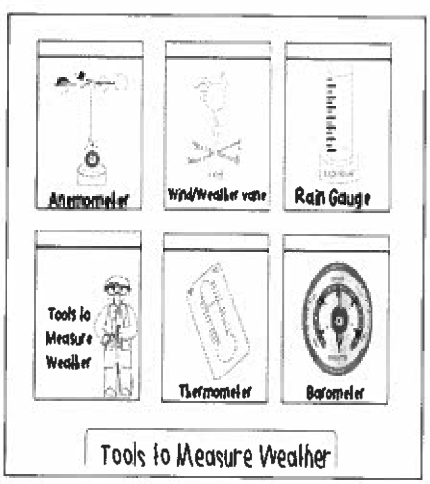
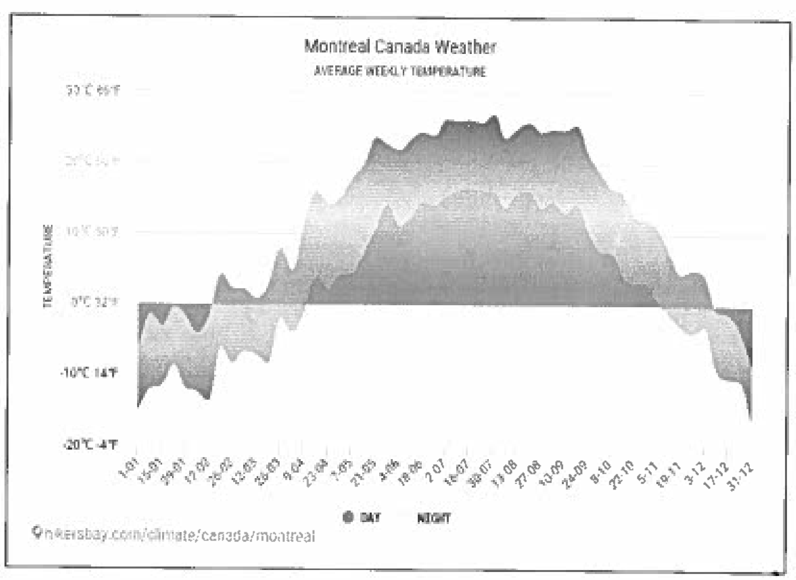
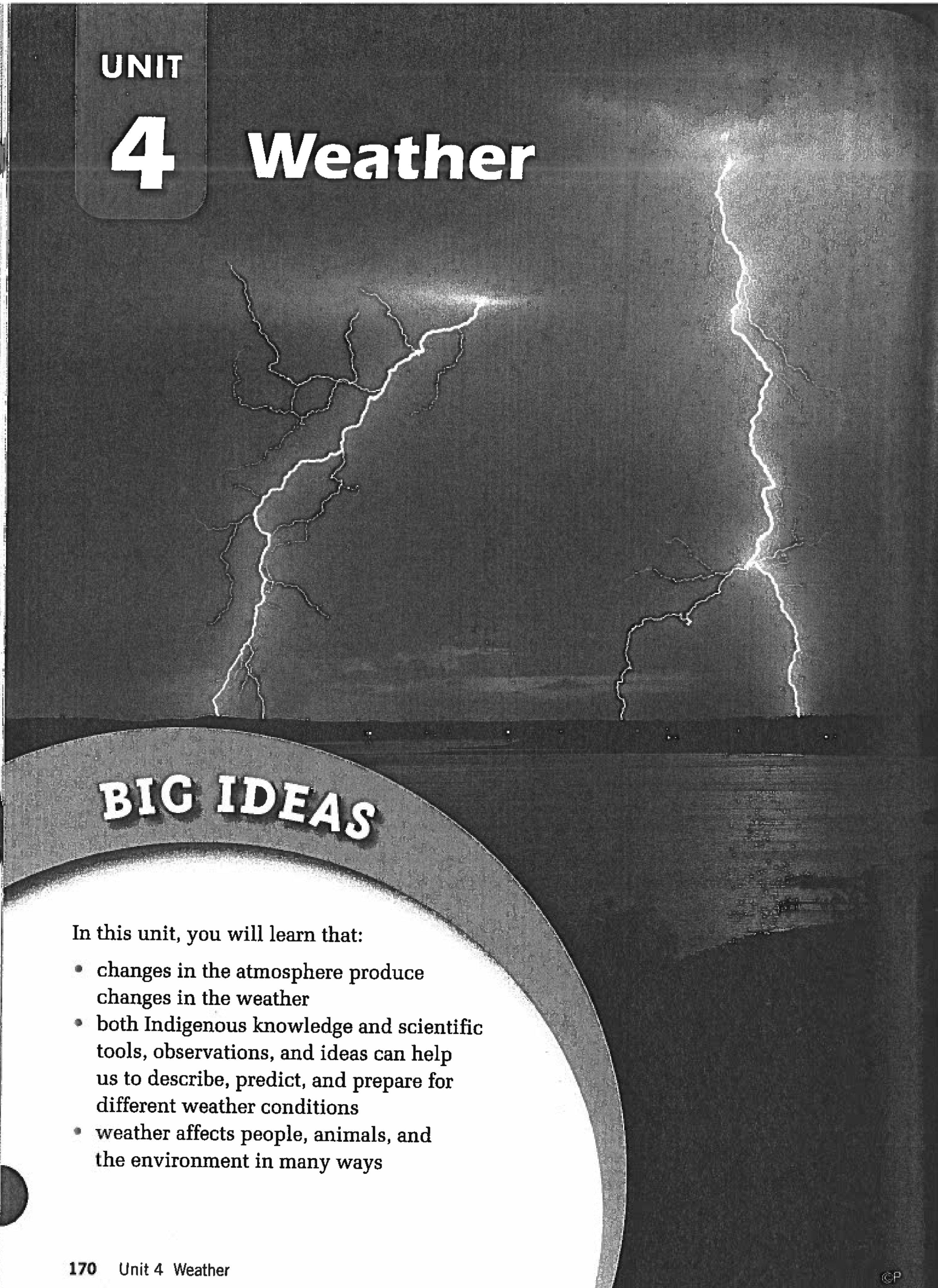
Weather


Anemometer
Wind/Weather vane
Rain Gauge
Tools to Measure Weather
Thermometer
Barometer
Tools to Measure Weather


Montreal Canada Weather
AVERAGE WEEKLY TEMPERATURE
TEMPERATURE
0°C 32°F
-10°C 14°F
-20°C -4°F
1-01 15-01 29-01 12-02 26-02 12-03 26-03 9-04 23-04 7-05 21-05 4-06 18-06 2-07 16-07 30-07 13-08 27-08 10-09 24-09 8-10 22-10 5-11 19-11 3-12 17-12 31-12
DAY
NIGHT
hikersbay.com/climate/canada/montreal



UNIT 4 Weather

BIG IDEAS

In this unit, you will learn that:

- changes in the atmosphere produce changes in the weather
- both Indigenous knowledge and scientific tools, observations, and ideas can help us to describe, predict, and prepare for different weather conditions
- weather affects people, animals, and the environment in many ways

"Hailey, how can the sky be alive?" asked Mark. All the Saskatchewan license plates on the highway had the same slogan: Land of Living Skies.

"What a silly question!" said Hailey. "The sky isn't alive."

But Mark wasn't so sure. The sky was a deep, even shade of blue. The clouds were so white and fluffy they looked like pillows you could sink into. Just a few hours ago, the sky had been dark. Huge, grey rain clouds had unleashed a downpour. Then, the sky had brightened and a beautiful rainbow had stretched over the highway.

"But Hailey, think about how often the sky changes," Mark urged.

Hailey thought about snowstorms and thunderstorms. "Do you remember watching lightning forks flash across the sky last year at the cottage?" she asked.

"I do," said Mark. "They looked like the fireworks on Canada Day."

The Sun was setting. Giant bands of red, pink, yellow, and orange were painted across the sky.

"Mark, I think I've changed my mind," Hailey said. "Maybe the sky is alive after all."

Looking Forward

1. Do you remember a time when the sky was alive? Share a weather story from your life with a partner.

Design Project

At the end of this unit, you will create a weather advertisement for a community somewhere in Canada. The *Build On What You Know* activities throughout this unit will help you with your project.

The Weather Today Is . . .

GET STARTED

Today you have already made a few important decisions. You have decided what to wear. Are you wearing shorts and a T-shirt or jeans and a sweatshirt? You have also probably decided on some activities you might do at recess or after school. Will you ride your bike? Your skateboard? Or do you plan on ice skating? All these decisions have something in common. Do you know what it is? If you said the weather, you would be correct! Weather happens all around you. Have you made any other decisions lately based on the weather?

Work On It

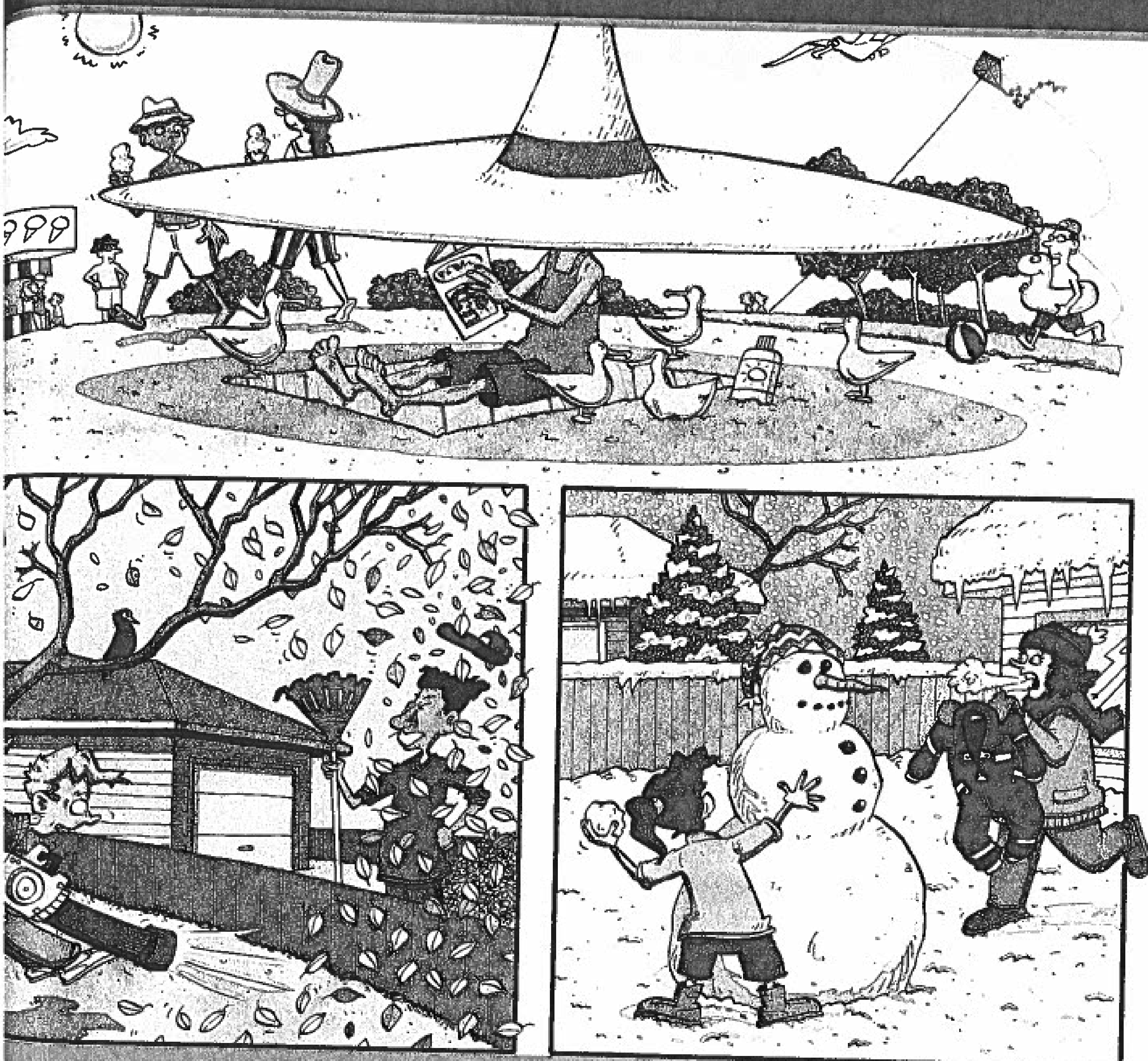
Single

- Identify the season in each picture. Now describe the weather. Use all the weather-related words you know. What other kinds of weather have you seen in each season?
- Draw a picture of the weather where you live today. What are people doing outside? What are they wearing?
- Which type of weather do you prefer? What do you like about it? Is your choice the most popular? Survey students in your class to see their choices. Graph the results on a bar graph.

