Name: _____

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Fifth Grade

Student Booklet
With Anchor Layer

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Ecosystems & The Food Web

5th Grade • NGSS • Unit Worksheets

Lesson 1

Why would a hawk move to New York City?

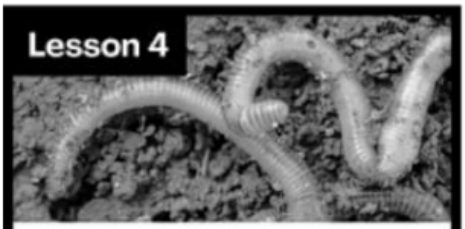
Lesson 2

What do plants eat?

Lesson 3

Where do fallen leaves go?

Lesson 4

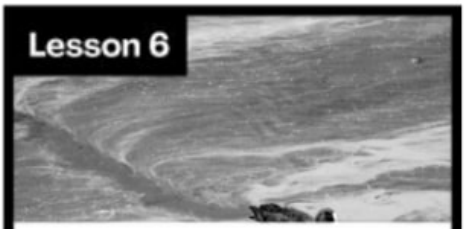


Do worms really eat dirt?

Lesson 5

Why do you have to clean a fish tank but not a pond?

Lesson 6



How can we protect Earth's environments?

Lesson 7

Why did the dinosaurs go extinct?

I am also curious about...

See-Think-Wonder Chart

Name: _____

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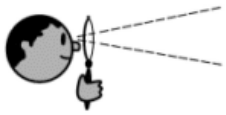
See	Think	Wonder
What did you observe? 	How can you explain what is happening? 	What questions do you have? 

Biosphere Bites

Name: _____

Challenge: You are moving into a dome that has enough water, heat and oxygen to support your crew. Your job is to make sure that there will be enough food for the crew to eat. You'll start with enough food for a few months and a pantry stocked with as much salt, sugar, and baking soda as you need. To survive in the dome, you need to create an ecosystem that provides all the other food you need.

Part 1: Think about what you'd like to eat on a typical day inside the dome. Write down a possible menu. As you decide your menu, keep in mind that you'll make your meals from plants and animals that live inside the dome with you.

Breakfast	Lunch	Dinner

Part 2:

Make a list of the ingredients you need to make the meals on your menu.

Part 3:

Organize your ingredients into ones you can grow and ones that come from animals (along with the animals that supply them). Then write down what you need to keep all the plants and animals healthy. (If you're not sure, don't worry. You'll come back to this.)

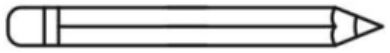
Ingredients

Grow	Comes from an Animal (include food and the animal it comes from)	What Do Those Organisms Need

Part 4:

Choose up to 20 organisms (living things) to put into the dome with you to make sure you have enough food for 2 years.

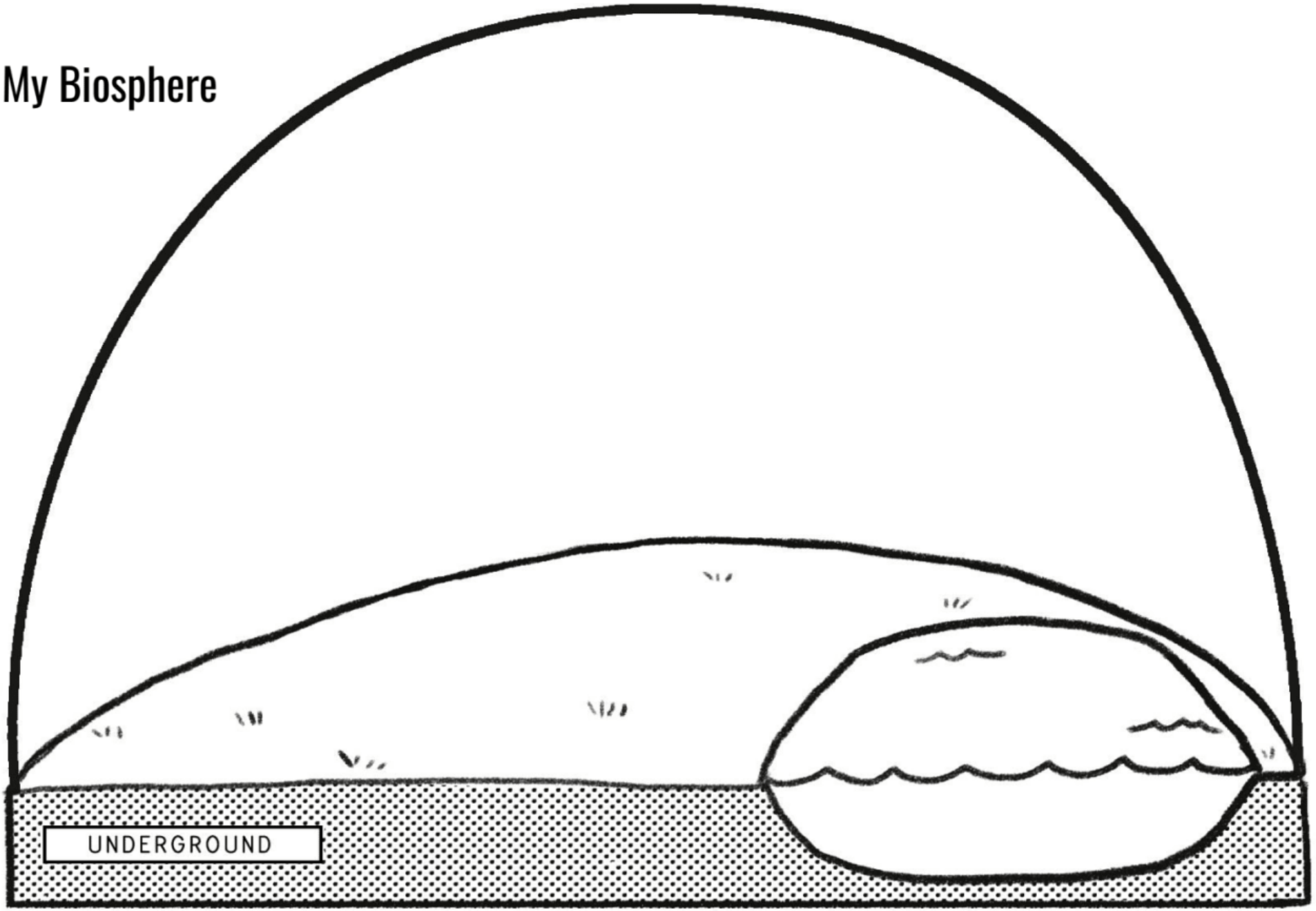
Use your menu ingredients to help you get started.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____

Part 5: Draw your organisms into the biosphere model below. Use labels and captions to help you explain your choices.

My Biosphere



Rules

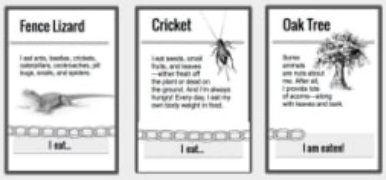
mystery science
Why would a hawk move to New York City?

THE GOALS OF THE GAME:

- Make as many food chains as you can.
- Make the chains as long as you can. (Longer chains get bonus points!)

HOW SCORING WORKS:

You'll get **1 point** for every card in a food chain:



*3 cards = **3 points***

If your chain is 4 cards or longer, you get an extra **2 bonus points**:

4 cards
+ 2 bonus points
= 6 points

HOW STEALING WORKS:

- You CAN'T steal on the first round.
- Starting in the second round, you can choose a card from the center stack **<u>or</u>** you can STEAL a card from another player *if* you can use that stolen card to make a chain right away.
- You CAN'T steal a card that is already in a player's food chain.

TIP: THINK CAREFULLY

Read the cards carefully. The Cricket card says crickets eat leaves. The Oak Tree has leaves. That means the cricket can eat the oak tree!

TIP: REARRANGE YOUR CHAINS

You can rearrange your food chains whenever you want. Take them apart and put them together in different ways. Can you figure out ways to get longer chains?

Score Card

Name: _____

1. WRITE DOWN YOUR LONGEST CHAIN:

_____ eats _____ eats _____ eats

_____ eats _____ eats _____. Yum!

2. ADD UP YOUR SCORE! Use the back if you run out of room:

Chain 1:
Write down how many cards are in the chain: _____
If there are 4 or more, add 2 bonus points: _____

Chain 2:
Write down how many cards are in the chain: _____
If there are 4 or more, add 2 bonus points: _____

Chain 3:
Write down how many cards are in the chain: _____
If there are 4 or more, add 2 bonus points: _____

Chain 4:
Write down how many cards are in the chain: _____
If there are 4 or more, add 2 bonus points: _____

Chain 5:
Write down how many cards are in the chain: _____
If there are 4 or more, add 2 bonus points: _____

TOTAL points = _____ points

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Why would a hawk move to New York City?

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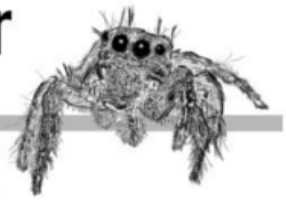
Why would a hawk move to New York City?

EAT OR BE EATEN

a food chain game

Jumping Spider



I pounce on insects that spend time on the ground. I eat crickets, ants, cockroaches, caterpillars, and even daddy long legs.

I eat...

mystery science

Fence Lizard

I eat ants, beetles, crickets, caterpillars, cockroaches, pill bugs, snails, and spiders.

I eat...

mystery science

Dead Leaves

I may not look tasty, but I'm just what some animals want for lunch.

I am eaten!

mystery science

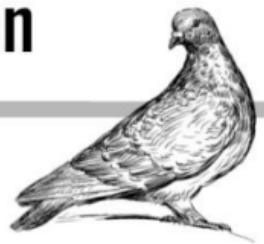
Mouse

Cartoon mice eat cheese. Real mice like me eat human food—when we can find it. I'll also eat seeds and nuts (like acorns), or snack on vegetables like zucchini or tomatoes. And sometimes I eat crickets and beetles.

I eat...

mystery science

Pigeon



You can feed me popcorn, bread crumbs, and peanuts. But when no one gives me human food, I eat seeds and berries—plus snails, earthworms, and crickets.

I eat...

mystery science

Web-spinning Spider

I eat flying insects. House flies, butterflies, and even honeybees can get caught in my web. Dinner is served.

I eat...

mystery science

Crow

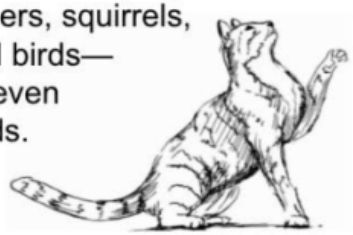
I eat almost anything: acorns, fruits, seeds, and human food. I like beetles, crickets, and cockroaches. I hunt for animals like frogs, moles, mice, and lizards. I'll even steal eggs from the nests of robins, sparrows, and pigeons.

I eat...

mystery science

House Cat

Yes, I eat cat food. But I like to hunt, too. I prey on mice, gophers, squirrels, small birds—and even lizards.



I eat...

Mystery science

Swallowtail Butterfly

I drink nectar from flowers—and I'm not picky about what flowers. I'm happy in a flower garden, vegetable garden, or a clover patch. Even a parsley plant is fine with me.

I eat...

Mystery science

Sparrow

I eat seeds, grains, grass, and berries. I'll also eat bread crumbs if they're around. And sometimes I'll snack on ants.

I eat...

Mystery science

Clover

I have leaves, flowers, and small seeds. They're a great snack if you like that sort of thing.

I am eaten!

Mystery science

Opossum

I eat all kinds of things. I catch frogs, moles, snakes, mice, and salamanders. I snack on beetles, cockroaches, earthworms, crickets, and snails. I'm also happy to eat vegetables, seeds, even human food!

I eat...

Mystery science

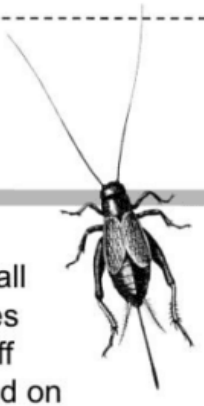
Snail

I eat soft green plant leaves—lettuce, parsley, flower leaves, clover, and even grass. Oak leaves are too tough for me, but if I'm hungry I'll nibble on dead leaves.

I eat...

Mystery science

Cricket



I eat seeds, small fruits, and leaves —either fresh off the plant or dead on the ground. And I'm always hungry! Every day, I eat my own body weight in food.

I eat...

Mystery science

Lunch Leftovers

I'm the lunch some kid didn't finish—half a peanut-butter sandwich and an apple with a bite out of it. That's OK—I'm the perfect treat for some hungry animal.

I am eaten!

Mystery science

Robin

I hop around searching for worms, caterpillars, snails, beetles, crickets, ants, spiders, and even daddy long legs. I'll also eat fruits and berries off bushes and trees.

I eat...

Mystery science

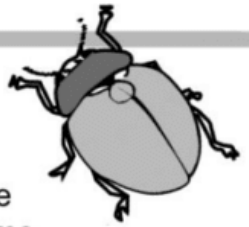
Caterpillar of a Moth

I chow down on rotting wood and dead leaves. That's why you can usually find me hiding under a rotting log.

I eat...

Mystery science

Beetle



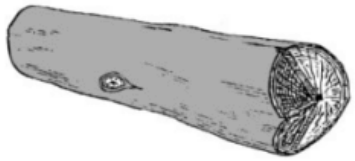
I eat caterpillars. In fact, some people call me the caterpillar hunter. I'll also eat earthworms and snails.

I eat...

Mystery science

Rotting Log

I'm where hungry animals can find rotting wood, bark, and dead leaves. I'm tasty eating for the right critter!

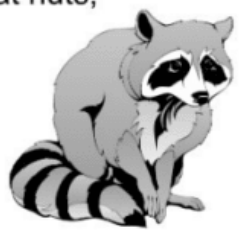


I am eaten!

Mystery science

Raccoon

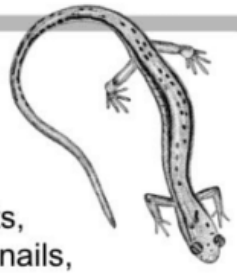
I sometimes raid trash cans for food you threw away. In the wild I eat nuts, fruit, beetles, worms, frogs, salamanders, mice, moles, and snakes.



I eat...

Mystery science

Salamander



I eat nice crunchy beetles, ants, crickets, along with snails, spiders, ants, and pillbugs. Want to join me for lunch?

I eat...

Mystery science

Frog

I eat insects with my long sticky tongue—beetles, cockroaches, crickets, houseflies, butterflies, and even bees. I'll also snack on earthworms, snails, and pillbugs. Yum!

I eat...

Mystery science

Parsley Plant

I'm where animals can find leaves, flowers, and small seeds. In fact, I'm one of the *only* plants that swallowtail caterpillars eat! Bragging rights.

I am eaten!

Mystery science

Hawk

I swoop down to grab small animals with my sharp claws. I eat gophers, mice, pigeons, robins, sparrows, even lizards and snakes!

I eat...

Mystery science

Daddy Longlegs

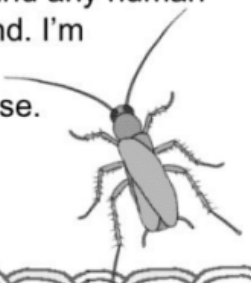
I eat insects of all kinds—along with worms, snails, and pill bugs. I'm not a spider, but I eat spiders when I catch them.

I eat...

Mystery science

Cockroach

I eat many things, including bark, paper, leaves (living and dead), and any human food I can find. I'm particularly fond of cheese.



I eat...

Mystery science

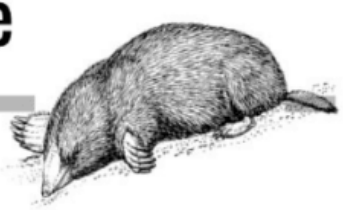
Oak Tree

Some animals are nuts about me. After all, I provide lots of acorns—along with leaves and bark.

I am eaten!

Mystery science

Mole



I chow down underground (and under logs). I'll eat beetles, earthworms, pill bugs, and crickets. I stay hidden in my tunnel, safe from hawks and housecats!

I eat...

Mystery science

Ant

I'm happy to eat human food (like peanut butter), but when that's not around, I'll eat nectar from flowers, seeds from grasses, and any dead insects I find lying around.

I eat...

Mystery science

Gopher

I tunnel underground and gnaw the roots of plants—any plants! Sometimes I leave my hole to snack on leaves—keeping an eye out for animals that want to snack on me!

I eat...

Mystery science

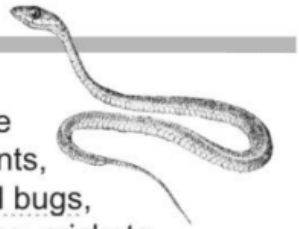
Flower Garden

Come and get it! I have lots of flowers with sweet nectar, plus lots of leaves and seeds.

I am eaten!

Mystery science

Garter Snake



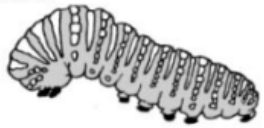
I hunt in the grass for ants, beetles, pill bugs, cockroaches, crickets, earthworms, and spiders. I also eat mice, frogs, salamanders, & lizards. Don't be scared of me...unless you're on my list of snacks.

I eat...

Mystery science

Swallowtail Caterpillar

Like many caterpillars, I'm a picky eater. I only eat carrot leaves and parsley plants from vegetable gardens.



I eat...

Mystery science

Gray Squirrel

I eat nuts, like acorns from the oak tree. But that's not all! I eat seeds, fruit, birds' eggs, even lunch leftovers! Peanut butter sandwich? Yes please!

I eat...

Mystery science

Grass

I have lots of leaves and lots of seeds. That's lunch for lots of critters.

I am eaten!

Mystery science

Earthworm

I eat bits of plants—like dead leaves or rotting wood. Anywhere that leaves are falling, I can find something for lunch.

I eat...

Mystery science

Honeybee

I eat pollen and nectar from flowers. I'm happy anywhere flowers bloom—a flower garden, a vegetable garden, a parsley plant, or a patch of clover.

I eat...

Mystery science

Pill bug

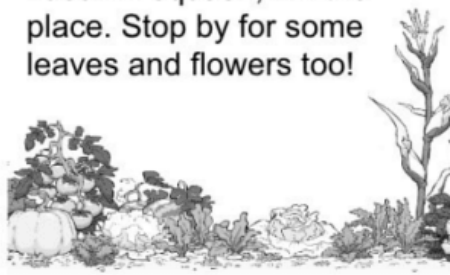
I eat dead leaves, rotting wood, and the fungi that grow on them. Look for me under logs. Poke me, and I roll in a ball—that's why some people call me a roly poly.

I eat...

Mystery science

Veggie Garden

If you're looking for lettuce, tomatoes, cucumbers, and zucchini squash, I'm the place. Stop by for some leaves and flowers too!



I am eaten!

Mystery science

Name: _____

Date: _____

Lesson Assessment

Mateo has a garden. He loves growing all sorts of plants in it that he can eat. Lettuce is one of his favorite things to eat from his garden.

1. In the space below, draw an arrow connecting the lettuce and Mateo to make a food chain. The arrows in food chains point **from** the food **to** the thing eating the food, so the arrow should point **from** the lettuce **to** Mateo.

Lettuce

Mateo

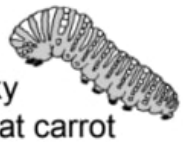
Recently, Mateo decided to start growing parsley in his garden. A few weeks after the parsley started to grow, Mateo looked out his window. There were more birds in his garden than he had ever seen before! He went outside to see why so many birds had flown in.

Mateo saw something else surprising: his parsley plants were covered in caterpillars! And sadly, almost all of the parsley had been eaten. Mateo wanted to figure out what was going on, so he read a book on gardening. He learned that the birds are **robins**, and the caterpillars are **swallowtail caterpillars.** Here is what he read in his book:

Robin

Robins eat worms, caterpillars, snails, beetles, crickets, ants, spiders, and even daddy long legs. They also eat fruits and berries off bushes and trees.

Swallowtail Caterpillar



Swallowtail caterpillars are picky eaters. They only eat carrot leaves and parsley leaves from vegetable gardens.

2. Use what you read from Mateo's book to make a food chain that includes **caterpillars**, **parsley**, and **birds**. To do this, write the names of each living thing in the correct order in each box. Then connect the boxes with arrows. Remember, arrows go **from** the food **to** the thing eating the food.

3. Why did so many robins come to Mateo's garden when he planted parsley? The food chain you made and the information you read might help you explain why this happened.

_____

_____

_____

4. If Mateo wants to get rid of the swallowtail caterpillars in his garden, what should he do? Circle **True** or **False** for each sentence.

True False Mateo should pull out the parsley plants and plant carrots instead.

True False Mateo should get a cat to scare the robins away.

True False Mateo should pull out the parsley plants and plant a bush that grows berries.

Before Mateo could do anything more to change his garden, he found a new problem. Something was digging tunnels under all of the plants! He went back to his gardening book, and he found this about an animal that digs tunnels:

Gopher

Gophers tunnel underground and gnaw the roots of plants—<u>any</u> plants! Sometimes they leave their hole to snack on leaves, too. But gophers have to watch out for hawks and cats.

The garden now has **gophers, swallowtail caterpillars, parsley, and robins**. There are no other animals, but there are many plants.

5. In the space below, draw a new food chain that includes **gophers**. Your food chain must include gophers, but it might not include all of the other living things mentioned in Mateo's gardening book. Write the name of each living thing that you think belongs in the food chain. Then draw a box around each name, and connect the boxes with arrows. Be sure the arrows point in the correct direction!

6. Mateo wants parsley. Will the gophers help him have more parsley? Why or why not? Look back to the food chains you've made to help answer this question.

_____

_____

_____

7. Mateo wants to get rid of the swallowtail caterpillars. Will the gophers help him get rid of the swallowtail caterpillars? Why or why not? Look back to the food chains you've made to help answer this question.

_____

_____

_____

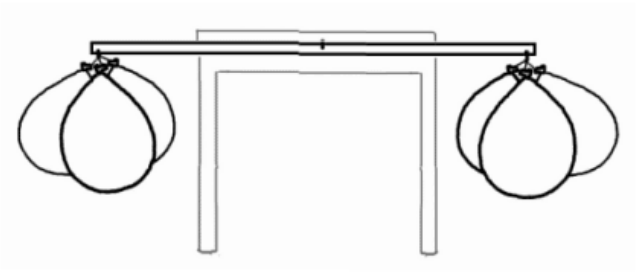
Weighing Air

Name: _____

mystery science

What do plants eat?

Right now, your set-up looks something like this. But soon your teacher will let out all the air from one side. What will happen? Answer the questions below, then find out!



1. Add arrows to the picture below to show how you think the scale will move if air DOES weigh something. Why do you think that?

_____

_____

_____

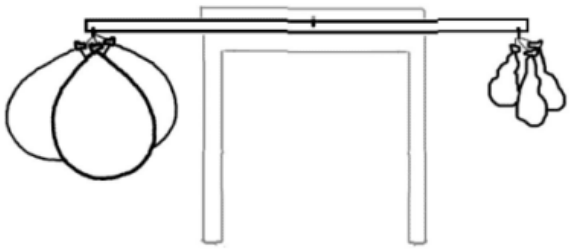
2. Add arrows to the picture below to show how you think the scale will move if air DOESN'T weigh anything. Why do you think that?

_____

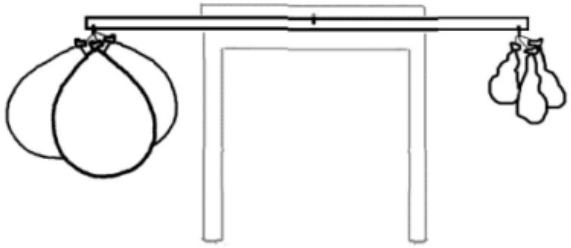
_____

_____

1



2



3. Which drawing did the experiment look like in the end? (Drawing 1 or drawing 2?) What does that mean about air?

_____

_____

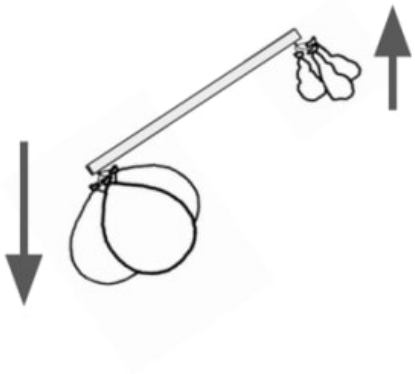
_____

Name: _____

Date: _____

Lesson Assessment

1. You learned that even giant trees get their weight mostly from the air. Your friend Zane doesn't believe you. He says "Air doesn't even weigh anything. How could a giant tree grow from air?!?"



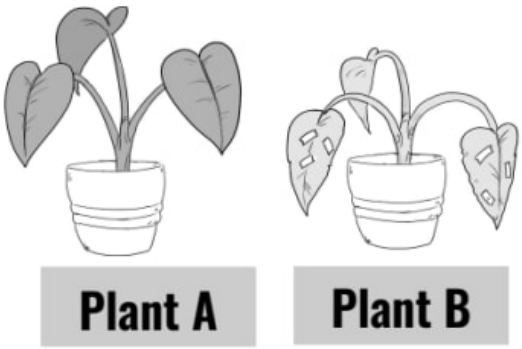
You set up a balloon experiment to show Zane that balloons filled with air pull a balance scale down when compared to balloons that do not have air in them. How does this experiment support your argument that plants grow using air? Circle **True** or **False** for each sentence.

True False The experiment shows that air has weight. This shows that air can contribute to the weight of a tree.

True False The experiment shows that air is needed for a plant to be healthy. This shows that air is needed for a plant to survive.

True False The experiment shows the process of how air can get into a plant. This shows that air can contribute to the weight of a tree.

2. You set up another experiment to help convince Zane. Plant leaves are covered in tiny holes that take in air. You start with two plants, Plant A and Plant B. You don't do anything to Plant A. But for Plant B, you cover most of the tiny holes with tape. The image to the right shows what happened to Plant A and Plant B after a few days.



How does this experiment support the argument that plants grow using air? Circle **True** or **False** for each sentence.

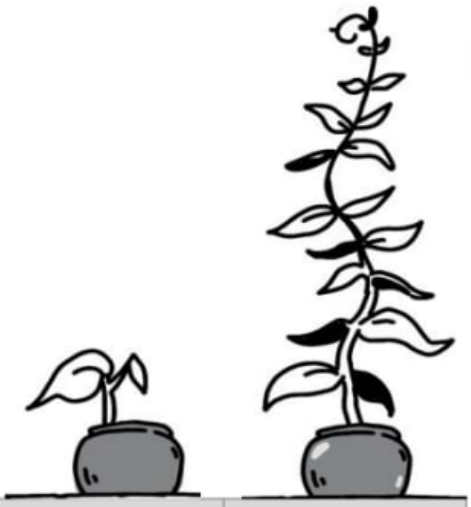
True False The experiment shows that air has weight. This shows that air can contribute to the weight of a tree.

True False The experiment shows that air is very important for the plant to be healthy. This shows that air is needed for a plant to survive.

True False The experiment shows the process of how air can get into a plant. This shows that air can contribute to the weight of a tree.

3. Zane is still not convinced. You show him one final experiment. In this experiment, you want to create a closed system that is easy to measure. So, you take one plant from outside and place it into a pot with soil.

You record how much the plant weighs and how much the soil weighs. You also add water to the soil. You let the plant grow for a few weeks. Then, you record how much the plant weighs and how much the soil weighs.



	WEEK 1	WEEK 3
PLANT	200 grams	800 grams
SOIL	500 grams	500 grams

The results of your experiment are shown to the right. What did you find out with your experiment?

Circle **True** or **False** for each sentence.

True	False	The plant weighed the same at the start and end of the experiment.
True	False	The plant weighed more at the end of the experiment.
True	False	The soil weighed the same at the start and end of the experiment.
True	False	The soil weighed less at the end of the experiment.

4. What evidence do you have to support your claim that plants mostly use materials from the air for their growth? Write an argument using evidence from any of the three experiments you showed to Zane to support your claim.

MOLD Your Plan & Prediction

Name: _____

Date: _____

1. **Discuss with your team:**
   How do you want to make your team's Mold Terrarium different from the Basic Terrarium?
   Write down at least 4 different conditions you want to test, and circle your team's two favorite ideas.

1	3
2	4

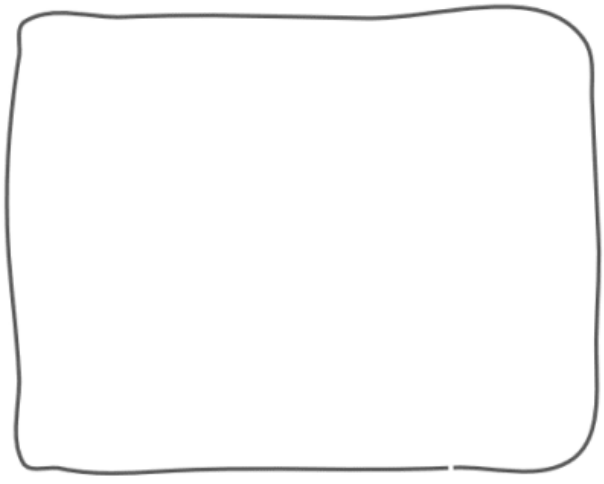
2. **After the group discussion, what's your team's plan?**

_____

_____

3. **What's your team name?** _____

4. **Draw your set up (the bag, plate, & food)**



What our set-up looked like on (date) _____

5. Do you think mold in your terrarium will grow faster or slower than mold in the basic terrarium? Why do you think that?

_____

_____

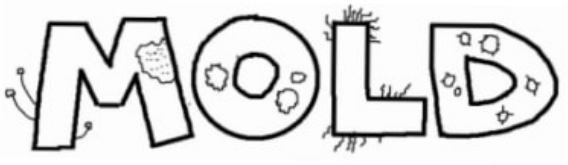
_____

_____

_____

_____

_____



Growth & Observations

Name: _____

Date started: _____

Example: Color in the bottom three circles when mold covers ½ the food

More than ½	○
½ moldy	●
¼ moldy	●
First mold	●

TEAM: _____

CONDITION: _____

Mark the days when you check for mold ➡		1	2	3	4	5	6	7	8	9	10	11	12	Describe or draw the mold (shape, color...)
Food 1: _____	More than½ ½ moldy ¼ moldy First mold No mold	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	
Food 2: _____	More than½ ½ moldy ¼ moldy First mold No mold	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	
Food 3: _____	More than½ ½ moldy ¼ moldy First mold No mold	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	
Food 4: _____	More than½ ½ moldy ¼ moldy First mold No mold	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	
Food 5: _____	More than½ ½ moldy ¼ moldy First mold No mold	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	○ ○ ○ ○ –	

Name: _____

Date: _____

Lesson Assessment

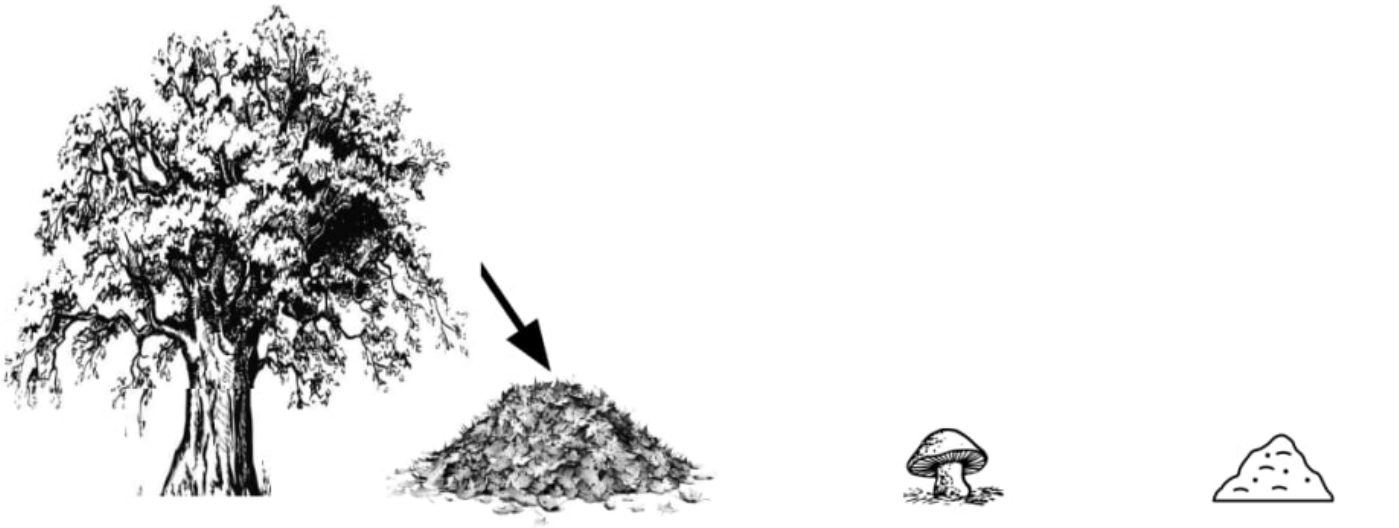
1. Fallen, dead leaves are broken down into soil nutrients with the help of decomposers, such as mushrooms and mold. The image above shows some of the organisms that you would find in a forest. Create a model with arrows to show how the material (matter) travels through this system over time. For example, the leaves of oak trees will eventually fall to the ground. So you would draw an arrow from the oak tree to the pile of dead leaves. This arrow is already drawn for you. Now you draw the other arrows.

2. Add to your model by labeling each part of the system with one of the following words. You may not use all the words. You may also use the same word multiple times.

Plant **Animal** **Decomposer** **Environment**

3. If you labeled the **arrows** in the model, what word best describes what they represent?

a. Plants
b. Animals
c. Decomposers
d. Environment
e. Matter



Use the model that you developed on page 1 to help you answer the following questions. The original images are shown above as a reminder.

4. We keep food in the refrigerator because it prevents our food from rotting. Decomposers, like mold, are still in the system, the cold temperature just means that they decompose material (matter) more slowly. If the forest system shown above is located in a climate that has very cold winters and warmer summers, what do you predict will happen? Choose all correct answers.

a. The dead leaves in the forest will decompose more quickly in the winter with cooler temperatures.
b. The dead leaves in the forest will decompose more slowly in the winter with cooler temperatures.
c. The dead leaves in the forest will decompose more quickly in the summer with warmer temperatures.
d. The dead leaves in the forest will decompose more slowly in the summer with the warmer temperatures.

5. Look back at your model. If there were suddenly no decomposers—no mushrooms, no mold, no fungus—what do you think would happen to the forest system? Support your thinking with reasoning using the model.

Name:_____

Worm Watcher Worksheet

1) Observe your worm and draw it here. It has no legs, yet it moves around. How does it manage that? If you like, draw a cartoon strip showing how your worm changes as it moves around. If you need more space, use the back of the paper.

Tips for a good observation

- Don't disturb the worm after putting it on the plate. You want to see what it does all on its own.
- Be patient. It can take a while for it to start moving.
- While waiting for your worm to move, check out what other people's worms are doing.

2) Watch your worm for a few minutes and write down what it does. (After a few minutes, most worms stop exploring and settle down where they are most comfortable.)

_____

_____

_____

3) Look at all the worms in your group. What do you notice about the places the worm chose to settle? Are those places wet or dry, dark or bright, in the open or under cover?

_____

_____

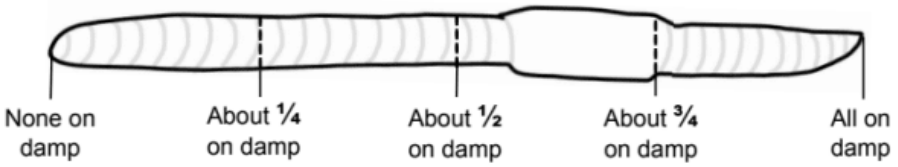
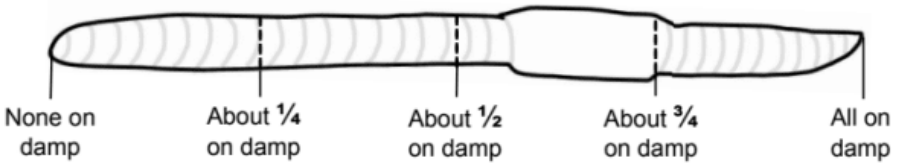
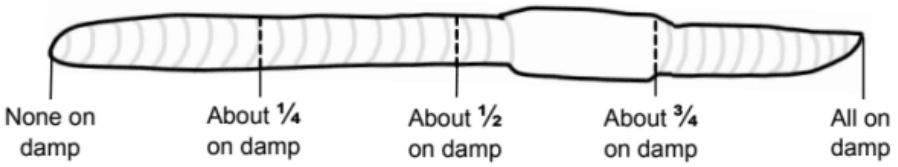
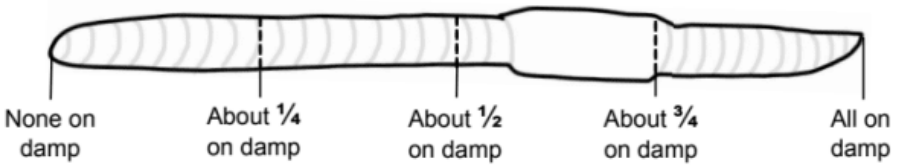
_____

_____

Name:_____

Ask a Worm Worksheet

Experiment to test the conclusion that worms like damp places. Note what happens below:

	Names	**Results.** Shade in how much of the worm is on the damp side.
1)	My name:	
2)	Partner's name:	
3)	Partner's name:	
4)	Partner's name:	

5) What might affect a worm's behavior (like light vs. dark)?

_____

_____

_____

6) Think of some questions you have about what worms like (or what they dislike):

_____

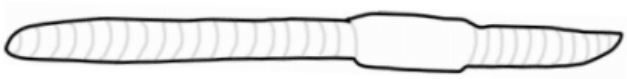
_____

_____

_____

Name:_____

Ask a Worm Worksheet, continued



7) Write the question you've decided to explore: _____

8) Describe or draw a picture of an experiment that you could do to find out the answer to your question. (Use the back if you need more space.)

9) What can you do to make sure your experiment is a fair test?

_____

_____

_____

_____

Name: _____

Date: _____

Lesson Assessment

1. When earthworms eat leaves, the leaves break down into worm poop inside the earthworm's body. Worm poop is called **castings**. Add two arrows to the drawings below: one showing the dead leaves going into the earthworm, and one showing the castings moving out onto the ground.

Dead Leaves

Earthworm

Castings

2. Reena was curious about how to make plants grow taller, so she set up an experiment. She filled one pot just with regular soil and planted a seed into the soil. Then she mixed soil and worm castings in another pot and planted the exact same kind of seed in that pot. After a few months of giving each plant the exact same amounts of water and light, they looked like this:

Just soil

Soil with worm castings

Circle **True** or **False** for each option.

True	False	Reena's plants can't grow at all in just soil.
True	False	The plant grown in soil with worm castings grew taller.
True	False	From this experiment, we know that **every** plant will **always** grow better in soil with worm castings.
True	False	From this experiment, we know that this one plant grown in soil with worm castings grew taller. But we would need to do more experiments if we wanted to know if this happens with other plants, too.

3. In school, Reena learned that when worms eat dead leaves and produce castings, the castings are full of nutrients that plants can use. The nutrients in the castings come from nutrients in the original dead leaves. This might explain why the plant she grew in soil with worm castings was so tall.

   Reena also learned that plants get some nutrients through their *leaves*, and they get other nutrients through their *roots*.

   Knowing what you know about earthworms, do you think that the nutrients from castings go into a plant's leaves or its roots? In the drawings below, add arrows to show the flow of nutrients, starting with the **dead** leaves. With the final arrow, show the nutrients either going to the plant's leaves or its roots. Remember, to answer this question, you'll need to apply what you have learned about earthworms.

Dead Leaves

Earthworm

Castings

4. In the previous question, you drew arrows to show the flow of nutrients from dead leaves to a growing plant. On the lines below, explain what your drawing shows.

_____

_____

_____

5. Now, explain **why** you drew the final arrow the way that you did. What do you know about earthworms that helped you draw that arrow?

_____

_____

_____

Mystery science

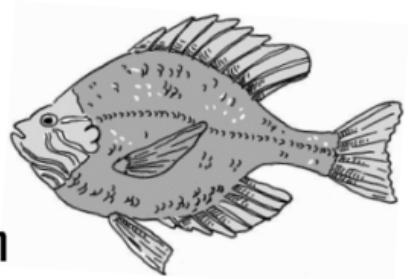
Why do you have to clean a fish tank but not a pond?

BIG FISH

Ecosystem Cards

Page 1

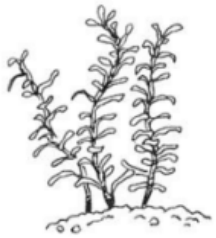
Big Fish



+6
carbon dioxide points

A Big Fish needs:
- at least 3 Big Fish Foods and 2 Decomposers
- a healthy carbon dioxide level

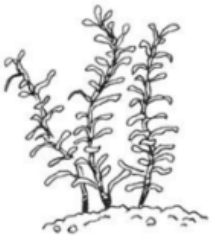
Underwater Plants (Producers)



-3
carbon dioxide points

These plants take all their carbon dioxide from the water.

Underwater Plants (Producers)



-3
carbon dioxide points

These plants take all their carbon dioxide from the water.

Phytoplankton (Producer)

-2
carbon dioxide points

These microscopic plants take carbon dioxide from the water.

Phytoplankton (Producer)

-2
carbon dioxide points

These microscopic plants take carbon dioxide from the water.

Phytoplankton (Producer)

-2
carbon dioxide points

These microscopic plants take carbon dioxide from the water.

Underwater Plants (Producers)

-3
carbon dioxide points

These plants take all their carbon dioxide from the water.

Fungi (Decomposers)

+3
carbon dioxide points

Fungi break down fish waste to make carbon dioxide and nutrients.

Fungi (Decomposers)

+3
carbon dioxide points

Fungi break down fish waste to make carbon dioxide and nutrients.

Bacteria (Decomposers)

+3
carbon dioxide points

Bacteria break down fish waste to make carbon dioxide and nutrients.

Bacteria (Decomposers)

+3
carbon dioxide points

Bacteria break down fish waste to make carbon dioxide and nutrients.

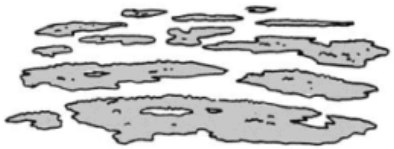
Mystery science

Why do you have to clean a fish tank but not a pond?

BIG FISH

Ecosystem Cards

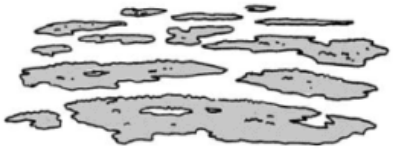
Page 2



Algae (Producers)

-3 carbon dioxide points

Algae take all their carbon dioxide from the water.

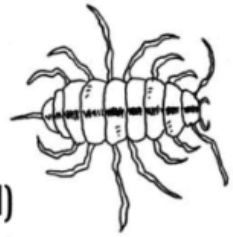


Algae (Producers)

-3 carbon dioxide points

Algae take all their carbon dioxide from the water.

Aquatic Sowbugs (Big Fish Food)



+1 carbon dioxide points

Your pond needs plants, algae, or phytoplankton for these aquatic sowbugs to eat.

Snails (Big Fish Food)

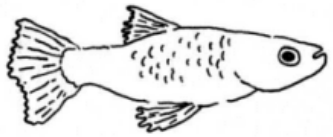
+2 carbon dioxide points

Your pond needs plants, algae, or phytoplankton for these snails to eat.

Tadpoles (Big Fish Food)

+2 carbon dioxide points

Your pond needs plants, algae, or phytoplankton for these tadpoles to eat.

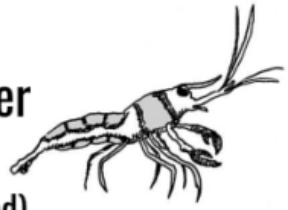


Guppies (Big Fish Food)

+2 carbon dioxide points

Your pond needs plants, algae, or phytoplankton for these guppies to eat.

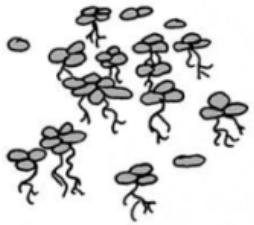
Freshwater Shrimp (Big Fish Food)



+2 carbon dioxide points

Your pond needs plants, algae, or phytoplankton for these shrimp to eat.

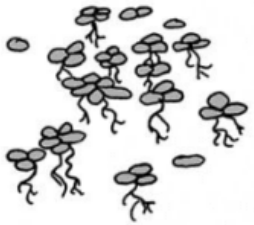
Duckweed (Producer)



-1 carbon dioxide points

This floating plant takes carbon from the air as well as the water.

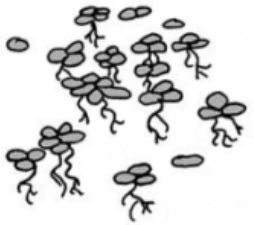
Duckweed (Producer)



-1 carbon dioxide points

This floating plant takes carbon from the air as well as the water.

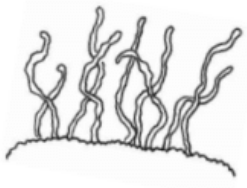
Duckweed (Producer)



-1 carbon dioxide points

This floating plant takes carbon from the air as well as the water.

Sludge Worms (Big Fish Food)



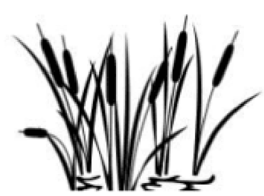
+1 carbon dioxide points

Your pond needs fish waste for these worms to eat.

PICK A CARD

DISCARD PILE

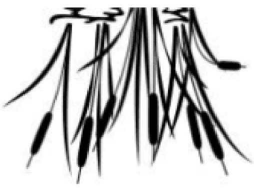
Here's how to play:



- When it's your turn, pick a card. Then play any card from your hand. You can:
  - Put a card in your pond and adjust the carbon dioxide level, OR
  - Read an Action Card if you have one, follow its instructions, then put it in the discard pile, OR
  - Throw a card away in the discard pile.
- You cannot add something to your pond if it will move the carbon dioxide into the unhealthy range.
- When your pond will support a Big Fish, say "Big Fish!" The Pond Checker will use the worksheet to make sure your pond has everything your Big Fish needs.
- Note: If you run out of cards in the pick-a-card pile, shuffle the discard pile and make it into the pick-a-card pile.

Mystery science

Why do you have to clean a fish tank but not a pond?



PICK A CARD

DISCARD PILE

Here's how to play:

- When it's your turn, pick a card. Then play any card from your hand. You can:
  - Put a card in your pond and adjust the carbon dioxide level, OR
  - Read an Action Card if you have one, follow its instructions, then put it in the discard pile, OR
  - Throw a card away in the discard pile.
- You cannot add something to your pond if it will move the carbon dioxide into the unhealthy range.
- When your pond will support a Big Fish, say "Big Fish!" The Pond Checker will use the worksheet to make sure your pond has everything your Big Fish needs.
- Note: If you run out of cards in the pick-a-card pile, shuffle the discard pile and make it into the pick-a-card pile.

Mystery science

Why do you have to clean a fish tank but not a pond?

mystery science

Why do you have to clean a fish tank but not a pond?

BIG FISH

Action Cards

(and two more big fish!)

ACTION CARD

(READ THIS ALOUD)

Every player passes one card to the player on their right.

ACTION CARD

(READ THIS ALOUD)

The tadpoles in all the ponds grow up into toads and leave.

All players remove tadpoles from their ponds and adjust the pond's carbon dioxide levels.

ACTION CARD

(READ THIS ALOUD)

Trade cards with any player.

You choose which card from your hand you will trade, and the other player does the same.

ACTION CARD

(READ THIS ALOUD)

Migrating ducks land in all the ponds and feast on duckweed.

All players remove duckweed from their ponds and adjust the pond's carbon dioxide levels.

ACTION CARD

(READ THIS ALOUD)

Steal one card from anyone's pond and put it in your pond.

ACTION CARD

(READ THIS ALOUD)

Every player passes one card to the player on their left.

ACTION CARD

(READ THIS ALOUD)

Steal one card from anyone's pond and put it in your pond.

ACTION CARD

(READ THIS ALOUD)

Trade cards with any player.

You choose which card from your hand you will trade, and the other player does the same.

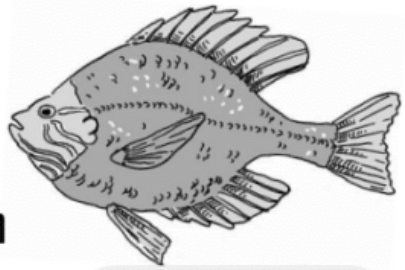
ACTION CARD

(READ THIS ALOUD)

A neighbor sprays to kill mosquito larvae. The spray gets into ponds and kills all the guppies.

All players remove guppies from their ponds and adjust the pond's carbon dioxide levels.

Big Fish



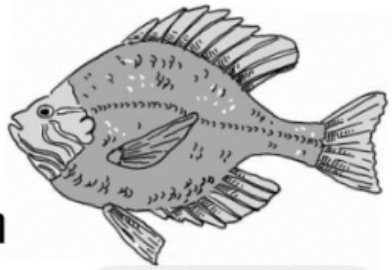
+6

carbon dioxide points

A Big Fish needs:

- at least 3 Big Fish Foods and 2 Decomposers
- a healthy carbon dioxide level

Big Fish



+6

carbon dioxide points

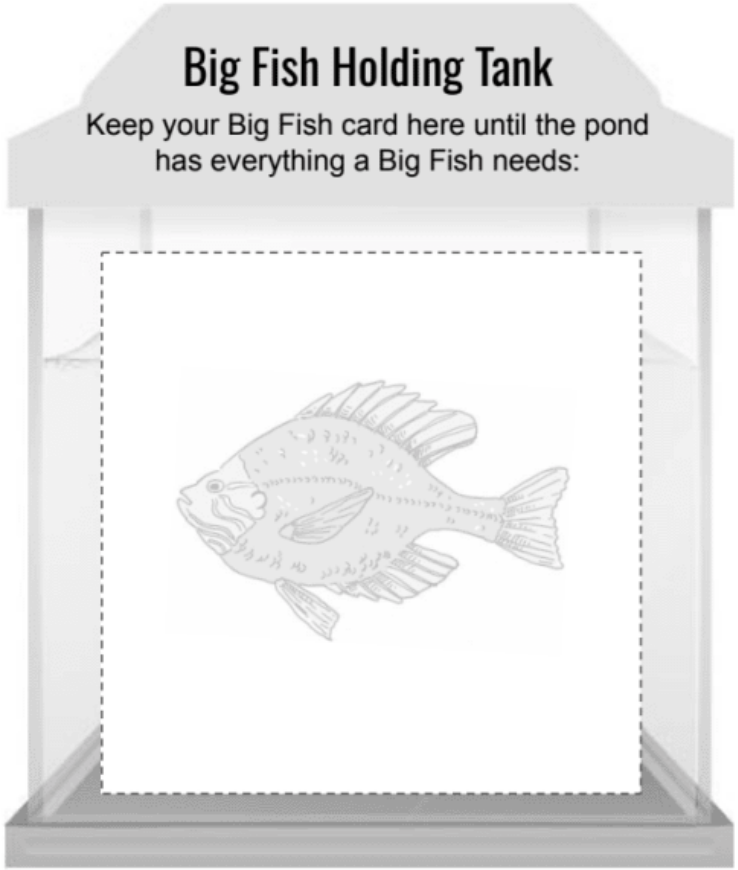
A Big Fish needs:

- at least 3 Big Fish Foods and 2 Decomposers
- a healthy carbon dioxide level

FISH-O-METER

Big Fish Holding Tank

Keep your Big Fish card here until the pond has everything a Big Fish needs:



CARBON DIOXIDE TRACKER

HEALTHY ZONE

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Bad for plants ← **Start here** → Bad for fish/animals

BIG FISH'S FOOD

At least **three**

PRODUCERS

As many as you want

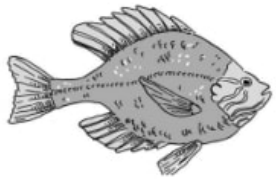
DECOMPOSERS

At least **two**

mystery science

Why do you have to clean a fish tank but not a pond?

Check the Pond!



Name: _____

To make sure the pond is ready for a big fish, answer the questions below.

1) Are there at least three foods for the big fish? Yes No
2) Are there at least two decomposers to clean up the waste? Yes No
3) Use this chart and the carbon dioxide double-checker at the bottom of this page to make sure the pond is healthy:

	Add up the carbon dioxide number on the cards write them in this column.	**Move the pointer to track the carbon dioxide points.**
Big Fish Food		Start at 15. Move the pointer to add these points.
Producers		Move the pointer to subtract these points.
Decomposers		Move the pointer to add these points.
Big Fish	6 points	Move the pointer to add these points.
	What's the final carbon dioxide level? (add the above numbers) Is that a healthy level? Yes No	

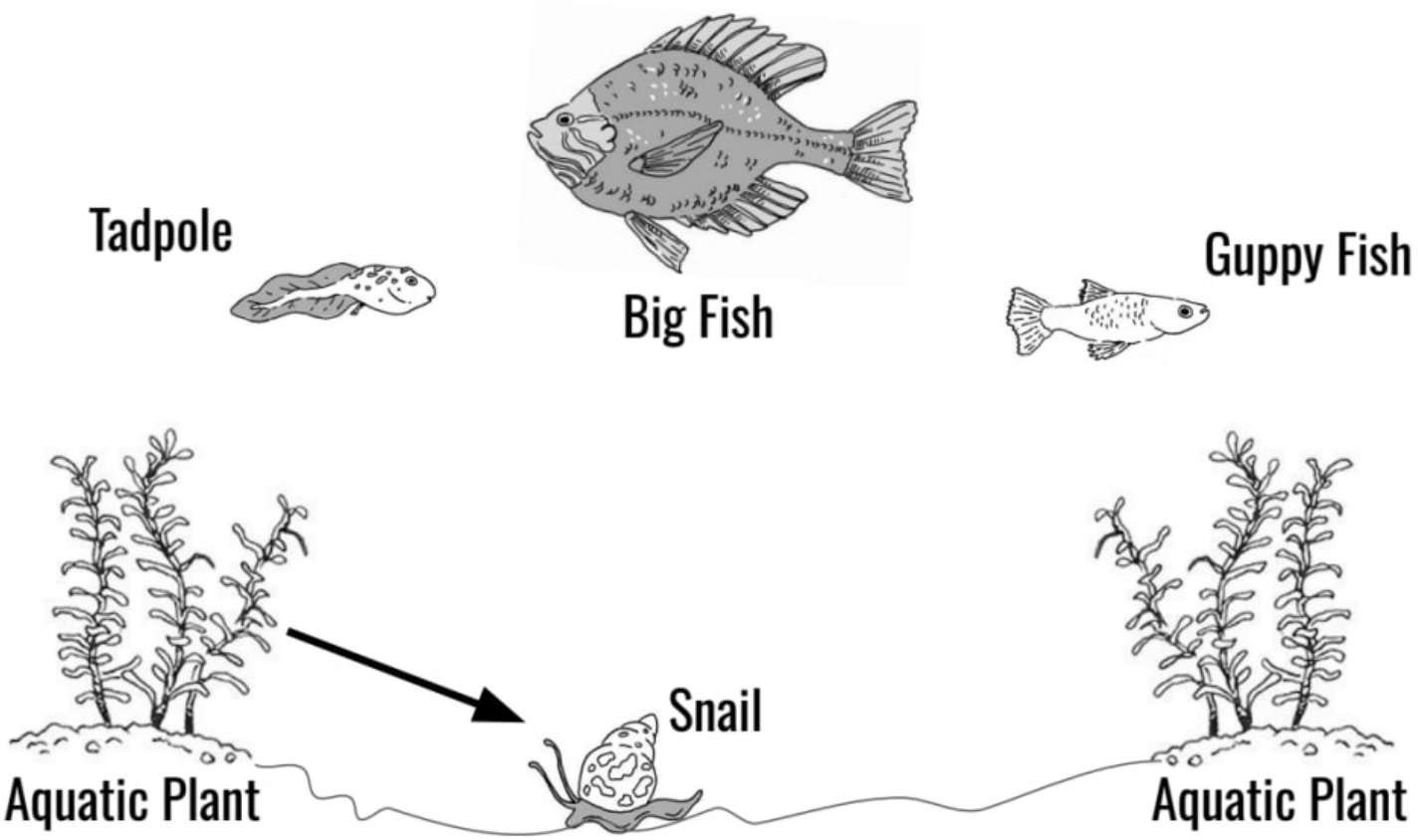
Carbon Dioxide Double-Checker:

					HEALTHY ZONE												
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Name: _____

Date: _____

Lesson Assessment

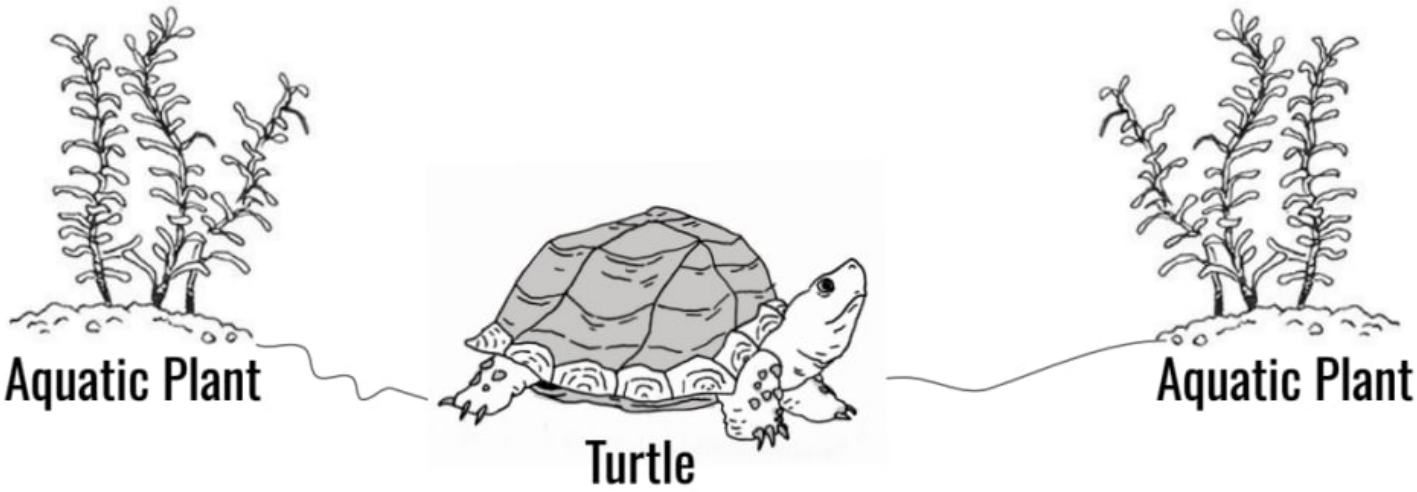


1. The image above is a model of a pond ecosystem. Aquatic plants are producers. Snails, tadpoles, guppy fish, and Big Fish are all consumers. Snails, tadpoles, and guppy fish eat aquatic plants. Big Fish eat all smaller consumers.

Develop the model by drawing arrows to show how materials (matter) move through this system. For example, snails eat aquatic plants. So you would draw an arrow from the plant to the snail because some of the plant's matter is eaten by the snail. This arrow is already drawn for you. Now you draw the other arrows.

2. Big Fish don't ONLY consume matter. Big Fish also release matter into the pond in the form of fish poop. The matter from that waste will enter back into the ecosystem, but needs the help of another organism. What key part of the ecosystem is missing from the model to help the nutrients from fish poop enter back into the system?

a. Plants, like algae and duckweed.
b. Decomposers, like bacteria and fungi.
c. Humans



Use the model that you developed on page 1 to help you answer the following questions.

3. A new organism, a turtle, is added into the pond ecosystem. This kind of turtle eats tadpoles, snails, and guppy fish. What will happen to this ecosystem if lots of these turtles start living here? Choose all correct answers.

a. The guppy fish will have a lot less to eat. They will need to find another food source or they will not survive.
b. The Big Fish will have a lot less to eat. They will need to find another food source or they will not survive.
c. The aquatic plants will probably grow bigger than before because there will be fewer tadpoles, snails, and guppy fish eating them.

4. A new pesticide is being used to reduce the number of mosquitoes that also live in the pond. The pesticide kills mosquito eggs, but it also has the effect of killing aquatic plants in the pond. If lots of aquatic plants in the pond die, what will happen to this ecosystem? Choose all correct answers.

a. The snails will have less to eat.
b. The big fish will have more to eat.
c. A larger amount of matter will need to be broken down by decomposers.

5. Organisms like snails get food from aquatic plants. Aquatic plants, like all plants, create their own food using carbon dioxide. But where does this carbon dioxide come from? Imagine you want to show this flow of matter in your ecosystem model on page 1. Where would you add an arrow? What would the arrow point toward? What word or words would you use to label where that arrow begins?

Prevent it! Spread the Word Project 1:

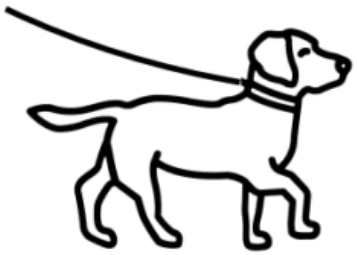
Clean up after dogs

Cards needed: **3**

Dog poop washes into lakes and makes algae grow! Spread the word to Laketown's dog-walkers that they need to clean up after their dogs.

	-3 algae from **one** lake
	Lower your algae tracker by **1**

✔ You got people to clean up after their dogs!



	-3 algae from **one** lake
	Lower your algae tracker by **1**

Place cards here

mystery science
How can we protect Earth's environments?

Prevent it! Spread the Word Project 2:

Keep storm drains clean

Cards needed: **5**

Drains that you see on every street flow directly into the lakes. Spread the word to people living in Laketown to keep these drains free of fertilizer and anything else that could hurt the lakes.

	-5 algae from **one** lake
	Lower your algae tracker by **2**

✔ You got people to keep storm drains clean!

	-5 algae from **one** lake
	Lower your algae tracker by **2**

Place cards here

mystery science
How can we protect Earth's environments?

Prevent it! Fertilizer Runoff Project 1:

Grow plants by the lakes

Cards needed: **3**

Plants near the edge of lakes can catch runoff and reduce the amount that flows into lakes.

	-3 algae from **one** lake
	Lower your algae tracker by **1**

✔ You grew plants by the lake!

