CALIFORNIA

Science

Activity Lab Book

Macmillan
McGraw-Hill

All photographs are by Macmillan/McGraw-Hill (MMH) except as noted below.
Cover Photos: (bkgd) Natural Selection Stock Photography; (inset) Pete Oxford/Steve Bloom Images/Alamy.
Science Content Standards for California Public Schools reproduced by permission, California Department of Education, CDE Press, 1430 N Street, Suite 3207, Sacramento, CA 95814. A

The McGraw-Hill Companies

Macmillan
McGraw-Hill

Published by Macmillan/McGraw-Hill, of McGraw-Hill Education, a division of The McGraw-Hill Companies, Inc., Two Penn Plaza, New York, New York 10121.

Printed in the United States of America

1 2 3 4 5 6 7 8 9 024 09 08 07 06

Contents

California science standards are noted at the top of activity pages. For the text of the standards, please refer to the Reference section of the California Science Student Edition.

Name _____ Date _____

Explore

California Standard
3 IE 5.e.

What do plants need to live?

Form a Hypothesis

Do plants need light? Do they need water? Write a hypothesis.

_____

_____

Materials

- 4 identical plants
- measuring cup and water

Test Your Hypothesis

1. Label four identical plants as shown.

2. **Observe** How do the plants look? Record your observations in a chart.

Plants	Day 1	Day 4	Day 8	Day 12
Light and Water				
Light and No Water				
No Light and Water				
No Light and No Water				

3. Put the plants labeled No Light in a dark place. Put the plants labeled Light in a sunny place. Water the plants labeled Water every few days.

4. **Predict** What do you think will happen to each plant?

_____

_____

_____

Name _____ Date _____

5 **Collect Data** Look at the plants every few days. Record your observations in your chart.

Draw Conclusions

6 **Analyze Data** Which plant grew the most after two weeks? Which plant looks the healthiest?

_____

_____

7 What do plants need to live?

_____

_____

Explore More

Experiment What else do plants need to live?

Inquiry: Open Think of your own question about what plants need to live.

My question is: _____

_____

How I can test it: _____

_____

_____

My results are: _____

_____

Name _____ Date _____

Alternative Explore

Picturing plant needs

Procedure

The first plant has received regular water and sunlight. The second plant received regular water but no sunlight. The last plant received regular sunlight but no water.

Materials

- 3 plants or photos of plants that are the same height and type

1. **Observe** Describe how each plant looks.

Plant 1 _____

_____

Plant 2 _____

_____

Plant 3 _____

_____

2. **Draw Conclusions** What do plants need in order to live?

_____

_____

 Name _____ Date _____

Observe plant parts

1. Get two plants to observe.

2. **Observe** Look at the parts of each plant. Does each plant have roots?

_____

How about stems and leaves?

_____

_____

3. **Record Data** Use pictures and words to describe each plant's parts.

Plant	Roots	Stems	Leaves
Carrot			
Basil			

4. **Compare** How are the parts of these plants alike? How are they different?

_____

_____

_____

Name _____ Date _____

Focus on Skills

California Standard 3 IE 5.e.

Classify

Earth is a big place. Millions of living things find homes in a wide range of environments around our planet. With all these living things and all these different environments, what can scientists do to understand life in our world? One thing they do is compare and classify living things and environments.

1 Learn It

When you classify, you put things into groups that are alike. Classifying is a useful tool for organizing and analyzing things. It is easier to study a few groups of things that are alike than millions of individual things.

2 Try It

You learned that scientists classify Earth's environments into biomes. They classify animals, too. Can you?

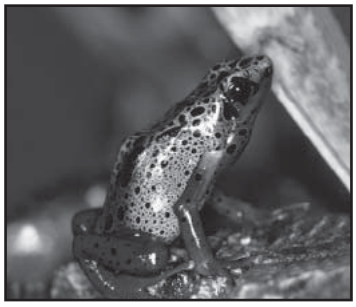
To start you need to come up with a rule. What will you use for grouping the animals shown on page 7? Let's try wings.

Then use your rule to put the animals into groups. Which animals have wings? Which animals do not? Make a T-chart to show your groups.

Name _____ Date _____

Wings	No Wings

Name _____ Date _____










Name _____ Date _____

3 Apply It

Classify these animals using a different rule.

Tails	No Tails

Name _____ Date _____

Explore

California Standard
3 IE 5.e.

What adaptations help plants survive in a desert?

Make a Prediction

Why can some plants live in dry environments? How do special structures help them survive? Write a prediction.

_____

_____

Materials

- scissors
- two plants
- hand lens

Test Your Prediction

1. **Observe** Use a hand lens to observe each plant. What structures do they have? What are their leaves like? What are their stems like?

2. **Record Data** Make a chart to record your observations. Use words and pictures.

_____

_____

3. **Observe** Cut a leaf from each plant in half. Use a hand lens to look at the leaves. What are the leaves like inside?

_____

_____

_____

Name _____ Date _____

Draw Conclusions

4 **Compare** How are the plants alike? How are they different?

_____

_____

_____

5 **Infer** What special structures help the desert plant survive in a hot, dry environment?

_____

Explore More

Experiment Put a leaf from each plant on the windowsill. How do the leaves change?

_____

_____

_____

Inquiry: Open Think of your own question about what desert plants need to live.

My question is: _____

_____

How I can test it: _____

_____

My results are: _____

_____

_____

Name _____ Date _____

Alternative Explore

Which plant can survive better in the desert?

Materials

- photographs of African violet and jade plants
- paper towels

Procedure

1. **Record Data** Look at the plants in the photographs. Describe the leaves of the two plants in a chart.

_____

_____

2. **Make a Model** Fold a paper towel in half so that you have two layers. Fold another paper towel so that you have eight layers. Wet both paper towels.

3. **Observe** Place both paper towels in a sunny window for an hour. Describe your observations.

_____

_____

4. **Compare** Which paper towel is like the leaves of an African violet plant? Which paper towel is like the leaves of the jade plant?

_____

_____

5. **Draw Conclusions** Which plant will survive better in the desert? How does this plant's leaves help it survive?

_____

_____

Name _____ Date _____

Desert adaptations

1. **Make a Model** Wet two paper towels. Then wrap one in wax paper. This models a plant that has waxy skin. Use the uncovered towel to model a plant that does not have waxy skin.

2. Place your models in a sunny window.

3. **Compare** How do the paper towels feel later in the day?

_____

_____

4. **Draw Conclusions** How does waxy skin help desert plants survive?

_____

_____

Name _____ Date _____

Be a Scientist

California Standard
3 IE 5.c., 3 IE 5.e.

How does camouflage help some animals survive?

Materials

- yellow paper
- brown paper
- stop watch

Form a Hypothesis

How does camouflage help animals stay safe? Record your hypothesis. Start with "If an animal has camouflage, then . . ."

_____

_____

Test Your Hypothesis

1. Cut out 20 yellow circles and 20 brown circles.
2. **Experiment** Spread out the circles on the paper. Then ask a classmate to pick up as many circles as he can in 10 seconds.
3. **Record Data** How many of each color circle did your classmate pick up? Use a chart to record the results.

Classmate's Name	Yellow Circles	Brown Circles

Repeat steps 1 and 2 with two other classmates.

Name _____ Date _____

Draw Conclusions

4 **Analyze Data** Did your classmates pick up more yellow or brown circles? Which circles were harder to find?

_____

_____

_____

5 How might camouflage help animals survive?

_____

_____

_____

Name _____ Date _____

Be a Scientist

How do pale colors help some animals survive?

Form a Hypothesis

Pale body coverings help desert animals stay cool. Why is this true? Write a hypothesis.

_____

_____

Materials

- white beans
- black beans
- two thermometers

Test Your Hypothesis

Design a plan to test your hypothesis. Use the materials shown. Write the steps you plan to follow.

1. _____
2. _____
3. _____
4. _____

Draw Conclusions

Did your results support your hypothesis? Why or why not? Share your results with your classmates.

_____

_____

Name _____ Date _____

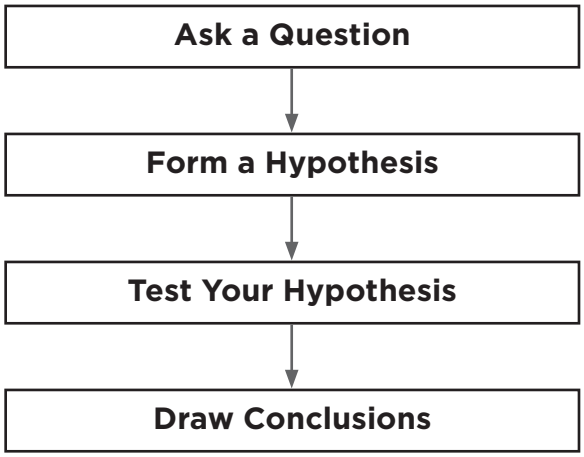
Inquiry: Open What other questions do you have about desert plants and animals? Talk with your classmates about questions you have. How might you find the answers to your questions?

_____

_____

_____

Remember to follow the steps of the scientific process.



Name _____ Date _____

Explore

California Standard
3 IE 5.d.

Why do some animals live in a grassland?

Make a Prediction

Why do animals live in grassland? Write your prediction.

_____

_____

Materials

- index card
- markers or pencils
- clear tape

Test Your Prediction

1. Use research materials to learn about an animal that lives in a grassland biome.

_____

_____

2. **Record Data** Make a picture fact card for your animal. Draw or tape a picture of the animal on the card and label it. On the other side, write the name of the grassland biome and list the three facts you learned.

_____

_____

_____

_____

Name _____ Date _____

Draw Conclusions

5 What are some important things that animals find in grassland biomes?

_____

Explore More

What would happen after a month of no rain in the grasslands? How does rainfall affect grassland animals?

_____

_____

_____

Inquiry: Open

My question is _____

How I can test it: _____

_____

My results are: _____

_____

_____

Name _____ Date _____

Alternative Explore

Which adaptations allow grassland animals to live within their environment?

Materials

- fact sheets about grassland animals
- encyclopedia/ Internet

Procedure

1. **Compare** Sort animals by their adaptations.

_____

_____

_____

2. **Draw Conclusions**

_____

_____

_____

 Name _____ Date _____

How grasses grow

1. Put some sand or pebbles in the bottom of a plastic cup. Add potting soil almost to the top. Sprinkle grass seeds over the soil. Water the soil. Place the cup in a sunny spot.

2. **Record Data** Record when you planted the grass on a calendar.

3. **Observe** Check your grass seeds each day. Keep the soil moist.

_____

_____

Materials

- sand or pebbles
- potting soil
- grass seeds
- paper cups
- water
- centimeter rulers

4. **Compare** Carefully uproot some grass. Measure the grass and the roots. Which is longer?

_____

_____

_____

Name _____ Date _____

Explore

California Standard 3 IE 5.d.

Will a plant grow toward light?

Make a Prediction

Plants need sunlight to survive. If something is blocking the light, how will a plant respond?

_____

_____

Materials

- scissors
- large shoebox
- heavy cardboard
- masking tape
- small potted plant (fast growing)

Test Your Prediction

1. Cut a hole in one end of a shoe box.
2. Cut two dividers from the cardboard as tall as the shoe box but an inch shorter than its width.
3. Tape the dividers upright along the inside of the box.
4. Put your plant in the end of the box opposite the hole. Then put the lid on the box and turn the hole toward bright sunlight.

Draw Conclusions

How does the plant get the light it needs?

_____

_____

_____

Name _____ Date _____

Explore More

Observe Observe plants around your school. Are they getting direct sunlight? Or are they in shade from a tree or building? How well have they adapted to their environment?

_____

_____

Inquiry: Open Ask students to think about the other aspects of their environment to which plants respond. Have them formulate a question on this topic, then design and carry out an experiment to answer it.

My question is: _____

_____

How I can test it: _____

_____

_____

My results are: _____

_____

Name _____ Date _____

Alternative Explore

Plants and light

Procedure

Materials

- two potted tomato seedlings or other fast-growing plants
- a light source

1. Place two plants on opposite sides of a light source.

2. **Compare** How do the two plants look?

_____

_____

_____

3. **Draw Conclusions**

_____

_____

Name _____ Date _____

Hiding out

Materials

- colored construction paper
- patterned fabric or gift wrap sheets
- colored markers
- scissors

1. **Make a Model** Fold a piece of colored construction paper in half. Draw a butterfly outline. Cut out two butterflies.
2. Select a piece of fabric or wrapping paper to be your butterfly habitat.
3. Draw two large spots or "eyes" on one butterfly's wings or tail. Color the other butterfly to look like the habitat.
4. **Observe** Place your butterflies on the habitat. Which one can you find quickly? Which one looks like it does not belong there?

_____

_____

_____

5. **Infer** Why would blending in help a butterfly stay safe?

_____

_____

Name _____ Date _____

Be a Scientist

California Standard 3 IE 5.d.

How do trees affect light in a rainforest?

Form a Hypothesis

Rain forest trees can grow as high as 60 m. The trees' branches spread wide to form the canopy. How does the thickness of the canopy affect the amount of light that reaches the forest floor? Write a hypothesis. Begin with "If the rain forest canopy is thick, then . . . ."

_____

_____

_____

Materials

- brown and green construction paper
- masking tape
- cardboard
- lamp

Test Your Hypothesis

1. **Make a Model** Use 6 sheets of brown paper to create 6 tubes of different height. These will model the tree trunks in your rain forest.

2. Draw two circles that have a diameter of 8 cm on green paper. Draw 3 more circles with 4 cm diameters. Cut out the circles. These will represent the canopy of the trees.

3. Tape the circles to the tree trunks. Arrange the trees onto a piece of cardboard so that the tree trunks are close to each other.

Name _____ Date _____

4 **Experiment** Set up a lamp to shine down onto the forest you created. Observe and record the brightness of the light that is shining on the top of the tall trees. Observe and record the amount of light that is shining under the trees.

5 **Measure** Use a thermometer to measure the temperature on top of the tallest tree and under the canopy. Record the temperatures in your journal in a chart like the one below.

	Top of Canopy	Under the Trees
Amount of light		
Temperature		

Draw Conclusions

1 **Observe** Was the light brighter on top of the tall trees or under the canopy? Explain.

_____

_____

2 **Infer** What adaptations will help plants in a rain forest if they grow on the ground?

_____

_____

Name _____ Date _____

Be a Scientist

Form a Hypothesis

How do the trees in a rain forest affect the amount of water that reaches the forest floor? Write in the form, "If trees in a rain forest have a large canopy, then the amount of rain that reaches the forest floor will . . ."

_____

_____

Test Your Hypothesis

Design an experiment to investigate how canopy size will affect the amount of water that reaches the forest floor.

My question is: _____

_____

How I can test it: _____

_____

_____

_____

My results are: _____

_____

_____

Draw Conclusions

Did your experiment support your hypothesis? Why or why not?

_____

_____

Name _____ Date _____

Do emergent trees affect the growth of plants below them?

Inquiry: Open What else could you learn about rain forests?

1. What happens to plants in the understory if an emergent tree is cut down?

2. What traits do plants in the understory have that help them survive?

Design an experiment. Your experiment must be organized to test only one variable, or one item being changed. Your experiment must be written so that another group can complete the experiment by following your instructions.

My question is: _____

_____

How I can test it: _____

_____

_____

_____

My results are: _____

_____

_____

Name _____ Date _____

Explore

California Standard
3 IE 5.d.

Does fat help animals survive in cold environments?

Materials

- vegetable fat
- paper towel
- ice water
- stopwatch

Form a Hypothesis

Does fat help animals stay warm? Does fat keep animals cool? Write a hypothesis. Start with "If an animal has extra fat, then . . ."

_____

_____

Test Your Hypothesis

1. Use a paper towel to spread vegetable fat over one of your index fingers. Try to coat your finger completely with fat.

2. **Predict** What will happen when you put both index fingers in a bowl of ice water?

_____

_____

3. **Collect Data** Ask a partner to time how long you can keep each index finger in the ice water. Record the data in a chart.

