Easy Science Activity Journals

Reproducible Journal Pages With Instant No-Mess Mini Experiments That Invite Kids to Learn and Write About Weather, Human Body, Space, and Other Science Topics You Teach

BY MARY KAY CARSON

SCHOLASTIC PROFESSIONAL BOOKS

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Introduction

WHY WRITE ABOUT SCIENCE?

Science is an important way we learn about the world around us. *Scientific inquiry* (or "doing science") involves observing our surroundings, collecting information, generating original ideas, and more. All these need to be clearly and precisely communicated when sharing with others. What better opportunity to inspire writing and practice good writing skills!

In fact, the process of doing science lends itself to narrative writing. Doing science involves wonder, personal experiences, and discovery. Students can share these experiences and discoveries through writing. This also provides an opportunity to emphasize the importance of conveying precise information in a clear manner through the written word.

Here are some ideas for maximizing the language-arts component of these science journals:

- Require students to write all answers in complete sentences.
- Encourage students to carefully check their answers for clarity and precision of language, and let them know that this will be part of the criteria for assessment.
- Have students write a summary of each activity in an engaging narrative form.
- Invite students to create a glossary of terms for each activity, or keep a cumulative glossary for each science subject of the book. Glossary words are italicized in the journals.

WHAT IS THE SCIENTIFIC METHOD?

What sets science apart from other types of knowledge is how scientific knowledge is generated. For a scientific fact to become scientific truth, it must be able to be proven again and again, anywhere and everywhere. The scientific fact that a molecule of water is made of two atoms of hydrogen and one atom of oxygen is true for water in the ocean, as well as for water in a sink.

The process of doing scientific study is often called the *scientific method**. It involves a number of steps that usually test an idea through experimentation. Here are its four basic steps:

1. Ask a question or make a prediction (hypothesis).

EXAMPLE: After watching minnows in an aquarium, you suspect that they prefer shaded water to sunny water.
QUESTION: Do minnows prefer shaded water? Why?
PREDICTION: If given a choice, minnows will choose shaded water.

2. Observe or experiment to answer the question or to prove or disprove the prediction.

EXAMPLE: You cover half of an aquarium with cardboard to create shade. Every half hour, count the number of minnows on the shaded and sunny sides.

3. Report the results: Was the prediction correct?

EXAMPLE: The data is tallied and twice as many minnows were counted on the shaded side as on the sunny side. The prediction is correct.

4. Draw conclusions based on the results.

EXAMPLE: Minnows prefer shade. But why? You suspect that minnows prefer shade because it's summer and their water is very warm. (But this was not proven in the experiment and another experiment needs to be conducted to study it.)

* NOTE: While there are guidelines and rules for doing reputable science, there is no single set-in-stone recipe. The scientific method is often used synonymously with hypothesis testing, as above. But there are actually a number of scientific methods used to gain knowledge. Just because "accidental" discoveries and the development of better tools and technology don't test hypotheses in the strict sense doesn't mean that they don't employ the scientific method.

USING THIS BOOK

This book is divided into three chapters: Life Science, Earth Science, and Physical Science. Within each chapter are two or three subjects, and each subject has three or four individual reproducible science journals. We have provided an attractive cover page for each of the book's eight subjects. Photocopy and distribute the covers to students to use as dividers or as cover pages in notebooks made of their completed science journals.

The table of contents lists each journal title followed by its science topic in parentheses. These science topics can be used as a quick guide when seeking journals that fit in with your unit or lesson. They also fall within the National Science Education Content Standards outlined on page 6. The science journals in this book can be integrated into your science units or can be used as student independent study.

Here's what you'll find in each science journal:

- About half of the science journals are "paper only" activities that need no other materials besides a pencil. The other half are quick, simple hands-on activities that require a few simple materials, listed in a "You'll Need" box.
- All the journals feature a "Think & Predict" section where students are asked

to write a prediction before doing the activity. Writing out a prediction personally engages the student in the upcoming activity and creates interest in its process and outcome. It's not a step to be skipped! Make sure students complete it before going on.

■ In the "Observe & Experiment" section, data is generated and the prediction tested. Here, students follow procedures, use tools, and gather information.

■ Students revisit their predictions and note the results in "What Happened?"

■ The majority of the writing comes in the final "Think & Write" section. Students draw conclusions based on their findings, and write about them by responding to critical-thinking questions.

■ "Think Harder!" questions challenge students further.

NATIONAL SCIENCE EDUCATION CONTENT STANDARDS

The science journals featured in this book meet many of the National Science Education Content Standards, the set of criteria that guides the quality of science teaching and learning in this country. The standards outline key science content areas and support a hands-on, inquiry-based approach to learning. The chart below shows how life, earth, and physical science topics in this book correlate with the standards for both elementary-age groups. (Note that many of these science topics are in parentheses after the activity titles in the table of contents.)

LIFE SCIENCE

Grades K-4

- Characteristics of organisms
- Life cycles of organisms
- Organisms and environments

Grades 5-8

- Structure and function in living systems
- Reproduction and heredity
- Regulation and behavior
- Populations and ecosystems
- Diversity and adaptations of organisms

EARTH SCIENCE

Grades K-4

- Properties of earth materials
- Objects in the sky
- Changes in earth and sky

Grades 5-8

- Structure of the earth system
- Earth's history
- Earth in the solar system

PHYSICAL SCIENCE

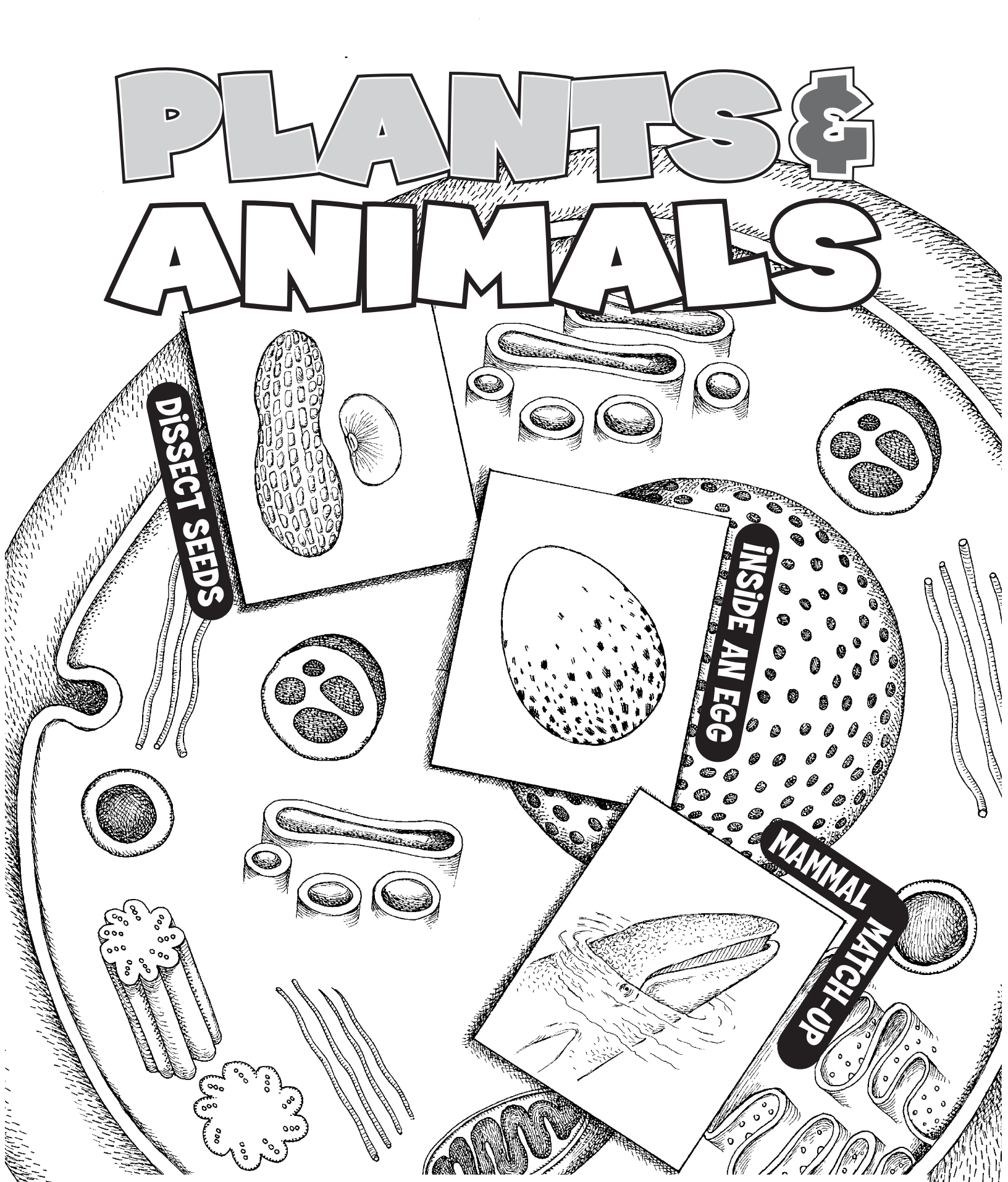
Grades K-4

- Properties of objects and materials
- Position and motion of objects
- Light, heat, electricity, and magnetism

Grades 5-8

- Properties and changes of properties in matter
- Motions and forces
- Transfer of energy

PLANTS & ANIMALS



NAME _____

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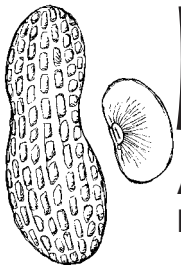


Dissect Seeds

A seed feeds and protects the young plant, or *embryo*, inside it. Find out what's inside a seed.

THINK & PREDICT

? What parts do you think are inside a seed?

_____

_____

? How do you think each of these parts help a seed do its job?

_____

_____

_____

OBSERVE & EXPERIMENT

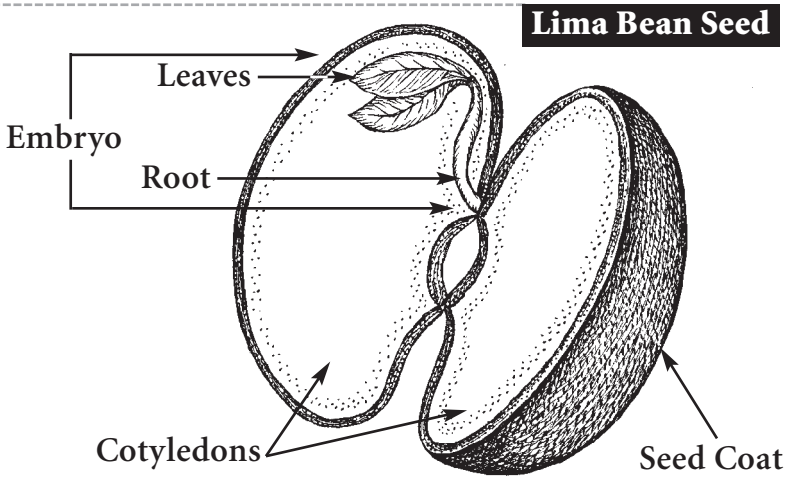
YOU'LL NEED

- soaked lima bean (soaked in water overnight)
- dried lima bean
- toothpick
- hand lens
- peanut in shell

1. Compare the soaked and dried lima bean seeds.
2. Use the toothpick to gently pry apart the two halves of the soaked lima bean.
3. Compare the opened lima bean seed to the picture below. Use the hand lens to see the smaller parts.

- Find the *embryo*. It has both leaves and a root.
- Look for the large seed halves, or *cotyledons*. These provide food for the newborn plant.
- The seed is covered in a tough protective layer, called the *seed coat*.

Lima Bean Seed



4 Remove the peanut's shell and skin. Repeat steps 2 and 3 with the peanut. Draw its parts and label them in the box at right.

Peanut

WHAT HAPPENED?

Read your predictions. Were you correct?

_____

What parts did you find inside both seeds?

_____

_____

_____

How are the seeds different? _____

_____

_____

THINK & WRITE

A seed is a plant's plan for the future. Explain how a seed and its parts do this job. How do you think all seeds are alike? How are they different?

_____

_____

_____

_____

_____

_____

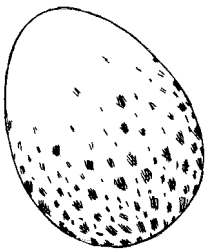
THINK HARDER!

What do you think a seed needs to begin growing?

_____

_____

Name _____



Inside an Egg

A chicken egg holds everything an embryo needs to grow into a ready-to-hatch chick.

THINK & PREDICT

? Think of a chick embryo inside an egg. What do you think it needs to grow?

_____

_____

_____

YOU'LL NEED

- raw chicken egg
- bowl
- wax paper sheet
- disposable gloves

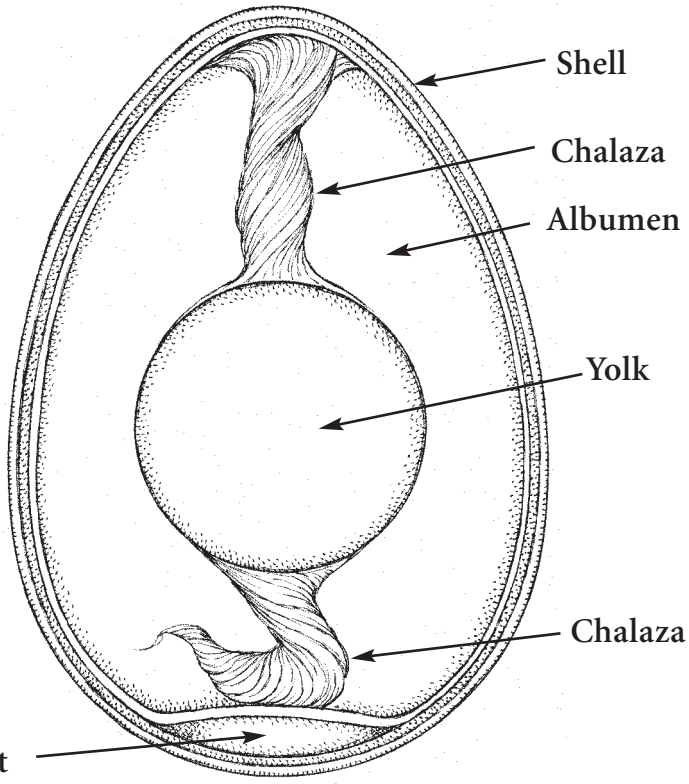
OBSERVE & EXPERIMENT

1 Put on the gloves. Carefully crack open the egg into a bowl. Try not to break the yolk. Set the shell on wax paper.

2 Look at the egg in the bowl and compare it to the picture here.

- Find the yellow *yolk*. This is food for the growing chick.
- Look at the clear egg white, or *albumen*. It is full of water and nutrients.
- Find the white rope-like *chalazas*. They hold the yolk in place.

3 Look at the eggshell. Pick up the half with the wider end. Can you find a bubble of air? What traps the air?



Throw away the egg, eggshell, and wax paper before taking off your gloves. Wash your hands with soap after throwing away the gloves.

WHAT HAPPENED?

Read your predictions. Were you correct? _____

What did you find inside an egg? What parts are there? _____

_____

_____

_____

_____

THINK & WRITE

Describe a chicken egg and explain how its parts help a chick grow. Do you think other animals' eggs are similar to a chicken's? Why or why not?