Communicate

Write

1. Describe a time when you had to change your plans because of the weather.



2. Most people check the weather forecast regularly. Why do you think people want to know the predicted weather?
3. What are some ways you know of collecting information about weather?
4. What questions do you have about the weather where you live?
5. What questions do you have about the weather in other parts of Canada?

Build On What You Know

What do you like about the weather where you live? What are the advantages of that weather? What are some of the disadvantages? How could you find something positive in the disadvantages? When you are trying to persuade someone to live somewhere because of the weather, you will want to find the positive in the negative.

1 What Is Air?

GOAL To recognize some properties of air

GET STARTED ▶

Many First Nations and Métis peoples understand that Mother Earth is made of four parts—rock, air, water, and fire.

Even though we do not see it, air is all around us. It is not something we often think about because it is always there. It is necessary for our life. Scientists can explain how changes in the air affect the weather we experience. Before you learn how, take a closer look at air.

Air Takes Up Space

When you blow into a balloon, you fill it with air. You cannot see the air, but you know it is there because it stretches the balloon into a different shape and makes the balloon bigger. Air takes up the space inside the balloon.

According to scientists, air is made up of different kinds of tiny particles. These particles are always moving. They bump into each other, and they bump into everything around them. Air pushes on trees, buildings, bicycles, furniture, and even you! Air pushes in all directions—up, down, and sideways.

The flame heats the air in a hot air balloon.

How Temperature Affects Air

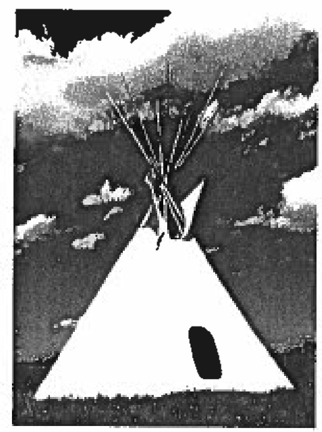
When air heats up, air particles move faster and push each other apart. When air cools down, air particles slow down and move closer together. An area of warm air has fewer air particles than an area of cool air, so warm air is lighter than cool air. That *is* why warm air rises and cool air sinks. This property of air makes it possible for a hot air balloon to float up into the sky. The heated air inside the balloon is lighter than the air outside the balloon, so the balloon rises. To bring the hot air balloon down, the air inside the balloon is allowed to cool off and the balloon sinks to the ground.

Wind

We cannot see air, but we can feel it when it moves. The natural movement of air parallel to Earth's surface is what scientists call **wind**. Wind can be helpful. It cools us on a hot summer day, helps kites stay high in the sky, and pushes sailboats across the water. Wind can also cause damage. Strong winds can knock down power lines. They can rip shingles off buildings and break branches off trees.

First Nations and Métis peoples, in particular, recognize and respect the power of the wind. It helps them dry animal hides and skins that are used to make traditional clothing and blankets. It helps them dry meat that can later be used to make a traditional food called pemmican. The wind also carries away things that could be harmful. For example, the wind can blow away insects that might otherwise destroy a forest.

The tipi is a shelter once used by the Plains Cree First Nations. It protected people from the wind, but it was also designed to use the wind. When the weather was warm, the bottom part of the tipi could be lifted to allow the wind to blow through and cool the air.



What are the effects of wind in these three situations?

Work On It

Pair

Warm Air Rises, Cool Air Sinks

Materials for each pair

- 2 medium-sized bowls
- hot water (not boiling)
- ice water
- small balloon
- plastic 2 L bottle without a lid

Procedure

1. Fill one bowl halfway with hot water and the other bowl halfway with ice water.

SAFETY CAUTION!
Be careful not to splash the hot water on yourself or anyone near you.

2. Stretch the balloon over the opening of the bottle.
3. Predict what will happen when you stand the bottle in the bowl of hot water. Then, stand the bottle in the hot water to test your prediction.

4. Predict what will happen if you move the bottle to the bowl of ice water. Then, stand the bottle in the ice water to test your prediction.
5. Record your observations in your notebook. Be sure to include a drawing of the bottle and balloon before and after being placed in each bowl of water.

Communicate

Write Present

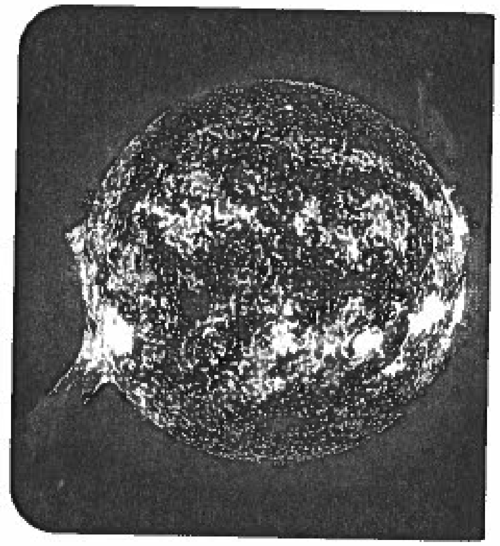
1. Explain what happened to the air inside the bottle once the bottle was placed in each bowl.
2. Explain what you think would happen if you put the bottle in the cold water first, and then in the hot water.
3. What would you say to someone who thinks an inflated balloon is empty? Explain your answer using the properties of air.
4. Think about how warm and cold air move. Where in a two-storey home would you expect to find the colder rooms? Explain your answer and include a drawing to show how air moves indoors.

2 Energy From the Sun

GOAL To explore how the Sun heats Earth

GET STARTED

The Sun is as crucial as air for life on Earth. Many First Nations and Métis peoples view the Sun as the ultimate gift from Creator. It is the gift that gives life to everything. Scientists view the Sun as a huge ball of hot gases that are constantly exploding. These explosions create energy in the form of light and heat. Energy from the Sun heats Earth's surface and this affects the weather we experience.



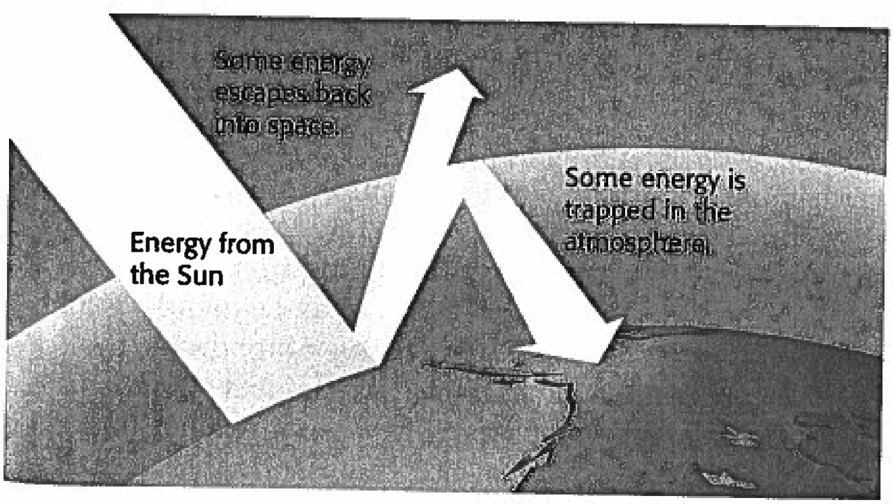
Light and energy from the Sun support life on Earth and cause the weather that we see every day.

The Atmosphere Traps Heat

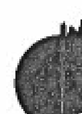
Air surrounds Earth like a blanket. This blanket of air is called the **atmosphere.** It is made up of many different kinds of gases. It also contains dust particles and water. Scientists have divided the atmosphere into four different layers. We live in the bottom layer, and this is where weather occurs. In fact, scientists define **weather** as the condition of the atmosphere at any particular time and place.

The atmosphere protects us. It lets some of the Sun's energy through but keeps harmful energy out. The energy that reaches Earth heats the surface, which then heats the air above it. The atmosphere traps some of this heat so that it cannot escape back into space.

As the air around us heats up or cools down, we experience different temperatures. **Temperature** is a measure of how hot or cold something is. We measure air temperature in order to find out how hot or cold the air is. Air temperature decreases as you move farther from Earth and higher up into the atmosphere.

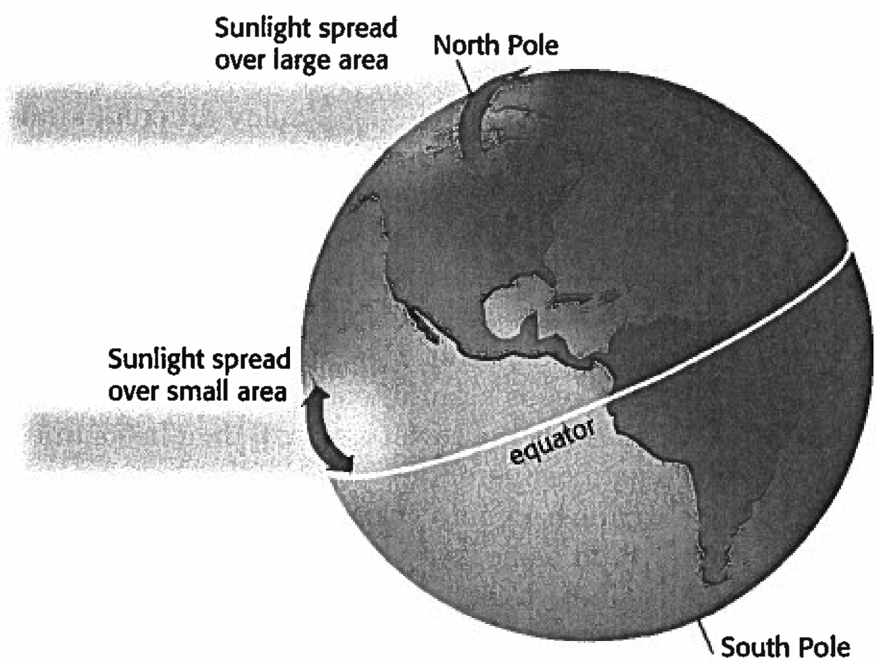


What happens to energy from the Sun



Heating Earth

Because Earth is shaped like a ball and tilted at an angle, different parts of our planet receive different amounts of the Sun's energy. Near the equator (an imaginary line around the centre of Earth), rays of sunlight hit Earth straight on and are concentrated on a small area. Places near the equator experience some of the hottest temperatures on Earth. As you travel away from the equator, sunlight hits Earth at more and more of an angle and is spread over a larger area. At the North and South Poles, the Sun's rays are spread out over a very large area. The more the sunlight is spread out, the less quickly the ground warms up, and the colder the temperature.