	-3 algae from **one** lake
	Lower your algae tracker by **1**

Place cards here

mystery science
How can we protect Earth's environments?

Prevent it! Fertilizer Runoff Project 2:

Farmers stop using fertilizer

Cards needed: **5**

Farms use a lot of fertilizer on their crops, which washes into lakes and makes algae grow. Laketown's farmers will stop using fertilizer on their crops to reduce this runoff.

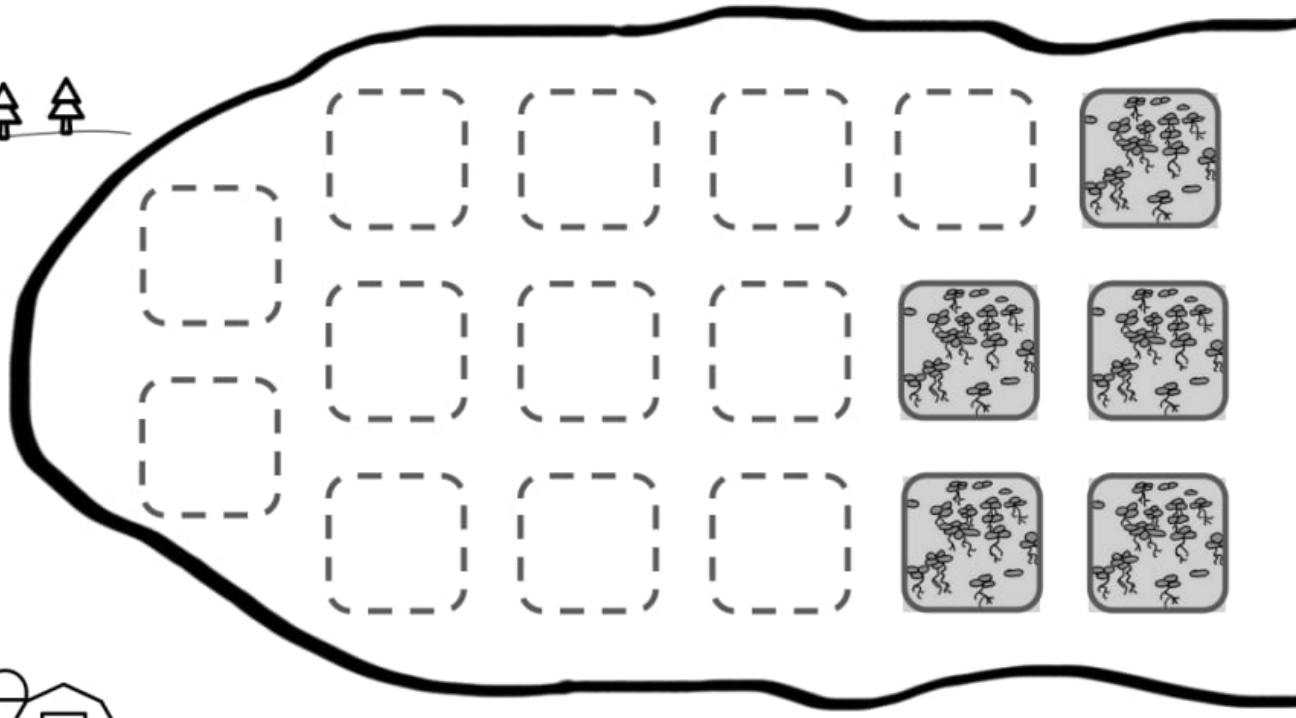
	-5 algae from **one** lake
	Lower your algae tracker by **2**

✔ You got farmers to stop using fertilizer!

	-5 algae from **one** lake
	Lower your algae tracker by **2**

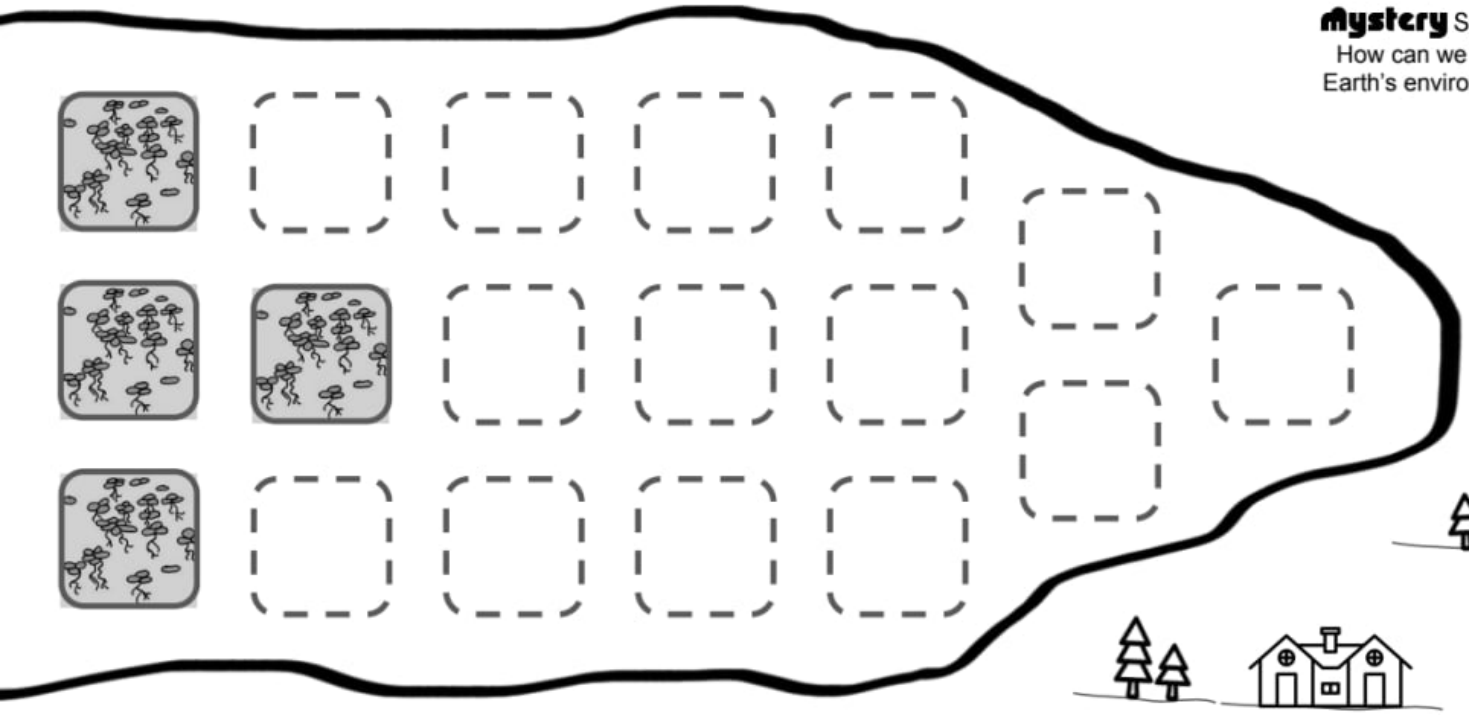
Place cards here

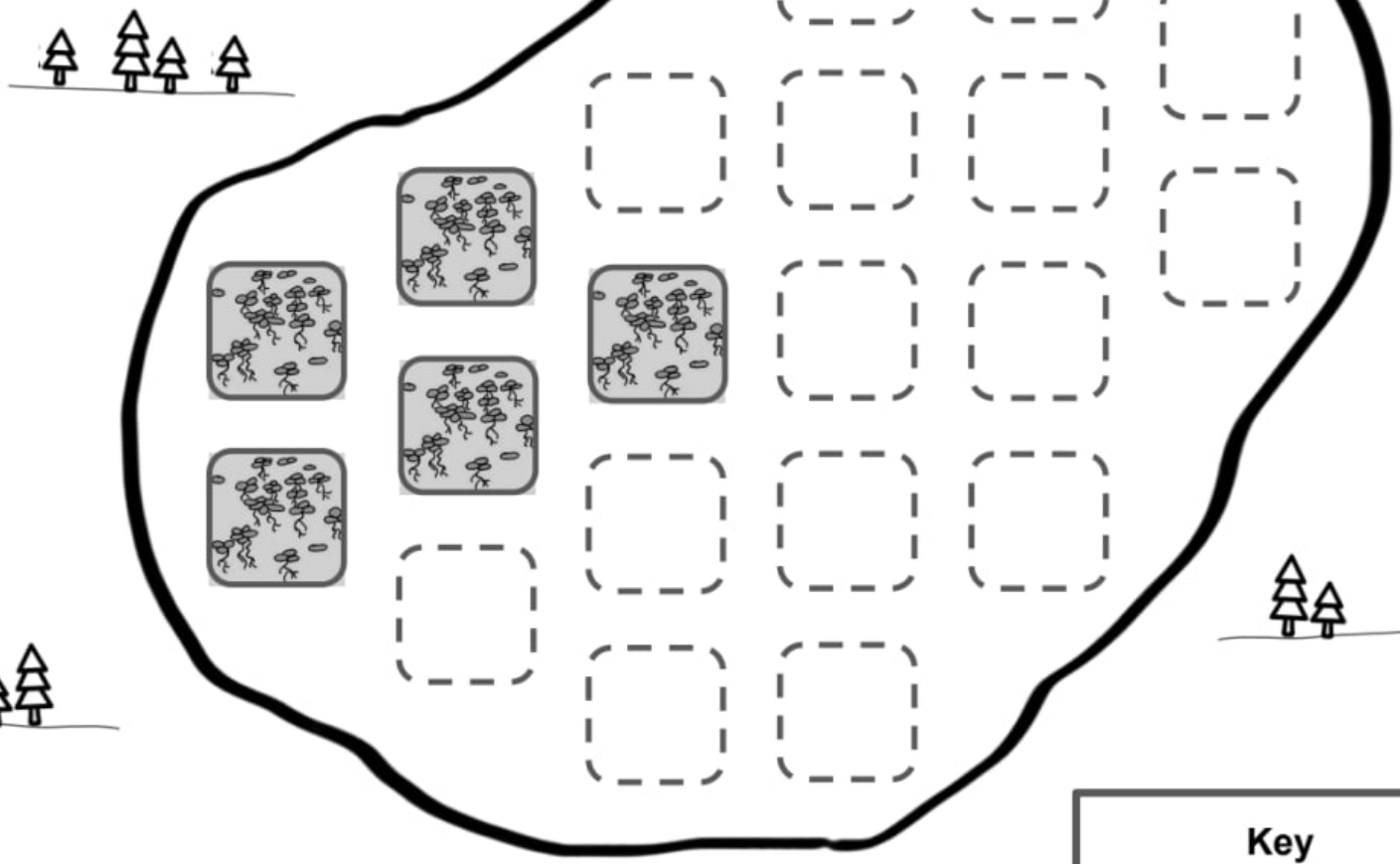
mystery science
How can we protect Earth's environments?



Laketown

Mystery science
How can we protect Earth's environments?





Win with 3 healthy lakes. Lose if 1 fills up!

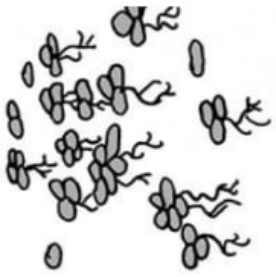
Key

= Healthy amount of algae

Consequences

(For Quick Fix Cards)

or	**Dirty Lake**	Oh no! The amount of fertilizers and waste in this lake is causing extra algae to grow!	**+3** algae to the lake with the **MOST** algae in it
or	**Unexpected Setback**	Oh no! The quick fix didn't work like we thought and set us back!	**Discard 1** Progress card from an **incomplete** Prevent It! project
or	**Nothing Happens**	Phew! The quick fix worked without any consequences!	



End-of-Round Algae Growth Tracker

Owner's name: _____

Add 3 algae to **EACH** lake	**Add 2** algae to **EACH** lake	**Add 1** algae to **EACH** lake	**Add 0** algae to **EACH** lake	**Remove 1** algae from **EACH** lake	**Remove 2** algae from **EACH** lake	**Remove 3** algae from **EACH** lake

Teacher Prep note:

Cards Page 1

Mystery science
How can we protect Earth's environments?

Progress Card

Fertilizer Runoff

Progress Card

Spread the Word

Progress Card

Wild Card

or

Use this card on any Prevent It! project!

Quick Fix

Add chemicals to a lake to treat algae

	**-3** algae from **one** lake
	Roll the dice to find out a consequence

Progress Card

Fertilizer Runoff

Progress Card

Spread the Word

Progress Card

Wild Card

or

Use this card on any Prevent It! project!

Place discarded cards here

Discard Pile

Place discarded cards here

Mystery science
How can we protect Earth's environments?

Discard Pile

Place discarded cards here.

Take at the start of your turn!

Progress Deck

Place cards here, facedown

Progress Deck

Take at the start of your turn!

Teacher Prep note:

Cards Page 2

mystery science
How can we protect Earth's environments?

Quick Fix

Add clay to lakes to treat algae

-2 algae from **TWO** lakes

Roll the dice to find out a consequence

Progress Card

Spread the Word

Quick Fix

Add chemicals to a lake to treat algae

-3 algae from **one** lake

Roll the dice to find out a consequence

Progress Card

Fertilizer Runoff

Progress Card

Wild Card

or

Use this card on any Prevent It! project!

Progress Card

Fertilizer Runoff

Quick Fix

Add clay to lakes to treat algae

-2 algae from **TWO** lakes

Roll the dice to find out a consequence

Progress Card

Spread the Word

Quick Fix

Add chemicals to a lake to treat algae

-3 algae from **one** lake

Roll the dice to find out a consequence

Progress Card

Fertilizer Runoff

Progress Card

Wild Card

or

Use this card on any Prevent It! project!

Progress Card

Spread the Word

Progress Card

Spread the Word

Quick Fix

Add clay to lakes to treat algae

-2 algae from **TWO** lakes

Roll the dice to find out a consequence

Progress Card

Fertilizer Runoff

Teacher Prep note:

Cards Page 3

mystery science
How can we protect Earth's environments?

Progress Card

Fertilizer Runoff

Progress Card

Spread the Word

Quick Fix

Add clay to lakes to treat algae

-2 algae from **TWO** lakes

Roll the dice to find out a consequence

Progress Card

Spread the Word

Progress Card

Wild Card

or

Use this card on any Prevent It! project!

Progress Card

Fertilizer Runoff

Quick Fix

Add chemicals to a lake to treat algae

-3 algae from **one** lake

Roll the dice to find out a consequence

Progress Card

Spread the Word

Quick Fix

Add clay to lakes to treat algae

-2 algae from **TWO** lakes

Roll the dice to find out a consequence

Progress Card

Fertilizer Runoff

Progress Card

Wild Card

or

Use this card on any Prevent It! project!

Progress Card

Spread the Word

Progress Card

Fertilizer Runoff

Quick Fix

Add chemicals to a lake to treat algae

-3 algae from **one** lake

Roll the dice to find out a consequence

Progress Card

Fertilizer Runoff

Teacher Prep note:

Cards Page 4

mystery science
How can we protect Earth's environments?

Progress Card

Spread the Word

Quick Fix

Add clay to lakes to treat algae

-2 algae from **TWO** lakes

Roll the dice to find out a consequence

Progress Card

Wild Card or

Use this card on any Prevent It! project!

Quick Fix

Add chemicals to a lake to treat algae

-3 algae from **one** lake

Roll the dice to find out a consequence

Progress Card

Fertilizer Runoff

Quick Fix

Add clay to lakes to treat algae

-2 algae from **TWO** lakes

Roll the dice to find out a consequence

Spread the Word

Progress Card

Wild Card or

Use this card on any Prevent It! project!

Progress Card

Spread the Word

Progress Card

Fertilizer Runoff

Quick Fix

Add chemicals to a lake to treat algae

-3 algae from **one** lake

Roll the dice to find out a consequence

Progress Card

Fertilizer Runoff

Quick Fix

Add clay to lakes to treat algae

-2 algae from **TWO** lakes

Roll the dice to find out a consequence

Progress Card

Spread the Word

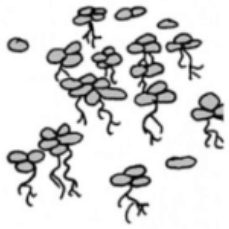
Quick Fix

Add chemicals to a lake to treat algae

-3 algae from **one** lake

Roll the dice to find out a consequence

RULES

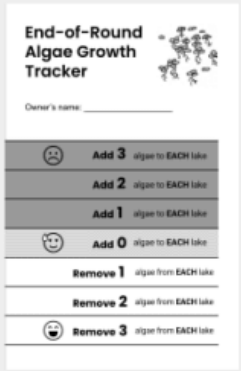


Setup

1) Add 6 algae tokens to EACH lake.
2) Place the 4 Prevent It! Projects above the map.
3) Put paperclip at "Add 3 algae to each lake" on the Algae Tracker.
4) All players: take 2 cards from the Progress Deck.

How to Play

1) Take 1 card from the Progress Deck and put it in your hand.
2) Play 1 card from your hand. If you don't have a card you want to play on your turn, you can pass.
3) Repeat steps 1 and 2 for each player on your team. Pause after Player 3's turn is over...



END OF ROUND - Algae grows

After Player 3's turn is over, it's the algae's turn to grow. Check your **End-of-Round Algae Growth Tracker** to see where the paper clip is pointing, and add that many algae tokens to EACH lake.
Then a new round starts with Player 1's turn.

How to Win

Work together to get **ALL THREE lakes** to a healthy algae level (the shaded squares) by removing all the algae tokens.

How to Lose

If any **ONE lake** completely fills up with algae (all squares are full), your team loses.

Types of Cards in the Deck

Progress cards:

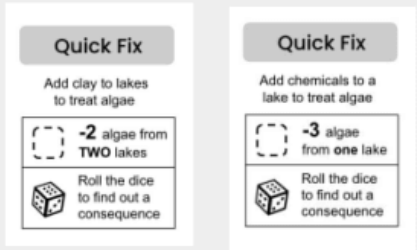
Use these to complete **Prevent It!** Projects of the same type.

Quick Fix cards:

Use these to reduce algae in your lakes right away, but at a cost! Roll the dice.

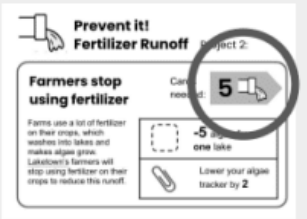
Then look at the **Consequences** sheet to see if anything bad happens.

Put Quick Fix cards in the discard pile after use.



Prevent It! Projects:

The number in the arrow on the Prevent It! Project is how many **Progress cards** your team needs to complete it and gain the rewards!



mystery science
How can we protect Earth's environments?

Name: _____

Date: _____

Lesson Assessment

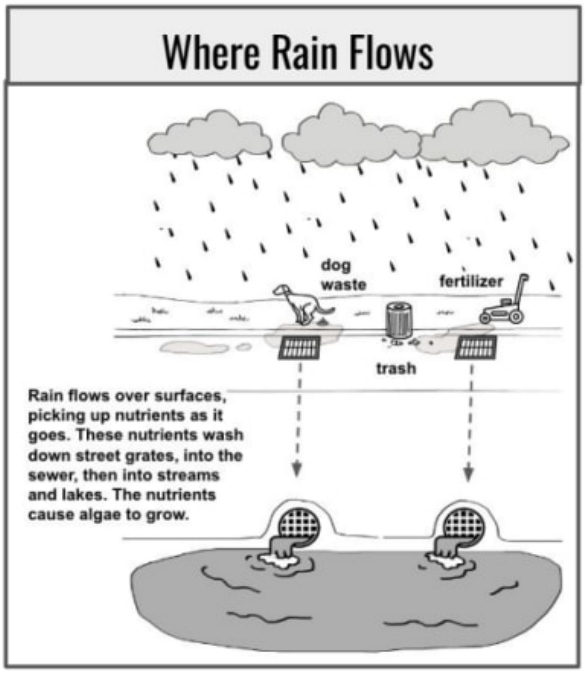
Marshall is a grumpy man who has a really cute dog named Button. But there's a problem. Marshall never picks up Button's poop after taking him for walks in the local park.

The lake in Marshall's town recently started to have problems with harmful algae blooms. Harmful algae blooms happen when there are too many nutrients in the water. The nutrients often come from fertilizers or other sources like dog poop. You are trying to convince Marshall to start picking up after his dog.

Marshall says: "I don't understand why picking up Button's poop matters. It's not like he's pooping in the lake! The lake is far away from the park where I bring Button for his walks."

You obtained the infographic on the right from the town's government website. Look at the information shown about runoff from rain.

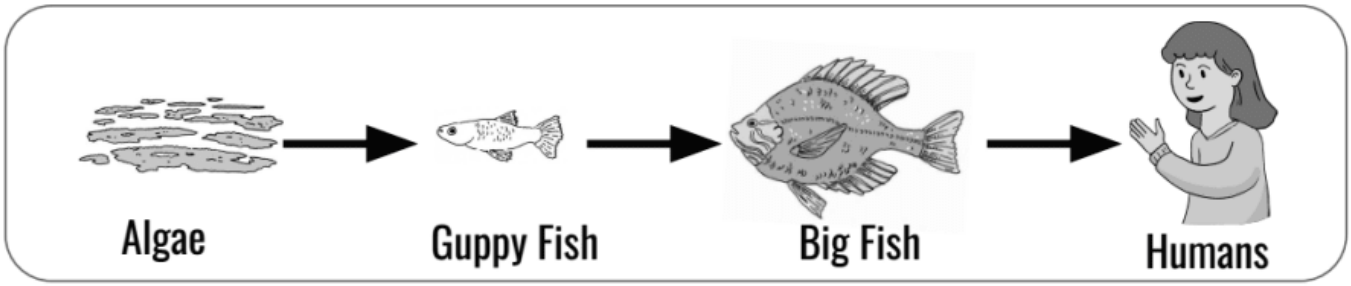
1. How can you explain to Marshall that poop from the park can affect the lake, even though they are far away from each other? Use the infographic from the government, and what you know about runoff and harmful algae blooms, to help create your explanation.



Marshall still isn't convinced. He says:

"Even if Button's poop is adding to the harmful algae bloom problem, what does that have to do with me? It's not like I live in the lake or eat algae. This doesn't affect me at all. So why should I care?"

A local scientist provides you with information about a food chain that starts with the algae in the town's lake. This is the food chain:



2. How could you convince Marshall that he should care about harmful algae blooms? Use what you know about food chains and the model above to help with your explanation.

3. If Marshall refuses to pick up Button's poop, can you suggest any other ways that Marshall could help the lake ecosystem? Use the information from the previous questions, along with what you know about runoff and harmful algae blooms, to help you answer.

mystery science

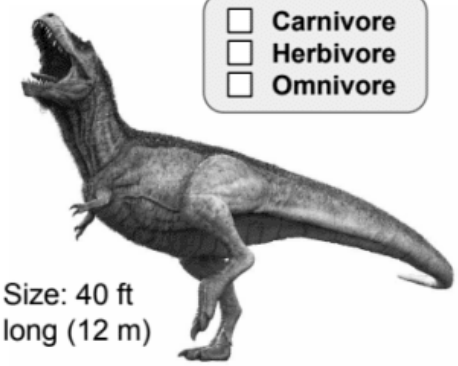
Why did the dinosaurs go extinct?

DINO DIE-OFF

a food web model

Tyrannosaurus rex

☐ Carnivore
☐ Herbivore
☐ Omnivore



Size: 40 ft long (12 m)

I get my energy by eating other dinosaurs. I like to munch on *Triceratops* or duckbill dinosaurs —but I'll eat smaller ones, too. I'm big, so I need a lot of food to keep going.

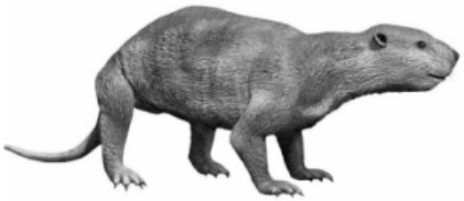
mystery science

Didelphodon

Size: 14 in long (35 cm)

☐ Carnivore
☐ Herbivore
☐ Omnivore

I'm a mammal! I get my energy by eating crickets, beetles, and worms. I have jaws that will crunch through turtle shell—or through the bones of dead animals. I also eat berries, if they're available.



mystery science

Duckbill dinosaur
(Corythosaurus)

Size: 32 ft long (10 m)

☐ Carnivore
☐ Herbivore
☐ Omnivore

I get my energy by eating twigs, leaves, and seeds from living plants. I always keep an eye out for *Tyrannosaurus*, who thinks I make a good snack.

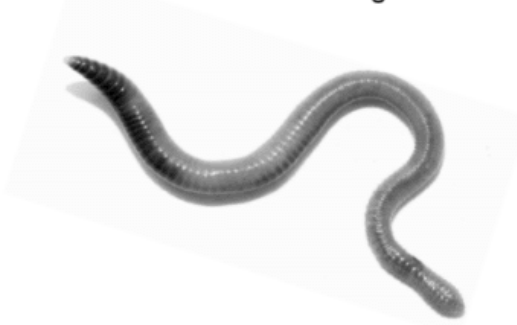
mystery science

Earthworm

Size: up to 8 in (20 cm)

☐ Carnivore
☐ Herbivore
☐ Omnivore

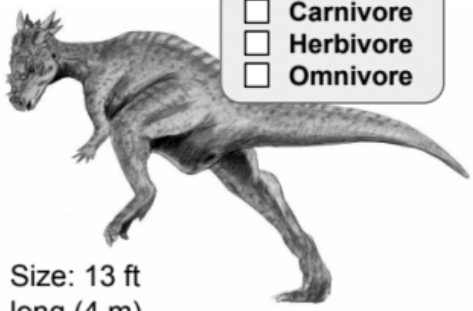
I get my energy from rotting wood, dead leaves, and rotting animals. I burrow underground.



mystery science

Dracorex hogwartsia

☐ Carnivore
☐ Herbivore
☐ Omnivore



Size: 13 ft long (4 m)

I get my energy from leaves, seeds, and fruits of living plants. My name means "dragon king of Hogwarts." I got my name when the scientists who found my skull in 2016 donated me to a museum.

mystery science

Prehistoric turtle
(Compsemys)

Size: 12 in (30 cm)

☐ Carnivore
☐ Herbivore
☐ Omnivore

I get my energy by eating worms and crickets. Like modern turtles, I can hibernate underwater when the weather is cold.

mystery science

Dryptosaurus

Size: 21 ft long (6.4 m)

☐ Carnivore
☐ Herbivore
☐ Omnivore

I get my energy from eating other dinosaurs. I hunt plant eaters that are my size or a little bit bigger.

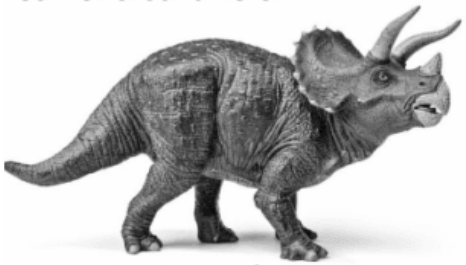
mystery science

Triceratops

Size: 30 ft long (9 m)

- ☐ Carnivore
- ☐ Herbivore
- ☐ Omnivore

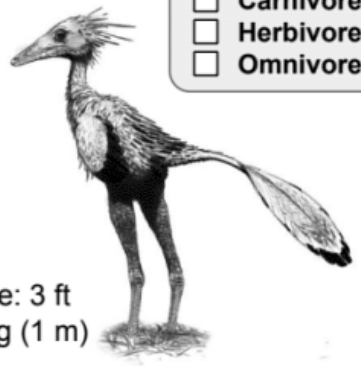
I get my energy by munching on living plants. And I'm big, so I need a lot of food to keep going. That means a lot of plants. Good thing that palm trees grow so well around here.



Mystery science

Sinornithoides

- ☐ Carnivore
- ☐ Herbivore
- ☐ Omnivore



Size: 3 ft long (1 m)

I've got feathers. If you saw me, you'd probably say I was a bird. I get my energy by eating worms and crickets and other small animals.

Mystery science

Prehistoric cricket

Size: up to 4 in (10 cm)

- ☐ Carnivore
- ☐ Herbivore
- ☐ Omnivore

I get my energy by eating seeds, berries, and leaves—either fresh off the living plant or dead on the ground. And I'm always hungry! Every day, I eat my own body weight in food.

Mystery science

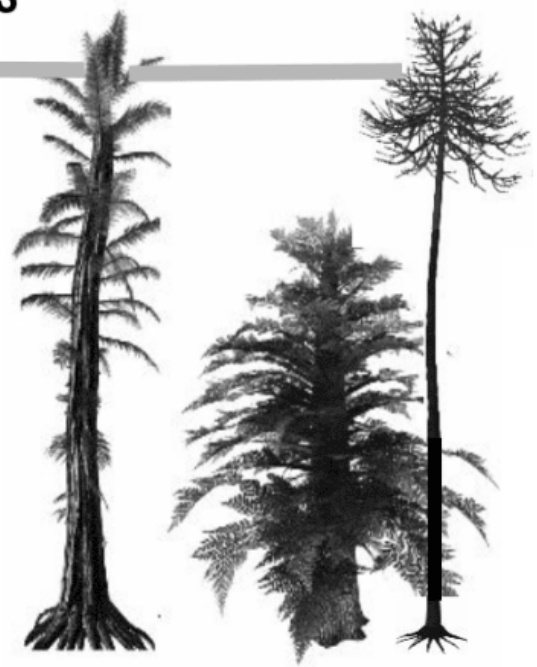
Sunlight

I'm the sun. My light and heat are both forms of energy. Every living thing—from palm trees to *Tyrannosaurus*—needs energy to move, to grow, to stay warm, and to heal when they are injured.

Mystery science

Living green plants

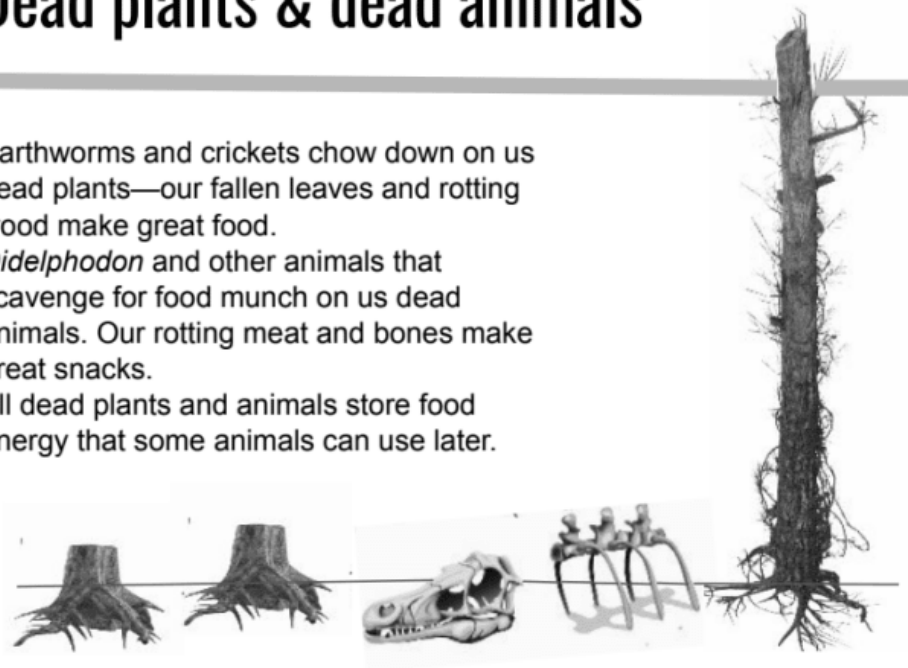
We're the plants of the Cretaceous period: leafy palm trees, evergreen trees, ferns, flowering plants, plants that grow berries, and more! All of us plants provide abundant food and energy for herbivores.



Mystery science

Dead plants & dead animals

Earthworms and crickets chow down on us dead plants—our fallen leaves and rotting wood make great food.
Didelphodon and other animals that scavenge for food munch on us dead animals. Our rotting meat and bones make great snacks.
All dead plants and animals store food energy that some animals can use later.



Mystery science

Name: _____

Dinosaur Food Web

1. What animals do you think *Tyrannosaurus rex* would eat? Why do you think that?

_____

_____

_____

_____

_____

2. List the animals you think can survive when the sunlight is blocked.

_____

_____

_____

3. Why did some animals go extinct while other animals survived? Construct an explanation using evidence from your food web.

_____

_____

_____

_____

_____

_____

_____

_____

Name: _____

Date: _____

Lesson Assessment

1. Caterpillars are small insects that can grow very quickly. Some caterpillars can double in size in just one day! Caterpillars have to eat a lot of food so that they have the energy to grow that quickly. The diagram below shows a food chain including a caterpillar.

SUN PLANTS CATERPILLAR

What does the above food chain show? Choose **all** correct answers.

a. Caterpillars get their energy directly from the Sun.
b. Caterpillars get their energy directly from plants.
c. Caterpillars use energy that originally came from the Sun. But they can't use energy *directly* from the Sun.
d. Caterpillars give energy to plants, and plants give energy to the Sun.

2. Some birds eat caterpillars. The caterpillars give them lots of energy so that they can do things like grow, fly, and build nests.

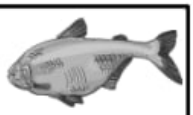
In the space below, create a food chain. Write the words **birds**, **caterpillars**, **Sun**, and **plants** on each of the lines. Make sure that you write them in the correct order.

_____ → _____ → _____ → _____

3. Caves are amazing underground places. Sunlight can shine into the openings of caves, but deep inside caves, it can become completely, totally dark. Even in some of the darkest caves, though, you can find living things.

Read the following cards about three types of real living things that can be found in or near caves:

Cave Fish



Cave fish live in pools of water inside of caves. They can't leave the water, which means they can't leave the cave. They live their **entire** lives in darkness without **ever** seeing the Sun. They get their energy by eating any small insects that come to the edge of the water for a drink.

Plants

All plants need sunlight for energy. This means that plants can grow near the openings of caves. But if you go deep into a cave, no plants can grow because there is no sunlight.

Cave Crickets

Cave crickets spend *most* of their lives in caves. They get their energy from eating any food they can find. Sometimes that means eating other insects, and sometimes it means they leave caves and look for plants to eat. They always come back to the cave, though.

Cave fish don't even see the Sun for their entire lives, but the Sun is still the original source of their energy. How can this be?

In the space below, create a food chain that shows how cave fish can get energy from the Sun even if they live their entire lives in complete darkness.

→ → →

4. The dinosaurs might have gone extinct because the light from the Sun was blocked. Cave fish already live in total darkness and never see the Sun. Do you think cave fish could survive if the Sun became blocked again? Explain your answer on the lines below. (It might help to look back at question 3.)

Mars Ecosystem Argument

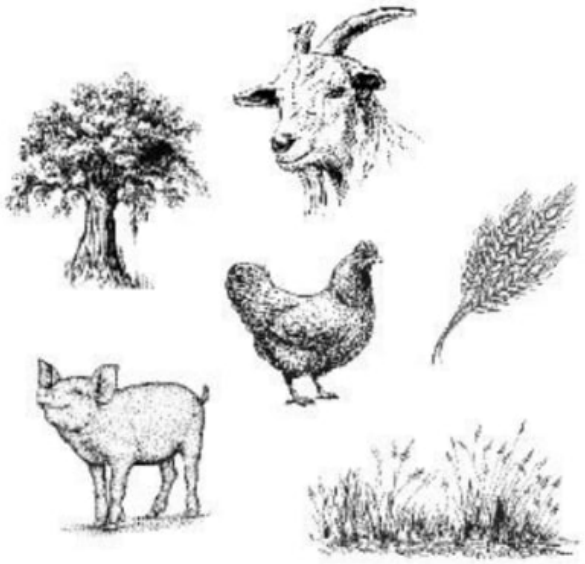
Name:_____

Part 1

Introduction: A team of NASA engineers has come up with a design idea for a Mars Habitat. They have made sure there is enough water, oxygen, carbon dioxide levels and heat to start with. They have proposed 15 living things that will be in the ecosystem for food.

Step 1: Look over the list of proposed organisms.
On each line, write the type of organism it is: **D** = *decomposer*, **P** = *producer/plant*, or **A** = *animal*.

Corn _____	Wheat _____	House Cat _____
Chicken _____	Grass _____	Goat _____
Beetles _____	Apple Tree _____	Pig _____
Jumping Spider _____	Veggie Garden with Parsley _____	Swallowtail Caterpillar _____
Frog _____	Mouse _____	Dairy Cow _____



Step 2: Use the provided Part 1 cards to arrange the organisms into a food web. Add your food web below. *Remember:* Use arrows to show how nutrients and energy move through the ecosystem.

Step 3: Evaluate the proposed ecosystem. Identify what will work and what will not work.

What **will** work in the proposed ecosystem? 	Why will this work? What science idea have you learned that helps you know this will work?
What **will NOT** work (or what is missing) in the proposed ecosystem? 	Why will this NOT work? What science idea that you learned explains why this will NOT work?

Step 4: **Make a claim** about whether the proposed ecosystem will work or not:

I think the ecosystem will _____

_____

_____

_____

Support with evidence and reasoning. Use the science ideas you have learned during this unit to support your answer.

I think this because _____

_____

_____

_____

_____

_____

_____

_____

_____

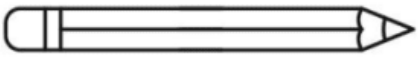
_____

Mars Ecosystem Argument

Name:_____

Part 2

Step 5: How would you improve the proposed ecosystem? List what organisms you would add and explain why. List what organisms you would remove and explain why.



_____

_____

_____

_____

_____

Step 6: The Mars ecosystem began with a healthy level of carbon dioxide, but changing the organisms will change the carbon dioxide level.

ADDED organism	Type of Organism *(Producer, Animal, Decomposer)*	Does ***adding*** the organism INCREASE or DECREASE the carbon dioxide level?
REMOVED organism	Type of Organism *(Producer, Animal, Decomposer)*	Does ***removing*** the organism INCREASE or DECREASE the carbon dioxide level?

CHALLENGE QUESTION: If your carbon dioxide levels are too LOW, how could you raise them?

_____

_____

If your carbon dioxide levels are too HIGH, how could you lower them?

_____

_____

mystery science

Ecosystems & The Food Web | Performance Task

Ecosystems & The Food Web Performance Task

Part 1 Cards

Jumping Spider

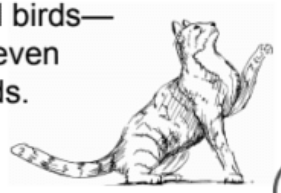
I pounce on insects that spend time on the ground. I eat crickets, ants, cockroaches, caterpillars, and even daddy long legs.

1

mystery science

House Cat

Yes, I eat cat food. But I like to hunt, too. I prey on mice, gophers, squirrels, small birds—and even lizards.

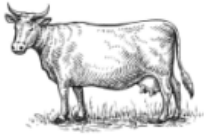


1

mystery science

Dairy Cow

I could munch on grass all day. I even like dried grass, called hay. If you have corn and wheat, I'll eat that too.



1

mystery science

Mouse

Cartoon mice eat cheese. Real mice like me eat human food—when we can find it. I'll also eat seeds and nuts (like acorns), or snack on vegetables like zucchini or tomatoes. And sometimes I eat crickets and beetles.

1

mystery science

Frog

I eat insects with my long sticky tongue—beetles, cockroaches, crickets, houseflies, butterflies, and even bees. I'll also snack on earthworms, snails, and pillbugs. Yum!

1

mystery science

Beetle

I eat caterpillars. In fact, some people call me the caterpillar hunter. I'll also eat corn, earthworms, and snails.

1

mystery science

Corn

I'm a farm favorite! Cows, mice, beetles, chickens, pigs, and goats love my sweet kernels.

1

mystery science

mystery science

Ecosystems & The Food Web| Performance Task

Chicken

I love plants like vegetables, fruits, grass, flowers, seeds, corn, and grains! I also like tiny bugs I can find by scratching the ground.

1

mystery science

Swallowtail Caterpillar

Like many caterpillars, I'm a picky eater. I only eat carrot leaves and parsley plants from vegetable gardens.

1

mystery science

Apple Tree

I'm a nutritious snack for many critters. Before apples grow on my branches, there are flowers! Over time, the flowers turn into apples with seeds inside.

1

mystery science

Grass

I have lots of leaves and lots of seeds. That's lunch for lots of critters.

1

mystery science

Goat

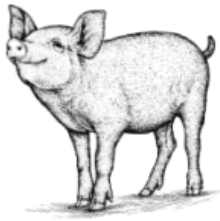
I'm known for eating everything! But to stay healthy I like plants. My favorites are hay (dried grass), veggies, trees, wheat, and shrub

1

mystery science

Pig

I love fruit, corn, leaves, and even flowers.



1

mystery science

Wheat

I'm a grain that needs sunlight to grow. I have lots of seeds! Many animals find me tasty, even humans!

1

mystery science

Veggie Garden

If you're looking for lettuce, tomatoes, cucumbers, carrots, and parsley I'm the place. Stop by for some leaves and flowers too!

1

mystery science

mystery science

Ecosystems & The Food Web | Performance Task

Web of Life Performance Task

Part 2 Cards

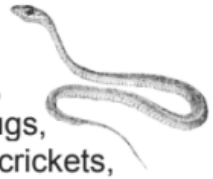
Gopher

I tunnel underground and gnaw the roots of plants—any plants! Sometimes I leave my hole to snack on leaves—keeping an eye out for animals that want to snack on me!

2

mystery science

Garter Snake



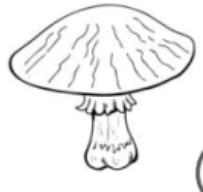
I hunt in the grass for ants, beetles, pill bugs, cockroaches, crickets, earthworms, and spiders. I also eat mice, frogs, salamanders, and lizards. Don't be scared of me...unless you're on my list of snacks.

2

mystery science

Mushroom

I may look like a plant because I grow in the ground, but I'm actually a fungus! I break down dead or decaying matter and use the nutrients to grow.



2

mystery science

Honeybee

I eat pollen and nectar from flowers. I'm happy anywhere flowers bloom—a flower garden, a vegetable garden, a parsley plant, or a patch of clover.

2

mystery science

Earthworm

I eat bits of plants—like dead leaves or rotting wood. Anywhere that leaves are falling, I can find something for lunch.

2

mystery science

Pill bug

I eat dead leaves, rotting wood, and the fungi that grow on them. Look for me under logs. Poke me, and I roll into a ball—that's why some people call me a roly poly.

2

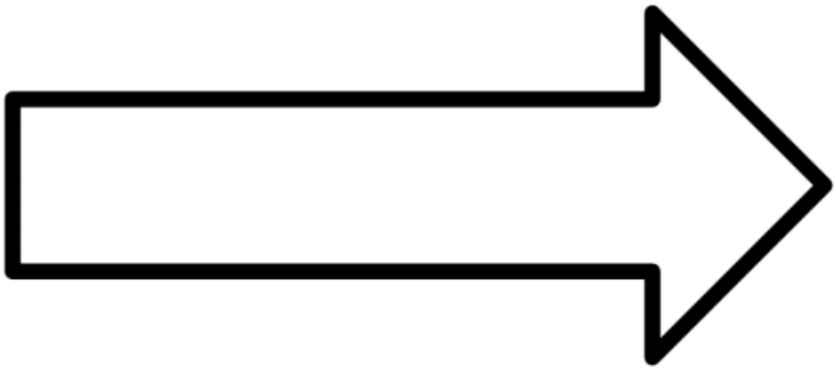
mystery science

Ant

I'm happy to eat human food (like peanut butter), but when that's not around, I'll eat nectar from flowers, seeds from grasses, and any dead insects I find lying around.

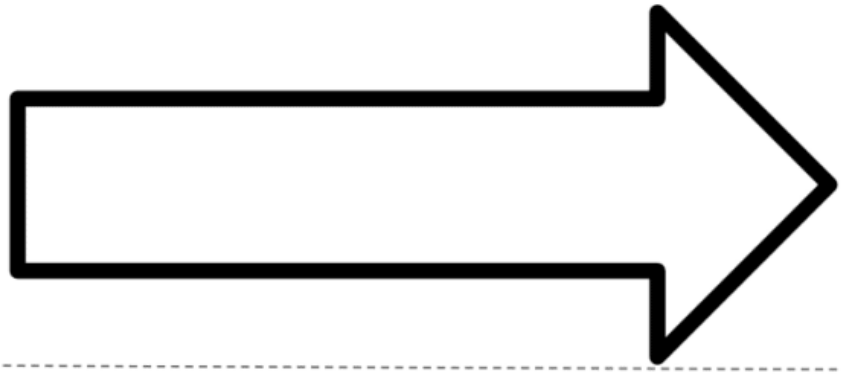
2

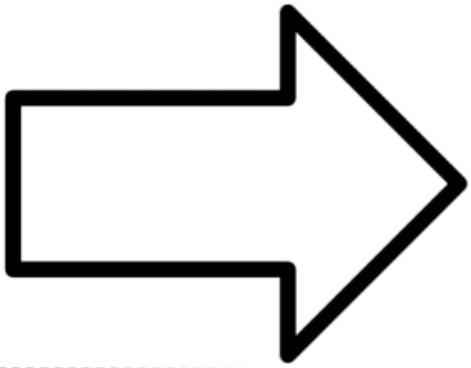
mystery science

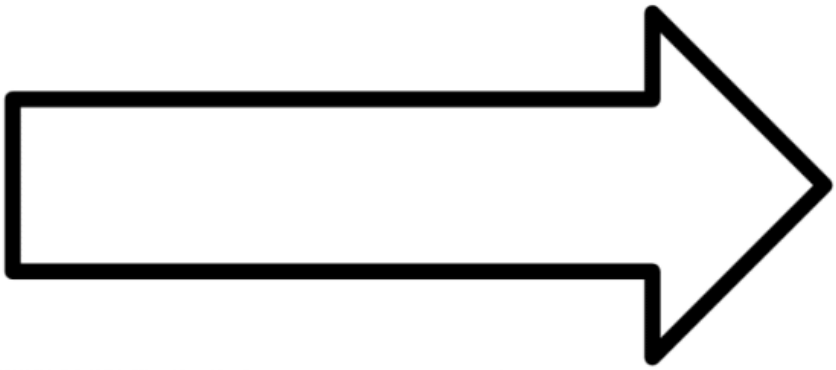


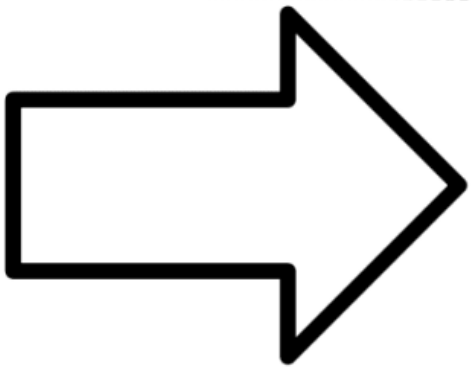
mystery science

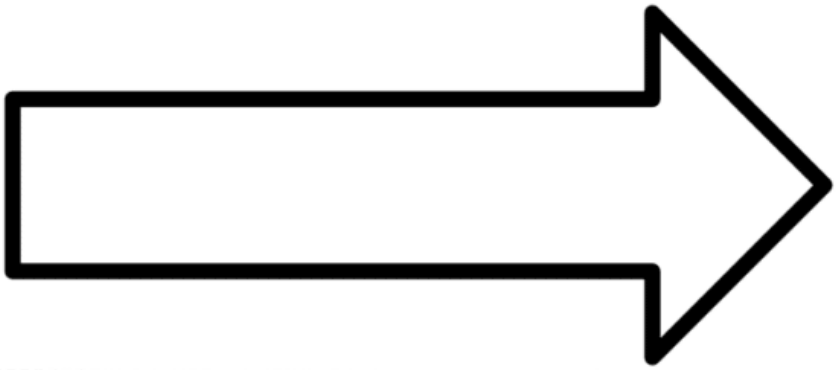
Ecosystems & The Food Web |
Performance Task