4. Trade roles with your partner and repeat steps 1 through 3.

Name _____ Date _____

Draw Conclusions

5 **Analyze Data** Did your observations match your prediction? What happened when you put both fingers in the ice water?

_____

_____

6 How does fat help animals survive in cold places?

_____

Explore More

How does thick fur help animals survive in cold environments? Form a hypothesis. Then make a plan to test it.

_____

_____

Inquiry: Open Ask students to think about how effective the fur of different kinds of animals would be at preventing loss of heat. Have them formulate a question on this topic, then design and carry out an experiment to answer it.

My question is: _____

How I can test it: _____

_____

My results are: _____

_____

_____

Name _____ Date _____

Alternative Explore

Insulation

Procedure

Materials

- Internet
- encyclopedia

1. **Record Data** What does insulation mean?

_____

_____

_____

2. **Compare** Why types of insulation keep animals warm?

_____

_____

_____

Name _____ Date _____

Arctic adaptations

1. **Observe** What do you notice about the arctic and desert foxes' features? What are their coats and bodies like?

_____

_____

_____

2. **Compare** How are the animals alike? How are they different?

_____

_____

_____

3. **Infer** How do the arctic fox's features help it survive in the arctic tundra?

_____

_____

_____

Name _____ Date _____ **Explore**

Can ocean animals live and grow in fresh water?

For a Hypothesis

Can brine shrimp grow in fresh water and salt water? Put the question into an "if, then" statement.

_____

_____

Materials

- 2 jars
- brine shrimp eggs
- measuring spoon
- measuring cup and water
- hand lens

Test Your Hypothesis

1. Fill each jar with 480 mL of water. Put two tablespoons of salt in one jar. Label the jars "Fresh Water" and "Salt Water."

2. Add one teaspoon of brine shrimp eggs to each jar.

3. **Observe** Watch what develops in each jar over the next few days. Use a hand lens.

Draw Conclusions

4. Can ocean animals live and grow in a freshwater environment?

_____

_____

Name _____ Date _____

Explore More

Does temperature affect the hatching of brine shrimp eggs? Design an experiment to find out.

_____

_____

_____

_____

Inquiry: Open Ask students to think about why organisms adapted to live in either fresh water or salt water cannot survive in a different water environment. Have them support their answers by explaining and comparing the composition of matter in salt water versus fresh water.

My question is: _____

_____

How I can test it: _____

_____

My results are: _____

_____

_____

_____

_____

Name _____ Date _____

Alternative Explore

Ocean animal survival

Procedure

Materials

- 2 clear cups
- thin potato strips
- plastic spoon
- salt
- measuring cup
- hand lens

1. Dissolve a tablespoon of salt in 60 mL of water in a cup.
2. Pour the same amount of pure water into another cup.
3. Submerge one potato strip in the salt water and the other in the pure water.
4. **Observe** Examine each potato strip after a few hours. What do you see?

_____

_____

_____

Draw Conclusions

5. What did you think happened to the potato strip. Why?

_____

_____

_____

Name _____ Date _____

Water temperatures

1. Fill two jars with water. Label one jar "Sunlight" and put it in a sunny place. Label the other jar "No Sunlight" and put it in a very dark place.

2. **Observe** After a few hours, measure the water temperature in each jar with a thermometer. Which jar is warmer?

_____

Draw Conclusions

3. The two jars model two parts of the ocean. What are those parts? How are they different?

_____

_____

_____

_____

4. **Infer** Where do you think most animals live in the ocean?

_____

_____

Predict

You just learned about saltwater and freshwater environments. Which do you think freezes faster, salt water or fresh water? To find answers to questions like this, scientists predict what they think will happen. Next, they experiment to find out what does happen. Then, they compare their results with their prediction.

Learn It

When you **predict,** you state the possible results of an event or experiment. It is important to record your prediction before you do an experiment, record your observations as you experiment, and record the final results. Then you have enough data to figure out if your prediction was correct.

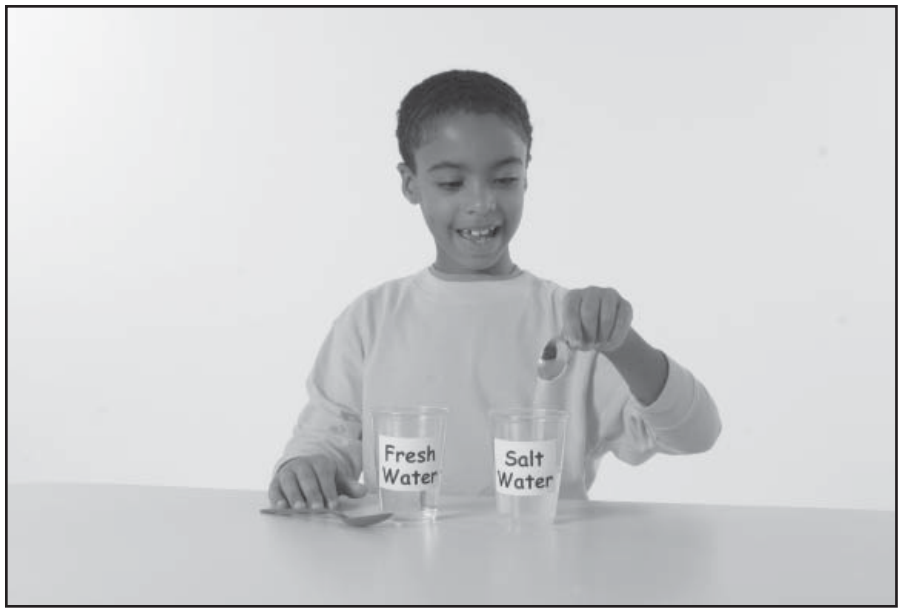
Name _____ Date _____

Try It

1. Make your prediction. Write it on a chart like the one shown on page 39.
2. Pour 125 mL (half cup) of water into one container. Label this container "fresh water."
3. Pour 125 mL (half cup) of water into the other container. Add 5 mL (1 teaspoon) of salt and stir with a spoon. Label this container "salt water."
4. Place both containers into the freezer. Check them every 15 minutes. Draw or write your observations.

Materials

- 2 clear plastic containers
- water
- 5 mL (1 teaspoon) salt
- plastic spoon
- measuring cup
- masking tape
- marker



Name _____ Date _____

Which Freezes Faster?	
My Predictions	
Observations of **Fresh Water**	
Observations of **Salt Water**	
Results	

Now answer these questions:

1. Which freezes faster, fresh water or salt water?

_____

2. Was your prediction correct?

_____

Name _____ Date _____

Apply It

Now that you've learned to think like a scientist, make another prediction. Do you predict that salt water or fresh water will evaporate faster?

_____

Plan an experiment to find out if your prediction is correct.

_____

_____

Name _____ Date _____

Explore

California Standard
3 IE 5.d.

How do jellyfish and some other water animals move?

Materials

- balloon

Purpose

To model how jellyfish and some other ocean animals are adapted to move through water.

Procedure

1. **Make a Model** Blow up a balloon. Hold the end of the balloon tight so the air cannot escape. The balloon models the hollow, bell-shaped body of a jellyfish. The air is like water that fills the jellyfish's body.

2. **Predict** What do you think will happen when you let go of the balloon? What happens as 'water' is pushed out of a "jellyfish's body?"

_____

_____

3. **Experiment** Let go of your balloon.

   △ **Be Careful.** Make sure you do this away from other students.

Draw Conclusions

4. How does a jellyfish move through the ocean?

_____

_____

Name _____ Date _____

Explore More

How do other animals move through the ocean? Do research to find out.

_____

_____

_____

Inquiry: Open Ask students to think about how the fins of fish help them move through the water. Have them design an experiment to show the advantage of fins.

My question is: _____

How I can test it: _____

_____

My results are: _____

_____

_____

Name _____ Date _____

Alternative Explore

How does a sea animal move through the water?

Materials

- baster
- pan of clear water
- pan of colored water

Procedure

1. Fill the baster with colored liquid. The baster represents a sea animal.
2. Eject the contents into the pan of clear water. Note how quickly the colored water moves through the clear water.

Draw Conclusions

3. **Infer** How does a sea animal, like an octopus, move through the water?

_____

_____

_____

_____

Name _____ Date _____

Plant growth

1. Get two self-sealing plastic bags. Place a paper towel in each plastic bag. Add 60 mL of water to one bag. Label it *Fresh Water.* Add 60 mL of water and 1 teaspoon of salt to the other bag. Label it *Salt Water.*

2. Punch a line of staples about 3 cm from the bottom of each bag. Drop 5 bean seeds into each bag. Hang the bags on a wall or window.

3. **Compare** Do plants grow in both water environments?

_____

_____

4. **Draw Conclusions** Do plants need special adaptations to survive in salt water?

_____

_____

Name _____ Date _____

Be a Scientist

California Standard 3 IE 5.e.

How does salt affect the way things float in water?

Form a Hypothesis

Animals that live in Earth's oceans move around easily. Does salt water affect the way things move or float? Form a hypothesis. Begin with "If water is salty, then . . ."

_____

_____

Materials

- 2 clear plastic mixing bowls
- 1 fresh egg
- sea salt
- plastic spoon
- measuring cup

Name _____ Date _____

Test Your Hypothesis

1. **Measure** Label one bowl *Fresh Water* and the other bowl *Salt Water.* Pour 400 mL into each bowl.

2. **Measure** Pour 1/8 cup of sea salt into the bowl labeled *Salt Water.*

3. **Observe** Carefully place a fresh egg in the bowl labeled *Fresh Water.* Take the egg out and gently place it in the bowl labeled *Salt Water.* Record what you observe in your chart.

_____

Bowl	What I Observed
Fresh Water	
Salt Water	

Name _____ Date _____

Be a Scientist

Does salt water affect plants?

Form a Hypothesis

Ocean water and fresh water will affect plants differently. What effect does salt water have on plants? Write your answer in the form "If water has salt then . . ."

_____

_____

Materials

- 2 plastic cups
- sea salt
- head of lettuce or pieces of lettuce

Test Your Hypothesis

Design an experiment to investigate what happens to lettuce when it absorbs fresh water and salt water. Use the materials shown.

1. Place a lettuce leaf in a cup labeled *Fresh Water.*
2. Place a lettuce leaf in a cup labeled *Salt Water.*
3. Observe each leaf after 15 minutes.
4. Which piece of lettuce is firm and which is flimsy?

_____

Draw Conclusions

5. Did your results support your hypothesis? Why or why not? Share your results with your classmates.

_____

Name _____ Date _____

Inquiry: Open What other questions do you have about animals and plants that live in the ocean? Talk with your classmates about questions you have. Make up steps you will follow to answer your questions. Write a list of materials you will use in your investigation.

_____

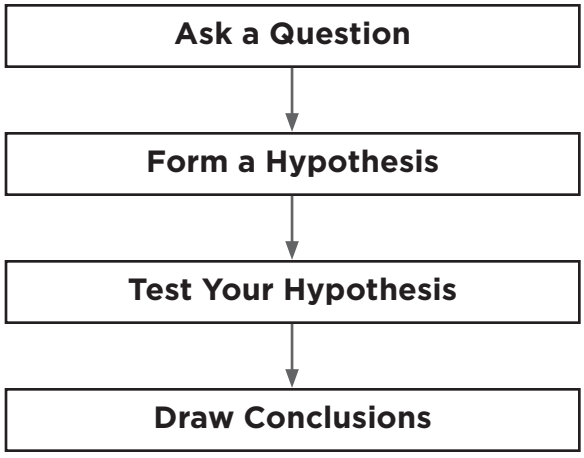
_____

_____

_____

_____

Remember to follow the steps of the scientific process.



Name _____ Date _____

Explore

California Standard 3 IE 5.e.

How do wetlands filter water?

Purpose

To demonstrate how wetlands filter water.

Materials

- aluminum pan
- modeling clay
- strip of indoor/outdoor carpeting
- turkey baster
- clear water
- muddy water

Procedure

1. Spread modeling clay in one half of the pan to represent land. Have the land slope down into the empty part of the pan.

2. **Observe** Use the baster to pour clean water over the land. This represents a heavy rain. How quickly does the heavy rain flood the low part of the land?

_____

3. **Observe** Remove the water and set up the carpet. Then once again use the baster to create "heavy rain." How quickly does the water from the heavy rain flood the low part of the land?

_____

_____

Name _____ Date _____

Draw Conclusions

4 What can a model teach us about the real environment?

_____

_____

Explore More

What other filters can you think of? Design an experiment that shows how they work.

_____

_____

Inquiry: Open What part of a wetland is the carpet supposed to represent in the model?

_____

_____

_____

Name _____ Date _____

Alternative Explore

Nature's sponge

Procedure

Materials

- aluminum pan
- sponge
- water
- book

1. Tilt the aluminum pan on a slight angle by placing a book underneath one end.
2. Pour a small amount of water in the raised part of the pan. Notice how the water runs to the bottom part of the pan.
3. Then, place the sponge in the middle of the aluminum pan.
4. Pour a small amount of water in the raised part of the pan. Notice how much water the sponge soaks up.
5. What does the sponge represent?

_____

Name _____ Date _____

Wetlands, plants, and water level

1. Place four moist sponges in a flat pan. Each sponge acts like a wetland to soak up water. Pour water into the pan, covering the sponges.

2. **Observe** Mark the level of water in the pan.

3. Pour the water out of the pan and wring out the sponges. Repeat steps 1 and 2 using only one sponge.

4. **Compare** How do the water levels compare in each situation? How can destroying wetlands affect non-wetland environments?

_____

_____

_____

_____

Name _____ Date _____

Explore

California Standard 3 IE 5.e.

How can worms change their environment?

Purpose

To find out how one living thing changes its environment.

Materials

- worms
- plastic containers
- leaves
- moist soil
- stones

Procedure

1. Put soil in the plastic container. Then put small stones and leaves on top of the soil. This models the forest floor.
2. Place live worms on the "forest floor."
3. **Predict** What will the worms do?

_____

_____

4. **Observe** Check the worms, soil, leaves, and stones every three to four days.

Draw a Conclusion

5. How do worms change the environment in which they live?

_____

_____

Name _____ Date _____

Explore More

How do other living things change their environments? Make a plan to test your ideas. Then try your plan.

_____

_____

Inquiry: Open When people go camping, they try not to change the environment. They have to bring supplies so that they can meet their needs and still not disturb the natural setting. Make a list of supplies you would need for a camping trip. Meet briefly with the group to which your teacher assigns you. When you meet with your group, bring the supplies list you wrote by yourself. Discuss as a group the supplies you would need for the trip. Most importantly, discuss how your group could build a campsite if you arrived at the campsite without your supplies.

My question is: _____

_____

How I can test it: _____

_____

My results are: _____

_____

_____

_____

Name _____ Date _____

Alternative Explore

Nesting behavior

Many animals change their environment by building a nest. In the wild, small rodents change their environment by finding and shredding nesting materials such as leaves, grass, and bits of wood.

Materials

- hamster or gerbil
- cage with litter
- water
- food
- cardboard tube from toilet paper roll

1. **Measure** Measure the length of the cardboard tube. Write down this measurement in the first rectangle of the chart you will make when you begin observing the animal.

2. **Record Data** Make a chart to record the behavior data. Observe the animal for a week. Within each day's rectangle on the chart, describe the animal's behavior, and be sure to write down information about the condition of the cardboard tube. Watch carefully to see how the tube changes.

3. **Analyze Data** How was the caged animal's nesting behavior similar to the behavior of a rodent in the wild?

_____

_____

4. Why might a rodent build a nest even though it is caged?

_____

_____

Quick Lab

Name _____ Date _____

What are the beaver's tools?

Materials

- several photographs of beavers
- access to the Internet

1. **Observe** Look at the photographs of beavers. Study the parts of their bodies. Which parts help them to swim, chew wood, and stay warm in cold water?