_____

_____

_____

_____

_____

_____

THINK HARDER!

The chalazas hold the yolk in place. Why do you think this is important?

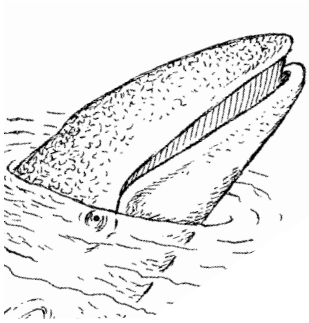
_____

_____

_____

_____

NAME _____



Mammal Match-Up

Mammals, like dogs, cats, and people, are animals that have hair or fur. They live in different kinds of environments. All mammals are adapted to survive in their environment.

THINK & PREDICT

? What kinds of adaptations do you think an arctic mammal might have to survive the cold?

_____

_____

? What kinds of adaptations might a desert mammal have?

_____

_____

? How might an aquatic (water-living) mammal be adapted to its environment?

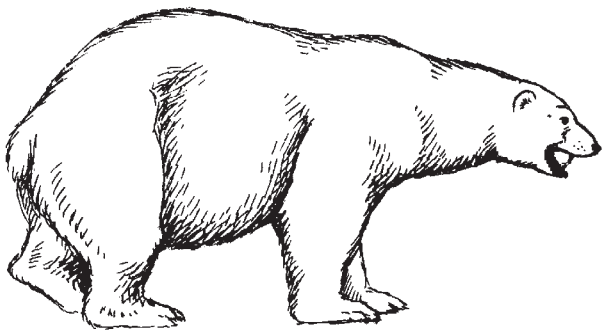
_____

_____

POLAR BEAR

This arctic hunter swims after seals and other prey in icy water. Its young are born in a den dug in a snow bank.

_____



KANGAROO RAT

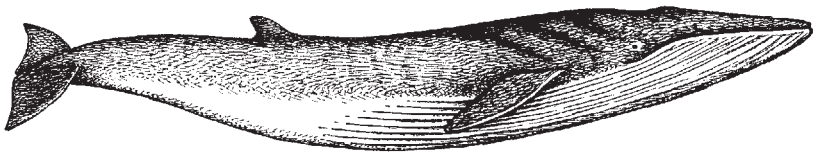
This jumping desert rodent gets all the water it needs from the seeds and plants it eats.

_____

BLUE WHALE

This 100-foot-long whale can eat up to four tons of *krill* (small shrimp-like creatures) a day.

_____



MAMMAL ADAPTATIONS

A. Special water-conserving kidneys
B. Black heat-soaking skin beneath its fur
C. Thick layer of warming fat
D. Giant air-storing lungs
E. Powerful hind legs
F. Flippers and fins, not arms and legs
G. Grinding teeth that constantly grow
H. Sharp prey-catching teeth and powerful claws
I. Comb-like teeth that strain small creatures out of seawater

OBSERVE & EXPERIMENT

1 Read about the polar bear, kangaroo rat, and blue whale. Then read the list of mammal adaptations above.

2 Match the mammal adaptation to the mammal it relates to. Write the correct letters on the blank line. (Note: Some adaptations may fit more than one mammal.)

WHAT HAPPENED?

Read the answers at the bottom of the page. Then check your predictions. Were you correct?

_____

THINK & WRITE

Choose one of the mammals at left. Describe what its environment is like, including what other animals and plants live there, and how the animal lives from day to day.

_____

_____

_____

_____

THINK HARDER!

Why do you think an animal as large as the blue whale has evolved to feed on such tiny prey?

_____

_____

_____

Answers: Polar Bear – B, C, H, possibly E; Kangaroo Rat – A, E, G; and Blue Whale – D, F, I, possibly C.

ENVIRONMENT

NAME _____

NAME _____

Sampling Biodiversity

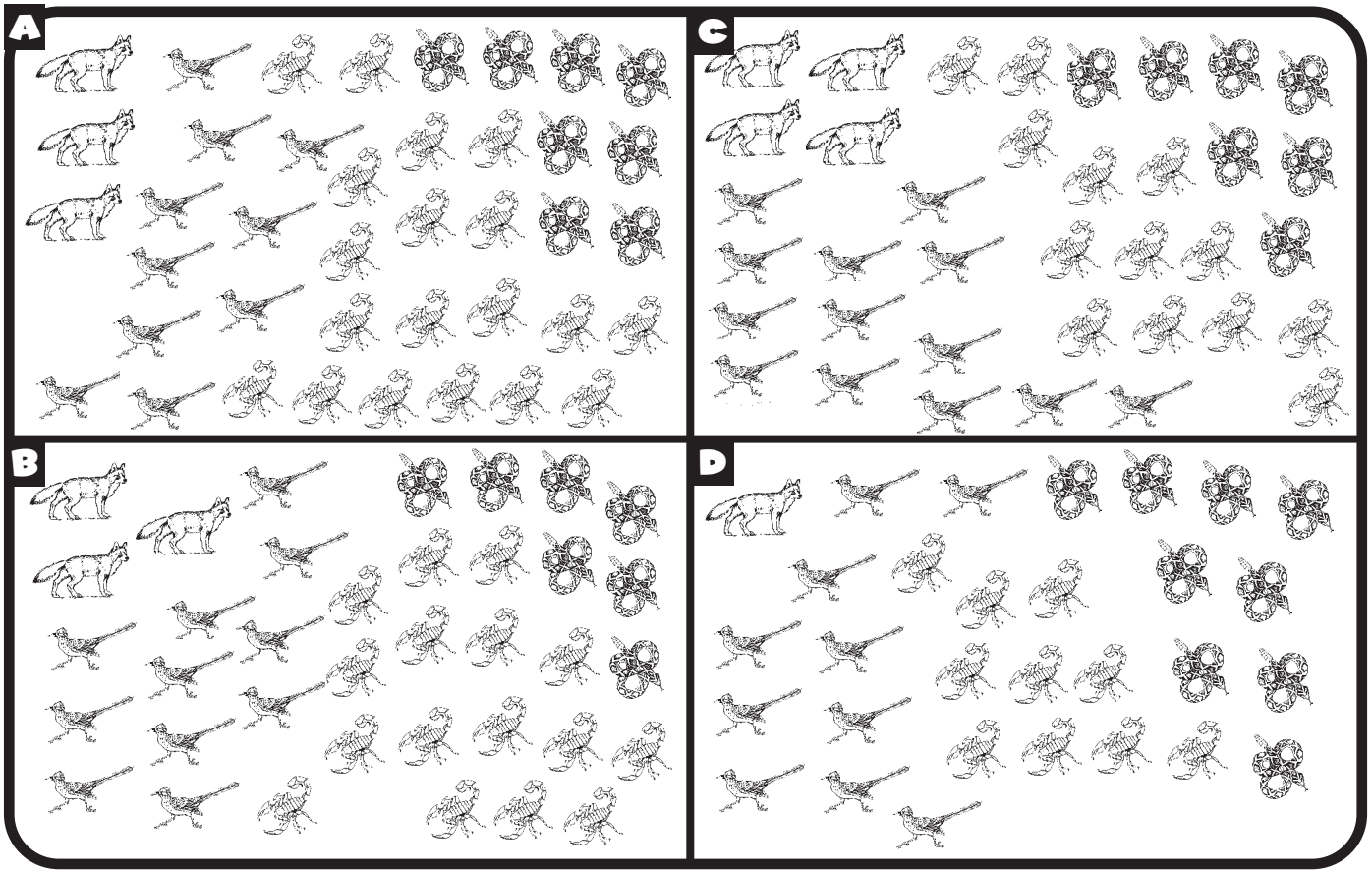
Biodiversity is a measure of how many of each kind of plant and animal lives in an ecosystem. But counting every single organism is often impossible, so scientists estimate the numbers by taking a sample.

THINK & PREDICT

? Without counting, guess how many of each animal there are in the grid below.

How many roadrunners? _____ How many coyotes? _____

How many rattlesnakes? _____ How many scorpions? _____



YOU'LL NEED

- a coin

OBSERVE & EXPERIMENT

1. Toss the coin onto the grid. What section did the coin land on—A, B, C, or D? Circle the section and write its letter in the SAMPLE column in the chart below.
2. Count the animals in your section. Record the number of each kind under SAMPLE. Fill in the third column to find the estimated total.
3. Count to find the actual population for the fourth column.

DESERT ANIMAL	SAMPLE Count the animals in section _____.	ESTIMATE of TOTAL Sample times 4 (number of sections)	ACTUAL TOTAL Count the animals in the grid.
		x 4 = _____	Total = _____
		x 4 = _____	Total = _____
		x 4 = _____	Total = _____
		x 4 = _____	Total = _____

WHAT HAPPENED?

Read your predictions and look at your completed chart. Were your predictions close? _____

On the chart, how close was your ESTIMATE OF TOTAL to the ACTUAL TOTAL for each animal?

_____

THINK & WRITE

What is a biological sample? How could you use it to estimate how many and what kinds of trees live in a large forest?_____

_____

_____

_____

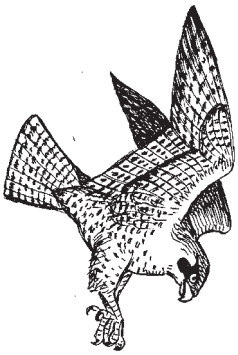
THINK HARDER!

How could you have gotten a more accurate estimate in this sample without counting all the animals?

_____

_____

NAME _____



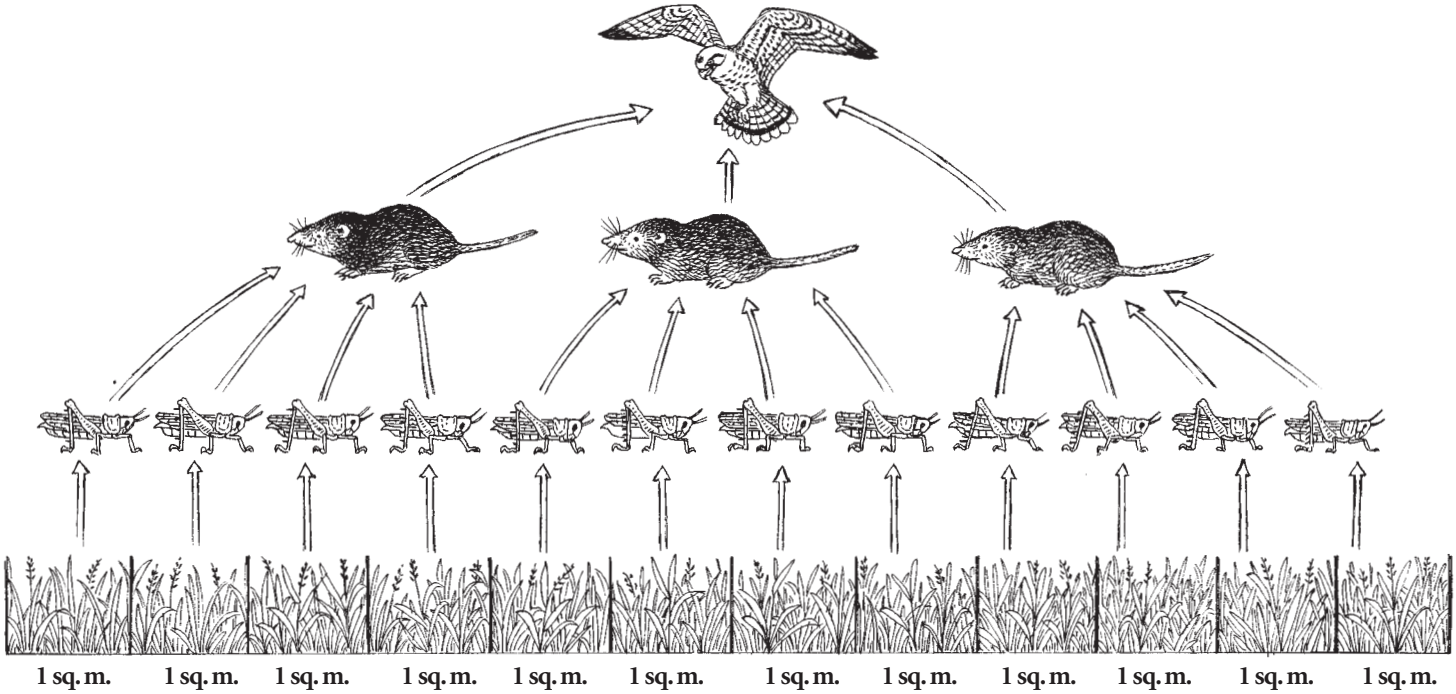
From Grass to Hawk

Animals depend on plants and other animals in their ecosystem for food. All these organisms are linked to each other in food chains. If something happens to one part of a food chain, all the organisms up that chain are affected.

THINK & PREDICT

? Look at the food-chain diagram below. What would happen if half of the grass (6 square meters) was turned into a parking lot? Would grasshoppers be affected? _____ Would shrews? _____ Would the hawk be affected? _____

What would happen if 2 square meters of grass were turned into a sidewalk? Would grasshoppers be affected? _____ Would shrews? _____ Would the hawk be affected? _____



OBSERVE & EXPERIMENT

YOU'LL NEED
- **2 different-colored pens or pencils**

1 Choose a colored pen. Start at the far left of the grass on the diagram. Cross out half (six meters) of the grass.

2 Cross out all the grasshoppers that depend on that grass for food. How many grasshoppers did you cross out? _____

3 Cross out all the shrews that depend on the lost grasshoppers for food. (Even if only one grasshopper is lost, a shrew won't have enough food to survive. Cross out that shrew as well.) How many shrews did you cross out? _____

4 Cross out the hawk if it depends on the lost shrews for food. (Even if only one shrew is lost, a hawk won't have enough food to survive.) Did you cross out the hawk? _____

5 Using the other pen, cross out two meters of grass from the other side of the diagram.

6 Repeat steps 2 to 4. How many grasshoppers did you cross out? _____ How many shrews? _____ Did you cross out the hawk? _____

WHAT HAPPENED?

Read your predictions. Which were correct and which were not? _____

_____

According to this food-chain diagram, how much grass does a hawk need to survive?

_____

THINK & WRITE

Green plants are called *producers* because they make their own food. All animals are *consumers* because they rely on something else for food. Which of the consumers in the food chain are plant eaters and which are meat eaters? Based on this example, do you think most ecosystems have more producers or consumers? More plant eaters or meat eaters? Why?

_____

_____

_____

_____

THINK HARDER!

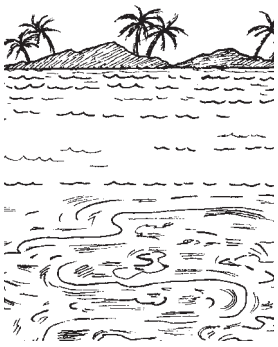
How could the food chain on the previous page be changed into a food web?
What would it look like?

_____

_____

_____

NAME _____



Pollution Dilution

Many pollutants are dangerous even in tiny amounts. Scientists measure these pollutants in units, like parts per thousand or parts per million.