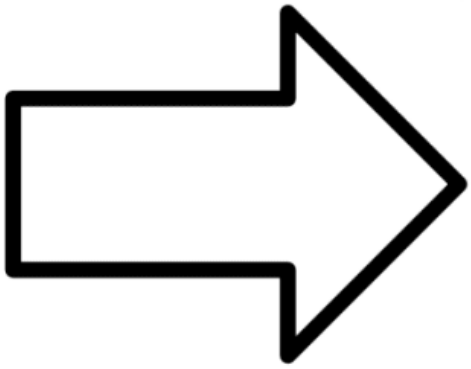


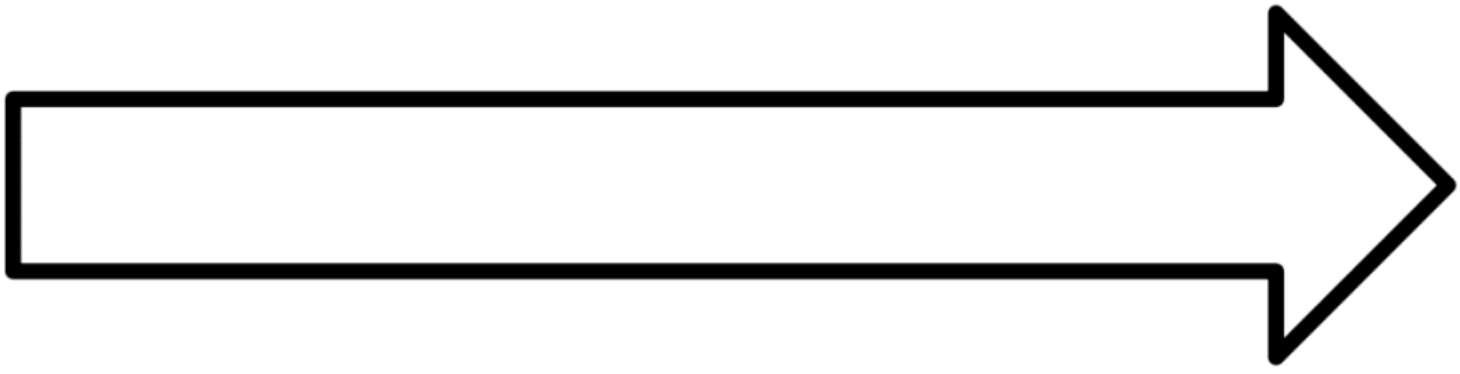


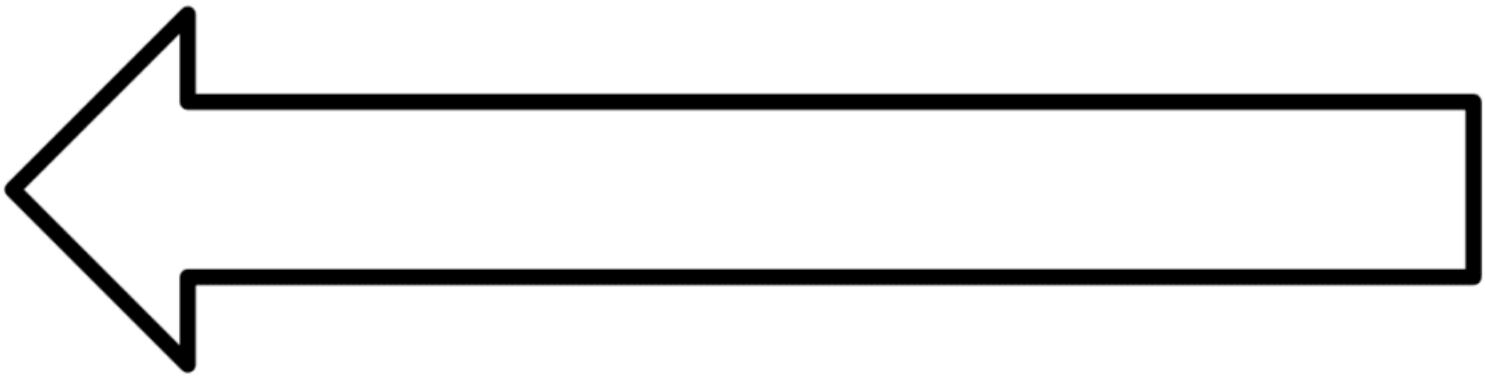


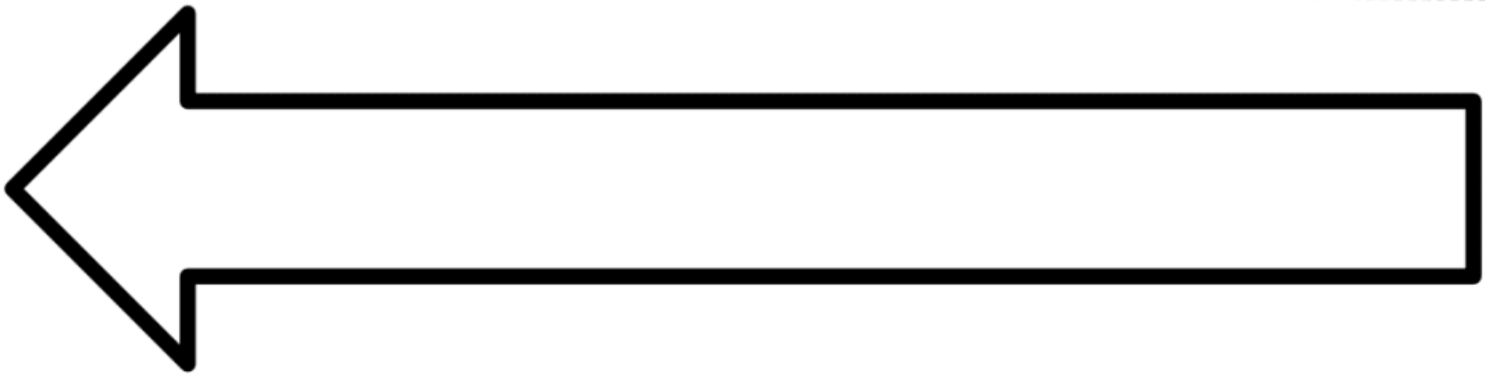


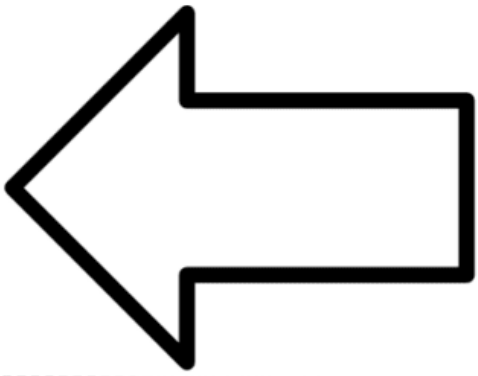


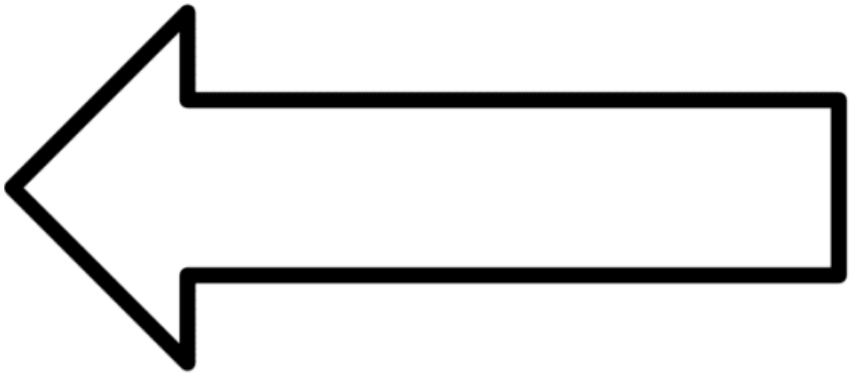


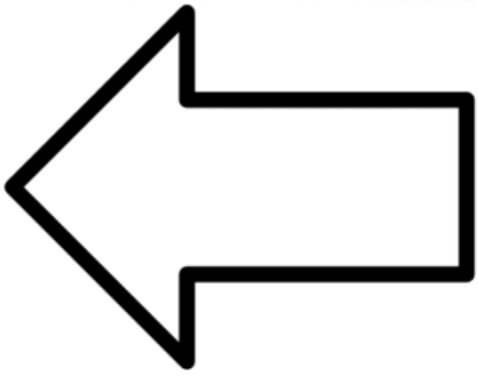


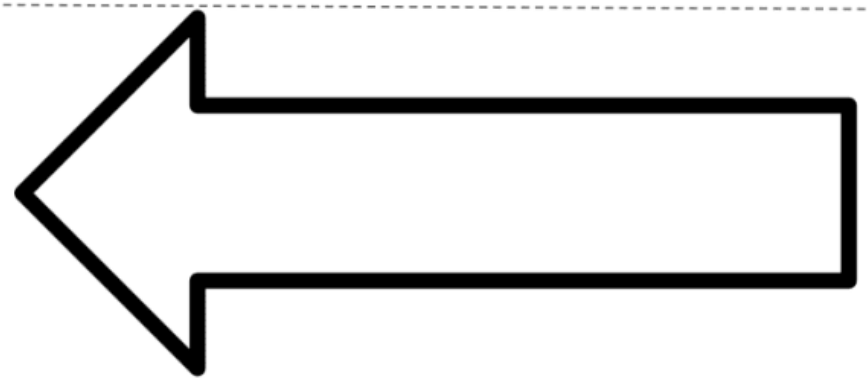


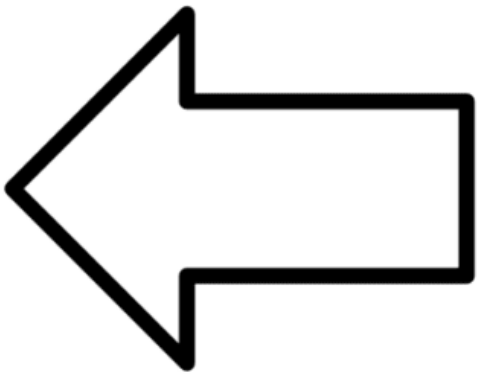


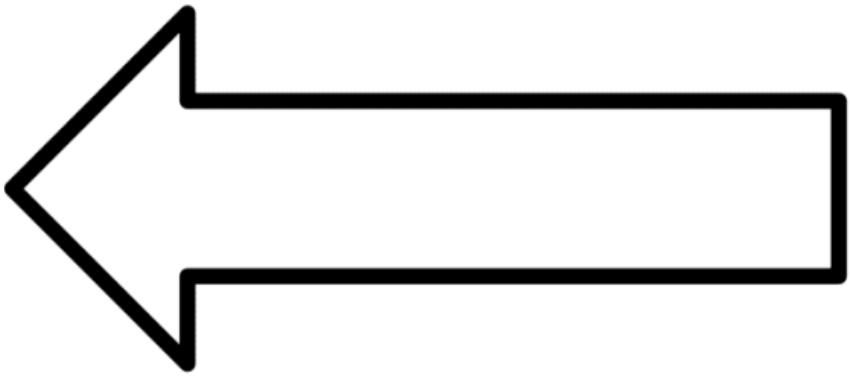


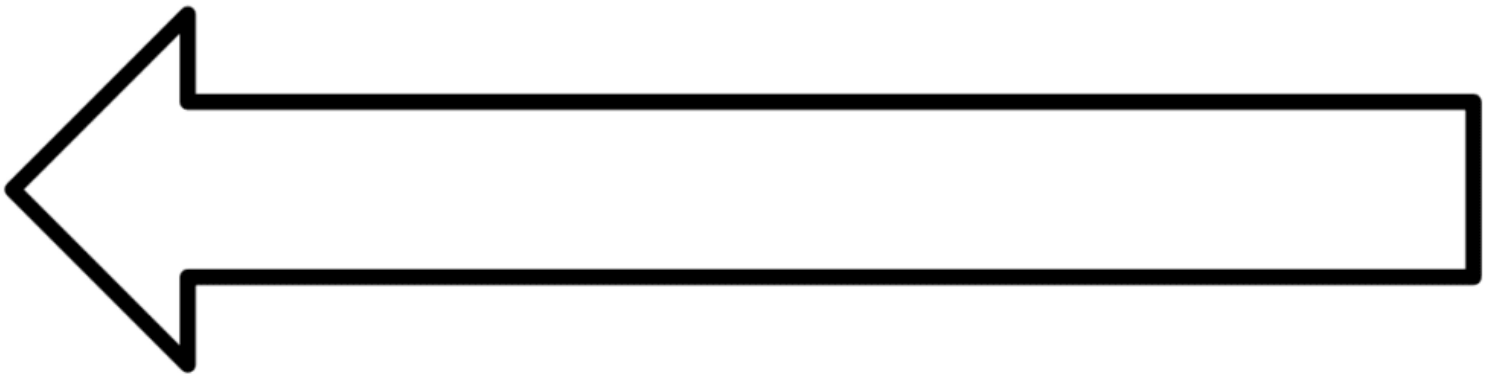


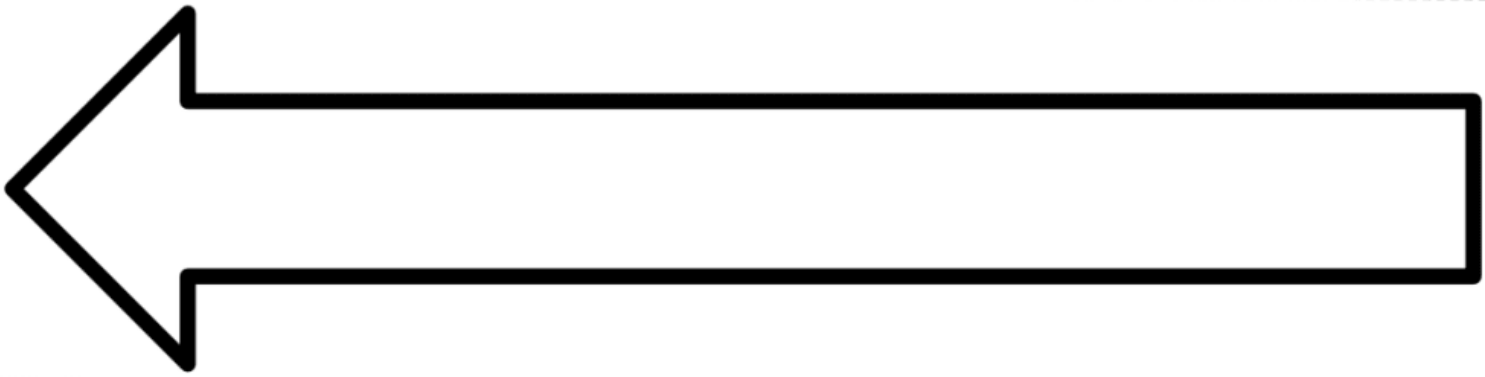


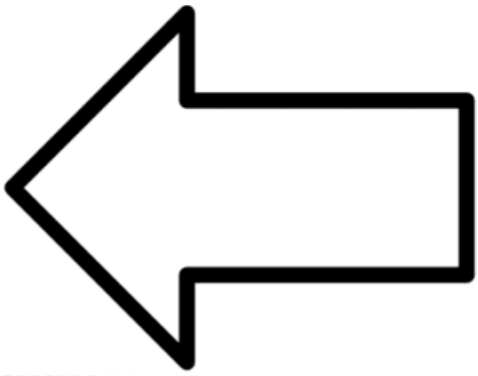


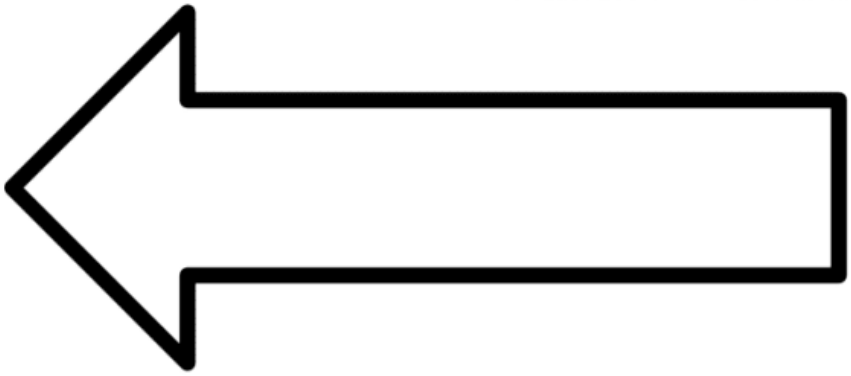


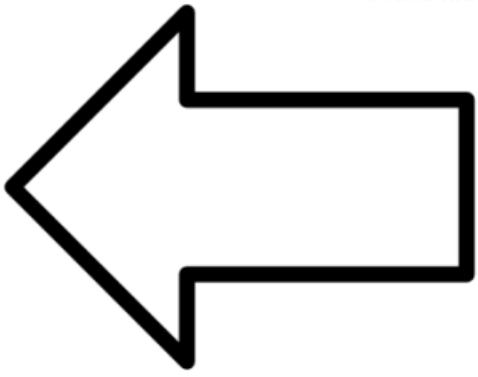


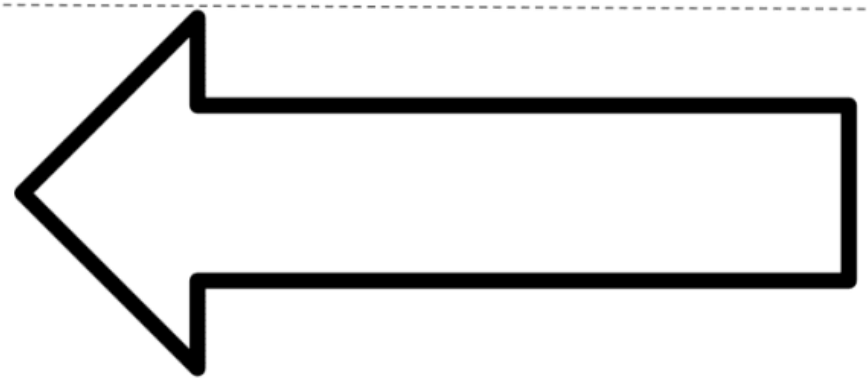


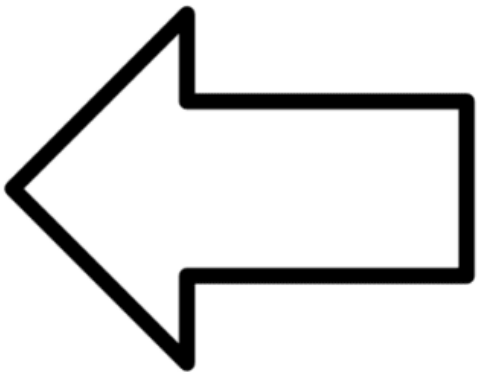


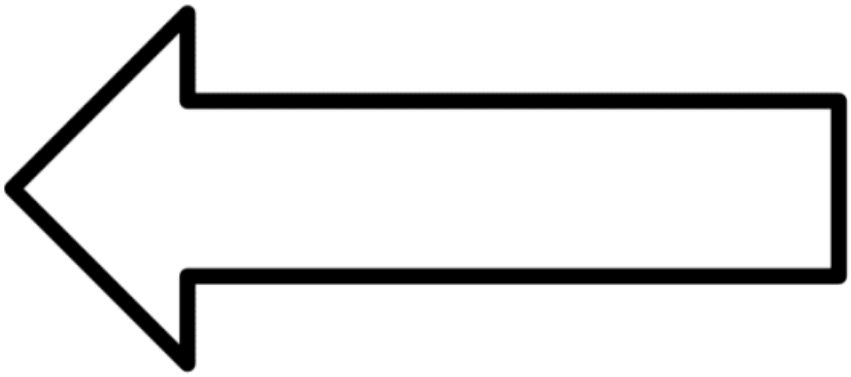


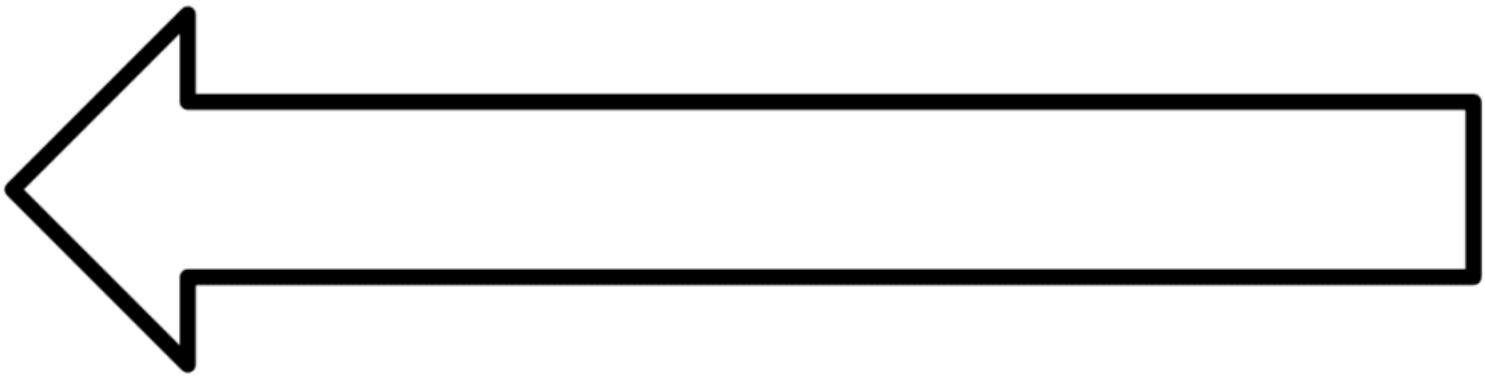


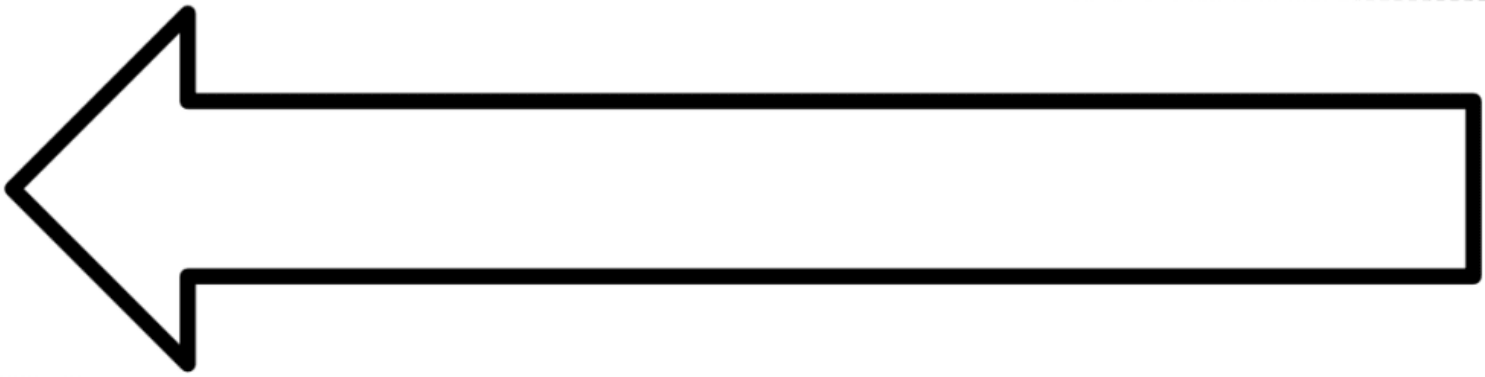


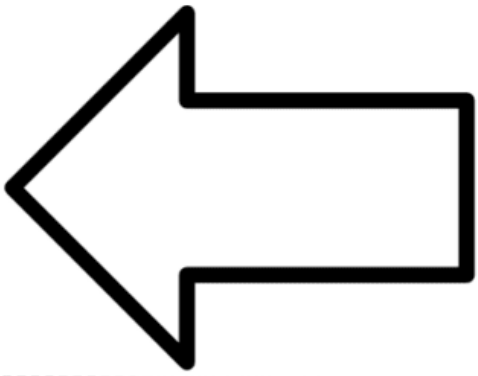


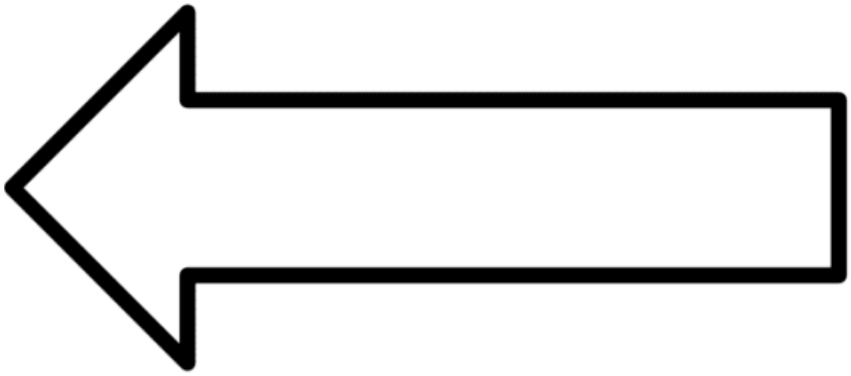


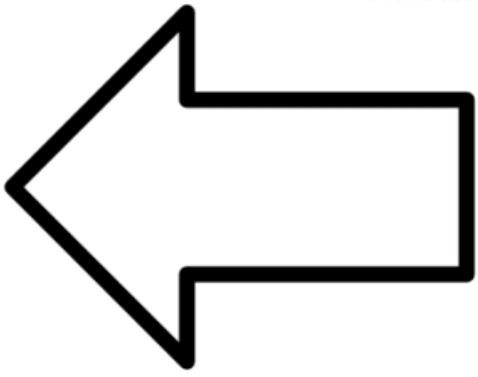


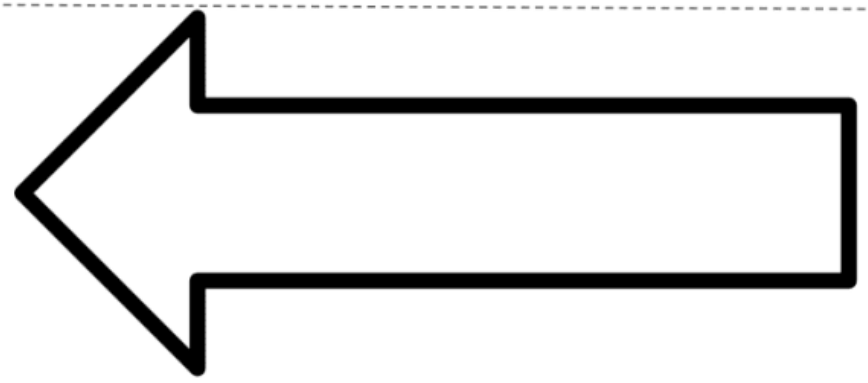


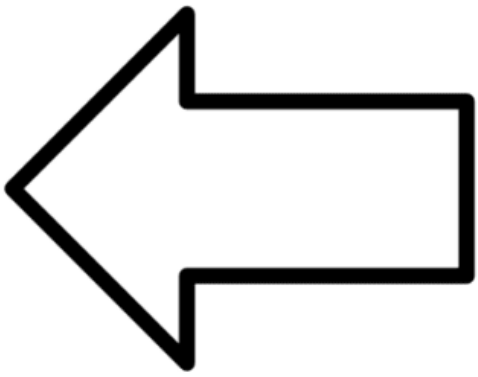


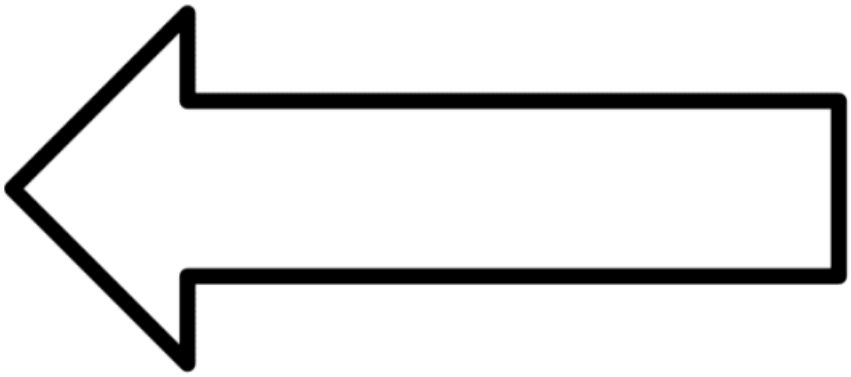










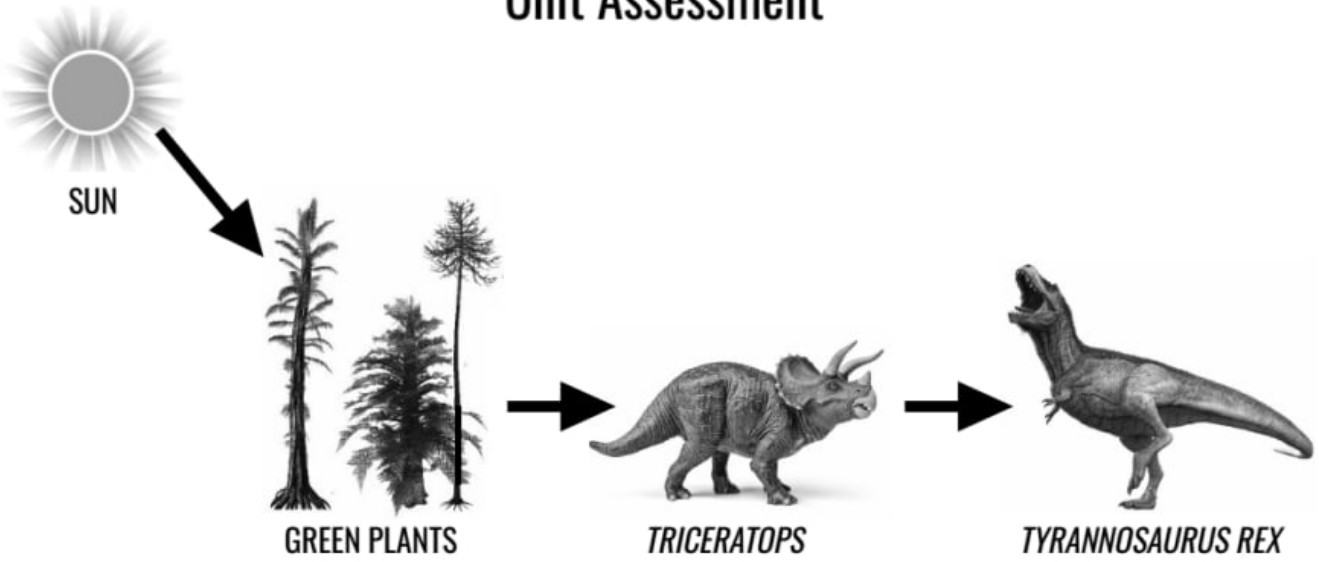


Ecosystems & The Food Web

Name: _____

Date: _____

Unit Assessment



The image above is a simple model of how energy flows through a dinosaur food chain. The arrows represent energy moving through the food chain. Use this model to answer Questions 1 & 2.

1. Scientists think that *Tyrannosaurus rex* was able to run at a speed of 12 miles per hour. Where did *T. rex* get the energy that it used to run when it was alive?

a. *T. rex* got its energy from *Triceratops*. That energy is not connected to the Sun.
b. *T. rex* got its energy from green plants, which got their energy from the Sun.
c. *T. rex* got its energy from eating *Triceratops*. *Triceratops* ate green plants and green plants got their energy from the Sun.
d. *T. rex* got its energy directly from the Sun.

2. Scientists think that the dinosaurs went extinct because an asteroid hit the Earth and created a giant dust cloud that covered up the Sun. Diego doesn't think this explanation makes sense. He says, "Some dinosaurs ate other dinosaurs to get their energy. Why would removing the Sun cause the carnivores to go extinct?" Explain to Diego why carnivores would go extinct without the Sun. You can use evidence from the energy model above.

_____

_____

_____

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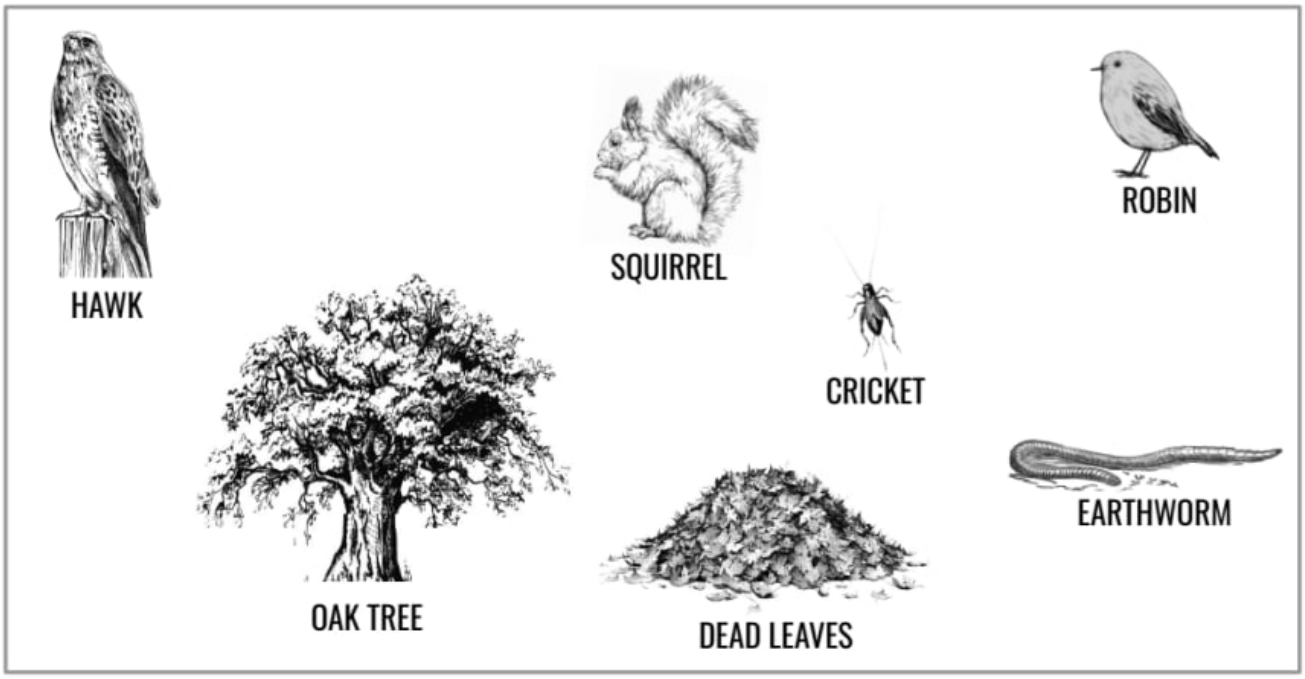


The images above show organisms that are part of a forest ecosystem. Use these images to answer Questions 3, 4, and 5.

3. Connect the organisms of the forest ecosystem with arrows to create food chains. Each arrow should point in the direction of how material (matter) travels in each food chain. For example, a squirrel eats acorns from an oak tree, so you would draw an arrow from the oak tree to the squirrel.

4. Scientists are worried that a disease that kills oak trees will spread into this forest. What would happen to this ecosystem if all the oak trees suddenly disappear? Choose all correct answers.

a. If there aren't any oak trees, the squirrels will not have anything to eat. They will need to find another food source or they will not survive.
b. If there aren't any oak trees, the robins will not have anything to eat. They will need to find another food source or they will not survive.
c. If there aren't any oak trees, the hawks may not have anything to eat because the squirrels and robins may not survive.

5. Amir released some pet frogs into the forest ecosystem shown above. These frogs eat earthworms and crickets. Hawks, robins, and squirrels do NOT eat these frogs. What will happen to this ecosystem if the frogs start living here? Choose all correct answers.

a. The dead leaves will pile up because the frogs will eat all the decomposers. The decomposers will not be there to eat the leaves.
b. The squirrels will not have anything to eat. They will need to find another food source or they will not survive.
c. The robins will not have anything to eat. They will need to find another food source or they will not survive.
d. The hawks will not have anything to eat. They will need to find another food source or they will not survive.

6. Ana wants to open a plant store, but she's worried that it will cost too much money. Ana thinks that as plants grow, they use the material from the soil to get bigger. Potting soil costs a lot of money. Ana is worried she will need to buy a lot of soil to feed her plants. She decides to set up an experiment. Ana grows one plant in a pot for 3 weeks. She weighs the plant and the soil at the start and end of the experiment.

	START	END
PLANT	300 grams	800 grams
SOIL	800 grams	800 grams

The results of Ana's experiment are shown to the right. What did Ana find out with her experiment? Circle TRUE or FALSE for each of the sentences below.

TRUE FALSE	The plant weighed the same at the start and end of the experiment.
TRUE FALSE	The plant weighed more at the end of the experiment.
TRUE FALSE	The soil weighed the same at the start and end of the experiment.
TRUE FALSE	The soil weighed less at the end of the experiment.

7. Do you think Ana should be worried about the cost of soil for her plant store? Why or why not? Provide an argument based on the results of her experiment.

_____

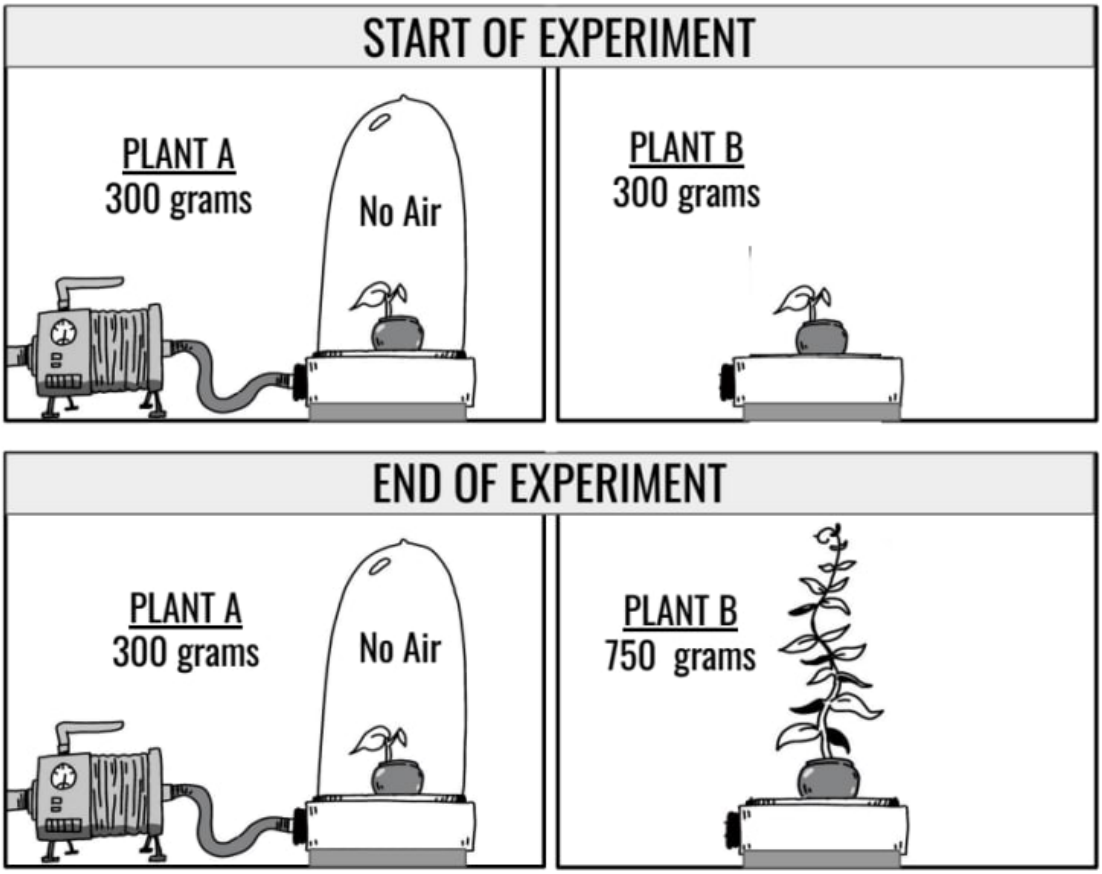
_____

_____

_____

_____

_____



Ana decides to do another experiment. She starts with two plants, Plant A and Plant B. Each plant weighs 300 grams. She attaches Plant A to a vacuum. The vacuum pumps all of the air out of the container around Plant A. Plant B is not attached to a vacuum, so it has air around it. Ana gives Plant A and Plant B the exact same amount of water. She runs the experiment for 3 weeks and then weighs the plants at the end of the experiment.

8. Looking at Ana's experiments, what is a claim that you can make about plants and their growth?

a. Plants mostly use materials from the soil for their growth.
b. Plants mostly use materials from water for their growth.
c. Plants mostly use materials from sunlight for their growth.
d. Plants mostly use materials from the air for their growth.

9. What evidence do you have to support your claim from the question above? Provide an argument using evidence from Ana's experiments to support your claim.

mystery science

Water Cycle & Earth's Systems

5th Grade • NGSS • Unit Worksheets

Lesson 1

How much water is in the world?

Lesson 2

How much salt is in the ocean?

Lesson 3

When you turn on the faucet, where does the water come from?

Lesson 4

Can we make it rain?

Lesson 5

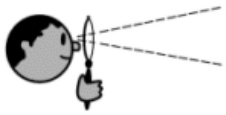
How can you save a town from a hurricane?

I am also curious about...

See-Think-Wonder Chart

Name: _____

mystery science

See	Think	Wonder
What did you observe? 	How can you explain what is happening? 	What questions do you have? 

Causes of the Dust Bowl

What I know

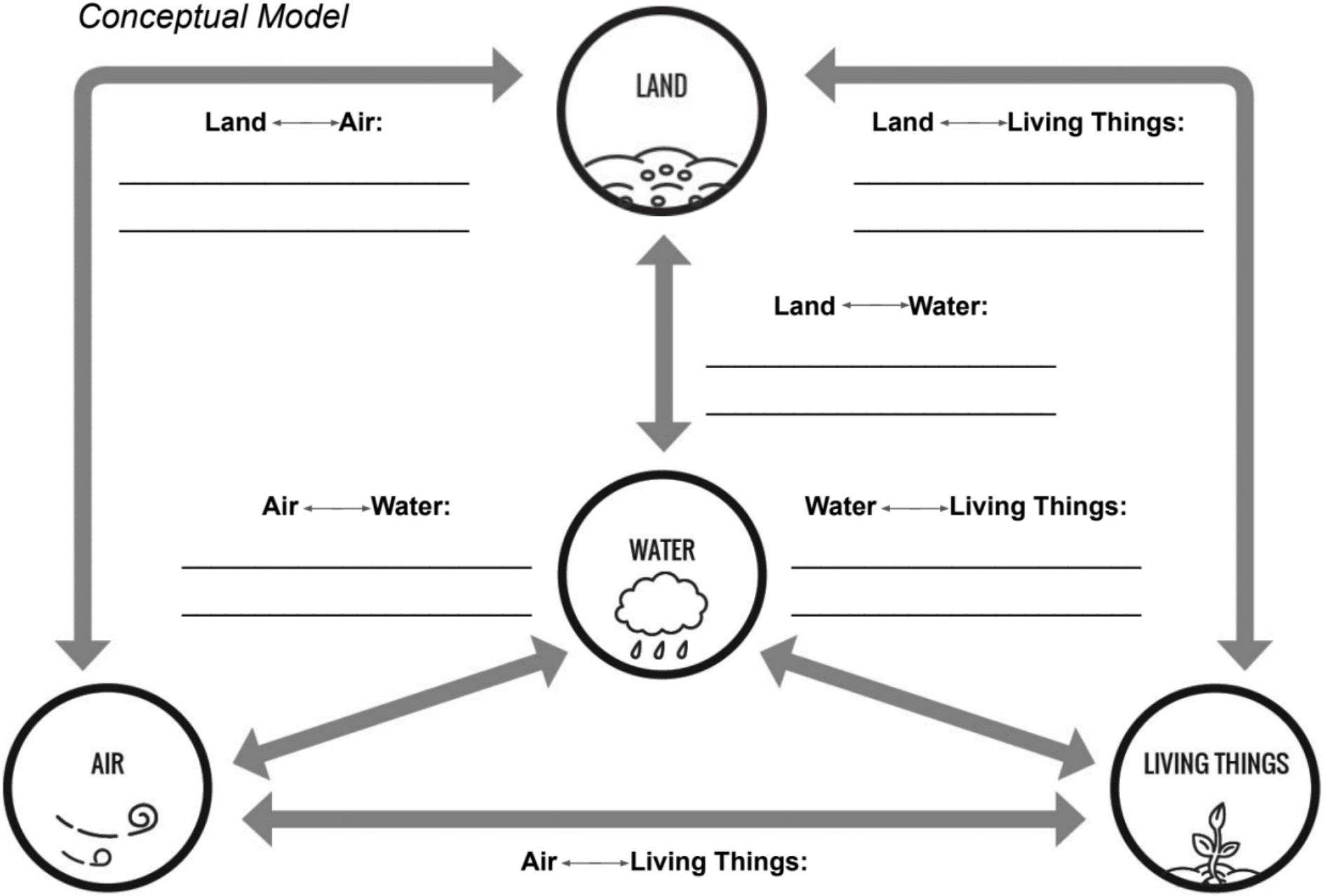
Name: _____

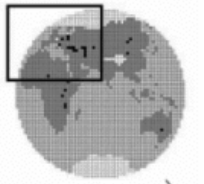
Directions: Describe what you know about the air, water, land, and living things during the Dust Bowl.

Causes of the Dust Bowl

Conceptual Model

Name: _____

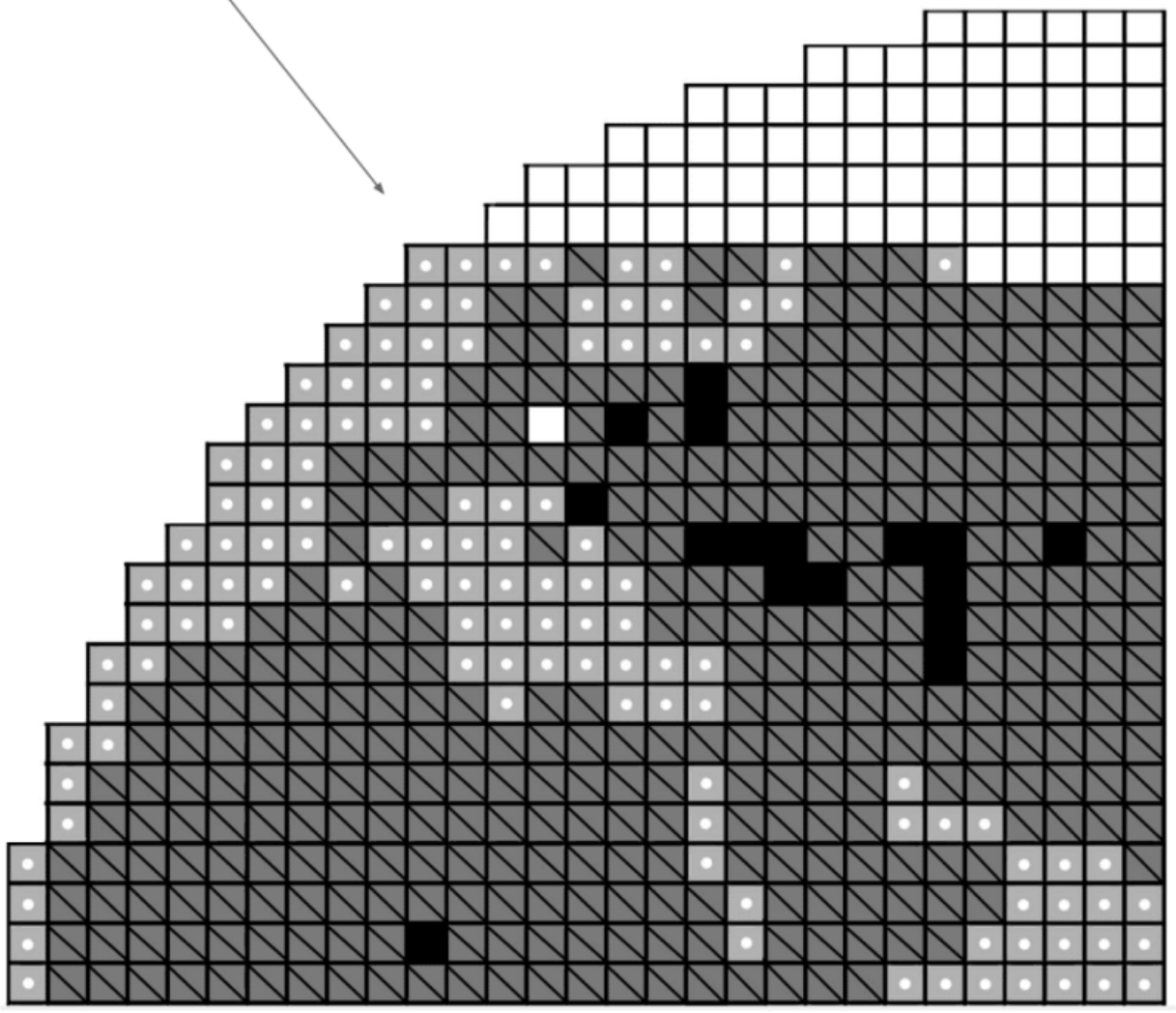




Map 1

mystery science
How much water is in the world?

Name: _____



1  How many squares of salt water are on your map?
_____ squares

2  How many squares of frozen fresh water are on your map?
_____ squares

3  How many squares of fresh water are on your map?
_____ squares

4  I have _____ squares of salt water. Divide by 50.
Stickers: ___ Remainder: _____

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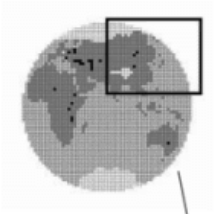
6  I have _____squares of fresh water. Divide by 50.
Stickers: ___ Remainder: _____

Fresh Water 

Frozen Fresh Water 

Salt Water 

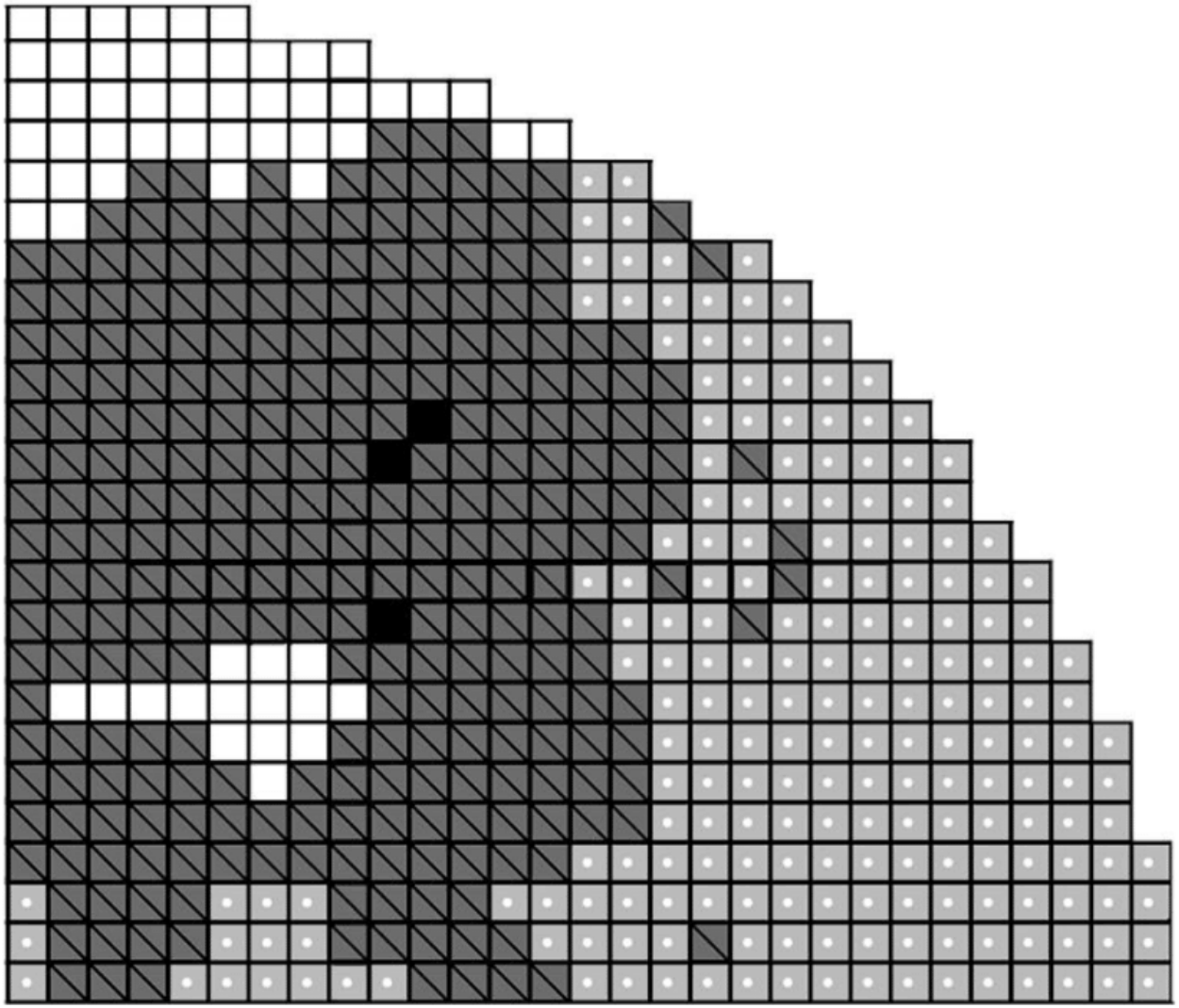
Land



Map 2

mystery science
How much water is in the world?

Name: _____



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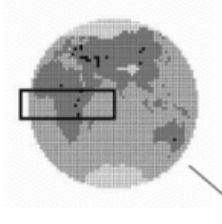
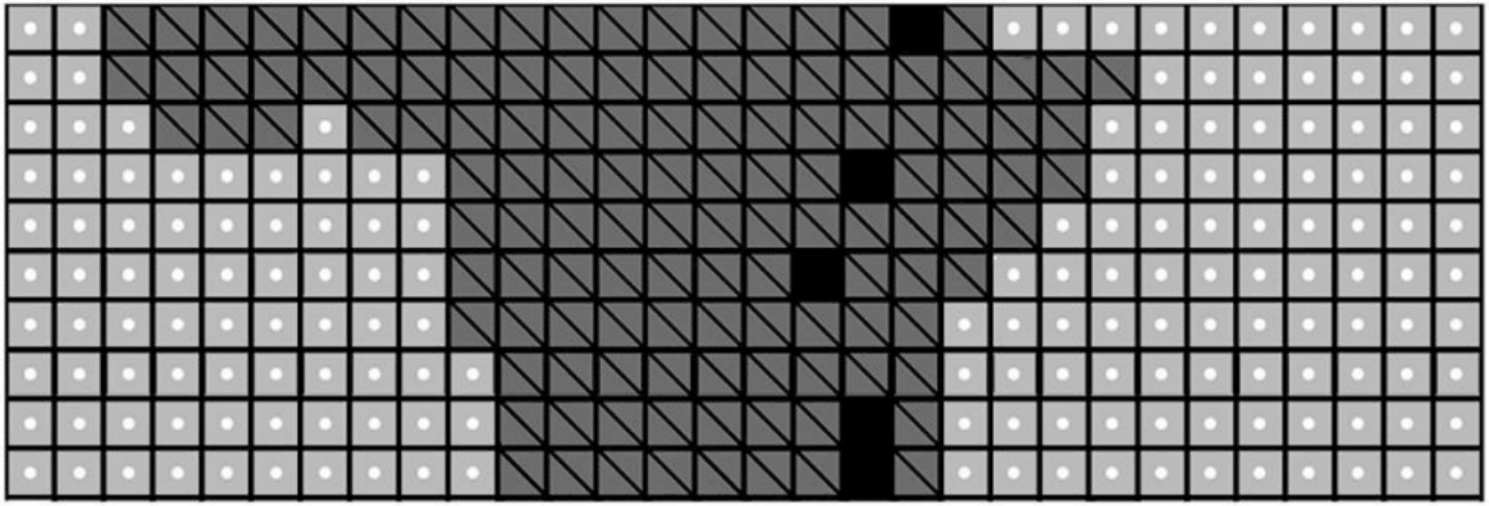
Fresh Water | Frozen Fresh Water | Salt Water | Land



Map 3

mystery science
How much water is in the world?

Name: _____



Fresh Water 

Frozen Fresh Water 

Salt Water 

Land

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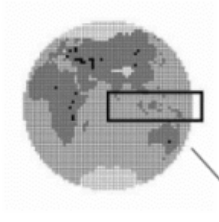
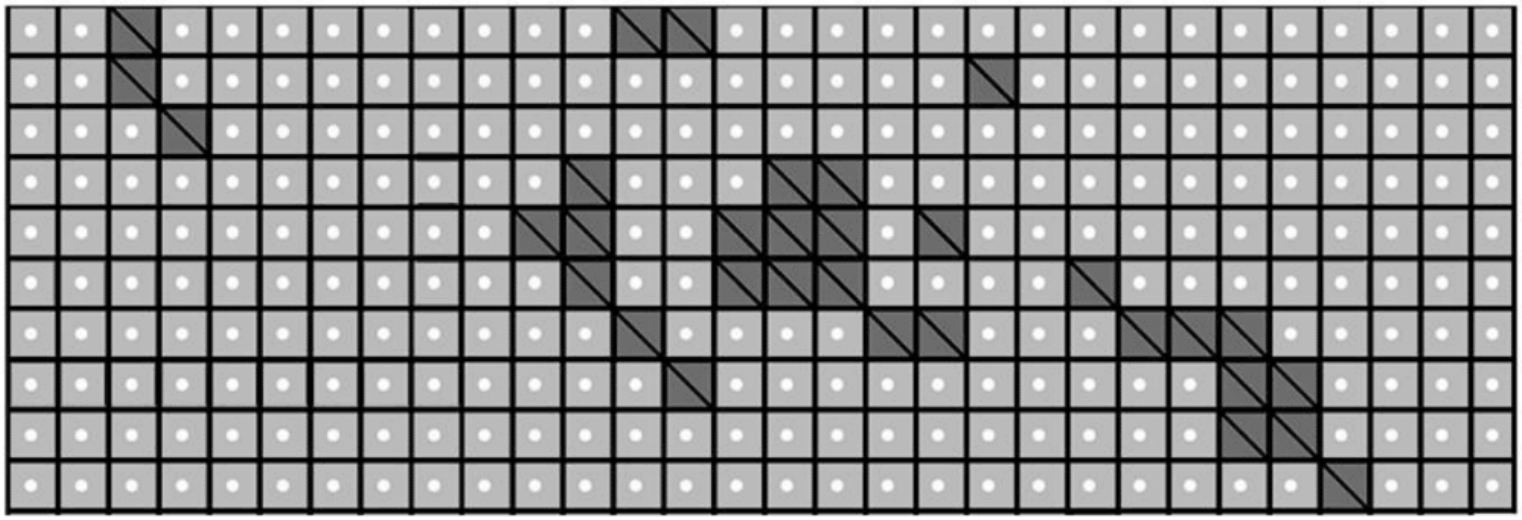


Map 4

mystery science
How much water is in the world?

Name:_____



Fresh Water 

Frozen Fresh Water 

Salt Water 

Land

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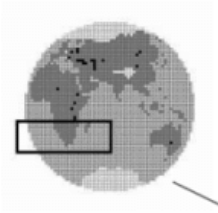
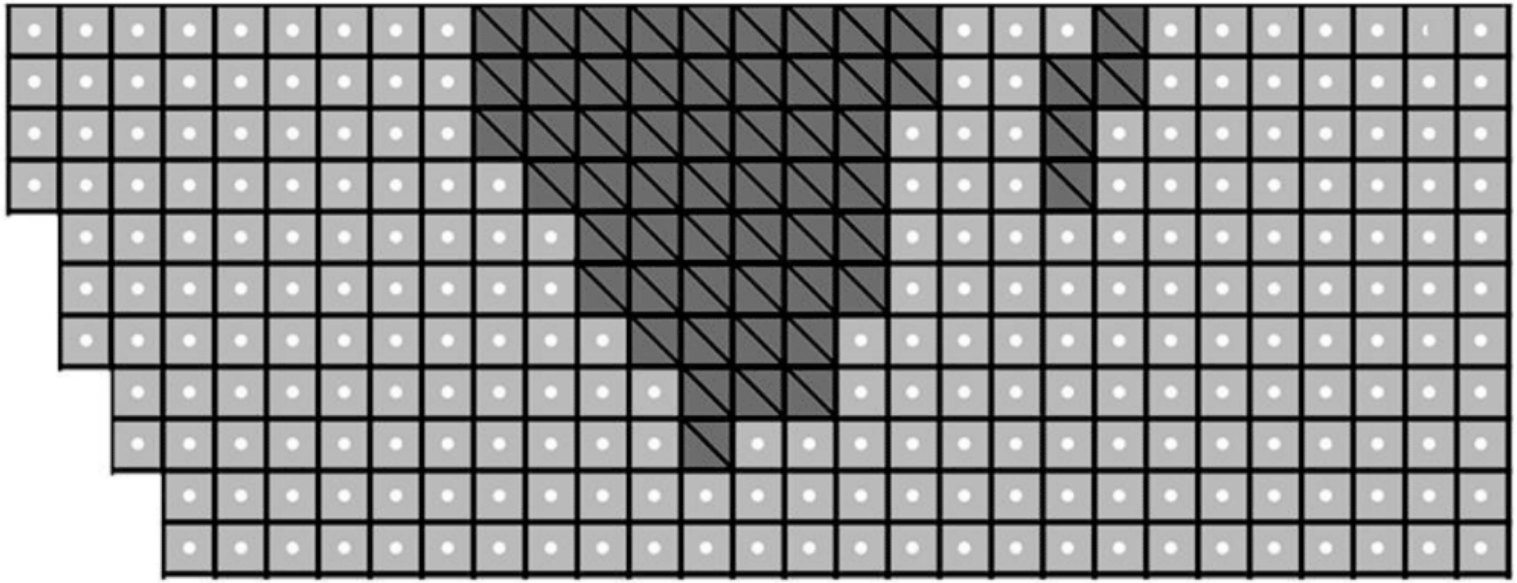


Map 5

mystery science
How much water is in the world?

Name: _____



Fresh Water | Frozen Fresh Water | Salt Water | Land

1 How many squares of <u>salt water</u> are on your map?
_____ squares

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_____ squares

3 How many squares of <u>fresh water</u> are on your map?
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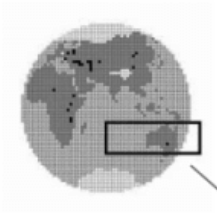
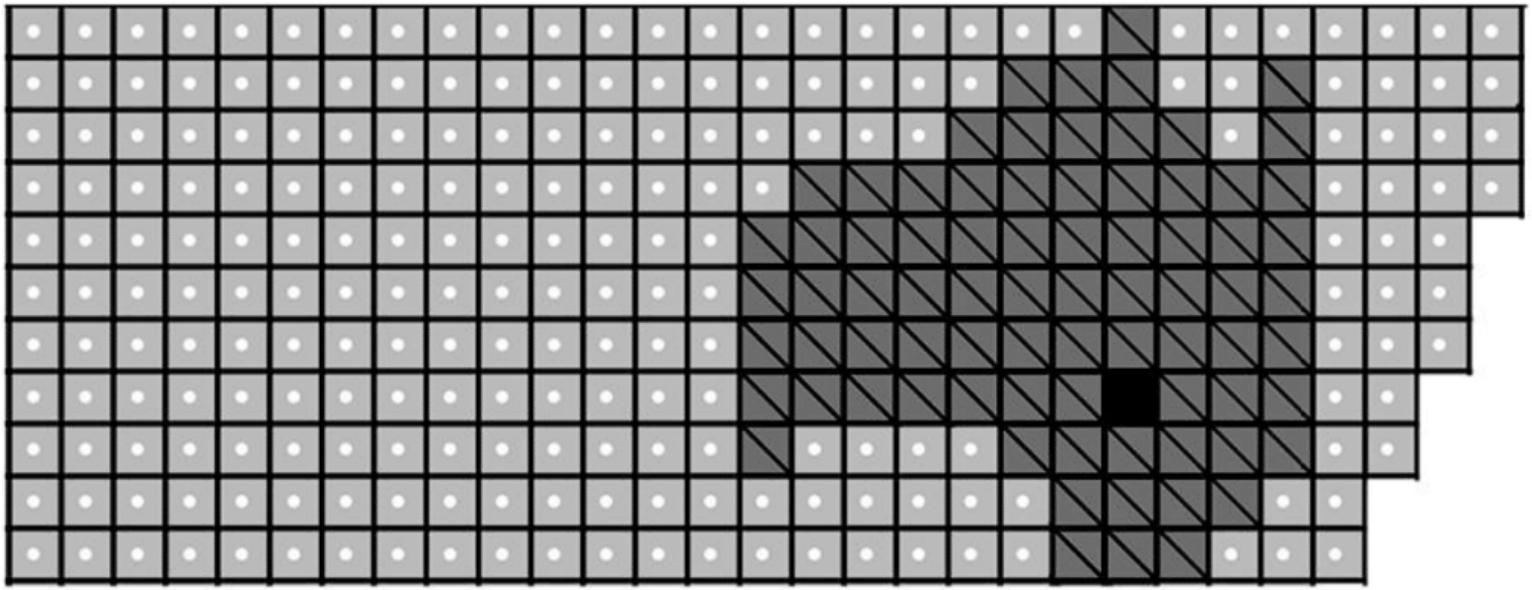


Map 6

mystery science
How much water is in the world?

Name: _____



Fresh Water | Frozen Fresh Water | Salt Water | Land

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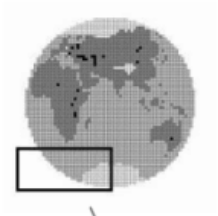
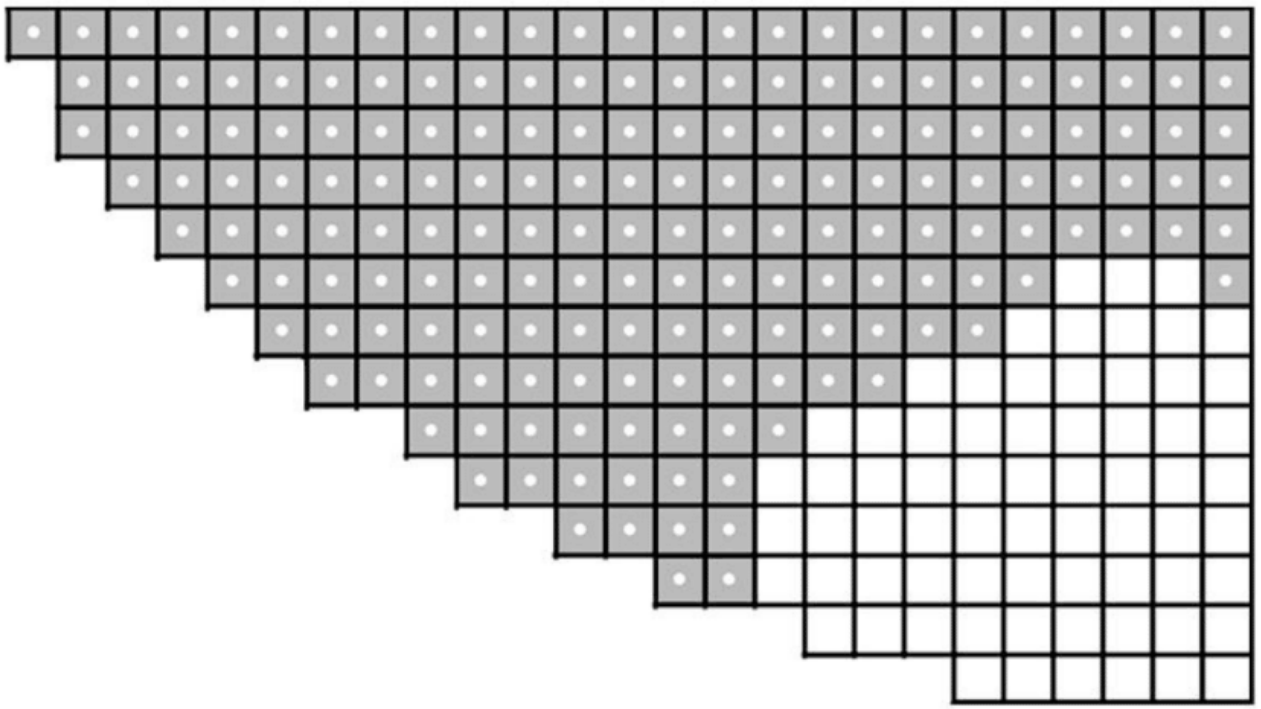


Map 7

mystery science
How much water is in the world?

Name: _____



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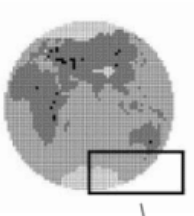
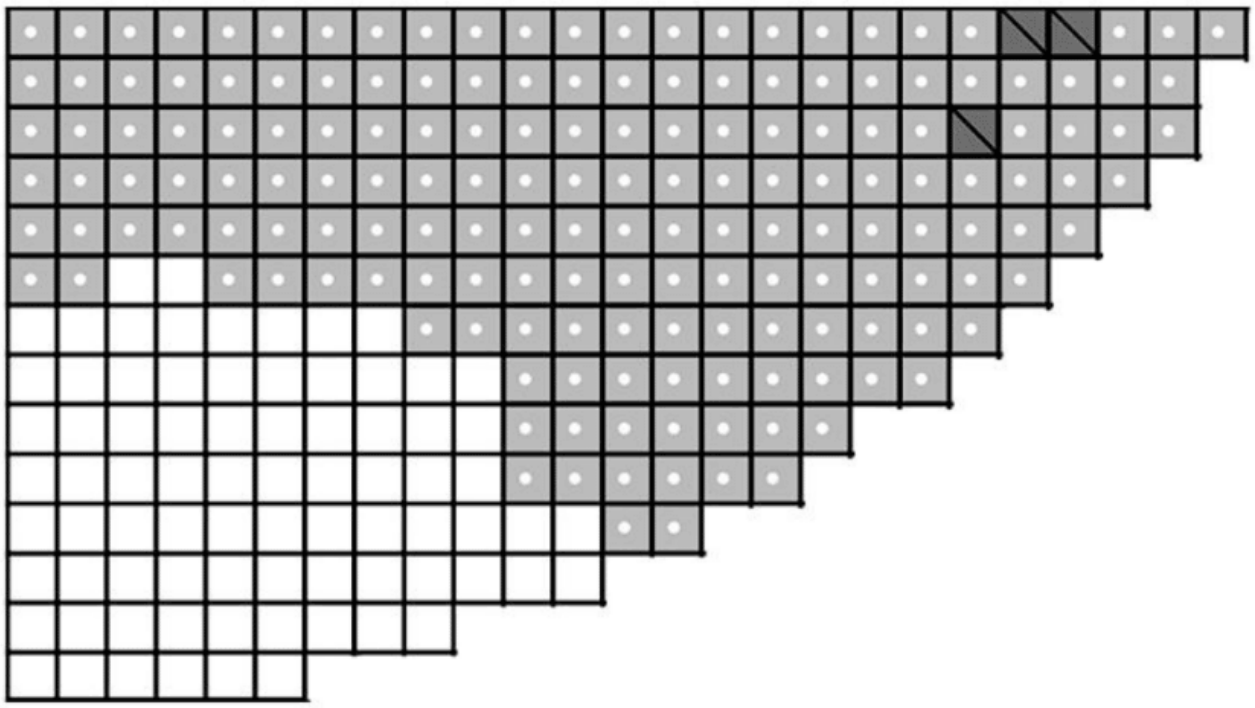
Fresh Water | Frozen Fresh Water | Salt Water | Land



Map 8

mystery science
How much water is in the world?

Name: _____



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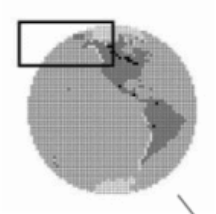
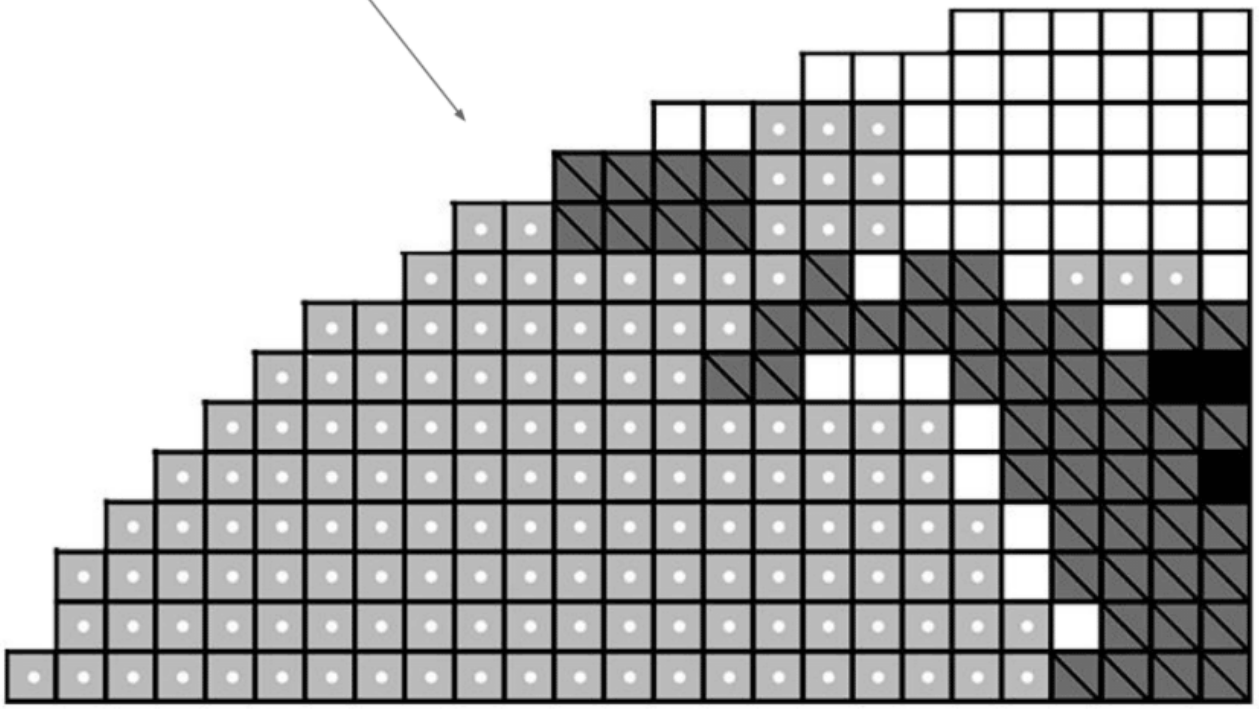
Fresh Water | Frozen Fresh Water | Salt Water | Land



Map 9

mystery science
How much water is in the world?

Name: _____



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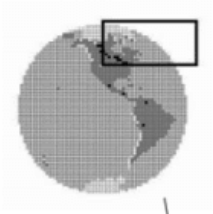
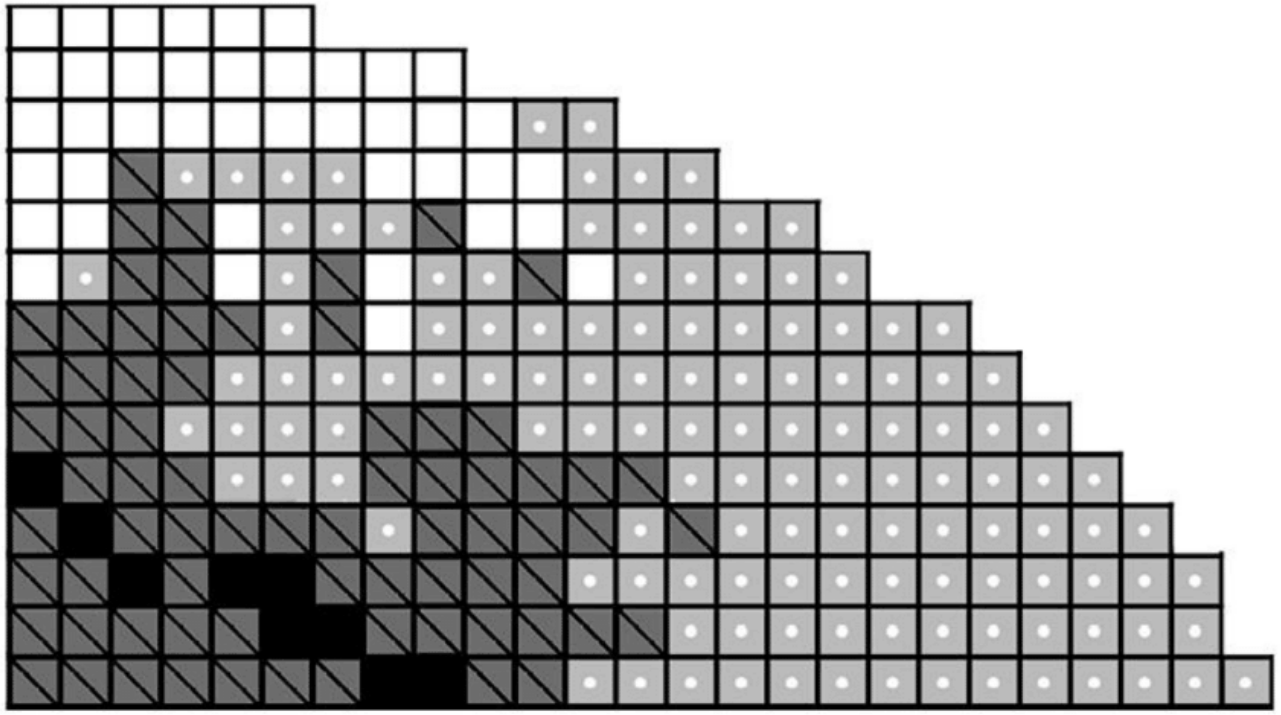
Fresh Water | Frozen Fresh Water | Salt Water | Land



Map 10

mystery science
How much water is in the world?