_____

_____

_____

_____

_____

2. **Observe** Use a chart to show that each body part of a beaver has a special purpose.

Body Part	Purpose

3. **Critical Thinking** Does a beaver help or harm the environment?

_____

_____

_____

Name _____ Date _____

Focus on Skills

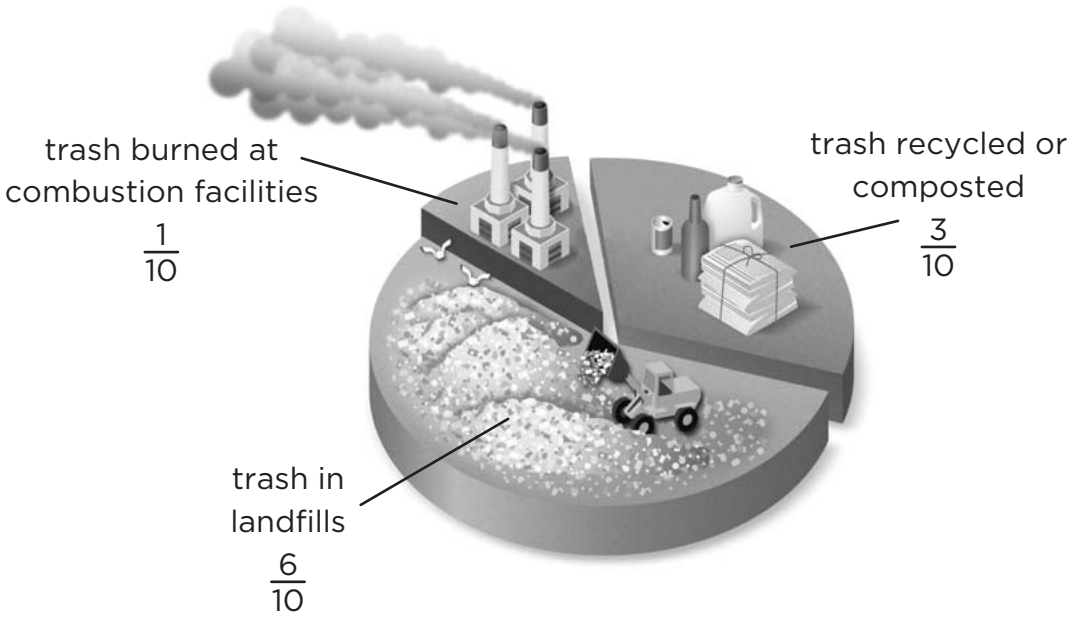
California Standard 3 IE 5.e.

Trash

You read that most Americans change their environment daily by creating about 2 kg (4 lbs.) of trash each! We can never completely get rid of trash and garbage. Even if we burn it, we still have the ash! So it is up to everyone to cut down on garbage. Do the kids in your school conserve? Find out the same way scientists do: gather and record data.

Record Data

When we record data, we write or draw facts we collect through measuring, counting, and testing. It is usually easier to study recorded information if we organize it on a chart or graph. Many times scientists gather data by asking questions or having people fill out surveys. You can do it, too.



Name _____ Date _____

Try It

In this activity, you'll gather data about how much tash is thrown out by students in your school. You cannot survey the whole school, but you'll do a mini-survey.

1. Choose five students to survey in the lunchroom today.
2. Ask each student questions about how many pieces of trash from lunch he or she threw away.
3. Record each student's data on a chart like the one shown.
4. Use the information from all five students to record your group's data.

Student's Name	Pieces Reused	Pieces Recycled	Pieces Thrown Away	Total Pieces of Trash

Draw Conclusions

5. Did every student throw out some trash or packaging material?

_____

_____

Apply It

Do you predict that these same students will throw out more or less trash tomorrow? Plan another survey to collect and record the data, and then compare those results to your first result, just as scientists do!

1. **Analyze Data** Record your new results on a chart similar to the one below.

Student's Name	Pieces Reused	Pieces Recycled	Pieces Thrown Away	Total Pieces of Trash

Draw Conclusions

1. Did most people continue with their same lunch habits from the first day to the next day of surveying?

_____

_____

_____

Name _____ Date _____

Bar graphs

1. Bar graphs compile data and show those results in a glance. Your teacher will review examples of bar graphs with you. Study the parts of a bar graph to understand how they work. Your teacher will give you a piece of graph paper to make your own bar graph.

Materials

- pencils
- draft paper
- examples of bar graphs

2. **Communicate** Practice making a bar graph from a new survey. For example, you might ask your classmates, "What is your favorite color?" Interview five classmates, and record the results on a bar graph similar to the ones you studied with your teacher.

Name _____ Date _____

Explore

California Standard 3 IE 5.d.

What happens to some plants when there is a flood?

Make a Prediction

What happens to plants when they get too much water? Make a prediction.

_____

_____

Materials

- three plants labeled A, B, and C
- graduated cylinder
- tray

Test Your Prediction

1. Water plant A once a week with 30 mL of water. Water plant B everyday with 60 mL of water. Water plant C everyday with 120 mL of water.

2. **Predict** What will happen to plants after three weeks? Record your prediction.

_____

_____

_____

3. **Record Data** Watch and study your plants every few days. Create a short journal to monitor the plants' progress. For every day that you observe the plants, make an entry on a separate piece of paper and describe how the plants look. Draw pictures that illustrate how the plants are doing. Measure how tall they grow and write down each of the measurements in your journal.

Name _____ Date _____

Draw Conclusions

4 How do the plants look after three weeks? Which plant looks the healthiest? Which plant received the right amount of water? Look back at your prediction. Did the experiment support your prediction? Write down answers to these questions in your journal.

_____

_____

Explore More

Continue to track the progress of the three plants. For example, if you decrease the amount of water for the plant that received too much water, do its appearance and health change?

Inquiry: Open What kinds of plants are not affected by flooding? Research at the library or on the Internet to discover types of plants that are flood-resistant. Plan and perform an experiment to test the flood-resistance of plants that you choose from your research.

My question is: _____

_____

How I can test it: _____

_____

_____

My results are: _____

_____

Name _____ Date _____

Alternative Explore

Identical succulent plants

1. **Predict** How do succulent plants respond to flood conditions?

_____

_____

_____

Materials

- two identical, potted succulent plants
- ruler

2. **Test Your Prediction** Treat both plants in the exact same way except when they are watered. Water and care for one plant according to the instructions from the plant nursery. Soak the soil for the second plant so that water constantly covers its surface for the full experimental period.

3. **Record** At the end of the experiment, measure the plants.

Plant A's last measurements: _____

Plant B's last measurements: _____

Name _____ Date _____

Grassland ecosystem

1. Make five character cards. Label the cards: prairie dog, burrowing owl, snake, eagle, coyote.
2. Paste the cards on a large sheet of paper.
3. Draw arrows from each card to show how the organisms depend on each other.

Materials

- 5 character cards labelled prairie dog, burrowing owl, snake, eagle, coyote

4. **Infer** What would happen if prairie dogs disappeared?

_____

_____

_____

Name _____ Date _____

Be a Scientist

California Standard 3 IE 5.b.

How do environmental changes affect plants?

Form a Hypothesis

Changes in the environment affect living things. A harmful change may cause plants to die. Some plants may be able to live in the new environment. What happens to bean plants when their environment changes? Start with "If the amount of water a plant gets changes, then . . ."

Materials

- aluminum pans
- soil
- 2 cactus plants
- 2 grass plants
- 2 African violets
- watering can

Test Your Hypothesis

1. **Experiment** Fill both pans with the same amount of soil. Label one pan FLOOD and the other pan DROUGHT.
2. Plant one of each kind of plant in each pan.
3. Water plants in the FLOOD pan daily. Do not water plants in the DROUGHT pan.
4. **Record Data** Monitor the growth of each plant. Draw and record the growth of each plant over two weeks.

Name _____ Date _____

Draw Conclusions

5 **Communicate** What happened to the plants in the FLOOD pan? What happened to the plants in the DROUGHT pan?

_____

_____

_____

_____

_____

_____

6 Which plants could survive during a drought? Which could survive during a flood?

_____

_____

7 **Infer** Why did the environmental changes affect plants differently?

Name _____ Date _____

Be a Scientist

How does shade affect plants?

Form a Hypothesis

What happens to plants if large trees grow above them and create shade? Write in the form, "If plants become shaded, then . . ."

_____

_____

Materials

- African violet
- cactus
- grass
- black construction paper

Test Your Hypothesis

Design an experiment to investigate the changes that shade will make to a plant. Write out the steps you will follow. Record your results and observations.

_____

_____

_____

_____

_____

Draw Conclusions

1. Did the results support your hypothesis?

_____

_____

_____

Name _____ Date _____

How do man-made environmental changes affect plants?

Design an experiment to answer your question. Your experiment must be organized to test only one variable or item being changed. Your experiment must be written so that another group can complete the experiment by following your instructions. Remember to follow the steps of the scientific process.

My question is: _____

_____

_____

_____

How I can test it: _____

_____

_____

_____

_____

My results are: _____

_____

Name _____ Date _____

Explore

California Standard 3 IE 5.e.

How do fossils tell us about the past?

Purpose

To learn how paleontologists find fossils.

Materials

- paper cup
- colored sand
- "fossil" objects
- white glue
- measuring cup
- brush

Procedure

1. Use the measuring cup to mix a little glue with water.

2. **Observe** Pour a thin layer of colored sand into a paper cup. Add a "fossil" object. Cover the object sand of the same color. Add a little water and glue to "set" this layer.

3. Use a different color sand to add a second fossil object. Set with glue and water. Make three or more colored sand layers with different fossil objects. Allow the layers to dry.

Draw a Conclusion

4. What can layers of rock and soil tell us about a fossil and its environment?

_____

_____

_____

Name _____ Date _____

Explore More

How else could you model a fossil? Make a plan and try it!

_____

_____

Inquiry: Open Where have the greatest number of fossils been found?

My question is: _____

_____

How I can test it: _____

_____

_____

My results are: _____

_____

_____

_____

Name _____ Date _____

Alternative Explore

Fossil layers

Make a Prediction

Begin your answer with the following form, "I can figure out what came first in fossil layers by . . ."

_____

_____

_____

Materials

- small containers
- sand or soil
- small classroom objects

1. **Observe** Study all of the layers and all of the items in the various layers.

2. **Infer** What appears to have been the first layer of items?

_____

_____

_____

3. **Record** From the bottom up, record what the order of the fossil layers appears to be.

4. **Communicate** Share the order of the layers you observed.

 Name _____ Date _____

Fossil mystery

Materials

- trilobite fossil or picture of a trilobite fossil

1. **Observe** Look at a trilobite fossil, or a picture of one. Does it look like any animal alive today?

_____

2. **Compare** Compare this fossil to an animal alive today. Write down the clues that tell you this animal is similar to a trilobite. Where does this animal live?

_____

3. **Infer** What environment was home to the trilobite? How did it move? What do you think it ate?

_____

_____

Draw Conclusions

4. How do trilobite fossils help people understand the past?

_____

_____

_____

Name _____ Date _____

Explore

California Standard
3 IE 5.d

How do shadows change?

Make a Prediction

Does the location of the Sun in the sky affect the length of shadows on the ground? Does it affect the position of the shadows? Write a hypothesis.

_____

_____

Materials

- chalk
- measuring tape
- pencil and paper

Test Your Prediction

1. Work in pairs outside on a sunny morning. Use the chalk to mark an X on the ground. Have your partner stand on the X.
2. Trace your partner's shadow.
3. **Measure** Use the measuring tape to find the length of the shadow. Record your results in a table.

Time	Length of Shadow
Morning	
Midday	
Afternoon	

Draw Conclusions

4. **Infer** What causes the shadow to change position and length?

_____

_____

_____

Name _____ Date _____

Explore More

During which month does the Sun's position appear highest in the sky? Lowest? How could you find out?

_____

_____

_____

_____

Inquiry: Open Ask students to think about how they could use this method to make a sundial. Have them develop a design and a method to calibrate a simple sundial that reads hours in the day. Have the students make the sundial.

My question is: _____

How I can test it: _____

_____

_____

_____

_____

_____

My results are: _____

_____

_____

Name _____ Date _____

Alternative Explore

Why are some hours' shadows different lengths?

Materials

- mounted globe
- ruler
- desk lamp
- matchstick
- sticky tack

Procedure

1. **Predict** At which hour will the shadow be the longest? The shortest?

   _____

   _____

   _____

2. Use the sticky tack to mount the matchstick on the globe at your location.

3. Position the lamp at a distance from the globe, turn it on, and lower the room lights.

4. Begin with the matchstick facing the lamp directly (noon) and measure the length of the shadow produced.

5. **Record Data** Record the length for noon.

6. Turn the globe 30 degrees (longitude) counterclockwise from above and measure the shadow length for 2 o'clock in the afternoon. Continue until the shadow disappears.

7. Identify when the Sun sets at the matchstick location.

Name _____ Date _____

A model of Earth

△ **Be Careful! Handle the pencil and its point with care.**

1. Push the pencil through the foam ball. Press the paper clip into the side of the ball.

2. **Make a Model** In a darkened room, shine the light on the paper clip. Where is it day on the model?

_____

3. Show how Earth rotates by turning the pencil. What happens to the light on the paper clip? Where is it day on the model? Where is it night?

_____

_____

_____

4. **Communicate** How does this model help explain what you know about day and night?

_____

_____

_____

_____

Name _____ Date _____

Focus on Skills

California Standard 3 IE 5.e

Day and night

Analyze Data

Have you ever noticed that some days seem longer than others? This happens because the Sun rises and sets at different times on different days. Some days seem longer because they have more hours of daylight than others. How did scientists figure this out? One way is to **analyze data** from past years.

Learn It

When you analyze data, you use information that has been gathered to answer questions or solve problems. It is easiest to analyze the data if it has been organized and placed in a chart or a graph. That way you can quickly see differences in the data.

Average Sunrise and Sunset Data for Los Angeles, California

Month	Sunrise	Sunset	Approximate Hours of Daylight
January	6:59 A.M.	5:07 P.M.	10
March	6:04 A.M.	6:01 P.M.	12
May	5:52 A.M.	7:48 P.M.	14
July	5:53 A.M.	8:05 P.M.	14
September	6:37 A.M.	7:00 P.M.	$12\frac{1}{2}$
November	6:27 A.M.	4:50 P.M.	$10\frac{1}{2}$

Name _____ Date _____

Bar graphs

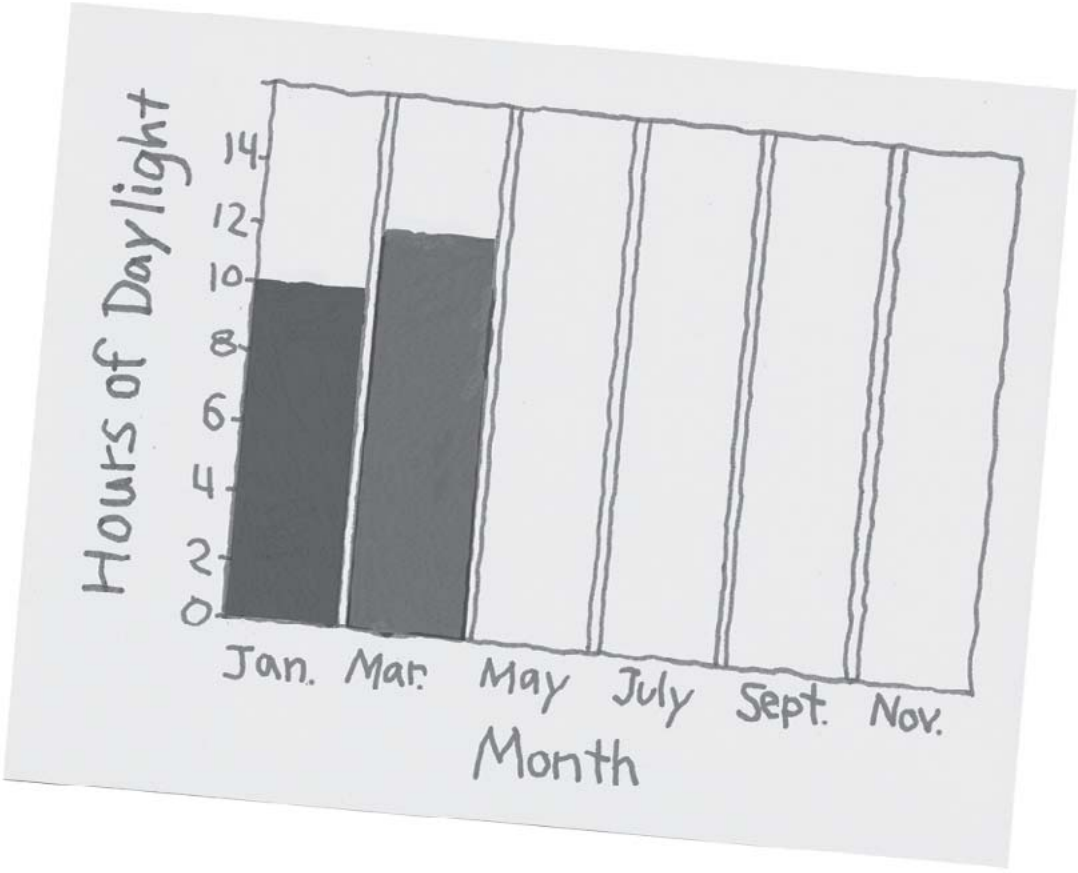
Try It

1. Use the data from the chart on the previous page to make a bar graph.
2. List the months along the bottom of the graph.
3. Write the numbers along the left side of the graph.
4. Draw a bar to match each of the numbers from your data.
5. Write a title for the graph to analyze the data. About how many hours of daylight will there be tomorrow? Explain in your answer.