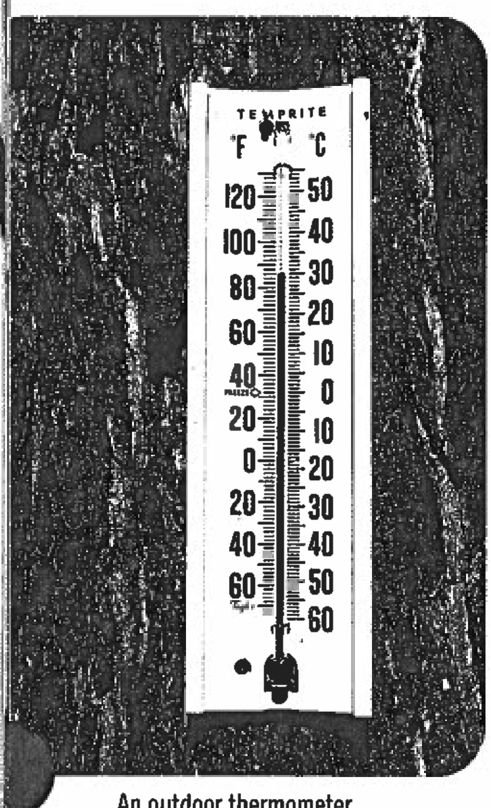


Sunlight hits Earth in different ways at different times of the year. This is because Earth moves around the Sun. This is how sunlight hits Earth in June. By December, Earth has travelled halfway around the Sun and is tilted away from it.

How much Earth heats up also depends on how long the Sun shines. During the summer where you live, days are longer, so the Sun shines for more hours per day. The longer the Sun shines, the more time the ground has to warm up.

How Hot or Cold Is It?

We can use a **thermometer** to measure temperature. The thermometer most commonly used for measuring air temperature is a glass tube with a liquid in it. As the temperature rises, the liquid heats up and expands, which means it rises in the tube. If the temperature drops, the liquid cools down and contracts, which means it falls in the tube. The liquid stops moving when it reaches the same temperature as whatever it is measuring.



An outdoor thermometer

Work On It

Pair

Does the Sun's energy heat up all materials at the same rate? Complete the following activities to find out. First you will test water, sand, and soil. Then you will design an experiment using ice cubes to test wood, grass, concrete, and asphalt.

Which Material Warms Up Fastest?

Part 1

Materials for each pair

- 3 identical plastic cups
- water
- dry sand
- soil
- 3 thermometers
- sunlight

Procedure

1. Fill each cup to the same level, one with water, one with sand, and one with soil.
2. Put a thermometer in each cup. Leave the thermometers in for about 5 minutes. Record the temperature for each cup.
3. Predict which material will warm the fastest. Place the cups in direct sunlight to test your prediction.
4. After 15 minutes, read and record the temperature again. Calculate the change in temperature for the water, sand, and soil. Which material warmed up the fastest?

Part 2

Materials for each pair

- wood
- grass
- concrete
- asphalt
- ice cubes
- any other materials you need

Procedure

1. Before you can design your experiment, you need to answer the following questions.
   - Think about the surfaces you will investigate. Where will you find them?
   - Think about the ice cubes. What will the ice cubes need to do for you to compare how hot the surfaces are?
   - What will you need to measure? How will you do that?
   - What information and measurements will you record?
   - What other materials will you need to complete your investigation?
   - Which surface do you think will heat up fastest? Record your prediction.
2. Design your experiment. Share your plan with other students and with your teacher.
3. Carry out your experiment.

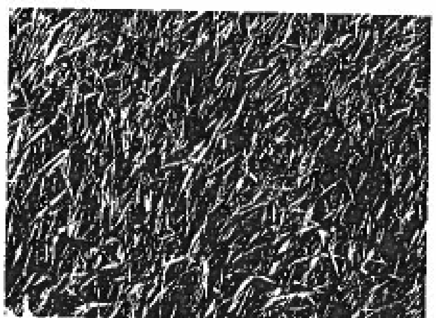
Think Again! How Will It Heat Up?

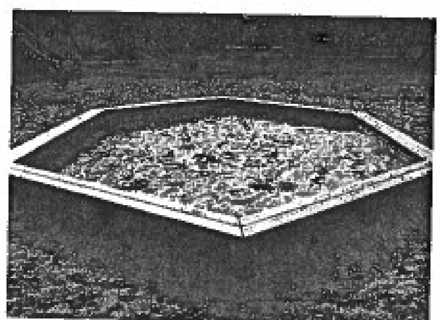
How quickly, and to what temperature, different surfaces are heated by the Sun depends on their colour, their texture, and whether they are wet or dry.

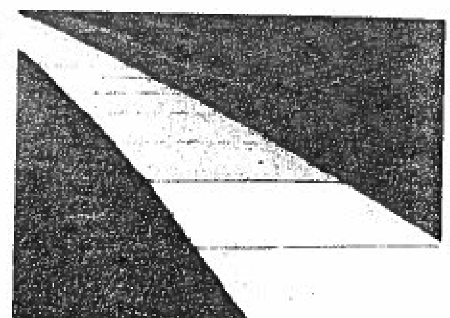
Communicate

Write Present

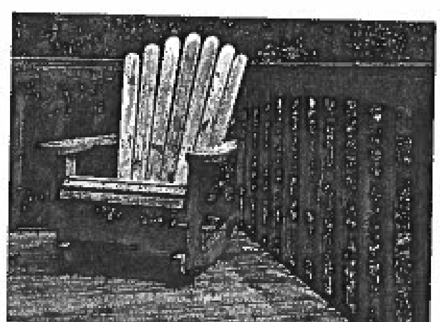
1. Organize the results from each experiment into a table or graph. Present your results to your classmates.
2. Which material in Part 1 had the greatest change in temperature? Which material had the smallest change in temperature? What did you notice about the material that heated the most? The material that heated the least?
3. On a hot summer day, where would you choose to sit for the afternoon: on a grass lawn, in a sandbox, on a concrete sidewalk, in a field of dirt, on a wood deck, or on an asphalt basketball court? Explain your choice. Which location do you think would be the worst? Why?

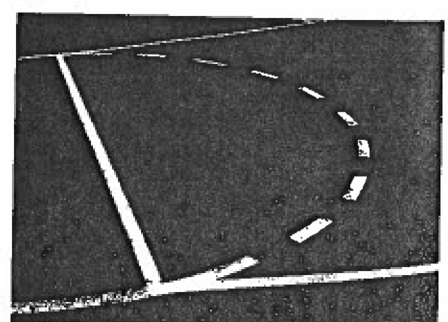

Grass


Sand


Concrete


Dirt

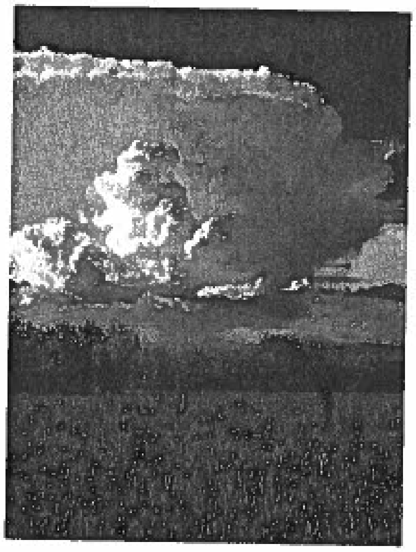

Wood


Asphalt

4. Name two or three locations on Earth that would heat more quickly than others. Give reasons for your choices.
5. Give at least two reasons why the average temperature in a desert near the equator would be higher than the average temperature on a mountain in Canada.

3 What Do Clouds Tell Us About the Weather?

GOAL To describe and classify clouds



When you look up into the sky, chances are you will see a cloud. If you watch clouds for a while, you will see that they are constantly changing in shape and size. In fact, the types of clouds that are in the sky and the way they move and change provide clues about what the weather will be.

According to scientists, **clouds** are made up of water droplets and/or ice crystals. Clouds form when water in the air changes from a gas (water vapour) to a liquid (water droplets) or a solid (ice crystals). This change happens when moist air rises and cools down.

Clouds are the source of precipitation. **Precipitation** is water that falls to the ground in any form—rain, snow, drizzle, hail, and more.

Even though all clouds are formed the same way, they can look very different. Scientists have named clouds according to how they look and how high up in the sky they are.

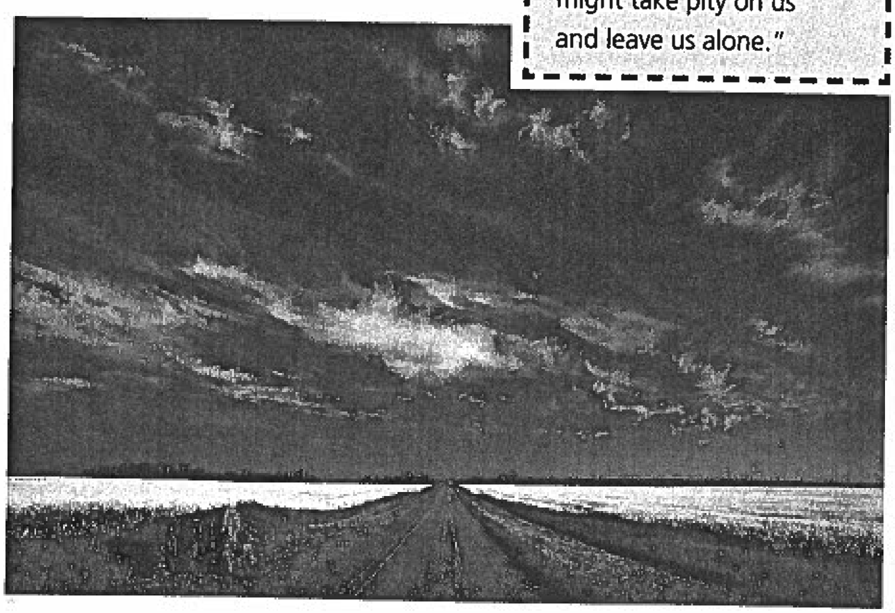
GET STARTED

Many First Nations and Métis peoples also observe clouds carefully. Anishinabe Elder Betty McKenna says:

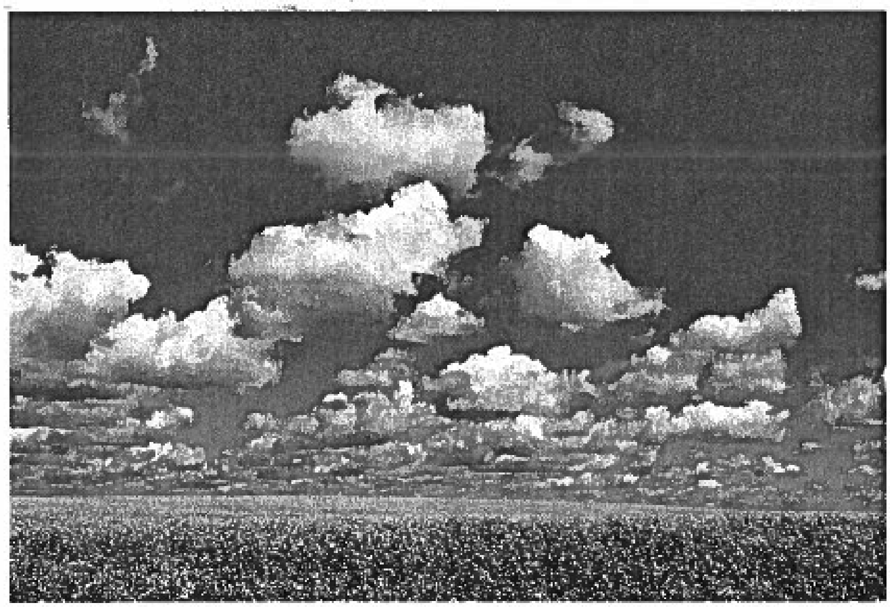
"We knew that when the clouds were low, we were going to get a bad storm, maybe even hail. When the clouds were big and puffy we were told not to look at them or talk about them. If we did, they would gather together and bring us a storm. If we ignored them, they might take pity on us and leave us alone."