Name: _____



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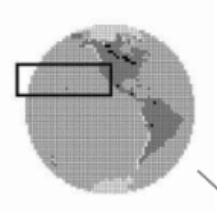
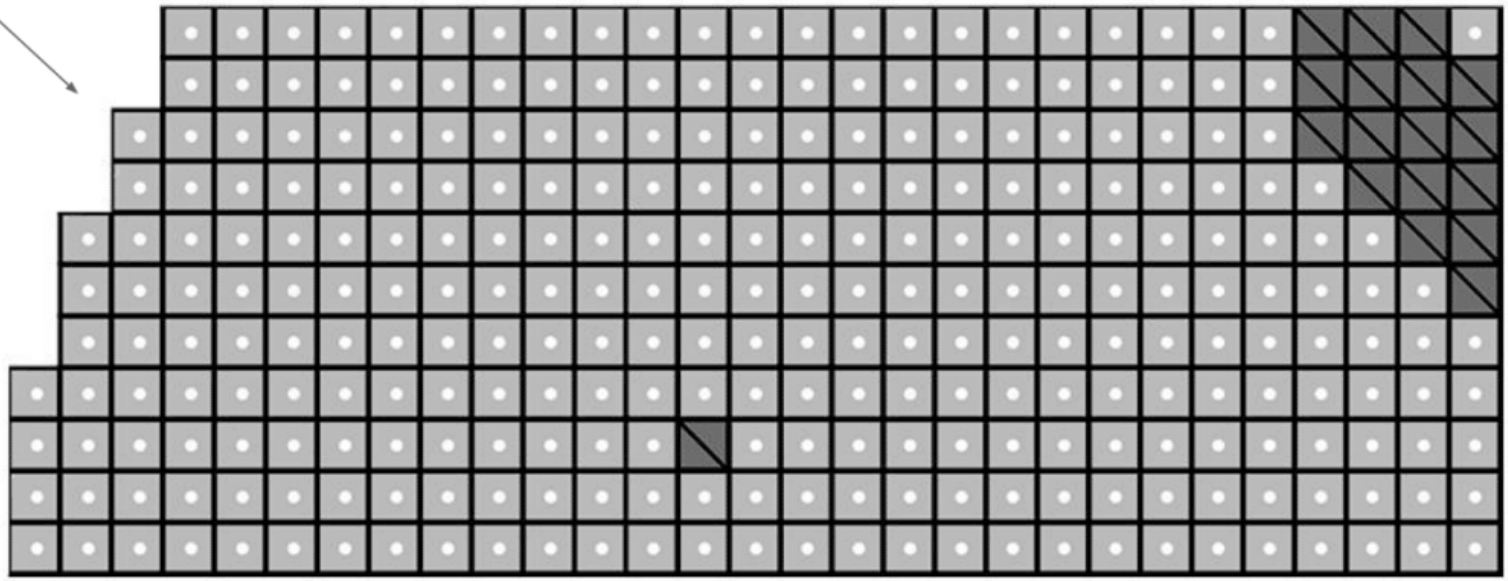
Fresh Water | Frozen Fresh Water | Salt Water | Land



Map 11

mystery science
How much water is in the world?

Name: _____



Fresh Water 

Frozen Fresh Water 

Salt Water 

Land

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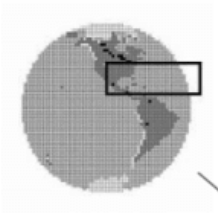
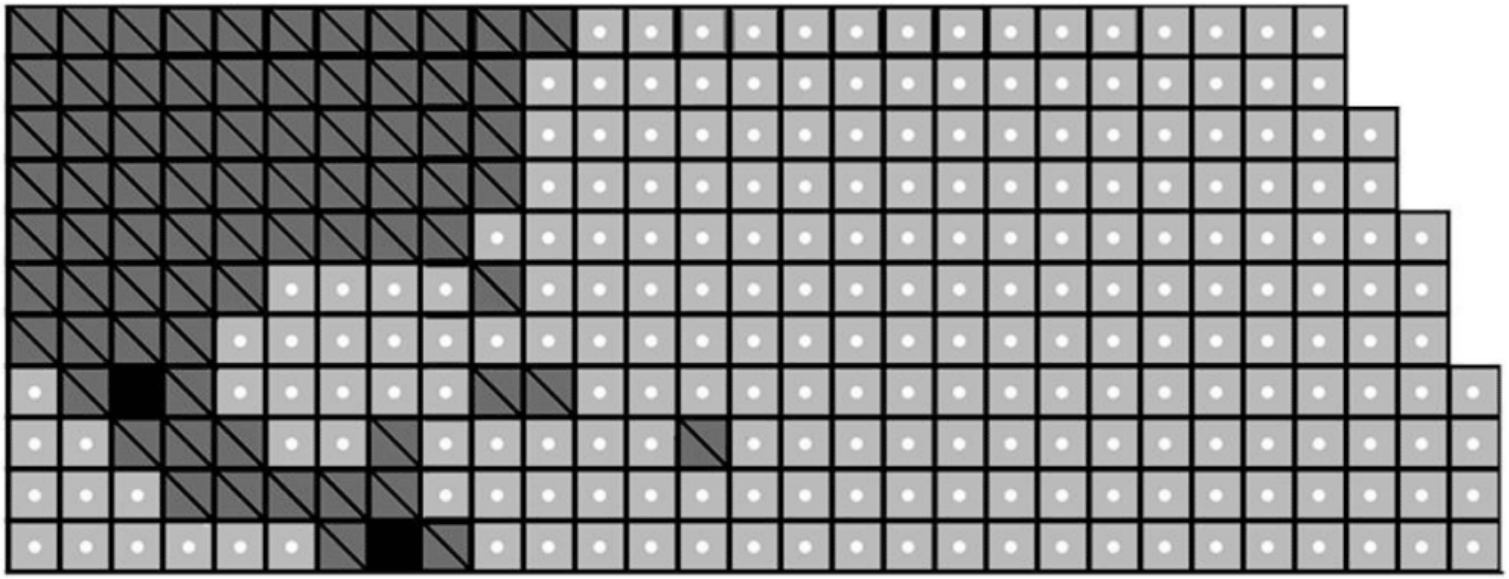


Map 12

mystery science
How much water is in the world?

Name: _____



Fresh Water

Frozen Fresh Water

Salt Water

Land

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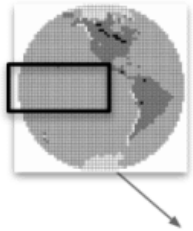
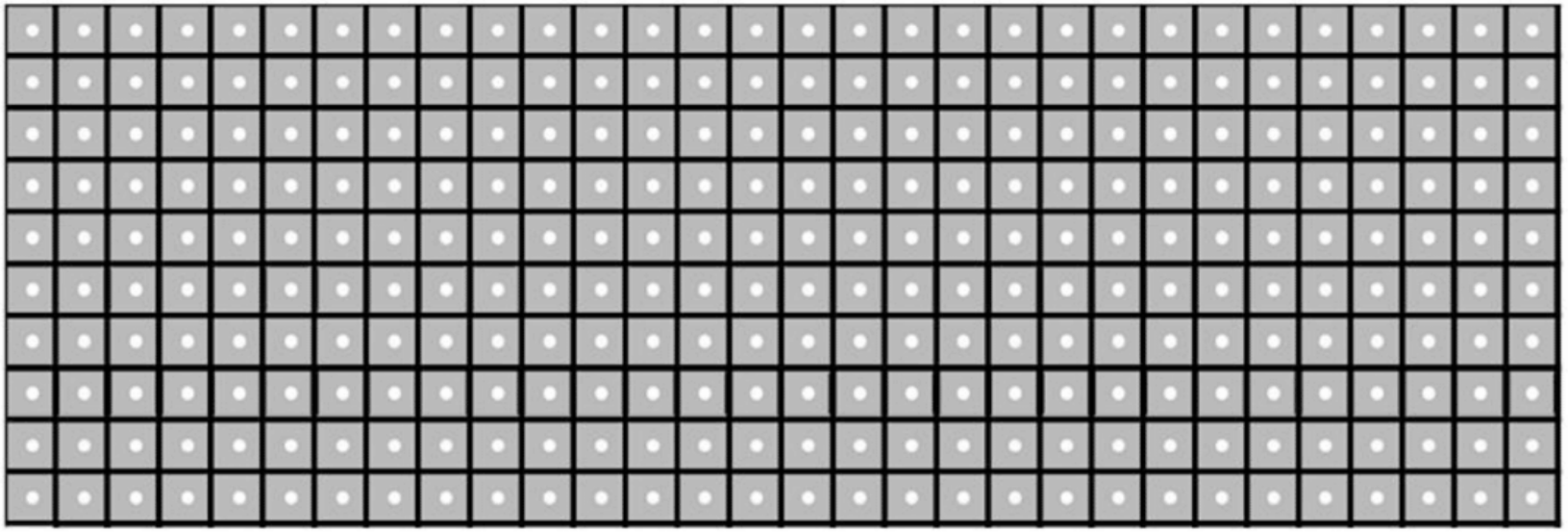


Map 13

mystery science
How much water is in the world?

Name: _____



Fresh Water 

Frozen Fresh Water 

Salt Water 

Land

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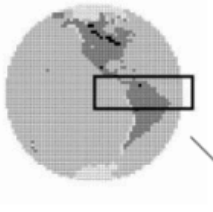
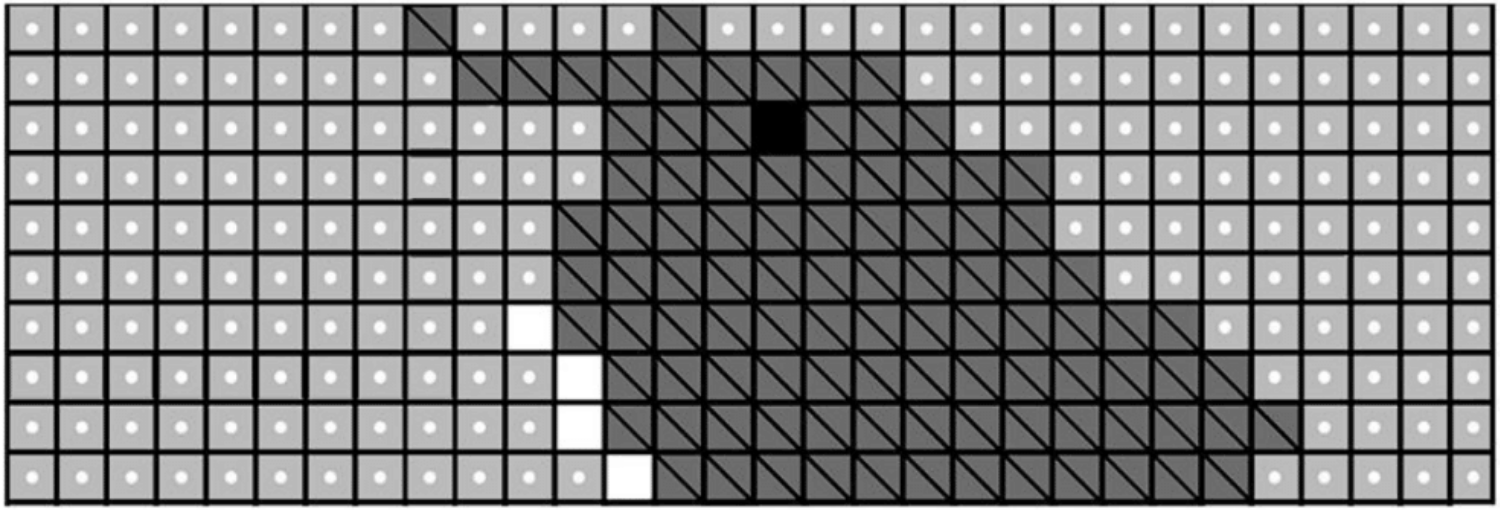


Map 14

mystery science
How much water is in the world?

Name: _____



Fresh Water 

Frozen Fresh Water 

Salt Water 

Land

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How many squares of <u>salt water</u> are on your map?
_____ squares

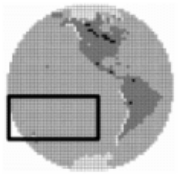
2 
How many squares of <u>frozen fresh water</u> are on your map?
_____ squares

3 
How many squares of <u>fresh water</u> are on your map?
_____ squares

4 
I have _____ squares of <u>salt water</u>.
Divide by 50. Stickers: ___ Remainder: _____

5 
I have _____ squares of <u>frozen fresh water</u>.
Divide by 50. Stickers: ___ Remainder: _____

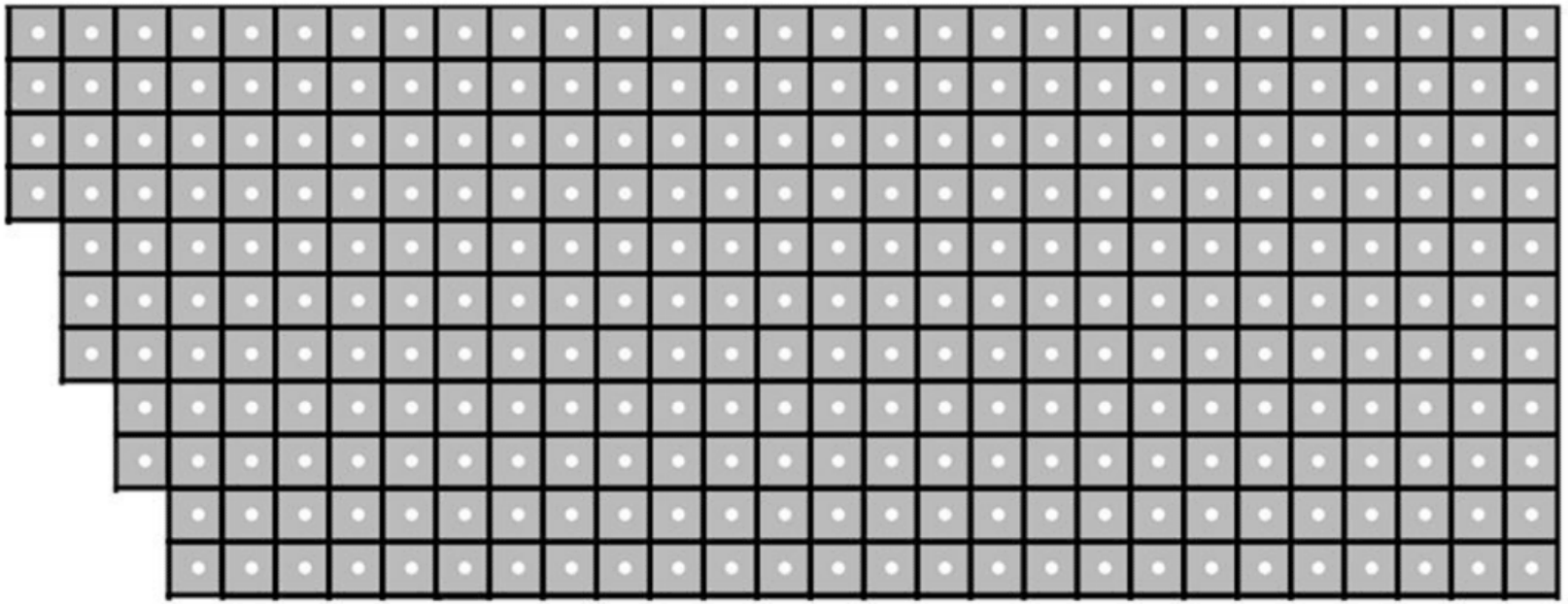
6 
I have _____squares of <u>fresh water</u>.
Divide by 50. Stickers: ___ Remainder: _____



Map 15

mystery science
How much water is in the world?

Name: _____



Fresh Water 

Frozen Fresh Water 

Salt Water 

Land

1 

How many squares of <u>salt water</u> are on your map?
_____ squares

2 

How many squares of <u>frozen fresh water</u> are on your map?
_____ squares

3 

How many squares of <u>fresh water</u> are on your map?
_____ squares

4 

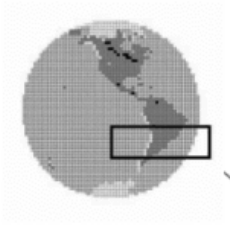
I have _____ squares of <u>salt water</u>.
Divide by 50. Stickers: ___ Remainder: _____

5 

I have _____ squares of <u>frozen fresh water</u>.
Divide by 50. Stickers: ___ Remainder: _____

6 

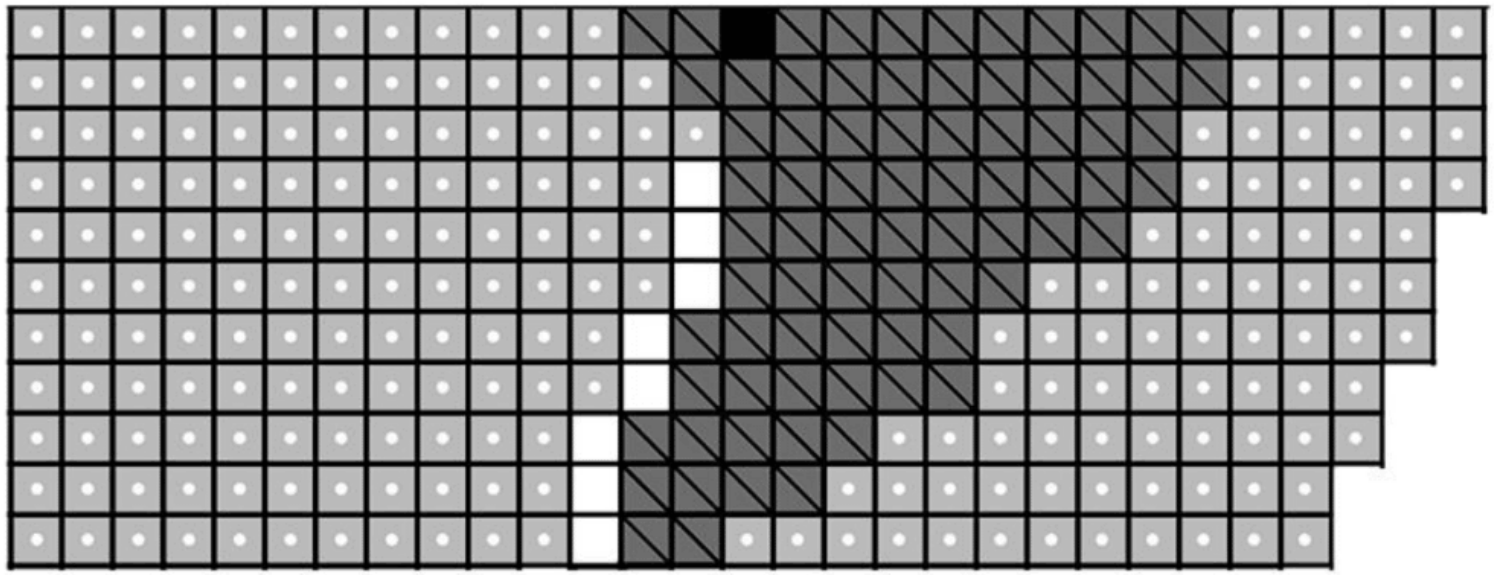
I have _____squares of <u>fresh water</u>.
Divide by 50. Stickers: ___ Remainder: _____



Map 16

mystery science
How much water is in the world?

Name: _____



Fresh Water 

Frozen Fresh Water 

Salt Water 

Land

1 
How many squares of <u>salt water</u> are on your map?
_____ squares

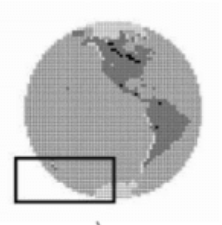
2 
How many squares of <u>frozen fresh water</u> are on your map?
_____ squares

3 
How many squares of <u>fresh water</u> are on your map?
_____ squares

4 
I have _____ squares of <u>salt water</u>.
Divide by 50. Stickers: ___ Remainder: _____

5 
I have _____ squares of <u>frozen fresh water</u>.
Divide by 50. Stickers: ___ Remainder: _____

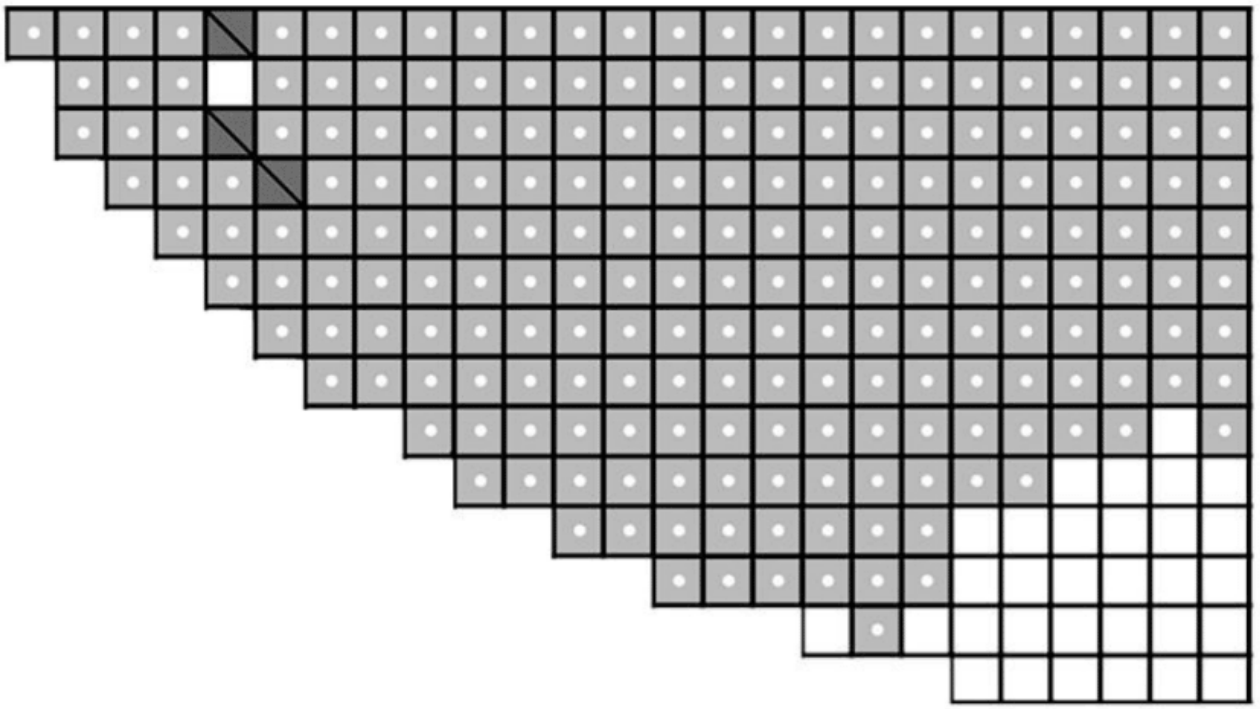
6 
I have _____squares of <u>fresh water</u>.
Divide by 50. Stickers: ___ Remainder: _____



Map 17

mystery science
How much water is in the world?

Name: _____



1 How many squares of salt water are on your map?
_____ squares

2 How many squares of frozen fresh water are on your map?
_____ squares

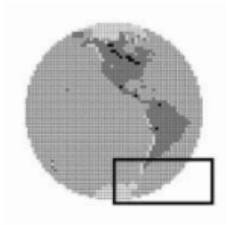
3 How many squares of fresh water are on your map?
_____ squares

4 I have _____ squares of salt water.
Divide by 50.
Stickers: ___ Remainder: _____

5 I have _____ squares of frozen fresh water. Divide by 50.
Stickers: ___ Remainder: _____

6 I have _____squares of fresh water.
Divide by 50.
Stickers: ___ Remainder: _____

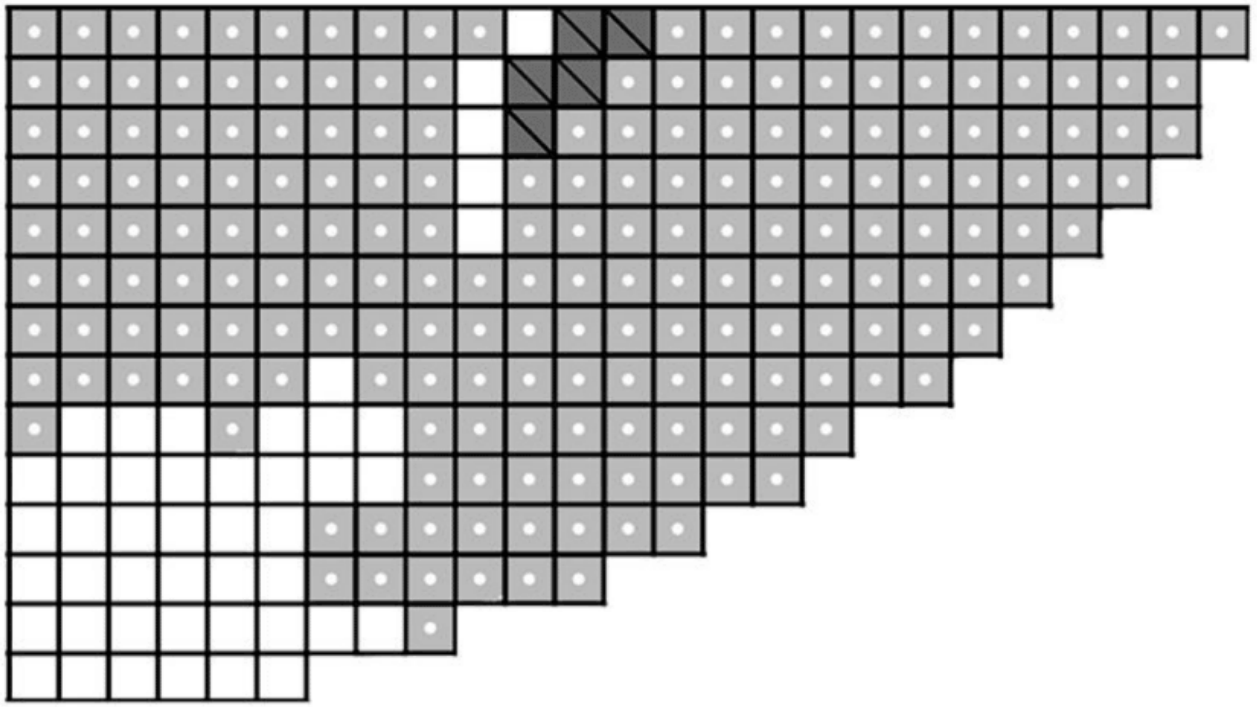
Fresh Water | Frozen Fresh Water | Salt Water | Land



Map 18

mystery science
How much water is in the world?

Name: _____



1 How many squares of salt water are on your map?
_____ squares

2 How many squares of frozen fresh water are on your map?
_____ squares

3 How many squares of fresh water are on your map?
_____ squares

4 I have _____ squares of salt water. Divide by 50.
Stickers: ___ Remainder: _____

5 I have _____ squares of frozen fresh water. Divide by 50.
Stickers: ___ Remainder: _____

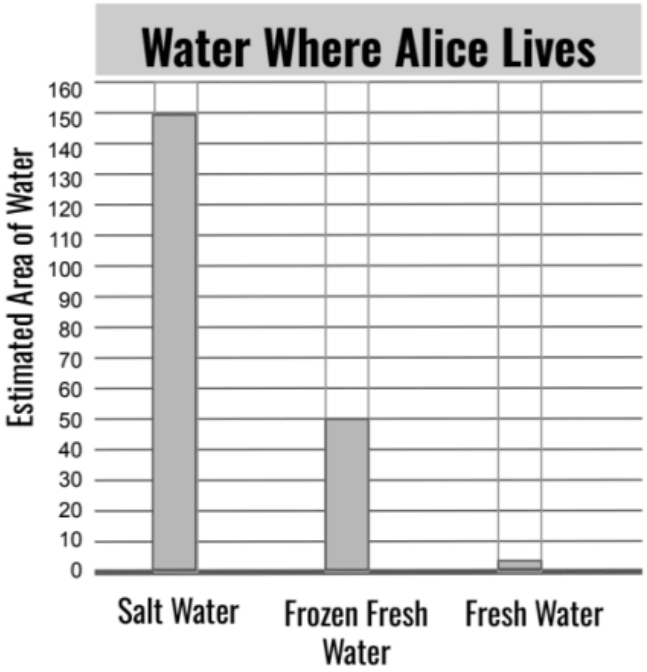
6 I have _____ squares of fresh water. Divide by 50. Stickers: ___
Remainder: _____

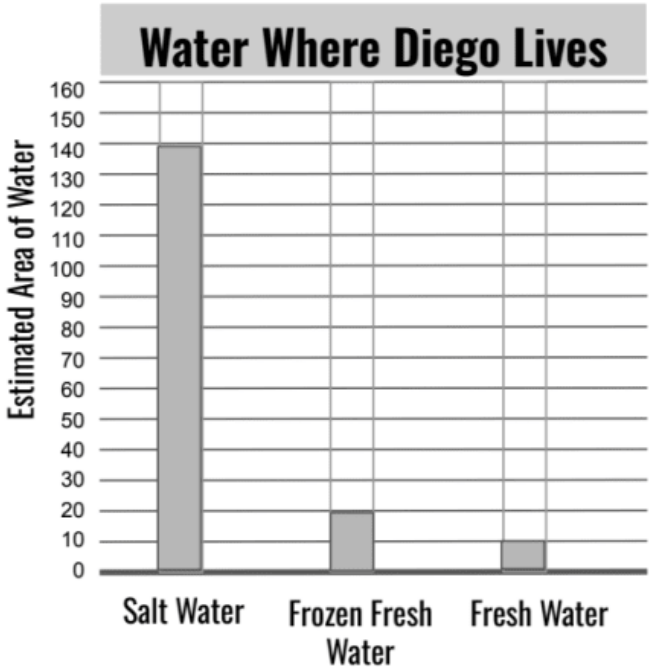
Fresh Water | Frozen Fresh Water | Salt Water | Land

Name: _____

Date: _____

Lesson Assessment





1. Alice and Diego are friends who live in different parts of the world. Alice lives in Alaska, USA, where there are many frozen ice caps. Diego lives in Ontario, Canada, where there are large fresh water lakes. The graphs above show the amounts of salt water, frozen fresh water, and fresh water where Alice lives and where Diego lives. Compare the information from the two graphs. Circle **True** or **False** for each sentence.

True False There is more salt water than frozen fresh water where Alice lives. There is more frozen fresh water than fresh water where Diego lives.

True False There is less salt water where Alice lives compared to the amount of salt water where Diego lives.

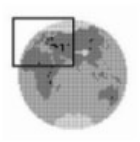
True False There is at least 3 times more frozen fresh water than fresh water where Alice lives.

2. Alice has more total fresh water where she lives, but Diego has more fresh water that is actually available to use (for drinking and washing his hands). Why is that?

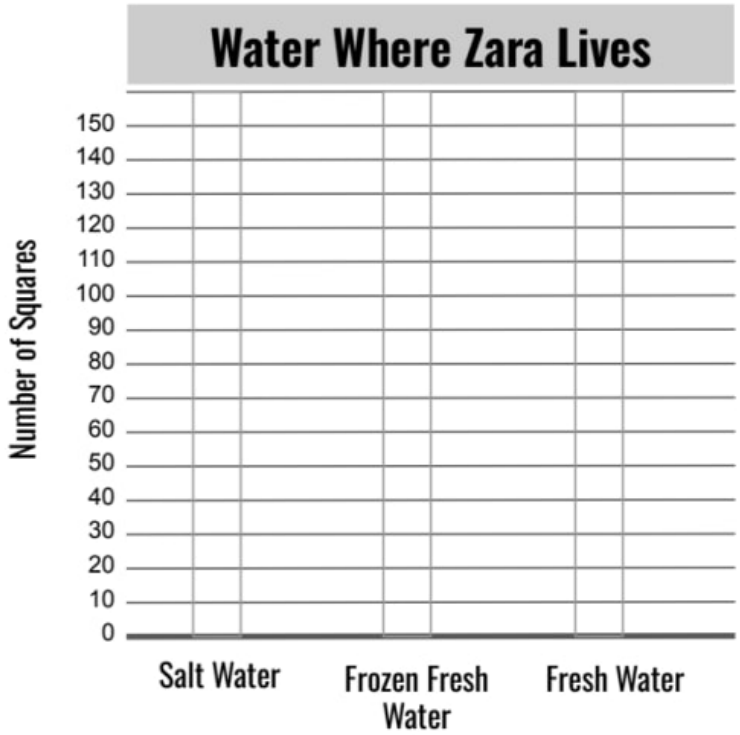
_____

_____

_____



3. Zara lives in Europe. She is curious about the types of water covering the surface of the Earth where she lives. The map above shows the types of water around Europe.The estimated surface areas of salt water, frozen fresh water, fresh water, and land are shown as squares in the image. Count up the squares of each type of water (salt water, frozen fresh water, fresh water) and use that information to complete the bar graph shown to the right. You do not need to count up or graph the squares of land.

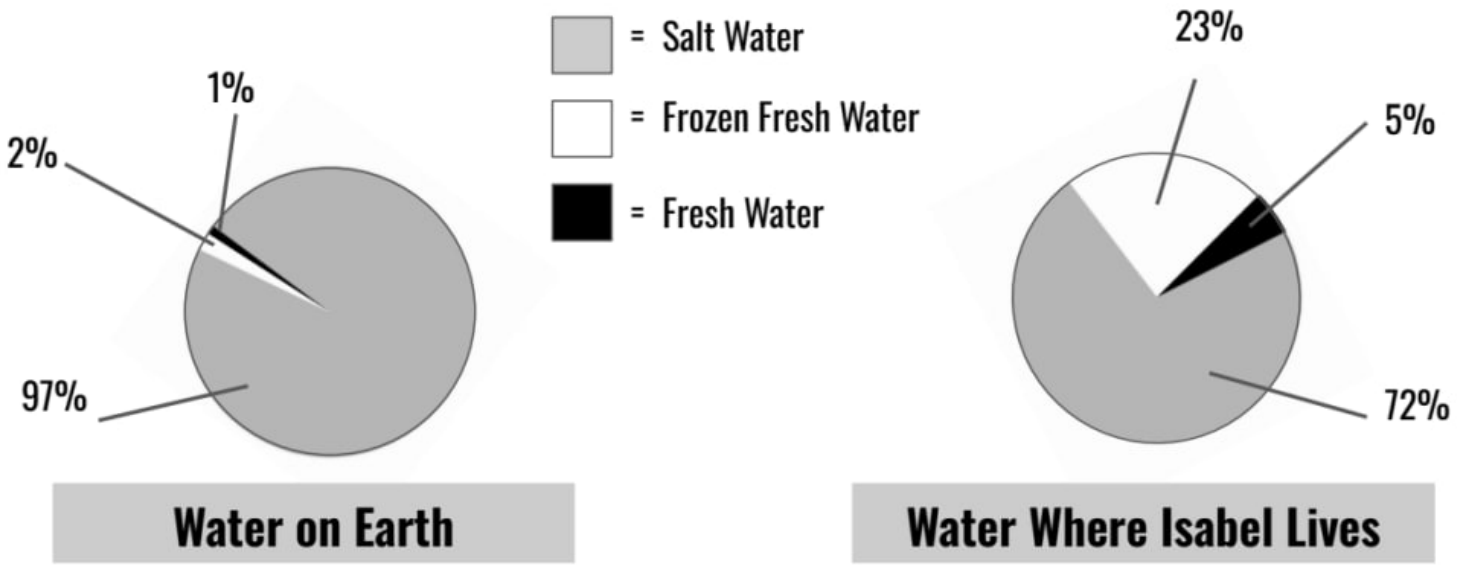


4. Using the bar graph you just created, answer each of the following statements.
Circle **True** or **False** for each sentence.

True False There is at least 2 times more salt water than frozen fresh water where Zara lives.

True False There is ½ as much fresh water as there is frozen fresh water where Zara lives.

True False Most of the fresh water is stored in frozen ice caps (glaciers) where Zara lives.



Isabel lives in a part of the world where there are many large natural lakes. She wants to know how the amount of fresh water found where she lives compares with the amount of fresh water found on the entire Earth. The pie chart on the left shows the percent of water types covering the surface of the entire Earth. The pie chart on the right shows the percent of water types covering the surface of the region of the Earth where Isabel lives.

5. Using information from the pie charts above, which of the following sentences are true? There may be more than 1 correct answer. Circle all correct answers.

a. The percentage of fresh water where Isabel lives is 5 times higher than the percentage of fresh water on the entire Earth.
b. The percentage of salt water where Isabel lives is ½ the percentage of salt water found on the entire Earth.
c. The percentage of frozen fresh water where Isabel lives is at least 10 times higher than the percentage of frozen fresh water elsewhere on Earth.

6. The pie chart above only shows the surface **areas** of water where Isabel lives. It does not consider the depth of water. If you made another pie chart that showed the **volumes** of salt water, frozen fresh water, and fresh water, describe how the pie chart would be different. (Hint: oceans are very deep—much deeper than most lakes and rivers.)

Tiny Ocean

Name: _____

1) What did your Tiny Ocean look like right after you added a teaspoon of salt? What does it look like now that you have mixed it? _____

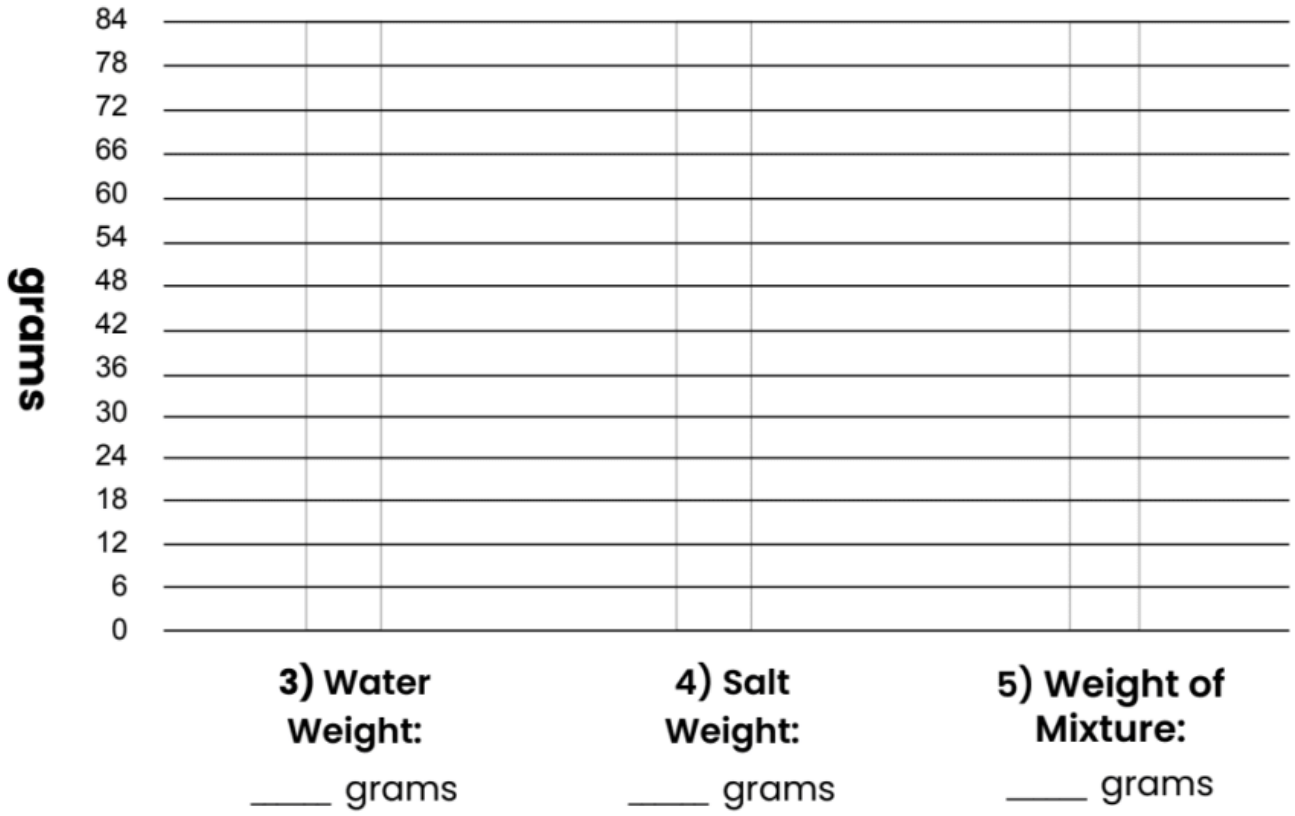
_____

2) What does your Tiny Ocean look like now that you added a second teaspoon of salt and mixed it?

_____

_____

Create a graph below:



3) Water Weight: _____ grams

4) Salt Weight: _____ grams

5) Weight of Mixture: _____ grams

6) How did weighing provide evidence that the salt is still in your Tiny Ocean? Answer this question **on the back of this worksheet.**

7) The name of this Tiny Ocean is: _____

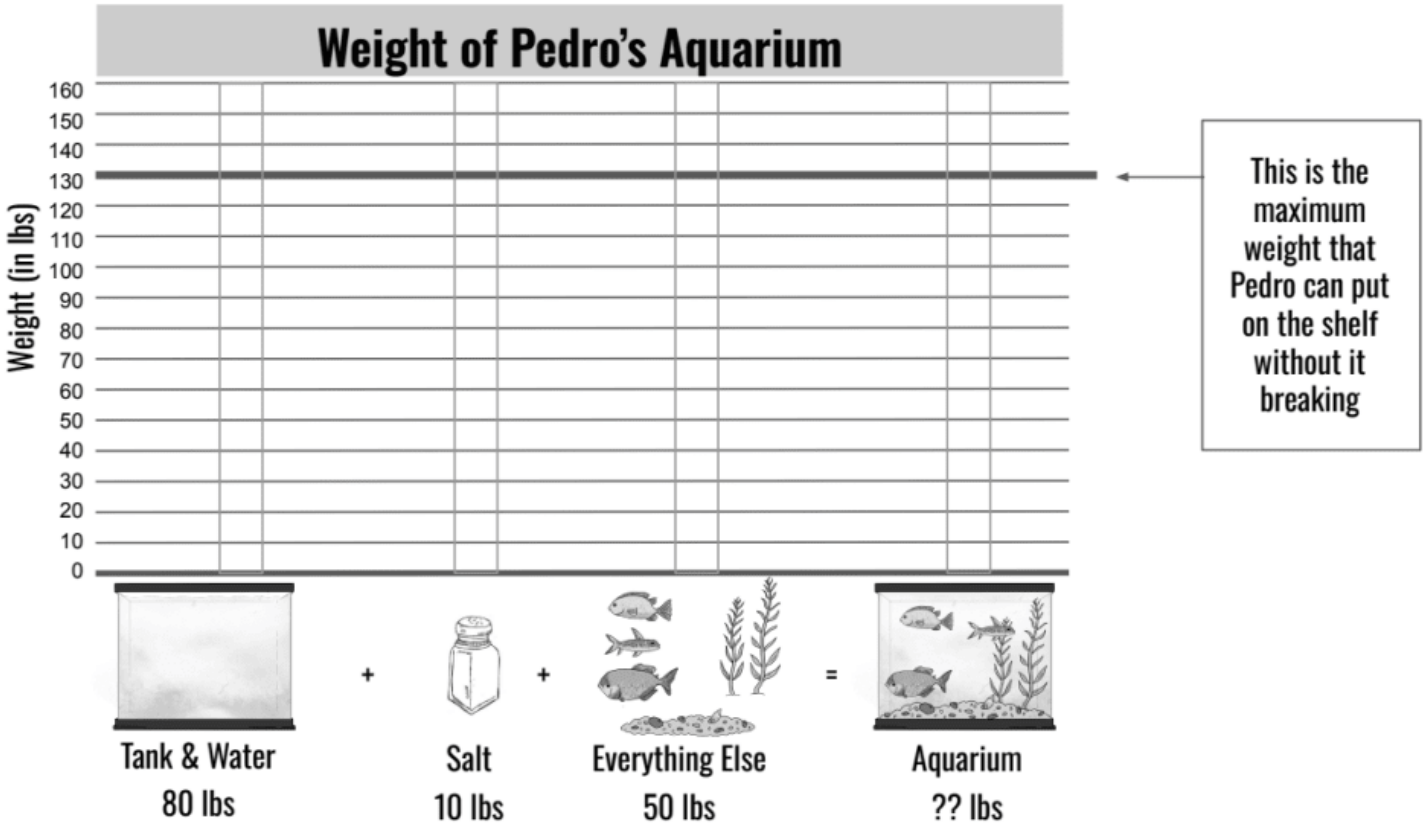
Name: _____

Date: _____

Lesson Assessment

1. Pedro wants a saltwater aquarium in his room. The only place where Pedro can fit the aquarium is on a shelf. The shelf can only hold 130 lbs of weight. Any more weight and the shelf will break!

Below are all the items that Pedro wants to include in his new aquarium. Even though fish float, all of their weight is added to the tank. Complete the bar graph below to show how much each item weighs, and figure out if it's a good idea for Pedro to put this aquarium on the shelf in his room.



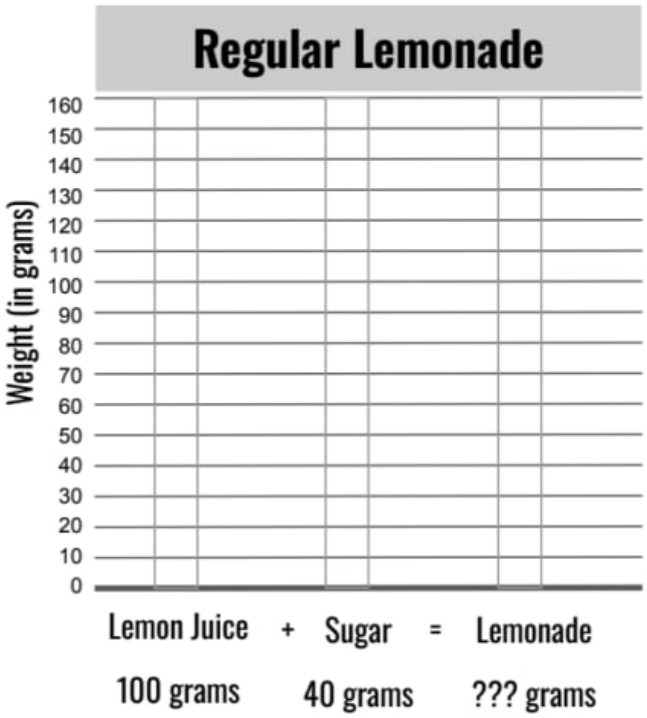
2. What can Pedro do to make sure his aquarium won't break the shelf?
Circle **True** or **False** for each statement.

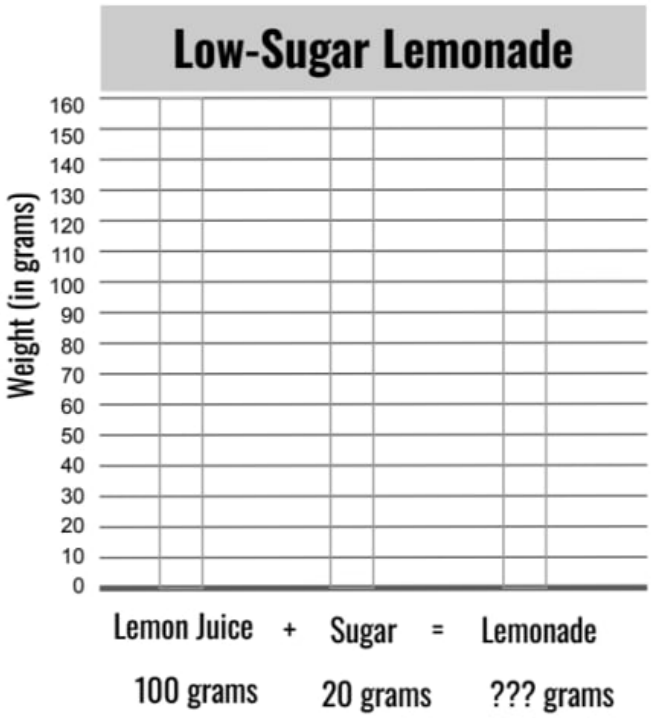
True False Pedro can build the saltwater aquarium as planned. The weight of the aquarium won't break the shelf.

True False Pedro could include fewer fish, plants, or rocks in the tank. This would lower the overall weight of the aquarium.

True False Pedro could keep the same number of fish, plants, and rocks in the tank. But he could decide to have a freshwater aquarium (instead of a saltwater aquarium).

3. Mai has a lemonade business. Her customers love her lemonade because the ingredients are very simple—she only uses lemon juice and sugar. Mai is starting to sell her lemonade in stores. She needs to figure out how much her lemonade weighs so that it can be safely shipped on a truck. Mai makes two types of lemonade. She makes regular lemonade, but she also makes a low-sugar lemonade that contains half the amount of sugar. Look at the weights shown below each ingredient. Add a bar to each graph to show how much the lemon juice, sugar, and lemonade weigh.





4. The bar graphs you just created show how much each bottle of regular lemonade weighs and how much each bottle of low-sugar lemonade weighs. Using the bar graphs you just created, answer each of the following statements. Circle **True** or **False** for each.

True False Once the sugar dissolves in the lemon juice, it completely vanishes. The sugar doesn't add weight to the lemonade. Mai can put the same number of bottles of regular lemonade and low-sugar lemonade in each truck because the weight is the same.

True False Once the sugar dissolves in the lemon juice, it looks like it vanishes, but it is actually still there. The sugar adds weight to the lemonade. So Mai will have to put fewer bottles of regular lemonade in a truck than low-sugar lemonade because the regular lemonade weighs more.

True False Once the sugar dissolves in the lemon juice, it looks like it vanishes, but it is actually still there. You can tell the sugar is still there because the lemonade tastes sweet. But the weight of the lemonade will NOT change based on the amount of sugar you add to the lemon juice.

Mystery Mountains

When you turn on the faucet, where does the water come from?

Where will you dig a well?
Your life depends on finding water!

Name: _____

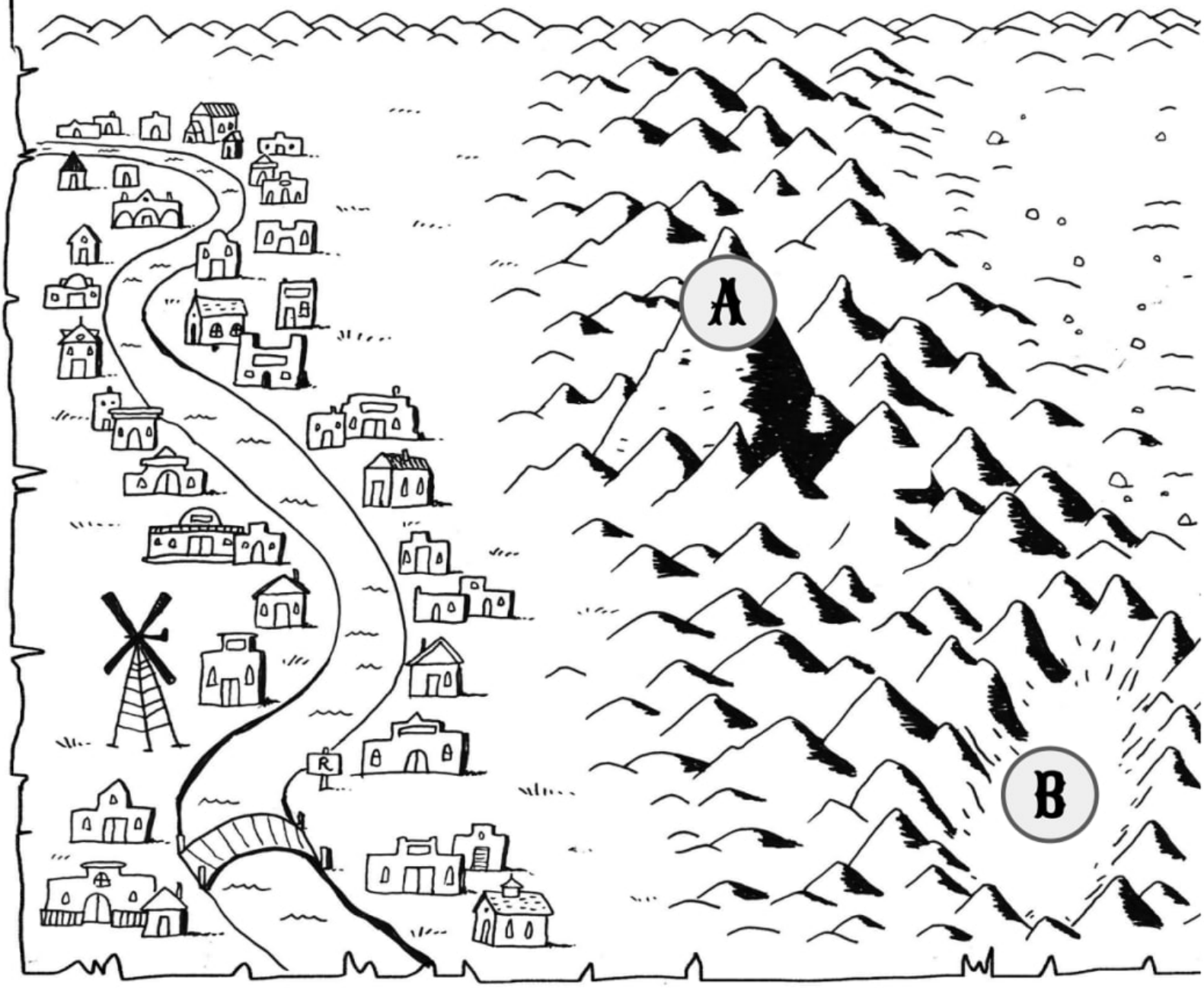
Wild West Nickname: _____

A - On a Beautiful Mountainside

1. **LAND:** If there's an aquifer here, I think it's:
   - ☐ near the surface. ☐ too far down to reach.
2. **PLANTS:** I think plant roots here get water from:
   - ☐ seasonal rains. ☐ an aquifer (underground water).
3. **ROCKS & SOIL :** I think the soil here will:
   - ☐ be easy to dig in. It's porous. Rain soaks in.
   - ☐ be hard to dig in. It's not porous. Rain won't soak in.
   - ☐ make the water undrinkable due to salt or poison.

B - Surrounded by Mountains

1. **LAND:** If there's an aquifer here, I think it's:
   - ☐ near the surface. ☐ too far down to reach.
2. **PLANTS:** I think plant roots here get water from:
   - ☐ seasonal rains. ☐ an aquifer (underground water).
3. **ROCKS & SOIL:** I think the soil here will:
   - ☐ be easy to dig in. It's porous. Rain soaks in.
   - ☐ be hard to dig in. It's not porous. Rain won't soak in.
   - ☐ make the water undrinkable due to salt or poison.



Thirsty Hills

When you turn on the faucet, where does the water come from?

Where will you dig a well?
Your life depends on finding water!

Name: _____

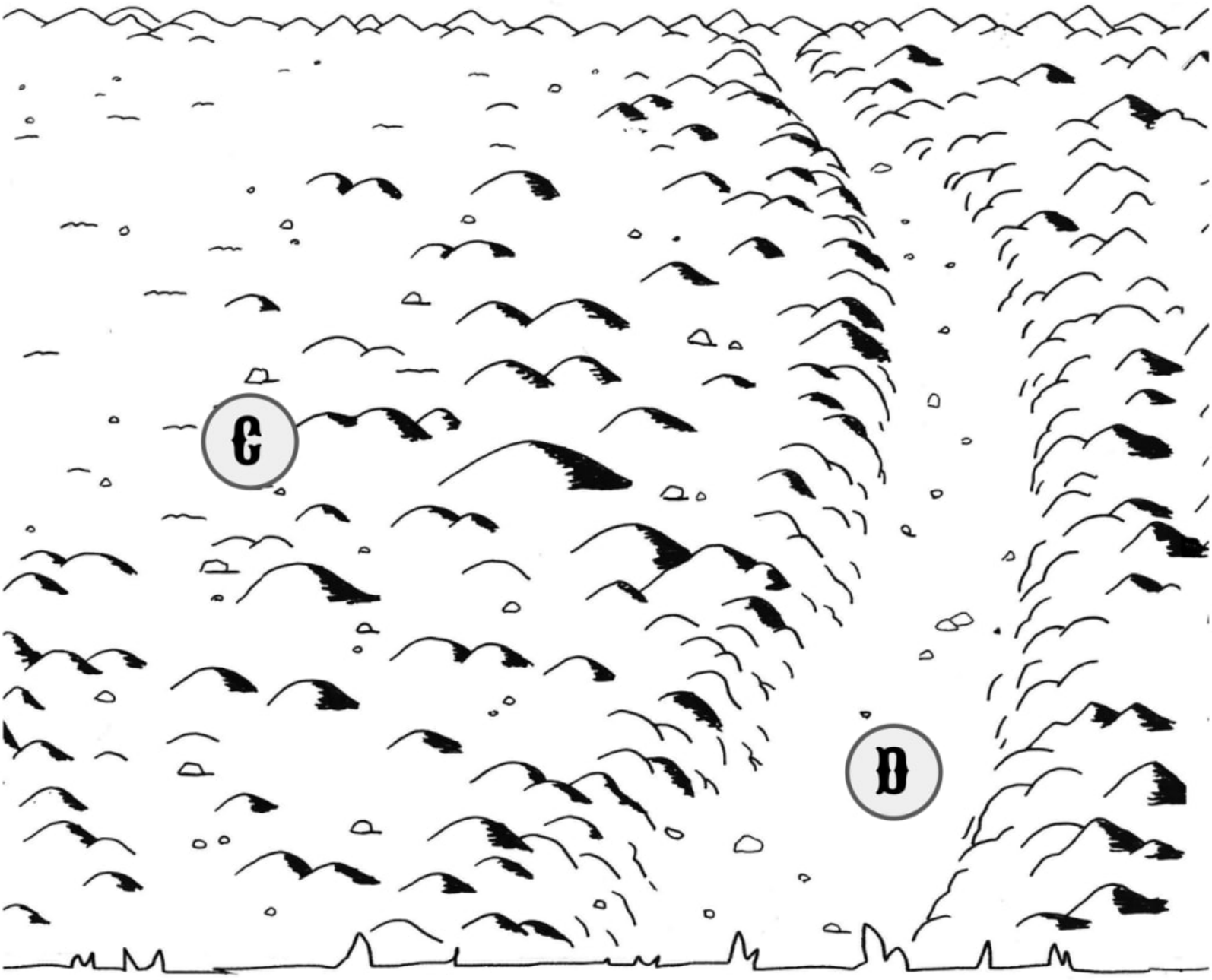
Wild West Nickname: _____

C - In the Rolling Hills

1. **LAND:** If there's an aquifer here, I think it's:
   - ☐ near the surface.
   - ☐ too far down to reach.
2. **PLANTS:** I think plant roots here get water from:
   - ☐ seasonal rains.
   - ☐ an aquifer (underground water).
3. **ROCKS & SOIL:** I think the soil here will:
   - ☐ be easy to dig in. It's porous. Rain soaks in.
   - ☐ be hard to dig in. It's not porous. Rain won't soak in.
   - ☐ make the water undrinkable due to salt or poison.

D - Down in the Valley

1. **LAND:** If there's an aquifer here, I think it's:
   - ☐ near the surface.
   - ☐ too far down to reach.
2. **PLANTS:** I think plant roots here get water from:
   - ☐ seasonal rains.
   - ☐ an aquifer (underground water).
3. **ROCKS & SOIL:** I think the soil here will:
   - ☐ be easy to dig in. It's porous. Rain soaks in.
   - ☐ be hard to dig in. It's not porous. Rain won't soak in.
   - ☐ make the water undrinkable due to salt or poison.



When you turn on the faucet, where does the water come from?

Dusty Flats

Where will you dig a well?
Your life depends on finding water!

