GRADE
4

Finish Line

Science

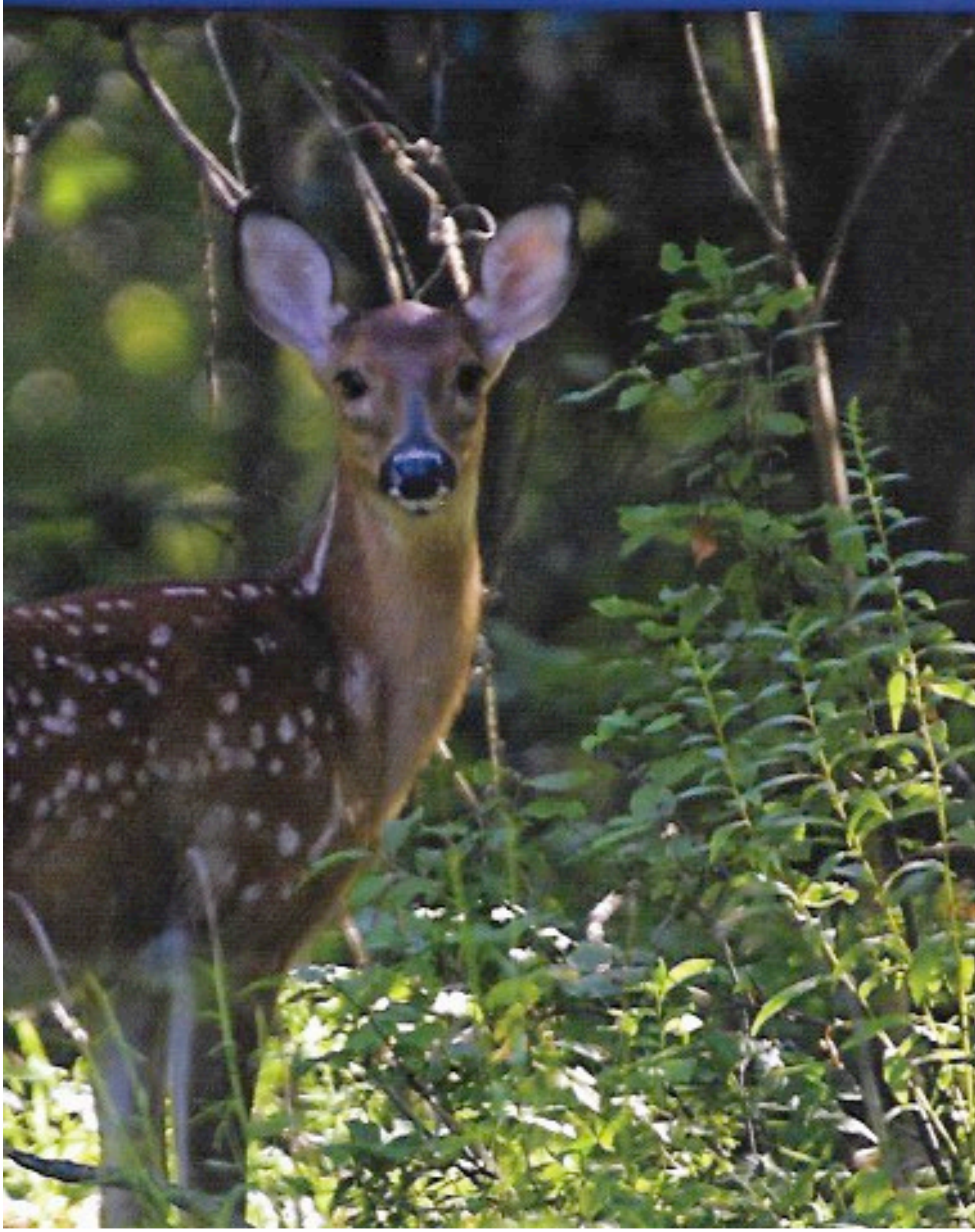


Table of Contents

Welcome to PSSA Finish Line Science

This book was written to help you get ready for the PSSA Science test. You've been studying science ever since you started school. You will need to remember things you have not studied in a long time. As you get close to the test, the best way to prepare is to review the ideas and practice the skills you will need for it.

PSSA Finish Line Science contains lessons to review the things you have learned in science class. Each lesson includes examples to remind you what an idea means or show you how a skill is used. On the right side of many lesson pages is a sidebar. It contains definitions of words you might not know or remember, and facts about things that are related to the main idea of the lesson. After each lesson, there are sample test questions to help you practice what you have reviewed.

The practice pages have two different kinds of questions. That's because the real Pennsylvania test has two kinds of questions. The questions in this book will help you find out what you know about science skills and ideas. Just like on real science tests, some of the questions in this book will be easy for you. Others may make you think a bit. And a few will be a challenge.

- The first type of question found in this book is a **multiple-choice** question. These questions give you four answers to choose from. In each lesson of this book, there are a few sample multiple-choice questions. A box under the item tells you how to think about the question so you can find the correct answer.

  When you answer a multiple-choice question, be sure to read all of the answer choices carefully before choosing one. Some questions can be tricky if you do not read closely.

- The other type of question is a **short open-ended (SOE)** question. These questions can be correctly answered in more than one way. You must answer these questions in writing, using your own words. Each question has two parts. Each part will ask you to identify, describe, or explain something. The answers you need to give might be very short and simple, or they might be very detailed. In almost every lesson, there is a sample short open-ended question. The box under the question will explain how to think about the question so you can answer it in your own words. Then, a sample answer is given.

To answer an open-ended question, follow the item instructions *exactly.* Ask yourself, "Am I answering the question that is being asked?" Always think about what you will say *before* writing your explanation. Your thoughts should be clear and organized. Your writing should be neat so it can be read.

At the end of each lesson there is a page or two of practice questions. Usually, there will be a few multiple-choice questions and one short open-ended question. These questions will give you an idea about how much you remember from the lesson. They will also give you practice answering questions like the ones you will see on the PSSA. You should do these questions on your own if possible, just as if you were taking the real test.

At the end of each unit there are a few pages of review questions. The questions in this section cover all the lessons in that unit, in a mixed order. The review includes both types of questions you worked with in the lessons: multiple-choice and short open-ended questions.

This workbook was created to give you some practice for the PSSA Science test. It will help you remember the science facts and ideas you have learned. It will give you the chance to answer the same kinds of questions you will see on the test. Good luck!

Unit 1
The Nature of Science

Scientists ask many questions about the world. They look for answers by observing things. Systems, models, and patterns help scientists understand and describe the natural world. In this unit, you will learn how to think like a scientist. You will also learn how to do a scientific investigation.

There are seven lessons in this unit:

1 **Reasoning in Science** Science is based on facts, not opinions. So it is important to know the difference between them. In this lesson, you will learn how scientists use observations to support scientific facts.

2 **Analysis in Science** Scientists study the natural world. They observe and measure the things they study. In this lesson, you will learn how scientists measure and describe the natural world.

3 **Tools in Scientific Investigations** Scientists use many different tools in their work. They use some tools to observe things. They use other tools to measure things. In this lesson, you will learn about the tools scientists use.

4 **Processes and Procedures of Scientific Investigations** Sometimes scientists do experiments. They use the data from the experiments to answer questions. In this lesson, you will learn how to design a fair experiment. You will learn how to collect and record data. Then you will learn how to use your data to support a conclusion.

5 **Systems** Almost everything scientists study is a system. Systems are made up of parts that work together and affect one another. In this lesson, you will learn about different kinds of systems. You will also learn how the parts of a system affect one another.

6 **Models** Models represent objects, events, or ideas. Scientists use models to help them study the natural world. In this lesson, you will learn about different kinds of models. You will also learn how to choose the best model for what you want to represent.

7 **Patterns** Scientists observe patterns in nature. They study these patterns to learn more about the natural world. In this lesson, you will learn about different patterns in nature. You will also learn to use patterns to make predictions.

LESSON 1

Reasoning in Science

Anchor and Eligible Content S4.A.1.1.1, 2

Scientists study the world around them. They ask questions about how things work and why things happen. To answer these questions, they make observations and inferences.

Observations and Inferences

An **observation** is something you notice. You make observations using your senses. For example, you could make observations about a tree. You could notice that the tree is taller than you are. You could feel that its bark is rough and see that its leaves are green. You could smell that its flowers are sweet.

You make **observations** when you see, hear, touch, taste, or smell things.

When you make observations in science, record them clearly and carefully. You can use numbers, words, or pictures to record observations. Be sure to record your observations in a way that makes them easy for others to understand.

Scientists use observations to help them make inferences. An **inference** is a guess based on observations. Sometimes, you cannot observe something directly. It might be too small, too large, or too far away. An event you want to observe might have happened already. Scientists can use observations about one object or event to make inferences about something they cannot observe firsthand.

An **inference** is a guess based on an observation.

No people were alive when the dinosaurs lived. Scientists have to make inferences to figure out what they might have looked like.

Opinions

You probably have a lot of ideas about things. You might think that broccoli tastes better than peas. You might think that soccer is more fun than baseball. These types of ideas are opinions. **Opinions** are statements of beliefs or feelings. They are neither wrong nor right. Opinions can change over time. One person's opinion can be different from another person's.

An **opinion** is something someone feels or believes. You cannot prove an opinion is true.

Suppose you think that Friday is the best day of the week. You like Friday because it means you get to do a favorite activity. It is your opinion that Friday is the best day. However, your friend might prefer Saturday because it means she gets to sleep late. You and your friend have different opinions. In this case, what is true for you is not true for your friend.

You cannot prove that an opinion is true. Even if your friend agreed that Friday is the best day of the week, it would not mean that your opinion is always true. Someone else could still like another day of the week better.

Which of these statements is an opinion?

A Pennsylvania is a state.

B Pennsylvania is in the United States.

C Pennsylvania is larger than Delaware.

D Pennsylvania is prettier than Maryland.

Choices A, B, and C are not opinions because they do not change based on a person's feelings. They are true for any person. Choice D is an opinion because it can be true for one person and not for another. Some people may think Maryland is prettier than Pennsylvania. The correct choice is D.

