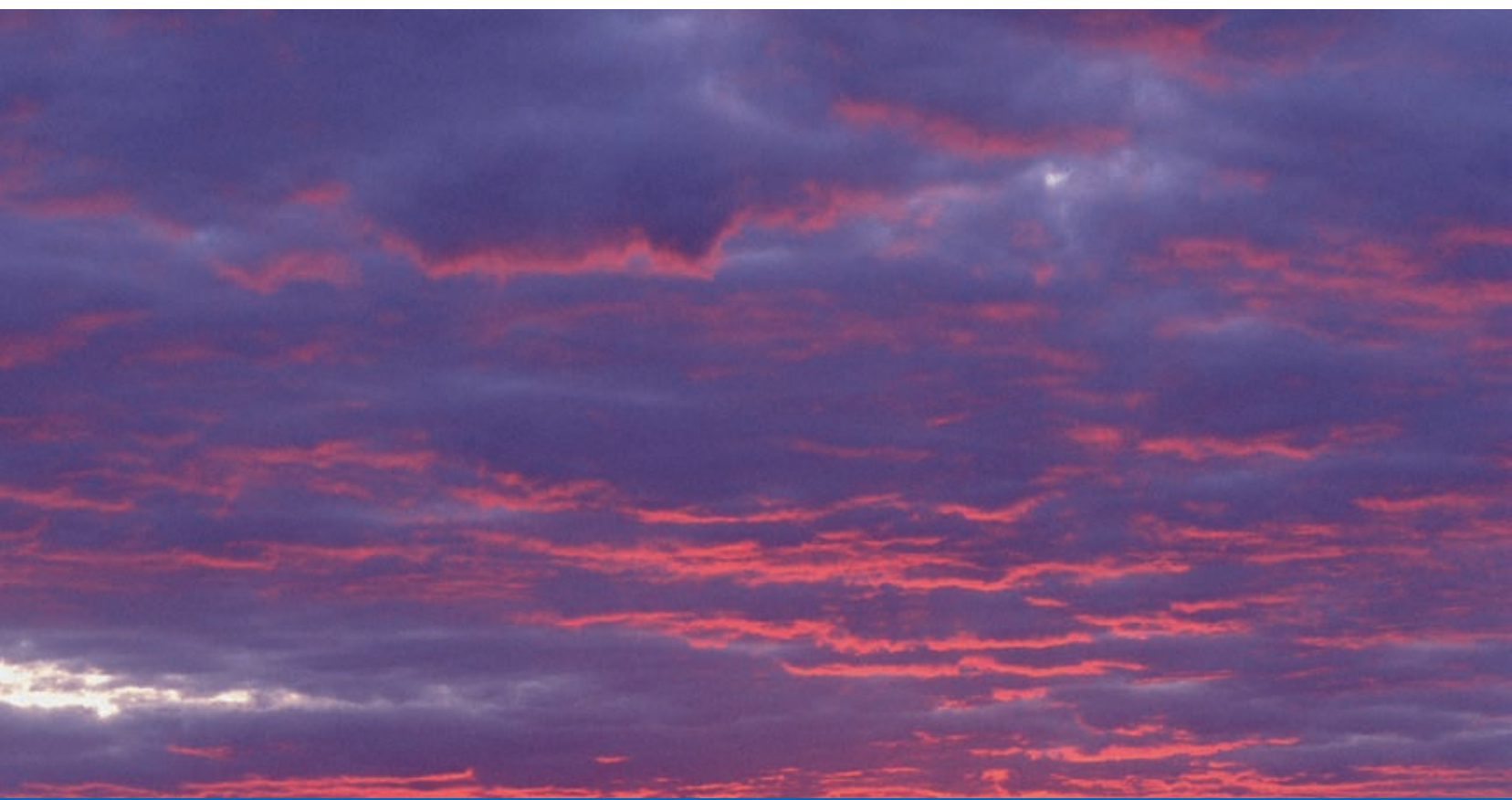
Student Lab Manual

Weather and Climate



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Weather and Climate

Work designed and produced by Sangari Research and Development Center

sangari **active science**

Weather and Climate

Dear Student,

Have you ever looked at the clouds and imagined you could see shapes such as animals or faces? Sometimes, even on a sunny day with fluffy-looking clouds, the clouds change, winds arise, and a storm happens. What makes the weather change?

This unit is all about weather and climate. You will use thermometers, weather vanes, and other tools to investigate, observe, record, and explain the weather around you. You will also talk about weather in other places. What is the difference between weather and climate? Or do they mean the same thing? Soon, you will be able to talk about both of them. And, you will be able to talk about natural phenomena in new ways because you will know more of the science behind why things happen.

Science is always about asking questions and investigating ways to answer them. You will do that in this unit as you begin with your questions: What do you want to know about weather or about climate? Ask your questions and see if you can answer them over the next few weeks.

Enjoy your discoveries!

The Sangari Active Science Team

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Safety

Sangari Active Science

Safety is important. During science activities, make sure to pay attention to the following safety symbols in your Student Lab Manual.

SO	**WH**	**PM**	**GO**	**ES**	**DT**	**CU**
sharp object	wash hands	poisonous material	wear goggles	energy source	don't taste	clean up

Follow these safety tips:

1. Follow your teacher's instructions.
2. Do not touch your face, eyes, nose, or mouth during investigations.
3. Do not mix things together to see what will happen.
4. Tie back long hair, and roll up sleeves before doing investigations.
5. Move everything out of the way that you do not need for science.
6. Tell your teacher right away if you have any accidents or spill anything.

How Is the Weather Where You Live?

Is it going to be warm or cold?

Looking at the sky, what can we say about the weather?

Lab Activity

Part 1: Weather in Photographs
Part 2: How Is the Weather There?