Name: _____

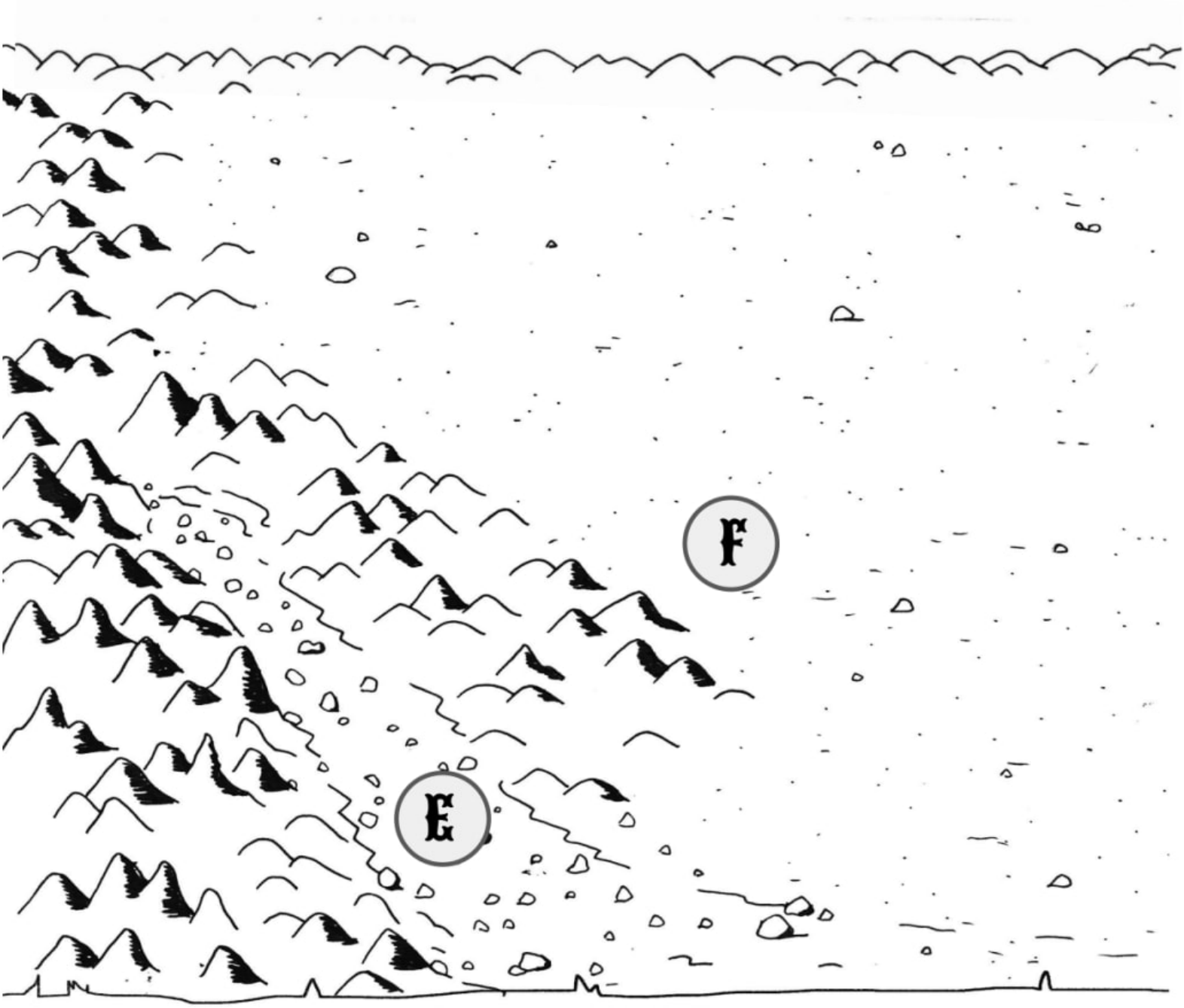
Wild West Nickname: _____

E - In the Dry Streambed

1. **LAND:** If there's an aquifer here, I think it's:
   - ☐ near the surface. ☐ too far down to reach.
2. **PLANTS:** I think plant roots here get water from:
   - ☐ seasonal rains. ☐ an aquifer (underground water).
3. **ROCKS & SOIL:** I think the soil here will:
   - ☐ be easy to dig in. It's porous. Rain soaks in.
   - ☐ be hard to dig in. It's not porous. Rain won't soak in.
   - ☐ make the water undrinkable due to salt or poison.

F - In the Flats near the Hills

1. **LAND:** If there's an aquifer here, I think it's:
   - ☐ near the surface. ☐ too far down to reach.
2. **PLANTS:** I think plant roots here get water from:
   - ☐ seasonal rains. ☐ an aquifer (underground water).
3. **ROCKS & SOIL:** I think the soil here will:
   - ☐ be easy to dig in. It's porous. Rain soaks in.
   - ☐ be hard to dig in. It's not porous. Rain won't soak in.
   - ☐ make the water undrinkable due to salt or poison.



Sandy Canyon

Where will you dig a well?
Your life depends on finding water!

Name: _____

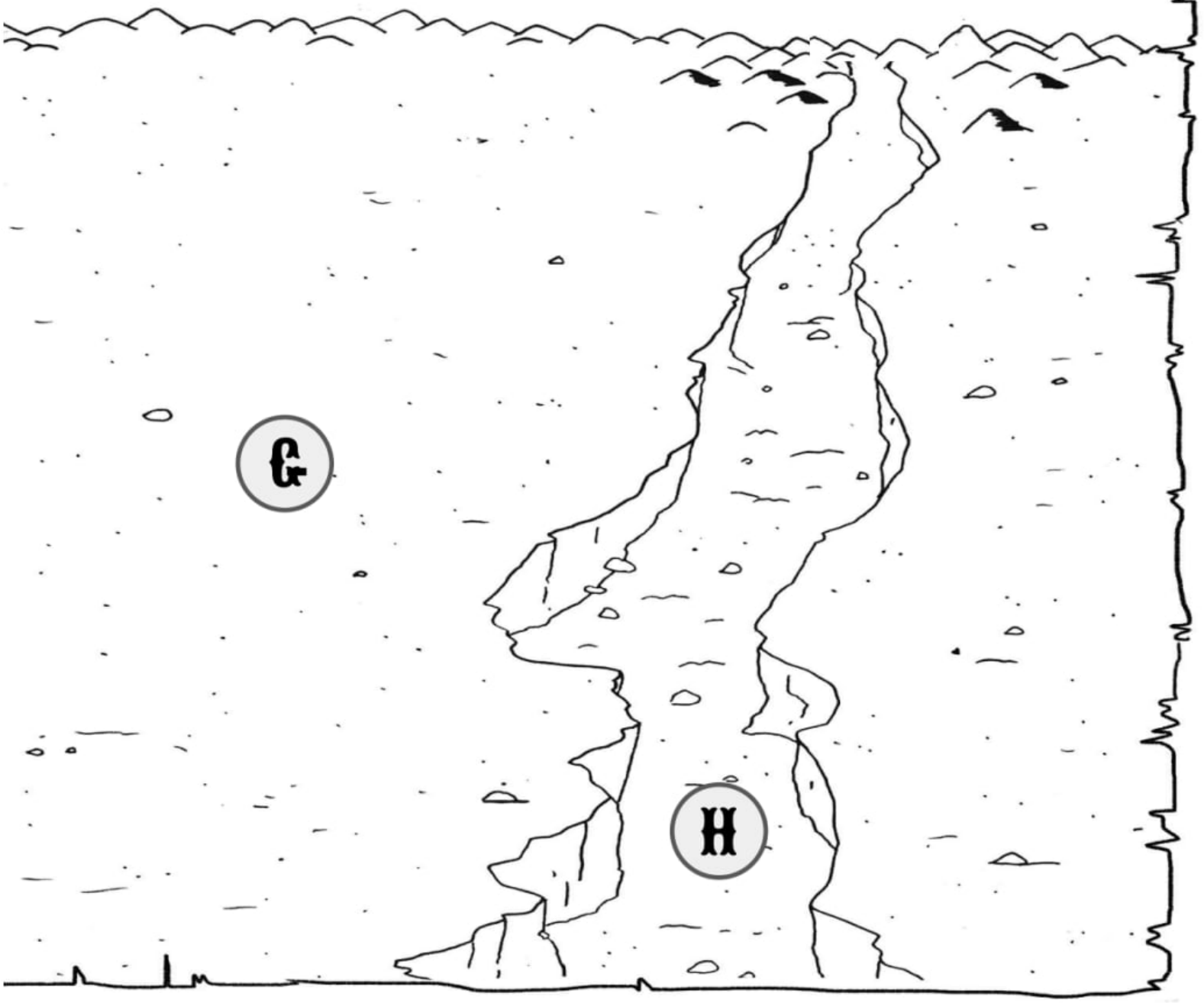
Wild West Nickname: _____

G--In the Plains

1. **LAND:** If there's an aquifer here, I think it's:
   - ☐ near the surface.
   - ☐ too far down to reach.
2. **PLANTS:** I think plant roots here get water from:
   - ☐ seasonal rains.
   - ☐ an aquifer (underground water).
3. **ROCKS & SOIL:** I think the soil here will:
   - ☐ be easy to dig in. It's porous. Rain soaks in.
   - ☐ be hard to dig in. It's not porous. Rain won't soak in.
   - ☐ make the water undrinkable due to salt or poison.

H -Down in the Canyon

1. **LAND:** If there's an aquifer here, I think it's:
   - ☐ near the surface.
   - ☐ too far down to reach.
2. **PLANTS:** I think plant roots here get water from:
   - ☐ seasonal rains.
   - ☐ an aquifer (underground water).
3. **ROCKS & SOIL:** I think the soil here will:
   - ☐ be easy to dig in. It's porous. Rain soaks in.
   - ☐ be hard to dig in. It's not porous. Rain won't soak in.
   - ☐ make the water undrinkable due to salt or poison.



PLANTS

mystery science

When you turn on the faucet, where does the water come from?

A

SPOT A: Bristlecone pine trees grow high in the Mystery Mountains. These twisted trees do just fine with very little rain.

B

SPOT B: Pickleweed is the only plant that grows in this dry lake bed. It grows well where water is just below the surface of the soil.

C

SPOT C: Joshua trees grow in these dry desert hills. They have long roots to gather what little water there is.

D

SPOT D: Greasewood fills this sunny valley. This plant has long roots and stays green when other plants wilt.

E

SPOT E: Willow trees flourish in this dry wash. The trees' long roots reach deep underground.

F

SPOT F: Wildflowers cover this plain. These flowers grow quickly after a rainstorm, but they don't live long.

G

SPOT G: Cactus live where it's dry. Whenever there's rain, they soak up the water and store it in their thick stems.

H

SPOT H: The palm trees in this canyon can be seen from miles away. In the desert, palm trees are often found near water holes.

ROCKS AND SOIL

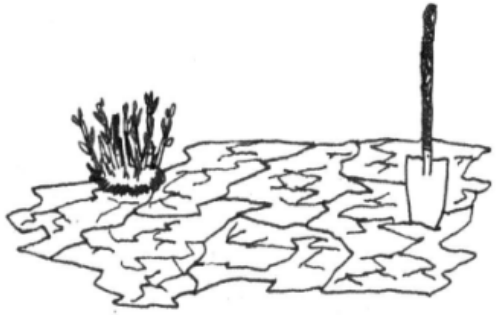
mystery science

When you turn on the faucet, where does the water come from?

A

SPOT A: Lots of rocks and very little dirt high in the mountains makes digging a challenge.

B



SPOT B: This soil is full of salt that washes down from the mountains. (Pickleweed is one of the few plants that can grow in salty soil.)

C

SPOT C: Sandstone boulders cover the hillsides, making digging difficult.

D

SPOT D: The sandy soil here filled with alkali, a poisonous kind of salt. Greasewood grows here, but not much else can.

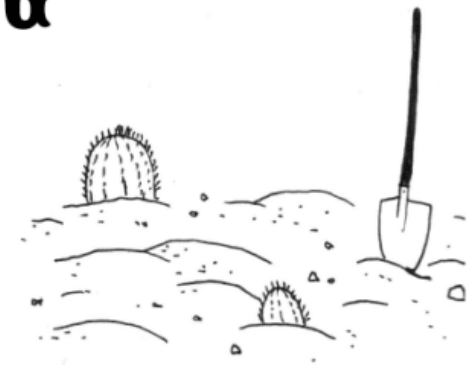
E

SPOT E: Gravel and soil fill this dry wash. Easy digging here.

F

SPOT F: Loose soil lies on top of a layer of clay that's as hard as brick.

G



SPOT G: Sandy soil with patches of gravel. Easy digging here.

H

SPOT H: Sandy soil makes digging easy in this canyon.

Group members: _____ _____ _____ _____

WANTED: A Well

1. For a well, you need a place where water is **close** to the surface. Look at the map. Remember that water flows downhill. **Cross out** all the spots where your team thinks water will be too far underground.

A B C D E F G H

2. Look at the naturalist's guide to **plants**. Does this information help you choose where to put your well? **Cross out** spots where you think the plants just use water from seasonal rains.

A B C D E F G H

3. Look at the miner's guide to **rocks and soil**. **Cross out** spots where digging will be difficult or the water will be undrinkable.

A B C D E F G H

4. As a team, choose a spot to dig a well and build a town. If you choose wisely, your town will have plenty of water. Write the letter of the spot you chose here: _____

5. Why did you choose that spot? What clues did you use?

_____

_____

_____

_____

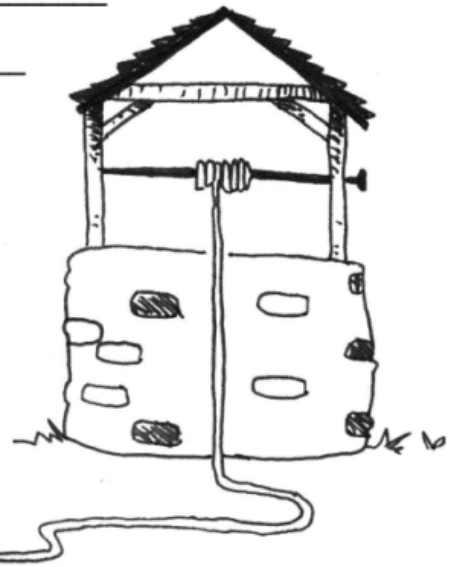
_____

_____

_____

6. Decide on a name for your town and write it here:

_____



Name: _____

Date: _____

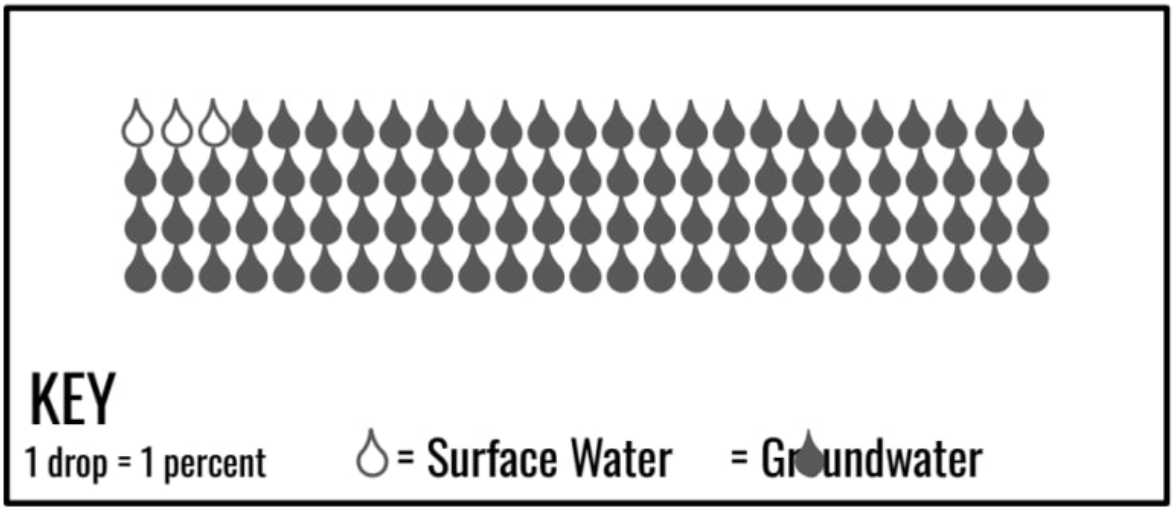
Lesson Assessment

The vast majority of the water on Earth is in the oceans. Unfortunately, all of it is salt water. People can't survive with only salt water, so liquid freshwater is very important to every single person on Earth.

Liquid freshwater is found in two places on Earth: on the surface and underground. Water on the surface of the Earth, such as rivers and lakes, is called surface water. Water underground is called groundwater.

The image below is a type of graph that shows the amount of liquid freshwater on Earth. There are 100 total drops to represent 100% of the liquid freshwater on Earth. Remember: this does not include water in the oceans. Use this graph to help you answer question 1.

Total Amount of Liquid Freshwater on Earth



1. Circle **True** or **False** for each of the following.

True False There is about the same amount of fresh surface water as there is fresh groundwater.

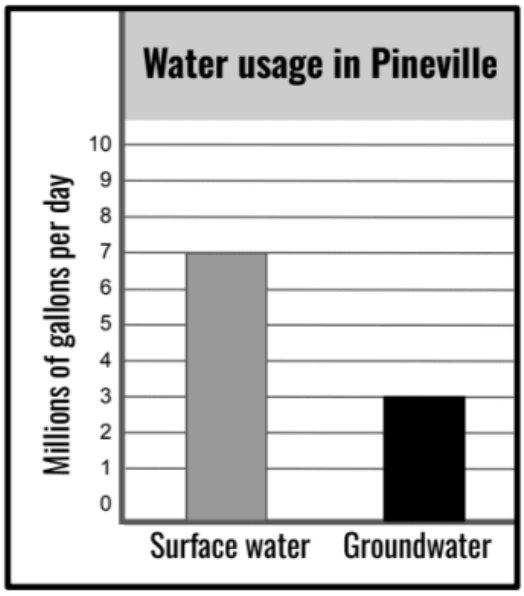
True False The majority of the liquid freshwater on Earth is water that people have to dig to find.

True False 10% of the liquid freshwater on Earth is on the surface of the Earth.

True False Rivers and lakes might look big, but they only hold a few percent of the total freshwater on Earth.

Even though there is less surface water on the Earth than groundwater, that doesn't mean that people *use* less surface water. In some places, it might be easier to use water that is already on the surface. So some people use more surface water, even though there is less of it.

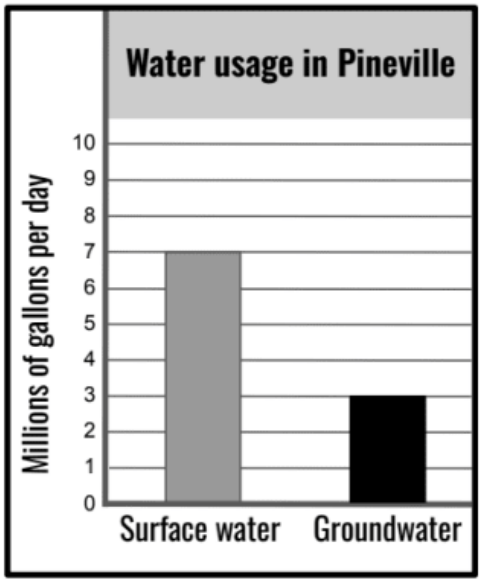
The graph on the right shows water usage in the city of Pineville. Use it to answer question 2.

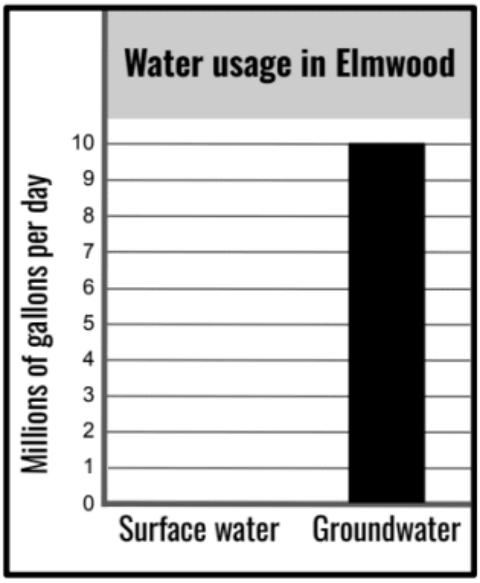


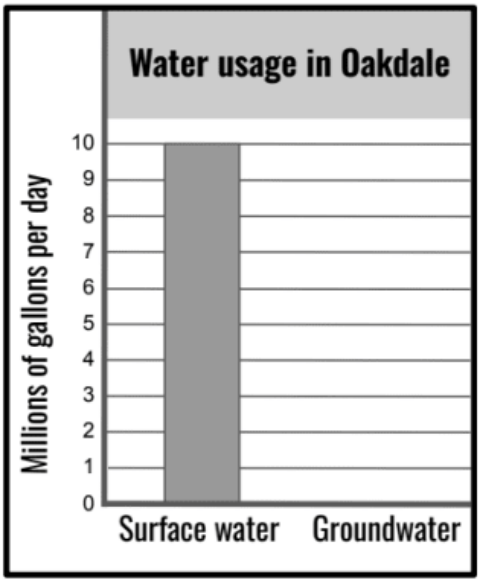
2. What does the graph tell us about water usage in Pineville?

a. People use more than twice as much surface water as they do groundwater.
b. People use equal amounts of surface water and groundwater.
c. People only use water from a lake or a river.
d. People use slightly more surface water than groundwater.

The following three graphs show water usage in the cities of Pineville, Elmwood, and Oakdale. Use them to answer question 3.







3. Circle **True** or **False** for each of the following.

True False It is possible for a city to only use groundwater and use no surface water at all.

True False Pineville <u>does not</u> get all ten million gallons of water it needs each day from just surface water and groundwater. They have to use other sources too.

True False Different cities use different amounts of water, but all cities use at least *some* surface water and *some* groundwater.

True False Most freshwater is groundwater. That's why all cities use groundwater.

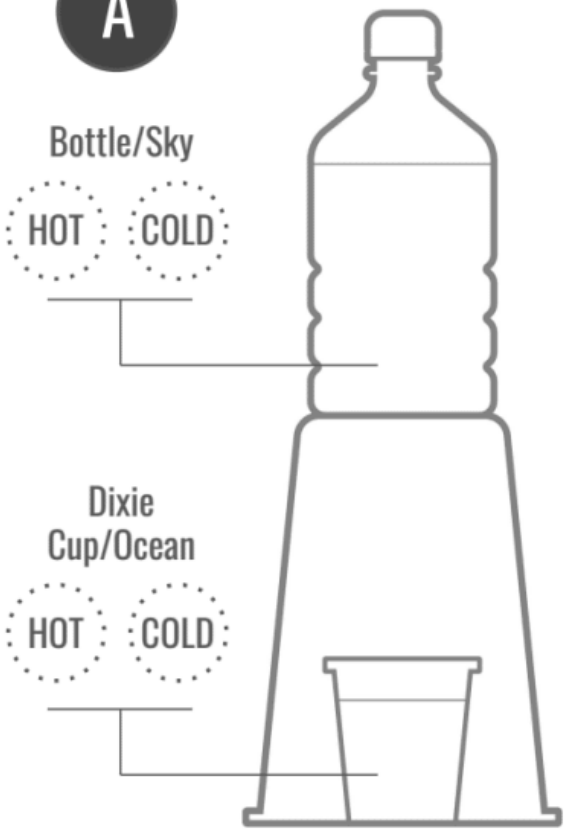
Rainmaker Experiments (Part 1)

mystery science
Can we make it rain?

Name: _____

Predict: Which experiment will make rain? **A** **B** **C** **D**

A



1. Do you see fog anywhere? Look at it closely. It's made of drops of water.

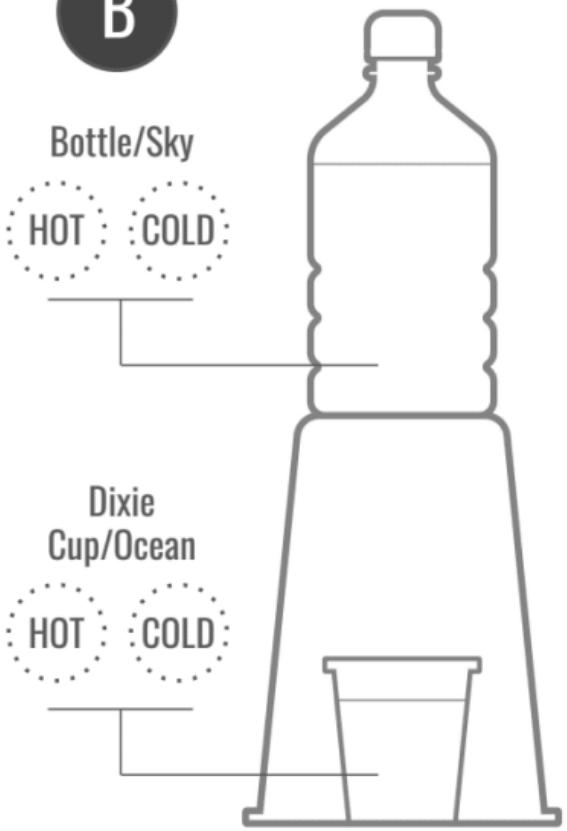
2. Use a pencil to lightly shade areas where you see water drops.

3. Touch the foggy spots. Is the water inside or outside the plastic?

   If it's inside, mark the spot with an I.
   If it's outside, mark the spot with an O.

4. Draw what you see on the top of the sky cup when you pick up the bottle.

B



1. Do you see fog anywhere? Look at it closely. It's made of drops of water.

2. Use a pencil to lightly shade areas where you see water drops.

3. Touch the foggy spots. Is the water inside or outside the plastic?

   If it's inside, mark the spot with an I.
   If it's outside, mark the spot with an O.

4. Draw what you see on the top of the sky cup when you pick up the bottle.

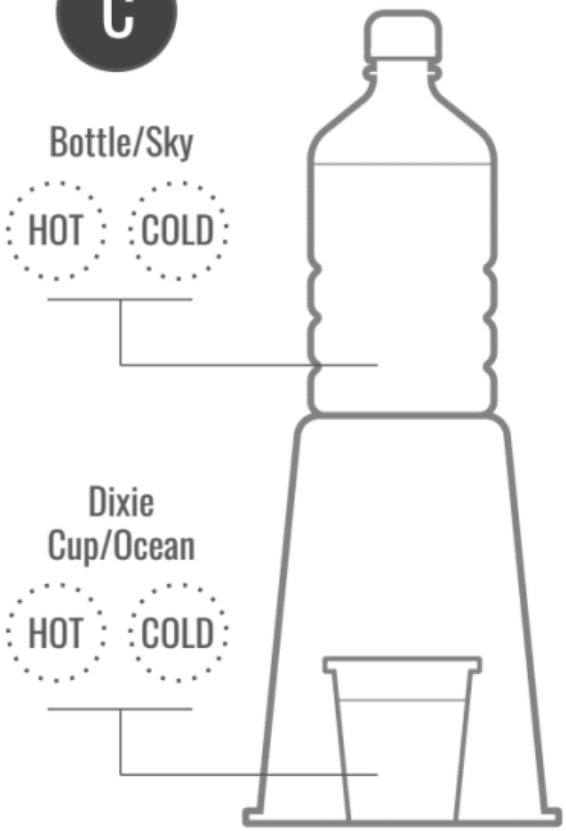
Rainmaker Experiments (Part 2)

mystery science
Can we make it rain?

Name: _____

Predict: Which experiment will make rain? **A** **B** **C** **D**

C



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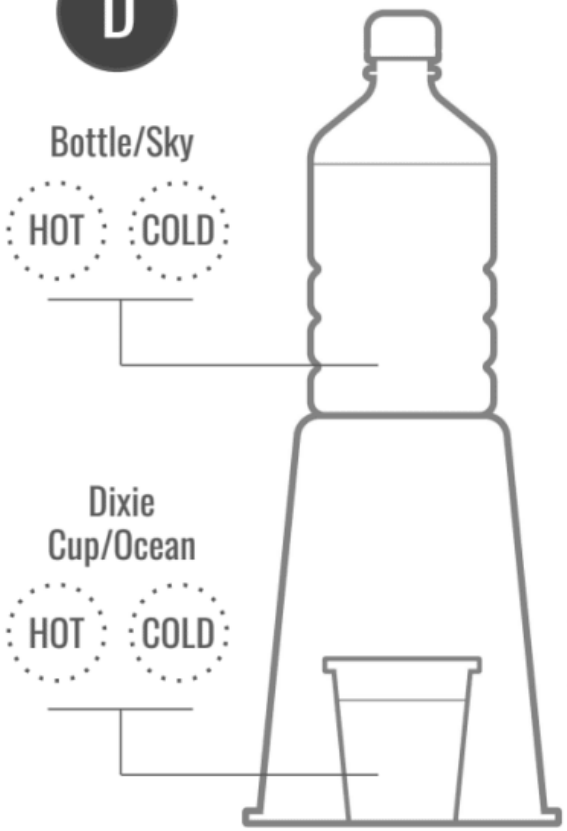
2. Use a pencil to lightly shade areas where you see water drops.

3. Touch the foggy spots. Is the water inside or outside the plastic?

   If it's inside, mark the spot with an I.
   If it's outside, mark the spot with an O.

4. Draw what you see on the top of the sky cup when you pick up the bottle.

D



1. Do you see fog anywhere? Look at it closely. It's made of drops of water.

2. Use a pencil to lightly shade areas where you see water drops.

3. Touch the foggy spots. Is the water inside or outside the plastic?

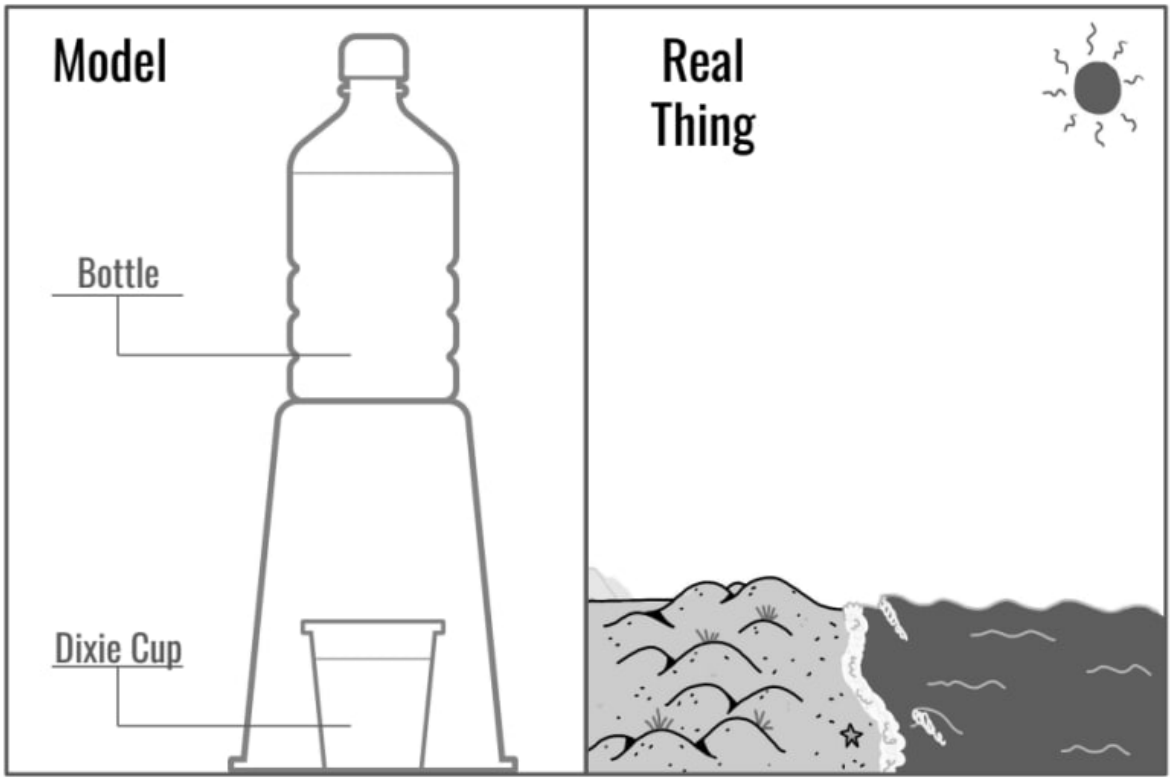
   If it's inside, mark the spot with an I.
   If it's outside, mark the spot with an O.

4. Draw what you see on the top of the sky cup when you pick up the bottle.

Name: _____

Date: _____

Lesson Assessment



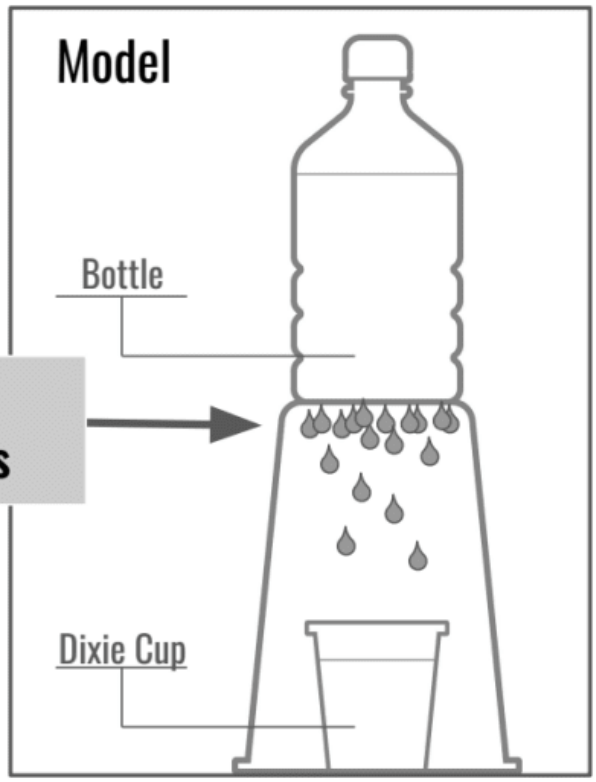
1. Malia wants to understand how the ocean (hydrosphere) and the sky (atmosphere) interact to make it rain. Malia decides to make a model, shown above. Which of the following sentences are true? There may be more than 1 correct answer. Circle all correct answers.

a. The Bottle represents the air (atmosphere).
b. The Dixie Cup represents the ocean (hydrosphere).
c. The Bottle represents the ocean (hydrosphere).
d. The Dixie Cup represents the ground (geosphere).

2. What would Malia need to do to create a model of the system to show what happens when a warm ocean and a cold sky interact? There may be more than 1 correct answer. Circle all correct answers.

a. Add warm water to the Bottle, which represents the air (atmosphere).
b. Add cool water to the Dixie Cup, which represents the ocean (hydrosphere).
c. Add cool water to the Bottle, which represents the air (atmosphere).
d. Add warm water to the Dixie Cup, which represents the ocean (hydrosphere).

3. Malia notices that water droplets have started to form on the bottom of the Bottle in her model. When she taps the cup, she can make some of these water droplets fall down into the Dixie Cup. What processes is Malia observing in her model? There may be more than 1 correct answer. Circle all correct answers.



a. Warm water in the Dixie Cup is boiling and turning into water vapor.
b. Water is collecting (condensing) on the bottom of the cold Bottle and creating a model cloud.
c. Water is falling down from the bottom of the Bottle like rain (precipitation).
d. Ice is melting and falling down from the bottom of the Bottle.

4. By looking at Malia's model, she notices that more water droplets form when the sky (atmosphere) is cold and the ocean (hydrosphere) is warm. How can Malia's model help us understand why it rains a lot in some places around the world? What about places around the world where it hardly ever rains?

Environmental Engineer: _____

(your name here)

What's your solution?

You'll help Beachtown by planting wetlands. A wetland is a swampy area between the ocean and dry land. The plants in a wetland knock down the storm surge so the town doesn't flood. Wetlands protect against storm surge but they don't protect against river flooding.

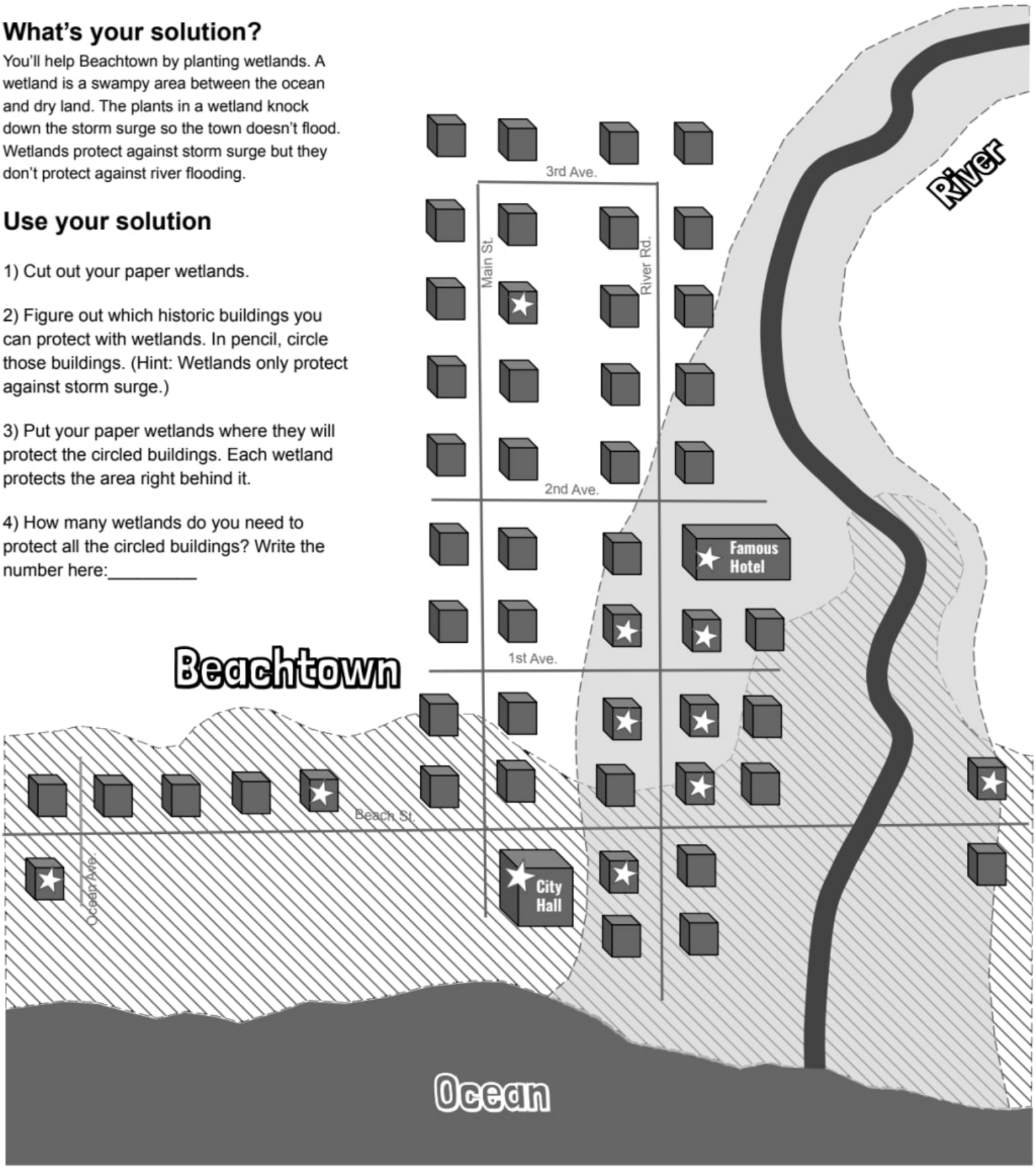
Use your solution

1) Cut out your paper wetlands.

2) Figure out which historic buildings you can protect with wetlands. In pencil, circle those buildings. (Hint: Wetlands only protect against storm surge.)

3) Put your paper wetlands where they will protect the circled buildings. Each wetland protects the area right behind it.

4) How many wetlands do you need to protect all the circled buildings? Write the number here:_____



Key:

- Flooded by the ocean storm surge
- Flooded by river overflow (due to rain)
- Historic building

mystery science
How can you save a town from a hurricane?

Seawall Engineer: _____

(your name here)

What's your solution?

You'll help Beachtown by building seawalls. A seawall is a strong concrete wall, built to stand between the ocean and the town. It can stop storm surge, but won't protect against river flooding.

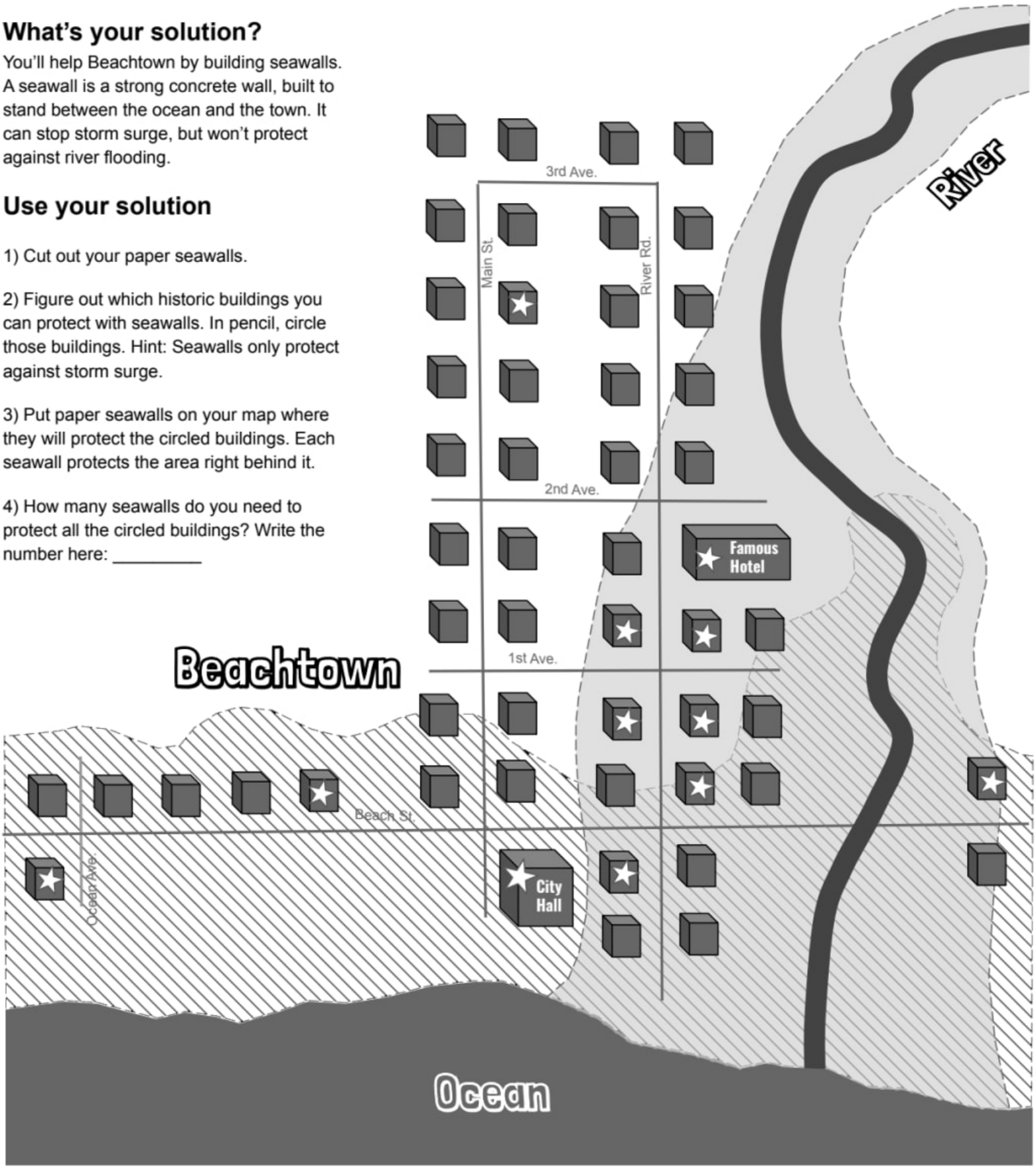
Use your solution

1) Cut out your paper seawalls.

2) Figure out which historic buildings you can protect with seawalls. In pencil, circle those buildings. Hint: Seawalls only protect against storm surge.

3) Put paper seawalls on your map where they will protect the circled buildings. Each seawall protects the area right behind it.

4) How many seawalls do you need to protect all the circled buildings? Write the number here: _____



Key:

- Flooded by the ocean storm surge
- Flooded by river overflow (due to rain)
- Historic building

mystery science
How can you save a town from a hurricane?

Levee Engineer: _____

(your name here)

What's your solution?

You'll help Beachtown by building levees. A levee is a wall of earth or stone built between the river and the town. Levees protect against a flooding river, but don't protect against storm surge from the ocean.

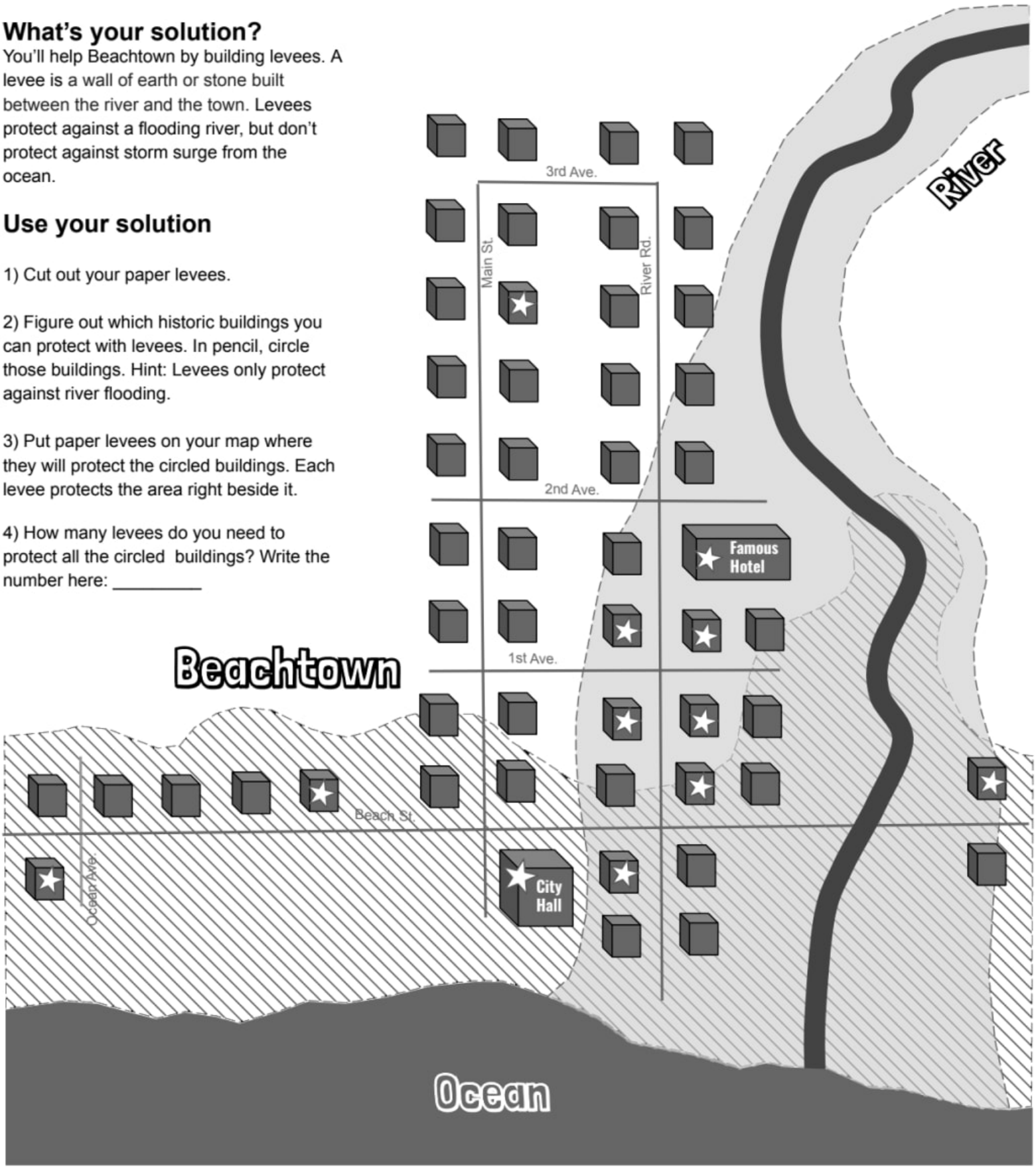
Use your solution

1) Cut out your paper levees.

2) Figure out which historic buildings you can protect with levees. In pencil, circle those buildings. Hint: Levees only protect against river flooding.

3) Put paper levees on your map where they will protect the circled buildings. Each levee protects the area right beside it.

4) How many levees do you need to protect all the circled buildings? Write the number here: _____



Key:

- Flooded by the ocean storm surge
- Flooded by river overflow (due to rain)
- Historic building

mystery science

How can you save a town from a hurricane?

Structural Engineer: _____

(your name here)

What's your solution?

You'll help Beachtown by putting buildings on stilts. Each set of stilts lifts a building above flood waters. For this solution to work, you must put stilts under every historic building you need to protect. Stilts protect from both river flooding and storm surge.

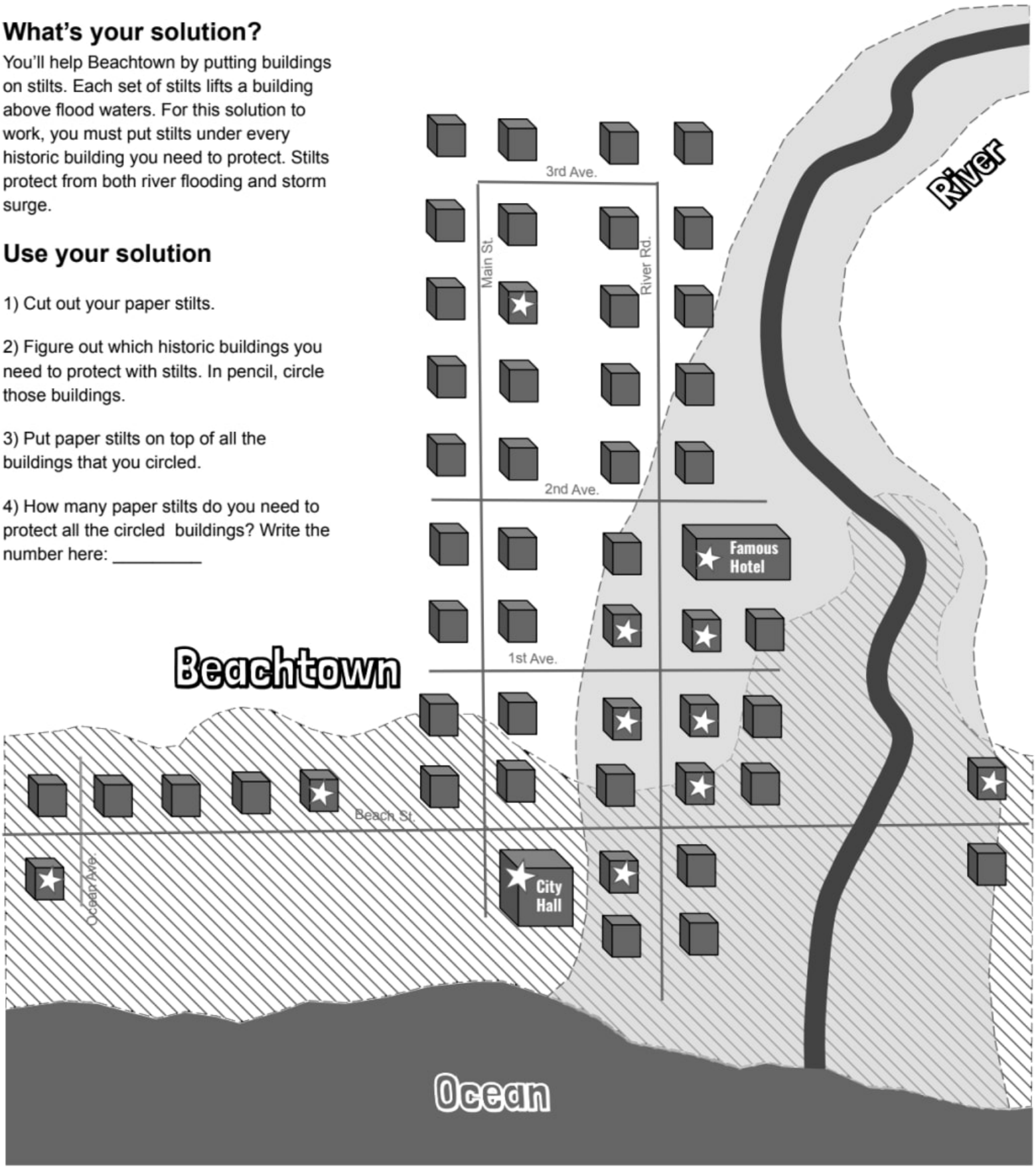
Use your solution

1) Cut out your paper stilts.

2) Figure out which historic buildings you need to protect with stilts. In pencil, circle those buildings.

3) Put paper stilts on top of all the buildings that you circled.

4) How many paper stilts do you need to protect all the circled buildings? Write the number here: _____



Key:

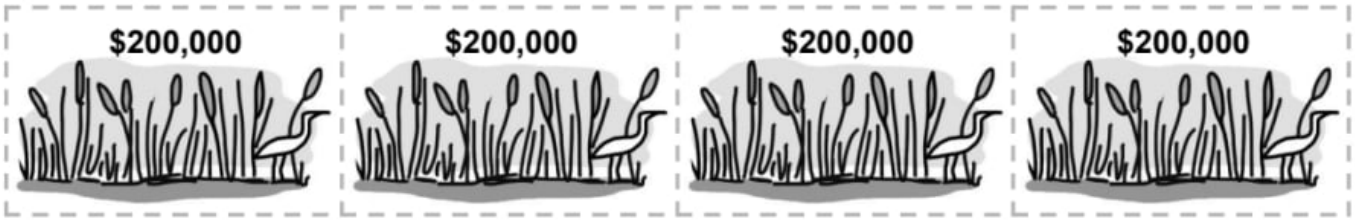
- Flooded by the ocean storm surge
- Flooded by river overflow (due to rain)
- Historic building

mystery science

How can you save a town from a hurricane?

Environmental Engineer

Solution: Protect against storm surge by planting wetlands

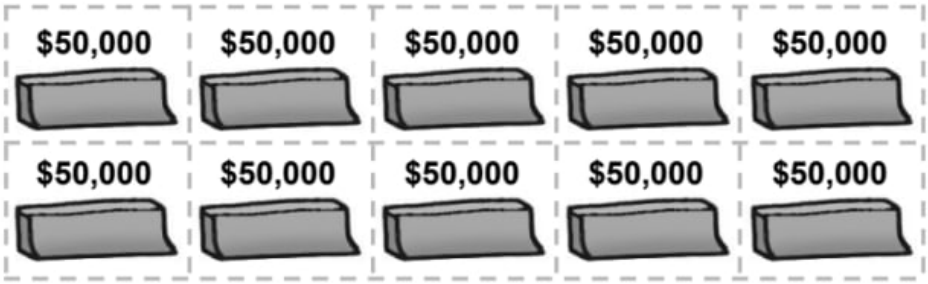


Structural Engineer

Solution: Protect against all kinds of floods by putting buildings on stilts

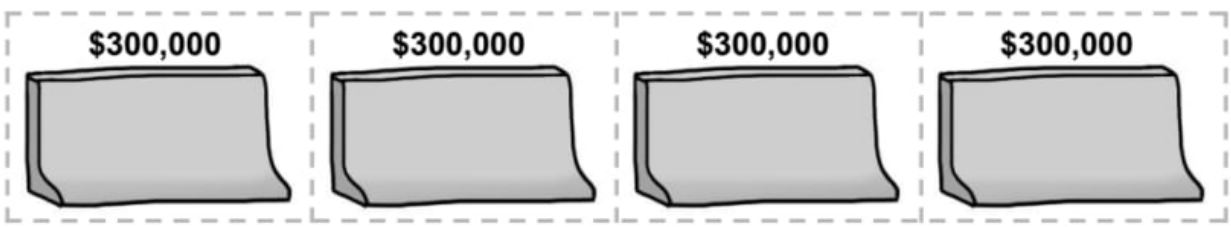
Levee Engineer

Solution: Protect against overflowing rivers by building levees



Seawall Engineer

Solution: Protect against storm surge by building seawalls



mystery science

How can you save a town from a hurricane?

Name: _____

Budget: What Can Beachtown Buy?

#1 Team Name (Company Name): _____

#2 Beachtown's Budget: $ _____

Table:

Solution	Cost of Solution	Calculate the Total Cost (You can do the math on the back of the paper)
#3 Seawall Engineer: How many seawalls will they build? # of seawalls _____	Each seawall costs $300,000 	The number of seawalls times the cost equals the total cost of seawalls. Answer: $_____
#4 Environmental Engineer: How many wetlands will they plant? # of wetlands _____	Each wetland costs $200,000 	The number of wetlands times the cost equals the total cost of wetlands. Answer: $_____
#5 Levee Engineer: How many levees will they build? # of levees _____	Each levee costs $50,000 	The number of levees times the cost equals the total cost of levees. Answer: $_____
#6 Structural Engineer: How many buildings will they put on stilts? # of stilts _____	Putting a building on stilts costs $150,000 	The number of stilts times the cost equals the total cost of stilts. Answer: $_____
#7 **To get the total cost of flood protection, add up all your totals.**		**Total cost:** $_____

#8 If your total cost is bigger than Beachtown's budget, you need to figure out how to lower your costs. Write your cost-saving ideas here.

_____

_____

_____

_____

(Hint: Look on the maps for historic buildings that are protected by more than one solution.)

Final Plan for the Town Council

Team Name:

_____

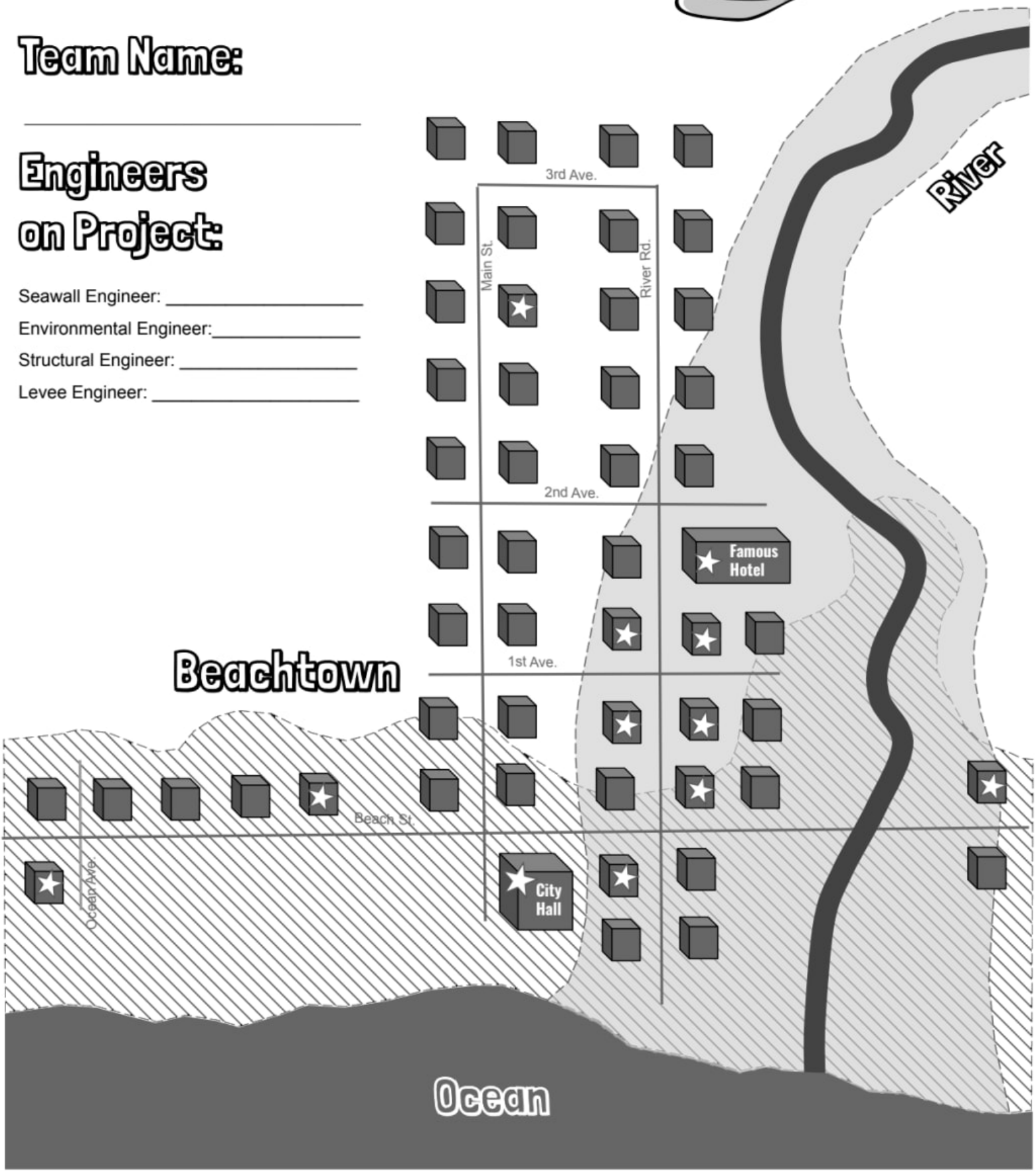
Engineers on Project:

Seawall Engineer: _____

Environmental Engineer: _____

Structural Engineer: _____

Levee Engineer: _____



Key:

- Flooded by the ocean storm surge
- Flooded by river overflow (due to rain)
- Historic building

mystery science

How can you save a town from a hurricane?

Final Plan for the Town Council

Team Name:

_____

Engineers on Project:

Seawall Engineer: _____

Environmental Engineer:_____

Structural Engineer: _____

Levee Engineer: _____

#1 Cost of Proposed Plan:

# of Each	Cost (# times cost of each)
#_____ seawalls at $300,000 each	$
#_____ marshlands at $200,000 each	$
#_____ levees at $50,000 each	$
#_____ buildings on stilts at $150,000 each	$
TOTAL COST *(add them up)*:	Total: $

Letter:

Dear Beachtown Town Council,

#2 If another hurricane strikes your town, our plan ensures that #_____ of the 12 historic buildings will be safe.

You gave us a budget of $1,000,000. Our company's plan costs $_____.

That's *(circle one)* under budget. / over budget. / exactly on budget.

#3 Our plan is the best because *(come up with at least three reasons)*:

- _____
  _____
- _____
  _____
- _____
  _____

Act now to keep historic Beachtown safe from flooding. When the storm winds blow and it's raining buckets, you'll be glad you did.