Scientific Facts

Many of your ideas about the world are based on facts. A **fact** is a statement that is always true. It does not change from person to person. **Scientific facts** are true statements about the world. For example, you know that if you drop a ball on Earth it will fall to the ground. This is a scientific fact. It is true for anyone who drops a ball on Earth.

A **fact** is a statement you can prove is true.

Scientific facts are facts about how the world works.

Unlike opinions, scientific facts can be tested. A scientist can do tests to learn if a scientific fact is true. There are no tests you can do to learn if an opinion is true.

Which of these statements is a scientific fact about fish?

A They are ugly.

B They can swim.

C They smell bad.

D They taste good.

Not all people would agree with choice A, choice C, and choice D. There is no way to do a test to show that these choices are true. Therefore, choices A, C, and D are opinions. Choice B is a scientific fact because it is always true. You could do tests to show that choice B is true. So, the correct choice is B.

Facts and Opinions in Science

A good scientist understands the difference between opinions and facts. Scientists study the world around them. They try to answer scientific questions. Scientists cannot test opinions, so they do not use them to answer scientific questions.

Many observations that scientists make support scientific facts. Observations that **support** a fact help prove that the fact is true. For example, suppose a scientist reads a book about the moon. The book says that the moon shows different shapes during a month. The scientist can observe the moon every night for a month and record what she observes. If the scientist sees different shapes, her observations support the scientific fact.

Something that supports a fact helps show that it is true.

Many people have opinions about things that scientists discover. Their opinions may be based on scientific facts. People may also use facts to try to convince others to change their opinions.

For example, people can use running water to make electricity. They build a dam across a river. The dam holds back the water in the river so it can flow only through a few small holes. People use the flowing water to make electricity. This is called hydroelectric power.

Many people think that hydroelectric power is a good idea. They like it because it does not make very much pollution. Their opinion that hydroelectric power is a good idea is based on the fact that it does not produce very much pollution.

You can learn more about pollution in Unit 2, Lesson 7.

Other people think hydroelectric power is a bad idea. They do not like it because building a dam across a river can harm the living things in the river. It can also harm the living things near the river. It can destroy the places they live. The opinion that hydroelectric power is a bad idea is based on the fact that it can harm living things.

Some people do not have an opinion about hydroelectric power. They do not know what to think about it. To form their opinions, they can learn facts about hydroelectric power. They can use the facts to help them decide what their opinion is.

Even if a person's opinion is based on scientific facts, it is still an opinion. You can base an opinion on facts, but you cannot change an opinion into a fact.

People use plastic to wrap foods. Student A thinks that plastic wrapping is a good idea. Student B thinks it is a bad idea.

A Give one scientific fact that student A's opinion could be based on.

B Give one scientific fact that student B's opinion could be based on.

Plastic wrapping helps to keep germs out of food. Keeping germs out of food helps keep people from getting sick. Student A's opinion could be based on that scientific fact. Making plastic causes pollution. Pollution harms many living things. Student B's opinion could be based on that scientific fact.

It's Your Turn

Please read each question carefully. To answer each multiple-choice question, circle the correct response.

1 Which of the following statements about an opinion is true?

A It can be tested.

B It is always false.

C It is the same for everyone.

D It can be based on feelings.

2 A person thinks that there should be more large farms. Which of these scientific facts is the person's opinion most likely based on?

A Large farms use a lot of energy.

B Large farms cause water pollution.

C Large farms make food for a lot of people.

D Large farms destroy places wild animals live.

3 It is a scientific fact that animals eat other living things. Which of these observations best supports this scientific fact?

A


C


B


D


This is a short open-ended question. Write your answer on the lines.

4 **For several days, a student observed a bird living in a tree near her home. Then the student made a prediction. She predicted that the bird would leave its nest at about 10:00 A.M. She predicted that it would bring food back to its nest at about 10:45 A.M.**

A **What did the student probably observe the bird doing on the days before she made her prediction?**

B **Explain how the observations you described in part A would help the student make her prediction.**

LESSON 2

Analysis in Science

Anchor and Eligible Content S4.A.1.3.1–5

The world around you is always changing. Snow melts on a sunny day. Cars move from place to place. Plants and animals grow over time. Scientists recognize changes in the world by making observations.

Suppose you make **observations** about a tree. You see that it has green leaves. You can also observe when it changes. You notice that the leaves change from green to yellow in the fall.

An **observation** is something you notice. You use your senses to make observations.

Scientists observe changes in the world around them.

Recognizing and Describing Changes

Scientists **analyze** the things they observe. This means that they study them very closely. Observing and analyzing the world help scientists recognize when something changes. These processes also help them learn what causes the change.

When you **analyze** something, you study it closely.

Once scientists recognize a change, they describe it. You can use numbers, words, or pictures to describe changes. For example, you can use measurements to describe changes. You can also describe changes by comparing one object to another. Scientists record their descriptions of changes clearly and carefully.

You can learn more about measurement in Unit 1, Lesson 3.

Change happens when objects move from place to place. You can measure time and distance to describe these changes. Suppose a toy car moved down a ramp. You can measure the time it took for the car to reach the bottom of the ramp. You can also measure the distance the car moved down the ramp. These measurements help you describe how the car's location changed.

You can learn more about the movement of objects in Unit 3, Lesson 4.

You can also compare the movement of the toy car to other objects. You could say that the toy car moved faster down the ramp than a wooden block did. You could say that the toy car moved farther than the length of your arm. These comparisons also describe how the toy car changed when it moved.

Many factors cause things to change. Sunlight can cause changes in plants. Some flowers close their petals at night when there is no sunlight. During the day, the flowers open up. You could describe these changes by drawing pictures like the ones below.

Flowers at night

Flowers during the day

Sunlight also helps plants grow. When a plant grows, its height changes. You can measure the height of a plant to describe its growth. You can also describe the change in a plant's height by comparing it to other things. For example, you could say that a plant grew taller than the fence.

Temperature can also cause objects to change. When an ice cube heats up enough, it will melt. When ice melts, it changes from a solid to a liquid. As an ice cube melts, its size gets smaller. Temperature also causes changes in people. When you get warm, your body may sweat. Sweating is a way to cool your skin. Your body makes this change when temperatures get high.

Light also causes changes in people's eyes. When the light is dim, the center of the eye (the pupil) gets bigger. When the light is bright, the pupil gets smaller.

Sunlight can also cause changes in people's skin. People can get sunburn if they stay out in the sun for too long.

A runner runs a race on a track. What could you do to describe the change in the runner's location?

A record the time of day

B measure the height of the runner

C record the temperature on the track

D measure the distance the runner ran

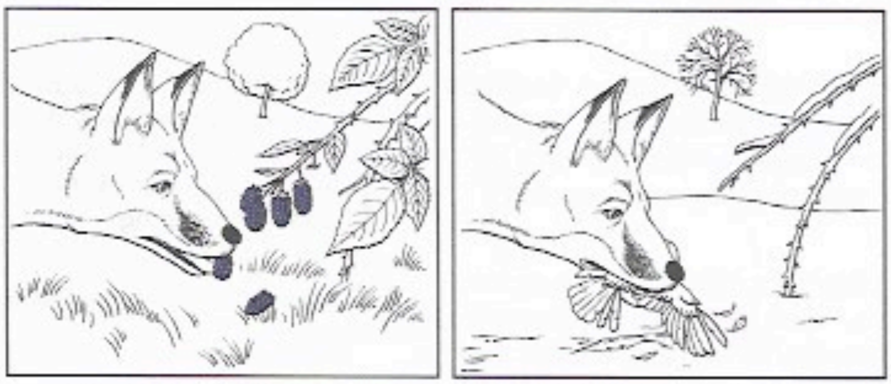
The runner changed location by running from one place to another. Recording the time of day or the temperature on the track does not describe this change. So, choices A and C are incorrect. In addition, the height of the runner does not describe how his position changed. So, choice B is incorrect. You can measure the distance over which the runner ran to help describe his change in location. The correct choice is D.

Changes to the Natural World

Many changes happen in the natural world. People cause some of these changes. Sometimes, people cut down forests so they can build houses and other buildings on the land. When people cut down trees, many forest animals lose their shelter. The animals might also lose their source of food.

When the environment changes, living things respond in different ways. Some animals move to new places. For example, if birds run out of food when a forest changes, they may fly somewhere else. Many birds also fly to new places when the seasons change.

When food supplies change, some animals change what they eat. For example, red foxes eat insects and fruits. However, the supply of these foods is smaller in winter. So, in the winter, red foxes eat birds and other small animals instead. If living things cannot move to new places or adjust to change, they cannot survive.



The food supply changes with the seasons. So red foxes eat different things in winter than in summer.

People also change the environment from activities they do every day. Many farmers use chemicals to help grow their crops. Some of these chemicals can get into rivers and streams. They can harm the water that fish and other animals live in. They can also make the water that people drink unclean.

People also burn fuels such as coal, oil, and gasoline. They burn fuels to make electricity. They also burn fuels to heat their homes and run their cars. However, burning fuels makes the air dirty. It releases harmful gases into the air. These gases can cause acid rain. Acid rain can harm plants, soil, and bodies of water. Gases from burning fuels can also make the temperatures on Earth higher.

You can learn more about changes to the environment in Unit 2, Lesson 6.

Food supplies in many environments get smaller in the winter. Some animals do not eat in the winter. They eat extra food in the fall and store it in their bodies as fat. Then they hibernate through the winter and live off the stored fat.

Many factories also release harmful things into the air as they make the products that people use every day.

Frogs need to live in moist environments such as wetlands. Suppose people covered a wetland with concrete so they could build stores there.

A Describe the effect of the people's actions on the frogs' environment.

B Describe two things that might happen to the frogs that lived in the wetland.

When people covered the wetland with concrete, they changed the frogs' environment. They destroyed the frogs' shelter and sources of food. The frogs might move to another wetland. If they could not move to another place, they would die.