Types of Clouds

Cirrus clouds are thin and look like curls of hair. They form very high up in the sky. It is so cold up there that cirrus clouds are only made up of ice crystals. When you see cirrus clouds in the sky it usually means there is going to be a change in the weather.

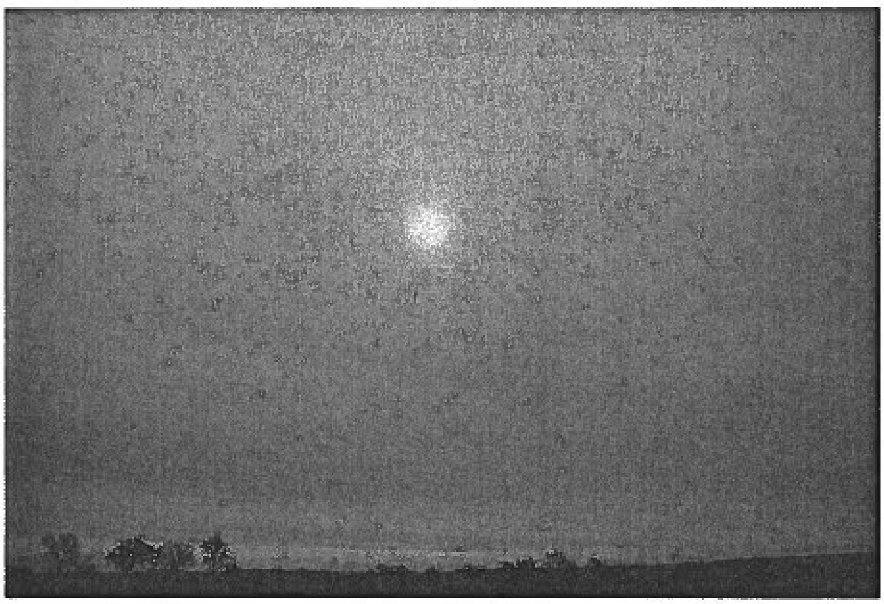


Cirrus means "curl."



Cumulus means "heap."

Cumulus clouds look puffy, like a pile of cotton balls, and have flat bottoms. You will usually see them on clear days when the sky is blue. These types of clouds are the best for watching as they are always changing shape. Cumulus clouds, and all clouds with "cumulus" in their name, indicate that the air is unstable.



Stratus means "spread out."

Stratus clouds are flat and form layers low in the sky. They stretch across and often cover the entire sky. When they touch the ground, stratus clouds are called **fog**. These are the only clouds that produce drizzle, freezing drizzle, and snow grains (which are actually tiny bits of ice). Stratus clouds, and all other clouds with "stratus" in their name, indicate that the air is stable.

The names of the three main types of clouds can be combined to describe other clouds. For example, cirrocumulus clouds are thin and form high in the sky like cirrus clouds, but they have a wave or ripple pattern.

Clouds with the word "nimbus" in their name bring precipitation. Nimbostratus clouds, for example, are low in the sky like stratus clouds but form a dark grey, wet-looking layer. Clouds with the word "alto" in their name are at a medium height—not low, not high. What do you think altocumulus clouds are like?

Work On It

Single

Use your observational skills to describe and classify the clouds you see in the sky.

Materials

- a cloudy day
- a compass

Procedure

1. Go outside and sit where you are able to see the sky.
2. Sketch the sky and all the clouds you see there in your notebook. Record the direction you are facing at the top of the page.
3. Under your drawing make jot notes about each cloud. What colour is it? Is it high in the sky or closer to the ground? Is it standing still or moving? Note anything you see that is unusual or interesting.
4. Classify all the clouds in your drawing as cumulus, cirrus, stratus, or other.
5. Observe and record the clouds in the sky and the weather conditions each day for a week. What weather conditions can you predict based on the types of clouds in the sky?

Communicate

Write Present

1. Create a table to summarize the results of your observations of the clouds. Share your results with the class.
2. Did all your classmates have the same results? Why might some students have different results?
3. Were there any clouds that looked like they might fit into more than one category? Explain where you ended up putting them and why.

Build On What You Know

Think about how you feel on sunny days and how you feel on cloudy or rainy days. Which do you prefer, and why? How do you think it would feel to live in a place where there was more or less sunshine than where you live now? Find out where the sunniest places in Canada are. Are they also the warmest places?

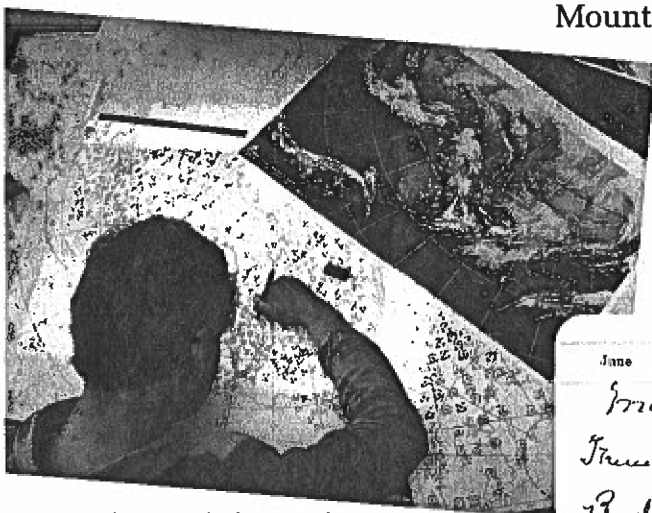
4 Weather Instruments

GOAL To make and use instruments that measure wind direction and speed

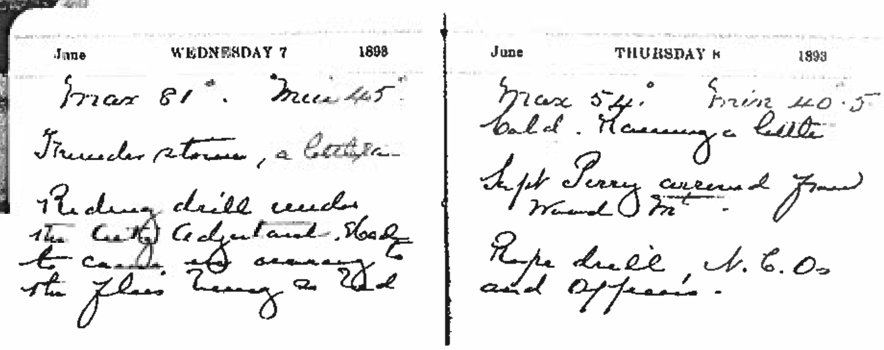
GET STARTED

Meteorology is the scientific study of weather. **Meteorologists** are people who study and predict, or forecast, the weather. Meteorology began in the 17th century when many instruments were invented to measure different weather conditions.

Weather data has been officially recorded in Saskatchewan since 1883. At that time, the North-West Mounted Police (now known as the RCMP) recorded daily maximum and minimum temperatures along with the amount of precipitation. This information was measured using a thermometer and rain gauge at the barracks in Regina until 1932. At that time, the instruments were moved and set up at the airport where a weather reporting station remains today.



A meteorologist at work



June WEDNESDAY 7 1893

Max 81°. Min 45°

June THURSDAY 8 1893

Max 54°. Min 40.5

Cold. Raining a little

Supt Perry arrived from Wood Mt.

Rope drill, N.C.Os and Officers.

Diary entries written in Regina in June 1893 include measurements of temperature and descriptions of the weather.

The weather reporting station at the Regina airport today

You will have the chance to design and make some of your own instruments. The measurements and observations you make with your instruments will help you identify and understand some weather patterns.

Work On It

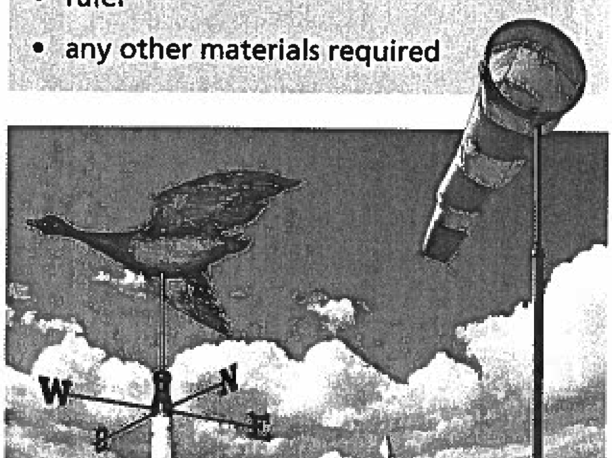
Pair

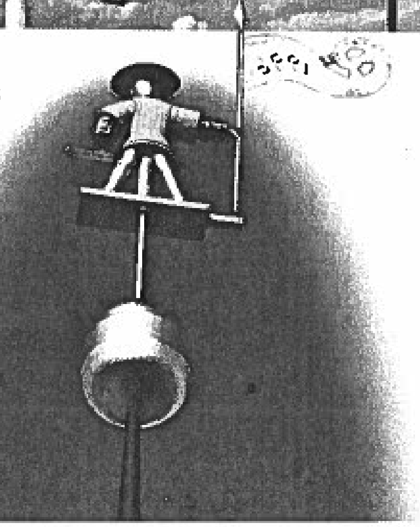
Design and Make a Weather Vane

A **weather vane** (or wind vane) shows the direction from which the wind is blowing. The wind is named according to this direction. For example, we call a wind blowing from the north a north wind, and one blowing from the west a west wind. The **prevailing wind** is the most common wind in a region.