_____

_____

_____



Name _____ Date _____

Apply It

It is your turn to analyze data. Measure the air temperature every hour for one day. Begin at 8 A.M. and end at 6 P.M. Record your data in a chart. Use the data in the chart to make a bar graph.

Now you can use the bar graph to analyze your data.

1. When is the air temperature the warmest?

_____

_____

2. When is the air temperature the coolest?

_____

_____

Name _____ Date _____

Explore

California Standard
3 IE 5.d

What happens when seasons change?

Make a Prediction

What happens to the length of a shadow as the seasons change? Write a hypothesis.

_____

_____

_____

Materials

- globe
- lamp
- small lump of clay
- 10-cm piece of drinking straw

Test Your Prediction

1. Make a model. Stick the clay over California on the globe. Stand the straw up in the clay.
2. Your teacher will place the lamp in the center of the room so the light hits the middle of Earth. The lamp represents the Sun.
3. In a darkened room, one person will hold the globe. The globe represents Earth. This person will walk around the Sun. Tip the Earth to show its tilt.

Draw Conclusions

4. **Infer** Where was the shadow shortest? Where was it longest?
5. Which of these is summer in the model? Which is winter?

_____

_____

_____

Name _____ Date _____

Explore More

How do you think this model might help explain the changing seasons?

_____

_____

Inquiry: Open Have the students think about the position of Earth and the Sun during spring and fall. Have them create a model that shows the position of Earth and the Sun during both of these seasons.

My question is: _____

_____

How I can test it: _____

_____

My results are: _____

_____

Name _____ Date _____

Alternative Explore

What is Earth's position with the Sun when it is winter in California?

Materials

- globe
- lamp without lampshade
- paper
- pencil

Procedure

1. Predict Earth's position with the Sun when it is winter in California.
2. Place the lamp on a table where all students can see and there is room to walk around the lamp.
3. Angle the globe so that it models Earth's tilt and position the globe so that the Northern Hemisphere is tilted toward the lamp and is illuminated.
4. This is a model of Earth's position with the Sun when it is summer in California.
5. Write a description or draw a diagram for Earth's position with the Sun when it is winter in California.

_____

Name _____ Date _____

Sunset times

1. Use research materials to find the average time of sunset where you live for each month.

2. Record this information in a chart.

3. During which month is sunset the latest? The earliest?

_____

_____

_____

4. **Infer** During which month is the Sun's path highest in the sky? Lowest? How do you know?

_____

_____

_____

Name _____ Date _____

Explore

California Standard
3 IE 5.d

How does the Moon's shape seem to change?

Materials

- pencil
- paper
- binoculars (optional)

Form a Hypothesis

How will the shape of the Moon seem to change during a week's time? Write a hypothesis.

_____

_____

Test Your Hypothesis

1. **Observe** Look at the Moon just after sunset each night for one week.

2. **Record** Draw the Moon as you see it each night. Label the picture with the day of the week.

Draw Conclusions

3. **Analyze Data** How does the Moon's shape change each night?

_____

_____

_____

4. **Predict** What do you think the Moon's shape will be like for the next few nights?

_____

_____

Name _____ Date _____

Explore More

Why do you think the Moon's shape appears to change each night?

_____

_____

_____

Inquiry: Open We only ever see one side of the Moon from Earth. Ask students to think about what the phases of the Moon on the far side would be like compared to our side. Ask them to formulate a testable question and design an experiment, to test it.

My question is: _____

_____

How I can test it: _____

_____

_____

_____

_____

My results are: _____

_____

Name _____ Date _____

Alternative Explore

What are the phases of the Moon?

Procedure

Materials

- globe
- flashlight
- ball

1. **Predict** How will the light affect the ability to see the Moon?

_____

_____

_____

_____

2. One student should hold the flashlight representing the Sun, and a second student should hold the ball representing the Moon.

3. Set the globe in a convenient central location. The flashlight holder should be off to one side. The student holding the ball must be able to walk easily around the globe.

4. The student with the Moon should begin behind the globe with the flashlight illuminating the Moon from the side.

5. **Record Data** Students should draw the Moon as it would be seen from Earth, their current perspective.

6. Continue the orbit of the Moon, stopping at positions that allow students to observe and record the phases and their changes.

Name _____ Date _____

Make a Moon phase flip book

1. Write the name of one of the eight Moon phases on the left side of each index card. See example below.

2. Draw what each phase looks like on the right side of each card.

3. Put the cards in order and staple the book together on the left side.

4. Flip the pages with your thumb to see the Moon's shape change.

5. How is this model of the Moon's phases like the real thing?

_____

_____

Name _____ Date _____

Be a Scientist

California Standard 3 IE 5.a

Why does the Moon's shape appear to change?

Materials

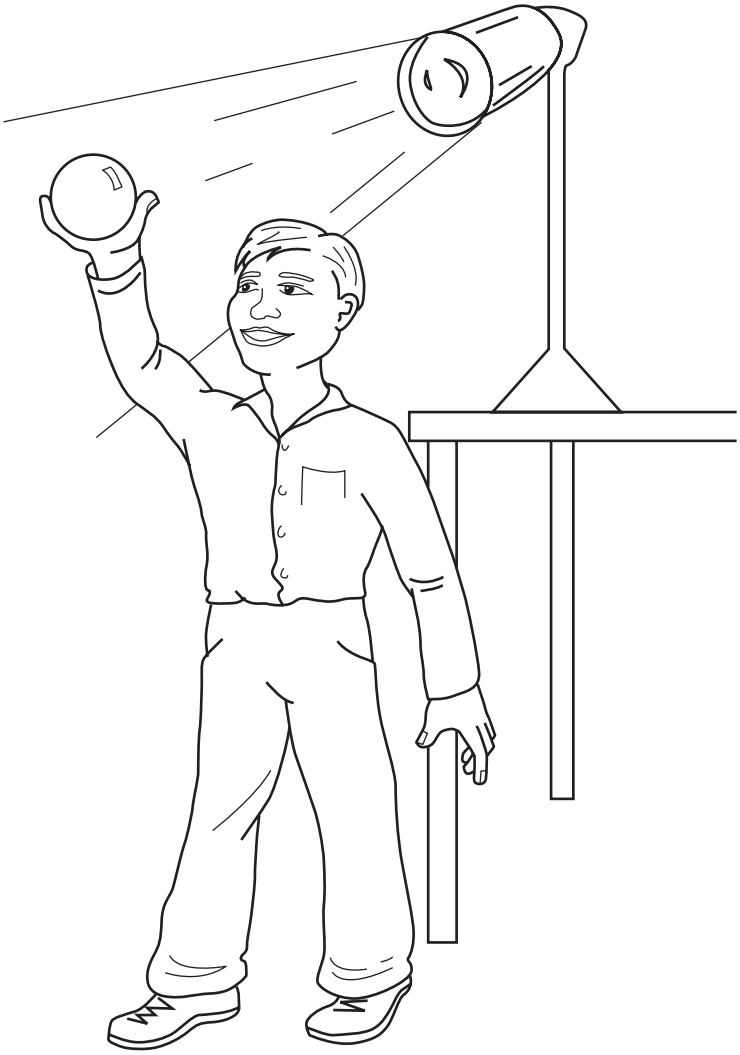
- ball
- lamp

Form a Hypothesis

Why does the Moon's shape appear to change? Write your hypothesis. Start with "The Moon's shape appears to change because . . ."

_____

_____



Name _____ Date _____

Test Your Hypothesis

1. **Make a Model** Your teacher will turn on a lamp. The lamp represents the Sun. Place the ball between the lamp and your head. The ball is the Moon, and your head is Earth.

2. **Observe** Turn your back to the light. Hold the ball a little higher than your head, so that the light is shining on the ball. What part of the ball is lit up?

_____

3. **Record Data** Slowly turn the ball and your body in a complete circle. Keep the ball in front of you. Record your observations.

_____

_____

Draw Conclusions

4. Why does the Moon appear to change its shape?

_____

_____

_____

Name _____ Date _____

Be a Scientist

California Standard 3 IE 5.d.

How does the Moon's position change in the night sky?

Materials

- binoculars (optional)
- blank monthly calendar
- clock or watch

Form a Hypothesis

How does the Moon's position change in the night sky?

_____

_____

Test Your Hypothesis

Design a plan to test your hypothesis. Use the materials shown here.

1. Pick a time to observe the night sky each day of the month.
2. **Observe** Where does the moon appear in the sky?
3. **Record** Draw a picture of the moon on the day you observed it in the calendar. Make sure to always include the same object in each picture, such as a house, so that there is a frame of reference. Continue this every day for a month.

Draw Conclusions

Did your results support your hypothesis? Why or why not? Share your results with your classmates.

_____

_____

Name _____ Date _____

Inquiry: Open What other questions do you have about the Moon? Talk with your classmates about questions you have. How might you find the answers to your questions?

_____

_____

_____

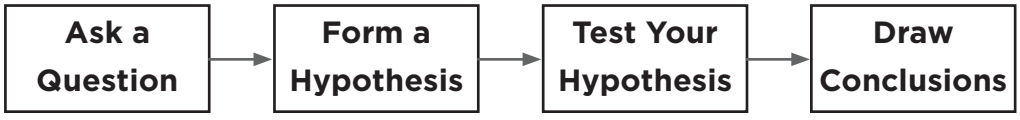
_____

_____

Possible investigations:

- How does the Moon affect ocean tides?
- Why do we always see the same side of the Moon?
- What is the environment like on the Moon?
- What is on the surface of the Moon?
- Why is the Moon sometimes visible during the day?
- How does Earth look from the Moon?

Remember to follow the steps of the scientific process.



Name _____ Date _____

Explore

California Standard
3 IE 5.e.

How do the planets move through space?

Purpose

To explore how the position of the planets changes.

Materials

- chair
- masking tape
- 9 planet cards and 1 Sun card

Procedure

1. Put a chair in the center of the room. Label the chair *Sun*. Tape a line from the chair to a wall.

2. Form two groups. Each student in the first group will take a card and line up in order along the tape.

3. **Make a Model** Model how the planets move by walking in a circle around the Sun. Students should count their steps together.

4. Students in the second group should observe how the planets move. Do all the planets complete one circle around the Sun within the same number of steps?

   _____

   _____

5. Trade roles and repeat the experiment.

Name _____ Date _____

Draw Conclusions

6 **Compare and Contrast** How are the orbits similar? How are they different?

_____

_____

7 **Infer** How do the planets move through space?

_____

Explore More

What planets are visible in the night sky in the area where you live?

_____

_____

Inquiry: Open Every day the Sun rises in the morning and then the Sun sets in the evening. Ask students to think about whether the stars and planets also appear to move because of Earth's rotation.

_____

_____

_____

Name _____ Date _____

Alternative Explore

Orbits

Why does it take Earth one year to orbit the Sun when Jupiter takes 12 years?

Materials

- paper handout
- pencils

Procedure

1. **Record Data** Draw Mars and Jupiter on a piece of paper so that both planets are in their orbits around the Sun, with Jupiter farther away from the Sun.

2. With a classmate, place a pencil on the orbit of each planet and move each pencil at the same speed around each orbit.

3. **Draw Conclusions**

_____

_____

_____

_____

_____

Name _____ Date _____

Why do planets shine?

1. Wrap a small ball in aluminum foil. This ball represents a planet. Use a flashlight to represent the Sun.

2. **Observe** In a darkened room, move the planet in a circle around the Sun.

3. **Infer** What makes the planet shine? What else did you observe?

_____

_____

Materials

- flashlight
- sheet of aluminum foil
- small ball

Name _____ Date _____

Focus on Skills

California Standard 3 IE 5.b.

Observe

You know that Earth is only one of the planets in our solar system. How do scientists learn about the other planets? How do they learn about meteors, comets, and asteroids? They **observe** the Sun, planets, moons, and all other objects in our solar system to learn about them.

1 Learn It

When you **observe,** you use one or more of your senses to learn about an object or event. Remember, your senses are sight, hearing, smell, taste, and touch. Scientists use their senses to observe things. They often use tools to help them make observations. Scientists use observations to draw conclusions about objects and events.

Name _____ Date _____

2 Try It

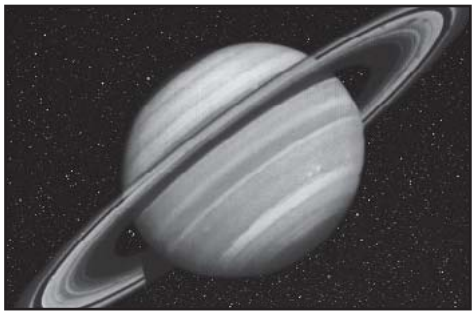
You can observe things, too. Look at the detail of the comet below. Observe its color and shape. Look for unique features that help you identify what it is.

What observations can you make that help you know this is a detail of a comet?

_____

3 Apply It

The photos below and on the following page show details of planets and other objects in our solar system. Observe each photo carefully. Use your observations to identify what the details show. What evidence in the photos supports how you have identified them?



Name _____ Date _____

Name _____ Date _____

Explore

California Standard 3 IE 5.a.

How do telescopes help us learn about distant objects?

Purpose

To learn what telescopes do.

Materials

- modeling clay
- 1 thick lens
- 1 thin lens
- 1 small cardboard tube
- 1 large cardboard tube

Procedure

1. Put the thick lens at one end of the small tube. Use the clay to hold the lens in place.
2. Do the same for the thin lens and the large tube.
3. Slide the open end of the small tube into the open end of the large tube.
4. **Observe** Look at a distant object. Now look at it through the small lens of your telescope.

Name _____ Date _____

Draw Conclusions

5 **Compare** Describe the difference in what you see with and without your telescope.

_____

6 **Infer** How do telescopes help us learn about distant objects?

_____

_____

Explore More

Experiment How will the moon look through binoculars? How will it look through your telescope?

_____

Inquiry: Open Ask students to analyze the difference between a telescope and a microscope and each instrument's ability to magnify the appearance of distant objects. Have the class formulate a question on this topic.

My question is: _____

_____

How I can test it: _____

_____

My results are: _____

_____

_____

_____

_____

Name _____ Date _____

Alternative Explore

How do binoculars help people see?