Please read each question carefully. To answer each multiple-choice question, circle the correct response.

1 The people in a city decide to walk instead of drive their cars. What will most likely happen when these people make this change?

A The air in the city will become cleaner.

B The buildings in the city will last longer.

C The water in the city will become dirtier.

D The roads in the city will be more crowded.

2 A fire burns a field. Which of these living things could not move to another place to escape the fire?

A


C


B


D


3 A girl observes that her skin became tan after going to the beach. What most likely caused this change to her skin?

A heat

B sunlight

C temperature

D ocean chemicals

4 **Which of these changes could you best describe by measuring length?**

A the freezing of water

B the growth of a caterpillar

C the movement of a pinwheel

D the loss of leaves from a tree

Use the pictures below to answer question 5.

5 **Based on the pictures, which of these best describes the size of the squirrel?**

A smaller than the mouse, bigger than the beaver

B bigger than the mouse, bigger than the beaver

C bigger than the mouse, smaller than the beaver

D smaller than the beaver, smaller than the mouse

LESSON 3

Tools in Scientific Investigations

Anchor and Eligible Content S4.A.2.2.1

Scientists use **data,** or pieces of information, to answer questions. Some data are words, pictures, or other descriptions. Data about a leaf might be that it is green, has rough edges, and feels fuzzy.

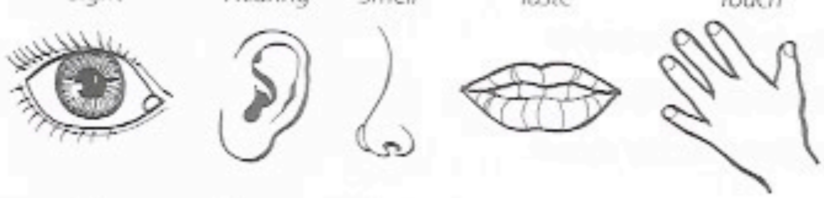
Some data are numbers. Some number data about a leaf might be that it is 5 cm long and 2 cm wide. Most data that are numbers come from measurements. Scientists make measurements using tools. In this lesson, you will learn about some tools and how they are used.

Data are pieces of information.

Cm is the abbreviation for *centimeter.*

Kinds of Tools

Scientists collect many kinds of data using only their five senses. For example, a scientist may look closely at a plant to learn the color and shape of its leaves.



You can collect some data using your five senses.

CAUTION: ***Never*** taste or smell anything in science class unless your teacher tells you to. ***Always*** wash your hands after you do a science activity.

Scientists also use tools to collect data. Tools help scientists collect data more exactly or clearly. For example, a scientist may use a video camera to record what something looks or sounds like.

Tools can also help scientists make exact measurements. For example, if the scientist used only her senses, she could not say exactly how tall a plant is. She could use a ruler to measure exactly how tall the plant is.

Scientists use different tools for different things. Some tools help them see things. Others help scientists measure things. The pictures on the next page show some common science tools and what you can use them for.

Hand lens

Binoculars

Telescope

You can use a **hand lens** to make things look larger. You can use **binoculars** or a **telescope** to help see things that are far away.

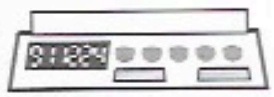
A **hand lens** (also called a magnifying glass) makes small things look larger.

Binoculars make things that are far away look closer.

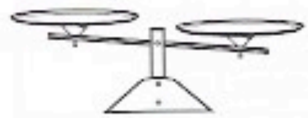
A **telescope,** like binoculars, makes things that are far away look closer.

Ruler

Scale



Balance

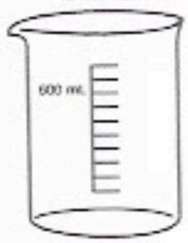


You can use a ruler to measure length. You can use a scale or a balance to measure mass.

Mass is the amount of material in something.

Thermometer

Beaker



Stopwatch

You can use a thermometer to measure **temperature.** You can use a **beaker** to measure the **volume** of a liquid. You can use a stopwatch to measure time.

Temperature is how hot or cold something is.

Volume is how much space something takes up.

A student uses a balance to measure an acorn. The student is most likely recording the acorn's

A length.

B mass.

C height.

D temperature.

You use a ruler to measure length and height, so choice A and choice C are incorrect. You use a thermometer to measure temperature, so choice D is incorrect. You use a balance to measure mass. Therefore, the correct choice is B.

When a question asks you to name something, think of the name first. Then, read the answer choices to find the one that is closest to the name you thought of.

When you make measurements, you should be careful to write them down correctly. You should also record the units of your measurements. Scientists use metric units of measurement. Some of these units are shown in the table below. You should use these units when you describe your measurements in science.

Measurement	Metric Unit or Units
length	kilometers (km) meters (m) centimeters (cm) millimeters (mm)
volume	liters (L) milliliters (mL)
mass	kilograms (kg) grams (g) milligrams (mg)
time	hours (h) minutes (min) seconds (s)
temperature	degrees Celsius (°C)

You are probably used to measuring length in feet and inches. You probably describe temperature with degrees Fahrenheit instead of degrees Celsius. However, scientists use metric units of measurement. When you record data, you should use metric measurements, too. ***Never*** use customary units such as feet, inches, pounds, or degrees Fahrenheit.

Scientists use prefixes to show how units are related. The prefix *kilo-* means "1,000." The prefix *centi-* means "$\frac{1}{100}$." The prefix *milli-* means "$\frac{1}{1,000}$." So, a kilogram is 1,000 grams. A milliliter is $\frac{1}{1,000}$ of a liter.

Look at the picture of the toy car below.

A What tool should you use to measure the length of the car in this picture?

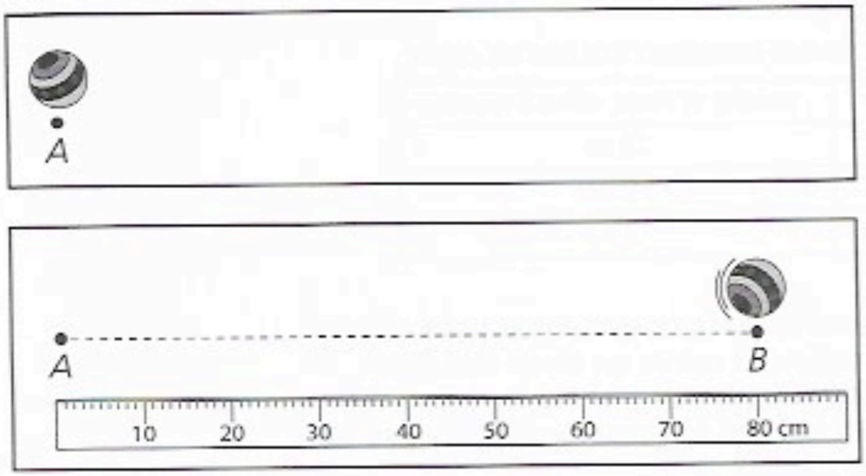
B Measure the length of the car in the picture. Record the length of the car in the space below. Make sure to use the correct units.

You should use a ruler to measure the length of the car. To use a ruler, hold it so that the "0" end is lined up with the end of the car. Read the number on the ruler that is lined up with the other end of the car. The picture below shows how to do this.

The mark on the ruler that is closest to the right end of the toy car is the 6-cm mark. Therefore, this car is 6 cm long.

Using Tools to Measure Change

You can use tools to measure change. Suppose you roll a ball across the floor. You can use a ruler to measure the distance between where the ball started and where the ball stopped. That tells you how the ball's location changed.



Which tool should you use to measure how long it takes the ball to roll along the floor?

- **A** ruler
- **B** balance
- **C** stopwatch
- **D** thermometer

The question is asking you which tool you would use to measure a change in time. You use a ruler to measure length, so choice A is incorrect. You use a balance to measure mass, so choice B is incorrect. You use a thermometer to measure temperature, so choice D is incorrect. You use a stopwatch to measure time. The correct choice is C.

Using Tools to Communicate

It is very important for scientists to talk, or communicate, with each other. It is also important for them to share their data. Scientists use many special tools to do this. They use computers to store their data. They use e-mail, the Internet, and the telephone to communicate with each other. They also use the Internet to share their data.

It's Your Turn

Please read each question carefully. To answer each multiple-choice question, circle the correct response.

Use the table below to answer question 1.

HEIGHTS OF PLANTS GROWN UNDER DIFFERENT COLORS OF LIGHT

Plant	Color of Light	Height of Plant After 2 weeks
1	red	15 cm
2	green	8 cm
3	blue	14 cm

1 A scientist did an experiment to learn how colored light affects plants. He shined light of different colors on three radish plants. He measured how tall they grew. The table shows the scientist's results. What tool did the scientist most likely use to measure the heights of the plants?

A


B


C


D


2 What data could you get by using a balance to measure part of a tree?

- **A** length of the stem
- **B** mass of fruit produced
- **C** time it takes for a bud to open
- **D** amount of water taken up by the roots

3 Which tool could you use to see details on the moon's surface?

- **A** beaker
- **B** hand lens
- **C** telescope
- **D** thermometer

LESSON 4

Processes and Procedures of Scientific Investigations

Anchor and Eligible Content S4.A.2.1.1–4

Imagine you found a rock that you had never seen before. How could you learn about it? First, you could ask questions. You could ask, "Is the rock heavy or light?" or "How did the rock form?"

Asking Scientific Questions

To learn about the world, you can ask scientific questions. Not every question is a scientific question. A scientific question can be answered using data. **Data** are pieces of information. Data include facts and observations. You cannot use an opinion to answer a scientific question.

All scientists use data to answer their questions. When you ask questions and collect data about the world around you, you are acting like a scientist.

Data are pieces of information.

Remember that an opinion is something someone believes or feels. You cannot prove an opinion is true.

Which of these questions is a scientific question?

A Which hamburger tastes the best?

B Which animal in the zoo weighs the most?

C Are purple flowers prettier than blue flowers?

D Do plants look nicer under red light or green light?