THINK & PREDICT

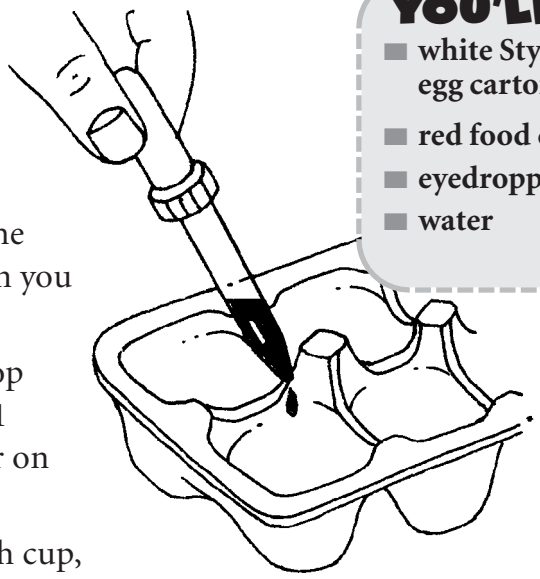
? Could you see one part per ten thousand of food coloring in water? _____

? Could you see one part per hundred thousand of food coloring in water? _____

? Could you see one part per million of food coloring in water? _____

OBSERVE & EXPERIMENT

YOU'LL NEED
- white Styrofoam egg carton, cut in half
- red food coloring
- eyedropper
- water



1 Label the outside of the egg-carton cups from A to F. Use the eyedropper to put 9 drops of water in each egg-carton cup.

2 In cup A, add 1 drop of red food coloring. The amount of food coloring is 1 part per 10. Can you see red? Write your answer on the chart below.

3 Rinse out the eyedropper. In cup B, add a drop of solution from cup A. The new solution is 1 part per 100. Can you see red? Write your answer on the chart.

4 Repeat step 3 for the rest of the cups. For each cup, take a drop of solution from the one before it.

Cup A	Cup B	Cup C	Cup D	Cup E	Cup F
1 part per 10 _____	1 part per 100 _____	1 part per 1,000 _____	1 part per 10,000 _____	1 part per 100,000 _____	1 part per 1,000,000 _____
See red? _____	See red? _____	See red? _____	See red? _____	See red? _____	See red? _____

WHAT HAPPENED?

Read your predictions. Were you correct? _____

At what concentration did the food coloring become invisible? _____

_____

THINK & WRITE

People often say, "Dilution is the solution to pollution." What do you think this means? It is true?

_____

_____

_____

_____

_____

_____

_____

_____

_____

THINK HARDER!

The food coloring became invisible to the eye as it was diluted. But was there still food coloring in the clear solutions? How could you find out?

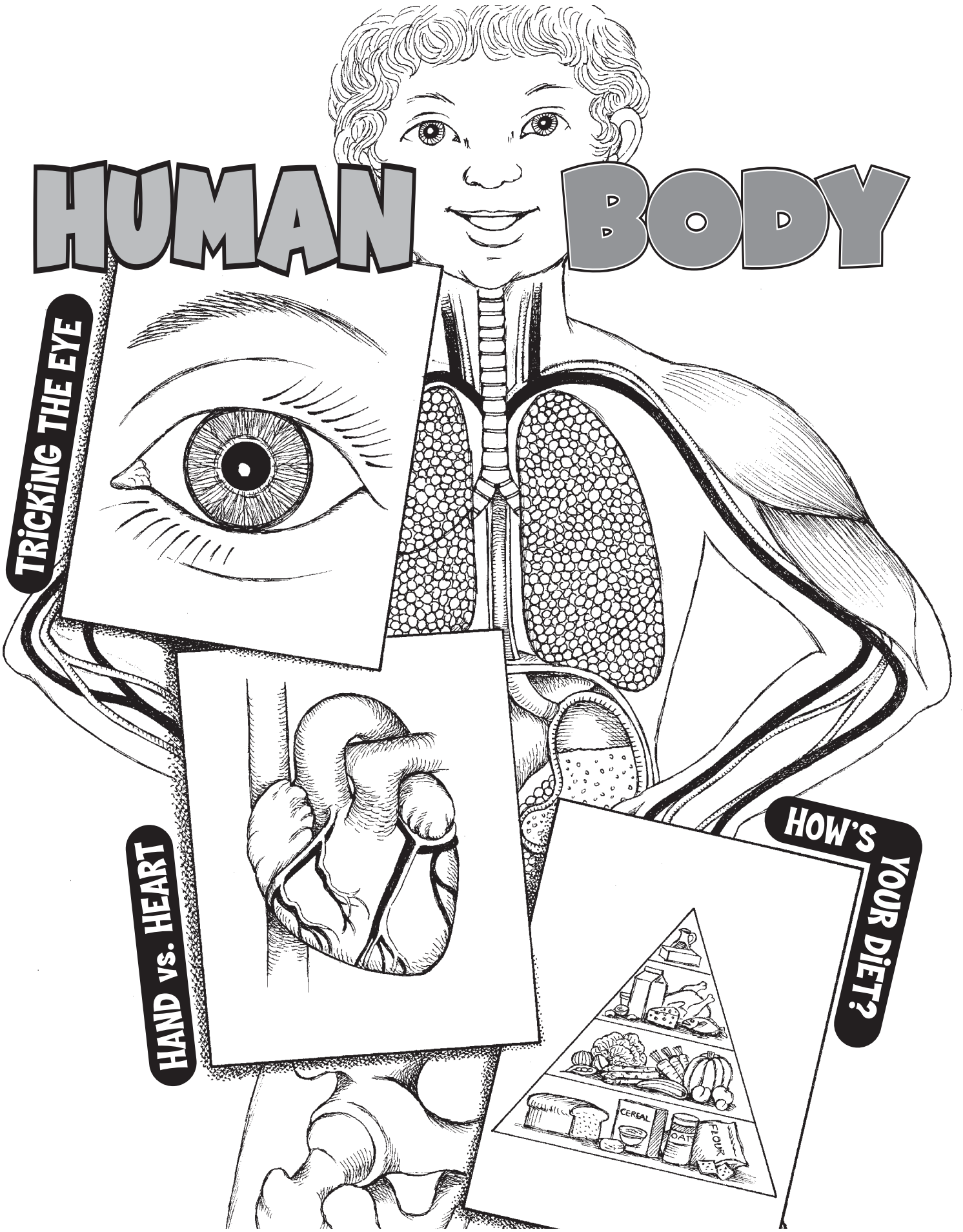
_____

_____

_____

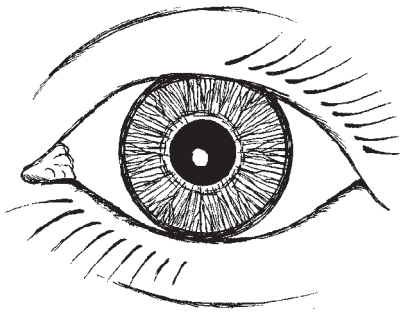
_____

_____



NAME _____

Name _____



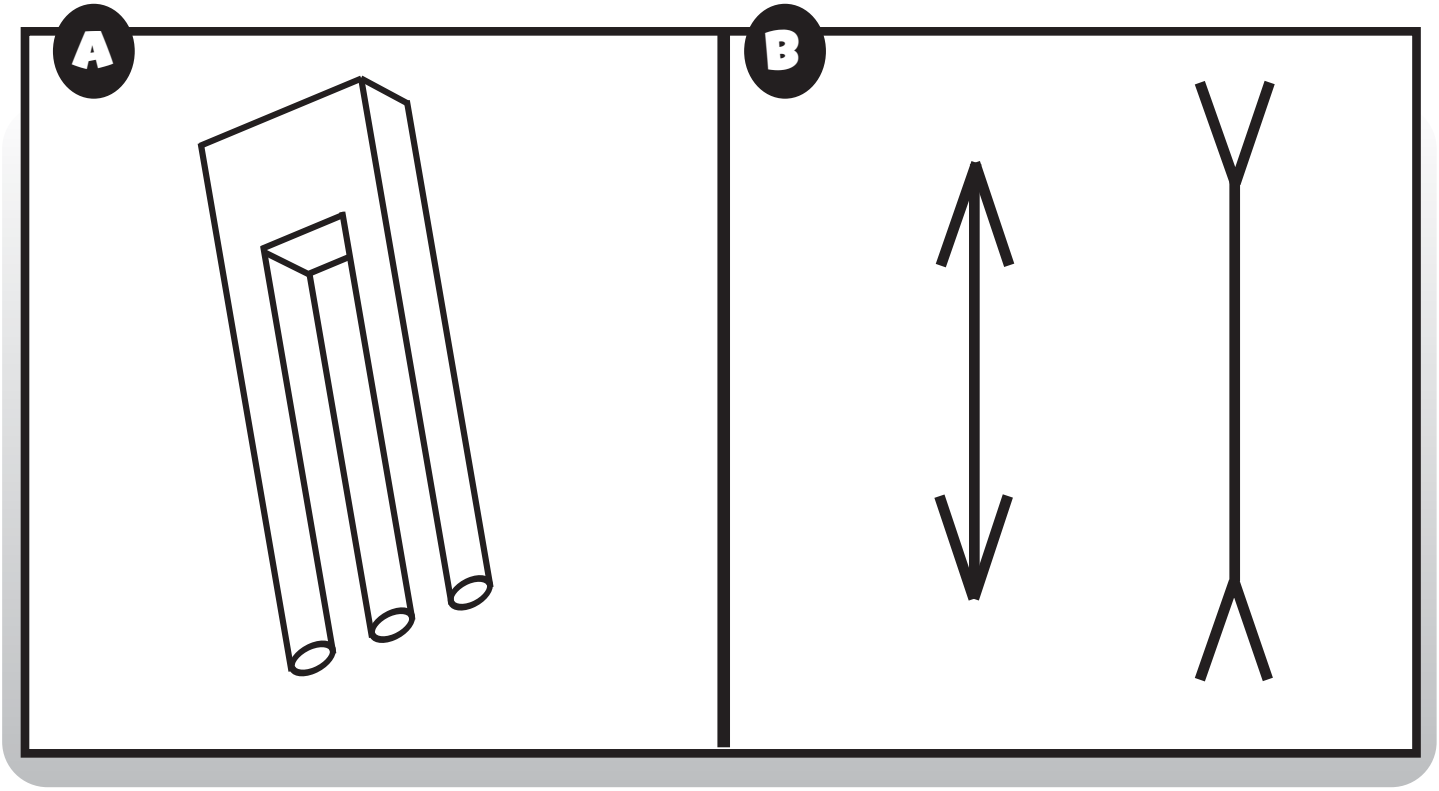
Tricking the Eye

You need eyes to see. But it's your brain that puts together the information gathered by your eyes and tells you what you see.

THINK & PREDICT

? Take a quick look at picture A. How many prongs does it have? _____

? Take a quick look at picture B. Which line is longer—the one on the left or the right? _____



YOU'LL NEED

- pencil
- ruler

OBSERVE & EXPERIMENT

1 Now take a long look at picture A. Use your pencil to color in all the prongs from their tips to the top. How many prongs are there? _____

2 Now take a long look at picture B. Use the ruler to measure each line. Which one is longer?

_____

WHAT HAPPENED?

Read your predictions. Were they correct? _____

THINK & WRITE

Which do you think is more important in determining what you actually see—your eyes or your brain? Why? Include other examples of "seeing is NOT believing."

_____

_____

_____

_____

_____

_____

THINK HARDER!

If you exchanged your eyes for those of a hawk, cat, or fly, would you actually "see" what that animal sees? Why or why not?

_____

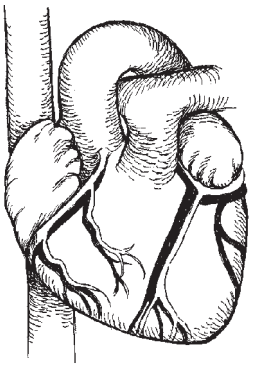
_____

_____

_____

_____

NAME _____



Hand vs. Heart

The heart is made of very strong cardiac muscle. Cardiac muscle is different from skeletal muscle, which is found in legs, arms, and hands.

THINK & PREDICT

? Which kind of muscle is stronger—heart muscle or skeletal muscle? _____

YOU'LL NEED
- stopwatch or clock with a second hand
- small rubber ball

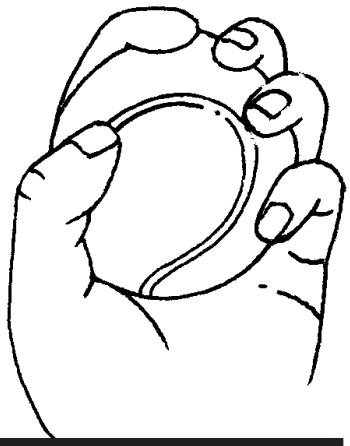
OBSERVE & EXPERIMENT

1 Find your pulse by pressing two fingers against the side of your neck. Each time your heart muscle *contracts* (or squeezes), it pumps blood and creates a *heartbeat*. The number of heartbeats per minute is called *heart rate* or *pulse*.

2 Count how many heartbeats you feel in a minute. Use a stopwatch or clock with a second hand to time yourself.

3 Write your heart rate on the chart. Remember, this is how many times your heart beats every minute for your whole life!

4 Pick up the rubber ball. Squeeze the ball the same number of times per minute as your heart muscle squeezes. How long can you continue without stopping to rest? Time yourself. Write the number of minutes and seconds on the chart.



	How many times per minute?	For how long?
Heart	_____	**A lifetime!**
Hand	_____ (same as heart)	_____ **minutes** _____ **seconds**

WHAT HAPPENED?

Read your prediction. Was it correct? _____

Which kind of muscle is stronger—cardiac or skeletal? _____

THINK & WRITE

Why do you think cardiac muscle is so strong? How is its job different from skeletal muscle?

_____

_____

_____

_____

_____

_____

_____

_____

_____

THINK HARDER!

What do you think would happen if you first did 20 jumping jacks before steps 2 and 4? How would the results change? Why?

_____

_____

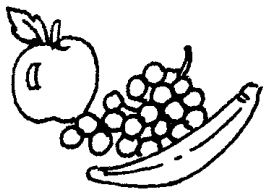
_____

_____

_____

_____

NAME _____



How's Your Diet?

How healthy is your diet? Are you eating the right amounts of the right foods to keep your body fueled and healthy?

THINK & PREDICT

? How many servings of fruits and vegetables do you eat daily? _____

? How many servings of bread, cereal, grains, or pasta do you eat daily? _____

? How many servings of meat, fish, eggs, or beans do you eat daily? _____

? How many servings of milk, yogurt, or cheese do you eat daily? _____

HELPFUL HINT! What Is a Serving?