How does distance affect how you see an object with just your eyes? How does using the binoculars change how you see distant objects?

Materials

- binoculars

Procedure

1. **Compare** Look at an object that is far away, such as a tree outside, with just your eyes. Then look at the same object through the binoculars.

2. **Draw Conclusions**

_____

_____

Name _____ Date _____

A water lens

1. Cover a piece of newspaper with some wax paper.

2. **Observe** Put a small drop of water over a letter. How does it look?

_____

3. **Experiment** How does the size of the drop affect the way the print looks?

_____

_____

4. **Infer** How is the lens in a telescope like the drop of water?

_____

_____

Name _____ Date _____

Be a Scientist

California Standard 3 IE 5.e.

How can you make distant objects appear closer and clearer?

Materials

- index cards
- telescope
- masking tape
- tape measure

Form a Hypothesis

If an object is close to you, you can see it clearly. You can observe its details. Can a telescope help you observe distant objects clearly? Write a hypothesis.

_____

_____

Test Your Hypothesis

1. Ask a partner to write a secret message on an index card. Keep the message hidden.

2. **Measure** Put a piece of tape on the floor. Measure 3 meters from the edge of the tape. Mark this distance with tape. Label it 3 meters. Continue to measure and label 3-meter distances four more times. Your last piece of tape should be 15 meters from your first piece of tape.

Name _____ Date _____

3. **Experiment** Stand on the last piece of tape while your partner stands on the first piece of tape with the secret message. Can you read the message? If not, move forward 3 meters and try again. Keep moving forward 3 meters at a time until you are able to correctly read the secret message.

4. **Record Data** How close did you need to be to read the message?

_____

_____

5. **Use Variables** Ask your partner to write a new message on an index card. Repeat steps 3 and 4 using a telescope. Then trade roles and do the experiment again.

Draw Conclusions

6. **Analyze Data** Describe the differences in how you saw the secret message with and without the telescope.

_____

7. **Infer** How might telescopes help you learn more about faraway objects in space?

_____

_____

_____

Name _____ Date _____

Be a Scientist

How do the stars appear to change position?

Form a Hypothesis

The stars appear to change position in the night sky. How do they change? Write a hypothesis.

_____

Test Your Hypothesis

Design a plan to test your hypothesis. What materials will you use? Write the steps you plan to follow.

1. Were the same stars visible each night?

_____

_____

2. Did they move from east to west or west to east?

_____

Draw Conclusions

Did your results support your hypothesis? Why or why not? Share your results with your classmates.

_____

_____

Name _____ Date _____

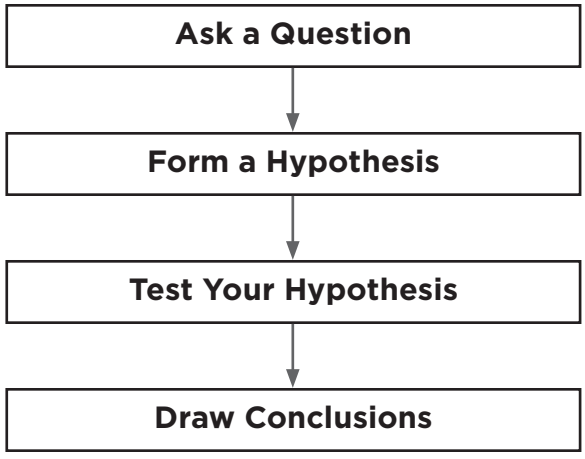
Inquiry: Open What other questions do you have about telescopes and our solar system? Talk with your classmates about questions you have. How might you find the answers to your questions?

Remember to follow the steps of the scientific processes.

_____

_____

_____



Name _____ Date _____

Explore

California Standard 3 IE 5.e.

Why do we only see the stars at night?

Materials

- white chalk
- black paper
- white paper
- measuring tape

Make a Prediction

Why do we not see stars in the daytime sky? Write a prediction.

_____

_____

_____

Test Your Prediction

1. Draw a 3 cm dot with chalk on black paper.
2. Draw a 3 cm dot with chalk on white paper.
3. Have your partner hold both papers 3 meters away from you.
4. **Observe** Describe what you see.

Draw Conclusions

5. Why was it easy to see one dot and not the other?

_____

_____

6. **Infer** Suppose the dots on the papers were stars. Why do you think you can only see the stars at night?

_____

_____

Name _____ Date _____

Explore More

Can we ever see the Moon during the day? Why or why not?

_____

_____

Inquiry: Open Ask students to think about how distance from Earth affects how a star appears in the night sky.

My question is: _____

How I can test it: _____

_____

_____

My results are: _____

_____

_____

Name _____ Date _____

Alternative Explore

Why can't stars be seen during the day?

Materials

- 2 sheets of white paper
- 1 sheet black or colored paper
- scissors
- tape

Procedure

1. Have students cut out two 3 centimeter circles from the white paper.
2. Paste one circle on a white sheet of paper and the other on a black sheet of paper.
3. Have a student go to the front of the class and hold up both white and black sheets of paper.
4. **Observe** On which sheet of paper is the white circle easier to see?

_____

_____

_____

Draw Conclusions

5. Why can you not see stars during the day?

_____

_____

_____

_____

Name _____ Date _____

Make a constellation

1. Make a star pattern on a piece of black paper. Use a pencil point to poke holes in your design.

2. **Make a Model** In a darkened room, hold the paper out at arms length toward a light source.

3. **Observe** Do you see a picture in your star pattern? What would you name your constellation?

_____

_____

Name _____ Date _____

Explore

California Standard
3 IE 5.e.

How do you describe objects?

Purpose

In this activity you will explore ways to describe objects.

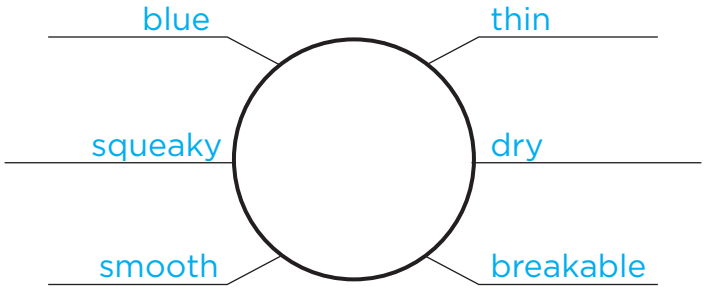
Procedure

1. **Observe** Select a "mystery object" in your classroom. Observe the object. What color is it? How does it feel or smell? What is the object's shape and size?

_____

_____

2. **Communicate** Record your observations in a concept web like the one shown. Label each line with a word that describes your "mystery object." Leave the center circle blank.



Name _____ Date _____

Draw Conclusions

3. **Infer** Trade concept webs with a classmate. Think about the descriptive words. What classroom object do the words describe? Label the center circle with the name of your classmate's "mystery object."

4. Were you able to guess your classmate's mystery object? Was your classmate able to guess your mystery object?

_____

Inquiry: Open Students should use a Venn diagram with 3 circles to compare and contrast the three states of matter.

My question is: _____

_____

How I can test it: _____

_____

My results are: _____

_____

Name _____ Date _____

Alternative Explore

Can you correctly guess the object?

Procedure

1. **Observe** Look at the four items before they are placed in the paper bag.
2. Try to correctly guess the object.
3. **Record Data** Record your guesses on paper.
4. Discuss descriptions and objects after the guessing has concluded.

Materials

- brown paper bag
- small bottle of water
- piece of paper
- small balloon
- pencil

Name _____ Date _____

Solids, liquids, and gases

Procedure

1. Blow into an empty bag. Then quickly seal the bag.

2. Fill a second small bag with some water and quickly seal this bag. Then put a rock in a third small bag and seal the bag.

3. **Observe** Each bag contains matter in a different state. How does each bag look and feel? Record your observations.

_____

_____

_____

_____

4. **Observe** Open each bag. What happens?

_____

_____

_____

5. **Communicate** Describe the properties of a solid, liquid, and gas. Tell how the three states of matter are different from one another.

_____

_____

_____

Name _____ Date _____

Focus on Skills

California Standard 3 IE 5.c.

Measure

You learned that matter is anything that takes up space and has mass. Water is matter that comes in three forms—solid, liquid, and gas. Does the solid form of water have the same mass as the liquid form? To answer questions like this, scientists measure things.

Learn It

When you **measure,** you find the size, distance, time, volume, area, mass, or temperature of an object. It's a good idea to record the measurements on a chart. That way you can compare the data at a glance.

Name _____ Date _____

Try It

You know that scientists measure things to answer questions. You can measure too, to answer this question: Do solid ice cubes have the same mass when they melt into water?

1. Place several ice cubes in a cup.
2. Cover the cup with plastic wrap so the water cannot evaporate.
3. Place the cup on one end of a balance scale.
4. Add weights to the other side of the scale until it balances. Record the mass on a chart.
5. Observe the scale every 1/2 hour until the ice is melted. Record each time if the mass of the cup changes (gets heavier or lighter).
6. Add or remove weights after the ice is totally melted to find the final mass. Record it on your chart.

Name _____ Date _____

Beginning Mass	Mass Every Half Hour	Ending Mass

Name _____ Date _____

Apply It

Now use your data to answer these questions:

1. Do the solid ice cubes have the same mass when they melt into water?

_____

_____

2. Do you think solid ice cream would have the same mass after it melted? How would a scientist prove it?

_____

_____

Name _____ Date _____

Explore

California Standard
3 IE 5.e.

How can you classify matter?

Purpose

Find out ways matter can be classified.

Materials

- toothbrush
- key
- coin
- ball
- comb
- pencil
- cotton ball

Procedure

1. **Observe** Observe the properties of each object. Record your observations in a chart.

2. **Classify** Divide the objects into groups that have the same properties.

3. **Communicate** Write a name for each group that describes how its items are alike.

_____

_____

Name _____ Date _____

Explore More

What if you have a can of mixed nuts and a can of stewed tomatoes? The cans look the same except for the labels. Now what if your baby brother takes the labels off? You want the nuts, but you don't want to open the tomatoes by mistake. What experiments can you do to find out what is inside before you open the cans?

_____

_____

_____

Inquiry: Open Provide students with a group of eight objects. Then have students divide these objects into two groups and provide names for the new groups. When finished, have students write a short paragraph explaining their classification scheme.

My question is: _____

How I can test it: _____

_____

My results are: _____

_____

_____

Name _____ Date _____

Alternative Explore

How can matter be classified?

Procedure

1. Look at the seven objects on the overhead.

2. Can you think of any other ways that the group of objects could have been sorted?

   _____

   _____

3. Record your response.

Name _____ Date _____

Model of an atom

1. **Observe** Look carefully at a piece of aluminum foil. Make a list of its properties.

_____

_____

2. Tear the foil in half. Then tear each half in two. Continue tearing the pieces until you have tiny little bits of foil.

3. **Compare** Read the properties you listed for the whole sheet of foil. Cross out any property that a foil bit lacks.

4. **Draw a Conclusion** Did the properties of the foil change as its size changed? How are the bits of foil similar to atoms of an element?

_____

_____

_____

Name _____ Date _____

Explore

California Standard 3 IE 5.d.

How does matter change?

Make a Prediction

Matter can change in many ways. How do flour and baking soda change when each is mixed with vinegar? Write a prediction.

_____

_____

_____

_____

Materials

- two clear plastic bottles
- two balloons
- vinegar
- flour
- baking soda
- goggles
- measuring cup
- tablespoon

Test Your Hypothesis

1. **Observe** List the properties of each substance. Record your observations in a chart.

2. Put 2 tablespoons of flour in one container. Add 1/4 cup of vinegar. Quickly put the balloon over the container's opening. Observe what occurs. Record your observations in your chart.

3. Put 2 tablespoons of baking soda in the second container. Add 1/4 cup vinegar. Quickly put the balloon over the container's opening. Observe what occurs. Record your observations in your chart.

Draw Conclusions

4. **Infer** What do you think caused the difference in the balloons?

_____

_____

Name _____ Date _____

Explore More

What do you think might happen to the balloon, if you add 2 tablespoons of baking soda and 50 mL of water to a container?

_____

_____

Inquiry: Open In the experiment, the inflation or deflation of the balloon was used to show the presence or absence of a gas. What is another method that could be used to prove the release of a gas occurred? Devise an experiment and show the new method.

My question is: _____

How I can test it: _____

_____

_____

My results are: _____

_____

Name _____ Date _____

Alternative Explore

What happens when two forms of matter are combined?

Materials

- clear plastic cup
- slice of potato about two inches in diameter
- hydrogen peroxide

Procedure

1. Put the slice of raw potato in the bottom of the plastic cup.
2. Add enough hydrogen peroxide to cover the piece of potato.
3. **Observe** What happens?

_____

_____

_____

_____

Draw Conclusions

4. What caused the changes you observed?

_____

_____

Name _____ Date _____

Chemical changes

Materials

- pennies
- salt
- bowl
- vinegar
- cup
- sugar

1. **Observe** Look closely at some pennies. Make a list of their properties.

2. Place 1 teaspoon of salt in a bowl. Add the vinegar. Stir until the salt dissolves.

3. **Compare** Dip a penny halfway into the liquid. Slowly count to 20 as you hold the coin there. Then remove the penny. Compare the half you held with the half that was in the liquid.

_____

4. **Infer** What caused the change of appearance?

_____

_____

5. **Experiment** Will other combinations of these substances clean a penny? Try it!

_____

_____

_____

Name _____ Date _____

Be a Scientist

California Standard 3 IE 5.b.

How can physical and chemical changes affect matter?

Form a Hypothesis

After a physical change, matter looks different, but is still the same kind of matter. During a chemical change, matter changes to become a different type of matter. How can physical and chemical changes affect chalk? Write a hypothesis.

Materials

- chalk
- black tag board
- vinegar
- hand lens
- eye-dropper

_____

_____

_____

Name _____ Date _____

Test Your Hypothesis

1. **Observe** Break a piece of chalk in half. Use a hand lens to look at the broken end of the chalk. Record your observations. Is this a chemical or physical change?

_____

_____

2. **Experiment** Use one of the chalk pieces and rub it on a piece of black tag board. Using the hand lens look at the chalk on the paper. Was this a chemical or physical change?

_____

3. **Experiment** Add 1 drop of vinegar to the chalk on the tag board using a dropper. Was this a chemical or physical change?

_____

Draw Conclusions

4. **Explain** What did you observe in the chalk with all three changes?

_____

_____

_____

_____

Name _____ Date _____

Be a Scientist

What are the signs of a chemical change?

Materials

- plastic cups
- spoon
- vinegar
- milk
- steel wool
- baking soda

Form a Hypothesis

How can you tell a chemical change has occurred? Write a hypothesis.

_____

_____

Test Your Hypothesis

Design an experiment to investigate some chemical changes. Write out the steps you will follow. Record your results and observations.

1. _____
2. _____

   _____
3. _____
4. _____
5. _____

   _____
6. _____

Draw Conclusions

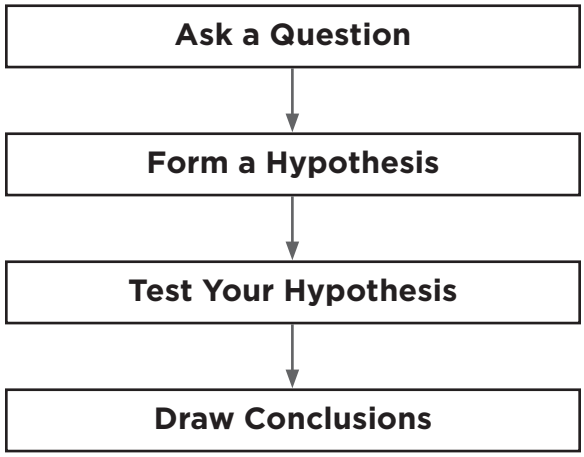
What types of changes did you observe throughout your experiment? Did your experiment support your hypothesis? Why or why not?