Remember that you cannot use opinions to answer scientific questions. A question that you can answer with an opinion is not a scientific question. Which hamburger tastes the best, whether a flower is pretty or not, and when plants look nicest are opinions. The weight of all the animals in the zoo is a fact because you can measure weight. The correct choice is B.

Types of Scientific Investigations

Once you ask your scientific question, you need to decide how to answer it. You could answer your question in different ways. You could look at the rock closely to learn its color, shape, and size. You could feel it to learn whether it is smooth, rough, hard, or soft. You could lift it up to learn if it is heavy or light. You could use a ruler to measure how long it is. You could read books about rocks to try to figure out what kind of rock it is and how it formed.

When you ask a question and then collect data to answer it, you are doing a science **investigation.** There are many ways to do a science investigation. Looking at the rock, feeling it, measuring it, describing it, and reading about it could all be parts of a scientific investigation.

Another way to conduct a scientific investigation is to do an experiment. In an **experiment,** a scientist changes a condition and observes the effects of the change. Many scientists do experiments to learn how different things affect one another. You can do experiments to learn about the world, too.

Before you do an experiment, you should plan it carefully. Make sure your experiment has only one variable. A **variable** is the condition that you change during an experiment. To do a good experiment, you need to keep all other conditions the same. If an experiment has more than one variable, you cannot know which variable caused what you observe.

An **investigation** is a careful study used to answer a scientific question.

In an **experiment,** you change a condition and observe the effects of the change.

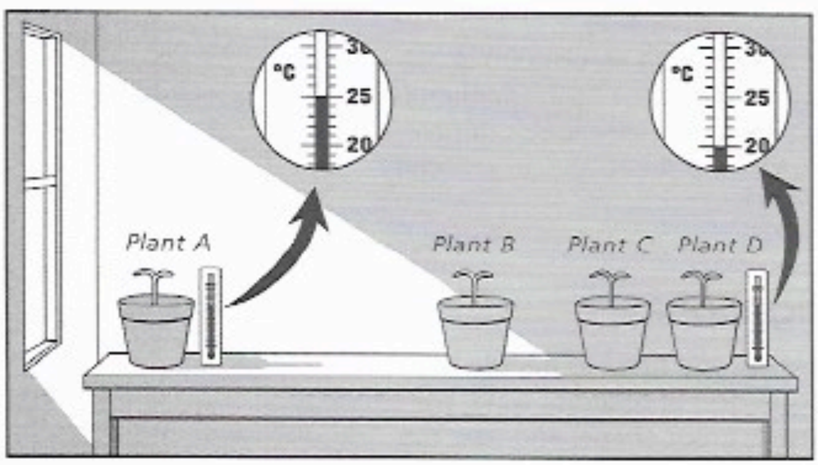
Although many scientists do experiments, many other scientists do not. A scientific investigation does not have to include an experiment.

A **variable** is the condition you change in an experiment.

Designing a Fair Experiment

Lee knows that plants need water to survive and grow. She wants to know if too much water can be harmful to a plant. She asks a scientific question: Can too much water keep a plant from growing?

Lee plans an experiment to learn if too much water can keep a plant from growing. She plants four tomato plants. She waters the plants every day. She gives the plants different amounts of water. Plant A sits near a window that gets bright sunlight. Plants B, C, and D sit in a darker part of the room. The dark part of the room is cooler than the bright part of the room. Lee plans to measure the height of each plant every week.



Is Lee's test fair? No, because Lee's experiment has too many variables. The plants will get different amounts of water and sunlight. They will also grow in different temperatures. If some of the plants do not grow, Lee cannot know if temperature, amount of sunlight, or amount of water was the cause.

Which statement best explains why Lee will not know what caused her results?

A She is growing more than one plant.

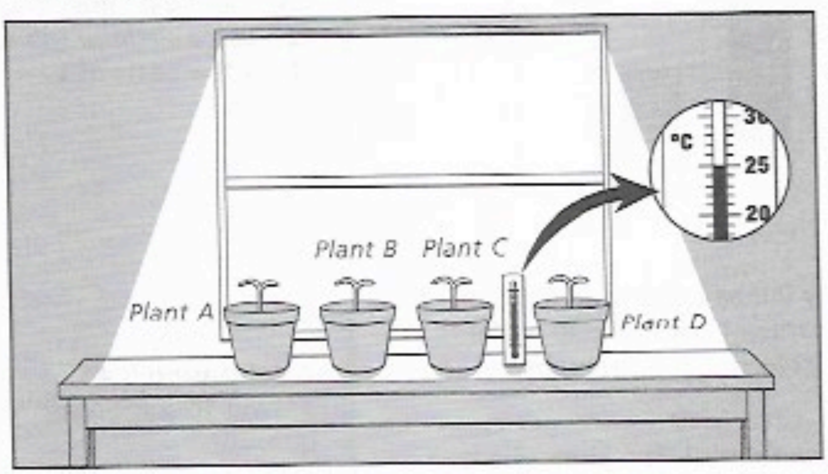
B She is growing the plants in the same kind of soil.

C She has too few variables in her experiment.

D She has too many variables in her experiment.

Lee has to grow more than one plant in her experiment so that she can compare them. So, choice A is incorrect. Lee should use the same kind of soil for each plant because she is not testing soil. So, choice B is incorrect. Her experiment has too many variables, not too few. So, the correct choice is D.

How could Lee change her experiment to make it a fair test? For Lee to be able to compare her results fairly, she must make sure her experiment has only one variable. She must keep the temperature and amount of sunlight the same for all the plants. She should change only the amounts of water she gives the plants. The figure below shows how Lee does her experiment so that it has only one variable.



Everything in this investigation is the same except the amount of water Lee gives each plant. This means Lee can compare the amounts of water and growth of the plants fairly.

Collecting Data

As scientists make observations during an investigation, they collect data. They record the data in an organized way so that the data are easy to read. The easiest way to record data is in a data table. A data table also makes it easy for scientists to share their data with others. Lee made this data table to record her data.

HEIGHTS OF FOUR PLANTS GIVEN DIFFERENT AMOUNTS OF WATER

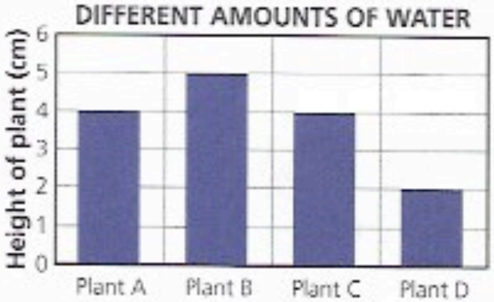
Plant	Amount of water each day (mL)	Height Week 1 (cm)	Height Week 2 (cm)	Height Week 3 (cm)
A	5	2	3	4
B	10	2	4	5
C	15	2	3	4
D	20	2	2	2

Scientists may also display their data in graphs. Tables and graphs help scientists see patterns in their data. Scientists can use patterns in data to help them make predictions. Tables and graphs also help other scientists understand the data easily.

You can learn more about using patterns to make predictions in Unit 1, Lesson 7.

Lee made the graph below to show the height of the plants after three weeks. The bar graph helps Lee compare the heights of the plants easily.

HEIGHTS OF FOUR PLANTS GIVEN DIFFERENT AMOUNTS OF WATER



You can use a *bar graph* to compare things. You can use a *line graph* to show how something changes over time. You can use a *circle graph* to show the parts of a whole.

Drawing Conclusions

After Lee collected data from her fair test, she used the data to answer her question: Can too much water be harmful to a plant? Lee analyzed her data to make a conclusion. A **conclusion** is an answer to a scientific question.

A **conclusion** is an answer to a scientific question.

Lee observed that plant D was the shortest. She knew she had given plant D the most water. Lee inferred that the amount of water she gave plant D was too much for the plant. Lee stated her conclusion: Too much water can keep a plant from growing.

Like Lee, you should always use data to support your conclusions. When you draw conclusions, always consider *all* the data you have. Do not ignore data that do not support your conclusions.

Let's look at another example of how to use data to draw conclusions. Jin and Laura learned about magnets in school. They found four different objects that they thought might be magnets. They asked the question: Are any of these objects magnets? They decided to do an investigation to find the answer to their question.

First, Jin and Laura learned what others know about magnets. They read about magnets in a science book, an encyclopedia, and a science magazine. They learned that some magnets are stronger than others. They also learned that strong magnets can:

- stick to some kinds of metal
- pull steel pins toward them
- make compass needles move

What is the most likely reason that Jin and Laura read about magnets at the beginning of their investigation?

A so they would not have to do an experiment

B to find paragraphs they could copy in their report

C so they would not have to make any observations

D to learn how to tell whether something is a magnet

Choice B is incorrect, because you should never copy paragraphs from another source when you write a science report. Choice C is incorrect, because you should always make observations when you do a science investigation. Choice A might be true, but choice D is more likely because reading about a subject is an important part of a scientific investigation. The correct choice is D.

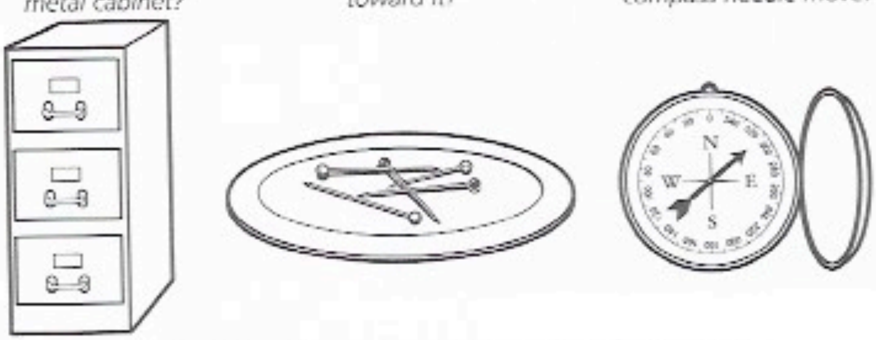
Pay attention to words in questions such as *most likely*. They mean that more than one of the answer choices might be partly true, but only one of the answer choices is completely true. Be sure to read all the choices before you pick one.