1 cup of milk or yogurt
1 1/2 ounces of cheese
2-3 ounces of cooked meat, poultry, or fish
1/2 cup of cooked dry beans
1 egg
2 tablespoons of peanut butter
1 cup of raw leafy vegetables
1/2 cup of cooked or chopped raw vegetables

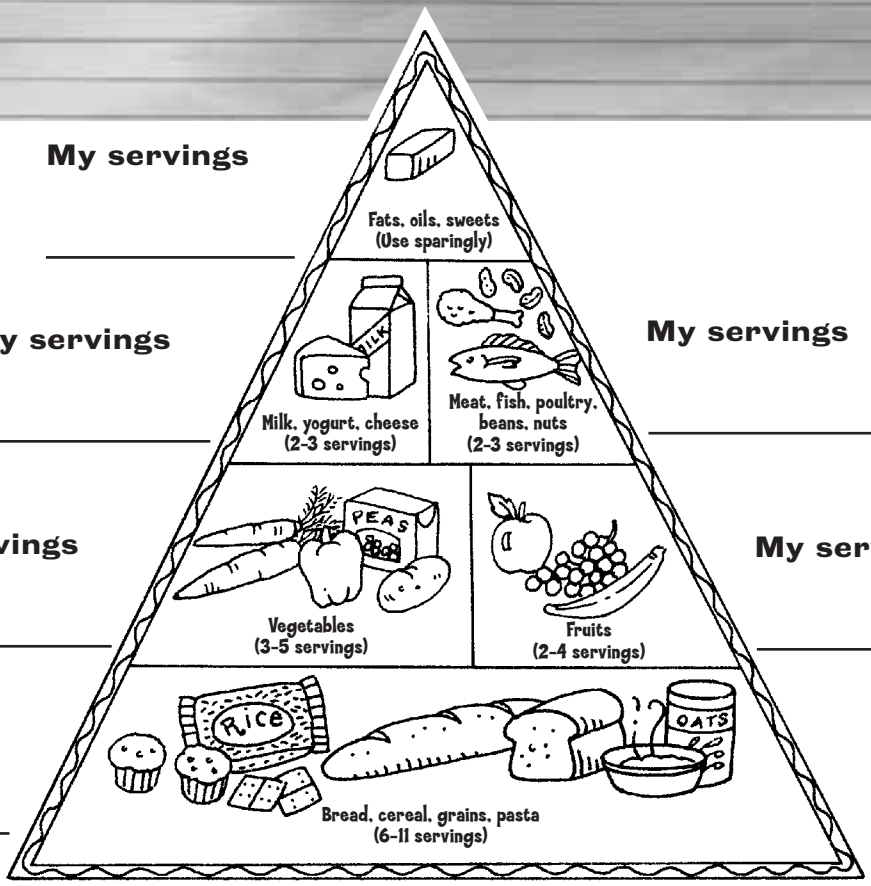
3/4 cup of vegetable or fruit juice
1 medium apple, banana, or orange
1/2 cup of chopped, cooked, or canned fruit
1 slice of bread
1 ounce of boxed cereal
1/2 cup of cooked cereal, rice, or pasta

OBSERVE & EXPERIMENT

1 Record everything you ate yesterday on the chart below. Include drinks and snacks, too.

Breakfast	Lunch	Snack	Dinner

2 Figure out how many servings of each food you ate. Then, tally them on the food pyramid.



WHAT HAPPENED?

Read your predictions. Were you correct? _____

Compare your servings to the recommended servings on the food pyramid. Are they close?

_____

THINK & WRITE

Look at your chart and the food pyramid. How healthy do you think your diet is? What are some good things about it? What are some bad things? How could you improve your diet?

_____

_____

_____

_____

_____

THINK HARDER!

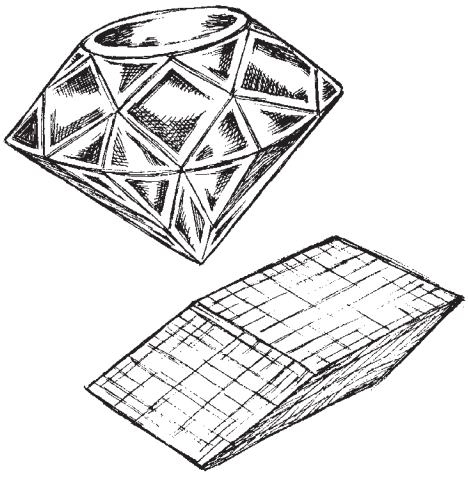
Vegans eat an animal- and dairy-free diet—no meat, poultry, fish, eggs, milk, or cheese. How can these people still eat healthy? _____

_____

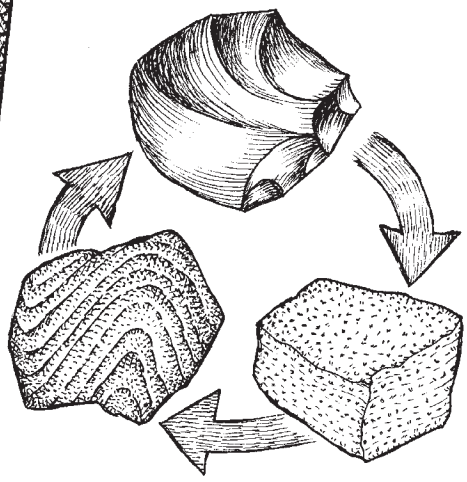
_____

ROCKS & MINERALS

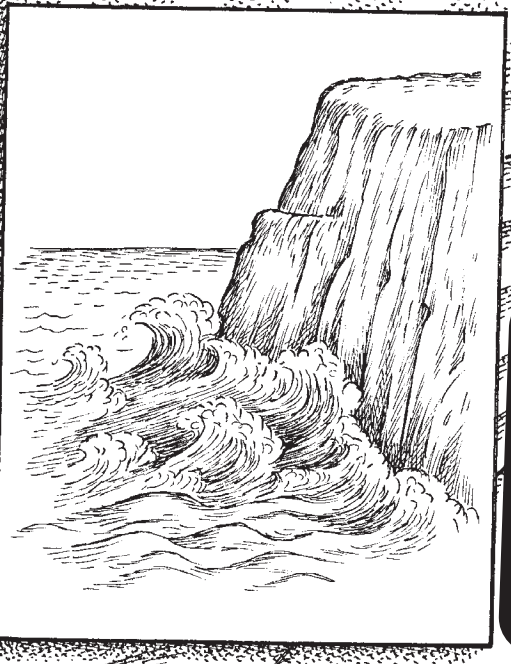
A HARD (NESS) TEST



WHAT KIND OF ROCK?

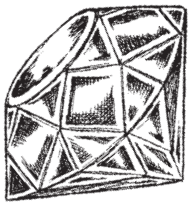


FADING AWAY



Name _____

NAME _____



A Hard(ness) Test

Scientists measure the hardness of rocks and minerals on a scale from 1 to 10. A rock that can easily be scratched by a fingernail is rated 1. A diamond, the hardest mineral known, has a rating of 10.

YOU'LL NEED
- 2 rock samples labeled A and B
- penny
- penknife
- glass jar
- steel file

THINK & PREDICT

? Your teacher will give you two rock samples. Which one do you think is harder? _____

Mohs Mineral Hardness Scale

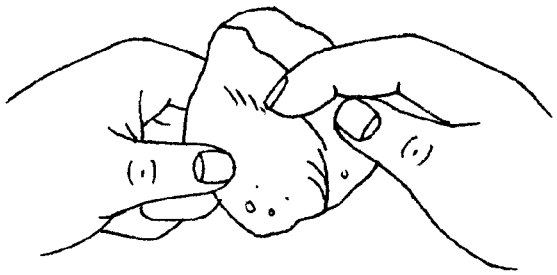
Hardness	Scratched by/Scratches	Rock A	Rock B
1	fingernail easily		
2	fingernail		
3	penny		
4	penknife easily or window glass		
5	penknife		
6	steel file easily; scratches window glass or penknife		
7	steel file		
8	steel file with difficulty		
9	steel file with much difficulty		
10	diamond only; scratches all others		

OBSERVE & EXPERIMENT

1 Pick up Rock A. Try to scratch the rock with your fingernail.

2 If your nail doesn't scratch the rock, move up to a penny. Keep testing higher on the Mohs scale until something scratches the rock. Record what does and doesn't scratch the rock in the third column of the chart on the previous page.

3 Repeat steps 1 and 2 with the second rock. Record your findings in the last column.



WHAT HAPPENED?

Read your prediction. Was it correct? _____

Which rock was harder? _____

THINK & WRITE

Use the information on the Mohs scale to describe each rock's hardness and to compare the two rocks. Why is hardness an important property for identifying rocks?

_____

_____

_____

_____

_____

_____

THINK HARDER!

The Mohs scale is actually a scale of mineral hardness. So why can it be used to measure the hardness of rocks? What's the difference between a rock and a mineral?

_____

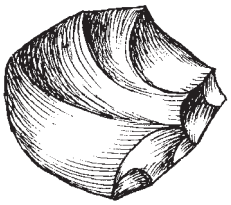
_____

_____

_____

NAME _____

What Kind of Rock?



The Earth's *crust* (outer layer) is made up of three types of rocks. *Igneous rocks* form when hot, molten rock cools and hardens. *Sedimentary rocks* are made up of layers of sand, pebbles, mud, and more that have been squeezed together into rock over time. *Metamorphic rocks* are rocks that have been changed by high heat and pressure within the Earth.

THINK & PREDICT

? Your teacher will give you three different rocks. Which of them do you think is an igneous rock?

_____ Which is sedimentary? _____

Which is metamorphic? _____

OBSERVE & EXPERIMENT

1 Choose a rock. Go to START on the rock flow chart on the next page. Read the first question. Use the hand lens to look closely at the rock and decide on an answer. Follow the correct answer down to the next question.

2 Continue to move down the flow chart by following the correct answer to each question.

3 If you need to do an acid fizz test, place the rock on a paper towel. Put a few drops of vinegar on the rock. Use the hand lens to watch for tiny bubbles (as in soda).

4 When you reach the bottom of the flow chart, set the rock on its rock type and leave it there.

5 Repeat steps 1 to 3 with the other two rocks.

YOU'LL NEED

- granite rock
- sandstone rock
- marble rock
- hand lens
- strong white vinegar
- eyedropper
- paper towel

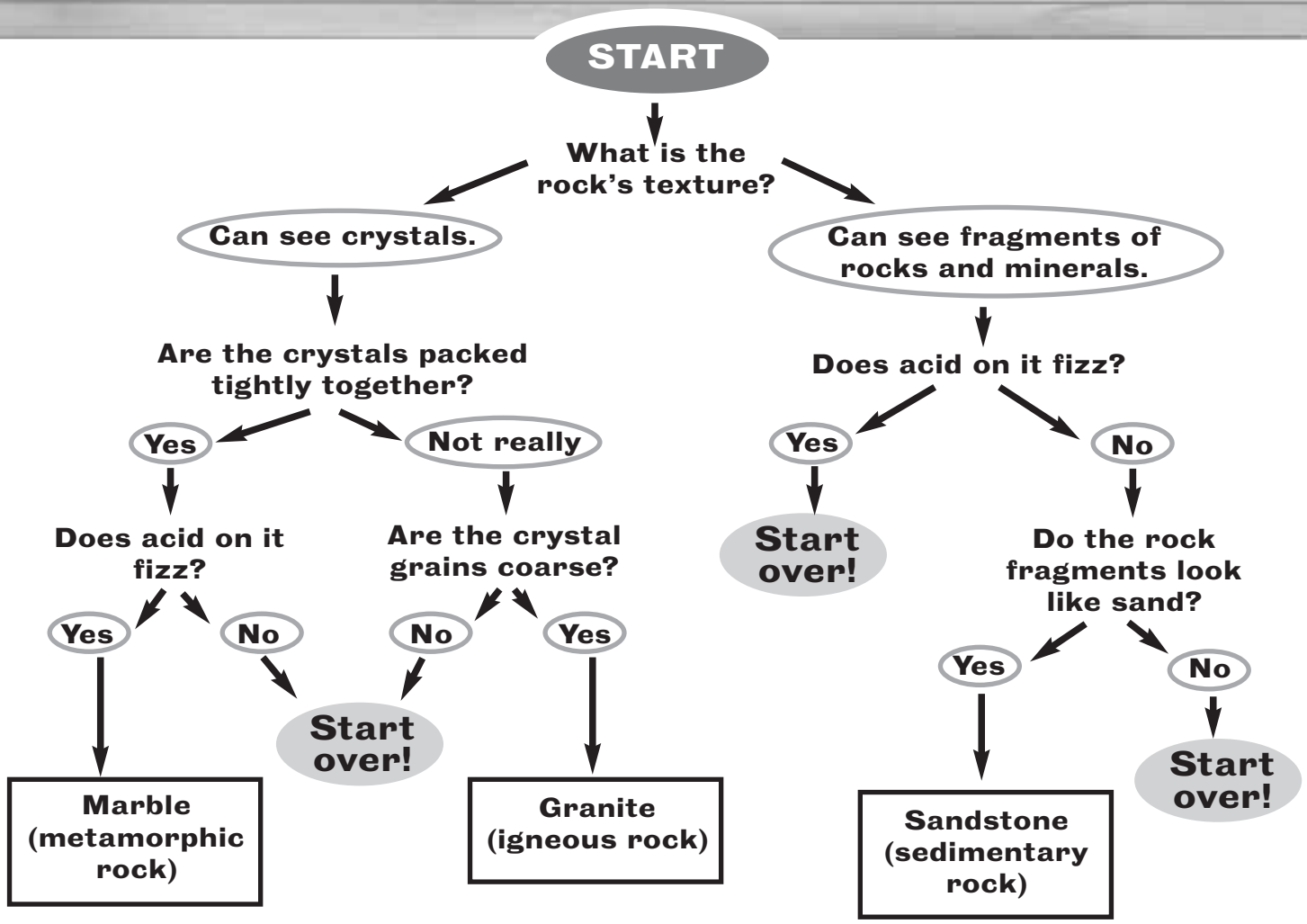
WHAT HAPPENED?

Were your predictions correct? What kind of rocks are granite, sandstone, and marble?

_____

_____

_____



THINK & WRITE

Lava and magma are liquid, melted rocks that cooled to form solid igneous rocks. But where did the melted rock come from? What kinds of rocks did the sand, mud, and pebbles that make up sedimentary rocks use to be? Heat and pressure can change any kind of rock into a metamorphic rock. Describe how the three types of rocks are changed and recycled in the Earth's crust in the rock cycle.

Name _____

Fading Away

Over time, *weathering* breaks down huge boulders into tiny grains of sand. There are two kinds of weathering. *Mechanical weathering* breaks down rocks by force. *Chemical weathering* chemically changes and weakens the minerals in rocks, causing them to break down.

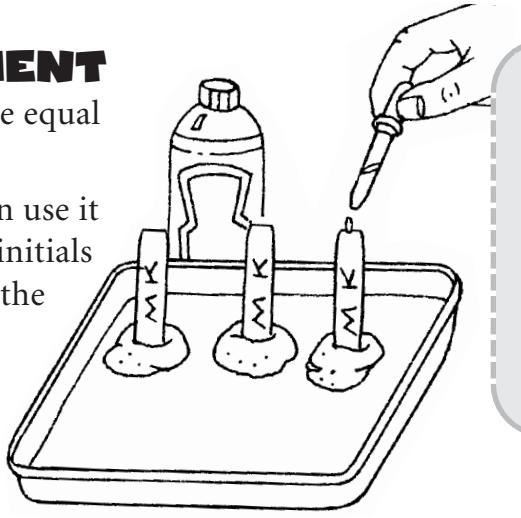
THINK & PREDICT

Imagine a gravestone on a windy hill in a polluted city. Wind and acid rain has worn away the gravestone, making the writing on it difficult to read.