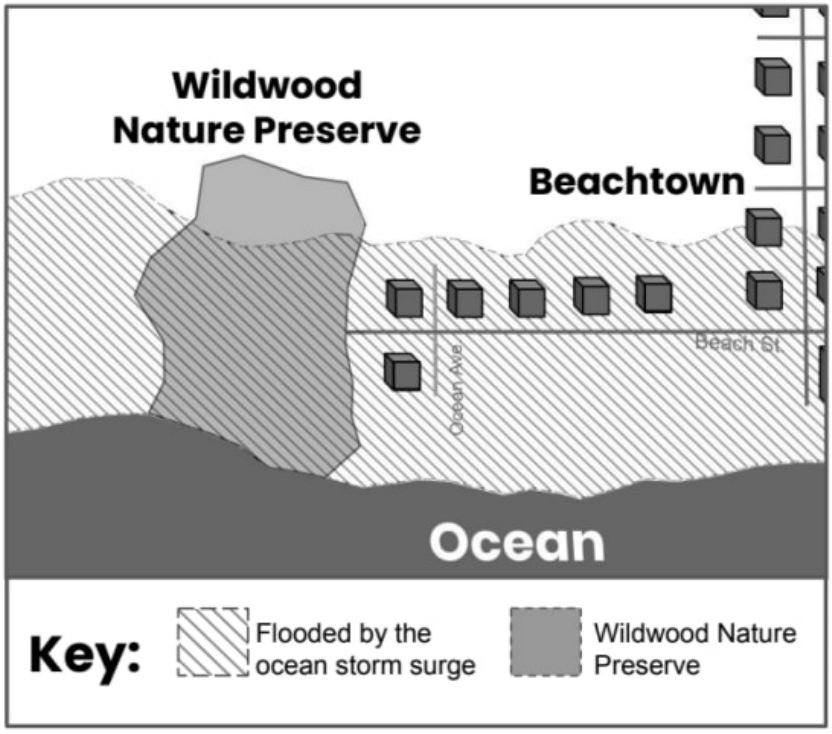
Sincerely, Team _____

Name: _____

Date: _____

Lesson Assessment

The people of Beachtown recently completed a few big construction projects to save their town from flood damage. But the people of Beachtown are also worried about a special area nearby. This area is called Wildwood Nature Preserve. Most people just call it Wildwood. Many different plants and animals live in Wildwood, and the people of Beachtown love visiting those plants and animals. Look at the map below to see where Wildwood Nature Preserve is. Be sure to look at the key as well.



Flooding is dangerous for the plants and animals in Wildwood just like it is dangerous for Beachtown. The people of Beachtown want to do something to protect the plants and animals that live there.

1. On the lines below, describe the problem that the people of Beachtown want to solve and why they want to solve it.

The people of Beachtown have decided to do something to protect the plants and animals at Wildwood. There is a budget of $1,000,000 for this project. It must protect the plants and animals from flooding. The finished design must also protect the natural beauty of Wildwood. The people of Beachtown don't want Wildwood to end up looking like a town—they want Wildwood to stay as close to natural as possible. Use this information to answer question 2.

2. The people of Beachtown have limits on what can be done to protect Wildwood. These limits are called constraints. They will only choose a plan that meets <u>all</u> of their constraints. What are the constraints that they have? Circle all that are correct.

   a. The finished design must cost less than $1,000,000.
   b. The finished design must look like it came from the same time period as the historic buildings of Beachtown.
   c. The finished design must look natural, so that it fits in with how Wildwood looks.
   d. The finished design must protect animals and plants.
   e. The finished design must be made of wood, because wood is natural.

Two companies have offered to design and build different things that will protect Wildwood. Read the plan from each company below:

<u>Cosmic Concrete's Plan</u>

We have a long history of helping Beachtown! Ten years ago, we built all of the sidewalks of Beachtown out of concrete, and the sidewalks still look brand new. At Wildwood, we will build seawalls out of the same kind of strong concrete you see all over Beachtown. They will only cost $900,000 to build, and they will protect the plants and animals from flooding.

<u>Wetland Wonders' Plan</u>

We love visiting the plants and animals at Wildwood, too. We think that the best way to do this is to create wetlands along the beach. We will have to do extra work to get the beach ready for the wetlands, though. The total cost will be $925,000 because of the extra work, but the wetlands will look natural and keep the plants and animals at Wildwood safe from flooding.

3. Circle **True** or **False** for each of the following.

True False Both plans meet all of the constraints for this project.

True False The fact that the concrete will look like the great sidewalks in Beachtown is actually a bad thing.

True False The plan from Cosmic Concrete is the best option because it is cheaper.

True False Even though the plan from Wetland Wonders is more expensive, it is the only plan that meets all of the constraints of the project.

My Kansas Farm

Name: _____

1. What problems could a drought cause on your farm?

_____

_____

_____

_____

_____

_____

_____

My Kansas Farm

Name: _____

Farm Resources: *Here's what your farm has on it.*

- Water source: Rainfall
- 100 acres of planted corn
- 100 acres of pasture land with native grasses
- A small tractor that's 10 years old
- A milk cow and her calf

2. What resources does your farm have that will protect it from a drought?

_____

_____

_____

_____

_____

_____

3. What changes would you make to your farm to protect it from a drought?

_____

_____

_____

_____

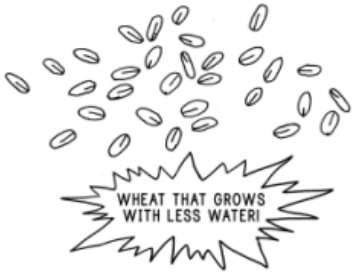
_____

_____

Drought Protection Kits Argument

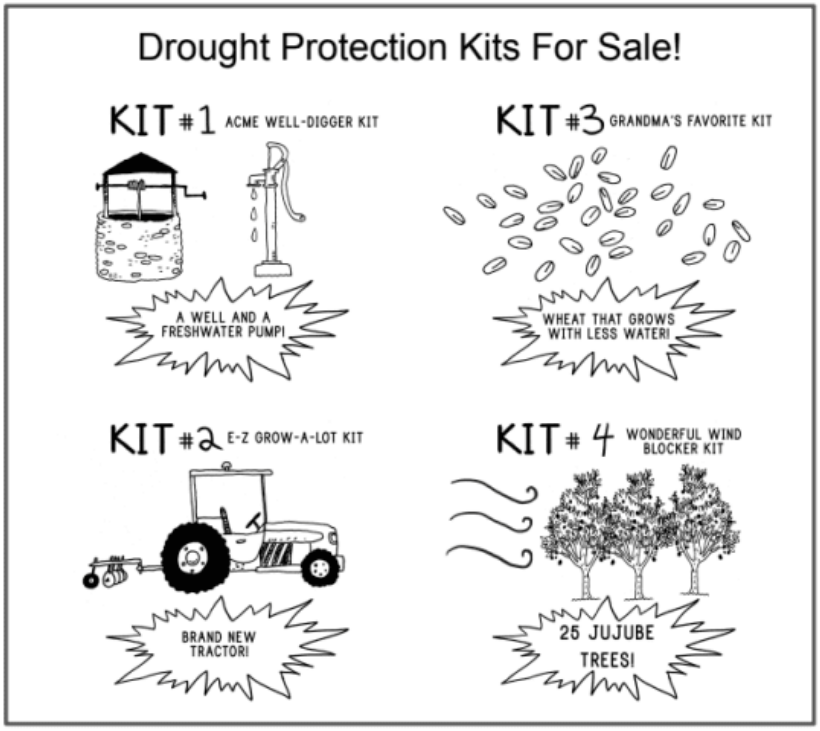
Name: _____

Directions: Listen to the sales pitch and farmer's comments about each Drought Protection Kit the general store has for sale. Write the pros and cons for each kit below.

Kits	Pros	Cons
KIT #1 ACME WELL-DIGGER KIT 		
KIT #2 E-Z GROW-A-LOT KIT 		
KIT #3 GRANDMA'S FAVORITE KIT 		
KIT # 4 WONDERFUL WIND BLOCKER KIT 		

Drought Protection Kits Argument

Name: _____



Make a claim:

I'm buying Kit # _____. My kit includes _____

_____.

Support with evidence:

This kit is the best choice to protect my farm against a drought because_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Water Cycle & Earth's Systems

Name: _____

Date: _____

Unit Assessment

It just stopped raining and now the Sun is shining, which is causing the air to warm up. Alisha decides to go outside and jump in the rain puddles on the pavement of the playground. When she comes back to the playground the next day, she notices that the puddles have all disappeared overnight, even though the puddles couldn't have soaked through the playground pavement.

1. Draw arrows and add words on the picture above to show how the puddles disappeared.

2. The Earth can be thought of as four systems (land, air, water, and living things). Two of these systems interacting caused the puddles to disappear from the playground. List which two systems you think they are and then describe how their interaction caused the puddles to disappear.

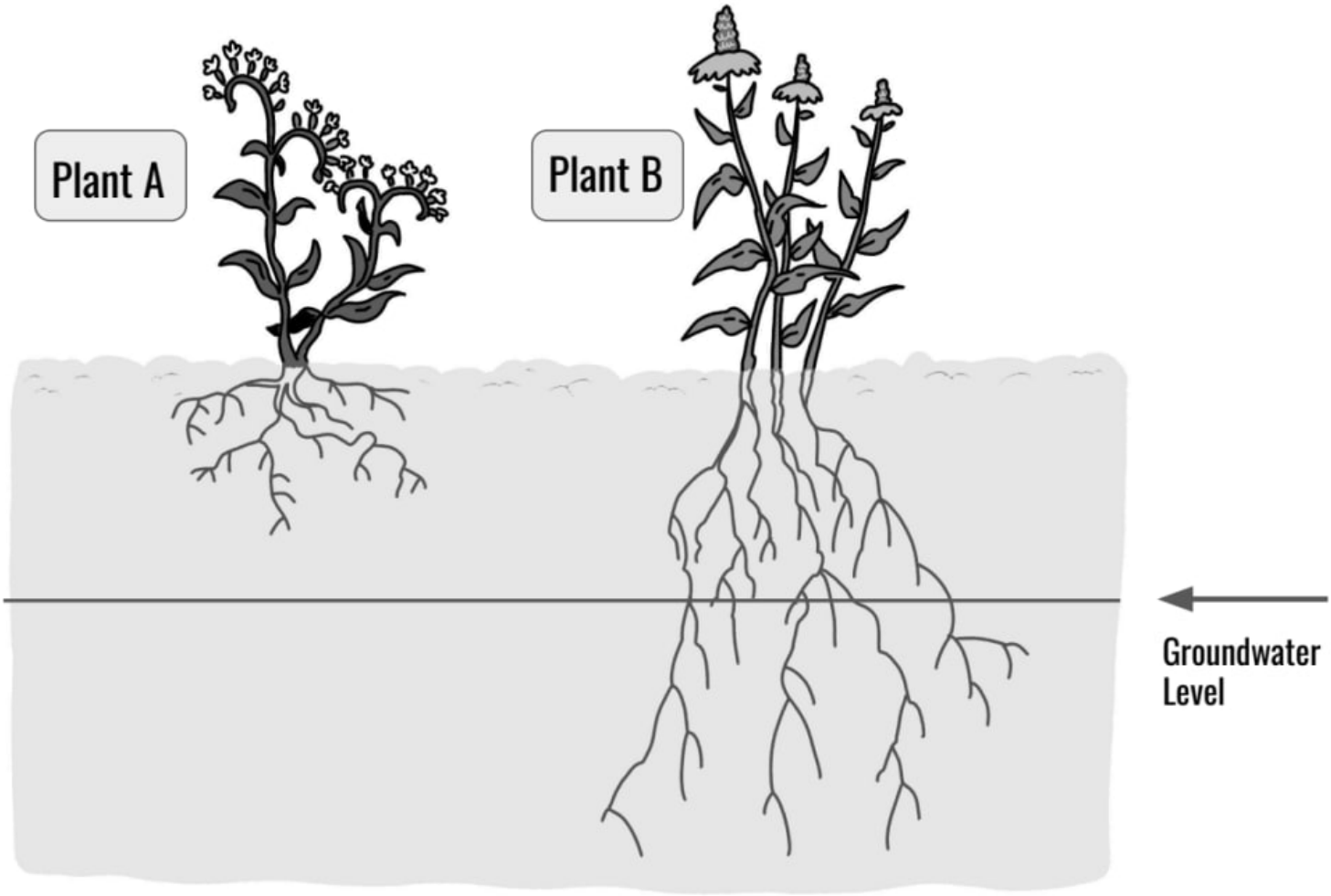
_____

_____

_____

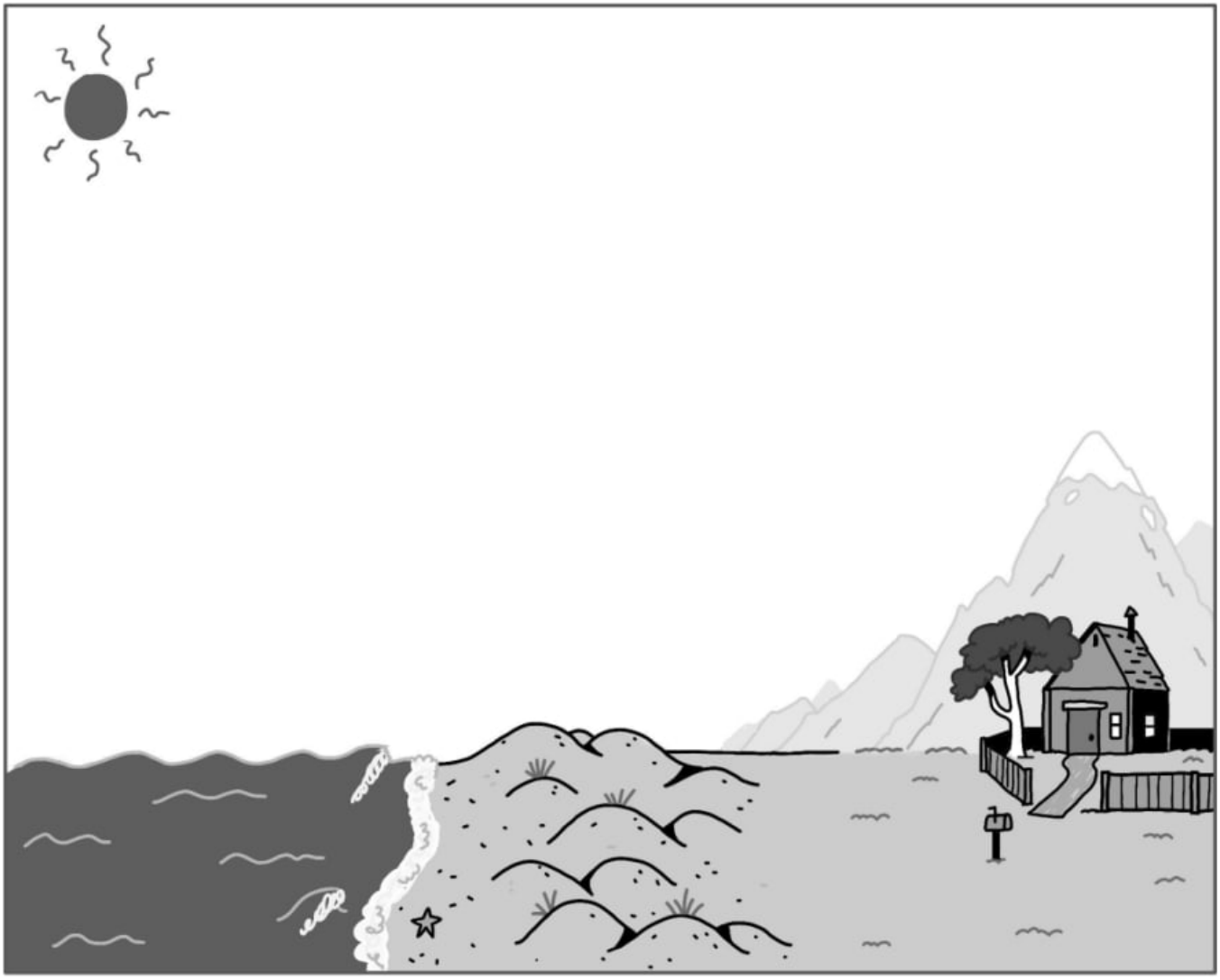
_____

_____



3. Jayden is trying to grow a flower garden in his town. He wants to grow two types of plants, Plant A and Plant B. Plant A has short, shallow roots and Plant B has long, deep roots. It hasn't rained in a very long time in Jayden's town. There is groundwater below the line shown in the picture above. Draw arrows and add words to the picture above to show how each plant does or does not interact with the groundwater.

4. Jayden wants to plant more flowers in his garden, but he also wants to conserve water. He wants to choose plants that won't need to be watered with a hose. Which plant, Plant A or Plant B, is a better option for Jayden's garden? Why? Use evidence from the model above to support your answer.



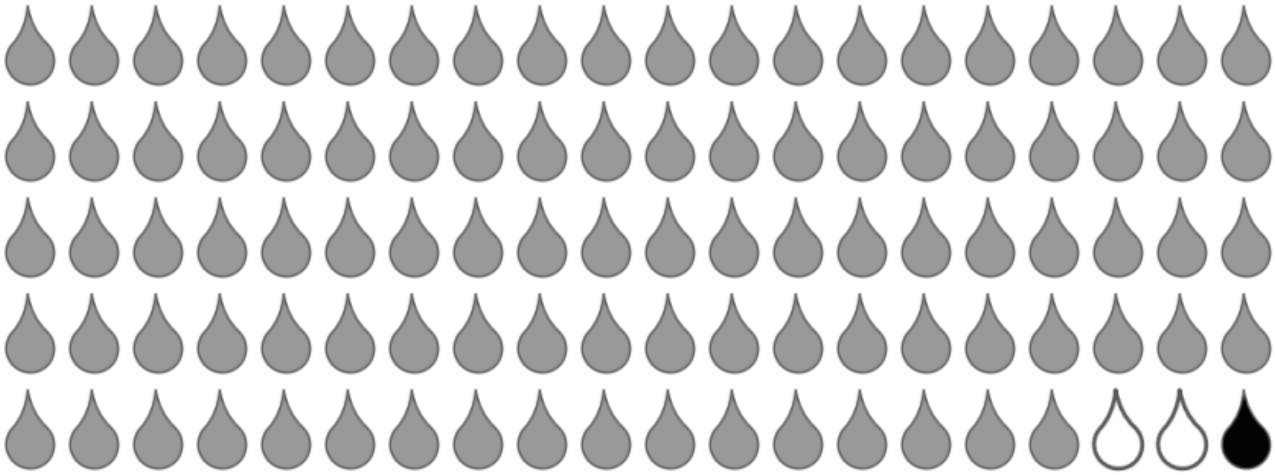
5. Sara lives in a house near the ocean. Both the air near her house and the ocean are very warm. Draw arrows on the picture above to show how the ocean (hydrosphere) can interact with the air (atmosphere) to eventually bring rain to Sara's yard. Add labels that include these words:

Condensation	**Evaporation**	**Clouds**	**Rain**

6. If the ocean stays the same temperature, but the air above the ocean changes to become very cold, what do you predict will most likely happen?

a. It would probably rain less in Sara's yard because there will be less evaporation.
b. It would probably rain less in Sara's yard because there will be less condensation.
c. It would probably rain more in Sara's yard because there will be more evaporation.
d. It would probably rain more in Sara's yard because there will be more condensation.

The Amount of Water on Earth



KEY

1 drop = 1 percent = Salt Water = Frozen Water = Fresh Water

The picture above is a type of graph that shows information about the amount of water on Earth. There are 100 drops to represent 100% of the water on Earth Use this graph to help you answer Questions 7, 8, and 9.

7. How would you describe the Earth's water?
   a. Most of Earth's water is salt water. The little bit of fresh water on Earth is mostly frozen.
   b. Most of Earth's water is fresh water. The little bit of salt water on Earth is mostly frozen.
   c. Most of Earth's water is salt water. The little bit of fresh water on Earth is not frozen.
   d. Most of Earth's water is fresh water. Most of the salt water is frozen.

8. What percentage of Earth's water is NOT salt water?
   a. 1%
   b. 2%
   c. 3%
   d. 97%

9. Describe why it's important to protect the Earth's freshwater resources. Use the graph above and any other information that you know about Earth's water to support your reasoning.

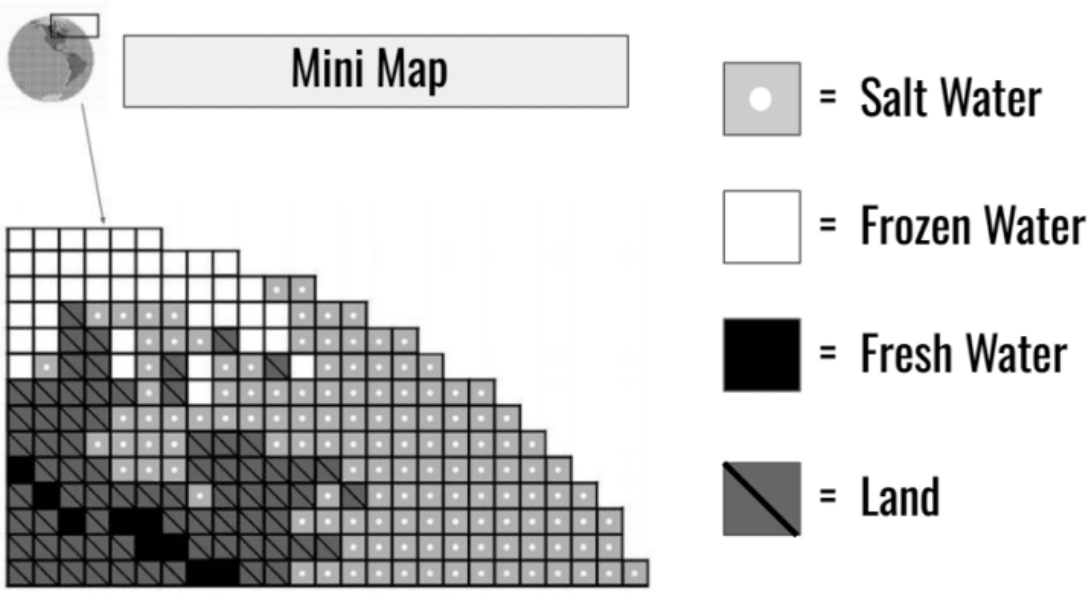
_____

_____

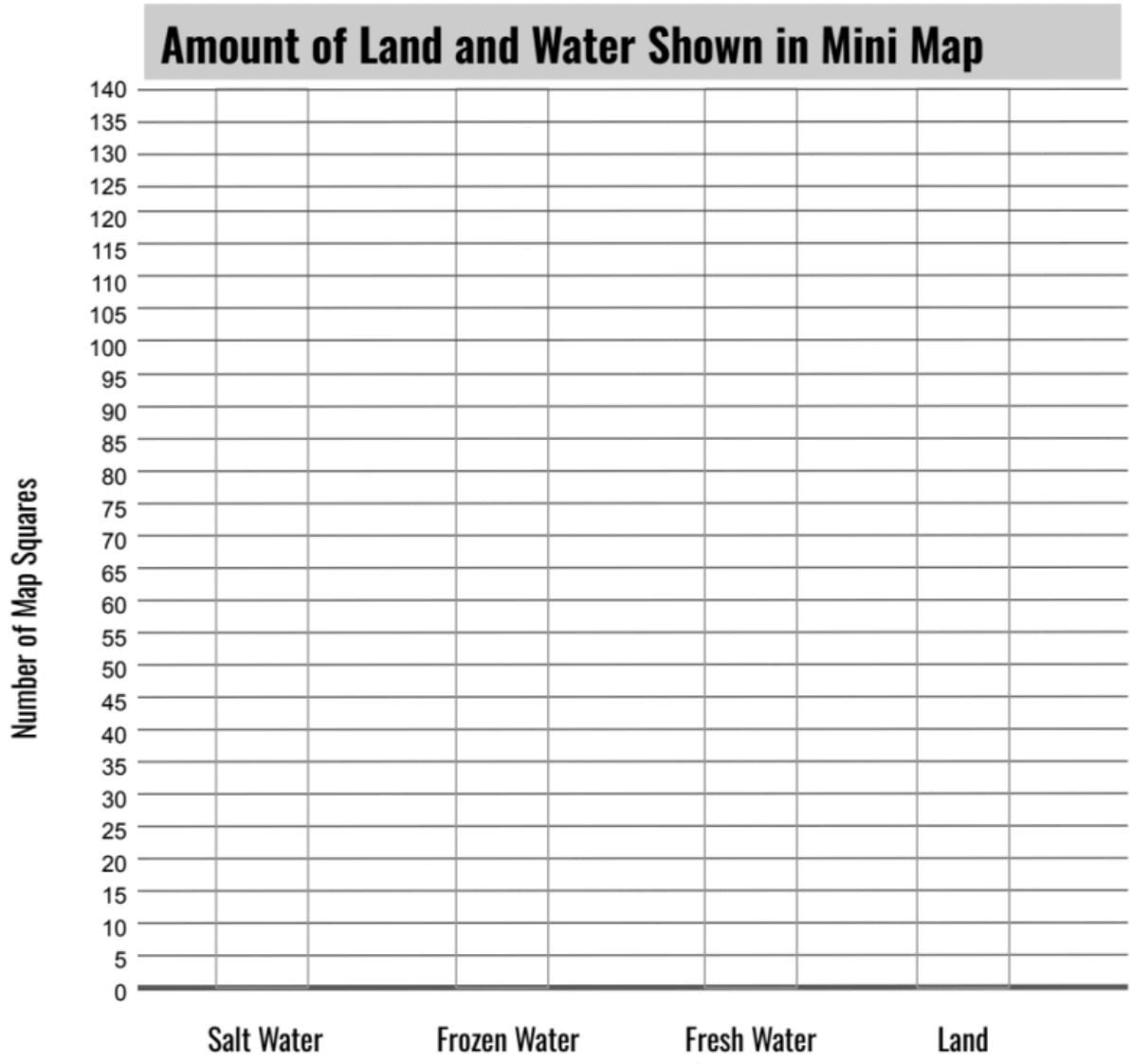
_____

_____

_____

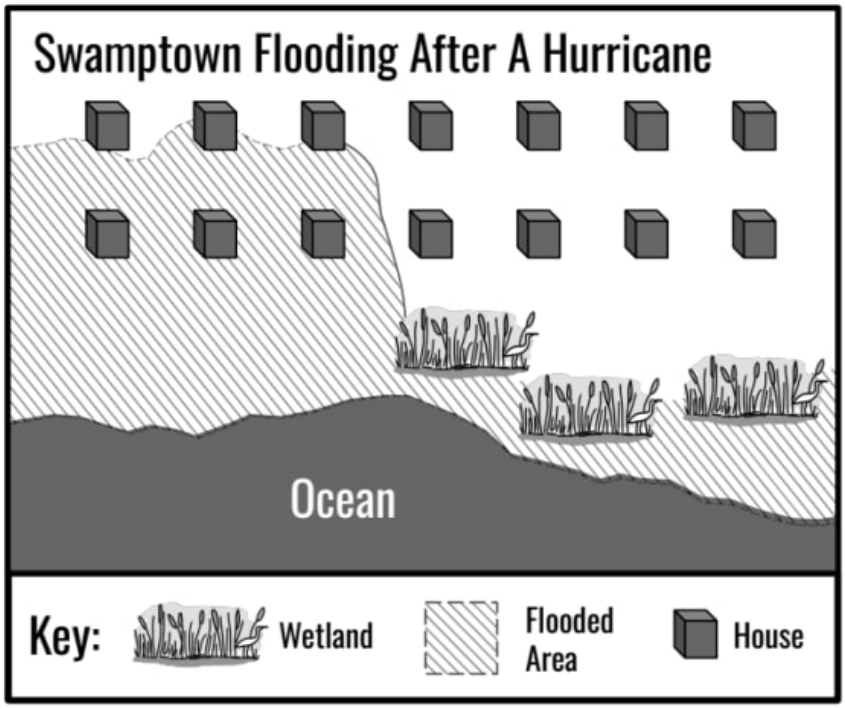


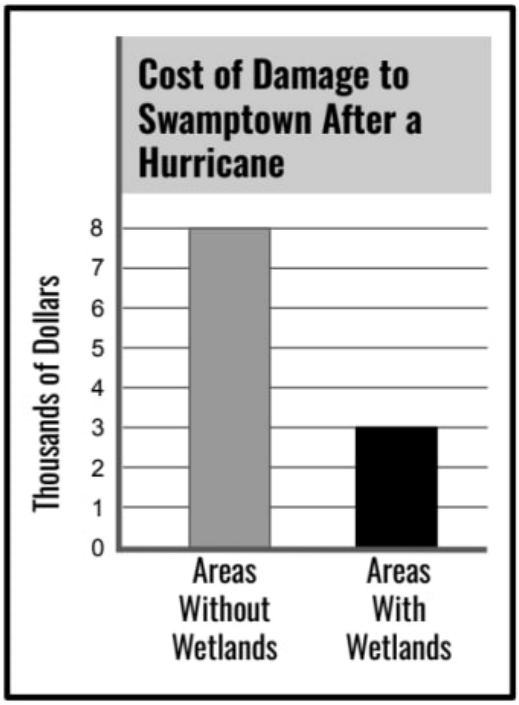
10. The Mini Map above shows the land and types of water in a small part of the world. There are 130 squares of salt water, 41 squares of frozen water, 9 squares of fresh water, and 72 squares of land. Use this information to complete the bar graph below, adding gray bars to compare the types of water and the land in this area.



11. Swamptown is a city in Florida located near the ocean. The city becomes flooded almost every year after hurricanes pass through. Half of the city is protected by wetlands -- swampy areas between the ocean and dry land. The wetlands are home to many plants and animals that can't live anywhere else.

Daniel from the Acme Construction company wants to remove the wetlands and replace them with houses. Naomi, a conservation biologist, argues that Daniel shouldn't do this. Naomi thinks the people in Swamptown should protect the wetlands. You go to the library and find the following map and graph that shows what happens to Swamptown after a hurricane.





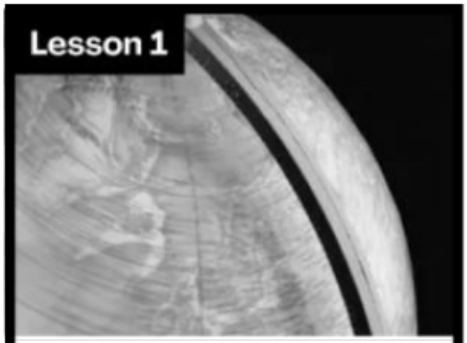
Based on the information you found, what do you think Swamptown should do? Should the city protect the wetlands? Support your answer with evidence.

mystery science

Earth & Space Patterns

5th Grade • NGSS • Unit Worksheets

Lesson 1



How fast does the Earth spin?

Lesson 2

Who set the first clock?

Lesson 3

How can the Sun tell you the season?

Lesson 4

Why do the stars change with the seasons?

Lesson 5

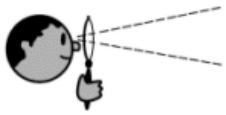
Why does the Moon change shape?

I am also curious about...

See-Think-Wonder Chart

Name: _____

mystery science

See	Think	Wonder
What did you observe? 	How can you explain what is happening? 	What questions do you have? 

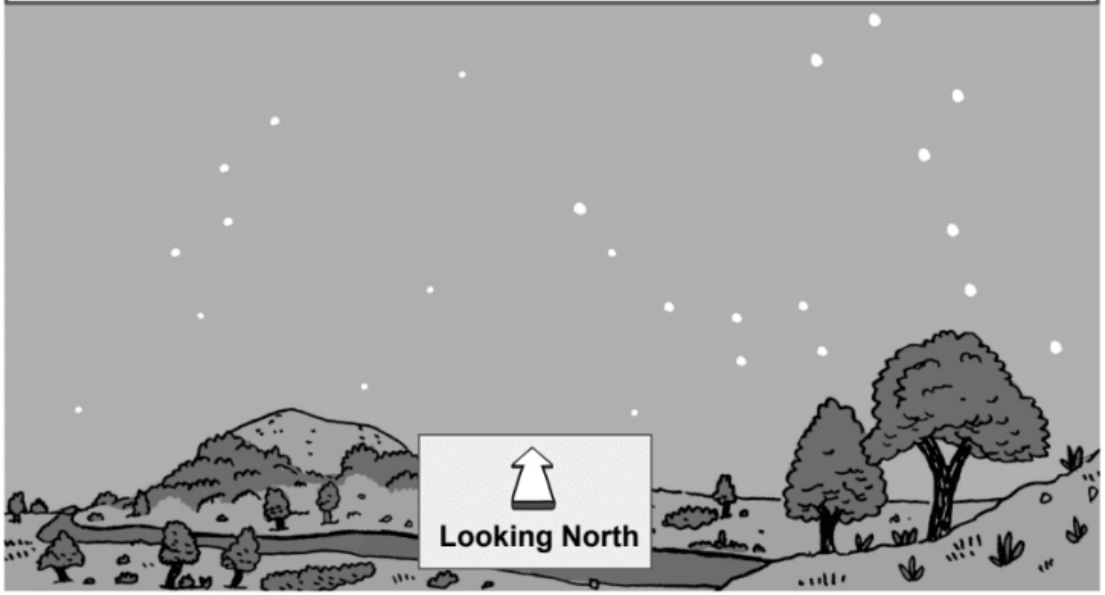
Night-Sky Patterns

mystery science
Earth & Space Patterns | Unit Starter

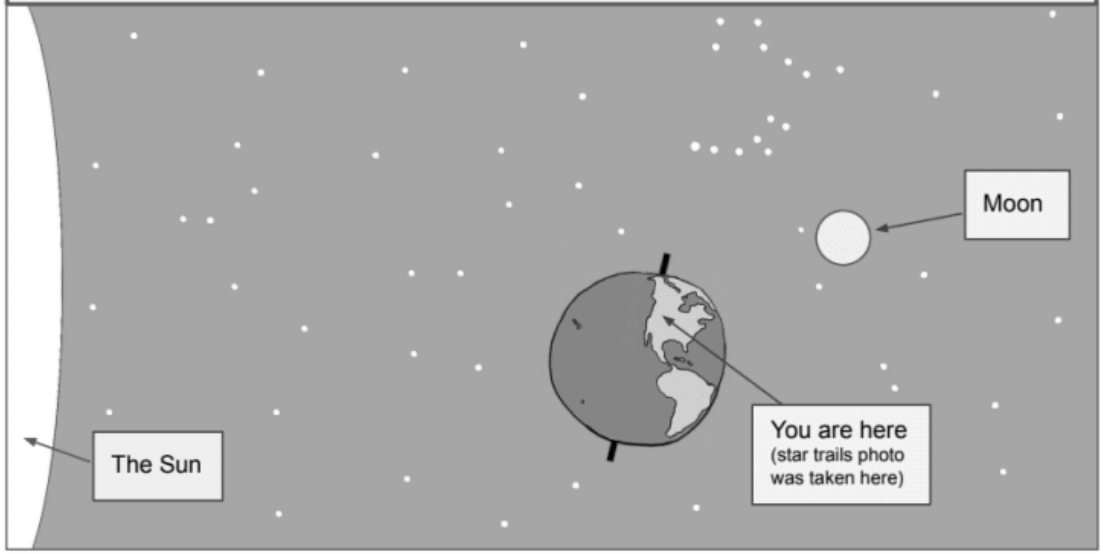
Name: _____

Date: _____ Your Ideas-Version #: ____

View of the night sky from Earth (from Washington State, America)



View of the Earth from space *(not to scale)*

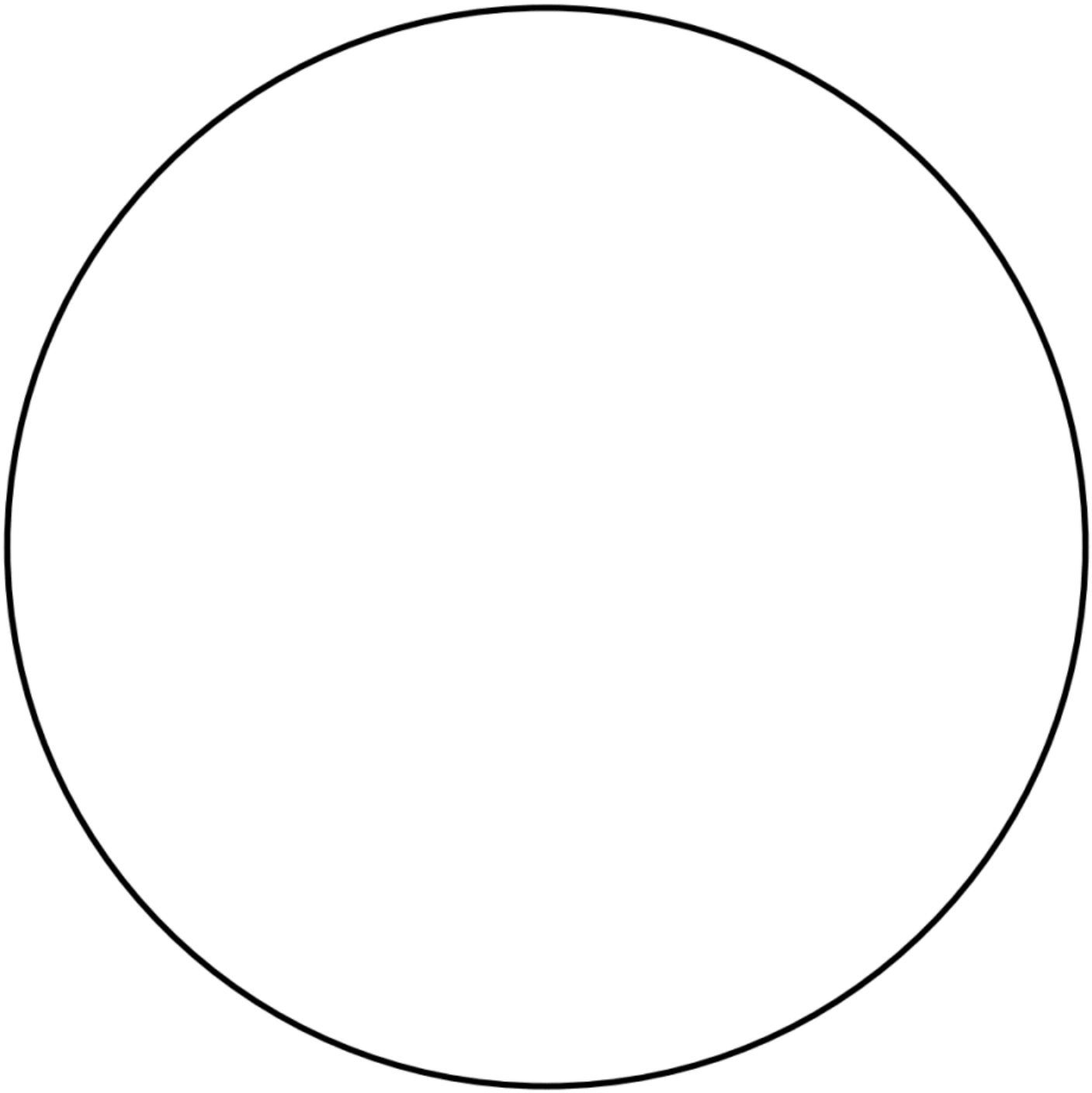


Directions: Use these images and writing space to record your observations of the night sky. Draw what you notice. Make notes of what you think about the patterns that you see. You'll add new information after each Mystery.

If you need more space for drawings or notes, use the back of this page.

mystery science
How fast does the Earth spin?

mystery science
How fast does the Earth spin?

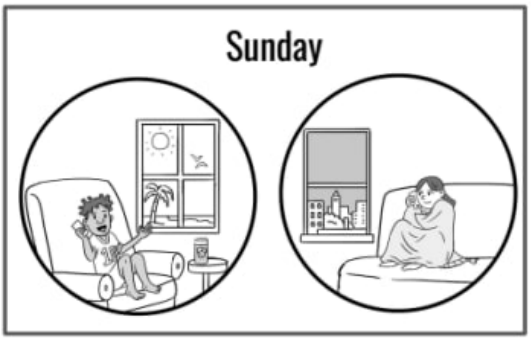


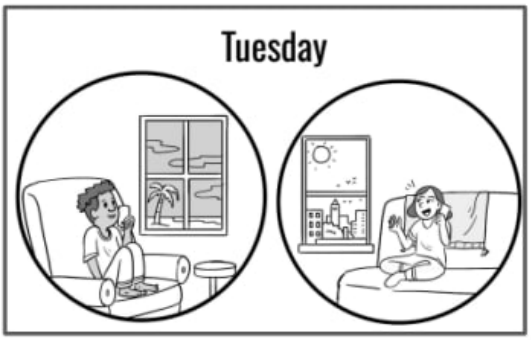
The Sun

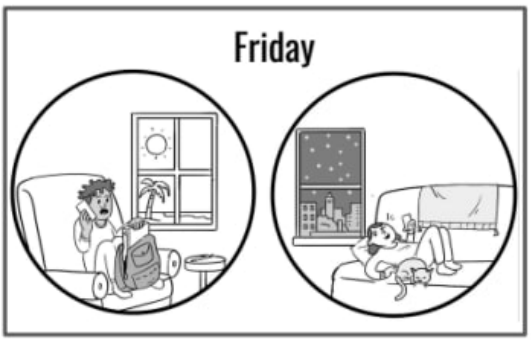
Name: _____

Date: _____

Lesson Assessment







1. Two friends, Dante and Kim, talk on the phone every day. The images on the right show what it looks like outside whenever Dante and Kim talk on the phone. Using information from the images, which of the following sentences are true? Circle **True** or **False** for each sentence.

True False When it's daytime for Dante, it's nighttime for Kim.

True False When it's daytime for Kim, it's daytime for Dante.

True False When it's nighttime for Kim, it's nighttime for Dante.

True False When it's nighttime for Dante, it's daytime for Kim.

2. Looking at the pattern of day and night in the images above, what can you say about where Dante and Kim live?

a. Dante and Kim must live on the same side of the Earth.
b. Dante and Kim must live on opposite sides of the Earth.
c. Dante lives at the North Pole and Kim lives at the South Pole.
d. Dante lives at the South Pole and Kim lives at the North Pole.

3. Compare the images of Dante and Kim on Sunday and Tuesday. What caused the change that you see in the sky? (Hint: Think about the rotation of the Earth.)

_____

_____

_____

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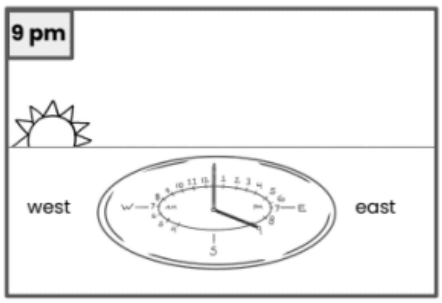
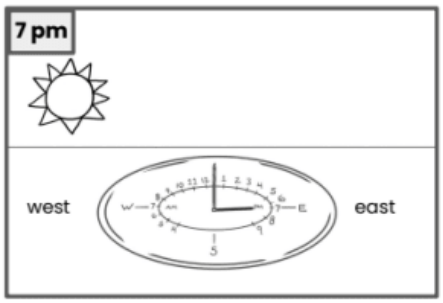
_____

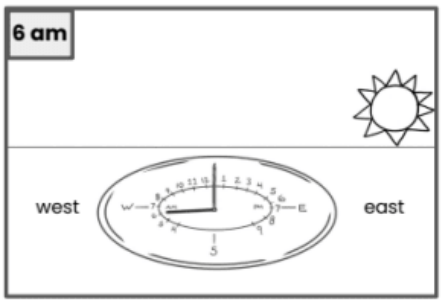
Name: _____

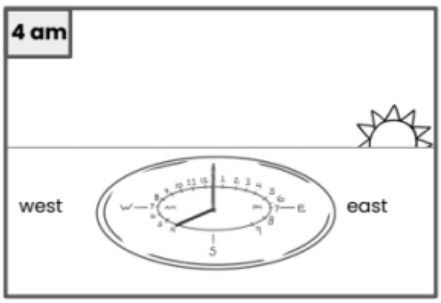
Date: _____

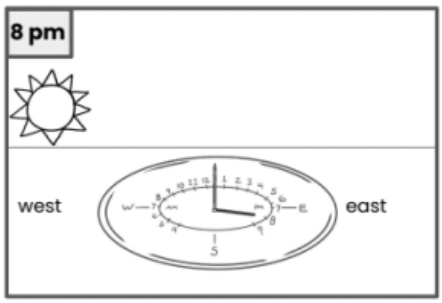
Lesson Assessment

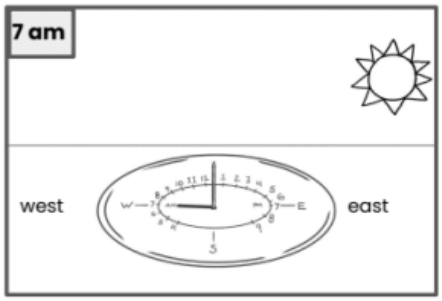












1. Joe made a shadow clock and then made observations throughout the day. Above are six images that show the time of day and the location of the Sun in the sky at each of those times. Using the images above, complete the table on the right with the correct location of the Sun at each time.
Circle if the Sun is closer to the **west** or **east** for each time.

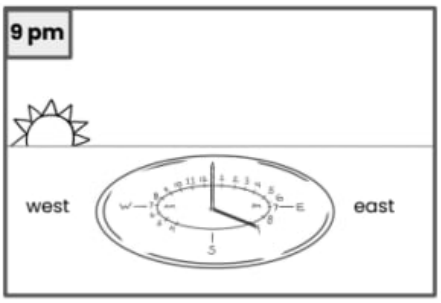
Time	Location of the Sun	
4am	west	east
6am	west	east
7am	west	east
7pm	west	east
8pm	west	east
9pm	west	east

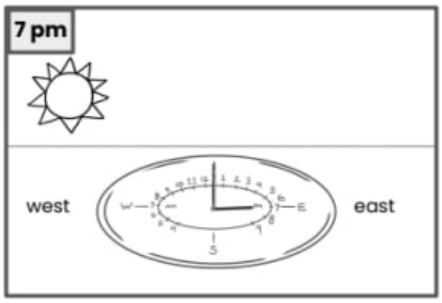
2. Using information from the table on the right, which of the following sentences are true?
Circle **True** or **False** for each sentence.

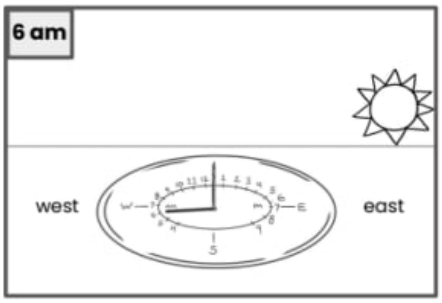
True False The location of the Sun is always in the **west** in the morning.

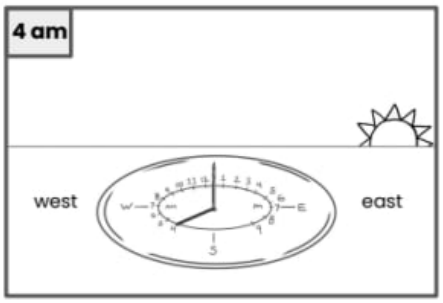
True False The location of the Sun is always in the **west** in the evening.

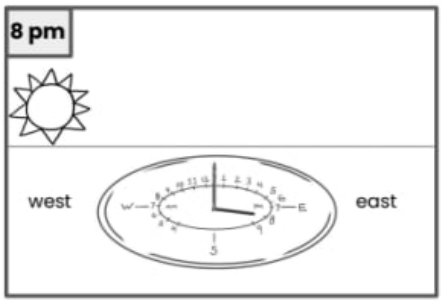
True False The Sun rises in the **east** at the start of the day and sets in the **west** at the end of the day.

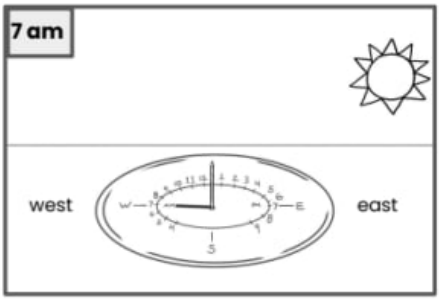












After taking another look at his shadow clock, Joe makes another observation. He notices that the Sun's position changes throughout the day, but he also notices that the length of the shadow that the clock makes changes too. Joe decides to measure the length of the shadow at different times throughout the day. Joe records the length of the shadow in the table on the right.

Time	Length of Shadow
4am	**7 cm**
6am	**5 cm**
7am	**4 cm**
7pm	**4 cm**
8pm	**5 cm**
9pm	**7 cm**

3. Using information from the table on the right, which of the following patterns do you notice?
Circle **True** or **False** for each sentence.

True False Shadows change throughout the day and there is no pattern.

True False Shadows are longer in the early morning and late evening.

True False Shadows are longest in the morning and decrease in length throughout the day.

4. Looking at the length of shadows, what would you expect the shadow at 5:00pm to look like?

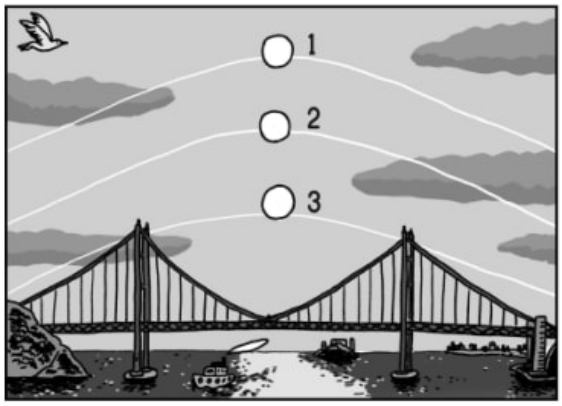
a. At 5:00pm, the shadow will likely be shorter than the shadow at 7:00pm.
b. At 5:00pm, the shadow will likely be the same as the shadow length at 7:00pm.
c. At 5:00pm, the shadow will likely be longer than the shadow at 7:00pm.
d. At 5:00pm, there won't be a shadow because it's evening.

Name: _____

Date: _____

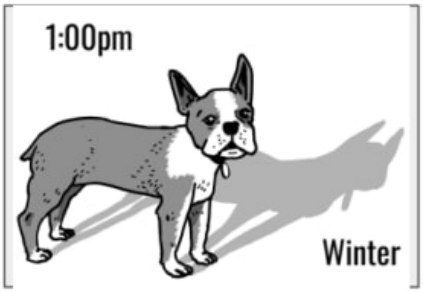
Lesson Assessment

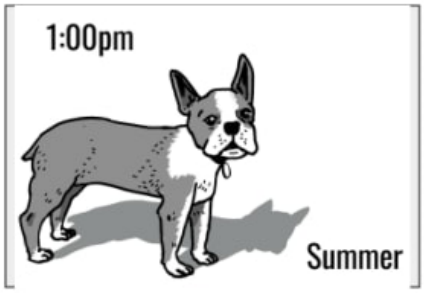
The image on the right shows the path of the Sun across the sky during different seasons when viewed from the Earth. Each path number represents the following season:



1 = Summer
2 = Spring and Fall
3 = Winter

Keisha takes her dog out for a walk every day across the bridge shown in the image above. Keisha notices that her dog's shadow doesn't always look the same throughout the year, even though she always takes him for a walk at the exact same time of day. Below are two photos of Keisha's dog. One photo was taken during the winter and one photo was taken during the summer.





1. Using information from the images above, which of the following patterns do you notice? Circle all correct answers. There may be more than one correct answer.

a. Shadows are longer in winter when the Sun's path is lower in the sky.
b. Shadows are longer in winter when the Sun's path is higher in the sky.
c. Shadows are shorter in the summer when the Sun's path is higher in the sky.
d. Shadows are shorter in the summer when the Sun's path is lower in the sky.

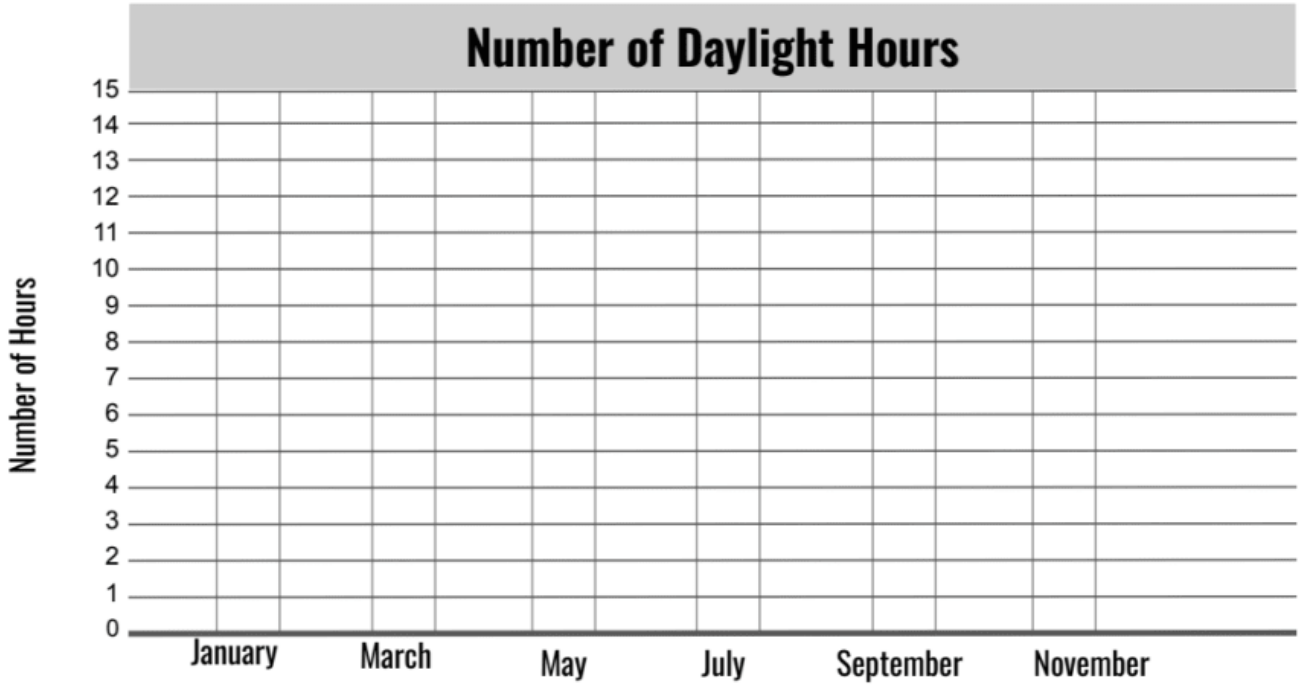
2. The Earth rotates on its axis once a day. The Moon orbits around the Earth once a month. The Earth orbits around the Sun once a year. In the image with the bridge, you can observe that the path of the Sun across the sky changes. What most likely causes that path to take as long as it does to change?

a. The Earth's rotation is most likely the cause because the pattern changes daily.
b. The orbit of the Moon around the Earth is most likely the cause because the pattern changes monthly.
c. The orbit of the Earth around the Sun is most likely the cause because the pattern changes yearly.

3. Keisha loves taking her dog for long walks. But she only likes to walk him during daylight. Keisha wants to figure out if she can take her dog out for longer walks in any particular season throughout the year.

The table on the right shows the time of sunrise and sunset for different months of the year where Keisha lives. Complete the table with the total number of daylight hours shown for each month. Then, use those numbers to complete the graph below.

Month	Sunrise	Sunset	Daylight Hours
January	7:30am	5:30pm	
March	7:00am	7:00pm	
May	6:30am	7:30pm	
July	6:30am	8:30pm	
September	7:00am	7:00pm	
November	7:30am	6:30pm	



4. The number of daylight hours in the table above follows a pattern. First, describe the pattern that you notice. Then, look back at the images on Page 1. How do the images help to explain the pattern?

Constellation Guide

Some constellations that you can see in the sky each season:

spring

Bootes,
the Ice Cream Cone

Ursa Major,
the Big Bear

Leo,
the Lion

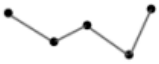
summer

Lyra,
the Harp

Sagittarius,
the Teapot

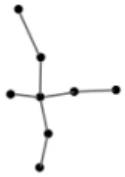
Scorpius,
the Scorpion

autumn



Cassiopeia,
the Crown

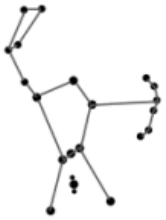
Pegasus,
the Horse
(head and front legs)



Cygnus,
the flying Swan

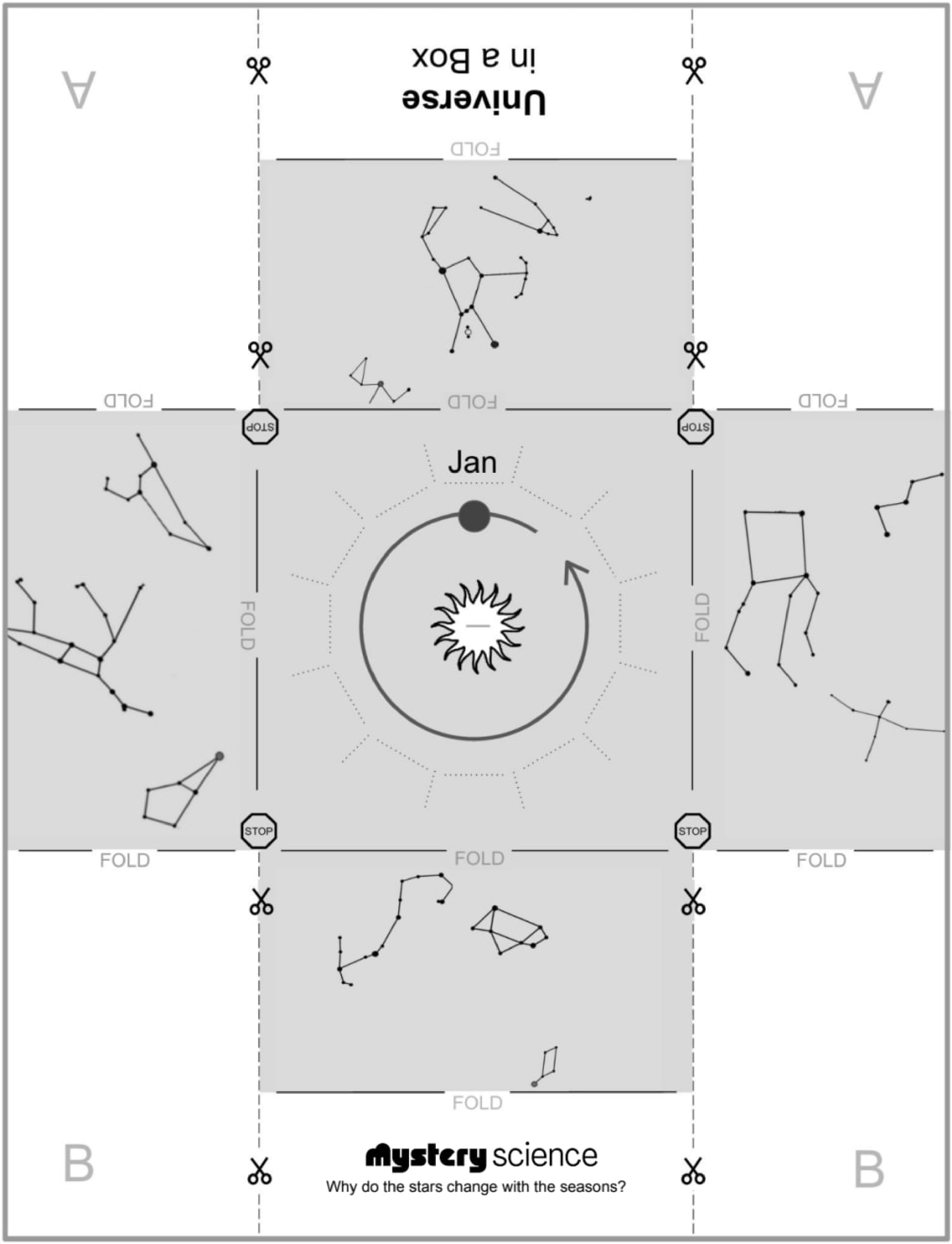
winter

Canis Major,
the Big Dog

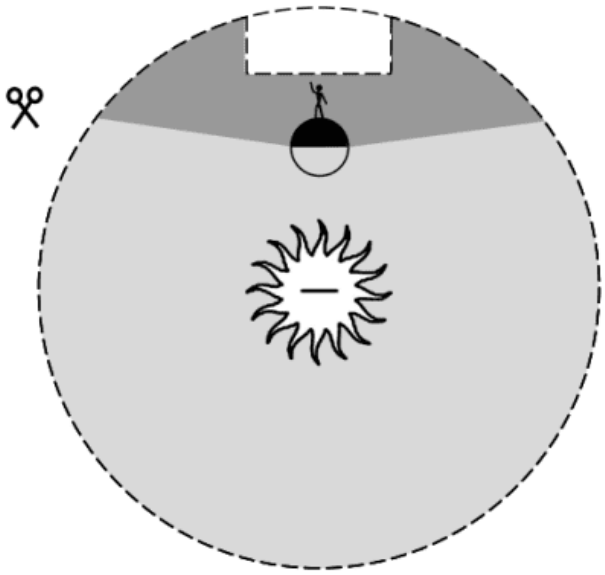


Orion,
the Hunter

Taurus,
the Bull's horns


Universe
in a Box
A
A
FOLD
Jan
STOP
B
B
Mystery science
Why do the stars change with the seasons?

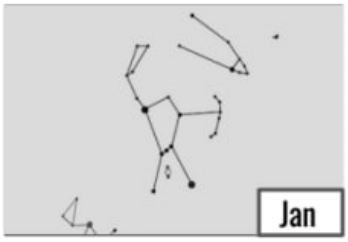
Universe
in a Box

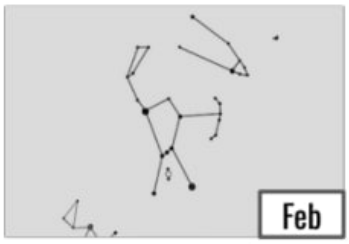


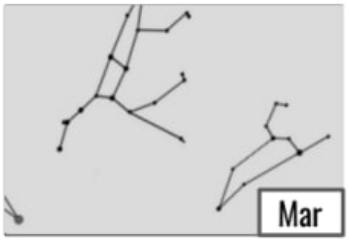
Name: _____

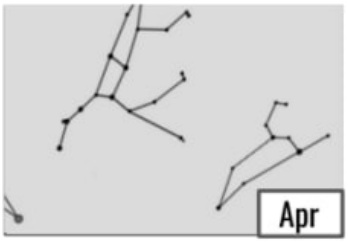
Date: _____

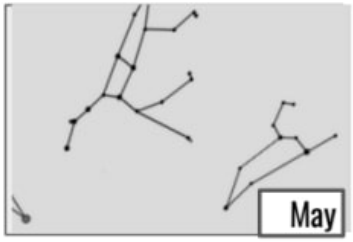
Lesson Assessment

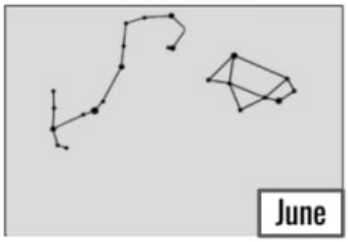


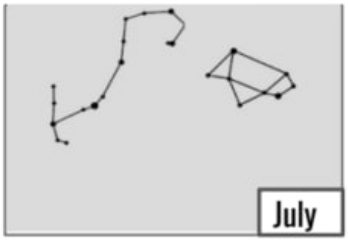


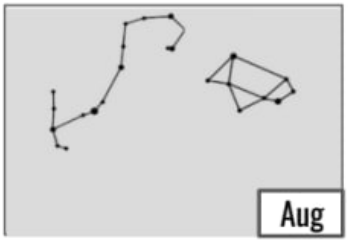


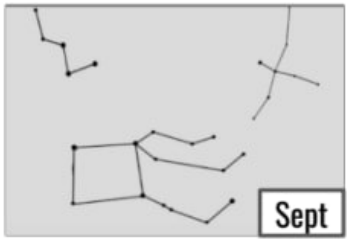


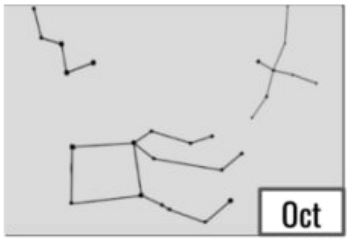


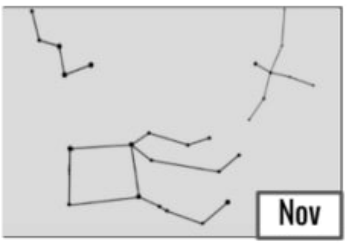


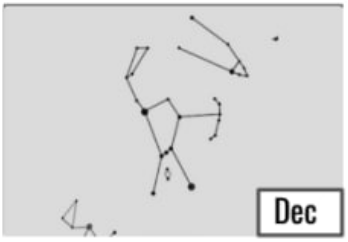












1. Darion has a telescope and he loves looking up at the constellations. Above are pictures that he drew of his favorite constellations he could see in the night sky each month throughout the year. Using the chart below, add an “X” in the first row for each month that you see the constellation “Pegasus” in the sky. In the second row, add an “X” for every month that you see the constellation “Leo” in the sky. In the third row, add an “X” for every month that you see the constellation “Sagittarius” in the sky.