Then, Jin and Laura tested each of the four objects in three different ways. First, they placed each object on the side of a metal cabinet in their classroom to see if it would stick. Next, they held each object near some steel pins to see if it would pull the pins toward it. Finally, they held each object near a compass to see if the object would make the compass needle move.

First test: Does it stick to a metal cabinet?

Second test: Does it pull steel pins toward it?

Third test: Does it make a compass needle move?



Jin and Laura tested each object in three ways.

The table below shows what Jin and Laura observed during their investigation.

MAGNETISM TEST FOR FOUR DIFFERENT OBJECTS

Object	Effect on Metal Cabinet	Effect on Metal Pins	Effect on Compass Needle
A	stuck to cabinet	picked up three pins	made compass needle move a lot
B	did not stick to cabinet	did not pick up any pins	did not make compass needle move
C	stuck to cabinet	made pins move, but did not pick any up	made compass needle move a little
D	stuck to cabinet	picked up one pin	made compass needle move a little

Next, Jin and Laura analyzed their observations. They thought about what they had learned about magnets. Then, they compared their observations to what they had read. Finally, they used the observations to draw a conclusion. Jin and Laura wrote out their conclusion below.

> **Jin's and Laura's conclusion:** Objects A, C, and D stuck to the cabinet, pulled the pins toward them, and made the compass needle move. The science magazine article stated that strong magnets have these properties. So, objects A, C, and D are all strong magnets. The article also said that things that are not magnets do not have these properties. So, we think object B is not a magnet.

Which new piece of data would most likely cause Jin and Laura to make a different conclusion about object B?

A if object B made the compass needle move

B if object B stuck to a wood cabinet

C if object B looked like the other objects

D if object B was larger than the other objects

Scientists must use data to support their conclusions. Sticking to wood is not a property of a magnet. So choice B is incorrect. Just because an object looks like a magnet does not mean it is a magnet. Choice C is incorrect. The size of an object does not determine whether it is a magnet. Choice D is incorrect. Making a compass needle move is one of the properties of magnets that Jin and Laura read about. So, the correct choice is A.

It's Your Turn

Please read each question carefully. To answer each multiple-choice question, circle the correct response.

1 Which question could someone answer with a scientific investigation?

- **A** Are trees prettier than grass?
- **B** Does pizza taste better than salad?
- **C** Does corn grow faster than soybeans?
- **D** Is it more fun to swim in a lake or in an ocean?

2 A student observes the changes in height of ocean water next to a dock over time. What is the best way for the student to record his observations?

- **A** writing a story
- **B** drawing a graph
- **C** taking one photograph
- **D** speaking to his class

Use the table below to answer question 3.

AMOUNT OF WATER THAT PAPER TOWELS OF DIFFERENT THICKNESS SOAK UP

Brand	Thickness of the towel	Amount of water soaked up (mL)
A	very thick	10
B	medium thickness	13
C	thin	10

3 A student did an experiment to learn which brand of paper towels can soak up the most liquid. He asks this scientific question: Do thicker paper towels soak up more water than thinner paper towels? The table above shows his results. Which conclusion do the data best support?

- **A** Thicker towels soak up the most water.
- **B** Thin towels soak up more water than thick towels.
- **C** You cannot tell how much water a towel will soak up based on its thickness.
- **D** You can tell how much water a towel will soak up based on thickness.

This is a short open-ended question. Write your answers on the lines.

Use the table below to answer question 4.

HEIGHT OF BOUNCING BALLS

Trial	Type of Ball	Type of Floor	Height Ball Dropped From (m)	Height Ball Bounced (cm)
1	golf ball	carpet	2.0	15
2	basketball	tile	1.0	60
3	soccer ball	wood	0.5	25
4	tennis ball	cement	1.5	90

4 A student does an experiment to learn which kind of ball bounces highest. The table shows how she set up her experiment and how high each ball bounced.

A Explain why the student's comparison of the height of the bouncing balls is unfair.

B The student wants to change her experiment so that she can compare her results fairly. Describe changes she should make to the experiment.

LESSON 5

Systems

Anchor and Eligible Content S4.A.3.1.1–4

Many of the things scientists study are systems. A **system** is a group of parts that work together and affect one another. Everything on Earth is part of one or more systems.

A system is a group of parts that work together.

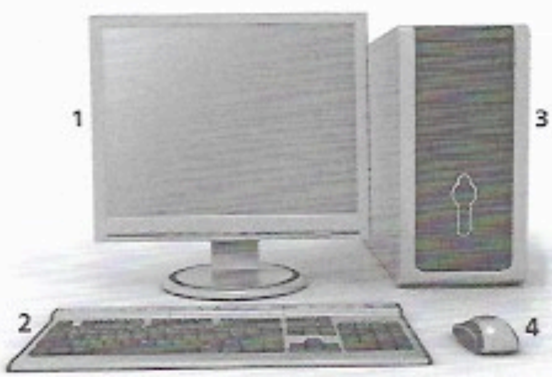
Systems and Their Parts

All systems are made up of parts. The parts of a system can be natural or human-made. They can be living or nonliving. The parts of a system can be ideas, energy, or even other systems.

The parts of a system have different **roles,** or jobs. Each role is important. If one of the roles is not filled, the system may not work. For example, a ballpoint pen is a system. One of the parts of the system is a tiny ball in the tip of the pen. The ball rolls around in the tip when someone writes with the pen. The role of the ball is to spread the ink evenly on the paper. If the ball gets stuck and cannot move, it cannot spread the ink. The pen will not work.

A part's **role** in a system is the job the part does in the system.

The picture below shows a system.



Which of these best describes the role of part 1 in this system?

A to process and store information

B to show information to a person

C to let a person type in information

D to print information on a piece of paper

If a picture and a question go together, read the question before looking at the picture. Then, use the question to help you figure out what parts of the picture are important.

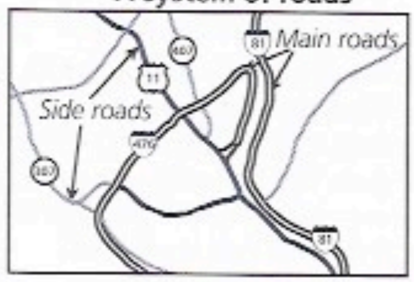
Part 1 is the computer screen. It does not process and store information, so choice A is incorrect. The keyboard lets people type in information, so choice C is incorrect. A printer prints information on paper, so choice D is incorrect. The computer screen shows people information, so choice B is correct.

Examples of Human-Made Systems

Most of the things we use every day are human-made systems. Human-made systems include bicycles, computers, maps, the Internet, electric lights, and water pipes. Most human-made systems are made up of nonliving, human-made parts. The pictures below show the parts of two human-made systems.

Parts of a car

A system of roads



Which of these systems is most likely made up of nonliving, human-made parts?

A a mountain

B a telephone

C a spider's web

D a long river

Remember that systems made of nonliving, human-made parts are human-made systems. A mountain, a spider's web, and a river are not human-made systems. Therefore, they are not made up of nonliving, human-made parts. Choices A, C, and D are incorrect. A telephone is a human-made system. Choice B is correct.

Not all human-made systems are made up of parts you can touch. Some human-made systems are made up of ideas. Many of these systems are important in science. Scientists develop these systems as they learn more about how the world works. Systems of ideas help scientists understand how different parts of the world are related.

Examples of Natural Systems

Earth is made up of many different natural systems. Living things, rivers, mountains, oceans, and even Earth itself are all examples of natural systems. The parts of a natural system can be living or nonliving. The parts in a natural system are not human-made. Each part has a certain role. The picture below shows an example of a natural system.

The forest system in the picture is an example of an ecosystem. An **ecosystem** is all the living and nonliving things in an area. Plants, animals, and other living things are living parts of a forest system. Rocks, soil, water, and air are nonliving parts of a forest system. There are many different kinds of ecosystems.

An **ecosystem** is a system made up of all the living and nonliving things in an area.

Each part of an ecosystem depends on the other parts. For example, think of the soil in a forest. Many organisms depend on soil. Some animals live in the soil or get their food there. Plants get water and some nutrients from the soil. However, the soil depends on organisms, too. Plant roots hold the soil in place when it rains. Nutrients from dead organisms go back into the soil and help other living things grow.

In many forests, rabbits eat young plants, and owls eat rabbits.

A What might happen to the plants if all the owls died? Explain your answer.

B If the owls died, what would eventually happen to the rabbits? Explain your answer.

When owls eat rabbits, the number of rabbits goes down. Therefore, if all the owls died, there would probably be more rabbits. If there are too many rabbits, they might eat all the plants. If the rabbits ate all the plants, there would be no plants left for them to eat. The rabbits could die out if they didn't have any food to eat.

Food and Fiber System

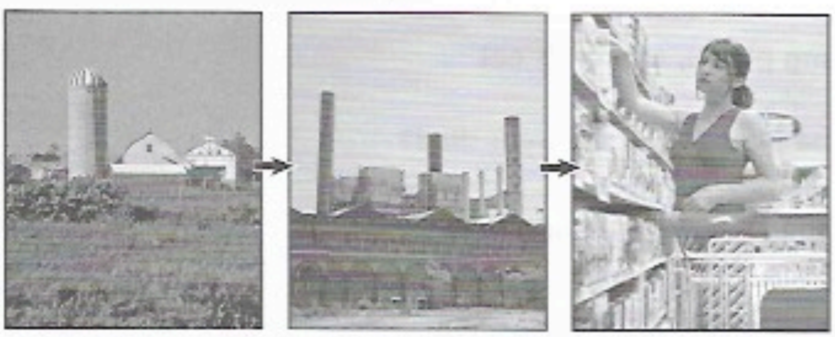
Some systems have both natural and human-made parts. A farm has buildings and machines that people make. A farm also needs materials from nature such as sunlight, water, and earthworms.

Perhaps you know that many foods such as milk, fruit, vegetables, and eggs come from farms. But where do foods such as popcorn or French fries come from? People might buy these items at a store or restaurant, but these foods also started out as crops on a farm.