1 In this *Weather and Climate* Unit you will study what happens in the atmosphere. You will learn about tools that can help you to predict the weather.

A. Discuss with your team the weather conditions you see in your photograph. Do not let other teams see the photograph yet.

B. Talk with your team about different ways you can describe the weather in your photograph as accurately as possible.

C. Think about the following questions: Is it rainy or sunny? Are there clouds or wind? How would you need to dress to be outside? What activities could you do outside?

D. Have one member of your team describe your photograph to the class. They will try to match your correct description with the photograph it is describing.

2 Discuss the following questions. After your discussion, answer *Explain* Questions 1–3 in your *Science Notebook*.

- Which descriptions allowed you to identify the photos the fastest?
- What characteristics of these descriptions made it easier to identify the correct photo?
- What is difficult about describing weather in a photograph? What details about weather conditions are you missing?

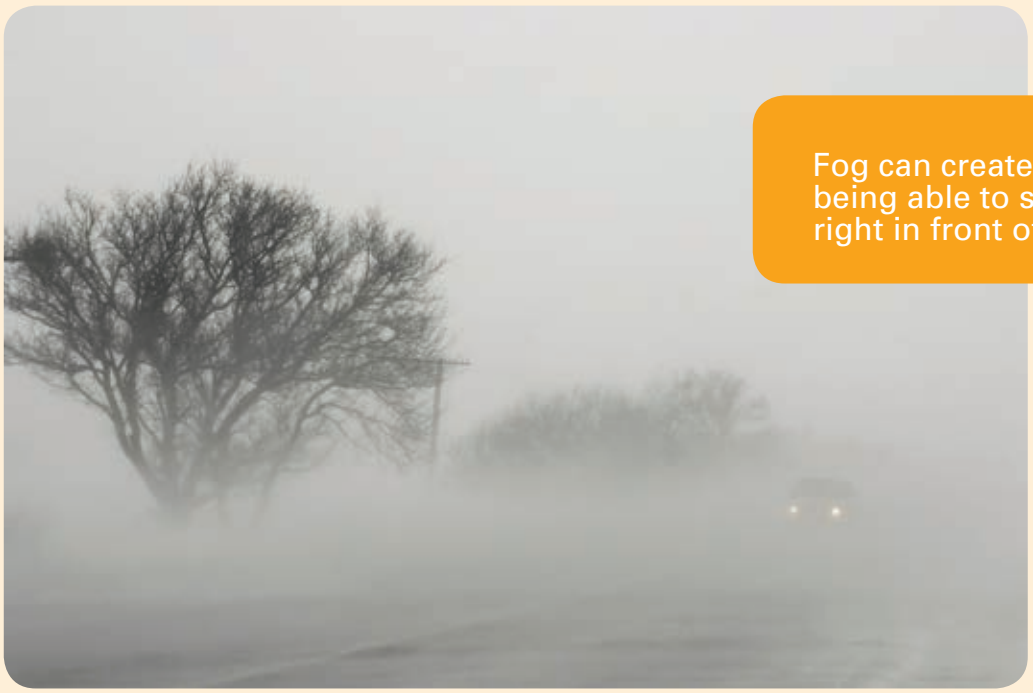
3. Use the weather chart in your *Science Notebook* to observe the weather each day and record your observations.

4. Check the weather forecast in the newspaper, Internet, or on television to determine the high and low temperatures for the next day. In a newspaper, you will find symbols for high and low temperature and high and low atmospheric pressure. Look at some weather charts and discuss with your teacher what the symbols mean.

5. Monitor daily conditions and write descriptions of the weather on the *Weather Chart*.

6. Use the data in your *Weather Chart* to forecast what the weather will be like for the next two or three days. Write a message to a friend who will be visiting to describe the weather you are predicting for when he or she comes. This will help your friend know what to bring for the visit. Include as many details as possible about the weather conditions you have observed.

Lab Activity Continued



Fog can create problems being able to see what is right in front of you.

Looking at this picture, what can you predict about the weather?