? Which causes chemical weathering—wind or acid rain? _____

? Which causes mechanical weathering—wind or acid rain? _____

OBSERVE & EXPERIMENT



YOU'LL NEED

- piece of chalk
- metal paper clip
- white vinegar
- eyedropper
- 3 dime-sized balls of modeling clay
- plate or tray

1 Break the piece of chalk into three equal pieces.

2 Unbend the paper clip so you can use it like a carving tool. Scratch your initials into the three chalk pieces in exactly the same way.

3 Set the three pieces of chalk in a row on the plate or tray. Use the balls of clay to hold up the chalk pieces.

4 Draw each chalk piece in the "At Start" row on the chart on the next page.

5 Blow 10 hard puffs on the left-hand chalk piece. Draw and note any changes in the "After 10" row.

6 Use the eyedropper to drop 10 drops of vinegar on the right-hand chalk piece. Draw and note any changes in the "After 10" row.

7 Repeat steps 5 and 6 and note any changes in the "After 20" row.

	Puffs of Wind	Nothing	Drops of Acid
At Start			
After 10...			
After 20...			

WHAT HAPPENED?

Which "weathered" away the chalk more—blowing on it or dropping vinegar on it?

_____

Read your predictions. Do you think they're correct now? Why or why not?

_____

THINK & WRITE

Write about other causes of weathering besides wind and acid rain. For example, water freezing and thawing, flowing water, plant roots, etc. Which of these are chemical weathering, and which are mechanical?

_____

_____

_____

_____

_____

THINK HARDER!

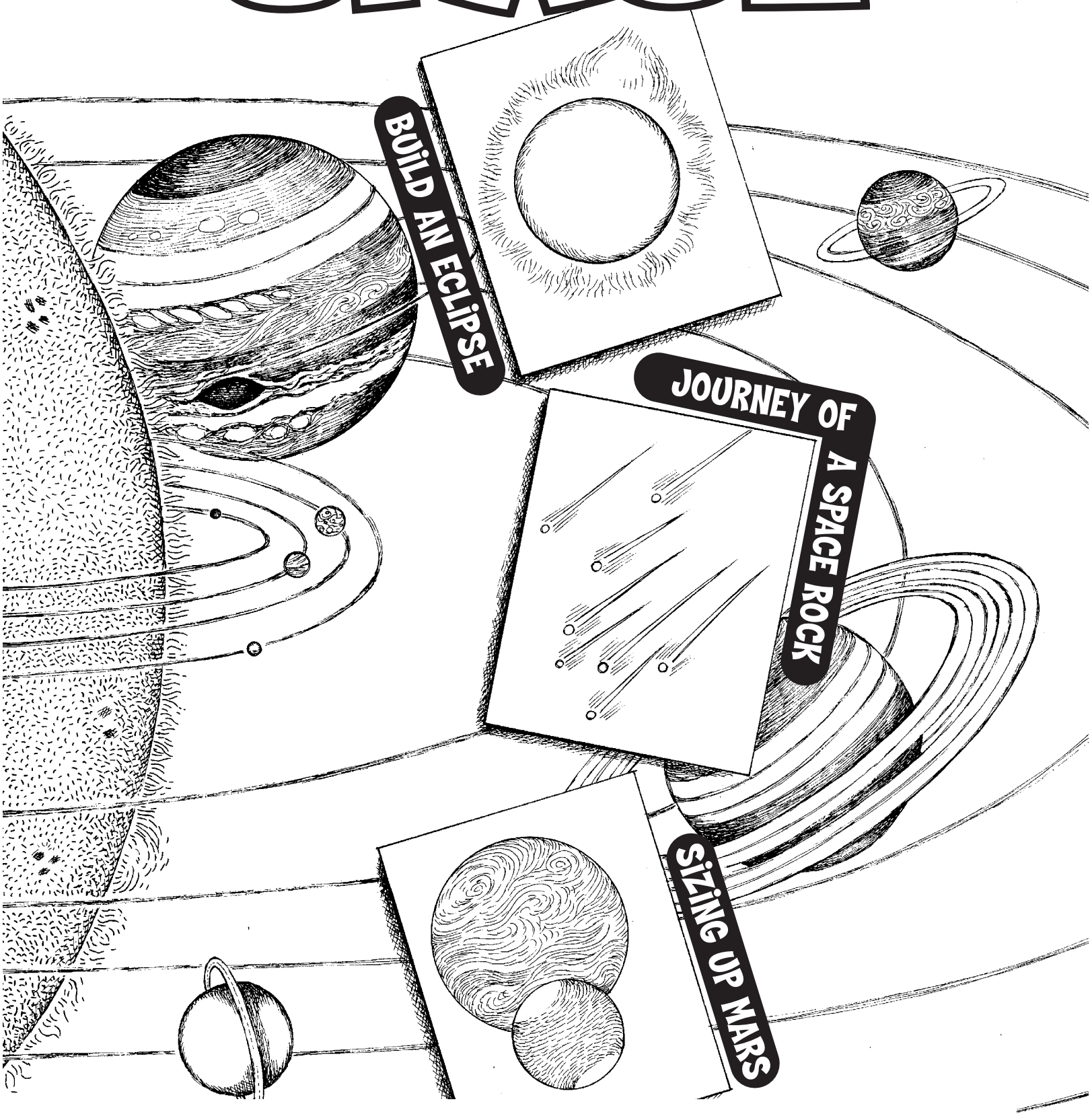
Say you used water instead of vinegar in your experiment. Would this be chemical or physical weathering? Why?

_____

_____

_____

SPACE



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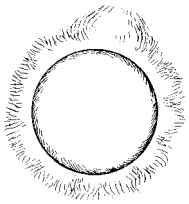


Build an Eclipse

Sometimes the movements of the Earth and moon block the sun's light from reaching each other. When the moon blocks the sun from our view, we have a *solar eclipse*. A *lunar eclipse* occurs when the moon passes through Earth's shadow.

THINK & PREDICT

? What arrangement of the sun, moon, and Earth do you think causes a solar eclipse? Sketch it here:

? What arrangement of the sun, moon, and Earth do you think causes a lunar eclipse? Sketch it here:

OBSERVE & EXPERIMENT

YOU'LL NEED
- strong flashlight
- toothpick
- dark-colored modeling clay

1 Form two balls out of clay—one the size of a pea, the other about the size of a Ping-Pong ball. Stick the toothpick into the pea-sized ball for a handle.

2 Turn on the flashlight and set it and the larger ball on a desk so the light shines directly on the ball. The flashlight represents the sun's light, the larger ball the Earth, and the smaller ball the moon.

HELPFUL HINT
The room doesn't have to be dark to do this activity. However, try to avoid direct sunlight or bright lights.

3 Hold the moon by its handle and position it in orbit around the Earth to create a solar eclipse. Draw your setup here:

4 Next, position the moon in orbit around the Earth to create a lunar eclipse. Draw your setup here:

WHAT HAPPENED?

Compare your first sketches with the ones you drew based on your experiment. Were your predictions correct? Why or why not?_____

_____

THINK & WRITE

Say you're watching a lunar eclipse. What do you see? What's happening to cause the eclipse?

_____

_____

_____

Say you're watching a solar eclipse. What do you see? What's happening to cause the eclipse?

_____

_____

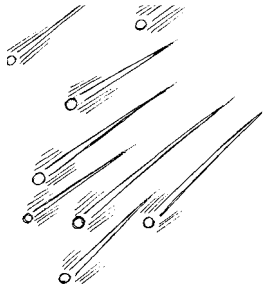
_____

THINK HARDER!

Eclipses are rare events. Why do you think they don't happen every month as the moon travels around the Earth? _____

_____

NAME _____



Journey of a Space Rock

Small chunks of rock—pieces of asteroids or comets—whiz through space. When these rocks enter a planet's atmosphere they burn up from *air friction*, creating streaks of light. Pieces that don't burn up fall to the ground.

THINK & PREDICT

? What is a meteor? _____

? What is a meteoroid? _____

? What is a meteorite? _____

OBSERVE & EXPERIMENT

1 Look at the three pictures below.

2 Circle the correct space rock term for each picture.

NASA

meteor
meteorite
meteoroid

YERKES OBSERVATORY PHOTOGRAPH

meteor
meteorite
meteoroid

THE SMITHSONIAN INSTITUTION

meteor
meteorite
meteoroid

WHAT HAPPENED?

Read the answers at the bottom of the page. Then check your predictions. Were you correct?

THINK & WRITE

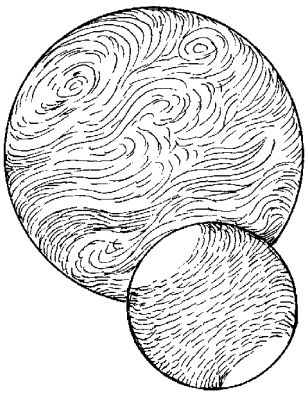
Write about how a space rock goes from a meteoroid to a meteor and sometimes to a meteorite. Include complete definitions of meteor, meteorite, and meteoroid.

THINK HARDER!

What's a shooting or falling star?

Answers: A is a meteoroid, B is a meteor, and C is a meteorite.

Name _____



Sizing Up Mars

Mars is our closest neighbor planet. Yet the red planet is very different from Earth. In fact, it's more like our moon than the Earth in some ways.

THINK & PREDICT

? How do you think Mars is like Earth? _____

_____

? How do you think Mars is like our moon? _____

OBSERVE & EXPERIMENT

1 Study the chart on the next page.

WHAT HAPPENED?

Read your predictions. Were they correct?

_____

THINK & WRITE

Using the chart for reference, write about Mars and compare it to both Earth and the moon. Is Mars suitable for life? Why do you think so?

_____

_____

_____

_____

_____

	MOON	MARS	EARTH
Rotation (day length)	27 days	24.5 hours	24 hours
Orbit (year length)	27 days	687 days	365 days
Size (diameter)	2,160 miles	4,217 miles	7,926 miles
High/Low Temperatures	273°F/ -243°F	32°F / -171°F	136°F / -129°F
Average Distance from Sun	93 million miles	142 million miles	93 million miles
Seasons?	no	yes	yes
Gravity (How much would a 100-pound person weigh?)	17 pounds	38 pounds	100 pounds
Atmosphere	none	thin, mostly carbon dioxide	mostly nitrogen (78%) and oxygen (20%)
Water	Some water ice in craters near its poles.	Some water ice at poles and possibly underground. There's also evidence of past water (dried river and lake beds).	About 70% of surface is covered in water.
Impact Craters	many	quite a few	Very few visible, most are covered in dirt or eroded.
Volcanoes	None now, though there are ancient lava flows.	Quite a few, including some larger than Mt. Everest.	Yes, and they're erupting all the time.

THINK HARDER!

How can both Earth and the moon have the same average distance from the sun?

_____

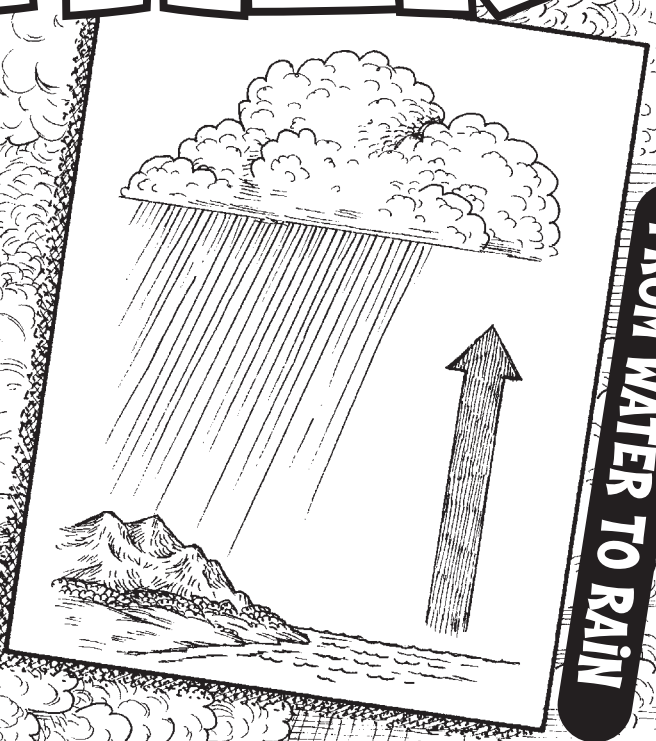
_____

_____

_____

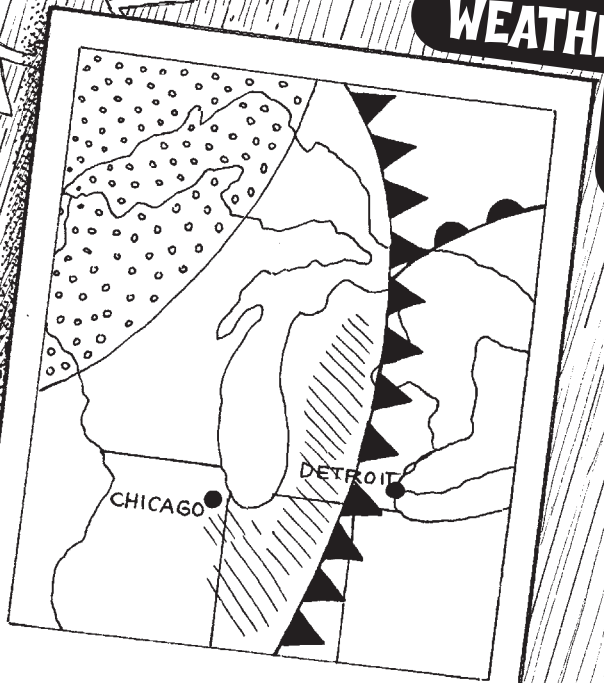
WEATHER

FROM WATER TO RAIN



CHILLY WIND

WEATHER MAP



NAME _____

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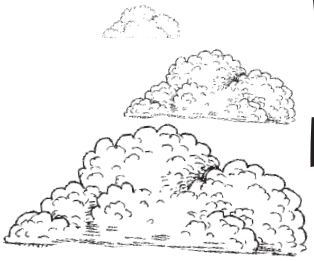


From Water TO RAIN

The continuous movement of water between Earth's surface and the atmosphere is called the *water cycle*. Warm liquid water changes into gaseous water vapor during *evaporation.* As water vapor rises, it cools and *condenses* to form cloud droplets. When these droplets grow too large, they fall back to the ground as *precipitation*.

THINK & PREDICT

? Where do you think more clouds usually form—over warm water or cold water? Why?

_____

_____

YOU'LL NEED

- 2 identical clear jars
- 2 ice cubes
- 2 rubber bands
- hot and cold water
- marker
- 2 pieces of heavy-duty aluminum foil (large enough to cover the mouth of the jar)

OBSERVE & EXPERIMENT

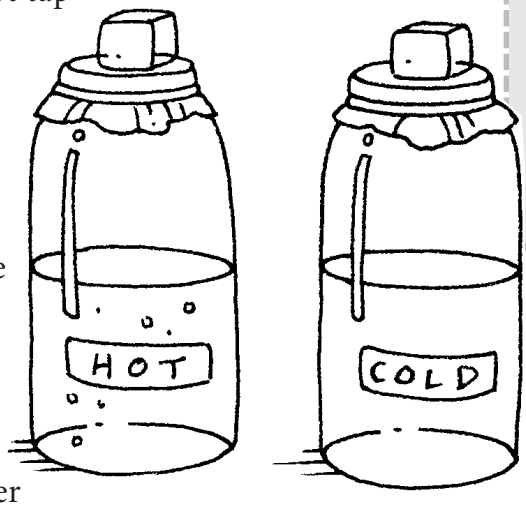
1 Use a marker to label one jar HOT and the other COLD.

