straw
- aluminum foil
- a plastic comb
- scissors
- copper wire
- tape
- a nail
- a hammer

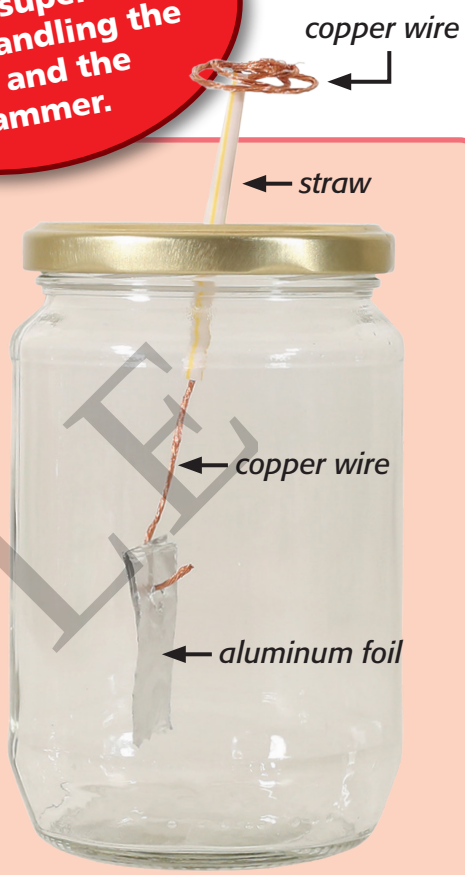
CAUTION!

Make sure you are supervised when handling the nail and the hammer.

Difficulty:

Time needed:
1 hour

In this experiment, you will build an electroscope to detect the presence of static electricity.



electroscope

What to do:

1. Use the nail and the hammer carefully to poke a hole in the middle of the lid.
2. Cut out a piece of straw that is 2 in (about 5 cm) long. Put it through the hole and tape it in place.
3. Cut out a piece of copper wire that is 6 in (about 15 cm) long and put it through the straw. Leave at least 1.5 in (about 4 cm) exposed on both ends.
4. Curl the upper end of the wire into a spiral to create a flat surface. Bend the other end to make a hook.
5. Cut out two pieces of 1.5-in-by-1-in (about 4-cm-by-2.5-cm) aluminum foil. Poke a small hole into each. Hook them to the wire.
6. Secure the lid to complete your electroscope.
7. Brush your hair with the plastic comb. Place it near the copper spiral but do not let it touch the spiral. Observe what happens to the pieces of aluminum foil.

WHAT *just* happened?

You should have noticed that in the electroscope you made, the pieces of aluminum foil moved apart and formed an inverted "V" shape. This is because of the presence of static electricity! Brushing the comb through your hair caused negative charges to build up on the comb. When the comb was close to the copper spiral, the negative charges on the comb repelled and pushed the negative charges on the spiral down to the pieces of foil. Once they took the negative charges, they repelled each other and formed an inverted "V."

The "V" formation in the electroscope is an indication of the presence of static electricity on the tested object!

- What is the function of the spiral? Can it be in other shapes?
- Why do you think it was important to let both foil pieces touch in the first place?
- Why does brushing your hair with the plastic comb create static electricity?
- Once you removed the comb, what did you notice?
- While the foil pieces stayed V-shaped, let the comb touch the spiral. What did you notice? Explain what happened.

- Test more household materials with your electroscope. Which ones could be charged with static electricity? Which ones could not? Which material had the potential to build up the greatest static electricity?
- What properties of aluminum make the electroscope function? What other materials can serve as an indicator of the electroscope?
- What will happen if you put more pieces of aluminum foil together on the hook?

Fun to know

Antistatic Gloves

Other than being an unpleasant surprise, static electricity does not bother us very much. However, protection against static electricity is important when handling sensitive and fragile electronics. Antistatic gloves, wrist straps, shoes, bags, and coatings all help prevent static electricity from damaging electronics when being handled.