French fries are made from potatoes. Farmers grow the potatoes and ship them to a factory. The factory cleans, cuts, and cooks the potatoes. Now the potatoes are French fries. The factory packages the fries and ships them to restaurants where they are heated and served to customers.

Popcorn starts out on a farm as kernels on an ear of corn. Farmers harvest the corn and ship it to a factory. At the factory, the kernels are removed from the corn cob and may be heated to make them pop. The factory may put the popcorn in bags and ship it to stores. Some factories bag the corn kernels and ship the bags to stores and movie theaters.

Farms, factories, and stores are all parts of a larger system called the food and fiber system. In this system, people use materials from farm plants and animals to make products such as foods and clothing. People move materials from farms to factories where the products are made. Then people move the products to stores where customers can buy them.



In the food and fiber system, materials move from farms to factories. Products from factories move to stores.

Trucks, roads, trains, airplanes, and boats are also parts of the food and fiber system. Without ways to move materials and products from one place to another, the system could not work.

You can learn more about agriculture in Unit 2, Lesson 7.

Some restaurants make their own French fries. They buy potatoes from farmers or a store. Then they cut and cook the French fries themselves.

It's Your Turn

Please read each question carefully. To answer each multiple-choice question, circle the correct response.

1 Which of these is the best example of a natural system?

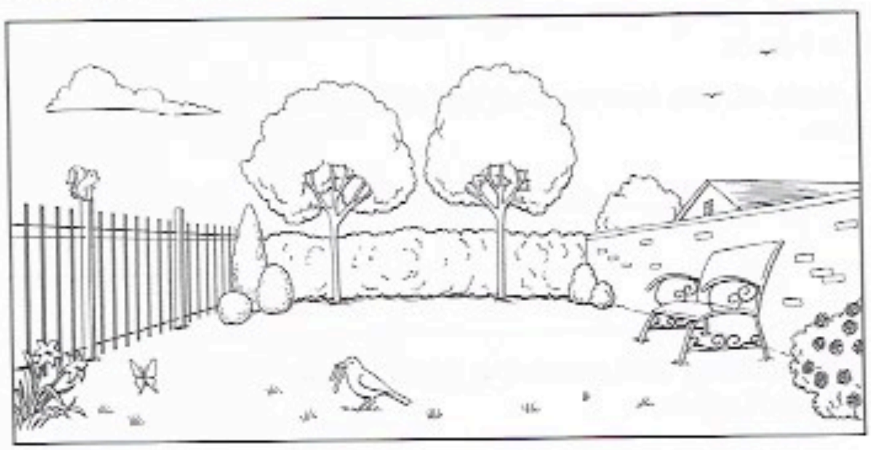
A

C

B

D

Use the picture below to answer question 2.



2 A student is writing down the nonliving things she sees in her backyard ecosystem. Which two things should the student record?

A flowers and grass

B grass and bench

C bench and fence

D fence and flowers

3 **Which list shows a correct path through a food and fiber system from source to consumer?**

A roots, corn, leaves, sunlight

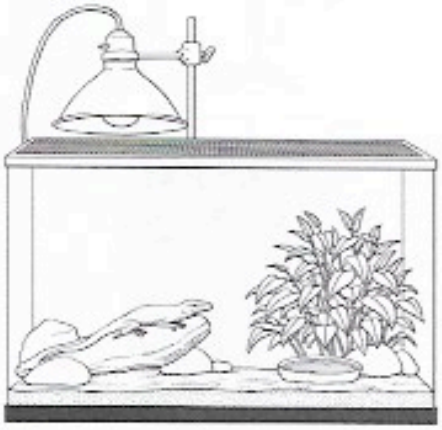
B cotton, grass, soybeans, sunflowers

C sweater, factory, wool, sheep

D seed, tree, fruit, store

This is a short open-ended question. Write your answers on the lines.

Use the picture below to answer question 4.



4 **A scientist is studying a lizard. The picture shows the system she made for the lizard to live in.**

A Name two living parts of this system and two nonliving parts of this system.

B Describe two ways the living and nonliving parts of this system could affect each other.

LESSON 6

Models

Anchor and Eligible Content S4.A.3.2.1–3

You have probably seen models many times without realizing that's what you were seeing. Whenever you find a place on a map or globe, you are using a model. Whenever you draw a picture of something you see, you are making a model.

What Is a Model?

A **model** is anything that represents an object, an event, or an idea. A globe represents Earth. A map represents a particular place. A graph represents observations you made in an investigation.

A model is simpler than the real object or event. It cannot show everything. For example, a map shows some features of a place, but it does not show you every detail. If the map below showed every road, mountain, river, and building in Pennsylvania, it would be too hard to read. The purpose of the map below is to show large rivers. If you wanted to learn where cities are in Pennsylvania, you would need to use a different map.

Like all models, a map is simpler than what it represents. A map cannot show you every detail of a place.

Types of Models

A map is an example of a physical model. Physical models can show you what an object looks like or how it works. You can see, touch, or hold a physical model. Some physical models, such as maps, are flat images on paper. Other physical models, such as globes, are three-dimensional (3-D). A **three-dimensional model** is not flat. It takes up space like the object it represents.

A **model** is something that represents an object, an event, or an idea.

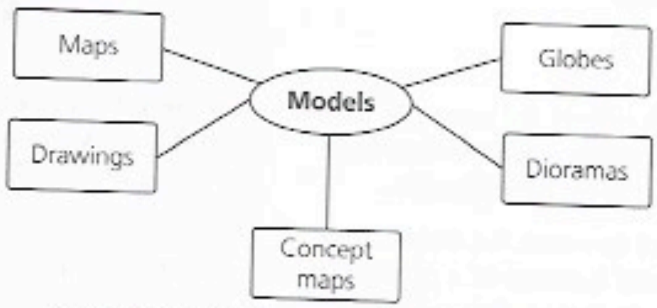
No single model can show you everything. To study one object or event, you might need to use several different kinds of models.

A **three-dimensional (3-D) model** takes up space like the thing it represents.

Many physical models are much larger or smaller than the thing they represent. A globe is much smaller than the actual Earth. A **diorama** is a 3-D model that uses objects to show a scene. A diorama of a desert is smaller than a real desert. Some models are the same size as the thing they represent. A crash-test dummy is a model of a human. It needs to be the same size as a person so that carmakers can learn how to keep people safe in cars.

A diorama is a 3-D model that shows a scene from an event or a place.

Not all models represent specific objects. Some models represent ideas or information. A concept map such as the one below is a model that shows how different ideas or pieces of information are related.



This concept map organizes information on different kinds of models.

A student wants to find the distance between Philadelphia and Pittsburgh. Which model would be most useful to her?

A concept map

B diorama

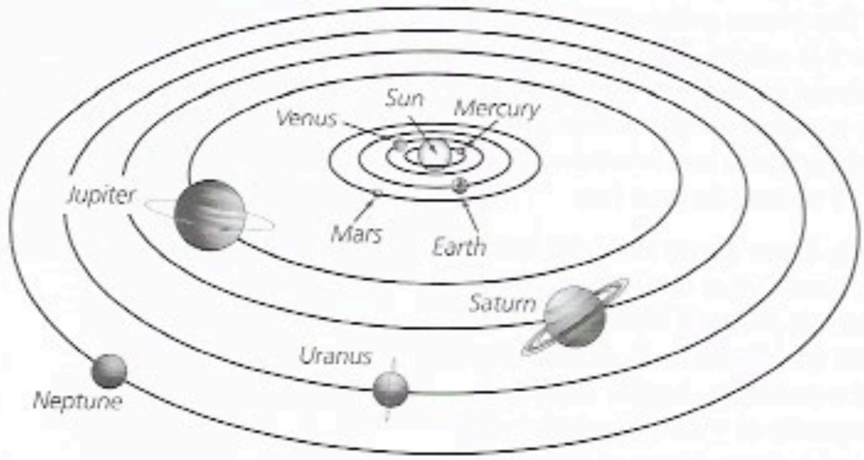
C globe

D road map

The model the student uses needs to show the two cities so that she can measure the distance between them. A concept map represents ideas, not objects or places, so choice A is incorrect. It would be difficult to measure the distance between the cities on a globe because a globe has too many other details. Choice C is incorrect. A diorama shows a scene, not the locations of cities. The correct choice is D.

Models in Science

Scientists make and use models to study the natural world. Many models in science represent objects that are too small, too large, or too far away to study. For example, if you wanted to learn the order of the planets from the sun, you would study a model of the solar system. You would not be able to look at all the actual planets at once because they are too far away. A model of the solar system is useful because it is much smaller than the real thing.



This model of the solar system does not show the real distances of planets from the sun. However, it does show you the order of the planets.

Engineers also make and study models. An **engineer** is a person who uses scientific facts to solve problems. Engineers design and build most of the products people use, such as bridges, cars, buildings, and computers. Models help engineers test possible solutions to design problems to see if they will work. Testing possible solutions on real objects such as bridges or cars would be very expensive. It could also be dangerous.

An **engineer** uses scientific knowledge to solve problems.

An engineer wants to design a bicycle helmet that will be even safer than current helmets.

A Describe a model the engineer could use as she designs and builds the helmet.

B Explain why the engineer should use models to test the helmet.

The question can have more than one correct answer, but you just need to identify one. The engineer could use a model of a person to test the helmet. The engineer should use a model of a person to test the helmet because that would be much safer than using a real person.

Like many open-ended questions, this one has more than one correct answer. The explanation given here is just one possible way to answer the question.