2 Fill the HOT jar halfway with hot tap water, and the COLD jar to an equal level with cold water.

3 Cover each jar with foil. Stretch the foil tight and hold it in place with a rubber band.

4 At the same time, set an ice cube on top of each jar. Wait until you see "fog" in one of the jars (about 5 to 10 minutes).

5 Remove the ice cubes and rubber bands. Carefully turn over the pieces of foil and compare.



■ What's on the inside of the foil lids?

_____

■ Where did it come from?

_____

■ How is this like cloud formation?

_____

■ Which jar produced more "clouds"?

_____

■ Why?

_____

WHAT HAPPENED?

Which jar made more rain-filled clouds? _____

Read your prediction. Was it correct? _____

THINK & WRITE

Describe how water moves through the water cycle. Use the terms *evaporation, condensation,* and *precipitation.* How does temperature make a difference?

_____

_____

_____

_____

_____

_____

THINK HARDER!

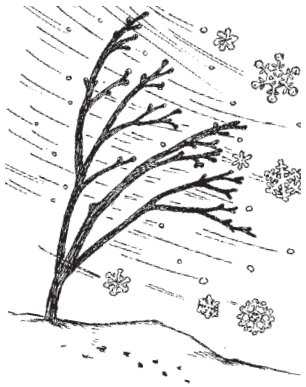
Hurricanes are giant ocean storms fueled by water that quickly evaporated and rose into the air. Why do you think the Atlantic Ocean hurricane season runs from June through November?

_____

_____

_____

Name _____



Chilly Wind

Wind can make cold temperatures feel even colder. That's because the wind blows away the layer of warmed air next to your skin. The faster the wind, the colder it feels. This is called the *windchill factor*.

THINK & PREDICT

? How much colder do you think a 25°F day would feel if there's a 10-mile-per-hour (mph) wind blowing? _____

? With a 20-mph wind?_____

OBSERVE & EXPERIMENT

1 Look at the windchill chart on the next page. The actual air temperature runs across the top and the wind speed on the left. To find the windchill temperature, find the air temperature and run your finger down the column until you reach the row with the correct wind speed. For example, a 15°F day with 25-mph wind feels like –4°F.

2 Use the chart to answer these questions:

A. Say it's 30°F outside and winds are blowing at 10 mph. How cold does it feel?

_____

B. The windchill temperature feels like –1°F even though the actual air temperature is 20°F. How fast must the wind be blowing? _____

C. Winds are blowing at 25 mph. The temperature feels like –11°F. What is the actual air temperature? _____

D. How much colder does a 20°F day feel if there's a 5-mph wind blowing? _____

WIND (MPH) \ TEMPERATURE (°F)	30	25	20	15	10	5	0	-5	-10	-15	-20	-25
5	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40
10	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47
15	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51
20	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55
25	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58
30	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60
35	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62
40	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64
45	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65
50	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67
55	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68
60	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69

WHAT HAPPENED?

Check your answers with those on the bottom of the page. Then compare your predictions with data on the windchill chart. Were you correct? How close were you?_____

_____

THINK & WRITE

Use the windchill chart to explain what windchill is and why it makes people and animals feel colder. Why do you think it's important to know windchill information?

_____

_____

_____

_____

_____

_____

THINK HARDER!

Before 2001, weather scientists used a different windchill chart. The old chart was based on a formula that measured winds at a height of 33 feet, the official height for weather observations. But the new formula uses wind speeds at 5 feet above the ground. Why do you think the new chart is better?

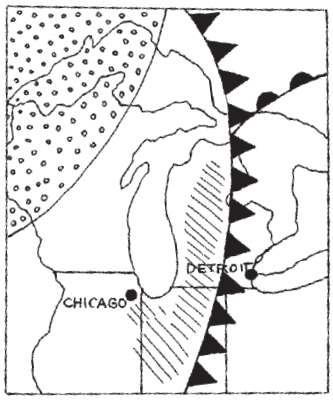
_____

_____

_____

Answers: A. 21°F B. 40 mph C. 10°F D. 7°F colder

NAME _____



Weather Map

People rely on weather maps to know what the weather is like in their area. Weather maps are everywhere—on TV, Web sites, and newspapers.

THINK & PREDICT

? What kinds of weather information can you find out from a weather map?

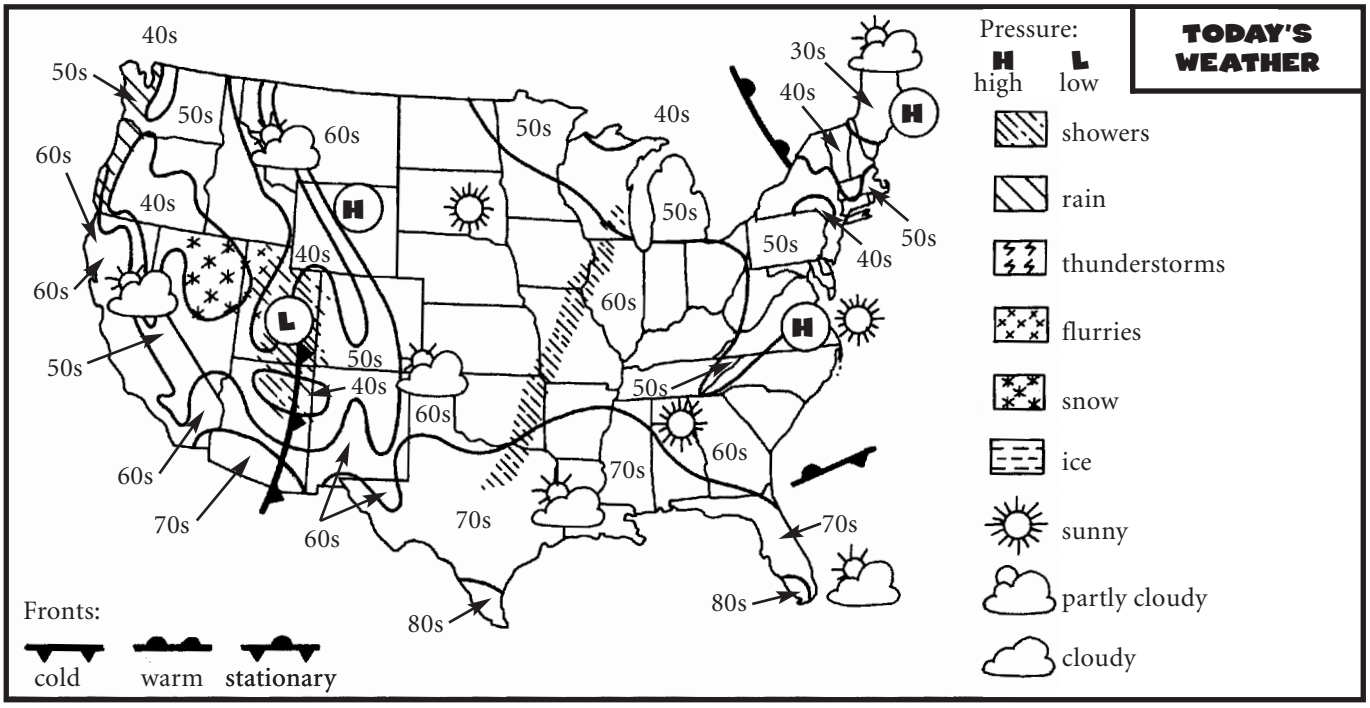
_____

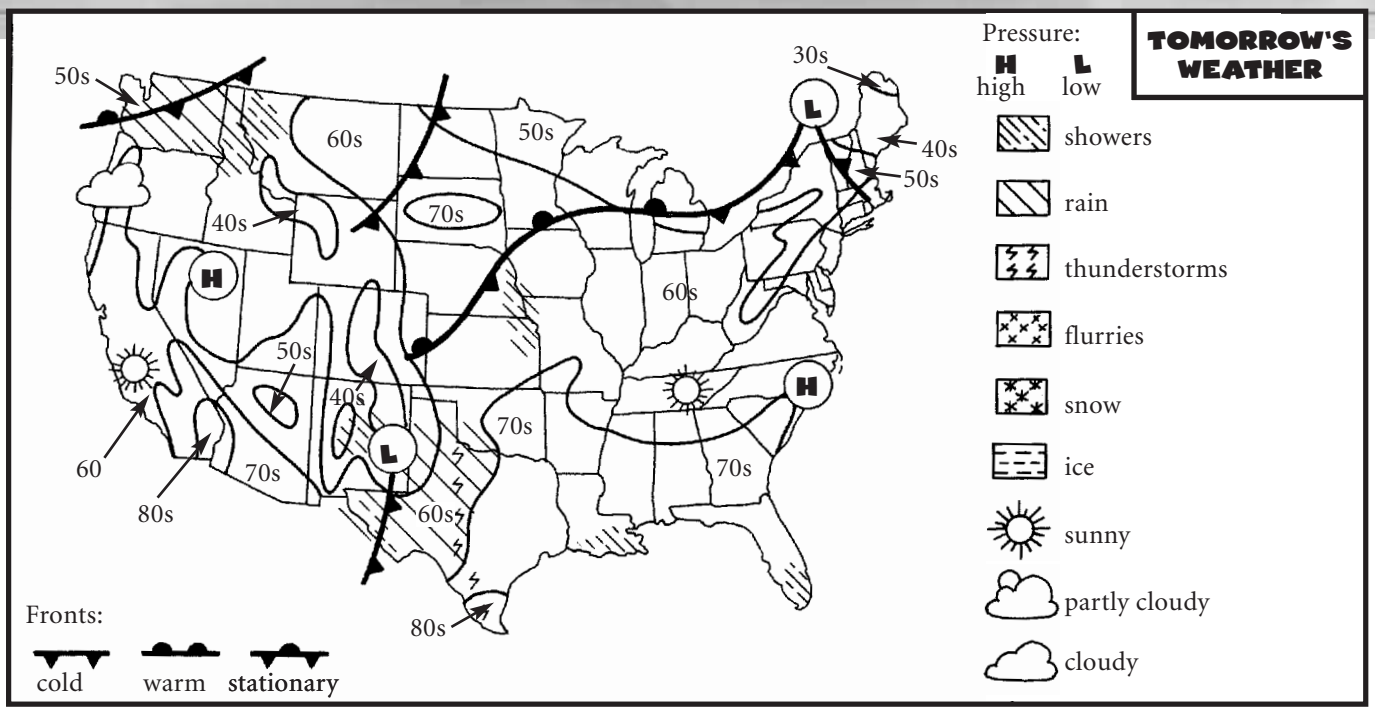
OBSERVE & EXPERIMENT

1 Look at the two weather maps below. What's the weather like today in your state? What will it be like tomorrow? Use the key to read the symbols.

2 What weather information is given on these maps?

_____





WHAT HAPPENED?

Read your predictions. Were you correct?_____

THINK & WRITE

Write a "morning news show"-style weather report for the nation using the two weather maps. Include both today and tomorrow's temperatures, front movements, and precipitation patterns for each region of the country, as well as highs and lows for cities within those regions.

_____

_____

_____

_____

_____

THINK HARDER!

What kind of weather does a high-pressure system bring to an area? _____

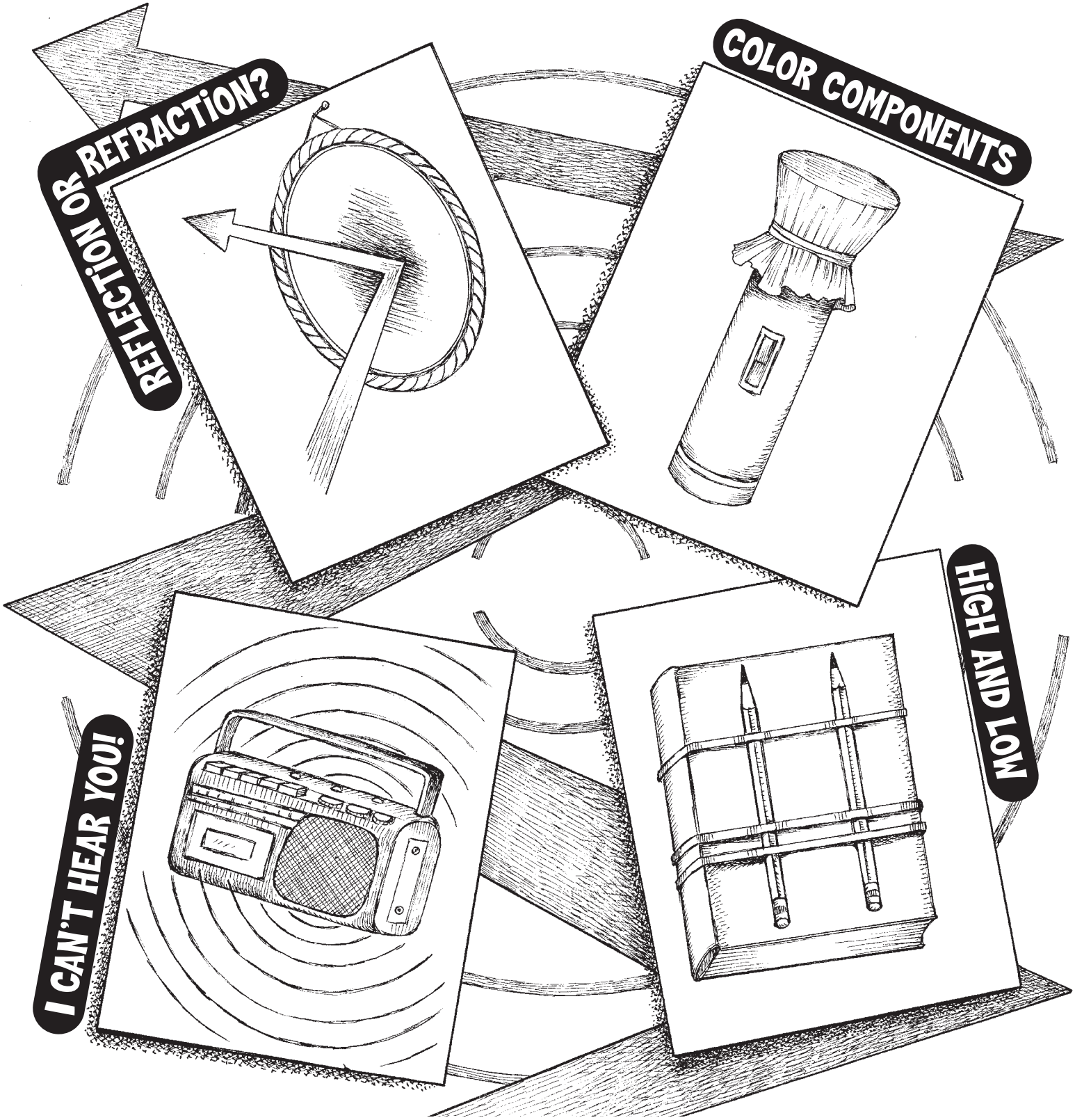
_____

_____

What kind of weather does a low-pressure system bring? _____

_____

LIGHT & SOUND



NAME _____

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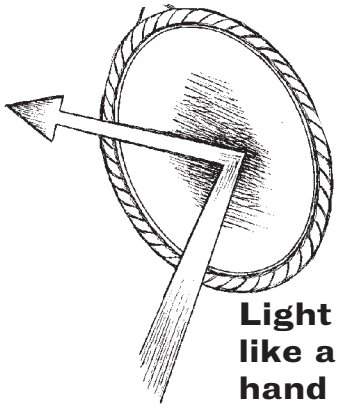


Reflection or Refraction?