Suggested materials

- stiff material, such as cardboard
- light material, such as tissue paper
- modelling clay
- plastic straws
- wooden dowels or pencils
- straight pins
- compass
- ruler
- any other materials required





Weather vanes

Procedure

1. Look for weather vanes in your neighbourhood. Find and examine pictures of weather vanes. How do they work? How are different weather vanes the same? How are they different?
2. Think about how you could make a weather vane and answer these questions:
   - What materials could you use?
   - How will your weather vane move easily in the wind?
   - Where are you going to place your weather vane? What materials are best for that place?
   - What criteria will you use to evaluate how well your weather vane works?
3. Design your weather vane using the materials that you think are best. Share your design with other students and with your teacher.
4. Build your weather vane.
5. Install and use your weather vane to see how it works. Does it do what it is supposed to do? Did you follow your original design? Make any changes you think will improve it.
6. Compare your weather vane with another group's. How are they the same? Different?
7. Check your weather vane several times each day for one week. What is the prevailing wind for that week?

continued →

Make an Anemometer

You can tell by observing the branches on trees or leaves on the ground if the wind is blowing, but you need an **anemometer** to measure the speed of the wind.

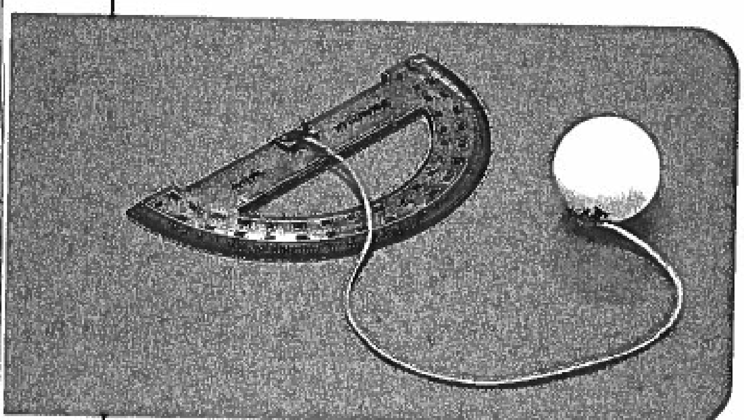
Materials for each pair

- string
- protractor
- table-tennis ball
- tape
- glue gun (optional)

SAFETY CAUTION!
Ask your teacher for help when using the glue gun.

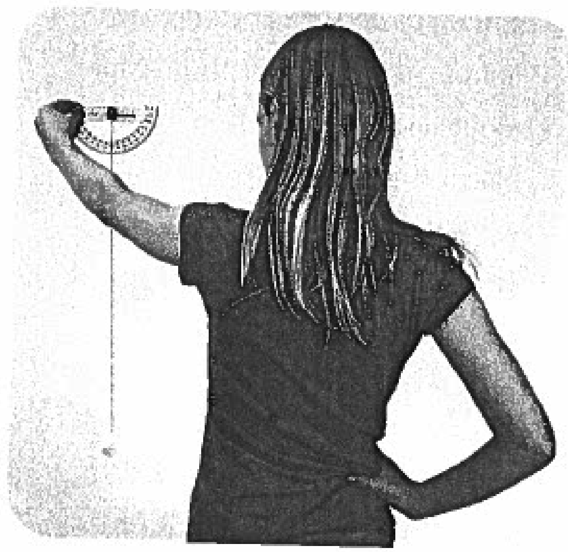
Procedure

1. Cut a piece of string 30 cm long. Tape it to the protractor as shown.



2. Attach the other end of the string to the table-tennis ball with tape or get help from your teacher to use a glue gun.

3. To use the anemometer:
   - Go outside. Hold the protractor so that the curved edge of the protractor is pointing down.
   - Find the direction the wind is blowing. (You can use your weather vane.)
   - Point the edge of the protractor into the wind, making sure the upper edge is parallel to the ground.
   - Hold your anemometer at arm's length from your body.



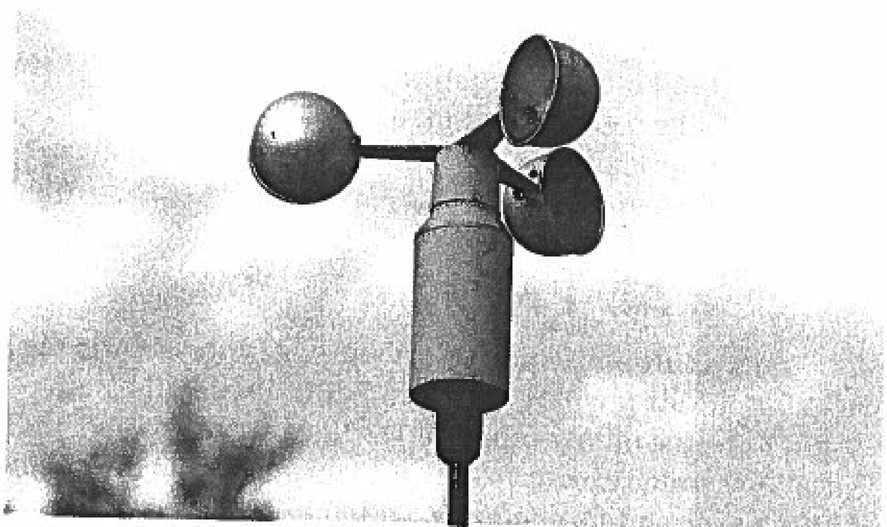
   - When there is no wind, the ball will hang straight down on the 90° mark.
   - To find how fast the wind is blowing, find the angle on the protractor where the string reaches. Look up the angle on the table shown here. It tells you the speed of the wind in kilometres per hour. Record the speed.

Angle	90°	85°	80°	75°	70°	65°	60°	55°	50°	45°	40°	35°	30°
Wind km/h	0	9.3	13.2	16.3	19.0	21.6	24.0	26.4	29.0	31.5	34.4	37.6	41.5

Communicate

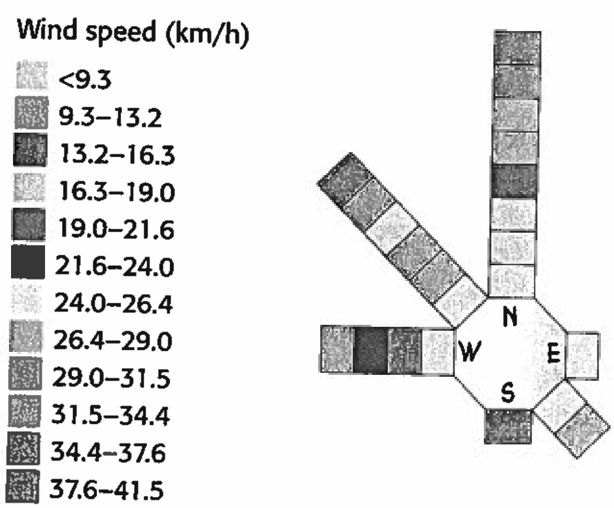
Write Present

1. You have tested your weather vane. Explain how you know it works well using the criteria you came up with.
2. Think about the jobs people have and the activities they enjoy doing. Who would be interested in knowing if it was going to be a windy day or a calm day? Who would want to know from which direction the wind is blowing?



On this anemometer, wind pushes the cups around and around. A device inside calculates how quickly the cups turn to determine the wind speed.

3. Use your anemometer and weather vane to find the wind speed and direction at the same times each day for one week. Use your data to create a **wind rose**, a type of graph that shows the wind speed and the direction of the wind.



What is the prevailing wind in this wind rose?

©P

5 More Weather Instruments

GOAL To make and use instruments that measure air pressure and rainfall

GET STARTED

! Drink Up

When you suck on a straw, you take air out of it. This makes the air pressure in the straw less than the air pressure outside the straw. Air outside the straw presses down on the liquid and forces it up the straw.

Can you drink through a straw that has a hole in it? No! You can never suck all the air out of the straw because more air keeps coming in through the hole. Without a difference in air pressure, the liquid won't go up the straw.

Wind speed and direction are only two characteristics of the air around you. Meteorologists observe and measure many more. For example, they can measure how much water vapour is in the air (**humidity**) and how much water falls to the ground as rain, snow, or hail.

An air mass is a large body of air that has similar temperature and moisture conditions throughout. Air masses might be wet, dry, warm, or cold. The boundary between two air masses is called a front. Weather changes when two air masses meet.

What Is Air Pressure?

Meterologists also measure air pressure. **Air pressure** is the weight of the air pushing down on Earth. When air rises, we have an area of low pressure. As the air rises, it cools. This allows water vapour in the air to turn into water droplets or ice crystals and form clouds, which bring precipitation. When air sinks, we have an area of high pressure. When there is high air pressure, water vapour cannot rise and condense, so clouds and precipitation do not form.

Height (distance from Earth) also affects air pressure. Have you ever felt your ears "pop"? Travelling in an airplane or driving up and down hills in a car usually causes this. Your ears pop because your body is trying to balance the difference in air pressure between the outside and inside of your ears.

Air Pressure and Weather

Winds blow when there is a difference in air pressure and temperature. Air always moves from areas of high pressure to areas of low pressure. As warm air rises, cool air moves in to take its place.

In areas with high pressure, the weather is usually clear, dry, and fair. On a weather map, high pressure is represented by an "H." We can think of "H" as "happy weather." In areas with low pressure, we can expect clouds and precipitation. On a weather map, low pressure is represented by an "L." We can think of "L" as "lousy weather."

Work On It

Pair

Make a Barometer

A **barometer** measures air pressure. In this activity, you will make a barometer using everyday materials.

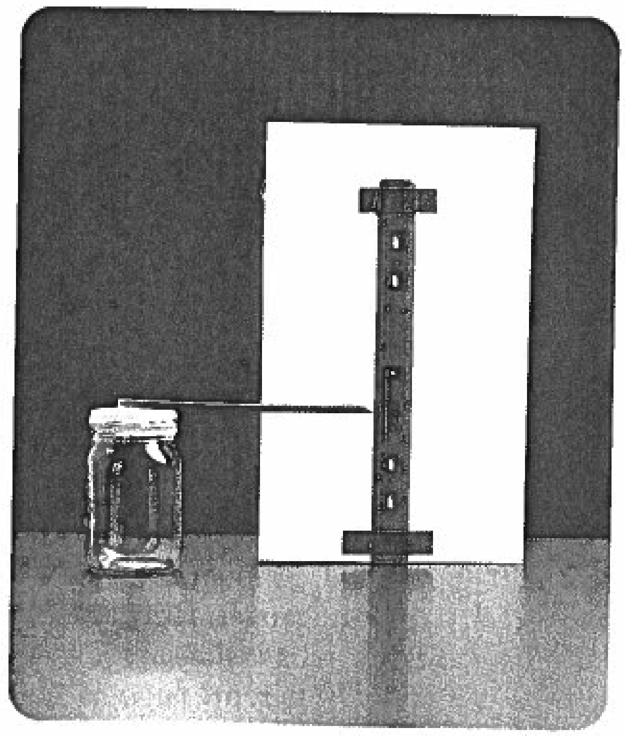
Materials for each pair

- scissors
- balloon
- glass bottle or jar, about 355 mL
- elastic band
- plastic straw
- tape
- glue
- white paper
- cereal box
- ruler

Procedure

1. Cut the balloon in half. Throw away the part with the neck. Stretch the other part tightly over the mouth of the jar.

2. Secure the balloon to the jar with an elastic band.
3. Cut one end of the straw into a point. Tape the other end of the straw to the middle of the balloon.
4. Glue a sheet of white paper to the middle of one of the sides of the cereal box. Tape a ruler to the middle of the white paper.