_____

Name _____ Date _____

Inquiry: Open What else would you like to know about physical and chemical change? Come up with a question to investigate. For example, how do pennies turn green? Design an experiment to answer your question.

Remember to follow the steps of the scientific process.



Name _____ Date _____

Explore

California Standard
3 IE 5.d.

What happens to air as it is heated?

Make a Prediction

How does heat affect air? Does it make air expand and rise? Does it make air contract and sink? Write a prediction.

_____

Materials

- empty plastic bottle
- plastic disk
- water

Test Your Prediction

1. Place a few drops of water along the edge of the bottle's opening. Place the plastic disk on top of the opening.

2. **Predict** What will happen to the disk as the air in the bottle is warmed?

_____

3. **Observe** Rub your hands back and forth rapidly. When your hands begin to feel warm, place them on the bottle. As you hold the bottle, observe the disk.

_____

Draw Conclusions

4. **Communicate** What happened to the disk? Did the results match your prediction?

_____

Name _____ Date _____

Explore More

Experiment Place an empty plastic bottle in the refrigerator for several hours. Remove the bottle from the refrigerator and immediately put a balloon over the opening. Predict what will happen to the balloon.

_____

_____

_____

Inquiry: Open Predict what will happen when an inflated balloon is placed in a freezer. Plan and perform an experiment to test your prediction.

My question is: _____

_____

How I can test it: _____

_____

_____

_____

My results are: _____

_____

Name _____ Date _____

Alternative Explore

Expanding

Procedure

Team up with a partner to work in pairs.

Materials

- 2-liter soft drink bottle
- black construction paper
- small balloon

1. Snap the neck of a small balloon onto the mouth of an empty 2-liter soft drink bottle wrapped with black construction paper. Place the balloon in a sunny window until expanding hot air causes the balloon to partially inflate.

2. **Observe** What happens to the balloon?

_____

_____

3. **Hypothesize** Why does the balloon expand as it sits in the window?

_____

_____

_____

4. **Communicate** Share your results with the class.

Name _____ Date _____

Forms of energy

Materials

- a thick rubber band
- or a balloon

1. Place a thick rubber band against the back of your hand to determine if it is warm, hot, or cold.
2. Stretch and release the thick rubber band 30 times.
3. **Observe** Repeat step 1. How does the rubber band feel? Is it warm, hot, or cold?
4. **Communicate** Describe how the rubber band changed.

_____

5. **Draw Conclusions** How is energy being changed from one form to another?

_____

_____

_____

Name _____ Date _____

Focus on Skills

California Standard 3 IE 5.b.

Draw Conclusions

You just did an experiment about the Sun's heat energy, and you read about other kinds of energy. In this section, you will experiment with one of those other kinds of energy. Scientists do a lot of experiments. They test their ideas and then draw conclusions about what they observed and recorded.

Learn It

When you draw conclusions, you interpret the results of an experiment to answer a question. You look at all the facts and decide what is true. As you gather facts and make observations, it is important to record everything on a chart. Then you will have all the data in one place to help you draw a conclusion.

Name _____ Date _____

Try It

Now gather facts and draw conclusions by following the steps below. Discover if water provides enough energy for a plastic plate to lift a paper clip!

Materials

- sturdy paper or plastic coated plate, 6″ diameter
- pencil
- piece of string, 6 1/2 inches
- paper clip

1. Cut four 2-inch slits into a plastic plate.
2. Then bend the slits to create a pinwheel.
3. Push a pencil through the center of the plate.
4. Tie a piece of thread to a paper clip and the other end to the pencil, near the hole in the plate.
5. Turn on the faucet so that the water runs slowly.
6. Rest the pencil across the palms of your hands.
7. Aim the edge of the plate 2 cm under the falling water. Record what you do and observe.

Name _____ Date _____

Focus on Skills

Now use the facts and your observations to answer these questions:

1. What conclusion can you draw about water energy?

_____

_____

2. What conclusion can you draw about the speed of water for supplying energy?

_____

_____

3. What do you think would happen if you used a heavier paper clip?

_____

_____

Name _____ Date _____

Apply It

Now that you've learned to think like a scientist, gather facts and draw more conclusions. Do you think a paper-plate water wheel could lift a wooden block? Test your idea, record your facts, and **draw conclusions!**

_____

_____

_____

_____

_____

Name _____ Date _____

Explore

California Standard 3 IE 5.e.

How can you increase the distance a toy car travels?

Materials

- toy car
- cardboard
- books
- masking tape
- meter stick

Form a Hypothesis

How will the steepness of a hill affect how far a car travels? Write a hypothesis.

_____

_____

Test Your Hypothesis

1. Stack three books on top of one another. Tape one edge of the cardboard to the edge of the top book. Tape the bottom edge of the cardboard to the floor. The cardboard should look like a slide.

2. Put a car at the edge of the cardboard and let it go.

3. **Measure** Place a piece of tape at the spot where the car stops moving. Use a meter stick to measure the distance from the stack of books to the tape. Record your measurement.

4. **Use Variables** Add another book to the stack and repeat. Continue adding books until you have six. Compare the distances the car traveled each time.

Draw Conclusions

5. How did the steepness of a hill affect how far the car traveled?

_____

Name _____ Date _____

Explore More

Experiment If you use a larger car, what will happen to the total distance traveled?

_____

_____

_____

_____

Inquiry: Open What will happen when two toy cars are rolled on different surfaces?

My question is: _____

_____

How I can test it: _____

_____

_____

_____

My results are: _____

_____

Name _____ Date _____

Alternative Explore

Marble race

Procedure

Materials

- marble
- rectangular piece of cardboard

1. **Hypothesize** How will the steepness of a ramp affect how far a marble rolls?

_____

_____

2. **Experiment**

1. Draw a centered line on the long dimension of the cardboard.
2. Fold a V-shape along the line.
3. Open the fold to a 45-degree angle to form a guided ramp.
4. Place one end of the ramp on the ground; raise the opposite end by the width of one finger.
5. Roll a marble down the ramp, and observe how far it rolls.
6. Repeat the process after raising the ramp to two, three, and four finger widths.

3. **Infer** What is the relationship between the height of the ramp and the distance that the marble rolls?

_____

4. **Communicate** Share your results with the class.

 Name _____ Date _____

Using energy

1. Your body needs energy. The table below shows the amount of energy in some of the foods we eat.

Materials

- pencil
- paper

Food	Energy in Calories
2% Chocolate Milk	220
1 cup of Tuna Salad	383
Pizza Slice	320

2. **Use Numbers** Using the table, plan a lunch. How many calories are in one lunch with those foods?

_____

3. **Analyze Data** The table below shows some activities. Choose one. How long will you need to do that activity before you have used all the calories from your lunch?

Activity	Calories Burned in 30 minutes
Biking (slow)	100
Jogging	160
Listening to Music	17

4. **Compare** Which activity uses the most energy?

_____

Name _____ Date _____

Explore

California Standard
3 IE 5.d.

Do waves carry energy?

Make a Prediction

Energy can be carried from one place to another by moving objects. Do waves transfer energy? Write a prediction.

_____

_____

Materials

- deep container of water
- table tennis ball
- small rock

Test Your Prediction

1. Pour water into the container so that it is nearly filled. Place the table tennis ball in the water.

2. **Observe** Drop the rock into the middle of the container. Observe the effect of the rock on the water and the ball.

_____

_____

Draw Conclusions

3. What caused the ball to move?

_____

_____

Name _____ Date _____

Explore More

How can you prove waves are transferring energy to the ball? Where does the energy come from?

_____

_____

Inquiry: Open Imagine that several smaller rocks were thrown into the same container of water. Would they have the same effect as the first rock?

My question is: _____

_____

How I can test it: _____

_____

_____

_____

_____

My results are: _____

_____

_____

Name _____ Date _____

Alternative Explore

How does the weather affect the energy of water waves?

Materials

- encyclopedias
- Internet
- other reference materials

Procedure

1. Look up tornados, tsunamis, and hurricanes in the encyclopedia or on the Internet. Do your sources mention that these weather events cause big ocean waves?

2. **Hypothesize**

_____

_____

3. **Observe** Are powerful waves related to each weather event?

_____

_____

4. **Communicate** Share your results with the class.

Name _____ Date _____

How sounds are made

1. Wrap several rubber bands around the cardboard box.

2. **Observe** Pluck the bands to make a sound. What do you see happening?

_____

_____

Materials

- rubber bands
- cardboard boxes

3. **Draw Conclusions** Can you make a sound without the rubber bands moving? Why or why not?

_____

_____

_____

Name _____ Date _____

Be a Scientist

California Standard 3 IE 5.e.

How does sound travel through different materials?

Form a Hypothesis

Energy can move in many different ways. Sound is a form of energy. It travels in waves through air, water, and solid objects. Traveling through some objects can slow sound waves down. They can be stopped, or absorbed, by other objects. How does sound travel through different materials? Write your hypothesis.

Materials

- plastic bag
- water
- tuning fork
- wood

_____

_____

Test Your Hypothesis

1. **Record** Fill a plastic bag with water, seal it, and hold it to your ear. In your journal, describe how sounds in the classroom change when you place the bag near your ear.

_____

_____

2. **Experiment** Hold a wooden block to your ear. Tap the tuning fork and hold it near the block. Record what you hear. Touch the tuning fork to the block. Record any change that you hear.

_____

_____

_____

Name _____ Date _____

Draw Conclusions

1. **Explain** What did the tuning fork sound like when it traveled through water? Was that different than what it sounded like when it traveled through air?

_____

_____

_____

2. **Analyze** Which material blocked more sound energy, air, wood or water? Why do you think the sound energy was blocked?

_____

_____

_____

3. **Infer** What materials would you use to build a room, such as a library, that needs to block sound?

_____

_____

_____

_____

Name _____ Date _____

Be a Scientist

How can light energy be changed?

Form a Hypothesis

What do light waves look like and how can you change them? Write a hypothesis.

_____

_____

_____

Materials

- a prism
- a flashlight
- a mirror
- colored construction paper
- colored cellophane

If you change a light wave with a . . . then you see . . .
prism
mirror
colored construction paper

Test Your Hypothesis

Design an experiment to investigate how light energy can be changed. Record your results and observations.

_____

_____

_____

_____

Name _____ Date _____

Inquiry: Open What else could you test about energy waves? Design an experiment to find out. Your experiment should test only one variable, or one item being changed. Your experiment must be written so that another group can complete the experiment by following your instructions.

_____

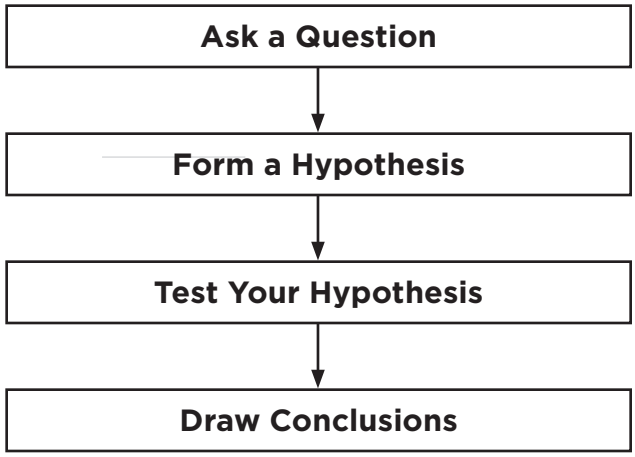
_____

_____

_____

_____

Remember to follow the steps of the scientific process.



Name _____ Date _____

Explore

California Standard 3 IE 5.e.

How does light move?

Make a Prediction

What happens to light when it hits a mirror?

_____

_____

Materials

- mirror
- flashlight

Test Your Prediction

1. Hold a mirror in front of you. Have a partner shine the flashlight onto the mirror.
2. **Observe** What happens to the flashlight's beam?
3. **Experiment** Pick a spot behind your partner. Can you make light bounce off the mirror and shine on that spot? How? Do you have to move the mirror, the flashlight, or both?

_____

_____

_____

_____

Draw Conclusions

4. What happened to the beam of light when it hit the mirror? What happened when you moved the mirror? _____

_____

_____

_____

_____

Name _____ Date _____

Communicate

5 **Experiment** Make a drawing to explain what you found out.

_____

_____

_____

_____

Explore More

Experiment Sit next to your partner and hold the mirror so that you can see your partner. Can your partner see you in the mirror? Can you see yourself and your partner at the same time in the mirror?

_____

_____

Inquiry: Open How could you measure the angles of light hitting and reflecting from a mirror to show that the angles are equal? Have the student design and carry out an experiment to accomplish this.

My question is: _____

_____

How I can test it: _____

_____

_____

_____

My results are: _____

Name _____ Date _____

Alternative Explore

Periscopes

Sailors on submarines use a periscope. With a periscope, they can see ships and aircraft when the submarine is under water.

Materials

- encyclopedias
- Internet
- other reference materials

Research

1. Find out how periscopes work. Use the Internet, encyclopedia, and other reference materials.

Record Data

2. Draw a diagram to show the placement of mirrors in a periscope.

3. **Infer** What other uses can you find for periscopes?

_____

_____

_____

Name _____ Date _____

Movement of light

Materials

- pencils
- index cards
- flashlights

1. Use a pencil point to carefully poke a hole in two index cards. Hold the cards upright on a flat surface so that the holes are lined up.

2. **Observe** Place a lit flashlight directly behind the last card. Then bend your body so that you are at eye level with the first card. Can you see the flashlight's beam?

_____

3. **Predict** What will happen if you move one of the cards? Will you still be able to see the light? Write down your prediction.

_____

_____

_____

4. **Draw Conclusions** What caused differences in your observations? Make a sketch to explain how light travels.

_____

_____

_____

_____

Name _____ Date _____

Focus on Skills

California Standard 3 PS 2.b.

Experiment

You just read that light moves in a straight path. How did scientists figure this out? They did an **experiment.** They recorded what they observed, and they analyzed the data to draw a conclusion.

Materials

- flashlight
- clay
- mirrors
- paper

Learn It

When you **experiment,** you make and follow a procedure to test a hypothesis. It is important to record what you observe during an experiment. Once you have enough information, you can decide whether your hypothesis is supported or disproved. Why is it important to record the results of each test?

_____

_____

Try It

In the following **experiment,** you will test the hypothesis that light moves in a straight line. Follow the steps of the procedure. Then use your observations to draw a conclusion.

Name _____ Date _____

Procedure

1. Draw a target on a sheet of white paper. Hang it on a wall near your desk or table.
2. Stand two mirrors in clay. Shine the flashlight into one mirror. Draw or write your observations on a chart.
3. Move the light or the mirror until the light is reflected off your target.
4. Shine the flashlight from a higher and then a lower angle. Record your observations.

What I Did	What I Observed
Shine the light in one mirror	
Made light reflect in the other mirror	
Shine the light from a higher angle	
Shine the light from a lower angle	

Draw Conclusions

1. How did you make the light hit the target?

_____

_____

2. What happened when the light came from a higher or lower angle?

_____

_____

Apply It

Now that you've done one experiment like a scientist, do another. Remember to record your observations.

1. Put the mirrors back in place.
2. Place a small object between them.
3. How many reflections do you see?

_____

_____

4. Move the mirrors closer together and then further apart. How many reflections do you see each time? Record your observations in a chart.

_____

_____

_____

_____

Distance between Mirrors	Number of Reflections

Name _____ Date _____

Finding the perimeter of a polygon

Your teacher will project a laser beam between a set of mirrors. The laser beam will make a polygon.

1. **Predict** What type of polygon will be produced by the laser light and mirrors?

_____

2. What type of polygon do you see?

_____

_____

3. **Measure and Record** Measure and record the length of each side of the polygon in centimeters. What is the perimeter of the polygon in centimeters?

_____

4. **Measure** The laser beams and mirrors can be set up and used in much the same way as part of a security system around a building. Draw a simple diagram of your room and count how many mirrors would be required to reflect a laser beam all the way around the edge of the room.

Name _____ Date _____

Explore

California Standard 3 IE 5.d.