Light travels in a straight line until it hits something. Some things, like a mirror, cause light to bounce or *reflect*. Other things, like a hand lens, cause light to *refract*, or bend and change direction.

THINK & PREDICT

? What are some everyday objects that reflect (bounce) light?

_____

? What are some everyday objects that refract (bend) light?

_____

OBSERVE & EXPERIMENT

1 Look at the chart on the next page. Do these things reflect or refract light? Circle your choices.

2 Complete squares G and H with your own ideas. (Hint: Use some from your predictions.)

WHAT HAPPENED?

Read the answers at the bottom of the next page. Then check your predictions. Were you correct? _____

THINK & WRITE

Compare reflection and refraction, defining each and using examples of tools, situations, and technologies that use either reflection or refraction.

_____

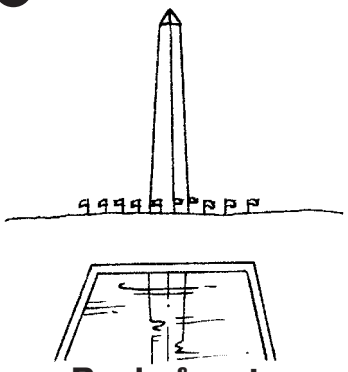
_____

_____

_____

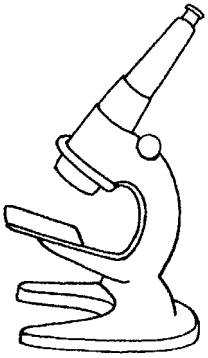
_____

A Reflect or Refract?



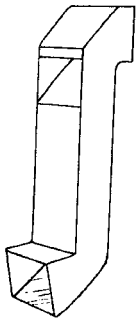
Pool of water

B Reflect or Refract?



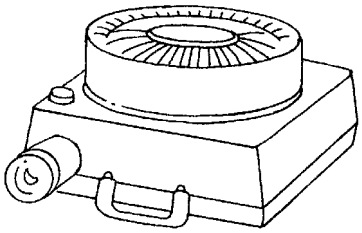
Microscope

C Reflect or Refract?



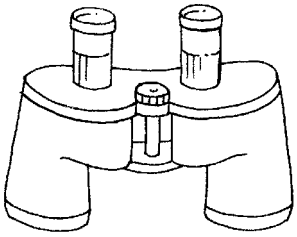
Periscope

D Reflect or Refract?



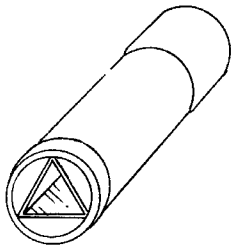
Slide projector

E Reflect or Refract?



Binoculars

F Reflect or Refract?



Kaleidoscope

G Reflect or Refract?

H Reflect or Refract?

THINK HARDER!

Reflection telescopes are used to view nearby space objects such as planets and the moon, while refraction telescopes are used to view stars and other faraway objects. Why?

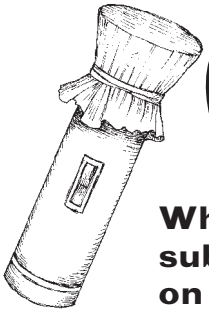
_____

_____

_____

Answers: Reflection: A, C, F Refraction: B, D, E

NAME _____



Color Components

What makes a blue painted wall look blue? The paint absorbs (or subtracts) all the other color wavelengths from white light shining on it and reflects only blue. Add a layer of yellow paint and you get green. That's because the yellow and blue pigments absorbed all the other color wavelengths of white light, leaving behind green. Combining pigment colors is called *subtractive color mixing.*

Mixing colored light is very different. When you combine two different colored lights, they add wavelengths of light to make colors. This is called *additive color mixing.*

THINK & PREDICT

? If you overlap beams of red and green light, what color do you see?

_____

? If you overlap beams of red, blue, and green light, what color do you see?

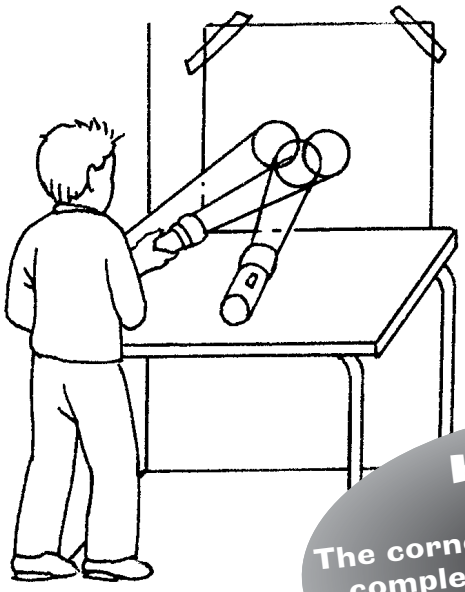
_____

YOU'LL NEED

- 3 flashlights
- tape
- rubber bands
- white paper
- red, blue, and green cellophane or color filters (colored food wrap or transparent plastic report covers work well)
- crayons

OBSERVE & EXPERIMENT

1 Find a dark corner of the classroom. Push a desk against the wall and tape a sheet of white paper above the desk, as shown.

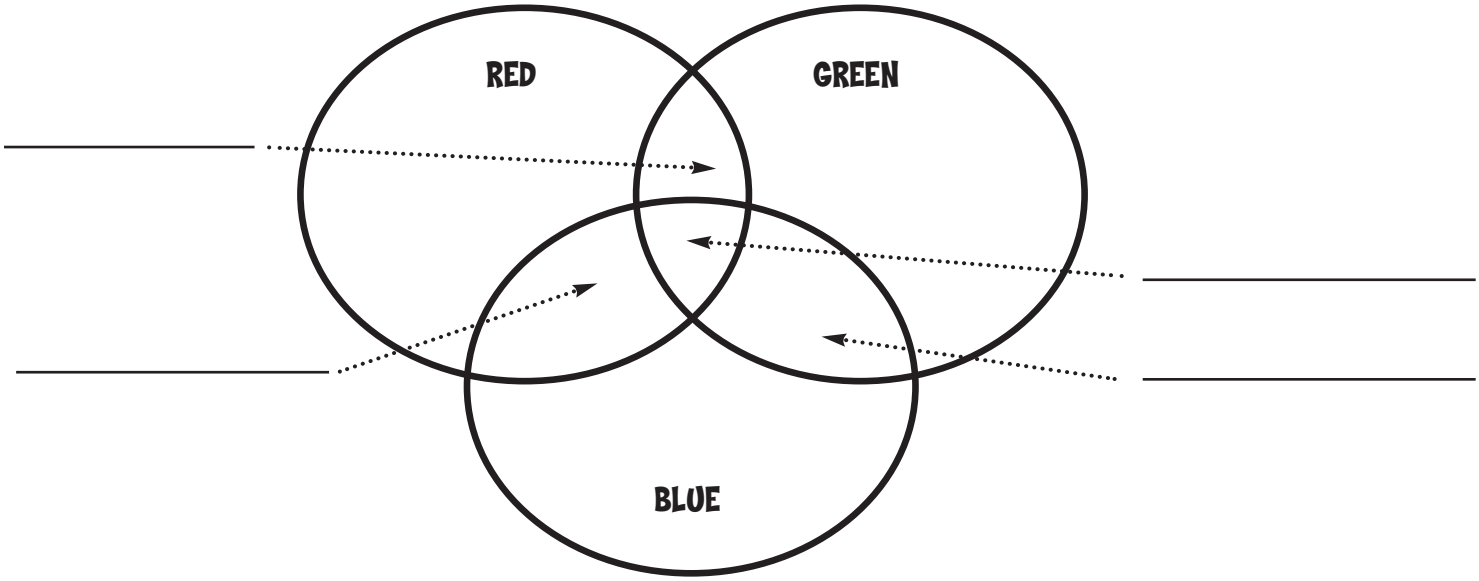


2 Cover each flashlight with different-colored cellophane. Hold the cellophane in place with a rubber band. Turn the flashlights on.

3 Set one flashlight on the desk so that the beam of light hits the paper. Hold the other two to make the beams overlap. Work close to the wall to get strong, clear beams of light.

4 On the next page use crayons to draw the colors you see. Label the colors.

HELPFUL HINT
The corner doesn't have to be completely dark to do this activity. Just dark enough for colors to show up clearly.



WHAT HAPPENED?

Check your predictions against your completed diagram. Were you correct?

_____

THINK & WRITE

How is mixing colored light different from mixing color pigments? Use the terms "additive color mixing" and "subtractive color mixing" in your explanation. Give specific examples of the results of additive color mixing based on your diagram.

_____

_____

_____

_____

_____

_____

THINK HARDER!

Mixing red, yellow, and blue paint makes black. How do you make black by mixing colors of light?

_____

_____

_____

_____

NAME _____

I Can't Hear You!

Sound is made when an object, such as a radio speaker, vibrates. This vibration makes the air, water, or walls around the object vibrate, too. These vibrations move away from the object in all directions.

THINK & PREDICT

? What is sound? _____

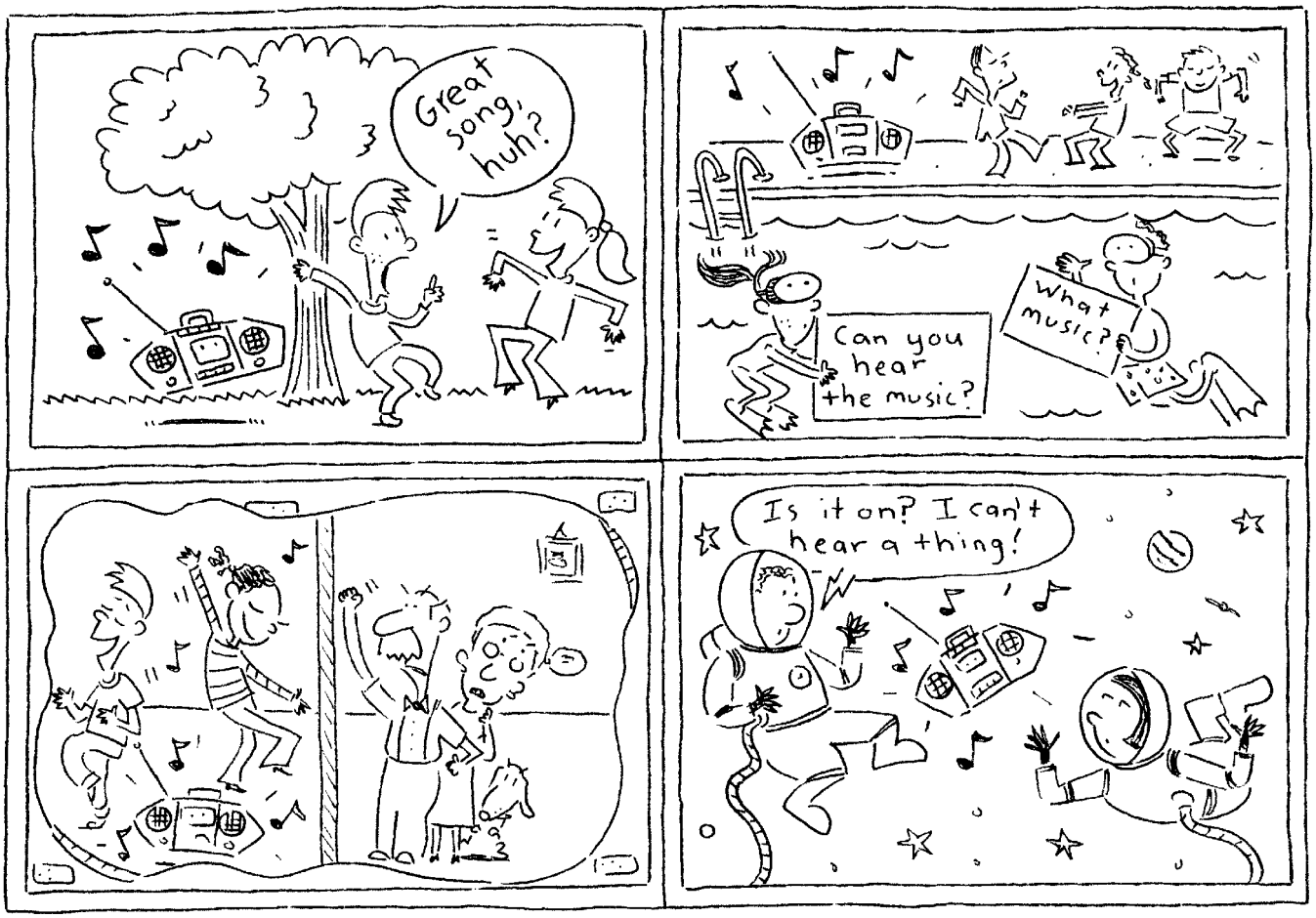
_____

? How—and in what form—does it travel or move? _____

_____

OBSERVE & EXPERIMENT

1 Look at the pictures below. Think about how sound works and moves in each.



2 Write a definition of sound:

_____

_____

_____

WHAT HAPPENED?

Read your predictions. Were you correct?

_____

THINK & WRITE

What is sound and how does it travel? Write an explanation of sound using someone listening to a drum as an example.

_____

_____

_____

_____

_____

_____

_____

THINK HARDER!

Lots of science-fiction movies have ships out in space exploding with loud booms and space weapons that make zapping sounds. Why is all this space noise wrong?

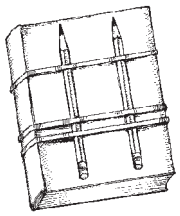
_____

_____

_____

_____

NAME _____



High and LOW

***Pitch* is how high or low a sound is. A sound's pitch is determined by its *frequency*, the number of waves per second the vibration creates.**

We make sound through the larynx in our throat. Two small folds of tissue, called vocal cords, stretch across the larynx and vibrate as air passes between them. The tighter the vocal cords are stretched, the faster they vibrate, and the higher-pitched the sound is.

THINK & PREDICT

? Imagine a taut rubber band and a loose rubber band. Which do you think would create a higher-pitched sound? _____

Why? _____

_____

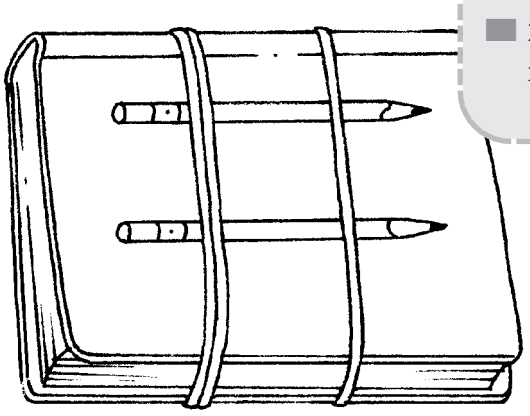
_____

YOU'LL NEED

- small hardcover book or CD case
- 2 pencils
- 2 identical large rubber bands

OBSERVE & EXPERIMENT

1 Wrap a rubber band once around a book. Wrap the other around the book twice. Slide two pencils underneath them, as shown.