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
 Pegasus												
 Leo												
 Sagittarius												

2. Using information from the table you created for Question #1, which of the following patterns do you notice? Circle **True** or **False** for each sentence.

True False All constellations can be seen at every month throughout the year.

True False The constellation Pegasus can only be seen in the fall/autumn months (Sept/Oct/Nov).

True False The constellation Leo can only be seen in the spring months (Mar/Apr/May).

True False The constellation Sagittarius can only be seen in the winter months (Dec/Jan/Feb).

3. The Earth rotates on its axis. The Earth completes one rotation each day. The Earth also revolves around the Sun. The Earth completes this revolution (also called an orbit) around the Sun once every year. Do you think the Earth's rotation or the Earth's revolution is the reason for the pattern you see in the constellations? Why do you think that?

[Hint: Look at the table in Question #1 for a clue.]

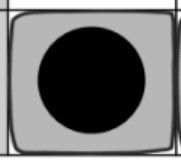
Name: _____

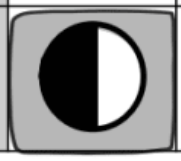
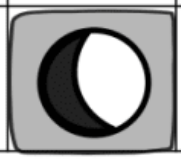
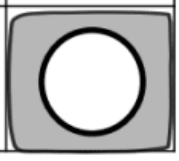
Date: _____

Lesson Assessment

1. Jin notices that the Moon doesn't always look the same every night. Jin wants to figure out if there is a pattern in how the appearance of the Moon changes. He has a telescope and decides to take a photo of the Moon each night for two weeks. The table below shows some of the photos that Jin took of the Moon. Even though some of Jin's photos are missing, what pattern do you notice? Circle all correct answers. There may be more than 1 correct answer.

a. The bright part of the Moon that he can see gets larger between night 1 and night 14.
b. The bright part of the Moon that he can see gets smaller between night 1 and night 14.
c. The dark part of the Moon that he can see gets larger between night 1 and night 14.
d. The dark part of the Moon that he can see gets smaller between night 1 and night 14.

Night	1	2	3	4	5	6	7
Moon's Appearance							

Night	8	9	10	11	12	13	14
Moon's Appearance							

2. Jin is missing photos of the Moon from night 3, 5, 6, 9, 11, 12, and 13. Look for the pattern of the Moon's appearance changing. Complete the table by drawing what you would expect the Moon to look like on those nights.

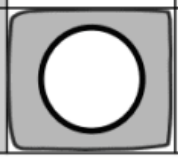
3. Jin knows that the Moon orbits the Earth. He also knows that it takes the Moon about 28 days, or one month, to complete its orbit. That's why we call it a *month* – similar to Moon-th!

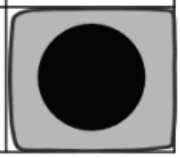
Jin noticed a pattern with the changing appearance of the Moon over the first 14 days of the month. Look back at Page 1 to see the pattern.

If Jin continues taking photos of the Moon every night for another two weeks, what pattern will he notice? Circle all correct answers. There may be more than 1 correct answer.

a. The bright part of the Moon that he can see will get larger between night 15 and night 28.
b. The bright part of the Moon that he can see will get smaller between night 15 and night 28.
c. The dark part of the Moon that he can see will get larger between night 15 and night 28.
d. The dark part of the Moon that he can see will get smaller between night 15 and night 28.

4. Complete the table below with a drawing of what the Moon will look like each night.

Night	15	16	17	18	19	20	21
Moon's Appearance							

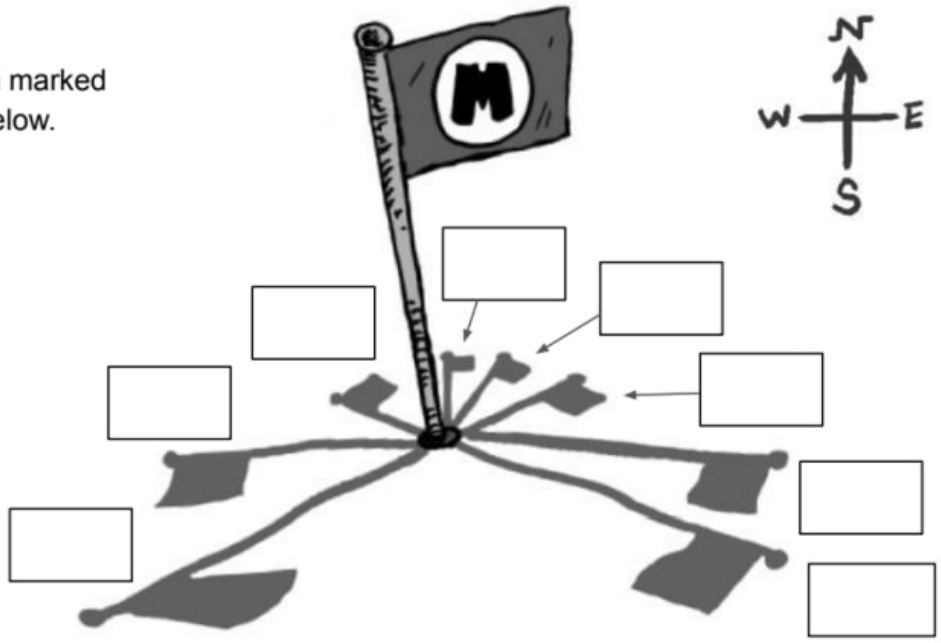
Night	22	23	24	25	26	27	28
Moon's Appearance							

5. Jin took all the photos of the Moon during the month of February. February is a month with 28 days. What do you expect the Moon to look like on the 1st day of March? Explain your reasoning using the pattern of the Moon's appearance from Jin's observations.

Name: _____

Daytime Clock

One day, a fifth grade class in Minnesota marked a flagpole's shadow at the times listed below. They made this diagram of their results.



1. Figure out which time each shadow was made and write the time in the box beside each shadow.

- 5 AM (sunrise)
- 8 AM
- 10 AM
- 12 PM (noon)
- 2 PM
- 4 PM
- 6 PM
- 7 PM (sunset)

Invent a Night-Sky Clock

2. What do you notice changing in the night sky? Describe and/or draw the changes you see. If you need more room, use the back of the paper.

_____

_____

_____

_____

_____

_____

_____

_____

3. Look at what you wrote or drew in question #2. Circle the changes that you think will repeat the next night in the same way. Those are patterns that are useful for telling time.

Name: _____

4. Look at the changes you circled in question #2. Which one will you use to make your Night-Sky Clock? Write your choice here:

_____

5. Write or draw your ideas about how you could record the changes in that pattern. How will you record the time that you see each change?

_____

_____

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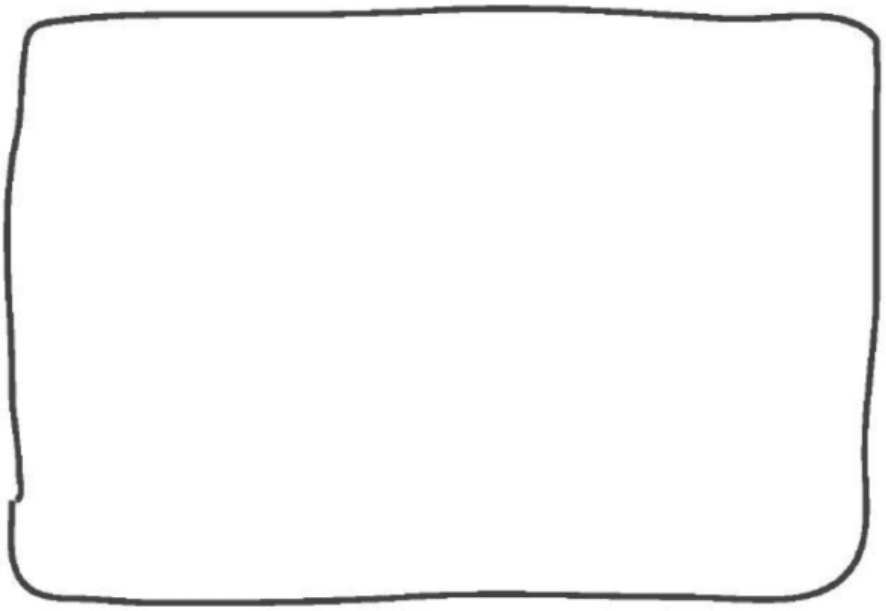

6. Write a description of how you'll tell time with your Night-Sky Clock. Or, if you'd prefer, draw a picture of your Night-Sky Clock, showing how you would use it to tell time.

_____

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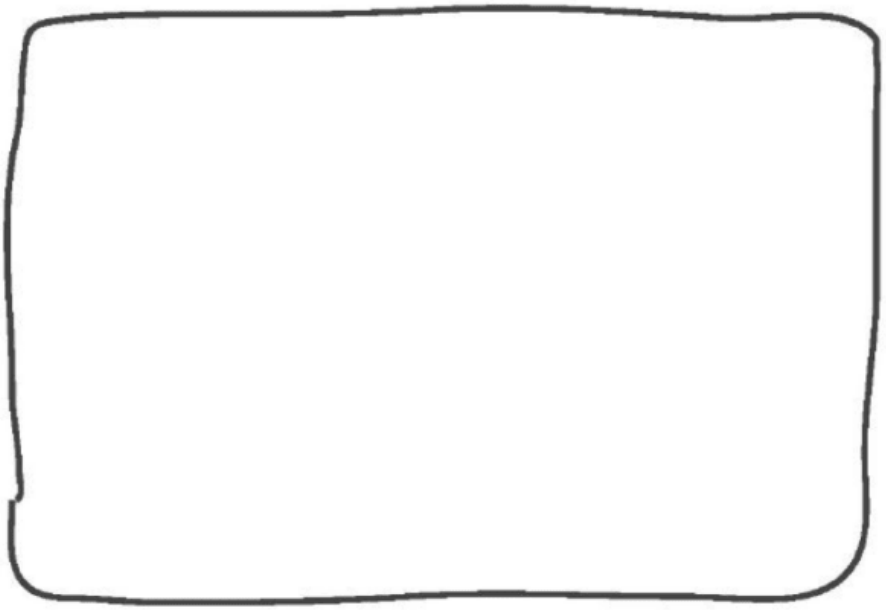


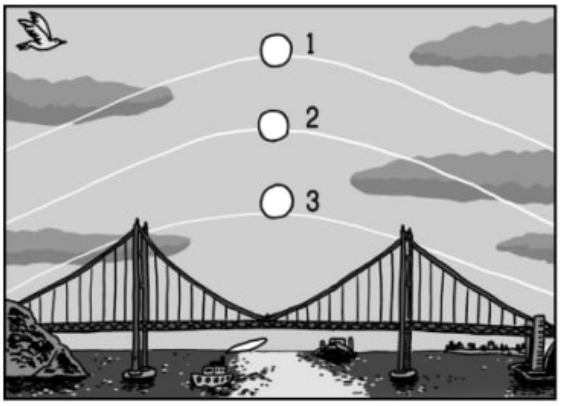
Earth & Space Patterns

Name: _____

Date: _____

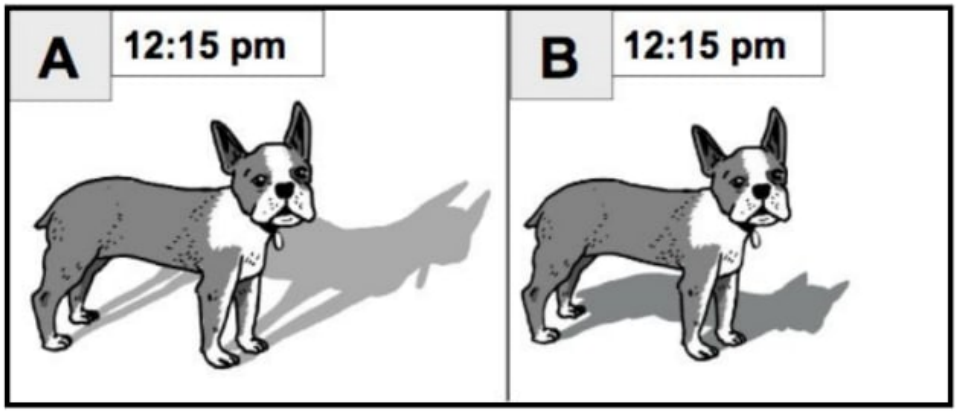
Unit Assessment

1. The image on the right shows the path of the Sun across the sky during different seasons when viewed from the Earth. Which season does each path represent?



a. 1 = summer, 2 = winter, 3 = spring and fall
b. 1 = summer, 2 = spring and fall, 3 = winter
c. 1 = winter, 2 = summer, 3 = spring and fall
d. 1 = winter, 2 = spring and fall, 3 = summer

2. These two photographs of the same dog were taken in two different seasons. Which photograph, A or B, was taken during winter? Why do you think this? Support your answer with reasoning.



_____

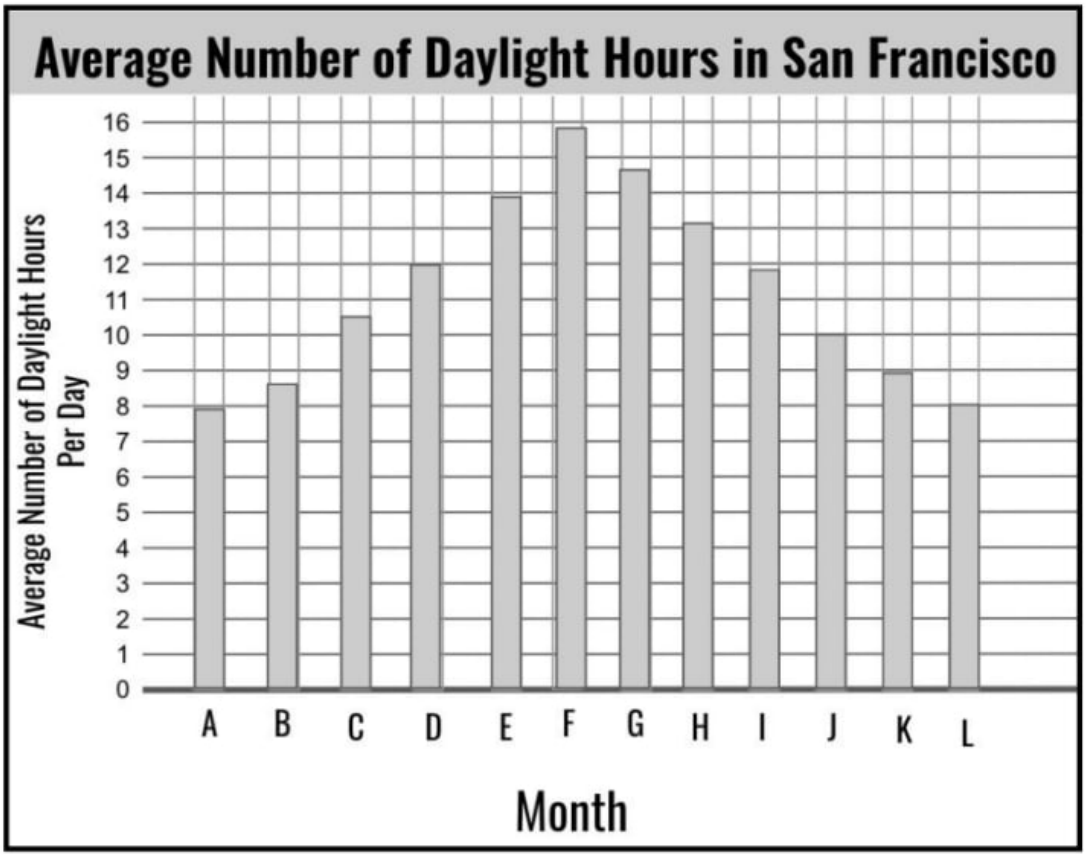
_____

_____

_____

_____

Use this Graph to help you answer Question 3 and Question 4.



3. This graph shows the average number of daylight hours during each month of the year in San Francisco, California. (San Francisco is in the Northern Hemisphere.) Which months in the graph are the summer months?

a. Months B, C, and D
b. Months E, F, and G
c. Months H, I, and J
d. Months K, L, and A

4. Why do you think these are the summer months? Support your answer to Question 3 with reasoning.

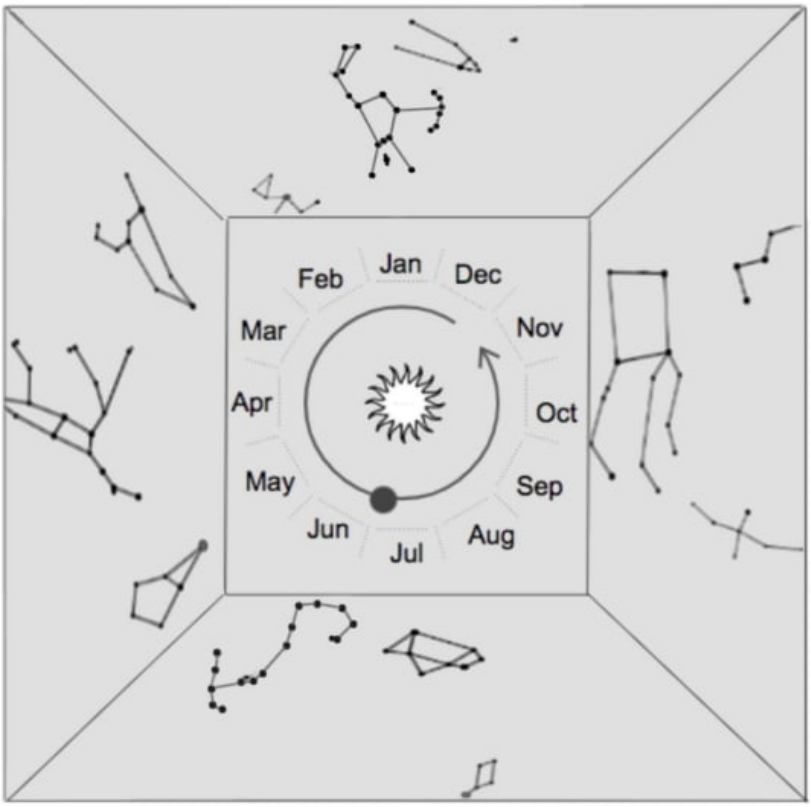
_____

_____

_____

_____

Use this Universe-in-a-Box to help you answer Question 5 and Question 6.

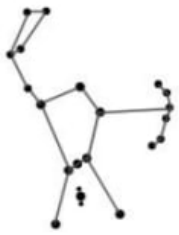


Universe-in-a-Box

Scorpius,
the Scorpion

5. You look up at the night sky and see the constellation Scorpius. What season is it?

a. Spring
b. Summer
c. Fall
d. Winter



Orion,
the Hunter

6. Why can't you see the constellation Orion during the summer? Support your answer with reasoning.

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Stars & Planets

5th Grade • NGSS • Unit Worksheets

How can the Sun help us explore other planets?

Why is gravity different on other planets?

Could there be life on other planets?

I am also curious about...

Name: _____

Wandering Stars

The night sky is filled with many stars. Ancient people noticed that some things that *looked* like stars appeared to wander in the sky. The ancient Greeks had a name for these wandering stars: planētēs.

On this page, you'll record your explanation for the wandering stars today. Then, at the end of this unit, you'll look back at this so that you can see all of the things that you learn.

The ancient Greeks called the wandering stars _____.

Ancient people noticed that the wandering stars were different from the other stars because they

_____.

Why do you think that the wandering stars appear to move, but the stars *don't* appear to move? You can draw in the space below, and write what you think on the lines.

_____

_____

_____

_____

Today, we know that the wandering stars are planets. What else do you know about the planets? You can continue onto the back of the page if you need more space.

_____

_____

_____

Name: _____

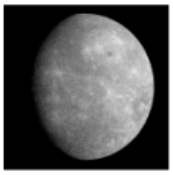
Solar System Notebook

In this unit, you will learn about some of the incredible places in our solar system. You will update this notebook with the things that you learn from each lesson in the unit.

At the end of this unit, you will use these notes in a performance task. The more notes you have, the better! You can write on the back of each page if you need more space.

Planets in the Solar System Notebook are not shown to scale.

Mercury

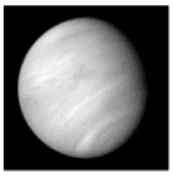


_____

_____

_____

Venus



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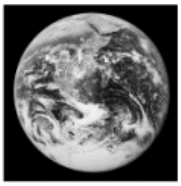
_____

_____

Earth



_____

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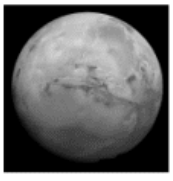
_____

Mars



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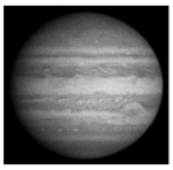
_____

_____

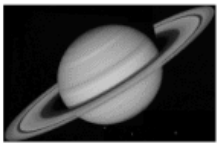
Solar System Notebook

Name: _____

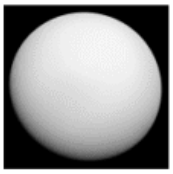
Jupiter



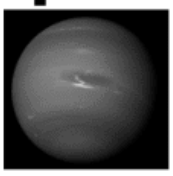
Saturn



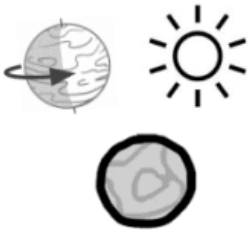
Uranus



Neptune



Other



See-Think-Wonder Chart

Name: _____

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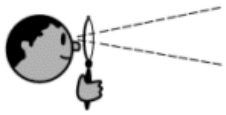
See	Think	Wonder
What did you observe? 	How can you explain what is happening? 	What questions do you have? 

Brightness Test

Names: _____ _____

Rover name: _____

How bright does the Sun look from each planet?

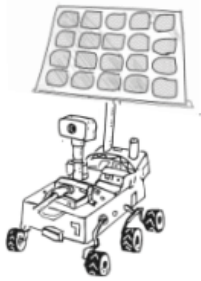
	1 **Mercury**	2 **Venus**	3 **Earth**	4 **Mars**	5 **Jupiter**	6 **Saturn**	7 **Uranus**	8 **Neptune**
	Very Bright	Very Bright	Very Bright	Very Bright	Very Bright	Very Bright	Very Bright	Very Bright
	Bright	Bright	Bright	Bright	Bright	Bright	Bright	Bright
	Dim	Dim	Dim	Dim	Dim	Dim	Dim	Dim
	Very Dim	Very Dim	Very Dim	Very Dim	Very Dim	Very Dim	Very Dim	Very Dim
	Barely Visible	**Barely Visible**	**Barely Visible**	**Barely Visible**	**Barely Visible**	**Barely Visible**	**Barely Visible**	**Barely Visible**
More data:								

1. Which planet are you going to send your solar-powered rover to? _____
2. Why did you choose that planet? Use evidence to support your argument. _____

_____

_____

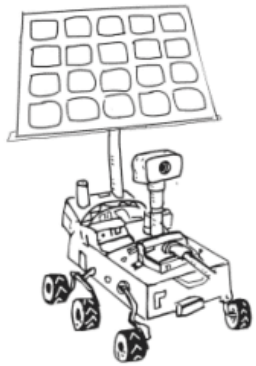
_____



mystery science

How can the Sun help us explore other planets?

Rover name: _____



Sun

1

2

3

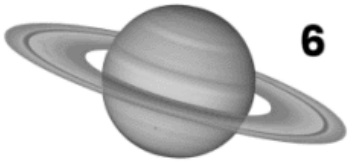
4

A

B

5

C



6

D

E

F

mystery science

How can the Sun help us explore other planets?

F

G

H

I

J

K

7

8

mystery science
How can the Sun help us explore other planets?

Name: _____

Date: _____

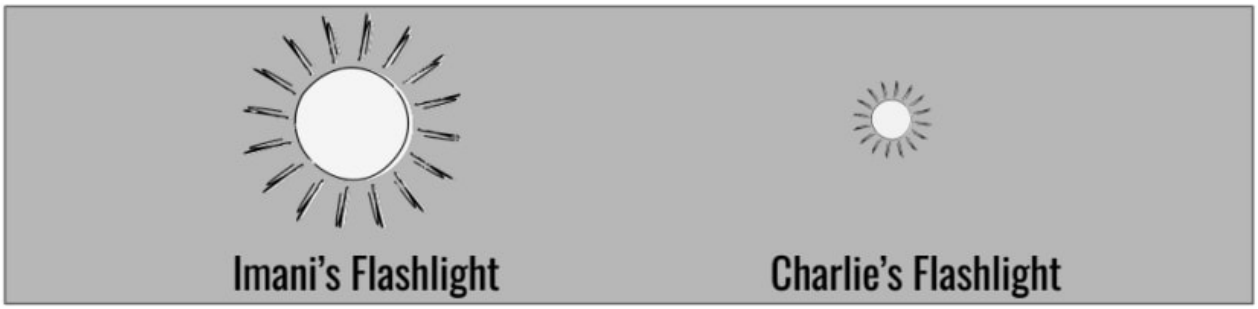
Lesson Assessment

1. You go on a camping trip with two friends, Imani and Charlie. You give each of them a flashlight so they don't get lost in the dark. Both flashlights are the exact same size and are equally bright.

Imani

Charlie

But as you sit in the dark, you see two lights. Imani's flashlight appears much, much brighter than Charlie's flashlight. You know that their flashlights are exactly the same. What could explain this?



Imani's Flashlight

Charlie's Flashlight

a. Imani is closer to you than Charlie is. Light appears dimmer the farther away you are from it, so because Imani's flashlight appears brighter, it must be closer.
b. Charlie is closer to you than Imani is. Light appears brighter the farther away you are from it, so because Imani's flashlight appears brighter, it must be the farther away.
c. Imani and Charlie are equally far away from you. Distance has no effect on how bright a light appears, so there must be some other explanation.

Model Not To Scale

2. The image above is a model that shows relative distances between the Sun and the planets in our solar system. The model doesn't show the size of the planets, but it helps to show how far away the planets are from the Sun. Use this model to help you think about the brightness of the Sun. Circle **True** or **False** for each sentence.

True False The Sun will appear brighter when viewed from Earth than when viewed from Saturn because Earth is closer to the Sun.

True False The Sun will appear equally bright when viewed from Jupiter and when viewed from Neptune because distance does not affect brightness.

True False The Sun will appear like a small, dim star when viewed from Neptune because it is so far away.

True False The Sun will always appear the same because distance does not change how bright the Sun appears.

3. Imagine someone says to you, "The Sun is just a star, even though it looks way bigger and brighter than all the other stars!" Do you agree or disagree? Support your answer with reasoning. You can use evidence from the other questions to support your answer!

Gravity Jump Data 

Name: _____

1. Measure how many centimeters you can jump.

Location	Height of Jump 1	Height of Jump 2
Earth	_____ cm	_____ cm

2. Find the average of how high you can jump.

Add your jumps together.	Divide your answer by 2.	Round to the nearest whole number.
		_____ cm This is your average Earth jump. (A)

3. Figure out how high you could jump on different planets and moons.

Location	(B) Compared to Earth, this place has...	(C) How many times more or less gravity does it have than Earth?	(D) In this place, my jump would be:	(E) To figure out my jump on this place, I need to:	Calculate how high you can jump on each planet or moon using the equation below.
Moon	more gravity less gravity		higher lower	multiply divide	(A) ____ (E) x or ÷ (C) ____ =
Jupiter	more gravity less gravity		higher lower	multiply divide	(A) ____ (E) x or ÷ (C) ____ =
Triton	more gravity less gravity		higher lower	multiply divide	(A) ____ (E) x or ÷ (C) ____ =
Titan	more gravity less gravity		higher lower	multiply divide	(A) ____ (E) x or ÷ (C) ____ =
Mars	more gravity less gravity		higher lower	multiply divide	(A) ____ (E) x or ÷ (C) ____ =
Neptune	more gravity less gravity		higher lower	multiply divide	(A) ____ (E) x or ÷ (C) ____ =

4. What pattern do you notice between how massive a planet or moon is and the amount of gravity that it has? Hint: Look at your graph.

I notice that _____

_____

_____

Gravity Graph

Name: _____

How High Could I Jump?

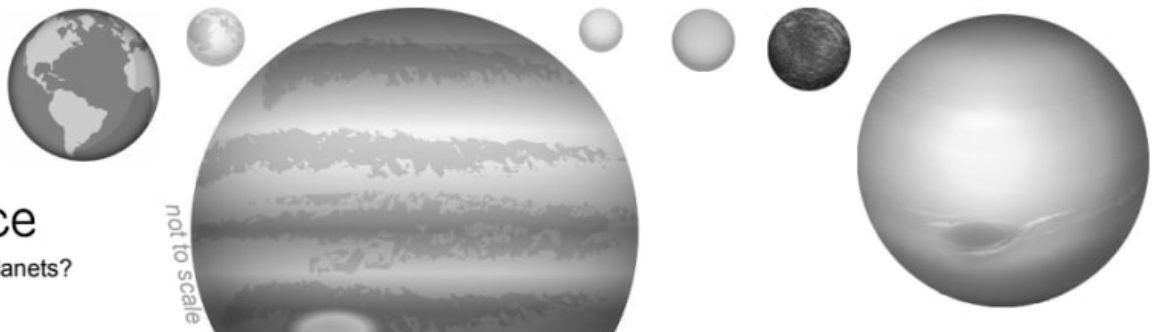
centimeters | cm

400 390 380 370 360 350 340 330 320 310 300 290 280 270 260 250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0

Can you jump over a basketball hoop?

Can you jump over a bear?

Can you jump so high you'd hit the ceiling?



mystery science

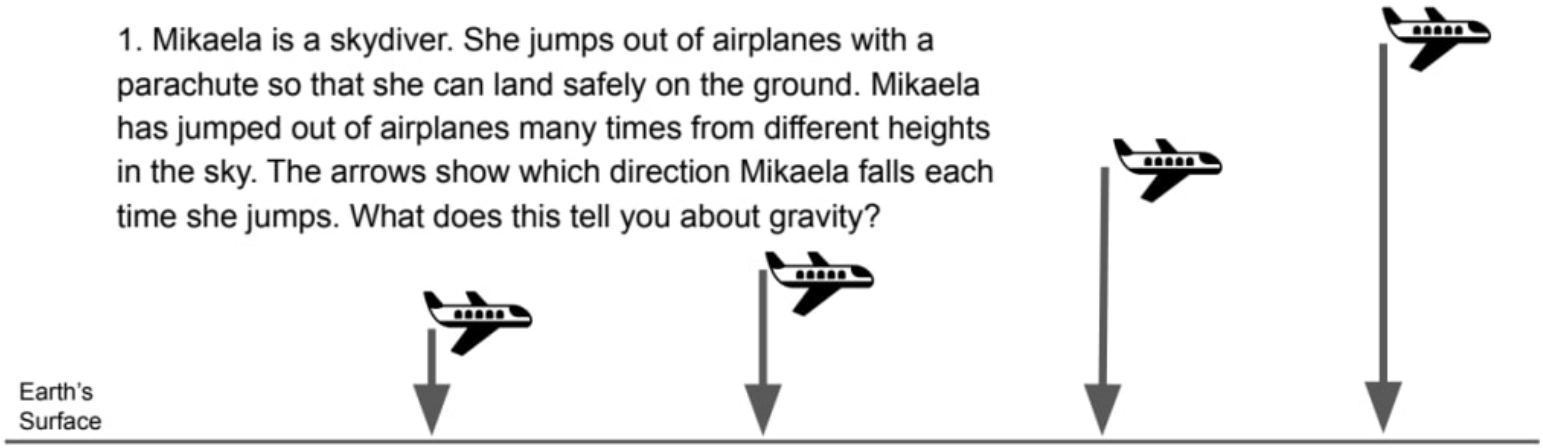
Why is gravity different on other planets?

Name: _____

Date: _____

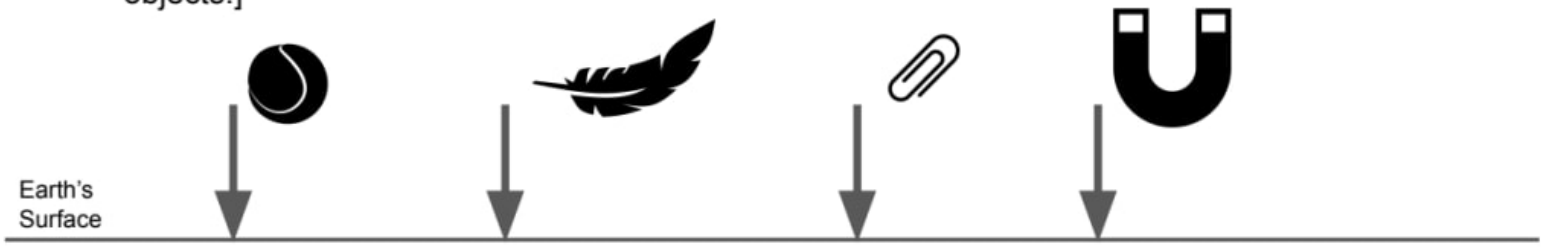
Lesson Assessment

1. Mikaela is a skydiver. She jumps out of airplanes with a parachute so that she can land safely on the ground. Mikaela has jumped out of airplanes many times from different heights in the sky. The arrows show which direction Mikaela falls each time she jumps. What does this tell you about gravity?



a. When Mikaela jumps from a distance that is farther away from the surface of the Earth, the direction of gravity changes.
b. When Mikaela jumps from a distance that is farther away from the surface of the Earth, the direction of gravity never changes.
c. When Mikaela jumps from a distance that is farther away from the surface of the Earth, the strength of gravity increases and she falls faster.
d. When Mikaela jumps from a distance that is farther away from the surface of the Earth, the strength of gravity decreases and she falls slower.

2. Mikaela decides to do an experiment. As she flies in the airplane, she drops different objects to see what happens. She drops a tennis ball, a feather, a paper clip, and a magnet. She watches what happens to each object. The arrows show which direction each object falls after it is dropped from the airplane. What does this tell you about gravity?
[Don't worry! She makes sure there aren't any people around so nobody gets hurt by falling objects!]



a. Gravity only pulls heavy objects down toward the surface of the Earth.
b. Gravity only pulls light objects down toward the surface of the Earth.
c. Gravity only pulls magnetic objects made of metal toward the surface of the Earth.
d. Gravity pulls all objects down toward the surface of the Earth.

3. Mikaela has jumped out of airplanes all over the world. Below is a drawing that shows the different locations where she has jumped out of an airplane. The arrows show which direction Mikaela fell after she jumped out of each airplane. What does this tell you about gravity? Choose all correct answers.

a. Gravity has no pattern. The direction it pulls objects is always different.
b. Gravity has a pattern. The direction it pulls objects is always “down” when down means toward the center of the Earth.
c. Gravity only pulls objects “down” toward the surface of the Earth in certain locations.
d. Gravity always pulls objects “down” toward the surface of the Earth, no matter the location.

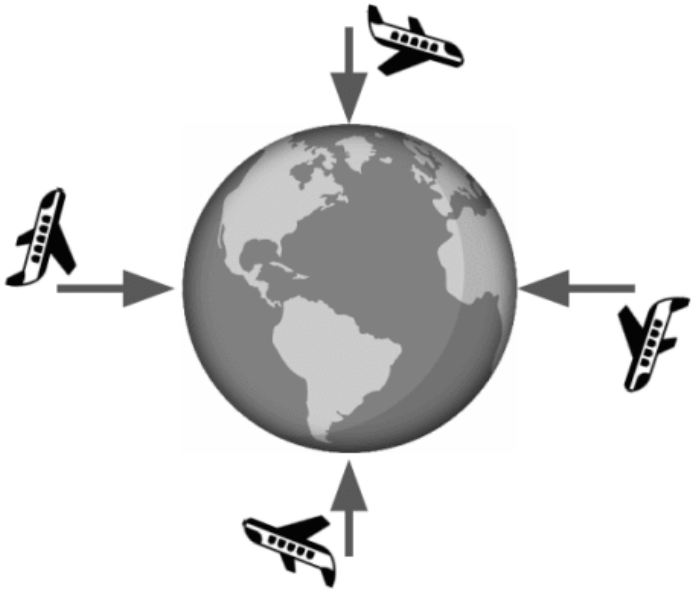


Image Not To Scale

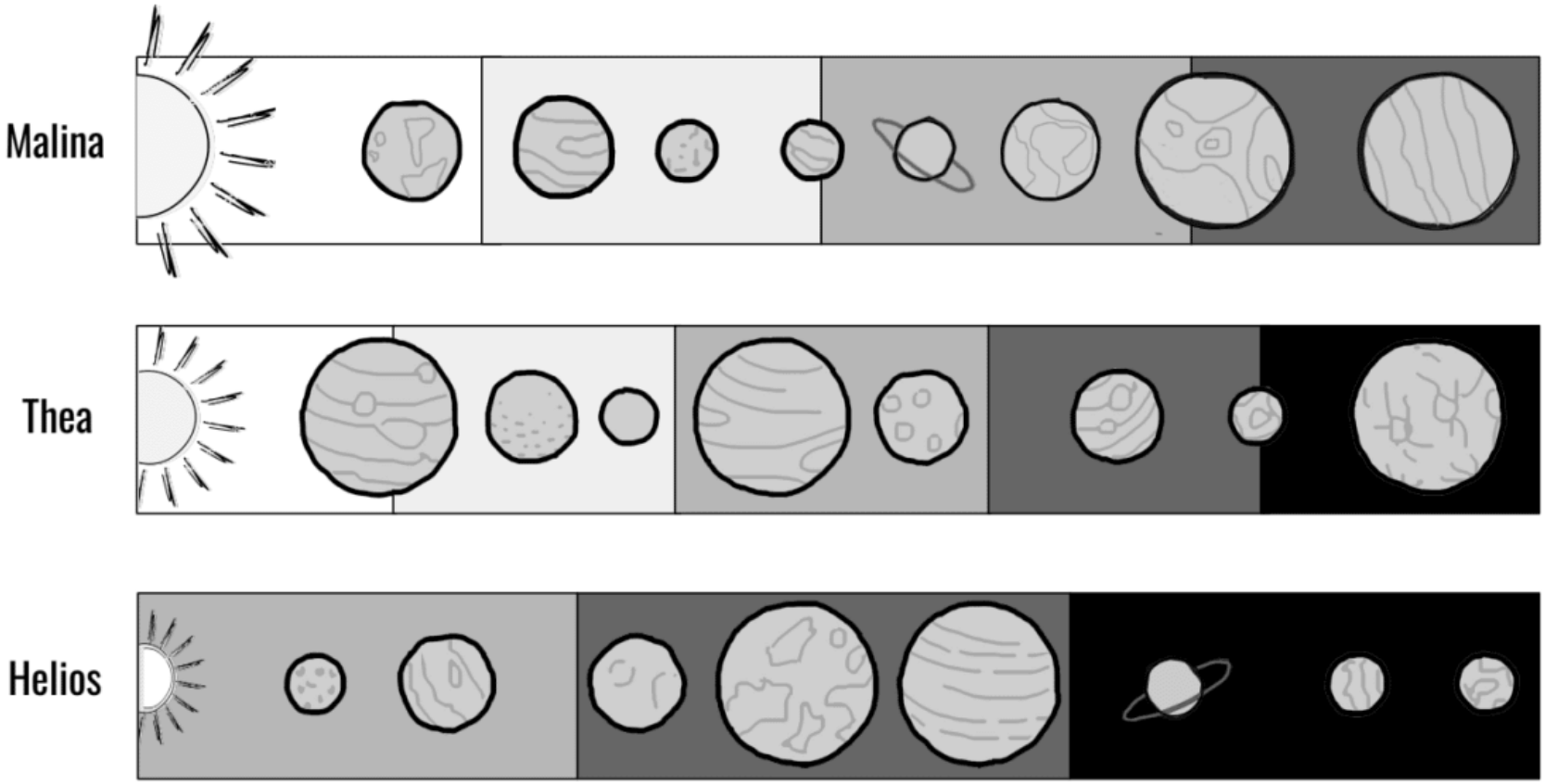
4. Andres is a new skydiver. He does his first jump out of an airplane and safely falls to the ground below. He’s very excited and says, “Did you see me jump and fall? That’s evidence of gravity as a force that pulls any object toward the surface of the Earth.” Do you think that the one jump Andres made is enough evidence to support his claim? If you think Andres needs more evidence, what kinds of evidence would help him make a much stronger argument about gravity?

Plant Pro (Botanist)

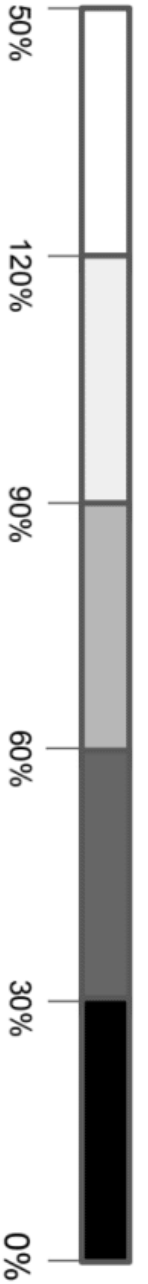
mystery science
Could there be life on other planets?

If we want to live on another planet, we will need to bring some plants from Earth with us. Plants need water and light to survive. But plants don't just need light, they need a certain amount of light. So you'll want to find planets that receive a similar amount of light from their star to what the Earth gets from the Sun.

If a planet gets less than 60% of the light we get here on Earth, plants will not be able to grow. But if a planet gets too much light, that's a problem too. Plants won't be able to survive on planets that get more than 120% of the light we get here on Earth.



Light Level Decoder



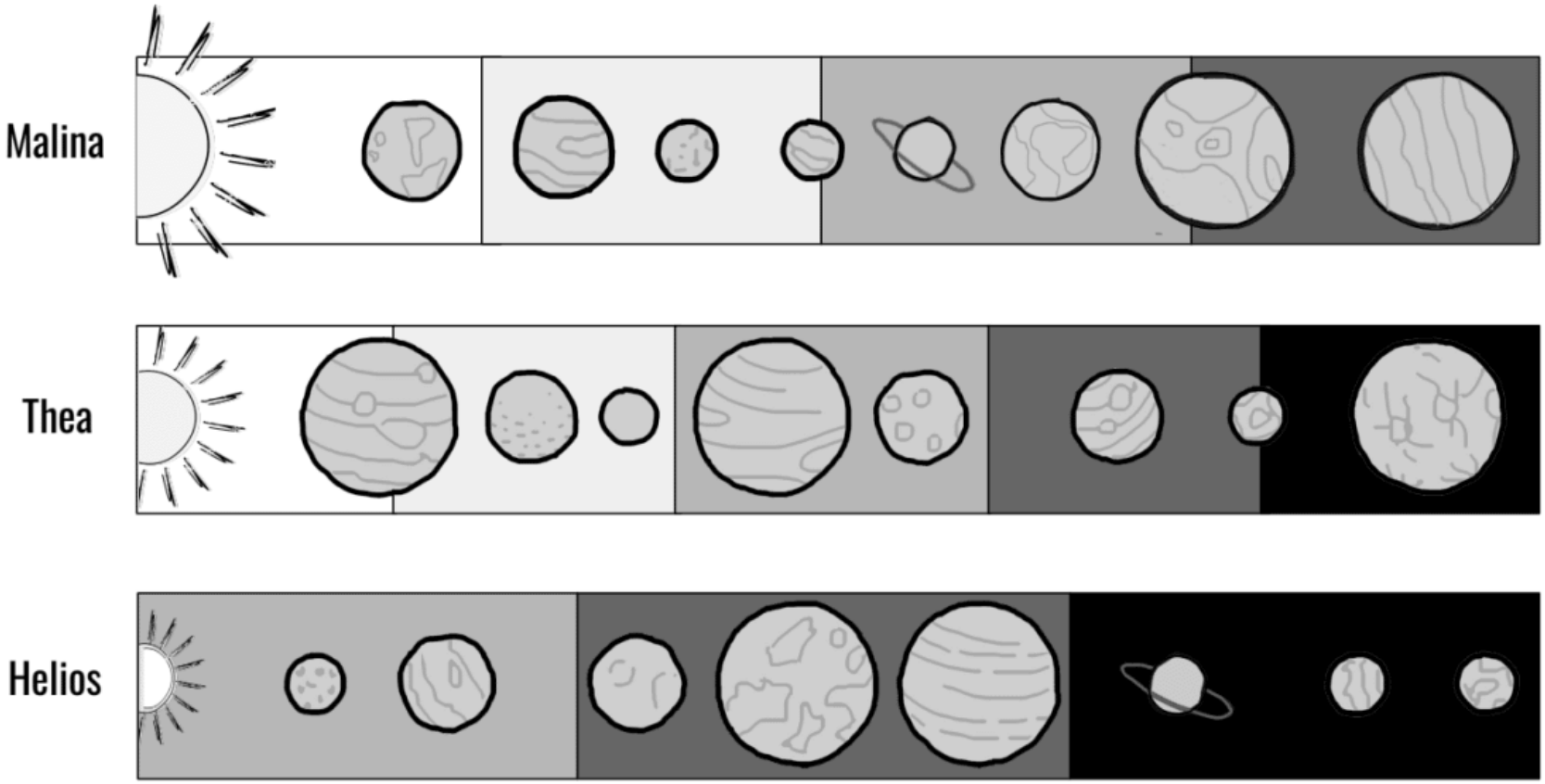
Water Wizard (Hydrologist)

mystery science
Could there be life on other planets?

Humans and all other forms of life on Earth need water to survive. If we want to live on another planet, it must have liquid water available.

Water starts to boil at 100°C. Planets that experience temperatures this high will have most of their water boil away and turn into water vapor.

Liquid water starts to form ice at 0°C. This means the planets below this temperature would be covered in permanent ice and snow. We can survive in cold places, but it will be more difficult to get liquid water for drinking.



Temperature Decoder

200°C (392°F)
150°C (302°F)
100°C (212°F)
50°C (122°F)
0°C (32°F)
-50°C (-58°F)

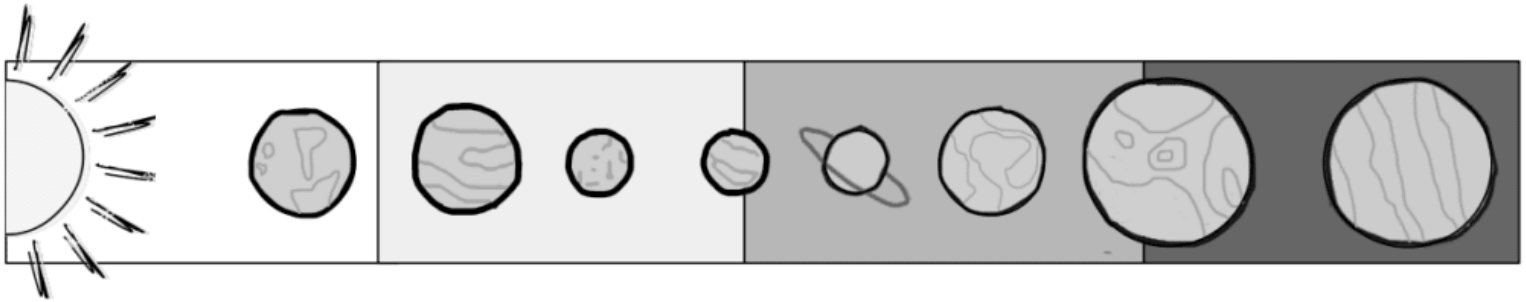
Mission Plan

mystery science
Could there be life on other planets?

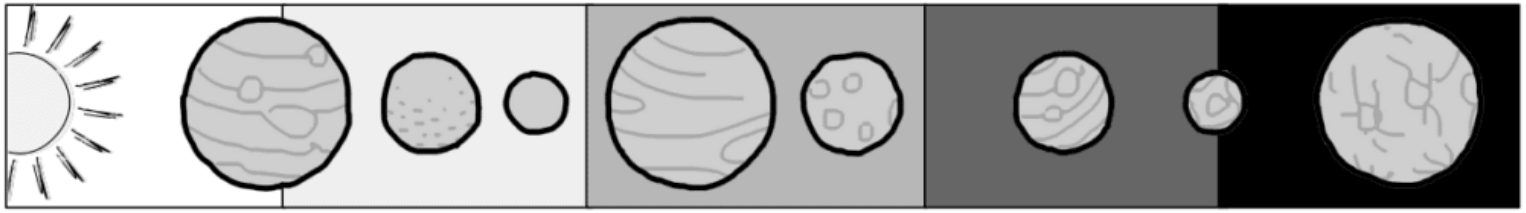
_____ (write your name)
Plant Pro

_____ (write your name)
Water Wizard

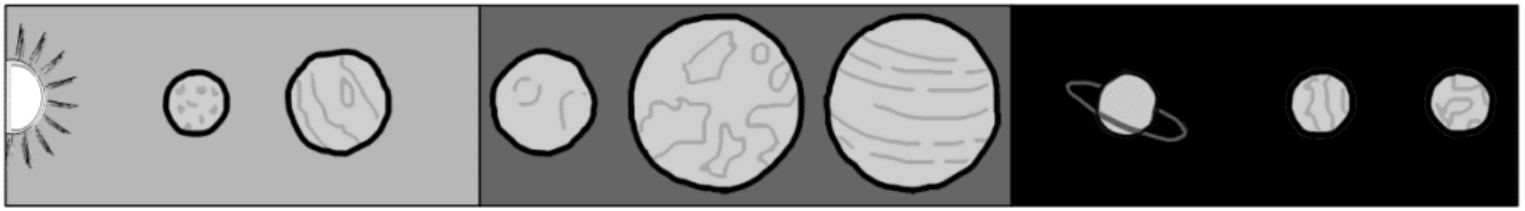
Malina



Thea



Helios



Starlight Guide

Name: _____

mystery science
Could there be life on other planets?

1) Look at how far the habitable planets are from their star. What do you notice?

I notice that _____

_____

2) What differences do you notice between the stars Malina, Thea, and Helios? Does that help explain what you noticed? I notice that _____

_____

_____

3) If you went on your Space Mission, you would spend several years traveling in space to get to your planet. When you land on the planet and look up at the sky, what would Earth's Sun look like from there?

_____

_____

_____

Starlight Guide

Name: _____

mystery science
Could there be life on other planets?

1) Look at how far the habitable planets are from their star. What do you notice?

I notice that _____

_____

2) What differences do you notice between the stars Malina, Thea, and Helios? Does that help explain what you noticed? I notice that _____

_____

_____

3) If you went on your Space Mission, you would spend several years traveling in space to get to your planet. When you land on the planet and look up at the sky, what would Earth's Sun look like from there?

_____

_____

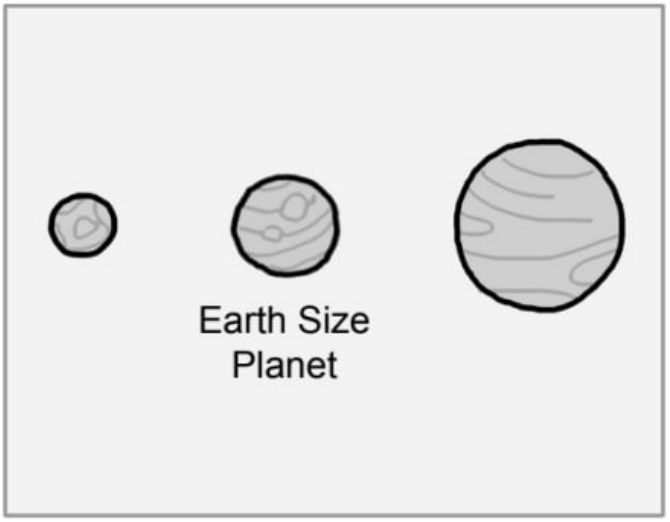
_____

Gravity Guru
(Physicist)

Gravity is the invisible force that pulls us towards the Earth. All other planets also have gravity.

The more massive a planet is, the more gravity it will have. So planets that are larger than the Earth will usually have more gravity.

If there is too much gravity, it may be extremely difficult to move and walk around on the surface of the planet. More gravity will also make it more challenging for plants to grow.

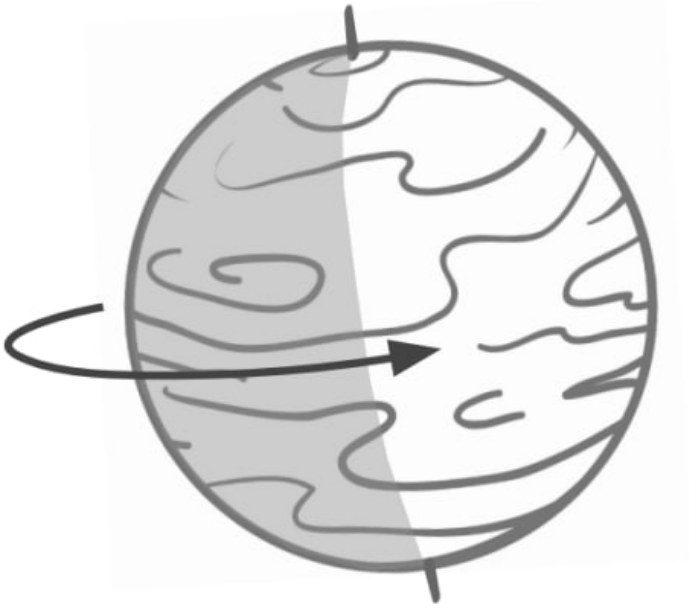


mystery science
Could there be life on other planets?

Spinning Specialist
(Astronomer)

The Earth completes one spin, or rotation, around its axis once every 24 hours. The Earth's spin is the reason we have day and night. Other planets also rotate. But other planets may rotate slower or faster than the Earth does.

Planets that are close to their star usually rotate very, very slowly. This means that one day on these planets will be extremely long. This may create problems for plants that need light because they will spend too much time in the dark.



Name: _____

Date: _____

Lesson Assessment

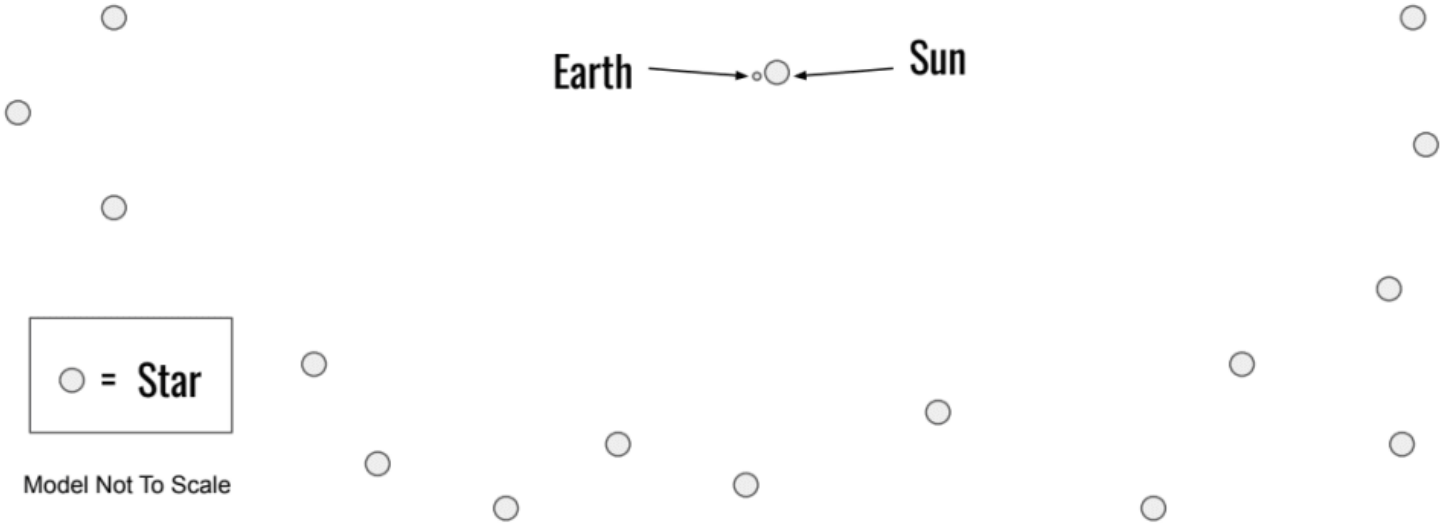
1. Astronomers have discovered two different stars, Star A and Star B. They have figured out that both stars give off light that is equally bright. This means Star A and Star B are the exact same brightness level. But when you look at them from Earth, they look like the drawings above. Star A appears much dimmer than Star B. What could explain this?

a. Light appears brighter the closer you are to it, so Star A must be closer to Earth than Star B.
b. Light appears brighter the closer you are to it, so Star B must be closer to Earth than Star A.
c. Distance has no effect on how bright stars appear. So there must be another explanation for why Star B appears brighter than Star A.

2. Star A looks like a dim tiny star in the night sky when viewed from the surface of Earth. But astronomers have discovered that Star A is actually much, much bigger than planet Earth! Then why does Star A look so tiny in the night sky? What could explain this?

Not To Scale

a. Star A is being blocked by the Moon so we can't see how big it actually is.
b. Star A is very, very far away from Earth so it looks small and dim even though it is large and bright.
c. Star A must actually be very small and the scientists didn't measure it correctly.



3. The image above is a model that shows relative distances of the Sun, Earth, and some of the closest stars to Earth. The model doesn't show all of the stars. But it helps to show how far away our closest stars are. How does this model help to explain why we can only see stars in the night sky? Circle all the correct answers.

a. The Sun is so big that it blocks most of the stars. That's why we can't see them during the day.
b. The Sun is so close to Earth. Because it is so close, it appears very bright to us on Earth. That's why we can't see the stars during the day.
c. The closest stars are very far away from Earth. Even if those stars are as bright as the Sun, we can only see them at night. They will appear dim because of the distance between them and the Earth.
d. The closest stars are not very far away from Earth. Stars are so bright that even large distances won't affect how bright they appear.

4. Imagine someone says to you, "The Sun is not a star! It's out in the daytime, and besides, stars are really tiny and dim. The Sun is big and bright." What would you say to convince them that the Sun is actually a star? Support your answer with reasoning. You can use evidence from the other questions to support your answer.

Name: _____

Solar System Trip Planner

Imagine you are planning a trip for yourself or for a friend or family member. But this isn't any ordinary trip: this is a trip to somewhere else in the solar system!

To plan a trip for yourself or someone else, you need to know important facts about the planet or moon they will be visiting. You also need to know facts about the person who will be going on the trip. That way, you can pick a destination that is a good match for that person.

1. Draft a brief introduction. Say who the traveler is, and state your **claim** about which planet or moon is the best for this traveler to visit. Add one or two reasons why they should be excited. You don't need to be detailed—this is just the introduction.

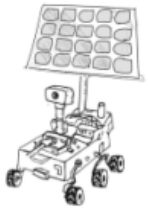
_____

_____

_____

_____

2. **Think back to the first lesson.**



- Is the destination brighter or dimmer than Earth? _____
- Explain <u>why</u> the destination is brighter or dimmer than Earth. _____

_____

- State your **reasoning** for why the traveler will like that it's brighter or dimmer than the Earth is.

_____

_____

Solar System Trip Planner

Name: _____

3. **Pick another fact about the destination to include.**

- _____

_____

_____

- State your **reasoning** for why the above fact(s) make this a good destination for the traveler.

_____

_____

4. **Pick another fact about the destination to include.**

- _____

_____

_____

- State your **reasoning** for why the above fact(s) make this a good destination for the traveler.

_____

_____

5. Draft a summary paragraph. Restate what you taught the traveler, and why they should be excited for the trip! _____

_____

_____

Name: _____

Date: _____

Unit Assessment

1. Four people are shown at different locations around the Earth. Draw an arrow next to each person. Make sure the arrow is pointing toward the direction that gravity will pull each person.

[not to scale]

2. The picture on the right shows the same person jumping as high as they can on two imaginary planets, Creon and Grumpia. Which planet has more gravity? Support your answer with reasoning.

_____

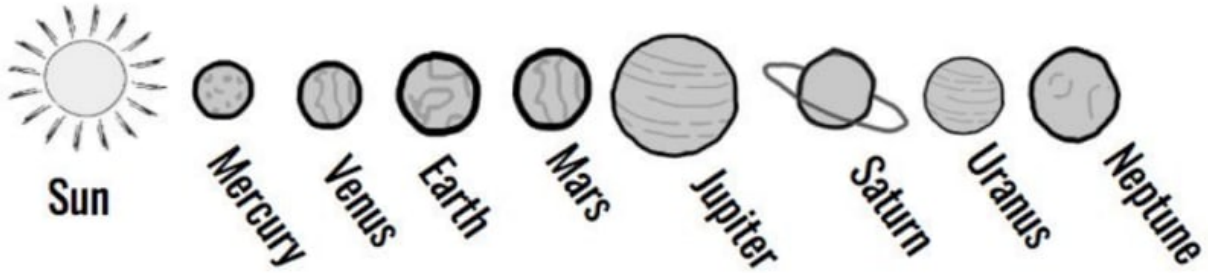
_____

_____

_____

_____

Below is a model of our solar system with the Sun and the planets. The Sun is shown on the left in the model, but actually, all of the planets orbit around the Sun. The model also doesn't show the very large amount of space between each of the planets.