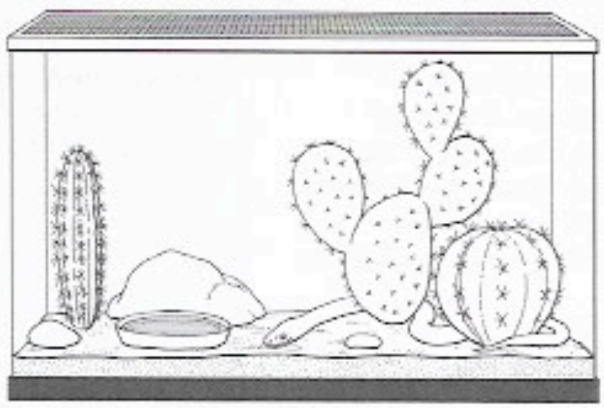
Making and Using Models

Before you make a model, you must decide which kind of model would be best. Some models are better than others at showing certain things. For example, a picture of a car could show you the color and shape of a car. However, if you wanted to look at the car from all sides or see how it moved, a 3-D model would be more useful.

Suppose you wanted to make a model to show a land habitat. You could draw a picture to show the plants and animals that live in a habitat. You could also make a 3-D model such as a diorama or a terrarium. A **terrarium** holds a living model of a land habitat. It uses a few real plants and animals to represent the plants and animals in a natural habitat. A terrarium also has nonliving parts, such as soil, water, and air, just like a natural habitat has.

A **terrarium** is a model of a natural habitat that contains living and nonliving things.

To make a terrarium, you need to learn about the land habitat you want to represent. You need to know what kind of nonliving things the real habitat has and what the animals in the habitat eat. A terrarium must include things that the plants and animals need to survive. Remember, though, that a model is simpler than the thing it represents. You could not include in your terrarium every kind of plant or animal in the natural habitat. Many of the plants and animals would be too large or dangerous to keep.



This terrarium represents a land habitat. It has soil, rocks, water, air, plants, and animals just like a natural habitat.

It's Your Turn

Please read each question carefully. To answer each multiple-choice question, circle the correct response.

1 Which of these models would be best for finding the names of all Earth's oceans?

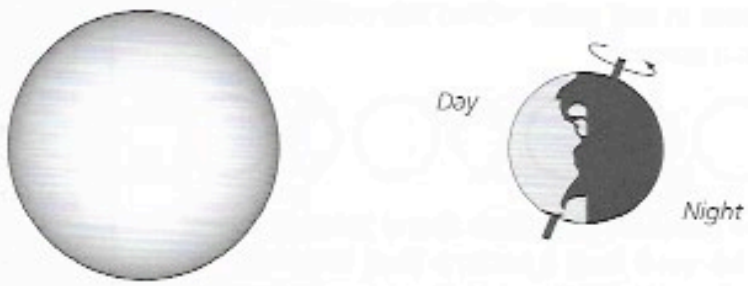
A diorama

B globe

C map

D photograph

Use the diagram below to answer question 2.



2 What does this model most likely represent?

A the actual size of Earth

B how far Earth is from the sun

C the cause of night and day

D how planets revolve around the sun

3 A student wants to make a terrarium to model a marsh habitat. Which item will he probably not include in the terrarium?

A beaver

B tadpole

C water

D grasses

LESSON 7

Patterns

Anchor and Eligible Content S4.A.3.3.1, 2

Patterns are all around you. You might find patterns in the clothes you wear or in the schedule of your day. Scientists study patterns in nature to learn how the natural world works.

What Is a Pattern?

A **pattern** has parts that repeat in a certain order. You might know that numbers and shapes can form patterns. For example, the series of numbers 1, 5, 2, 1, 5, 2, 1, 5, 2, 1, 5, 2 is a pattern. The numbers 1, 5, and 2 repeat in that order within this pattern. The shapes below also form a pattern.

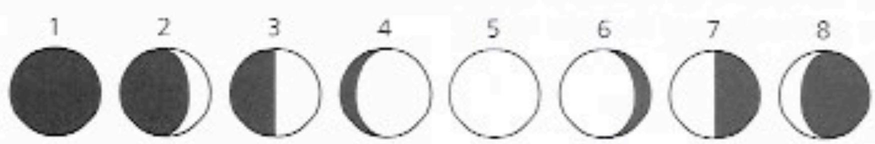
Not all patterns have numbers or shapes. Some patterns repeat over time. The days of the week form a pattern. They follow in order: Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, and Saturday. After Saturday, the pattern starts again with Sunday.

A **pattern** has parts that repeat in a certain order.

Some patterns grow. The series of numbers 2, 4, 6, 8, 10 is also a pattern because each number increases by 2. "Adding 2" is the part of the pattern that repeats.

Patterns in Nature

There are many patterns in nature. Some of these patterns repeat over time. For example, if you could observe the moon every night for one month, you would see that the moon appears to have different shapes. If you do this for another month, you will see the same shapes repeated. The different shapes of the moon follow a pattern. They repeat in the same order every month.



The shapes of the moon repeat in this order every month.

Seasons are also a pattern. You know that winter is followed by spring, summer, and fall. The seasons repeat in this order every year. Each season also has a pattern of weather. For example, in Pennsylvania, winters are usually cold and snowy, and summers are usually hot.

The lives of many plants and animals show patterns that follow the seasons. Many birds in Pennsylvania fly south when the weather turns cool. They spend the winter in the warmer south and

Some birds have a very long flight pattern. They can fly over thousands of miles when the seasons change.

return to Pennsylvania in the spring. The birds repeat this pattern every year. Many trees drop their leaves when the weather turns cool, so they can save energy during the winter. In the spring, the trees grow new leaves. They repeat this pattern every year.

Some patterns in nature are physical. This means you can observe those patterns with your senses. Leaves have tube-like parts called veins. If you look closely at a leaf, you can see its veins. The ways veins grow in leaves form different patterns. In some leaves, the veins grow in straight rows. In other leaves, the veins branch out in different directions.

Straight vein pattern

Branched vein pattern

Some physical patterns are part of the way something grows or develops. The development of butterflies follows a pattern. Caterpillars hatch from eggs. Then they go through changes to become butterflies. In time, the butterflies lay eggs. Caterpillars hatch from these eggs, and the pattern repeats.

Monsoons are wind patterns in some parts of the world. They are caused by temperature changes between seasons. In India, monsoons bring a lot of rain in summer months. They bring very little rain in winter months. Which of the following best explains how monsoons form a pattern?

A They repeat every year.

B They repeat every month.

C They repeat every week.

D They repeat every day.

You already know that the seasons repeat every year. In other words, winter comes once a year and summer comes once a year. The question says that monsoons are related to changes in seasons. Since the seasons are yearly patterns, and the monsoons depend on changes in seasons, the monsoons must be yearly patterns as well. The correct choice is A.

Remember that you can observe physical characteristics with your senses.

Some patterns in nature are very hard for scientists to see. Scientists discover new patterns by using tools that help them observe things that are very small or very far away.

Using Patterns to Make Predictions

Scientists find patterns in the natural world by making observations. Because patterns repeat, scientists use them to make predictions. In other words, they use patterns to guess what will happen in the future.

Suppose a scientist observes the way leaves grow on a stem. She notices that leaves grow on only one side of the stem. New leaves grow at the top of the stem and are smaller than older leaves. Based on this pattern, the scientist can predict that the next leaf will grow on the same side of the stem as the other leaves. It will grow at the top of the stem and be smaller than the other leaves.

Remember that a prediction is a guess about what will happen in the future. It is based on observations.

A scientist observes the development of frogs. She records each growth stage and what it looks like in this table.

Stage	Appearance
1	eggs
2	tadpoles
3	tadpoles with legs
4	young frogs
5	adult frogs

A Frog eggs hatch into tadpoles. Predict what will happen in the next three stages.

B Explain how the development of frogs is a pattern.

Use the pattern in the data to make the prediction. The tadpoles will develop legs. Then they will become young frogs and then adult frogs. The development of frogs follows an order from eggs to adults. After the adult frog stage, the pattern starts over with the egg stage.

It's Your Turn

Please read each question carefully. To answer each multiple-choice question, circle the correct response.

Use the table below to answer questions 1 and 2.

Year	Season	Average High Temperature
1	winter	7°C
1	spring	14°C
1	summer	26°C
1	fall	15°C
2	winter	6°C
2	spring	14°C
2	summer	25°C
2	fall	15°C

1 Meg records the average high temperature in her hometown during each season for two years. The table above shows her data. Which of these statements best describes the pattern in the data?

A Temperature goes up from winter to summer.

B Temperature goes up from fall to winter.

C Temperature stays the same from spring to fall.

D Temperature stays the same from winter to summer.

2 Which of these will most likely be the average high temperature in the spring of year 3?

A 7°C

B 15°C

C 24°C

D 27°C

---

3 Jon observes the time the sun sets every day during the month of September. He notices that the sun sets one minute earlier each night. On Monday the sun sets at 6:55 P.M. At what time will it most likely set on Wednesday?

A 6:56 P.M.

B 6:55 P.M.

C 6:54 P.M.

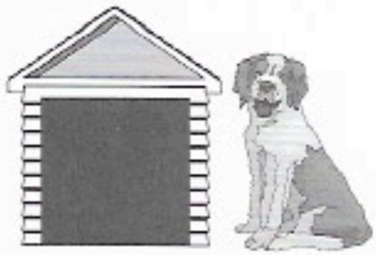
D 6:53 P.M.

The Nature of Science Review

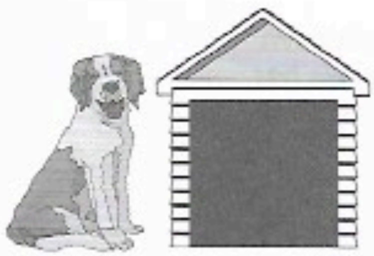
Please read each question carefully. To answer each multiple-choice question, circle the correct response.

1 From which picture can you infer that the dog is farthest from the doghouse?

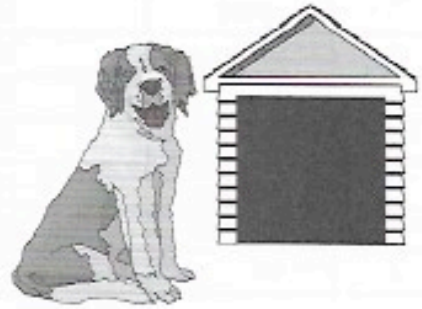
A



B



C



D

2 A student plays outside in the evenings. She observes that the amount of daylight increases from December 22 to June 21 and decreases from June 22 to December 21. Based on this pattern, during which month will the student have the most daylight for playing outdoors?