2 Strum each rubber band in between the pencils. Which has a higher pitch—the once- or twice-wrapped rubber band?

WHAT HAPPENED?

Which had a higher pitch—the once- or twice-wrapped rubber band?_____

_____

Read your predictions. Were you correct?

_____

THINK & WRITE

What is pitch and how is it related to frequency? How does a singer change the pitch of his or her voice? _____

_____

_____

_____

_____

_____

_____

_____

THINK HARDER!

What do you think happens to the sound-making vocal cords of a young man when his voice "changes" and deepens?

_____

_____

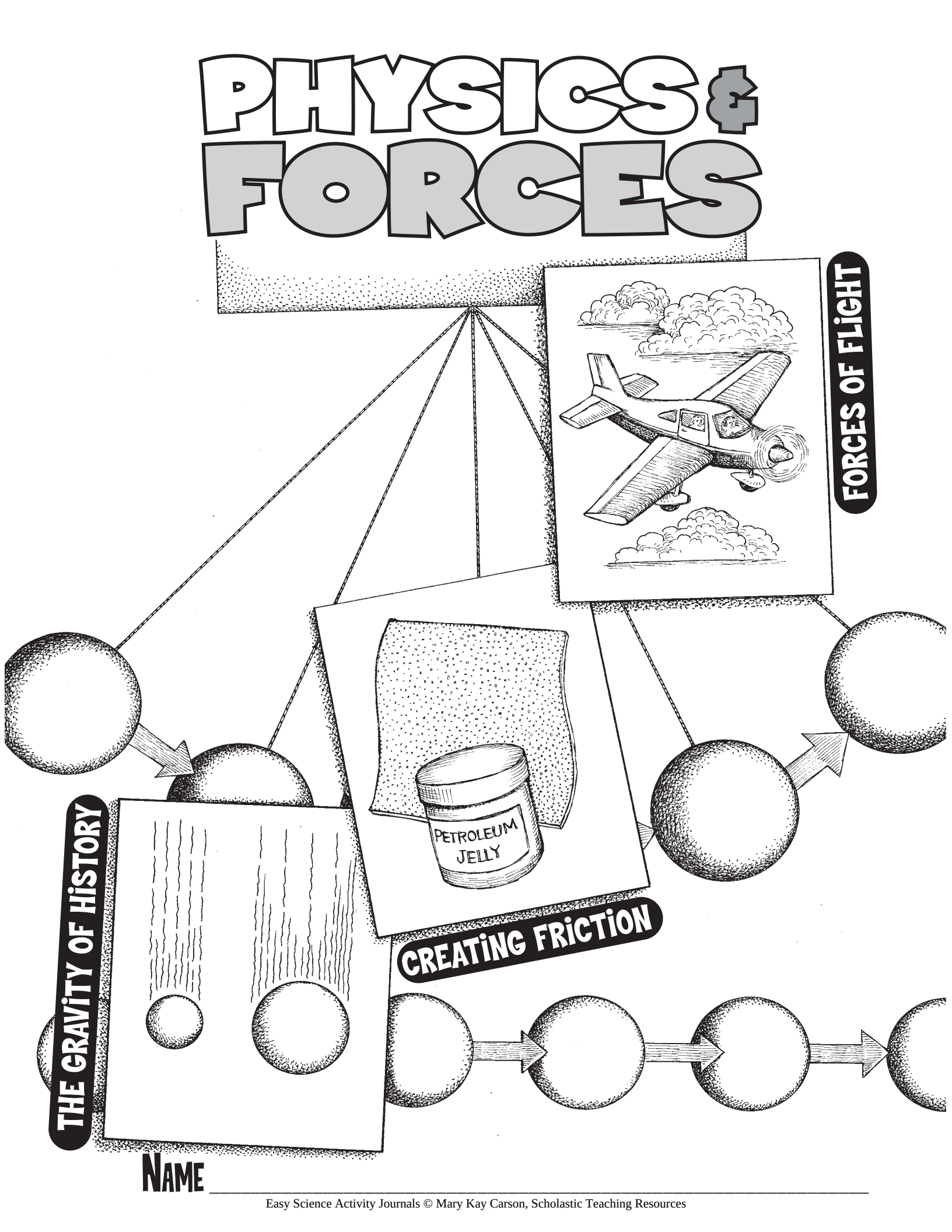
_____

_____

_____

_____

PHYSICS & FORCES



NAME _____

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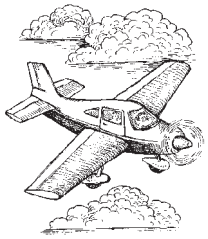


Forces of Flight

***Lift*, *drag*, *gravity*, and *thrust*—these four forces work together to keep a heavy plane up in the air. Find out how each force works and how it helps keep a plane in flight.**

THINK & PREDICT

? How does lift affect flight? _____

? How does gravity affect flight? _____

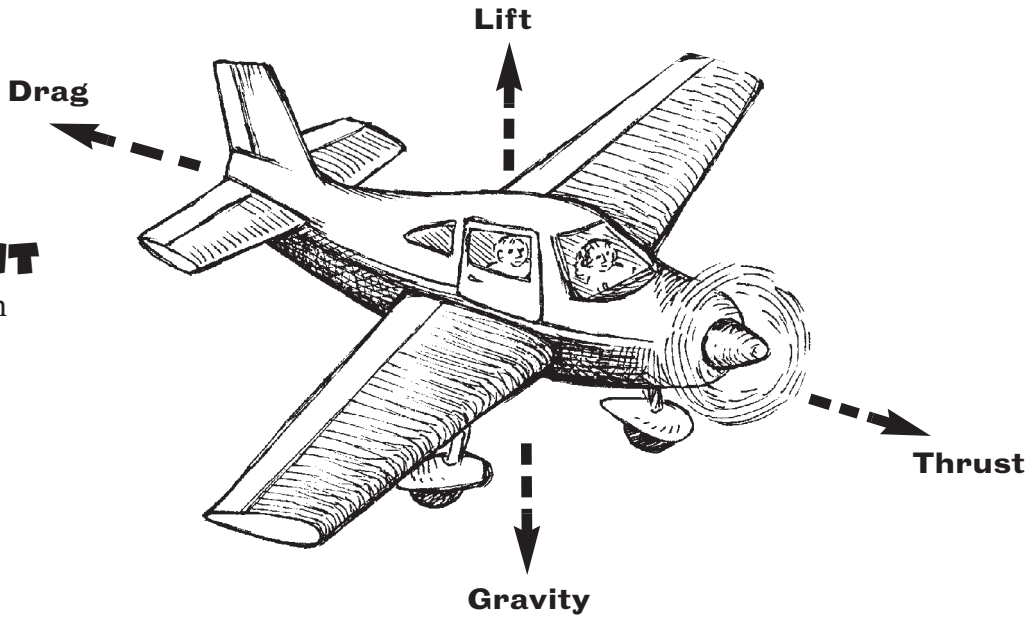
? How does drag affect flight? _____

? How does thrust affect flight? _____

OBSERVE & EXPERIMENT

1 Read the diagram at right and the definitions below.

2 Think about the role each force plays in flight.



LIFT is the force created as air rushes over the top of the wings and pushes from below the wings, raising the plane skyward.

DRAG slows a plane down. It's caused by air friction on the plane.

GRAVITY pulls the plane's mass (like it does everything else) down toward Earth.

THRUST is the engine-powered force that pushes the plane forward through the air.

WHAT HAPPENED?

Read your predictions. Were they correct and complete? _____

_____

THINK & WRITE

How does an airplane balance the competing forces of thrust, drag, lift, and gravity in order to fly?

_____

_____

_____

_____

_____

_____

_____

_____

_____

THINK HARDER!

Why does an airplane stop flying and "stall out" when its upward angle is too steep?

_____

_____

_____

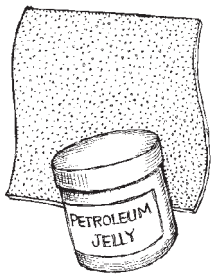
_____

_____

_____

_____

NAME _____



Creating Friction

When objects rub against each other, they create *friction*. Friction helps you grip and twist open jars, and walk without slipping. Friction also produces heat. When you rub your hands together to warm them, that's friction at work. *Lubricants*, such as grease or oil, reduce friction by coating moving parts and keeping them from directly touching.

THINK & PREDICT

?Anything rubbed against sandpaper creates friction and produces heat. How much hotter do you think a thermometer rubbed on sandpaper without lubricant would be compared to one with lubricant? _____°F

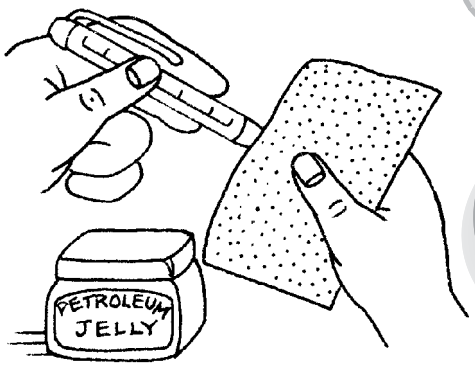
YOU'LL NEED

- two 4-inch squares of fine-grit sandpaper (or emery boards)
- aquarium thermometer
- petroleum jelly
- stopwatch or clock with a second hand

OBSERVE & EXPERIMENT

1 Write down the temperature on the aquarium thermometer. _____°F

2 Hold the thermometer like a pen and rub its bulb back and forth across a sandpaper square for 60 seconds.



3 Quickly read the thermometer and record its temperature. _____°F.

HELPFUL HINT
Make sure all the materials start at room temperature.

4 Cover the other square of sandpaper with a 1/4-inch-thick layer of petroleum jelly.

5 Make sure the thermometer has returned to room temperature. Record the temperature on the thermometer. _____°F

6 Repeat step 2 using the lubricated sandpaper square.

7 Quickly read the thermometer and record its temperature. _____°F

WHAT HAPPENED?

What was the temperature difference between step 1 and 3? _____°F

What was the temperature difference between step 5 and 7? _____°F

How close are these numbers to your prediction?_____

THINK & WRITE

Write your own definition of friction. Include when it happens, why it happens, and what can be done about it. Give real world examples of friction and lubrication.

_____

_____

_____

_____

_____

_____

_____

_____

THINK HARDER!

How do you think the temperature difference would change if water were used instead of petroleum?

_____

_____

_____

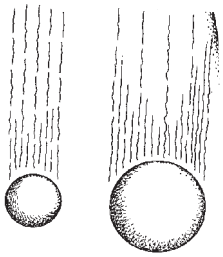
What if a coarser type of sandpaper was used?

_____

_____

_____

NAME _____



The Gravity of History

Gravity **is the force that holds the universe together. Gravity pulls objects toward each other, keeps the Earth orbiting around the sun, and keeps you on the ground. Two famous thinkers named Aristotle and Galileo conducted important experiments about how gravity acted on falling objects.**

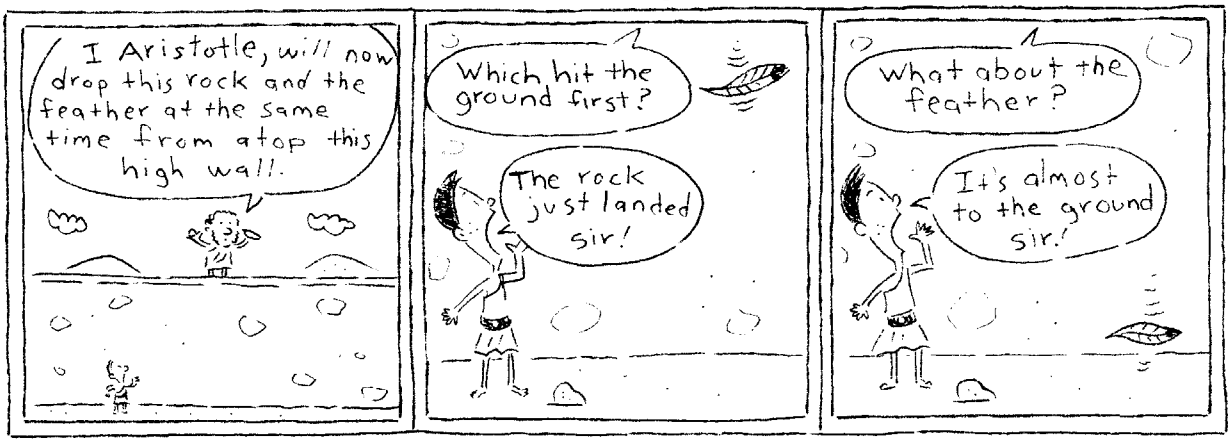
THINK & PREDICT

? Which one do you think got it right—Aristotle or Galileo? _____

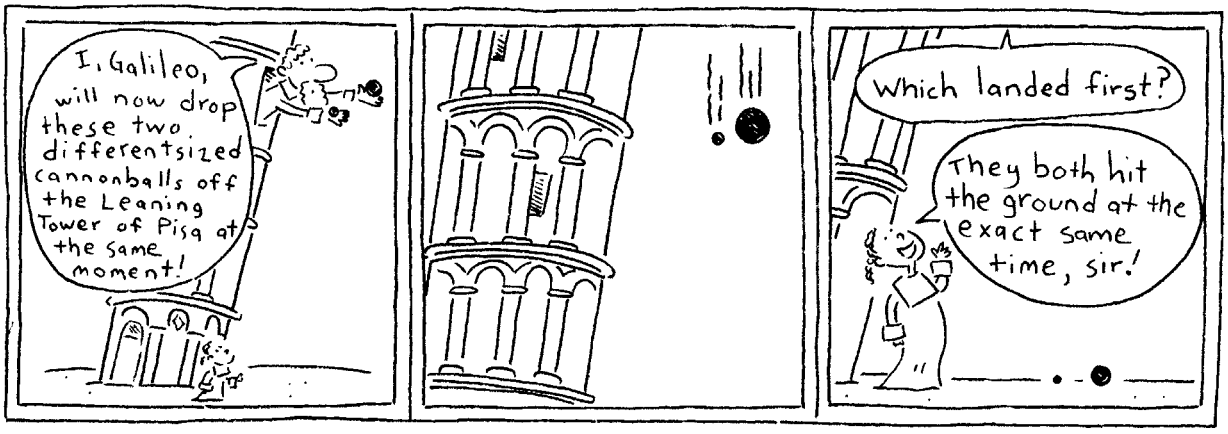
OBSERVE & EXPERIMENT

1 Read the two historical experiments.

Aristotle's Experiment



Galileo's Experiment



WHAT HAPPENED?

Check your prediction. Do you still agree with it? _____

Which scientist theorized that objects fall with the same acceleration (rate of change of velocity), unless some other force slows them down? _____

THINK & WRITE

Which experiment was correct in explaining how gravity acted on falling objects? Why? Why was the other experiment flawed?

_____

_____

_____

_____

_____

_____

_____

_____

THINK HARDER!

Would Galileo's experiment still work on the moon? How would it be different?

_____

_____

_____

_____

Would Aristotle's experiment have a different result on the moon? Why?

_____

_____

_____

_____