5. Test your barometer outdoors. Watch it over the course of a day. What do you observe? Repeat your observations over the course of a week.

continued →

Design and Make a Rain Gauge

A **rain gauge** measures how much rain falls in any period of time.

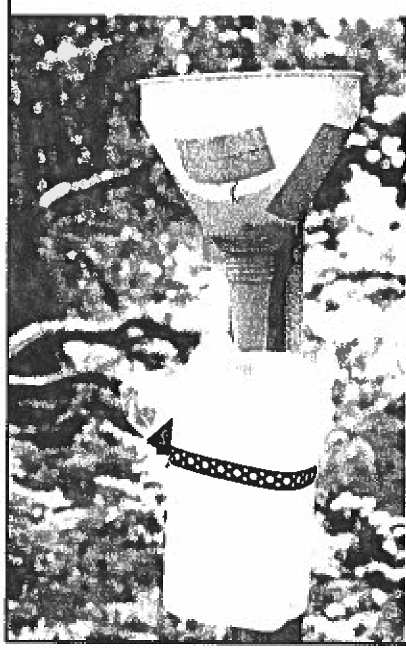
> SAFETY CAUTION!
> **Do not check your rain gauge during lightning storms.**

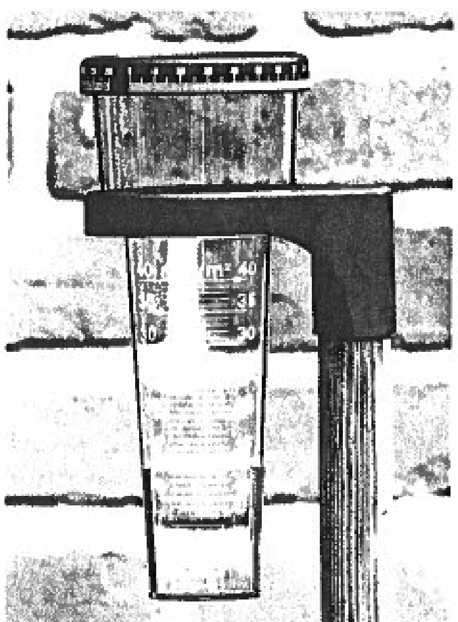
Suggested Materials

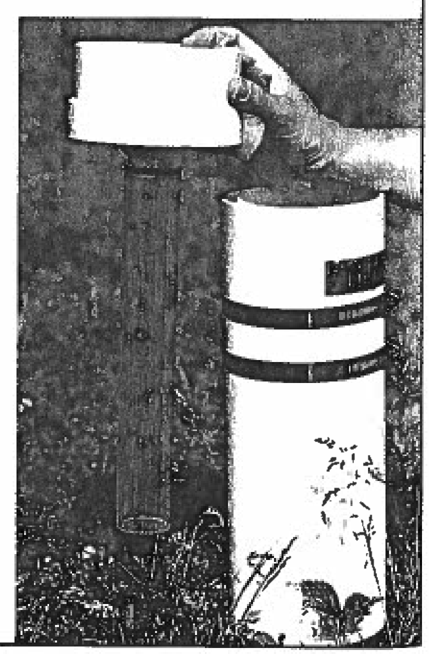
- container, such as a tin can, pail, or jar
- masking tape
- ruler
- permanent marker
- any other materials required

Procedure

1. Look for rain gauges in your neighbourhood. Find and examine pictures of rain gauges. How are different rain gauges the same? How are they different?
2. Think about how you can make a rain gauge and answer these questions:
   - What materials could you use?
   - What will you have to measure and how can you do it?
   - Where are you going to place your rain gauge? What materials are best for that place?
   - What criteria will you use to evaluate how well your rain gauge works?
3. Design your rain gauge using the materials that you think are best. Share your design with other students and with your teacher.
4. Build your rain gauge.
5. Use your rain gauge to see how it works. Does it do what it is supposed to do? Did you follow your original design? Make any changes you think will improve it.
6. Compare your rain gauge with another group's. How are they the same? How are they different?







Think Again! How Your Barometer Moves

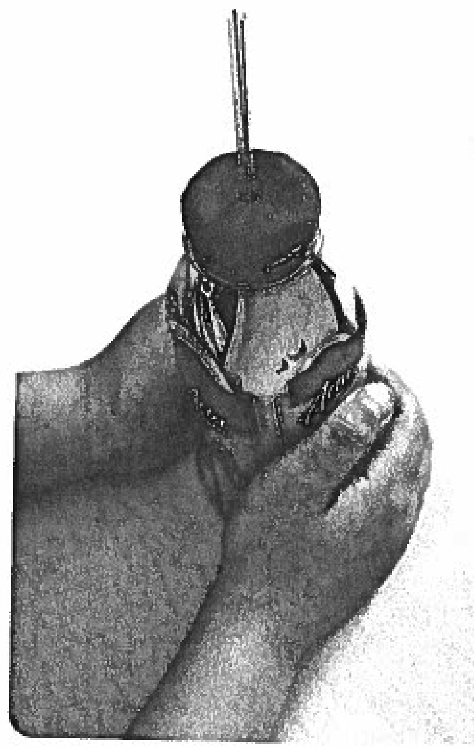
When the straw is parallel to the ground, the outside air pressure is equal to the air pressure in the jar. Watch the movement of the straw over time to see if it is moving up or down on the ruler. If the straw is moving up, the outside air pressure is increasing. If the straw is moving down, the outside air pressure is dropping.

> **!** Two units used to measure air pressure are millibar (mb) and kilopascals (kPa). The standard air pressure at sea level and at a temperature of 15°C is 1013.5 mb = 101.35 kPa.

Communicate

Write

1. In high places, such as mountain tops, there is less air pushing down on Earth's surface. If you were to take a barometer to the top of a mountain, would you expect to find a reading of low or high pressure? Explain your answer.
2. If your barometer shows that the air pressure is dropping, what might happen to the temperature and skies the next day? If the air pressure is increasing, what do you predict will happen?
3. If you seal the space around a straw, do you think it will be easier or harder to drink from the straw? Answer using what you know about air pressure.
4. Compare the amount of rainfall you measured for a certain day with the amount reported in a newspaper. How do they compare? Why might they be different?
5. Research the amount of rainfall where you live. In what season or month do you get the most rainfall? What is the average amount of rainfall in any given month? Leave your rain gauge out for an extended period of time. How does the amount of rainfall you collected compare with the average rainfall?
6. List all the weather instruments you have made. Explain how each one works and what it measures.



Build On What You Know

Listen to or read a weather report. Think of the instruments you have made and used. What parts of the weather can you not yet measure or observe? Choose one and find out more about it. Think about why it is included in weather reports. The more you know about all parts of the weather, the better you will understand the weather in the community you promote.

6 What Helps Us Predict the Weather? Part 1

GOAL To examine the role of observation in predicting the weather

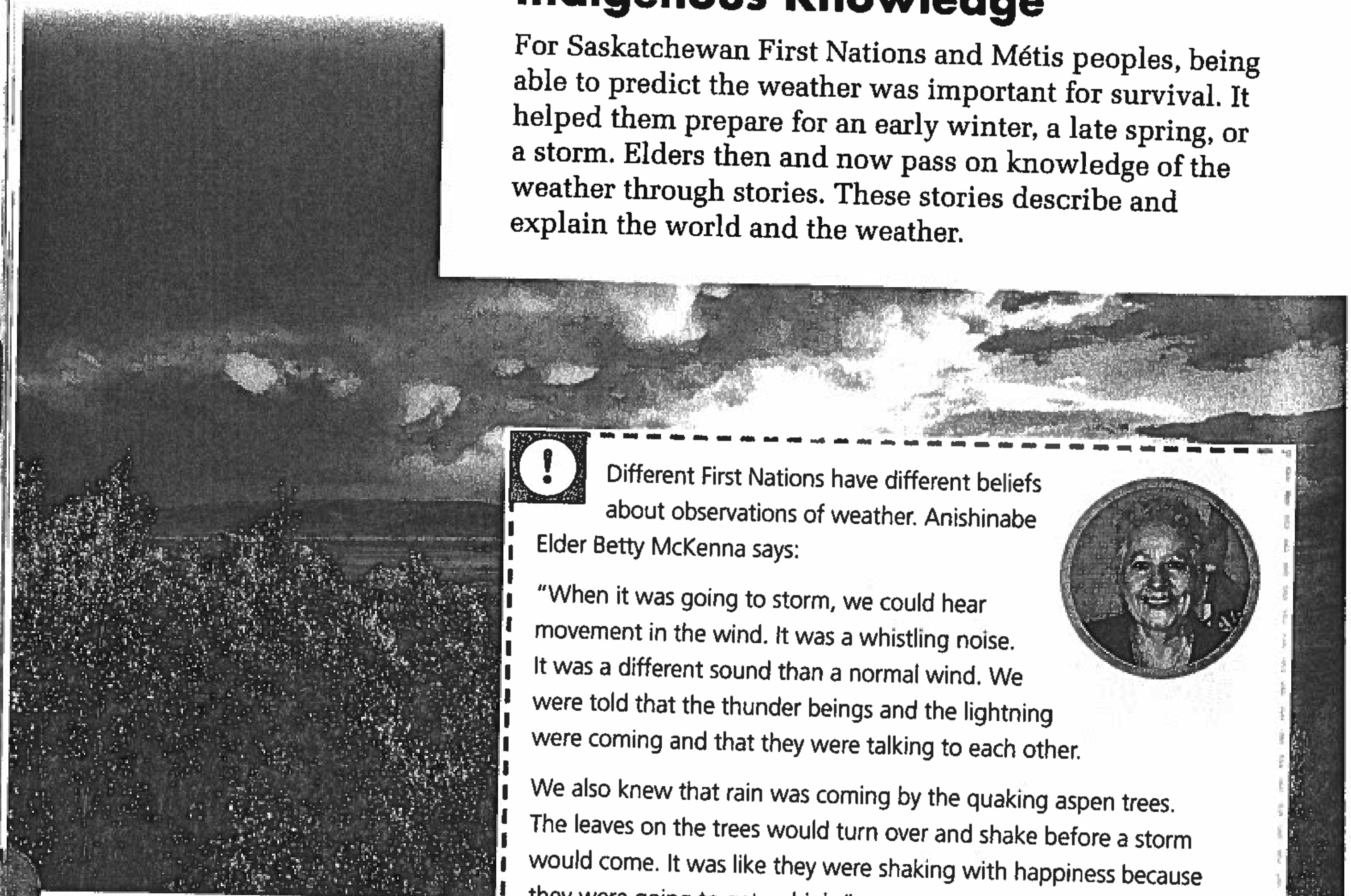
GET STARTED ▶

What is the weather right now? Go outside and look. You may see the Sun shining or clouds moving across the sky. You can feel the temperature. You may hear the wind, the rain, or thunder. If you observe the weather and your environment over time, you will notice patterns. For example, you might notice that where you live the wind usually blows from a certain direction before a storm. Or you might notice that your community usually gets more snow than a nearby community.

People all around the world have always used observations of the sky, the Moon, animals, and plants to help predict the weather today, tomorrow, and in the future.

Indigenous Knowledge

For Saskatchewan First Nations and Métis peoples, being able to predict the weather was important for survival. It helped them prepare for an early winter, a late spring, or a storm. Elders then and now pass on knowledge of the weather through stories. These stories describe and explain the world and the weather.