A December

B March

C June

D September

3 Which of the following statements can be tested?

A Spiders are uglier than flies.

B Peaches taste better than plums.

C Turtles move faster than snails.

D Swans are prettier than doves.

4 **Nobu observes the phase of the moon every week for seven weeks. He records his observations in the table below.**

MOON OBSERVATIONS

Week	Moon Phase
1	last quarter
2	new
3	first quarter
4	full
5	last quarter
6	new
7	first quarter

Based on these observations, what moon phase do you predict Nobu will see in week 8?

A new

B first quarter

C full

D last quarter

5 **Cars burn gasoline to run. How does burning gasoline change the environment?**

A It causes forest fires.

B It makes the air dirty.

C It causes rivers to flood.

D It changes what animals eat.

6 **Many of the products that people buy today come in plastic containers. What can happen if people do not recycle these containers?**

A They will fertilize the soil.

B They will build up in landfills.

C They will become new containers.

D They will become food for animals.

7 **Which of these is the best example of parts of a natural system?**

A a flower and a rock

B a wire and a battery

C a truck and a factory

D a person and a jacket

Use the information below to answer questions 8 and 9.

A student did an investigation about spiders in his backyard. The table shows his data.

LENGTHS OF DIFFERENT TYPES OF SPIDERS

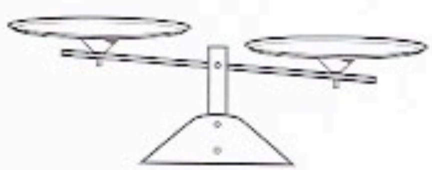
Type of Spider	Length (mm)
Yellow garden spider	25
Wolf spider	35
Nursery web spider	76

8 What tool did the student most likely use to collect these data?

A

C

B



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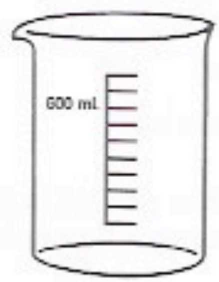

9 Which question was the student most likely trying to answer?

A Does the wolf spider build the largest web?

B What is the longest spider in my backyard?

C How big is the yellow garden spider's web?

D Which spider in my backyard is poisonous?

Use the information below to answer questions 10 and 11.

TESTING PLANT FERTILIZERS

Fertilizers can help plants grow taller. A scientist used a fair test to study three fertilizers. He planted one tomato plant in each type of fertilizer. He watered the plants every day for four weeks. He recorded his data in the data table below.

EFFECT OF THREE FERTILIZERS ON TOMATO PLANT HEIGHT

	Type of Fertilizer	Height of Plant (cm)
Tomato Plant 1	A	40
Tomato Plant 2	B	47
Tomato Plant 3	C	32

10 What conclusion can the scientist draw from his data?

A Fertilizer C makes tomatoes ripen faster.

B Tomato plant 3 will not produce any tomatoes.

C Fertilizer B helps tomato plants grow tallest.

D Tomato plant 1 will produce the largest tomatoes.

11 What did the scientist most likely do to make sure his test was fair?

A give each plant different amounts of fertilizer

B give tomato plant 2 more sunlight and water

C give each plant the same amount of water

D give tomato plant 3 less fertilizer and heat

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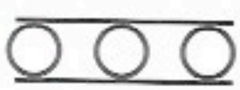
12 A scientist is studying a snake. She sees that the snake has a pattern on its skin. The pattern looks like circles with stripes through them. Which of these is most likely the pattern on the snake's skin?

A


C


B


D


13 **A student is studying a map of a park near her school. What is the student most likely trying to learn about?**

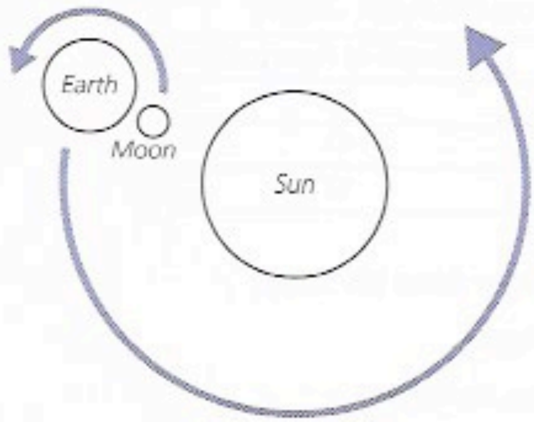
A Earth's age

B Earth's orbit

C Earth's size

D Earth's surface

Use the model below to answer question 14.



14 **Which of these best describes what the model shows?**

A Earth orbits the sun, and the moon orbits Earth.

B Earth orbits the moon, and the sun orbits Earth.

C Earth orbits the sun, and the sun orbits the moon.

D Earth orbits the moon, and the sun orbits the moon.

15 **When people get too hot, their bodies sweat to cool them off. Dogs do not sweat. Instead, dogs pant to cool their bodies off. How are sweating and panting similar?**

A They both happen in people and in dogs.

B They are both changes in response to heat.

C They both happen when temperatures are low.

D They are both changes in the motion of objects.

16 **It does not rain for several months. The drought causes the water in a pond to dry up. What will most likely happen to the fish in the pond?**

A They will swim to another pond.

B They will get oxygen from air.

C They will eat new foods.

D They will die.

17 Which of these can people make from plants on a farm?

A cotton jeans

B hamburgers

C wool socks

D glass bottles

Use the paragraph below to answer question 18.

JELLYFISH

Jellyfish are animals that live in oceans. They are not really fish, because they do not have bones or fins. Jellyfish get oxygen from the water. The water also helps hold the jellyfish's body up.

18 Which of the following best describes the relationship between the jellyfish and the water?

A The water helps the jellyfish stay alive.

B The jellyfish helps the water stay clean.

C The jellyfish stops the water from freezing.

D The water stops the jellyfish from reproducing.

19 Which of the following is the best model of an ecosystem?

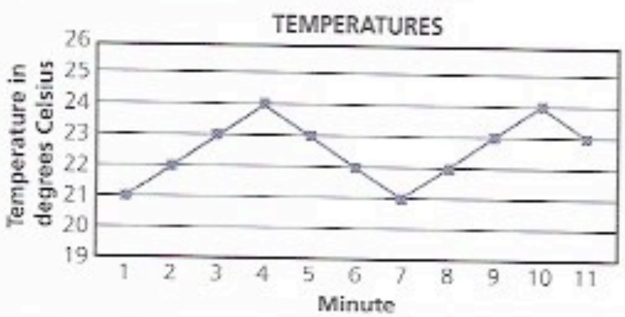
A a ladder

B a terrarium

C a rain forest

D a tree branch

Use the graph below to answer question 20.



20 A scientist did an experiment by mixing chemicals in a container. He measured the temperature of the chemicals every minute. The graph shows his data. Based on the graph, what will the temperature most likely be in minute 12?

A 21°C

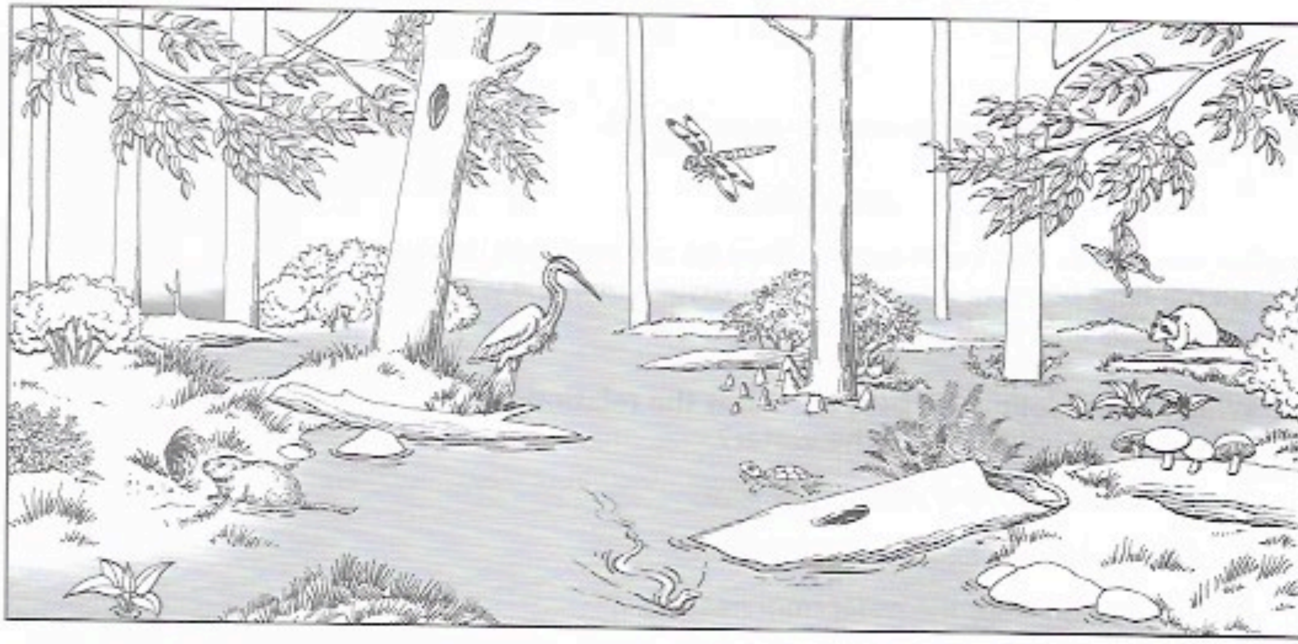
B 22°C

C 23°C

D 24°C

This is a short open-ended question. Write your answers on the lines.

Use the picture below to answer question 21.



21 The picture shows some of the parts of a swamp ecosystem.

A Identify two nonliving parts of the ecosystem.

B Describe one role of each of the things you identified in part A.