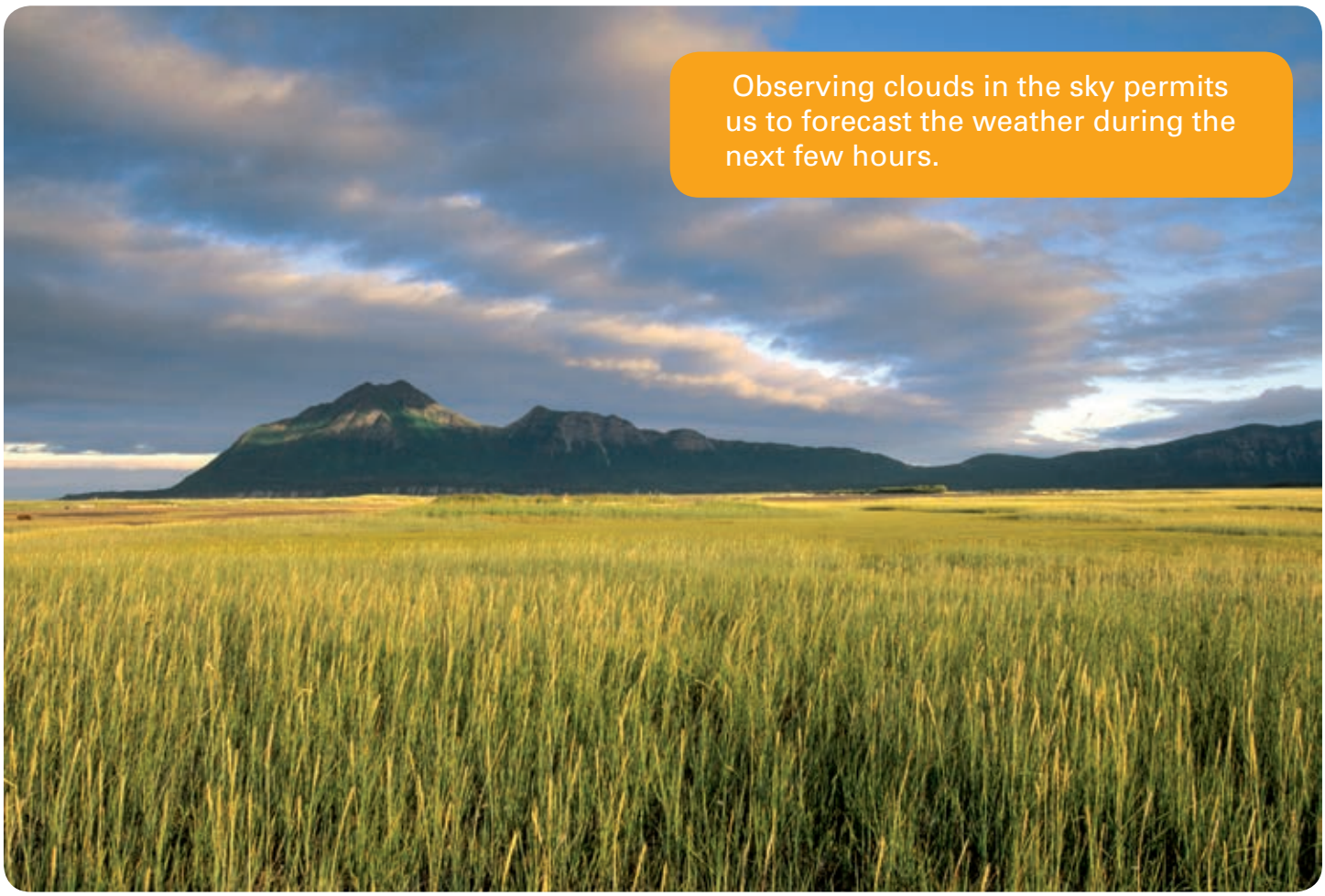
What can you tell about the weather in this picture?

Learn More

Observing the Weather

People have always been interested in the weather. Ancient people spent most of their time outside, so they observed weather conditions carefully. They knew that if dark clouds covered the sky, they should stay close to shelter to avoid wind, rain, thunder, and lightning. In regions with cold winters, forecasting the weather was important before going hunting or fishing, or even foraging for roots or fruit. If a snowstorm surprised a group of travelers, the trip home could be difficult or even dangerous.

Observation of the weather became especially important when humans started farming and became dependent on growing their own food. To grow crops successfully, farmers need to know the best time to plant. The seeds of most plants need rain and warm soil to germinate. Some seeds rot if they get too much rain. For farmers the weeks following planting can be critical.

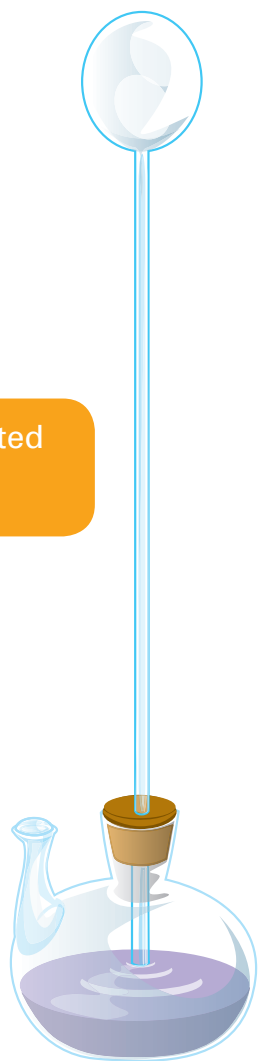


Observing clouds in the sky permits us to forecast the weather during the next few hours.

For thousands of years, observing weather conditions meant looking at the sky. People checked clouds for clues about what was going to happen. They could feel changes in wind or temperature. By the 17th century, observing weather became more scientific. Around the year 1600, a scientist named Galileo Galilei (1564-1642), invented the thermoscope. It measured changes in temperature. The thermoscope is the beginning of what is now known as a thermometer.

A few years later, another scientist, Evangelista Torricelli (1608-1647), invented the barometer. A barometer measures air pressure. Another scientist, Otto von Guericke (1602-1686), used a barometer and discovered that atmospheric pressure was always lower before a storm. New instruments were invented over time. They measured temperature, air pressure, amount of rain, and wind speed. The new inventions led to new sciences to study the atmosphere. Meteorology was one of those new sciences. The first meteorological stations were built and equipped with devices and instruments to measure weather conditions.

Galileo Galilei



Thermoscope invented by Galileo Galilei

Learn Even More

Thanks to modern instruments for observation, scientists can predict (or forecast) the weather all over the earth. They can tell what the weather will be like several hours, days, or weeks ahead of time. This is important for farmers, but forecasts are also useful so that people know if they need to take a coat or an umbrella with them before leaving home.