How does light affect the color you see?

Form a Hypothesis

Will the color of an object appear to be different if we look at it through a colored filter?

_____

_____

_____

Materials

- large sheet of white paper
- sheets of colored paper
- colored report folders

Test Your Hypothesis

1. **Predict** Look at a sheet of white paper and a few sheets of colored paper. What color will each sheet of paper appear to be if you observe it through the blue filter? The red? The green? Write down your predictions.

_____

_____

2. **Experiment** Look at the white paper and the colored paper through the red filter. Repeat for each of your colored filters.

Draw Conclusions

3. **Analyze Data** Why did you see different colors?

_____

_____

_____

Name _____ Date _____

Explore More

Experiment What color will a white object be if you look at it through both a blue and a red filter? How can you explain this?

_____

_____

_____

_____

Inquiry: Open White objects will take on different colors when viewed through different combinations of yellow, red, and blue filters? What will these colors be? Write a plan for your experiment. Then do the experiment to test your prediction. Make sure to record your results.

My question is: _____

_____

How I can test it: _____

_____

My results are: _____

_____

_____

_____

Name _____ Date _____

Alternative Explore

Projecting color

Your teacher will project white light onto a wall or screen.

Materials

- overhead projector
- colored transparent report folders

Make a Prediction

1. How will the color of light change when the teacher places a colored report folder in front of the projector?

_____

_____

Record Data

2. Predict which color different objects will appear under colored light. On a chart similar to the one below, write down your prediction and then what actually happens in the experiment.

Object Projected Color	Your Prediction	Actual Result

Analyze Data

3. Explain your observations. Why do you see different colors when using the colored filters?

_____

_____

_____

_____

 Name _____ Date _____

How light affects your pupils

Materials

- mirror

1. **Predict** How do you think the amount of light in the room affects the size of your pupils? Write down your prediction.

_____

_____

2. **Observe** Dim the classroom lights. Look at your pupils in the mirror. What do you see? Make a sketch of what you see.

_____

3. **Observe** Turn on the classroom lights. Again, look at your pupils in the mirror. What do you see? Make a sketch of what you see.

_____

4. **Compare** How do your sketches differ?

_____

Draw Conclusions

5. What caused the differences you saw? What does this show about the amount of light that enters your eyes?

_____

_____

Name _____ Date _____

Be a Scientist

California Standard 3 IE 5.d.

How can you mix colors of light?

Materials

- paper plates
- crayons or colored markers
- pencil

Form a Hypothesis

You learned that drops of water in the sky can act like a prism. The prism separates white light into bands of color. Can you mix bands of color to get white light? Write a hypothesis. Start with, "If I mix the right colors, then. . . ."

_____

Test Your Hypothesis

1. Divide the white paper plate into 8 equal sections by folding the plate in half 3 times. Color each section in a different color.
2. Carefully push a pencil into the center of the circle.
3. Spin your spinner away from your body.
4. **Observe** What color do you see while the spinner is spinning?

   _____

5. **Experiment** Repeat steps 1–3 and choose colors to make the spinner appear white.

Draw Conclusions

6. What colors did you mix together to make the best white?

   _____

   _____

Name _____ Date _____

Prisms and the spectrum of light

Materials

- prisms
- paper
- crayons or markers

1. **Predict** What colors do you expect to see when you aim a prism at an object?

_____

_____

2. **Observe** Your teacher will hand you a prism to experiment with. What colors do you see when you aim the prism at something?

_____

_____

3. Draw a diagram that shows white light entering a prism, and the full spectrum of colors as the light exits the other side.

Name _____ Date _____

Be a Scientist

How are the colors of the rainbow arranged?

Materials

- prism
- white paper
- flashlight

Form a Hypothesis

Rainbows often don't last very long. Sometimes we even miss seeing them! What colors are in a rainbow? In what order do they appear? Write a hypothesis.

Test Your Hypothesis

Design an experiment to test your hypothesis. Use the materials shown. Write out the steps you will follow. Record your results and observations.

Draw Conclusions

1. If you were asked to draw a rainbow, in which order would you put the colors?

Name _____ Date _____

2 Does every rainbow have these specific colors and are these colors always arranged in the same order?

_____

_____

Inquiry: Open What other questions do you have about light or rainbows? Talk with your classmates about questions you have. How might you find the answers to your questions?

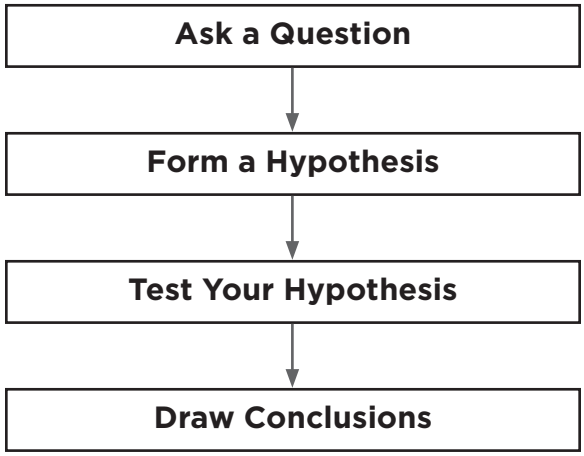
_____

_____

_____

_____

Remember to follow the steps of the scientific process.



Name _____ Date _____

Explore

California Standard
3 IE 5.a.

How do materials affect light?

Make a Prediction

Do all materials allow light to pass through them? What kinds of materials block light?

_____

_____

_____

_____

_____

_____

Materials

- flashlight
- clear plastic cup
- paper cup
- plastic wrap
- aluminum foil

Test Your Prediction

1. **Predict** Which materials will allow light to pass through them? Which ones will not?

2. **Experiment** Turn off the lights. Have a partner hold up the clear plastic cup. Shine the flashlight on the cup. Does the light pass through the cup? Then shine the flashlight on the paper cup, the clear plastic wrap, and the aluminum foil. _____

_____

_____

_____

3. **Draw Conclusions** How are the items that the light passed through alike? How are the items that blocked the light alike?

_____

_____

Name _____ Date _____

Explore More

Experiment Does the brightness of light affect how well light passes through materials? Make a plan to find out.

_____

_____

_____

_____

Inquiry: Open Can the same material have two different light-passing properties? Can the same material be opaque when the light is low but translucent under brighter light? Make up a question on this topic.

My question is: _____

_____

How I can test it: _____

_____

_____

_____

My results are: _____

_____

_____

_____

Name _____ Date _____

Alternative Explore

Shifting shadows

1. **Prepare** In a dark room, somebody points a flashlight at the board.
2. **Observe** Another person moves a pencil or pen back and forth in the flashlight beam.

Materials

- flashlight
- pen or pencil

3. **Explain** Tell why the shadow gets bigger or smaller. Your clue is to look at how close the pen or pencil is to the flashlight.

_____

_____

_____

_____

_____

 Name _____ Date _____

What causes a shadow to change size?

Materials

- paper
- tape
- flashlight
- pencil
- ruler

1. **Predict** Can the position of light change the size of a shadow? Write down your ideas.

_____

_____

2. **Observe** Tape the paper to a smooth wall. Have a classmate hold the object in front of the paper. Shine the flashlight on the object. Have another classmate trace the outline of the shadow that forms on the paper. Measure the size of the shadow.

_____

_____

3. **Experiment** What will happen to the size of the shadow if the person with the flashlight moves farther away? Closer? Try it and find out.

_____

_____

Draw Conclusions

4. What caused differences in your outlines?

_____

_____

The water planet

Seventy-five percent of the Earth is covered with water. Transportation on water is very common and important. Boats used to be built out of wood because wood floats. However, today, boats are made out of steel. Steel itself does not float but when it is shaped a certain way it can float. This is explained by Archimedes' Principle. Archimedes was a Greek scientist who lived about 2,000 years ago. He discovered that when an object is in a fluid such as water, the object is pushed upward by a force equal to the weight of the fluid that is displaced by that object. What this means is that the more water an object pushes aside, the stronger the water pushes against the object, making it float.

Materials

- clay
- bowl of water

Purpose

What shape of boat would you design with clay so that your boat floats?

Form a Hypothesis

_____

Test Your Hypothesis

1. Take a piece of clay (1″ x 1″) and roll it into a ball.
2. Shape another piece of clay (1″ x 1″) into a boat. Make sure the sides are high enough so that the boat doesn't flood with water.
3. Put both pieces of clay in the bowl filled with water.
4. **Observe** Observe what happens (if the boat sinks, reshape it until it floats).

Name _____ Date _____

Draw Conclusions

What did you observe?

_____

_____

_____

_____

_____

Based on your results what is your conclusion?

_____

_____

_____

_____

Critical Thinking

1. Why is it when you are in a pool and curl yourself up in a ball with your arms wrapped around your legs you will sink to the bottom of the pool, but when you stretch yourself out flat like a piece of paper you will float?

2. What would happen if more weight is added to a ship? Will it sink?

Name _____ Date _____

Records from the past

Fossils are the remains (left-overs) or traces (like a foot print) of a dead organism. A paleontologist is a scientist who studies fossils to learn about how life was on Earth in the past. A paleontologist goes out in the field and looks for fossils. When a fossil is found, the paleontologist carefully digs out the fossil with special tools and then carefully transports the fossil back to the lab. At the lab, the paleontologist cleans the fossil and then studies the fossil to answer questions such as: What kind of animal did the fossil belong to? When was the animal alive? How old was the animal?

Materials

- plaster
- sand
- plastic animals
- water
- bucket or bowl
- disposable foil form
- wooden spoon or stick
- paint brush
- digging utensils

Purpose

Tell what a paleontologist would do if he/she found a site that could contain fossils?

Hypothesis

Write a hypothesis. Do you believe that fossils can be preserved under the earth for a long time? If so, this is the hypothesis you have to prove true or false.

_____

_____

Test Your Hypothesis

1. In a bucket or bowl mix sand, plaster, and water using the following ratio: 3 parts sand, 1 part plaster, and 1 part water. If too dry add a little bit more water, but make sure it is not too wet. You can make your fossil dig as large as you would like depending on the disposable foil form you decide to use. It is best to use an old spoon or stick to mix.
2. Pour half of the plaster/sand mixture in disposable form.
3. Add various "fossils" on top of the plaster/sand mixture. Make sure that you spread them out.
4. Pour remaining plaster/sand mixture on top of fossils.
5. Let the fossil dig dry (can take from hours to days depending on how wet the mixture is and the humidity in the air). Placing it in the oven will speed up the drying process (see teacher's notes).
6. When fossil dig is dry, you can start digging the fossils out with your tools. Carefully, scrape away the plaster and use the brush to brush away the "dirt."

Name _____ Date _____

Draw Conclusions

What did you observe?

_____

_____

_____

Based on your results what is your conclusion?

_____

_____

_____

Critical Thinking

1. Why do you only find fossil bones and teeth and not other parts of animals?

_____

_____

_____

2. In what way are your buried animals not like real fossils?

_____

_____

_____

_____

Seasons

Seasons change because of the position of the earth relative to the sun. When the sun is higher in the sky and the sunlight is coming in more directly, days are longer and warmer (summer). When the sun is lower in the sky and the sunlight is less direct, days are shorter and colder (winter). The change of seasons can be seen in many trees. In the winter, many trees have no leaves and are dormant (they are resting and don't grow during this time). In the spring, the trees produce leaves, flowers, and fruits. In the summer, the trees store food reserves. In the fall, the trees start preparing for the winter and loose their fruits and leaves. Inside the branches and trunk of a tree, during the spring and summer, the tree produces more woody tissue and grows. From year to year, this growth is shown by a new ring of wood.

Materials

- small branch or tree

Purpose

To tell the age of a tree branch.

Make a Prediction

_____

_____

Name _____ Date _____

Test Your Prediction

1. Find a tree branch and count the number of rings.

2. Compare this branch with a thicker or thinner branch from another kind of tree. Does the new branch have more or fewer rings?

_____

_____

3. Compare the thickness of the rings in one tree branch. Do they vary in thickness? What might this tell you about tree growth?

_____

_____

_____

Draw Conclusions

4. What did you observe? How old do you think the first tree you looked at is?

_____

_____

_____

5. Is the second tree you looked at older or younger than the first tree? Why?

_____

_____

_____

Critical Thinking

1. Do all places on Earth have seasons?

_____

_____

_____

2. What can annual rings in a tree tell us about the environment?

_____

_____

_____

Name _____ Date _____

Nocturnal animals

Nocturnal animals are animals that are active at night and many of these animals can see well in the dark. Humans, however, can not see well in the dark. That is why we use artificial light to see at night (such as flashlights, car lights, and lamps). You probably have experienced that when you enter a very dark room it takes a while for your eyes to get used to the dark. In fact, it takes about half an hour for your eyes to fully adjust to the dark. If you used a regular flashlight to look at a star chart while you were stargazing, your eyes would need to get adjusted to the dark every single time you turned on the flashlight. The white light from the flashlight breaks down chemicals in your eyes that help you see in the dark.

Materials

- flashlight
- red cellophane
- rubber band
- star chart

Purpose

To tell what would happen if you cover a flashlight with red cellophane and use that flashlight for stargazing?

Form a Hypothesis

If red light does not break down chemicals in the eye that help you to see in the dark, your eyes should adjust to the low light levels more quickly. Write a hypothesis expressing this idea.

_____

_____

Test Your Hypothesis

1. Cover a flashlight with red cellophane and secure it with a rubber band.
2. Use this flashlight for stargazing.

Draw Conclusions

What did you observe?

_____

_____

_____

Based on your results what is your conclusion?

_____

_____

Name _____ Date _____

Critical Thinking

1. Are all stars yellow?

_____

_____

_____

_____

2. What is a shooting star?

_____

_____

_____

Matter

Matter can either be a gas, a liquid, or a solid. Molecules make up matter. When many molecules are linked together in a special way then a polymer is made. The longer and more complicated a polymer the harder it is for the molecules to move and the more likely it is that the polymer is a solid. Borax is a cross-linker. This means that borax links different chains of polymers together to make a more complex polymer.

Materials

- Elmer's glue
- plastic cups
- food coloring
- borax
- popsicle sticks
- sandwich bags

Purpose

To decide what would happen if I add the liquid glue (glue plus water forms a polymer) to a borax solution?

Make a Prediction

_____

_____

Name _____ Date _____

Test Your Prediction

1. In a plastic cup mix 1/4 cup of Elmer's glue with 3 drops of food coloring.
2. Add 2 tablespoons of the Borax solution (to make this solution add 1 tablespoon of Borax with 1/2 cup of water).
3. Using the Popsicle stick, mix this all together for about 30 seconds. This forms your slime (it will be rather thick).
4. Remove the slime and knead it with your hands for about 5 minutes.
5. Now, if you want to make a bouncy ball you need to squeeze as much water out as you can while kneading it. Then roll the slime between your hands to make a ball. Then watch it bounce!

Draw Conclusions

6 What did you observe?

_____

_____

Based on your results, was your prediction supported?

_____

_____

Critical Thinking

7 What do you think super absorbent molecules are?

_____

_____

8 In Greek, poly means many and meros means parts. What does polymers mean and is this an appropriate name?

_____

_____

_____

Name _____ Date _____

Physical and chemical changes

Matter can undergo physical and chemical changes. After a physical change the matter looks different but still has the same properties. After a chemical change the matter has different properties and a new matter is created.

Materials

- ice cubes
- salt

Purpose

To tell what would happen if salt is sprinkled on top of an ice cube.

Make a Prediction

_____

Test Your Prediction

1. Sprinkle salt on an ice cube.
2. Place the second ice cube on top of the first ice cube.

Draw Conclusions

3. What did you observe?

_____

_____

_____

4. Based on your results what is your conclusion?

_____

_____

_____

Name _____ Date _____

Critical Thinking

5 Is the melting of ice with salt a physical or chemical change?

_____

_____

6 Can you explain why salt is used on the roads in areas where there is a lot of snow and ice in winter?

_____

_____

_____

Name _____ Date _____

Energy

Materials

- small, moderately stiff spring

Although there are many different kinds of energy, all kinds of energy are used to perform some kind of work. The energy in food is called chemical energy. The energy used to turn on light bulbs is called electrical energy. Food and electricity contain potential energy (stored energy). When this potential energy is converted to kinetic energy (energy of motion) work is performed (such as moving muscles using chemical energy from food, turning on a light bulb using electrical energy, and driving a car using energy from gasoline).