Aspen trees about to get a drink

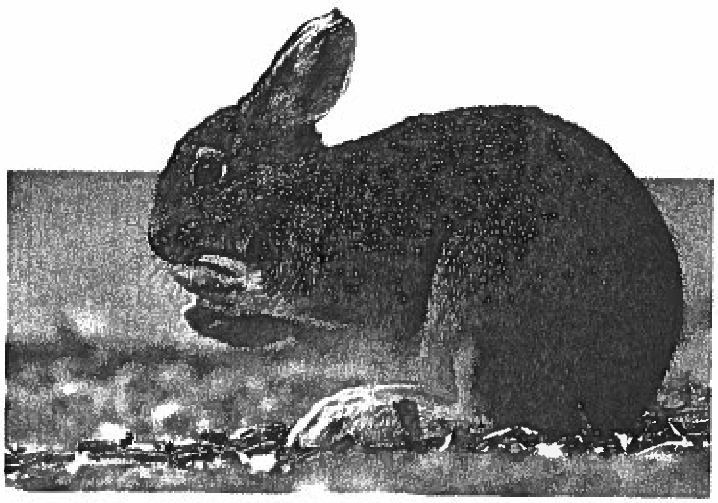
! Different First Nations have different beliefs about observations of weather. Anishinabe Elder Betty McKenna says:

"When it was going to storm, we could hear movement in the wind. It was a whistling noise. It was a different sound than a normal wind. We were told that the thunder beings and the lightning were coming and that they were talking to each other.

We also knew that rain was coming by the quaking aspen trees. The leaves on the trees would turn over and shake before a storm would come. It was like they were shaking with happiness because they were going to get a drink."

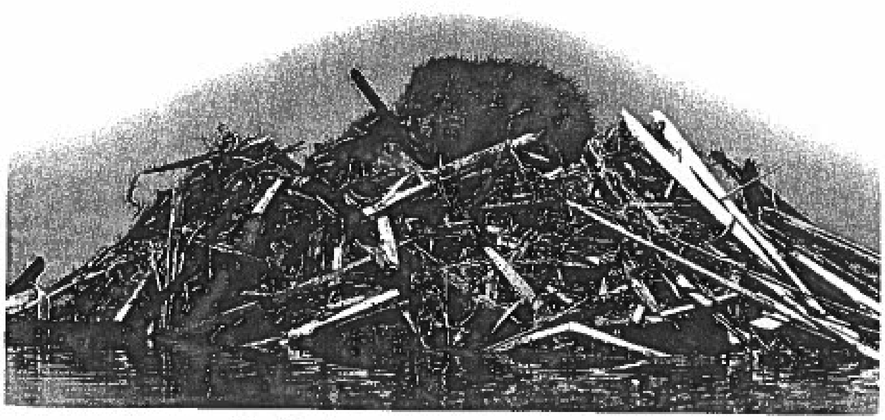
We all know that birds returning from the south are a sign that spring is about to arrive. But many other animals helped First Nations and Métis peoples predict the weather. The Cree knew if the coyotes were howling at night, it meant a storm was coming. The Dené would predict the amount of snow that would fall in the winter by the width of a snowshoe hare's footprints in the fall. If the footprints were wide, it meant the snowshoe hares' hind feet had extra fur and lots of snow would be heading their way.

Many First Nations and Métis peoples see plants and animals as brothers and sisters who can teach, guide, and take care of us.



A snowshoe hare

Muskrat lodges also helped predict the weather in the coming winter. If a muskrat built its lodge close to the edge of the water, the winter would be mild. If the lodge was built in the middle of the lake, the winter would be long. A lodge that was high and full also indicated a longer winter. If the muskrat built its lodge early in the fall, winter would come early.



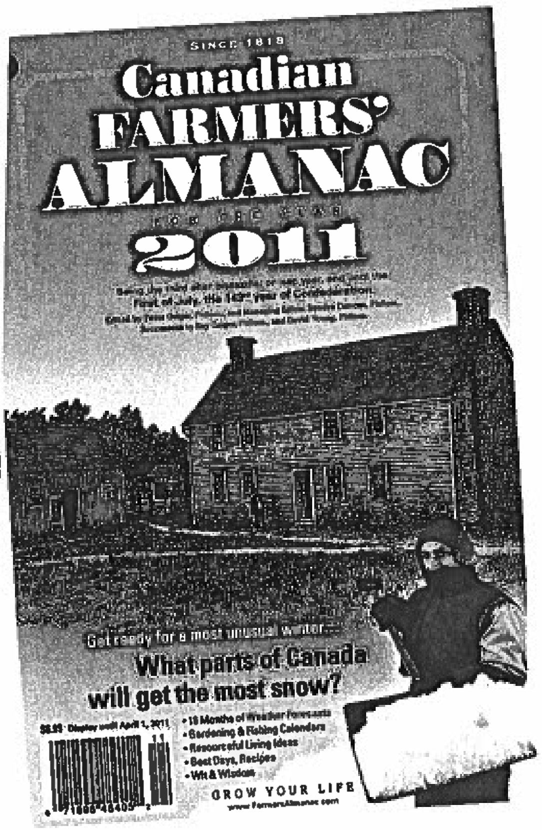
Muskrats at work on their winter lodge

Today, First Nations and Métis people continue to share and use the weather knowledge passed on over many generations, but they also check weather forecasts and use modern tools and weather instruments to predict the weather.

Sayings and Rhymes

Farmers, sailors, fishers, and other people around the world whose work depends on weather also pay careful attention to it. Their observations over the years were passed on in short sayings that often rhymed so that they were easy to remember. Which of these sayings have you heard before?

- A ring around the Sun or Moon means rain or snow coming soon.
- If bees stay at home, rain will soon come; if they fly away, fine will be the day.
- Red sky at night sailor's delight. Red sky in the morning sailor's warning.
- Cold is the night when the stars shine bright.
- When teeth and bones and bunions ache, expect the clouds to fill the lake.
- When clouds look like black smoke, a wise man will put on his cloak.
- A sun-shiny shower won't last half an hour.
- The winds of the daytime wrestle and fight, longer and stronger than those of the night.
- When the wind blows from the west, fish bite best. When it blows from the east, fish bite least.
- When grass is dry at morning light, look for rain before the night.



A farmer's almanac gives information and makes predictions about the weather in the coming year. It includes the best times of year to plant different crops. Predictions are based on observations and calculations.

Sun dogs are two bright patches of light on either side of the Sun or Moon. Sometimes the bright patches are part of a ring around the Sun or Moon.

Work On It

Single

You will take a close look at sayings about the weather.

Materials

- the Internet, books, and other sources

Procedure

1. Choose two weather sayings from the list on the previous page. What do you think they mean?
2. Research each saying. Answer the following questions:
   - What does the saying predict?
   - Can you check the prediction yourself?
   - How reliable is the prediction? Is it always true or only sometimes true? How can you find out?
   - Is there any scientific evidence for the prediction? Can you explain why the prediction might be true or not true based on what you have learned so far about weather?
3. Share your research with your classmates.

Communicate

Write Discuss

1. If a weather saying or story says one thing and the weather report says another, which would you believe and why? Can both be right? Can both be helpful? Explain.
2. How do you think that traditionally sharing stories is helpful in understanding weather conditions and patterns?
3. Interview a grandparent or older member of your community about the weather sayings or knowledge he or she knows.

Build On What You Know

How could you find out about local sayings and Indigenous knowledge for a different community in Canada? Where would you look? Who might you speak to? You will want to find weather sayings and Indigenous knowledge about the weather in the community you will promote.

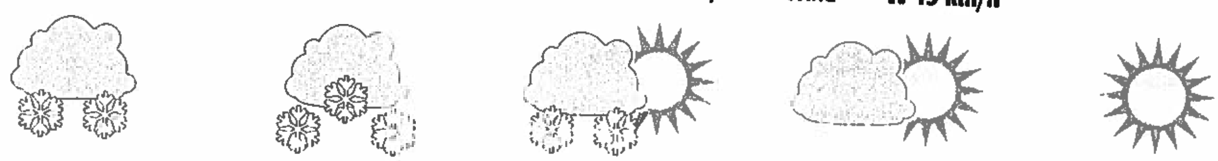
7 What Helps Us Predict the Weather? Part 2

GOAL To examine the role of technology in predicting the weather

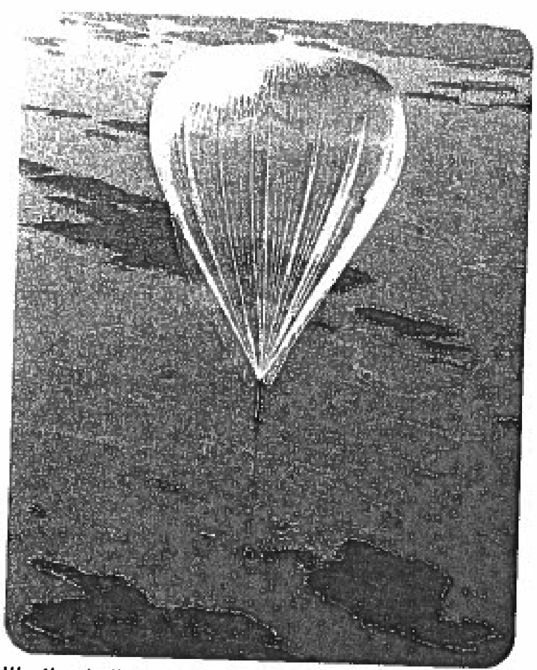
GET STARTED

Weather is constantly changing. Maybe you wore a jacket to school this morning, but by lunchtime you did not need it anymore. Weather forecasts tell us what to expect from the weather over the next few hours or days. They let us know if we should expect wind, rain, sunshine, snow, or a storm. Weather forecasts also predict what the temperature will be. You can find weather forecasts and updates on television, on the radio, and on the Internet.

	WEDNESDAY	**THURSDAY**	**FRIDAY**	**SATURDAY**	**SUNDAY**
	Isolated flurries	Snow	Mainly cloudy with flurries	Sunny with cloudy periods	Sunny
High	**-4°C**	**-4°C**	**-3°C**	**-6°C**	**-8°C**
Low	**-11°C**	**-11°C**	**-8°C**	**-14°C**	**-15°C**
P.O.P.	**70%**	**80%**	**60%**	**10%**	
Wind	**W 10–20 km/h**	**W 20 km/h**	**SW 30 km/h**	**W 15 km/h**	



A five-day forecast. What do you think P.O.P. stands for?



Weather balloons usually travel 30 km up into the sky.

In the past, meteorologists were only able to predict the weather a few hours ahead. With new and improved technologies, meteorologists are able to make predictions about the weather many days in advance. Here are some of the technologies they use.