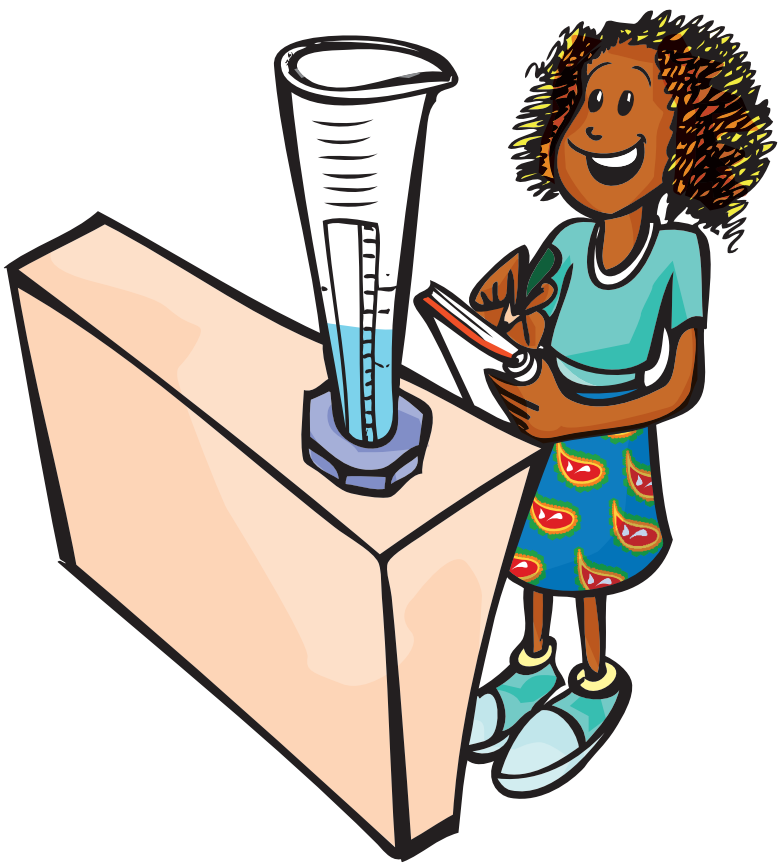
This picture shows a meteorological station with instruments to measure wind speed and direction, temperature, humidity, and the amount of solar energy.

On this map, the winds are represented by blowing faces.

Thanks to these modern observation instruments, scientists can forecast or predict the weather for various regions of Earth. They can tell what the weather will be several hours to days or even weeks in advance. Besides being important for agriculture, these forecasts are useful to know whether we have to take an umbrella with us before leaving home for school in the morning.

This photograph represents NOAA-I meteorological satellite shown during laboratory testing. This satellite is 4.18 meters high and was launched on August 9, 1993.

How Much Did It Rain?



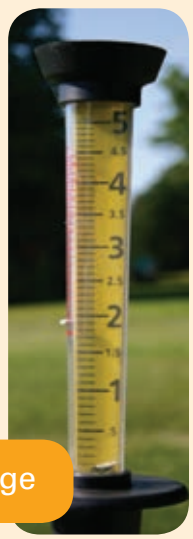
How can you measure how much it rained?

What could happen if a lot of rain fell in a short period of time?

Lab Activity

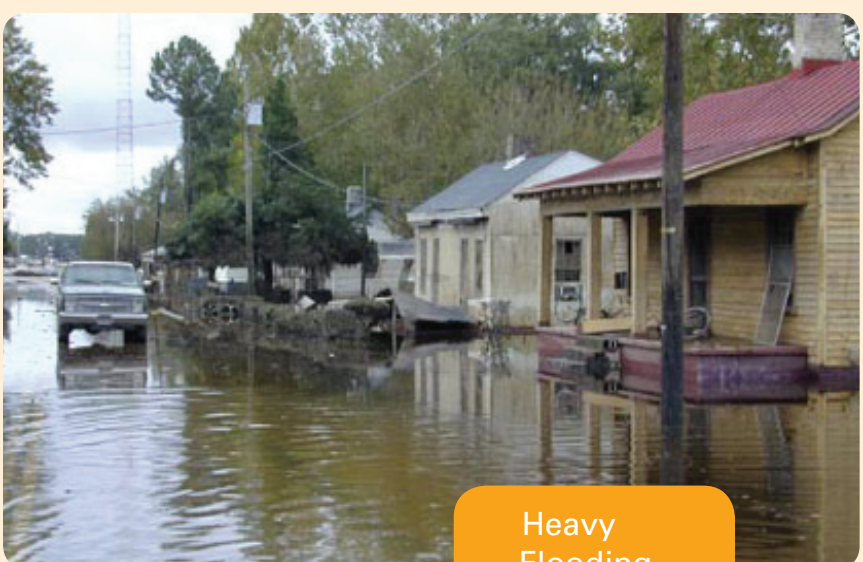
Got Rain?

1. Observe the photographs below and discuss how the quantity of rain can affect a population. How do droughts or floods affect different areas? If you placed two different-sized containers in the same location where rain falls, would the water reach the same height in both containers? Record your predictions in your *Science Notebook*.



Rain Gauge

Extreme Drought



Heavy Flooding

2. When was the last time you remember seeing rain? Discuss these questions with your teammates.
   - Was the rain light or heavy? How long did it last?
   - How could you have measured how much it rained?
   - Watch the "rainfall" your teacher creates. How can you accurately measure it?

3 We can measure rain in several ways. We usually use a tube with one end closed. Then, we can measure how much rain fell into the tube. For instance, we might say it rained 2-cm today. Measure the rainfall in both containers to see how much "rain" fell. In your *Science Notebook*, answer these questions.