3. If a spacecraft starts from Earth and travels toward Neptune, where will the Sun look the **brightest**?

a. Earth
b. Mars
c. Jupiter
d. Saturn

4. If a spacecraft starts from Earth and travels toward Neptune, where will the Sun look the **dimmest**?

a. Earth
b. Mars
c. Jupiter
d. Saturn

5. If the spacecraft keeps traveling through outer space and it goes past Neptune, it will eventually leave our solar system. If the spacecraft keeps going and going, farther and farther away, do you think the Sun will look like a star? Why or why not? Support your answer with reasoning.

mystery science

Chemical Reactions & Properties of Matter

5th Grade • NGSS • Unit Worksheets

Lesson 1

Are magic potions real?

Lesson 2

Could you transform something worthless into gold?

Lesson 3

What would happen if you drank a glass of acid?

Lesson 4

What do fireworks, rubber, and Silly Putty have in common?

Lesson 5

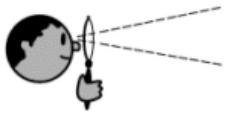
Why do some things explode?

I am also curious about...

See-Think-Wonder Chart

Name: _____

mystery science

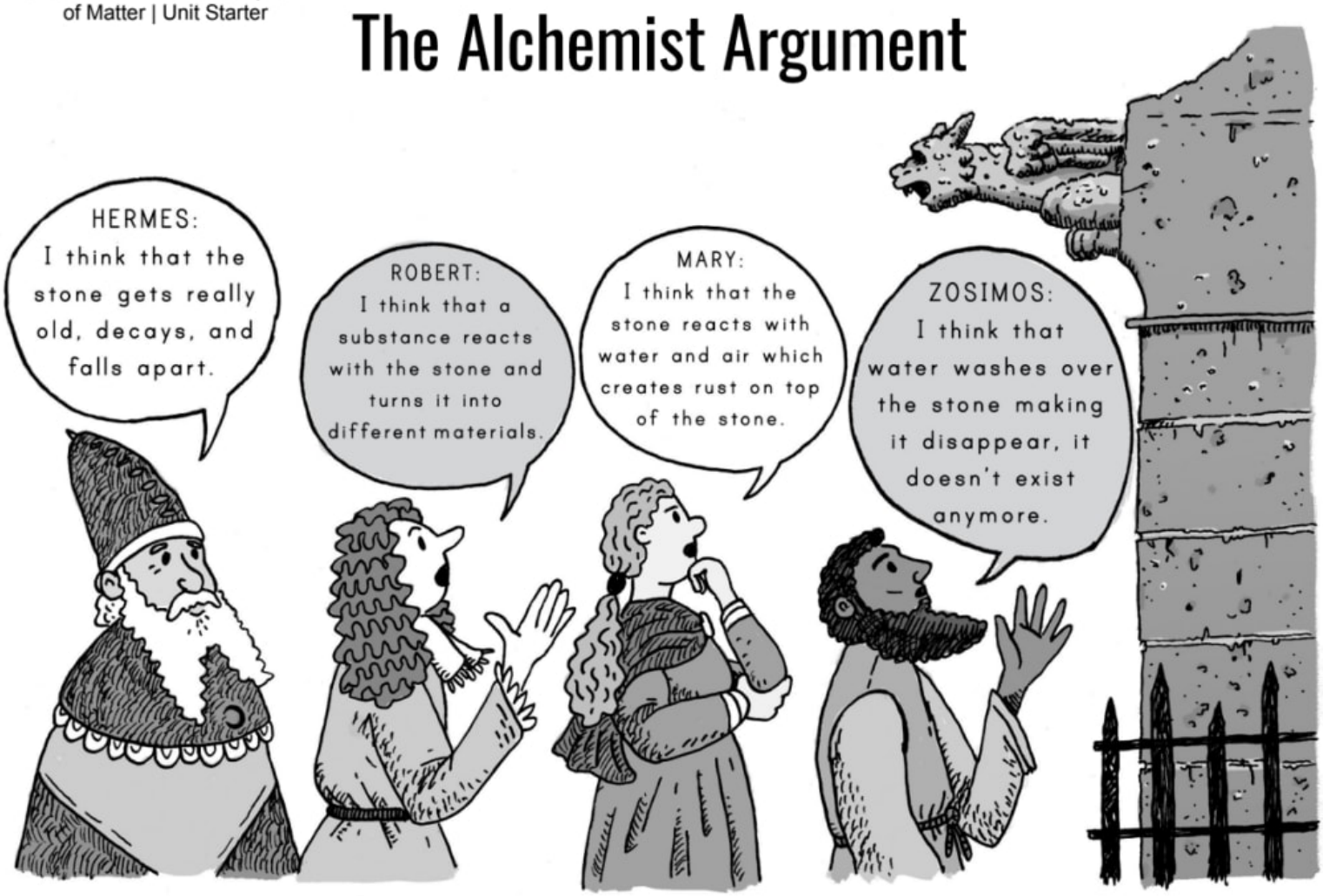
See	Think	Wonder
What did you observe? 	How can you explain what is happening? 	What questions do you have? 

mystery science

Chemical Reactions & Properties of Matter | Unit Starter

Name: _____

The Alchemist Argument



Make a claim:

I agree with _____. I think that _____

_____

_____.

Support with evidence:

I think this because _____

_____

_____

_____

_____

_____

_____

_____

The Alchemist Argument
Evidence

Name: _____

mystery science
Chemical Reactions & Properties of Matter | Unit Starter

Directions: After each Mystery, add any new evidence that supports an alchemist's claim. Use the evidence to help you support your argument.

	Hermes: "I think that the stone gets really old, decays, and falls apart."	**Robert: "**I think that a substance reacts with the stone and turns it into different materials."	**Mary:** "I think that the stone reacts with water and air which creates rust on top of the stone."	**Zosimos: "**I think that water washes over the stone, making it disappear, it doesn't exist anymore."
Mystery 1: Are magic potions real?				
Mystery 2: Could you transform something worthless into gold?				
Mystery 3: What would happen if you drank a glass of acid?				
Mystery 4: What do fireworks, rubber and silly putty have in common?				
Mystery 5: Why do some things explode?				

Test like an alchemist

What happens to a copper penny when you dip it in…

Soapy Water

Vinegar

Salt & Vinegar

Salty Water

The Alchemist's Potion
PART 1

Name: _____

Date: _____

My Initial Model

1a) In the box below, draw a picture of what you think happened to make the dull penny become shiny. It's ok if it's just a guess for now. Label your drawing. If you want, include things that are too small to see.

1b) Figuring out why the penny became shiny is tricky. Can you think of questions about the pennies and liquid that will help you figure it out?

_____

_____

_____

_____

_____

_____

_____

_____

My Revised Model

2a) Your ideas might have changed since your last drawing. In the box below, draw what you think happens when dull brown copper pennies get shiny. Label your drawing. If you want, include things that are too small to see.

2b) Explain your drawing: _____

_____

_____

_____

_____

_____

_____

_____

_____

You'll fill in Part 2 of this worksheet on another day, when you do the next Mystery

mystery science

Are magic potions real?

Name: _____

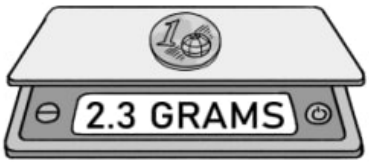
Date: _____

Lesson Assessment

1. Maria learned in school that she can make a dull penny shiny again with vinegar and salt. Maria thought this was fun, and it gave her an idea for a new experiment.

Maria is from Spain, and she has a coin from there called a 1 Euro cent. Maria's 1 Euro cent looks a lot like the dull, brown pennies from her class. She was curious if she could do some new things with her Euro cent.

Before she did any experiments on her dull, brown 1 Euro cent, she asked her teacher for a scale. She put the coin on the scale. The scale is shown below. Read the scale. Then, shade in the bar graph below with the measurement.



Dull, Brown Coin

Weight (in grams)

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5

2. Now that Maria knew how much the coin weighed, it was time to experiment. She took a small piece of sandpaper and scratched it all over the coin. Dull, brown bits of stuff fell off wherever she scratched the coin. After a few minutes of scratching, the coin became shiny, and there was a small pile of dull, brown bits. She put the coin back on the scale now that it was shiny. It weighed 2.2 grams. Then she put the pile of dull, brown bits on the scale. The pile weighed 0.1 grams. Shade in each bar graph below with her measurements.

Shiny Coin

Weight (in grams)

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5

Dull Bits

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5

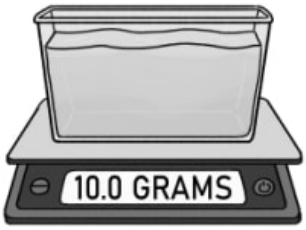
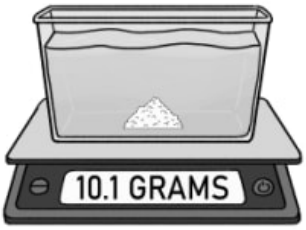
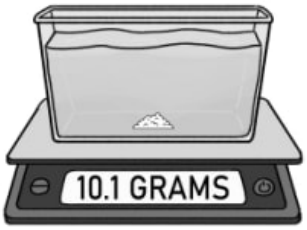
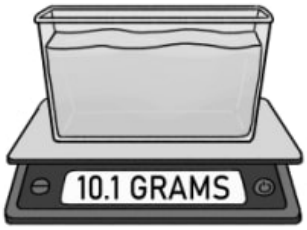
3. Circle **True** or **False** for each of the statements below. Use the measurements of Maria's coin to help you choose.

True False When the sandpaper scratched the coin, it added new, shiny stuff onto the coin. The shiny stuff made the coin heavier.

True False The little brown bits were probably scratched off of the coin. That's why the weight of the coin went down.

True False The sandpaper made the coin shiny, but nothing was added to it or scratched off of it. The dull, brown bits probably came from the sandpaper instead.

4. Maria wanted to know what would happen if she put the pile of dull, brown bits into a bag with vinegar and salt. She got a little tub with vinegar and salt in it, and she set it onto a scale to see how much it weighed. Then she dumped the little pile of bits into the tub, and watched what happened. Each step is shown below. Here is what she saw:

Tub of just vinegar and salt:	After adding the pile of dull, brown bits:	30 seconds later:	1 minute later:
			

Here are three possible explanations for what Maria saw after 1 minute went by. Circle **True** or **False** for each option.

True False After 1 minute, the dull, brown bits are no longer visible. They aren't in the tub at all any more. They're totally gone! That's why the total weight went down, and that's why Maria couldn't see them anymore.

True False After 1 minute, the dull, brown bits broke down into tinier and tinier pieces. Those tiny pieces were too small to see, but they were still in the tub. The weight went up because there were so many teeny tiny pieces.

True False After 1 minute, the dull, brown bits broke down into even smaller little bits. Those little bits were too small to see, but they were still in the tub. Those little bits all add up to the **same** amount of stuff as it was to start with, though. That's why the total weight stayed the same.

Remember, you did Part 1 of this sheet last Mystery (questions 1 & 2).

The Alchemist's Potion
PART 2

Name: _____

Date: _____

Set Up

3a) Write the date and time. In the box below, draw what your experiment looks like now.

Date: _____ Time: _____

3b) Describe the liquid in the bag:

_____

_____

3c) Read what you wrote in question 2b (on Part 1 of the worksheet from last Mystery).

3d) Remembering what you wrote in 2b, think about what might happen in this experiment. Write your ideas:

_____

_____

_____

_____

_____

Your experiment may take a few hours to finish. If you notice something changing in the bag, draw a picture on the back of this page and write down the time.

Explanation

4a) Make a drawing that explains how you think the copper got onto the nail. Label your drawing. If you want, include things that are too small to see.

4b) What evidence do you have to support the explanation that you drew? (Use information from your observations or from videos you saw in class.)

_____

_____

_____

_____

_____

_____

_____

_____

_____

Name: _____

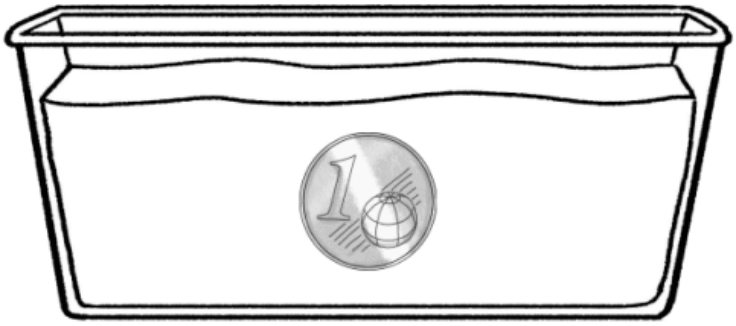
Date: _____

Lesson Assessment

Maria has a coin called a 1 Euro cent. Maria's 1 Euro cent is dull, brown, and made of copper.

At home, she put her dull, brown 1 Euro cent into a tub of vinegar and salt. The copper 1 Euro cent changed from dull to shiny because some of the copper was leaving the coin. The strange part was that Maria couldn't actually see the copper going anywhere.

1. Below, there is a tub of vinegar and salt with a coin in it. How could copper leave the coin if Maria couldn't see it happening? Draw a model to show how copper could leave the coin even though Maria couldn't see it happening. You might draw shapes, arrows, or anything else. Then, explain what your model shows by writing on the lines.



_____

_____

_____

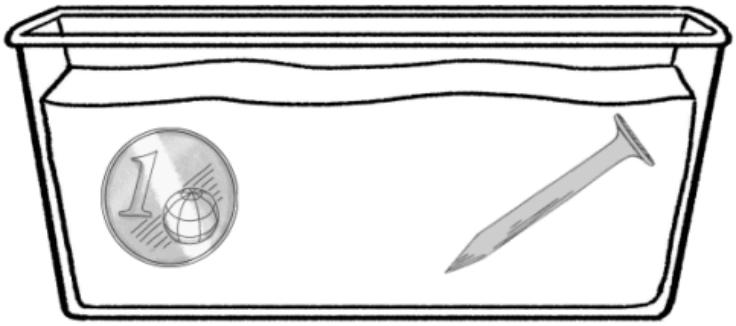
_____

_____

After Maria left the coin in the vinegar and salt for a while, she added a steel nail to the tub. The nail slowly became covered in copper.

Somehow, the copper went *from* the coin *to* the nail. The strange part was that Maria never saw any copper in between the coin and the nail. She could only see the copper coin, and the copper that somehow showed up on the nail.

2. The tub below shows the nail in the vinegar and salt, along with the coin. Draw a model to show how copper could show up on the nail, even though Maria couldn't see how it was happening. You might draw shapes, arrows, or anything else. Then, explain what your model shows by writing on the lines.



3. Why could Maria see the copper coin *and* see the copper on the nail, but *not* see the copper in between those two things?

Mixing Sheet

mystery science

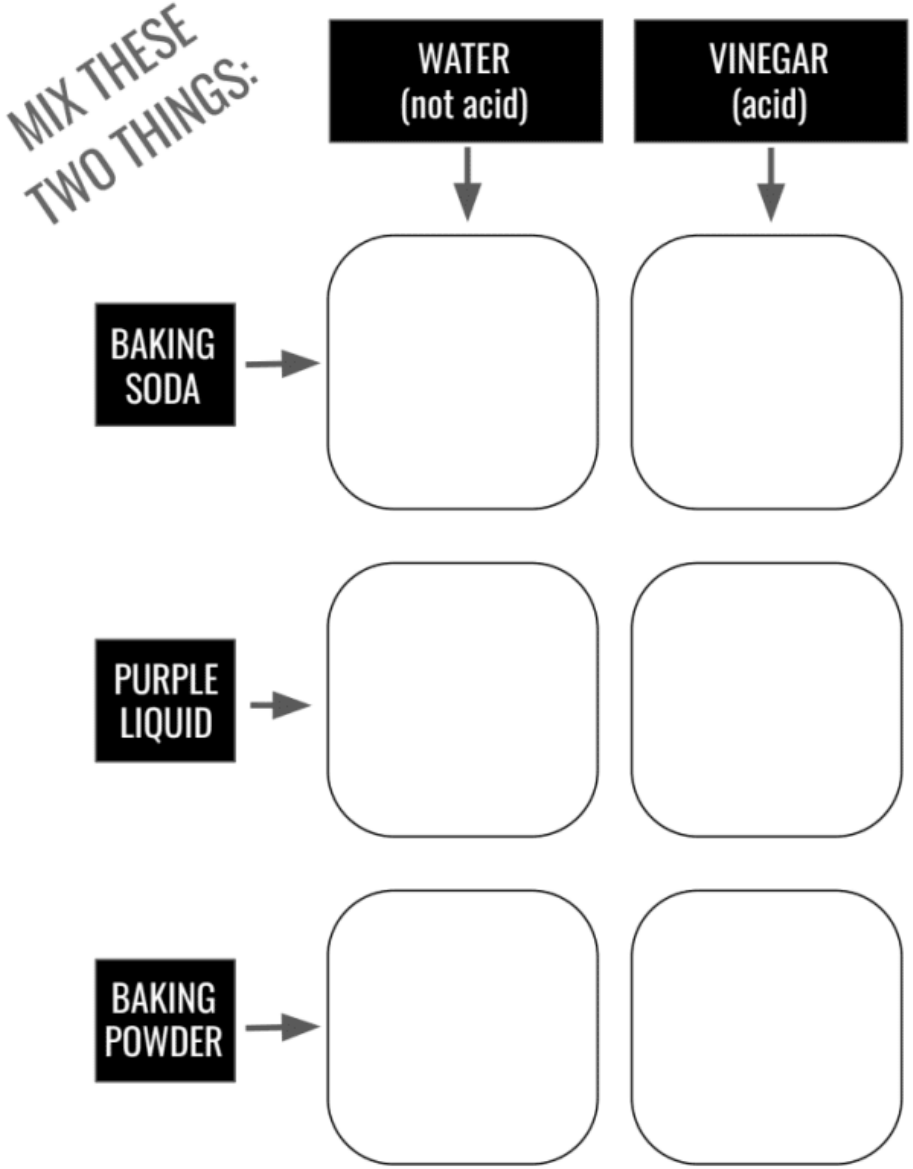
What would happen if you drank a glass of acid?

Practice

Practice

Practice

Practice



Test Substance #1:

Test Substance #2:

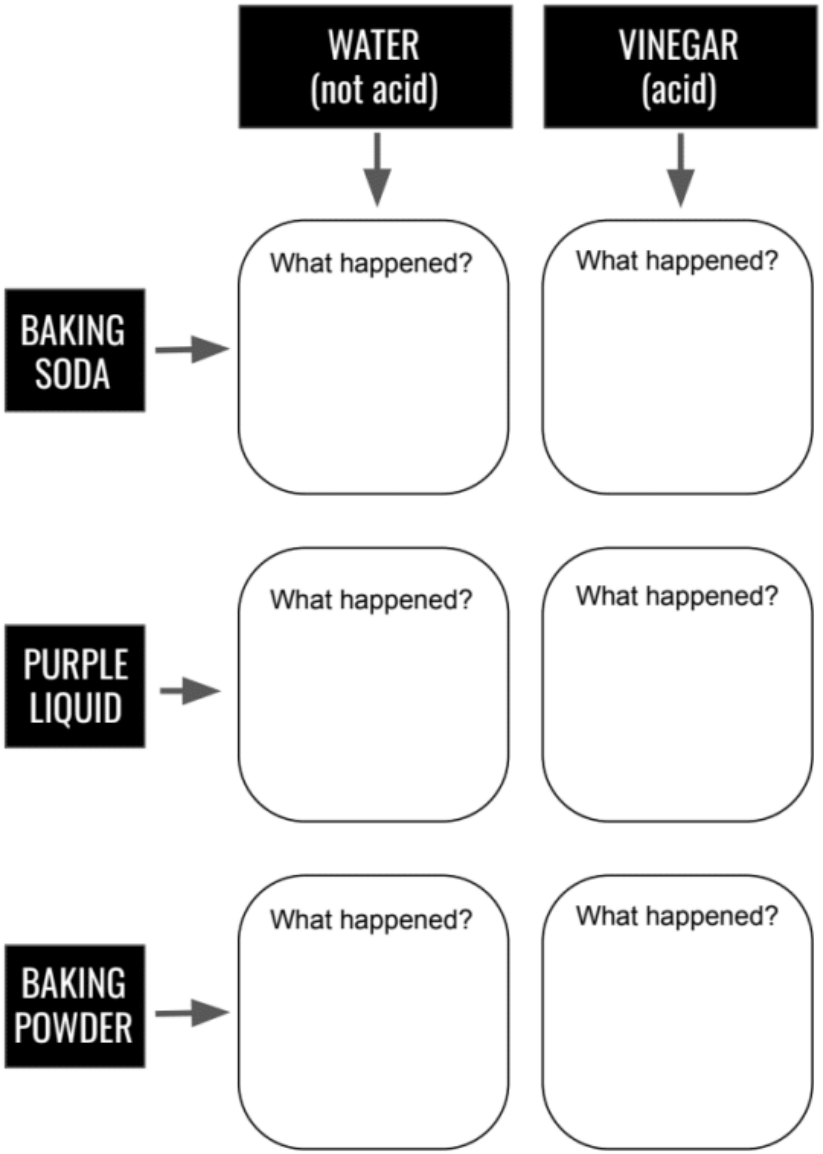
Results

Name: _____

mystery science

What would happen if you drank a glass of acid?

Describe what happened:



1). Would you use baking soda to test whether or not a substance is an acid? YES / NO
Why or why not? _____

_____

_____

_____

2). Would you use purple liquid to test whether or not a substance is an acid?
YES / NO Why or why not? _____

_____

_____

_____

3). Would you use baking powder to test whether or not a substance is an acid?
YES / NO Why or why not? _____

_____

_____

_____

Which are acids?

Test Substance #1:

4). I tested _____

using _____

What happened?

Do you think it's an acid? YES / NO

Test Substance #2:

5). I tested _____

using _____

What happened?

Do you think it's an acid? YES / NO

Name: _____

Date: _____

Lesson Assessment

1. Dara learned something surprising at school. She likes drinking lemonade, orange juice, and tomato juice, and she learned that these are all acids.

   She wants to figure out which juice is the least acidic (a weak acid) and which is the most acidic (a strong acid). She knows that acids will react with baking soda, so she decides to use baking soda in her tests.

   To figure out how strong of an acid each juice is, what should Dara do with the baking soda?

   a. Mix all of the juices together. Then, add some baking soda to the mix.
   b. Mix 10 milliliters of each juice with 1 gram of baking soda. Only mix one juice with baking soda at a time.
   c. Mix a few grams of baking soda with one juice first. Then, carefully mix in all of the other juices, too.
   d. Mix 10 milliliters of two juices together at a time, but don't add any baking soda.

2. Dara decided to mix a few drops of each juice with baking soda to see what would happen. She also mixed some water with baking soda, because she knows water isn't an acid at all. The results of each test are shown below:

water with baking soda	**lemonade** with baking soda	**tomato juice** with baking soda	**orange juice** with baking soda
			
no bubbles	lots of bubbles	almost no bubbles	some bubbles

Use the results shown above to rank the juices from least to most acidic. Write the name of each juice on one of the lines. Water is already done for you.

water _____ _____ _____

least acidic ⟶ *most acidic*

3. How did you use the results of the baking soda tests to rank the juices from least to most acidic? Explain your reasoning on the lines below.

_____

_____

_____

_____

_____

4. Dara learned that there is a special tool that can measure how strong an acid is. She used one of these tools to measure each liquid that she had mixed with baking soda. She recorded her measurements of acid strength in this table:

Liquid	water	lemonade	tomato juice	orange juice
Acid Strength	7	2.5	5	3.5

Circle **True** or **False** for each option. Look back to the previous questions to help you make your choices here.

True False Stronger acids have a higher measurement from the tool.

True False When the tool measures a liquid as a 7, it means it isn't acidic at all.

True False If a new liquid had a measurement of 1 on the tool, it would bubble *more* with baking soda than any of the others.

True False If a new liquid measured at 4, it would mean that the new liquid is *less* acidic than tomato juice. It's less acidic because the measurement of 4 is lower than 5.

practice space

practice space

practice space

practice space

practice space

Mystery science

What do fireworks, rubber, and Silly Putty have in common?

MIX THESE TWO THINGS:

BAKING SODA | BORAX | GLUE | VINEGAR

MILK →

Mix milk with everything

BAKING SODA →

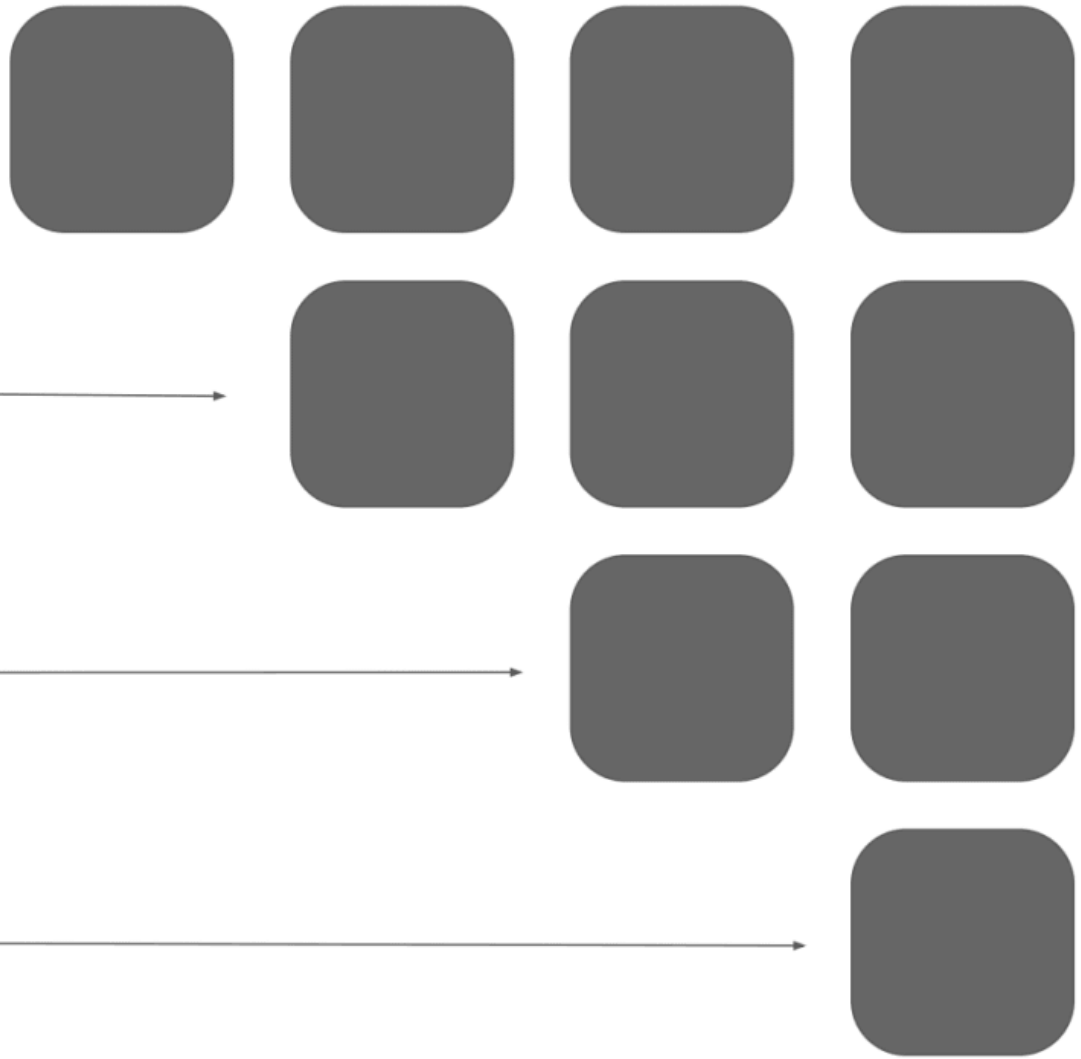
Mix baking soda with everything but milk (you already mixed baking soda and milk!)

BORAX →

Mix borax with everything but milk and baking soda (you already mixed those!)

GLUE →

Mix glue with everything but milk, baking soda, and borax (you already mixed those!)

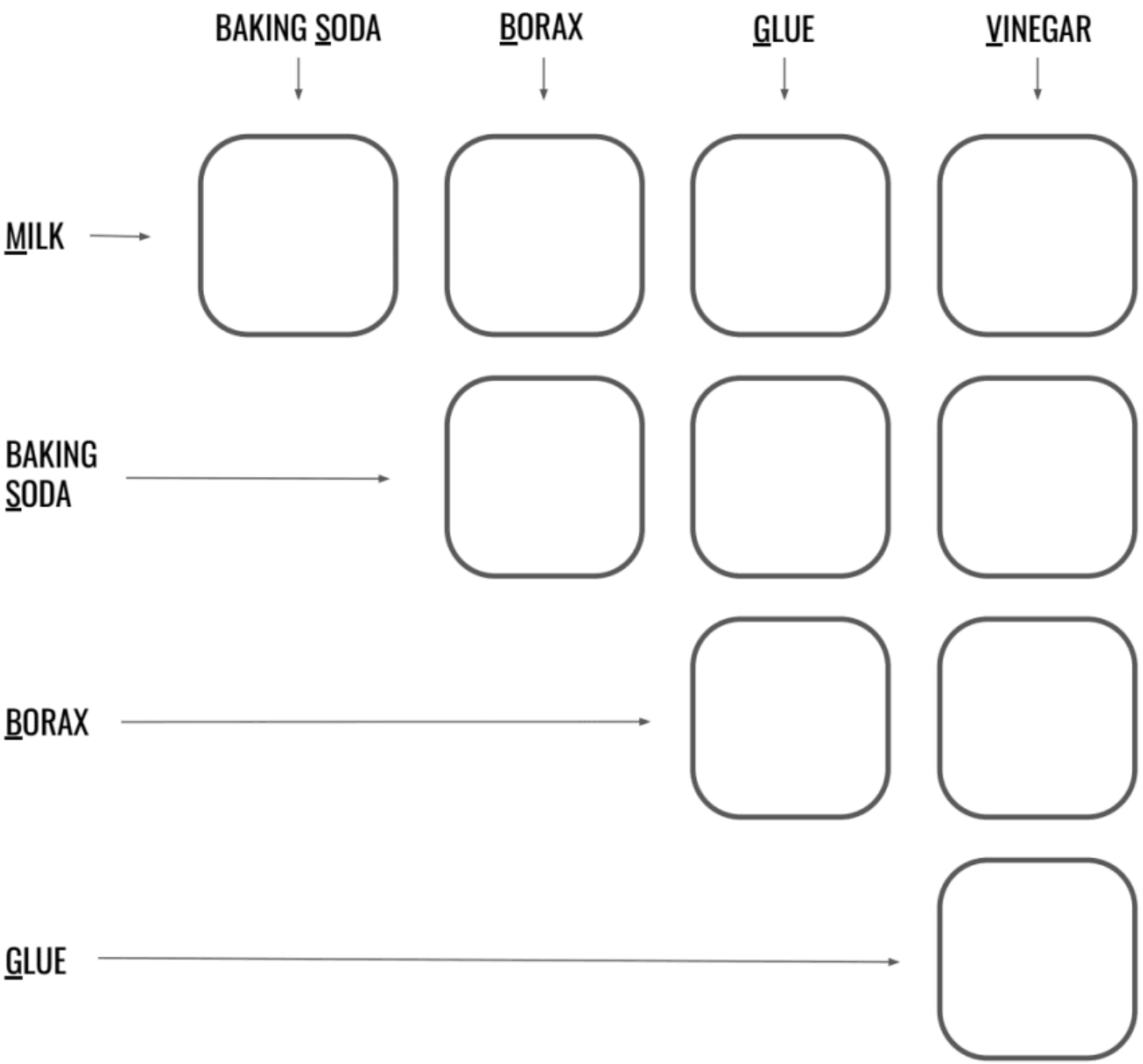


Name: _____

Name: _____

Takes notes on what happened in each box.

Was there a reaction? If so, did it make goo?



Name: _____

Date: _____

Lesson Assessment

1. Imagine you need white glue and regular milk for a science activity. Your teacher leaves these two glass containers for you. Unfortunately, they aren't labeled, so you don't know which liquid is in which container. Which properties might help you identify each liquid? Circle all of the correct answers.

   a. Glue is very thick and hard to pour. Milk is very runny and easy to pour. You can use the property of how easily they pour to help figure out which one is milk and which one is glue.
   b. Both liquids are white. Because they are both the same color, you **can't** use the property of their color to tell them apart.
   c. White school glue comes in plastic bottles. These liquids are not in plastic bottles. That means you can use the property of which container they are in to know that *neither* are glue.
   d. Milk should only be in a refrigerator. These containers are not in a refrigerator, so neither of them are milk. You can use the property of their location to know *neither* of them are milk.

2. When you mixed white glue with borax, you made goo. You could tell that the goo was a new substance because it had new properties. The following data table shows the results of mixing milk with glue and milk with vinegar. The milk and glue both started as white liquids. The vinegar started as a clear liquid. Read the results:

	GLUE	VINEGAR
MILK →	turned into a white liquid when mixed	turned into white clumps and clear liquid when mixed

Circle **True** or **False** for each option.

True	False	The mixture of milk and glue is a new substance because it is a liquid, and being a liquid is a new property.
True	False	Both mixtures are new substances, because new substances always form whenever two things are mixed.
True	False	The milk and vinegar mixture is a new substance, because it has totally different properties than the milk and vinegar had separately.
True	False	The milk and glue mixture doesn't have new properties, so it probably isn't a new substance.

3. Imagine you have two new liquids: Liquid A and Liquid B. Both liquids are cloudy and gray. When mixed together, they form a green liquid that is not cloudy. Fill in the table below with the correct properties in the correct places.

	Liquid A	Liquid B	Mixture of A and B
Properties			

4. Did mixing liquids A and B create a new substance? Circle one: **Yes** **No**

   How do you know? Explain your evidence on the lines below.

   I know this because _____

   _____

5. Omar has 10 grams of liquid X, and 10 grams of liquid Y. When he mixes them, everything about them looks exactly the same, except the new mixture has a total mass of 20 grams. He says, "I think this means the mixture is a new substance. Each substance before only had a mass of 10 grams. The new mixture is 20 grams, so it has new properties. That means it's a new substance."

   Do you agree or disagree with Omar? Is the mass different before and after the liquids are mixed? And is the mixture a new substance? Explain on the lines below.

_____

_____

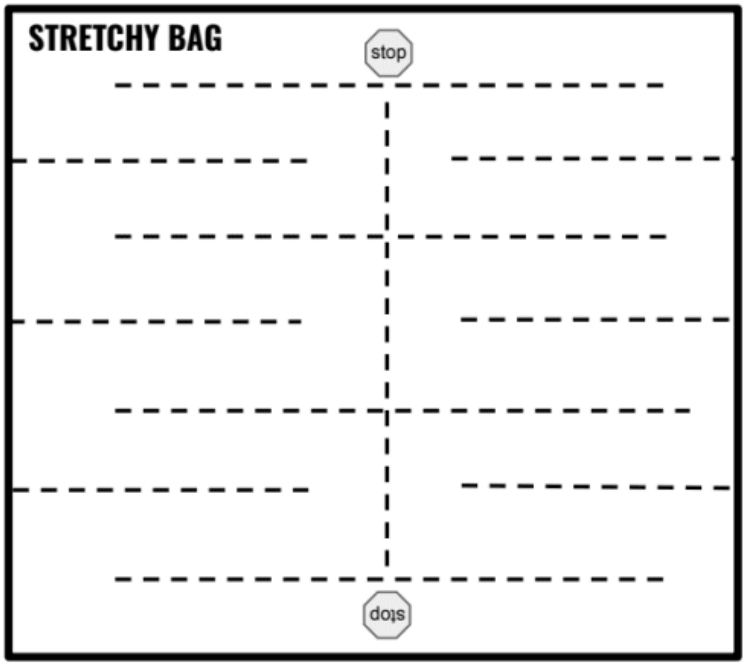
_____

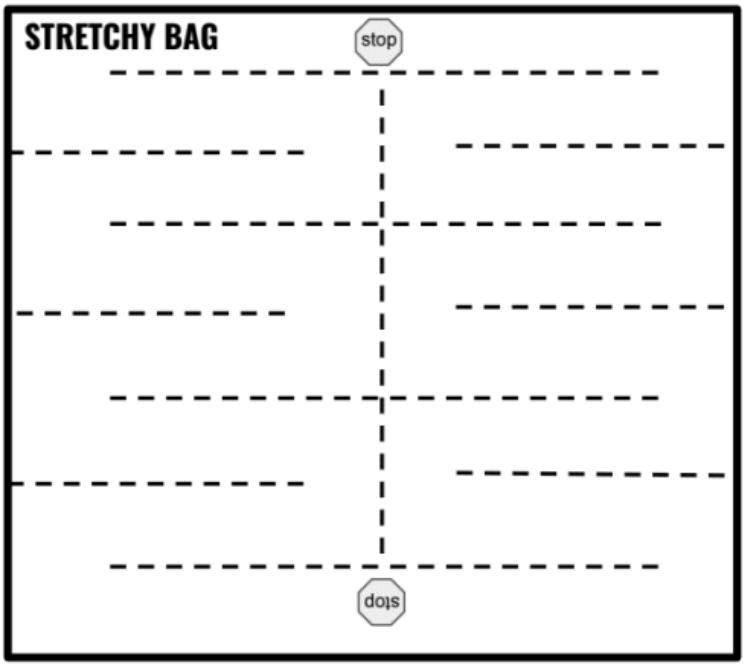
_____

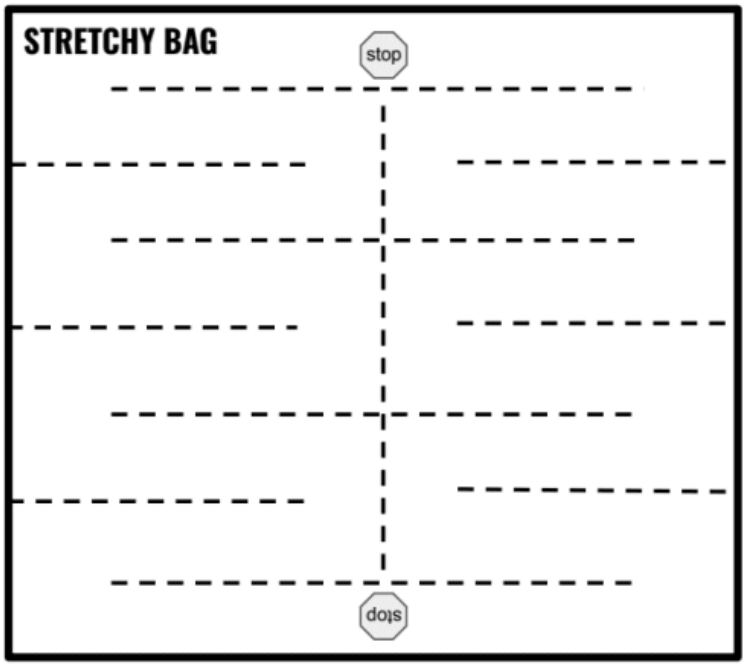
_____

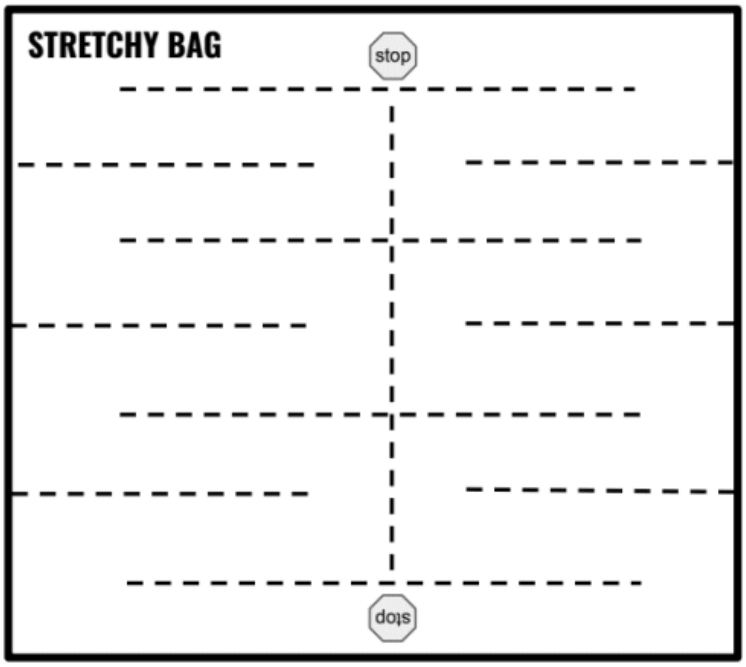
Stretchy Bag Templates

Mystery science
Why do some things explode?









Capturing Chaos

mystery science
Why do some things explode?

Name: _____

Experiment #1

1). Describe what happened when you mixed baking soda and vinegar in your sealed bag:

_____

_____

_____

2. Think about why that happened. Draw a picture (or pictures) below that will show what you think made that happen. Write labels and captions if you need them to make your ideas clear. You can include things that are too small to see.

Experiment #2

With your partner, decide on your second experiment and answer the questions below. If your first experiment exploded, we challenge you to make your bag inflate until it ALMOST pops, but doesn't!

3. What is your goal? _____

4. Last time, you used 6 spoons of vinegar and 1 spoon of baking soda. What will you do differently this time?

_____

5. What happened? Why do you think that happened? _____

_____

_____

Name: _____

Date: _____

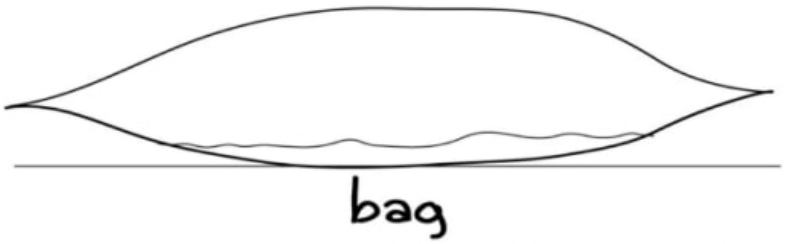
Lesson Assessment

1. When vinegar and baking soda are mixed in a sealed bag, the bag puffs up like a balloon. And sometimes, the bag can even explode! The strange thing is that we can't actually see anything that is puffing the bag up. It's totally invisible.

Circle **True** or **False** for each option.

True	False	The bag puffs up, but nothing is making it happen. We know this because we can't see anything puffing the bag up. If you can't see something, it means nothing is there.
True	False	The bag puffs up, and there is something making it happen. You can't see what is inside of the bag, but you can feel that the bag is being puffed up.
True	False	The bag is being puffed up like a balloon by gas. The gas is made up of lots of particles. The particles fly around and push against the sides of the bag.
True	False	The particles of gas in the bag are too small to see. But even though they are tiny, there are so many particles that they puff the bag up like a balloon.

2. In the bag, the vinegar is a liquid made of particles, and the baking soda is a powder made of particles. When the vinegar and baking soda mix, they form a new substance. That new substance is still made of particles, but it is a gas. The particles of this new gas are too small for us to see, but what might they look like if we *could* see them? Draw a model of what the particles of gas might look like inside of the bag below. You can use arrows to show the particles moving and causing the bag to inflate.



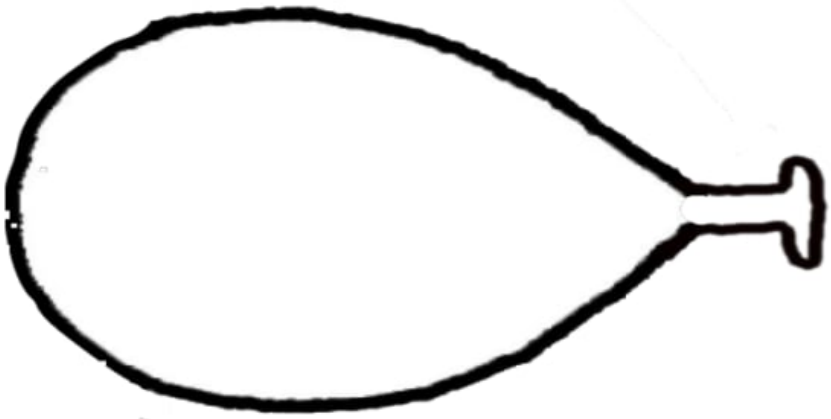
3. Use your drawing to explain how extremely tiny particles can make a bag puff up like a balloon.

4. Julian was helping to get ready for a birthday party for his little sister. His job was to inflate a bunch of balloons. He took deep breaths in, and then blew them into each balloon to inflate it.

   But the more he thought about it, the stranger this seemed. For his breaths to get into the balloon, they had to fit through the tiny opening of the balloon. So, his breaths must be very tiny. But his breaths also had to be very big, because they puffed the balloon up very big.

   How can a breath be tiny enough to go through the tiny opening of the balloon, but also be big enough to make the balloon puff up?

   In the space below, draw a model that would help Julian understand how a breath can fit through the tiny opening while still puffing the balloon up. Be sure to show the particles of air. You can use arrows to show the particles moving and inflating the balloon.



5. Circle **True** or **False** for each option below. Use the model of the balloon that you drew to help you decide.

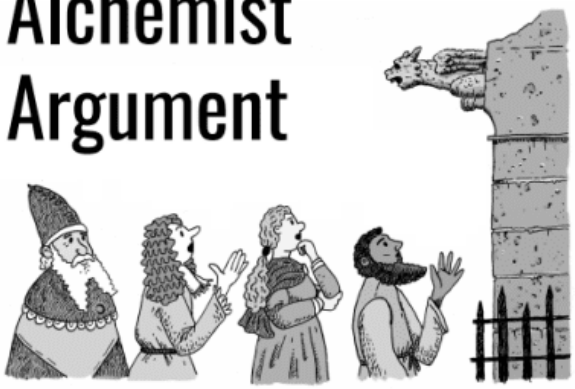
True	False	Each individual particle of gas that makes up a person's breath is very tiny, so it can easily fit into a balloon.
True	False	One single breath is made up of one single particle of gas. Those single particles are the same size as a balloon, and that's why balloons inflate.
True	False	We can't see the particles of a gas because they are so tiny. But we *can* see balloons inflate because they are filled with a huge number of tiny particles.
True	False	Once the particles of gas are inside of a balloon, they don't move at all any more.

Final Alchemist Argument

Name: _____

mystery science

Chemical Reactions & Properties of Matter | Performance Task



Directions: Make a particle model to show what happens to the stone over time. Use labels and symbols to make your model clear.

Make a claim:

I think that _____

_____

_____.

Support with evidence:

I think this because _____

_____

_____

_____

_____

_____

_____

Chemical Reactions & Properties of Matter

Name: _____

Date: _____

Unit Assessment

1. Mia, Kayla, and Eli have all set up lemonade stands in their neighborhood. Each person started with the same amount of lemon juice and then added different amounts of sugar, as shown in the table below. Fill in the table with the total weight of each person's lemonade.

	Lemon Juice	Sugar	Total Weight of Lemonade
Mia	200 grams	10 grams	
Kayla	200 grams	20 grams	
Eli	200 grams	30 grams	

2. Sadly, Mia, Kayla, and Eli didn't sell any lemonade. So they all decide that they will turn their lemonade into popsicles. All they do is take the lemonade they made the day before and freeze it. Circle **True** or **False** for each sentence.

True False Eli's popsicles will taste sweeter than Mia's popsicles or Kayla's popsicles because there is more sugar in them.

True False Eli's popsicles will weigh slightly more than Mia's popsicles or Kayla's popsicles because there is more sugar in them.

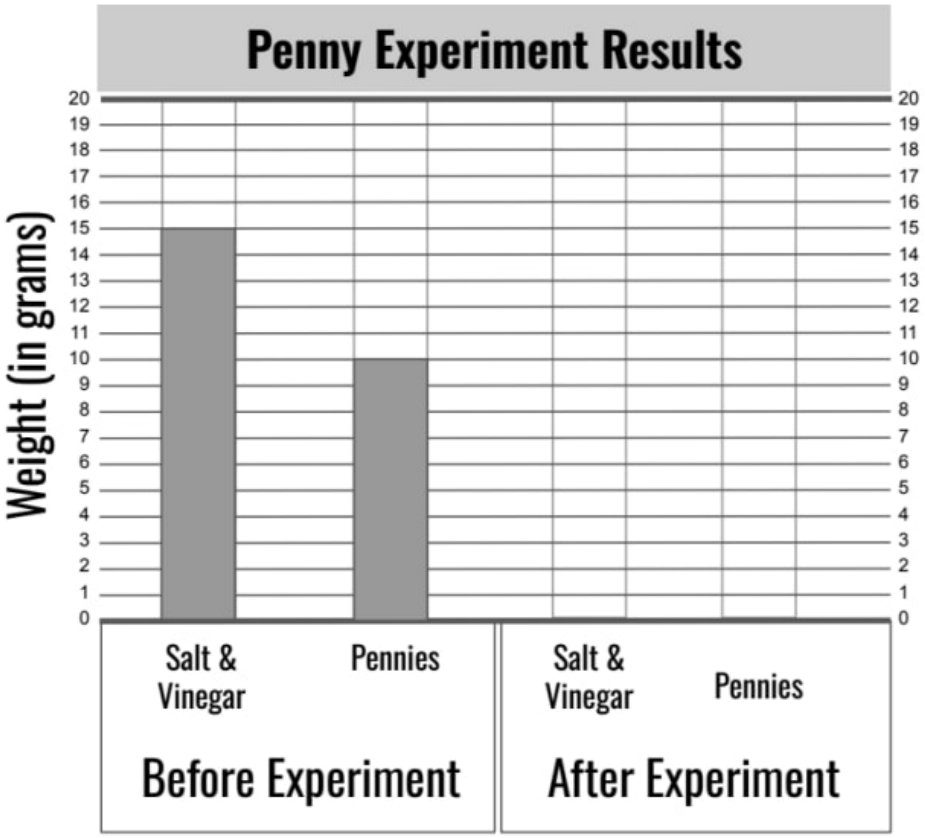
True False Eli's, Mia's, and Kayla's popsicles will all be exactly the same.

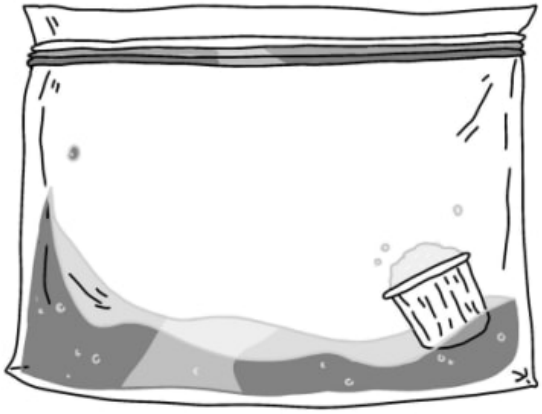
Laila empties her piggy bank and finds ten dull, brown pennies. Laila wants her pennies to look shiny, so she performs an experiment. First, she pours salt and vinegar into a container. Then, she adds the ten pennies and waits a few minutes. When she takes the pennies out of the salt and vinegar solution, they look shiny and new!

3. If Laila weighs the salt and vinegar solution and the pennies **after** the experiment, what do you think she will find?

a. The solution will weigh more and the pennies will weigh less after the experiment.
b. The solution will weigh less and the pennies will weigh more after the experiment.
c. The solution will weigh the same and the pennies will weigh the same after the experiment.
d. The solution will weigh the same and the pennies will weigh less after the experiment.

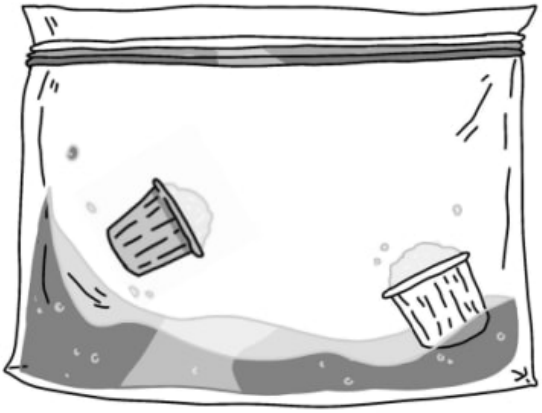
4. The graph to the right shows how much the salt and vinegar solution weighed before the experiment. It also shows how much the pennies weighed before the experiment. Laila weighs the pennies after the experiment and finds that they weigh 8 grams. Complete the bar graph to show how much the pennies weighed and how much the salt & vinegar solution weighed **after** the experiment.





5. The picture above shows a sealed plastic bag filled with vinegar at the bottom. A cup of baking soda is about to mix with the vinegar. When the baking soda mixes with the vinegar, bubbles will form and the plastic bag will start to expand. Why does the bag expand? In the picture above, draw what happens inside the bag. Use arrows and words to explain your drawing.

6. If two cups of baking soda are added to the vinegar in the bag, describe how that would change your model from Question 5.



_____

_____

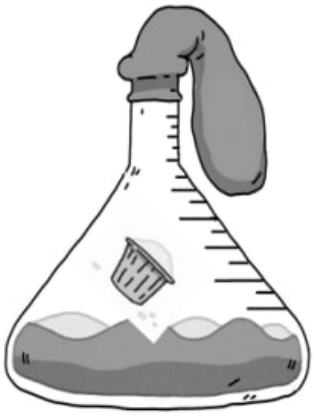
_____

_____

_____

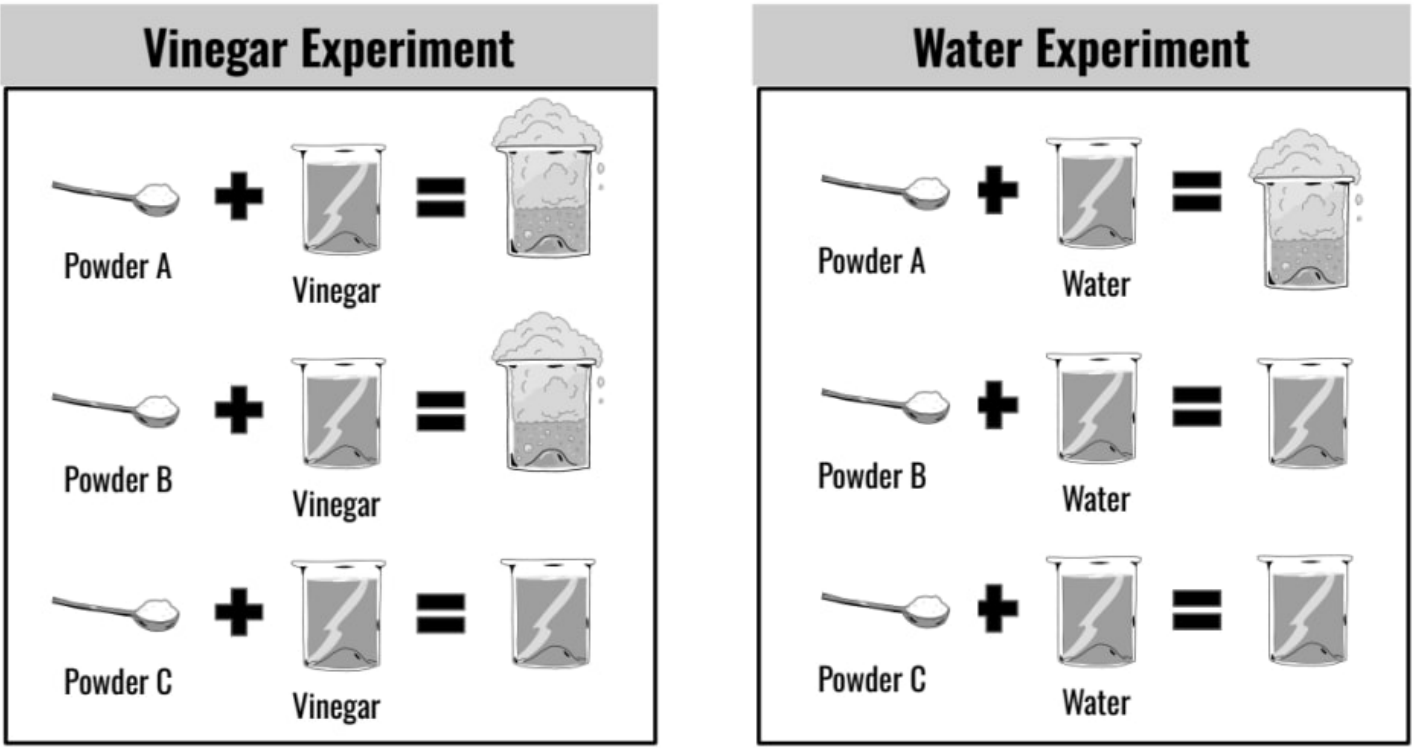
_____

7. Emi drops a cup of baking soda into a glass container that has vinegar at the bottom of it. Then, she quickly puts a balloon on top of the container. What do you predict will happen to the balloon?



a. The balloon will get bigger because it will become filled with solid (baking soda) particles that are too small to be seen.
b. The balloon will get bigger because it will become filled with liquid (vinegar) particles that are too small to be seen.
c. The balloon will get bigger because it will become filled with gas particles that are too small to be seen.
d. The balloon will stay the same because it will not become filled with anything.

Priya needs some baking **soda** to bake a cake. She has three white powders (salt, baking **soda**, and baking **powder**) in her kitchen, but they don't have labels. She knows that baking **soda** will bubble and fizz if mixed with vinegar, but not with water. Baking **powder** will bubble and fizz if mixed with vinegar. It also bubbles when mixed with water. Salt does not bubble with vinegar or water. Priya conducts the following two experiments in her kitchen.



8. If Priya only looks at the results of the Vinegar Experiment, what can she figure out?
   a. Either B or C is the baking soda. A must be the salt.
   b. Either A or B is the baking soda. C must be the salt.
   c. Either A or C is the baking soda. B must be the salt.
   d. Priya can't figure anything out if she only looks at the Vinegar Experiment.

9. Which of the three powders (Powder A, Powder B, or Powder C) do you think is the baking **soda**? Why do you think that? Support your answer with evidence from the experiments.

_____

_____

_____

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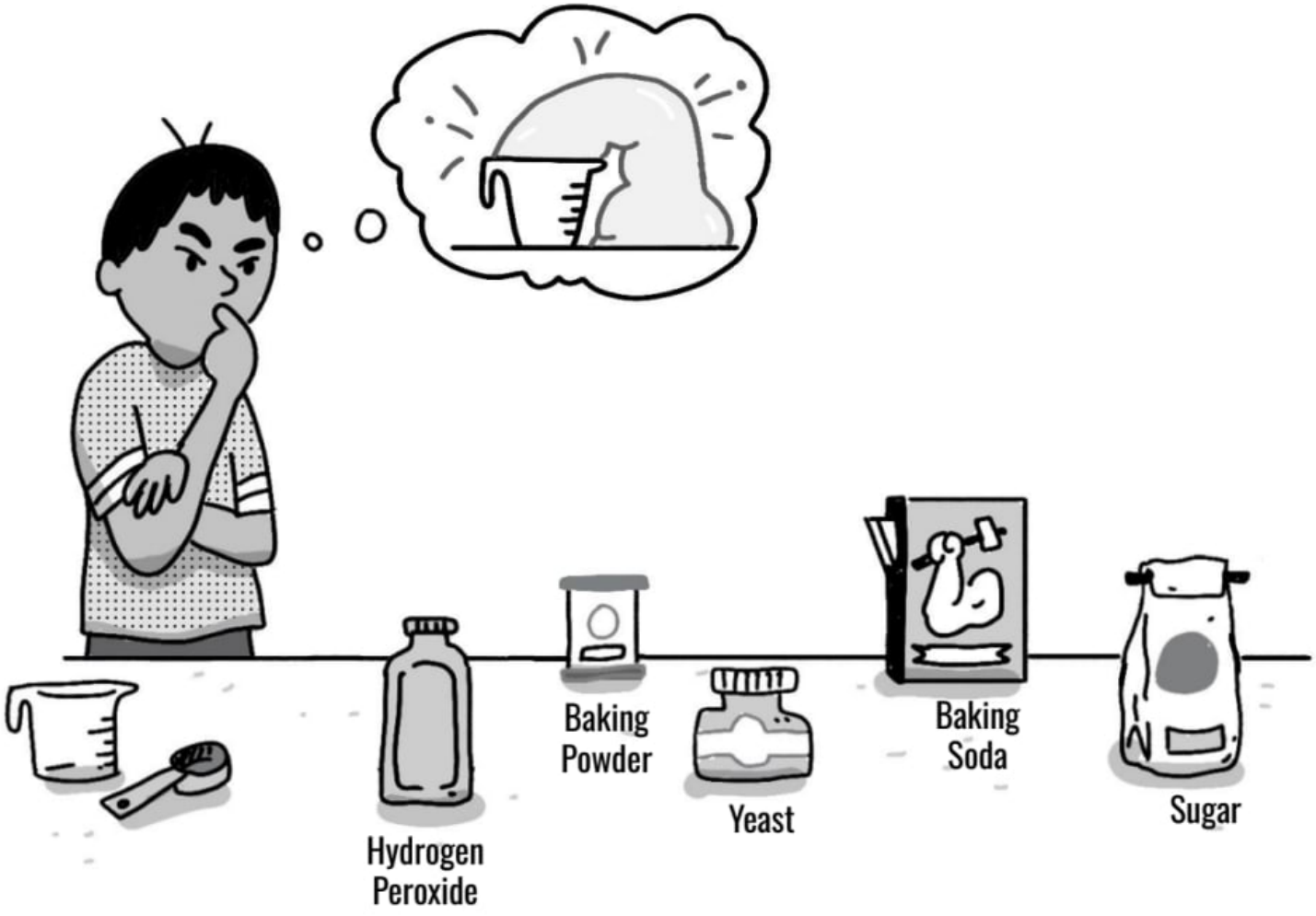

10. Samuel wants to make something called “elephant toothpaste.” It’s a chemical reaction that creates lots of white foam that looks like toothpaste for an elephant! Samuel knows that the reaction happens when two ingredients are mixed together. He also knows that one of the ingredients is hydrogen peroxide. Samuel doesn’t know what the other ingredient is. Using the ingredients shown in the picture above, describe the steps of an experiment that Samuel could perform to figure out what he needs to make “elephant toothpaste.”