Purpose

To show how potential energy can be turned into kinetic energy.

Make a Prediction

_____

_____

Name _____ Date _____

Test Your Prediction

1. Place one end of the spring on the floor and press down on it.
2. Quickly take your hand away from the spring.

Draw Conclusions

3. What did you observe?

_____

_____

_____

4. Based on your results what is your conclusion?

_____

_____

_____

Critical Thinking

5 When you release the spring, do you think the kinetic energy of the spring is more or less than the potential energy before the spring was released?

_____

_____

_____

6 Give other examples of how kinetic energy is transformed into potential energy.

_____

_____

_____

_____

_____

_____

Name _____ Date _____

Light

White light is made up of different colors of light. When white light hits an object like a prism, the different colored light waves spread out and that is why we see the rainbow of colors coming out of the prism. White light can also be created by combining these same rainbow colors.

Materials

- pencil
- white cardboard
- coloring pencils
- markers

Purpose

To tell what would happen if you spin a disc that has the colors of the rainbow.

Make a Prediction

_____

_____

Test Your Prediction

1. Cut a circular disc out of white cardboard (with diameter 6 inches).
2. Divide the white part of the cardboard in 6 equal pieces and color the parts the colors of the rainbow.
3. Push a sharp pencil half way through the center of the circle.
4. Hold the pencil with the point on the table and spin fast.

Name _____ Date _____

Draw Conclusions

5 What did you observe?

_____

_____

_____

_____

_____

_____

6 Based on your results what is your conclusion?

_____

_____

_____

Critical Thinking

7 How is a rainbow formed?

_____

_____

_____

8 What is refraction?

_____

_____

_____

_____

Name _____ Date _____ Learning Lab

How does color help living things survive?

Inquiry: Structured

It Pays to Advertise

Materials

- 2 color pages from the comics
- 2 black and white pages from a newspaper
- scissors

Ask Questions

Flowers need to be noticed. They need animals to find them and help them reproduce and make seeds. Does the color of the flower help the flower advertise itself?

Make a Prediction

What colors help a flower get noticed? Do different colors work better in different places?

_____

_____

Test Your Prediction

1. Decide on a typical shape for a flower blossom. The overall size should be about 2 cm in diameter or less. Draw 10 flowers on a comic page and another 10 flowers on a black and white page. Cut them out.

2. While your back is turned have a friend spread out the 20 cut out flowers all over a black and white page.

3. **Experiment** When your friend says go, turn around and pick up as many as possible in just 3 seconds. Pick up one flower and place it on the table before you pick up another flower. Do the test 3 times.

Name _____ Date _____

4 **Record Data** Make a chart and record how many of the flowers you picked up were colored and how many were black and white.

My Results (flowers on black and white paper)	Number of colored flowers	Number of black and white flowers
test 1		
test 2		
test 3		

5 Trade roles with your partner and repeat steps 2–4.

My Partner's Results (flowers on black and white paper)	Number of colored flowers	Number of black and white flowers
test 1		
test 2		
test 3		

6 Use your data to make a bar graph showing how many flowers of each color were picked up each time you did the test. There will be 2 columns for each test, one for colored flowers and one for black and white flowers.

7 Repeat steps 1–6, and this time place the flowers on a color comic page.

My Results (flowers on colored paper)	Number of colored flowers	Number of black and white flowers
test 1		
test 2		
test 3		

My Partner's Results (flowers on colored paper)	Number of colored flowers	Number of black and white flowers
test 1		
test 2		
test 3		

Name _____ Date _____

Communicate Your Results

Have a class discussion and share your results and graphs. What did you find out? Use your data to answer these questions:

- What flowers were best able to get noticed? Did the color of the sheet of paper make a difference?

_____

_____

_____

- What flowers were least able to get noticed? Did the color of the sheet of paper make a difference?

_____

_____

_____

- If flowers grew in a place where everything was brightly colored with different colors, what color flowers what be most easily noticed?

_____

_____

_____

- How do colors help flowers get noticed? What evidence supports your idea?

_____

_____

Name _____ Date _____

Inquiry: Guided
Hiding in Plain Sight

Ask Questions

Hiding helps some animals keep from being eaten. Some animals need to hide so that animals they want to eat do not see them waiting for a meal. How are some animals able to hide but still be right in front of us?

Materials

- crayons, markers, or colored pencils
- scissors
- clear tape

Make a Prediction

How does camouflage help some animals?

_____

_____

Test Your Prediction

1. With your pencil, draw a simple picture of a lizard or a frog as if you were looking straight down on it from above. The drawing should be 10 to 15 cm long.
2. Color your drawing carefully so that it can hide in the classroom in plain sight. Decide where you will hide your animal. Maybe you could put it on a wall, poster, desktop, or the back of a chair.
3. When everyone's drawings are colored and cut out, you and half of your classmates will be the "hiders" and should tape drawings on the surfaces you've chosen. Do not hide it under or behind anything. The other half of your classmates will be the "seekers" and should go out of the room so they cannot see where the drawings are being hidden.
4. After all the drawings are hidden, your classmates will try to find and list as many of the drawings as possible in 1 minute.

Name _____ Date _____

Communicate Your Results

Work in groups of 4 to 8 and discuss what you found out about hiding in plain sight.

- How many pictures were hidden? How many pictures did each student find?

_____

_____

- Were some easier to find than others? Describe the color of the drawing and the color of the background of 1 picture that was easy to find. Describe the colors of a drawing and background of a picture that was hard to find.

_____

_____

_____

- How do colors help animals hide? What evidence supports your idea?

_____

_____

Inquiry: Open

Now You See It, Now You Don't

Invent and test other ways to explore showing off or hiding. Design and perform an experiment. Ask a question, make a prediction, test your prediction, record your data, and communicate your findings. Make a poster to show what you did and what you found out. Here are some ideas to get you started:

- Make a showing-off and hiding survey of organisms in your schoolyard. What organisms in your schoolyard are most easily seen? What organisms are not easily seen? What makes them good advertisers or hiders?
- Other than color, what structures could help organisms advertise or hide? Could shape make a difference?

My question is: _____

_____

My prediction is: _____

_____

My test is: _____

_____

_____

_____

_____

My conclusions are: _____

_____

Name _____ Date _____

Tracking the Sun and the Moon

Inquiry: Structured

Chasing Shadows

Materials

- 1 pencil or other long, thin stick
- 1 piece of clay large enough to hold up the stick
- 1 piece of white construction paper
- 2 magic markers, 1 blue and 1 red

Ask Questions

How do shadows made by sunlight change during the day? Do they change length during the day? Do they point in different directions? How can we explain the changes?

Make a Prediction

How do shadows change in length and direction with the time of day? Write a prediction.

_____

_____

_____

Test Your Prediction

1. In a south-facing window or outside (where you can see the Sun all day) place the construction paper with the pencil upright in the clay in the middle of the paper.
2. Mark the shadow of the pencil with the red marker by drawing a line on the paper.
3. Then predict about where the shadow will be in 1, 2, 3, and 4 hours by drawing lines with a blue marker.

4. Make certain that no one moves the paper during the day. As the shadow changes, mark the shadow with the red marker and compare the actual positions with your predictions.

5. Repeat the experiment a few days later.

Communicate Your Results

- How did the shadow change in length?

_____

_____

_____

- How did it change in direction?

_____

_____

_____

Name _____ Date _____

- Share your shadow recording with others and post them in the classroom.
- Write a story about how your shadow changed in length and direction.
- Were the predictions better on the second day than the first? How close were your predictions?

_____

_____

_____

_____

- Have a class meeting and try to explain what made the shadows change.

_____

_____

_____

_____

_____

_____

Name _____ Date _____ Learning Lab

Inquiry: Guided
Moon Tracking

Ask Questions

Does the Moon appear to move across the sky like the Sun does? How would you find out?

Materials

- 12 inch ruler

Make a Prediction

Earth's rotation causes the Sun to appear to rise, move across the sky, and set. Do all objects in the sky move in a similar way? Write a prediction about the movement of the Moon based on this idea.

_____

Test Your Prediction

1. Go outside with a parent or teacher, at a time when the Moon is visible in the sky. Good times to do this would be late afternoon or early evening. Try to allow at least an hour between observations.
2. **Observe** Observe the Moon. Hold one arm straight out toward the horizon. Hold the other arm straight and point it toward the Moon. Draw the angle between your arms on a piece of paper. Have your parent or teacher help you. Record this measurement.
3. Repeat step 2 one and two hours later.

Name _____ Date _____

Communicate Your Results

- Did the Moon's position change over time? Did the Moon rise or fall in the sky?

_____

- During the time you observed it, did the Moon change its phase?

_____

- Do your results support your prediction? Can you explain the motion, if any, of the Moon across the sky?

_____

_____

Inquiry: Open

More Moon Observations

Be a Moon watcher. How else can you track Moon changes? Ask a question, make a prediction, set up an investigation, record your data, and communicate your findings. Here are some suggestions to get you started:

- Can you explain what causes the different phases of the Moon by making a model of Earth, the Moon, and the Sun?

_____

_____

- At night does moonlight make a shadow? Do shadows from moonlight change like shadows from the Sun?

_____

_____

Communicate Your Results

- Share your drawings of what the phases of the Moon looked like in your model.
- Where was the Moon when the part facing the Earth was completely light? Where was the Moon when the lighted part looked like a first quarter Moon? Draw pictures to show your ideas

_____

_____

_____

- As a class try to explain the phases of the Moon.

_____

_____

Name _____ Date _____

More Moon Observations

- Observe the Moon at night just after a New moon. Ask your teacher when the Moon is a New Moon. Go outside with an adult and watch changes from night to night over 2 weeks. The Moon will be seen in the West above where the Sun sets. How did the Moon change in an hour? How did it change in 1 to 3 days if viewed at the same time each day?

_____

_____

_____

My question is: _____

_____

How I can test it: _____

_____

_____

_____

_____

My results are: _____

_____

_____

_____

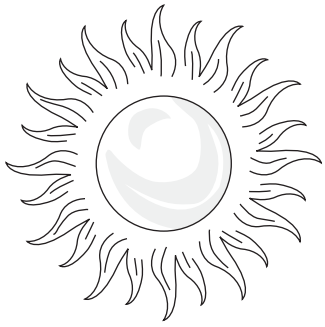
_____

Name _____ Date _____ Learning Lab

Measuring Light Energy

Inquiry: Structured

Collecting Light



Materials

- 2 clean socks: 1 black and 1 white
- 2 clear transparent plastic cups with lids or 2 500 ml beakers
- 20 drops of blue food coloring
- 2 thermometers

Ask Questions

How can we collect solar energy from the Sun? How would we know if we actually collected it?

Make a Prediction

If objects of different colors absorb different amounts of light energy, it should be possible to measure how much energy they absorb by measuring how warm they become. Write a prediction about what you think will happen to different colored objects exposed to sunlight.

_____

_____

Name _____ Date _____

Test Your Prediction

Part 1

1. Place the black and white socks on your hands like you would put on gloves and hold your hands in direct sunlight for 2 to 5 minutes. Predict what you think the socks will feel like when they are held in the Sun.

_____

_____

2. Perform this test and record your observations. Describe what the different socks feel like.

_____

_____

Part 2

3. Fill 2 transparent cups 3/4 full of cold water. Add 15 drops of blue food coloring to one of the cups (until the water is dark blue). Put a cover on each cup.
4. Record the temperature of the water you put in the cups.
5. Set both cups in direct sunlight. Place them on a piece of white cardboard or foam.
6. Predict how you think the temperature will change in each cup.

_____

7. Measure the temperature of the water in each cup every 5 minutes for 1 hour. Make a line graph to show the temperature change in each cup.
8. Repeat your experiment and compare the results to the first experiment.

Communicate Your Results

- What happened to the socks when they were placed in sunlight? What do your experiments suggest about how energy from the Sun was being collected and stored?

_____

_____

- How does the clear and colored water act like light and dark socks when placed in the Sun? What do you think is causing the difference in the samples of water?

_____

_____

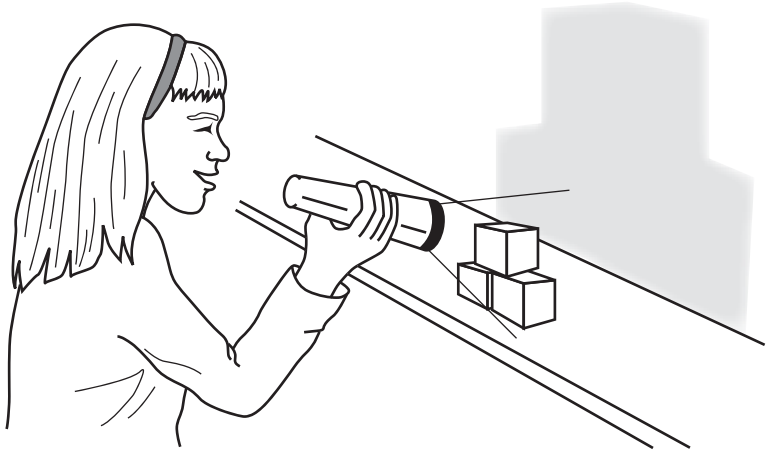
_____

Name _____ Date _____

Inquiry: Guided
Blocking Light

Ask Questions

How are shadows made? How can we change how shadows look? What are shadows made of?



Materials

- 1 flashlight (a flashlight with a focused beam works best)
- 2 objects from around the classroom to use for making shadows
- a darkened corner of the classroom for making shadows on a wall or piece of cardboard
- paper on which to trace shadows that you make

Make a Prediction

To create a shadow, some opaque objects must block light that is shining toward them. Use this fact to make a prediction about what causes shadows and how their shapes might be changed.

_____

_____

_____

Test Your Prediction

Part 1

1. Pick 2 objects of different shapes that you will use to make shadows.
2. Decide how you will make a shadow by using a flashlight and one of the objects. Record how far apart the flashlight, object, and wall will be from each other.
3. On a piece of paper, draw a prediction of what the shadow of the object will look like and how big it will be when you use a flashlight to make a shadow from the object.
4. Now make a shadow with the flashlight and draw the actual shadow on the piece of paper where you drew your prediction.

Part 2

5. Try to make different shaped shadows with the same object. Draw your results. Record what you did to change the shape of the shadow.

Part 3

6. Make a shadow on a wall using an object and the flashlight. Is there a shadow in the air between the object and the image on the wall? How can you tell?

_____

_____

_____

Name _____ Date _____

Communicate Your Results

- Share your shadow drawings of your prediction and the actual results of making a shadow. Make a rule that would tell others how shadows are made and how we can change the shape or size of a shadow.

_____

_____

- Have a shadow art show and post drawings of actual shadows you made by moving an object into different positions. Have other students guess what object was used to make each shadow.
- With classmates discuss what shadows are made of. Are they made by light? The object? The wall? Is the shadow only on the wall or floor? What is the evidence for your answers?

_____

_____

_____

Inquiry: Open More Brilliant Experiments

What questions about collecting or blocking light do you have? What experiments would you like to do to find out more about light? Here are some ideas:

- What kind of shadows can you make using 2 flashlights and one object?
- What is the biggest shadow we can make in the classroom with an object the size of a baseball?
- How can we build a new sunlight (solar energy) collector? Can we use a shoebox or a plastic trash bag? How about a coffee can?

Design an experiment based on your questions. What else do you want to explore? Ask a question, make your prediction, plan an investigation, perform the experiment, record your data, and communicate your findings. Make a poster to show what you did and what you found out. What did you observe?