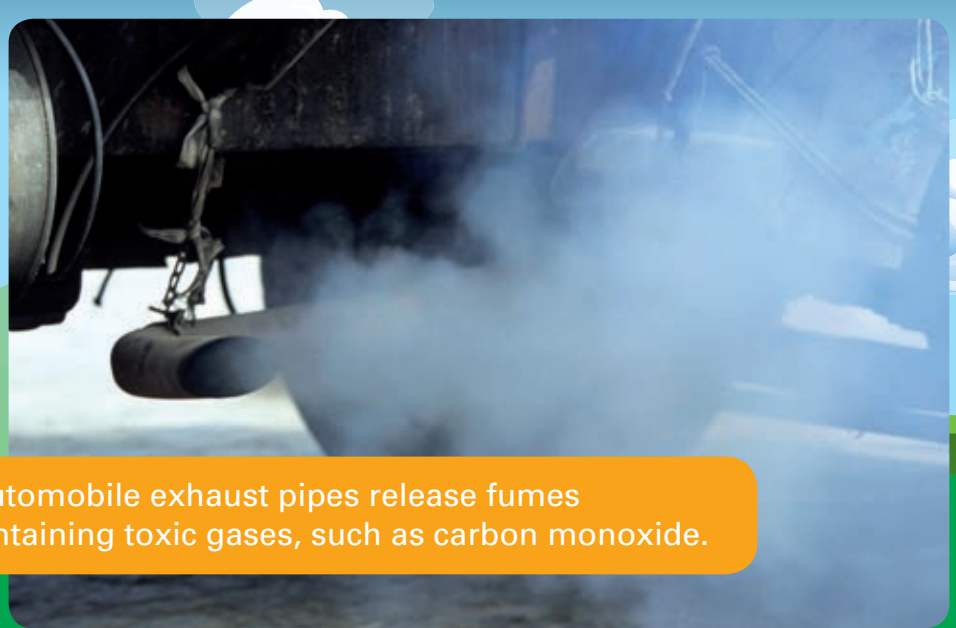
- What is a rain gauge? How does it work? Why is it made with a cylinder?
- How is it useful to us to know the quantity of rain that has fallen?

4 Record your observations in your *Science Notebook.*

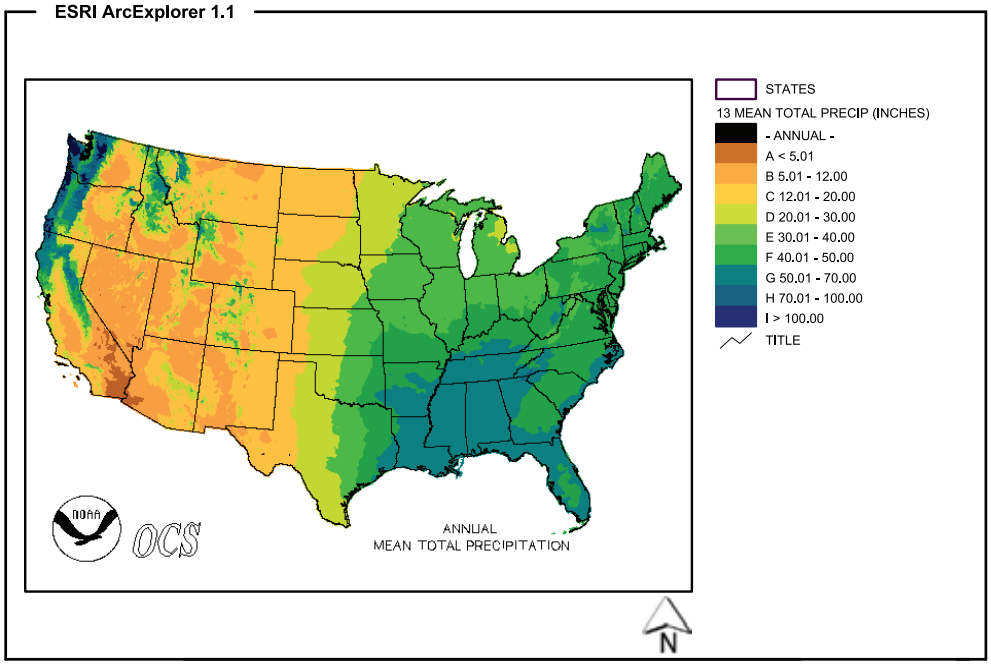
Learn More

What Is Acid Rain?

Humans get a lot of the energy they use by burning fossil fuels—usually coal, oil, or natural gas. These fuels, *fossil fuels*, were formed from plants and organisms that were once alive. Covered by layers of soil and rock for millions of years, the organisms go through chemical transformations as a result of intense heat and pressure. Humans get them from underground to use as fuels. As fossil fuels burn, chemical transformations take place. They change into new substances, and release energy as they burn. But burning fossil fuels also releases pollutants. Watch the smoke released from the exhaust pipe of cars, buses, or factory chimneys. Smoke contains pollutants such as carbon monoxide, sulfur dioxide, and nitrogen oxide. These substances in the air, land on trees, rivers, soil, lakes, and buildings in the area where they were produced.

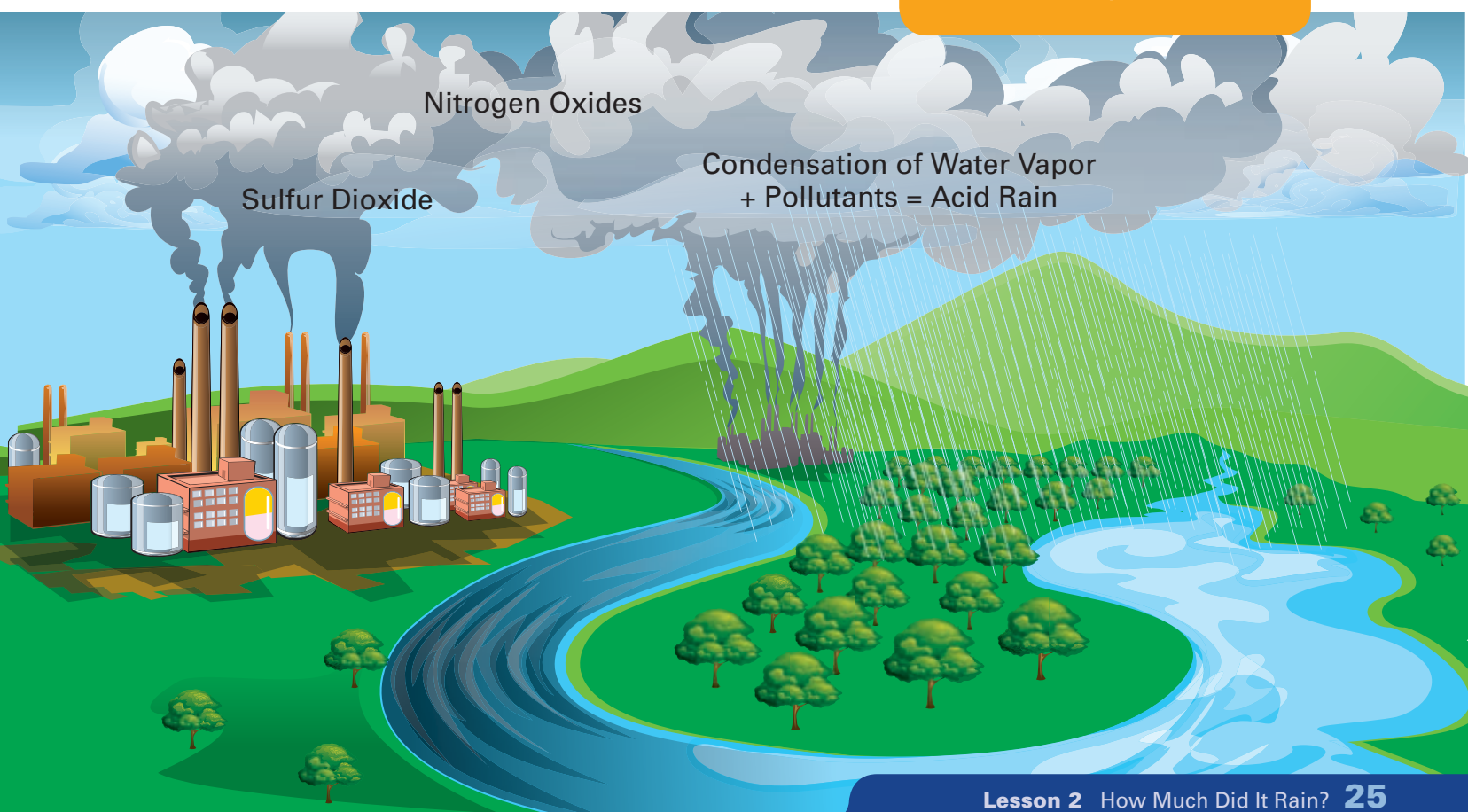


Automobile exhaust pipes release fumes containing toxic gases, such as carbon monoxide.



The pollutants react with other substances in the atmosphere, including water. Some of these combinations form acids. When it rains, the acids return to Earth. Some travel in the air, carried by the wind. Some fall into water sources. Acid rain is made up of condensed water vapor in the air combined with these acids.

Pollution Cycle of Water



Learn Even More

Acid rain is a serious and challenging problem. It affects the environment in many ways. Acid harms trees and other plants. It affects the health of the soil. It affects animals that live and eat in rivers, fields, and forests. Nitrogen compounds carried by acid rain also affect water resources, causing algae to grow out of control, for example. As algae grow, they can raise the oxygen level of the water too high, causing many plants and aquatic animals to die. Metal and stone structures are also affected by acid rain, which can cause structures to deteriorate.

Many sculptures are being destroyed by the corrosive activity of acid rain.

Large quantities of acid rain can affect the survival of plants and aquatic animals.

LESSON 3

Where Does Rainwater Come From?

Why do we need to treat the water from rivers and reservoirs before we consume it?

What are some things that could happen if we were to drink untreated water?

Lab Activity

Rain Formation Model

1 You are going to build a model of rain formation. Follow this procedure, in which you will use a plastic container filled with a small quantity of lukewarm water.

A. Use the plastic film to completely cover the container of lukewarm water. Attach the plastic film with tape or a rubber band if it is loose.

B. Place ice on the plastic film.

2 Observe what happens inside the container. In your *Science Notebook*, draw what you see.

- Where did the waterdroplets come from?
- How did the water rise to the underside of the container's wrap?
- Where else have you seen the same process you are observing in the container?

Record what you have observed.

3 Answer these questions in your *Science Notebook*:

- Where did the water droplets come from?
- How did the water get on the underside of the wrap on the container?
- What happens to the drops of water on the plastic film? Why does this happen?

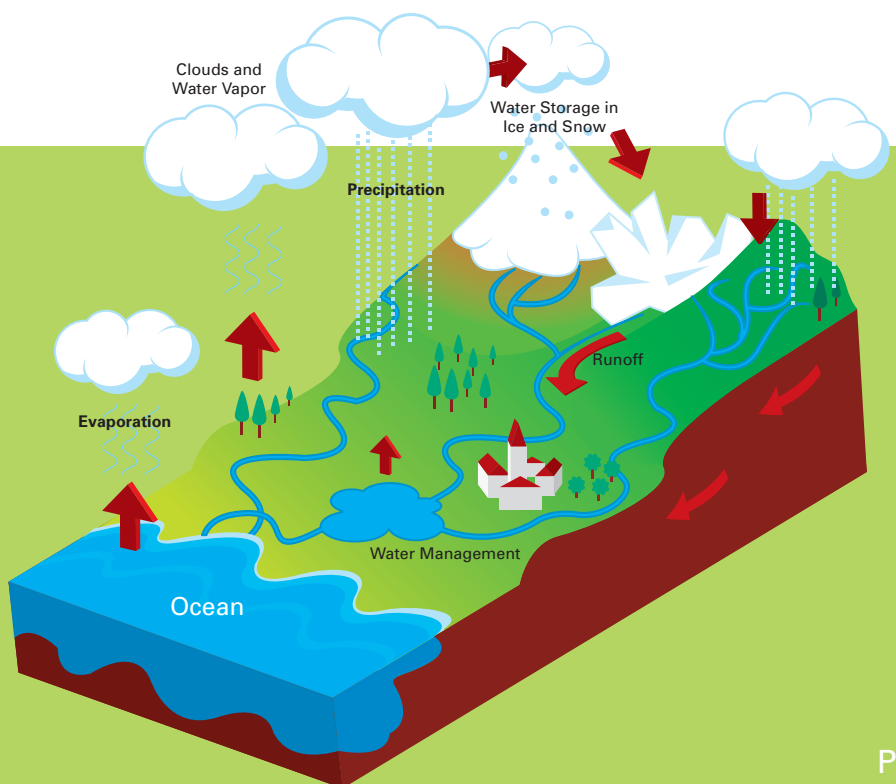
4 Put a piece of aluminum foil over your container to change the temperature of the water in the container. Then compare this to the experiment using plastic wrap. Write your findings in your *Science Notebook.*

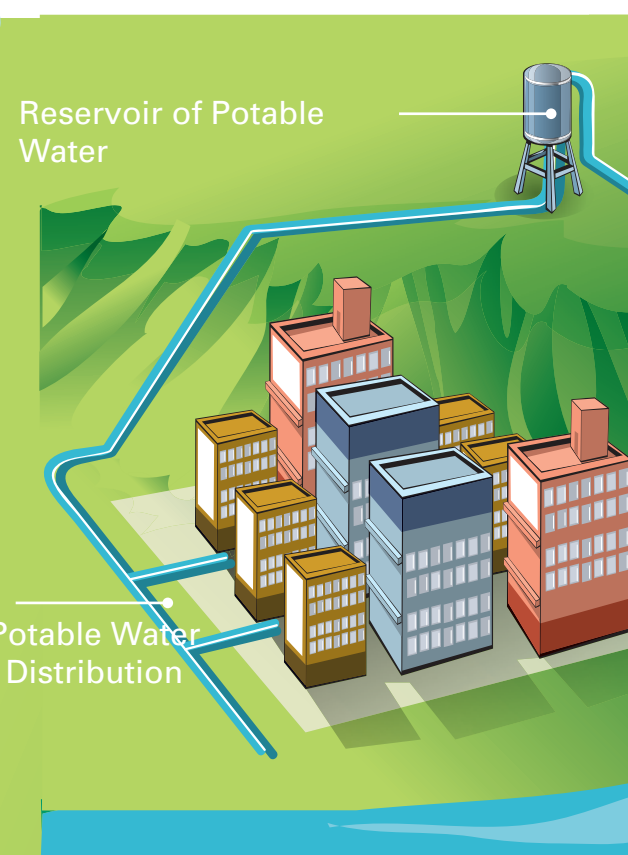
5 Use what happened in your model to answer questions 5-7 in your *Science Notebook.*

Learn More

Potable Water

Have you ever thought about the path water takes to get to where you live? The water that comes out of faucets is part of the water cycle. Water is always moving through a cycle of evaporation and condensation. Precipitation and runoff water fill rivers, lakes, and all reservoirs of fresh water. This water is used for drinking and many other purposes. But before it is safe to drink, water goes through a treatment process. That process makes it potable, or safe to drink. When any water source is polluted by sewers, a farm, or industrial waste, the treatment process is more complex, and it takes more time. Polluted water contains toxic materials or tiny organisms that transmit diseases. A water treatment process must remove those microorganisms before the water is considered safe.





A system for water sanitation is very important. It involves many components: collection, transportation, treatment, a destination for garbage, sewer collection, and water supply.

Water makes its way to cities through a complex network. To begin, water is collected from a source by pumps. After that, a system of pipes transports the water to a treatment facility. There it is processed into potable water.

The clean water is stored in natural reservoirs or in tanks. Then, it is distributed to homes, businesses, and any place that needs clean, safe water. Between the treatment facility and the place where it will be used, the water can be

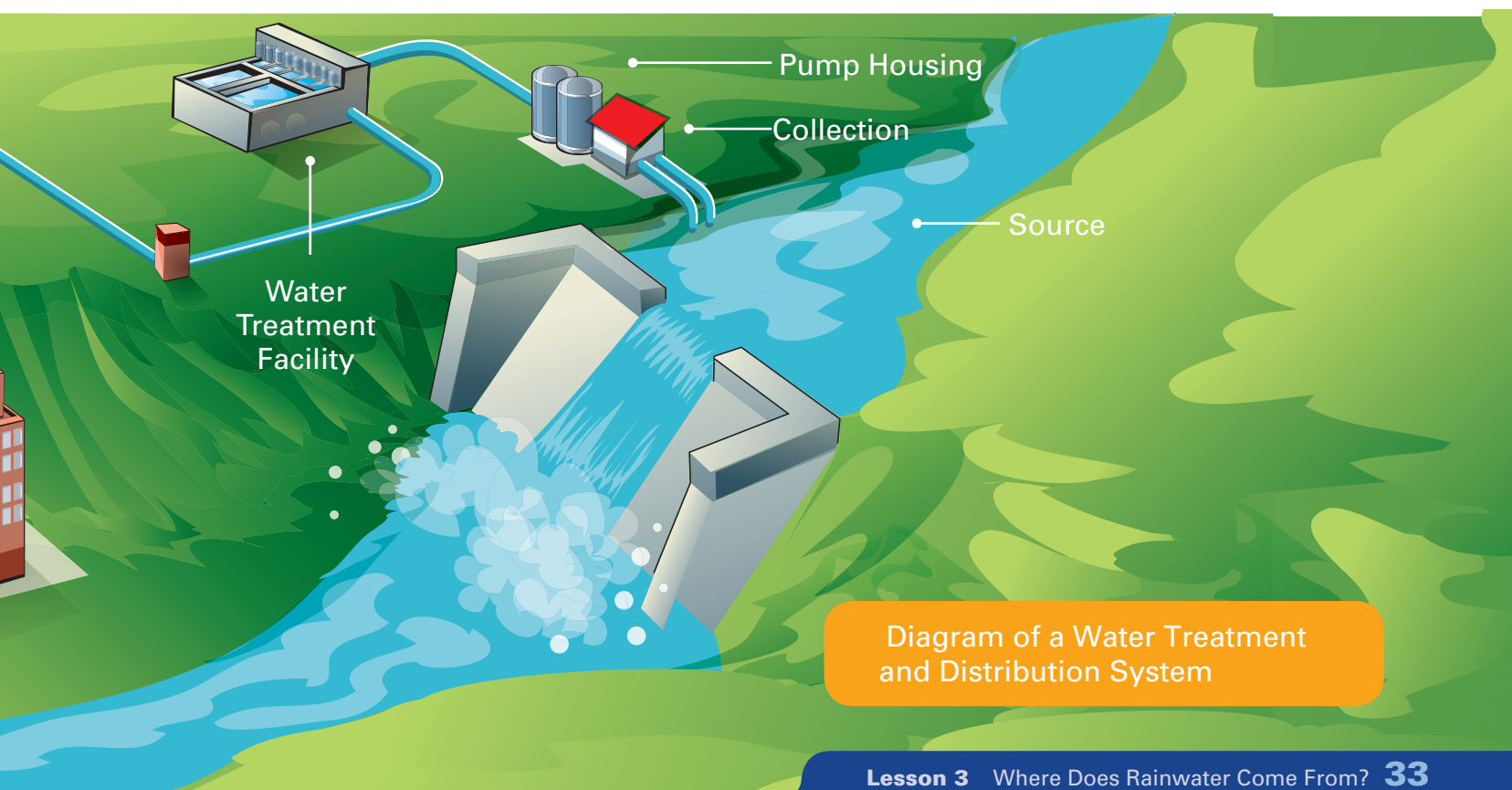
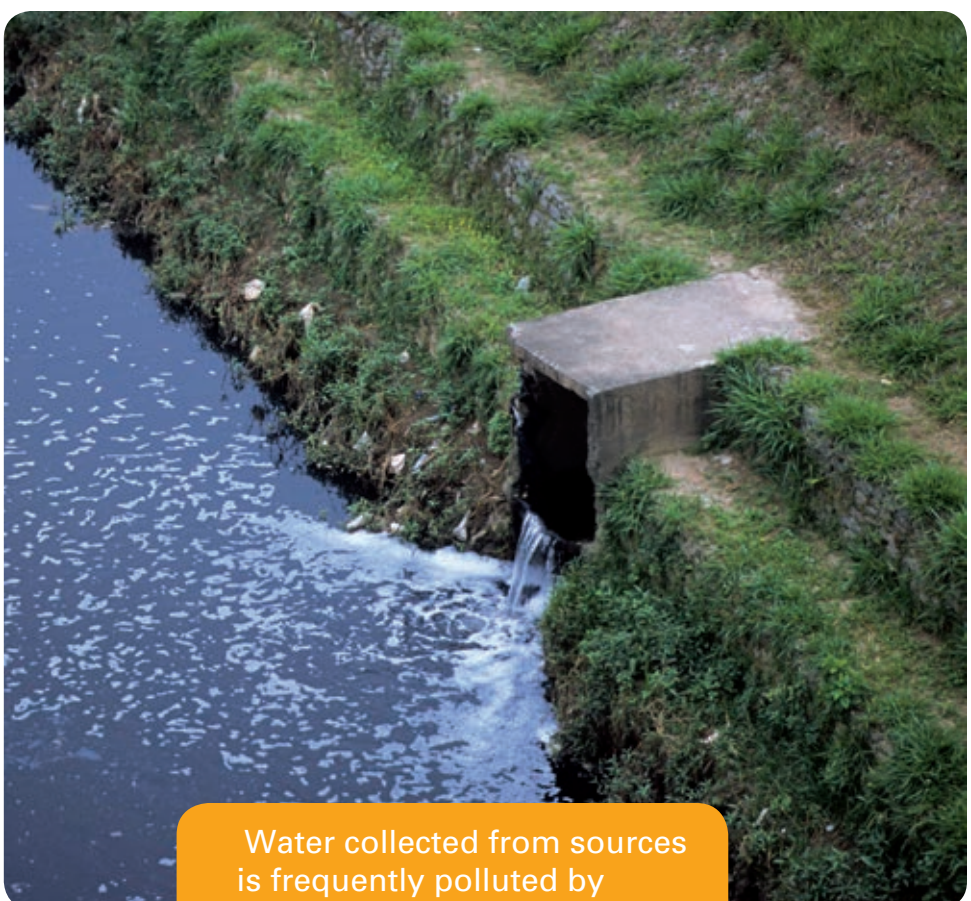


Diagram of a Water Treatment and Distribution System

contaminated. Harmful substances and organisms can get into the water at several points in the process. Therefore, treated water is analyzed periodically to check for contamination. Also, the amount of certain chemicals allowed in water is monitored. These include iron, chlorine, and lead. Monitoring water quality is an important part of the process of getting safe water to people.

With the steady growth in the number of people in large cities, the need to identify water sources that are safe for humans is more important than ever. Everyone needs to take care of springs and rivers that are sources of cleaner water.



Water collected from sources is frequently polluted by sewers and industrial waste.

To protect these areas, laws govern how they can be used for building roads, homes, or other construction. Certain areas are protected so that water sources that support living species stay untouched.

At the treatment facility, untreated water is converted to potable water.