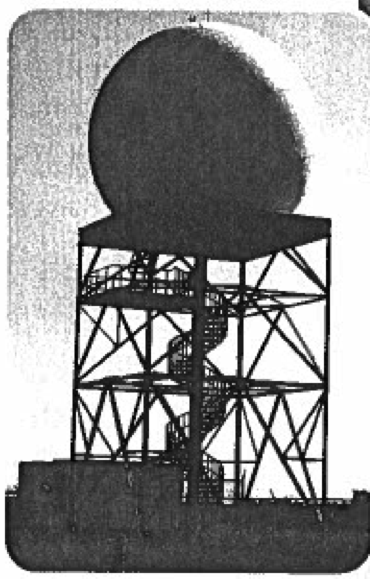
Weather Balloons

Environment Canada, a federal government department, is the main source of weather measurements in Canada. Environment Canada uses **weather balloons** to gather information about the weather. These large, thin balloons are filled with helium, a gas that is lighter than air. The balloons carry equipment into the sky. Environment Canada sends up weather balloons twice a day, in the morning and in the evening.

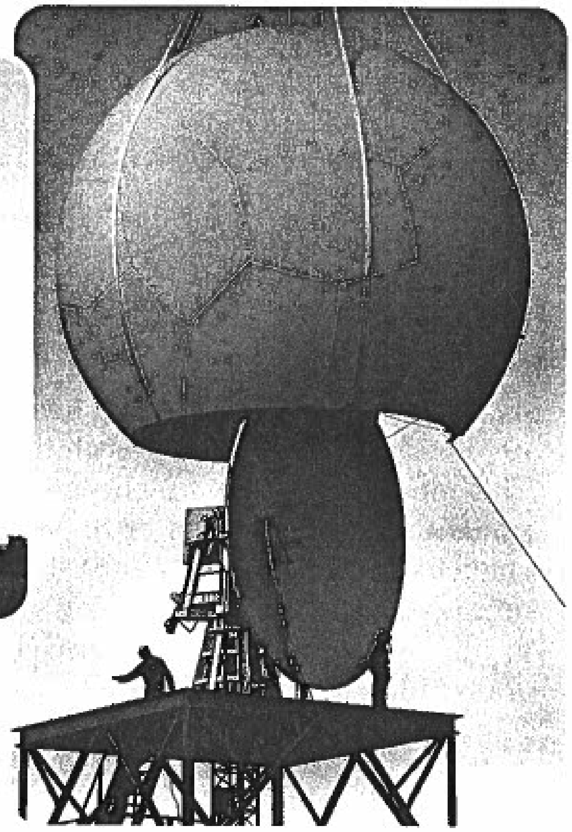
As a weather balloon rises, the equipment it carries measures air temperature, air pressure, humidity, and the speed and direction of the wind. A radio transmitter sends these measurements back to Earth. The balloon continues to expand as it rises and eventually bursts. A parachute attached to the equipment lets it fall safely back to the ground.

Radar

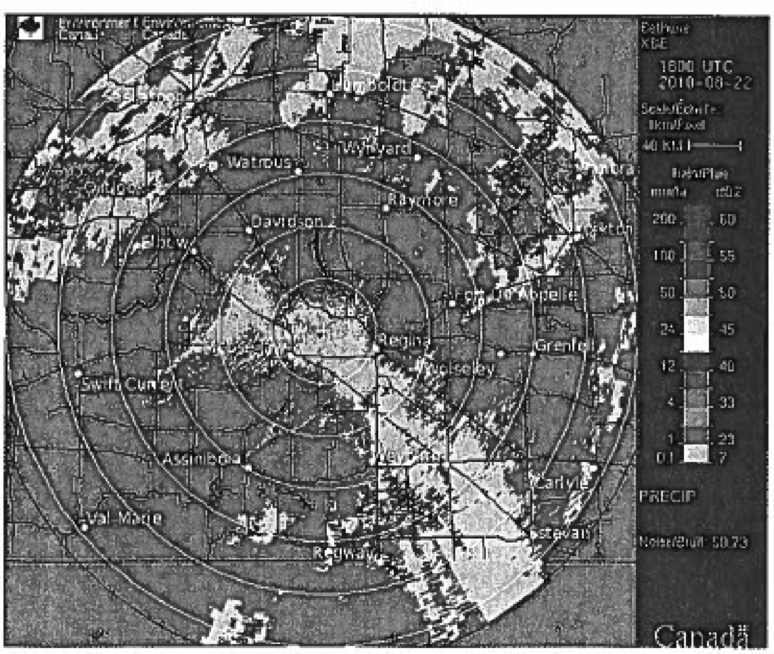
Radar is a device that uses radio waves to locate objects. Weather radar sends radio signals from an antenna out into the air. When these radio signals hit precipitation in any form—raindrops, snow, or hail—they bounce off and travel back to the antenna at the radar station. The information the radio waves send back is changed into pictures on a map. Different colours on the map show where precipitation is and how much there is.



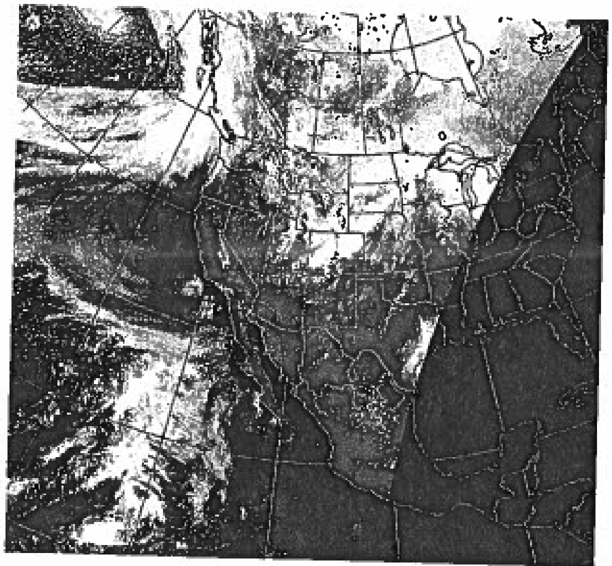
The radar station in Bethune is one of two operated by Environment Canada in Saskatchewan.



The dome of a radar station protects the antenna, which looks like a big satellite dish.



A map produced by the radar station in Bethune on August 22, 2010, shows at least some precipitation in many parts of southern Saskatchewan.



A satellite image of the Pacific coast of North and South America

Weather Satellites

Weather satellites are launched into space. They orbit Earth and take pictures of it. Satellite pictures can show where clouds are and how they are moving. Environment Canada has weather centres across the country that have satellite receivers. These receivers pick up the pictures that are sent from space. Meteorologists use the pictures from the satellites to make predictions about which direction storms are travelling and how strong or weak they are.

Work On It

Single

In a weather forecast, you will hear predictions expressed as probabilities. This means that there is a chance something might happen. A 10 percent chance of rain means it is unlikely to rain where you are. A 90 percent chance means rain is very likely. How accurate are weather forecasts? Complete the following activity to find out.

Materials

- a newspaper or the Internet

Procedure

1. You will need six copies of the table below to record information for these locations:
   - where you live
   - a town or city in Saskatchewan
   - Yellowknife, NT
   - Vancouver, BC
   - Ottawa, ON
   - St. John's, NL

Location ______________________

	Monday	Tuesday	Wednesday	Thursday	Friday
Forecasted weather					
Actual weather					

Work On It (continued)

2. Find the weather forecast for the next week in a newspaper or on the Internet. Record the weather forecast for each city in the "Forecasted Weather" row. Be sure to record all the information that is given, including temperature, precipitation, and cloud cover.

3. At the end of each day, look up and record the weather that actually occurred in each city in the "Actual Weather" row. Compare the actual weather to the forecasted weather. Do they match? If not, how are they different?

4. At the end of the week, examine the information in your tables. Do you notice any patterns? What predictions can you make about the weather in other parts of Saskatchewan? Other areas in Canada?

5. Interview a family member to find out how and why they use weather forecasts.

Communicate

Write

1. What information can weather forecasts provide us with?
2. Which of the following do you think would be more accurate: a weather forecast for tomorrow or a weather forecast for five days from now? Explain your answer.
3. Look in the newspaper or on the Internet to find out about the weather in other parts of the world. Where would you like to be right now? Explain your choice.

Build On What You Know

Think about how and why different people use weather forecasts. How might forecasts be especially helpful when you are visiting a different city or country? How is what a visitor wants to know about the weather in a particular location different from what a person who lives there wants to know?

How can we collect information about the weather?

Ask...

A Meteorologist

Dave Carlsen is a meteorologist. He produces weather forecasts, weather watches, and weather warnings for southern Saskatchewan, all of Manitoba, and eastern Nunavut.

Dave uses different types of equipment to gather information about the weather. Weather stations, ships and buoys, and lightning detectors collect information at ground level. Weather balloons and special temperature sensors on some aircraft collect information in the sky. Weather satellites collect information in space.

However, technology cannot always tell Dave what is actually happening on Earth's surface. For example, radar can tell if water is falling to the ground, but it cannot tell if the water is falling as rain, snow, or hail. Radar can tell if there are strong rotations in a thunderstorm, but it cannot tell if a tornado is touching the ground. Meteorologists like Dave rely on human observations to get a complete picture of the weather.

A Storm Chaser

Greg Johnson has seen many storms up close. As a storm chaser, he travels all over Canada and the United States to follow and document storms as they are happening. His observations, photographs, and videos help meteorologists and the public see first hand how dangerous and powerful severe weather can be.

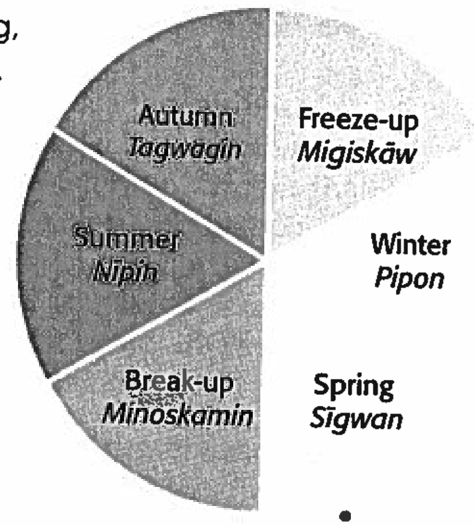
Greg tries to get as close as possible to each storm, to get the best photos. He usually has to keep getting in and out of his car so he can move quickly and follow the storm.

While Greg is chasing a storm, he is also analyzing radar and weather data on his laptop computer. This information tells him which direction and at what speed a storm is travelling. Radar data also tells Greg if a storm has the potential to produce a tornado, hail, or lightning. He is then prepared and able to observe just how severe the storm can become.

An Elder

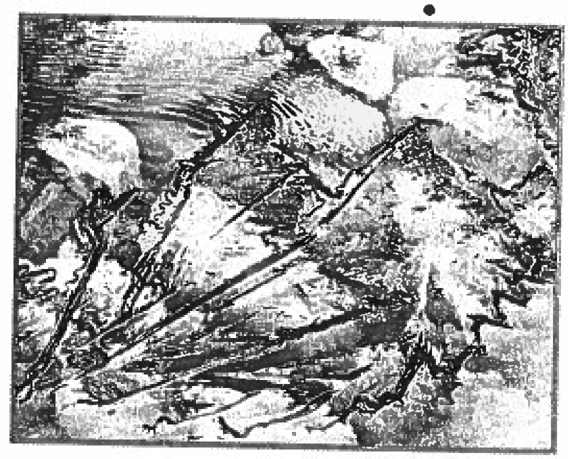
In northern Saskatchewan, the Dené, as well as their neighbours the Northern Cree, divide the year into six seasons: spring, spring break-up, summer, autumn, freeze-up, and winter.

Elder Pauline Fontaine explains that freeze-up was the time to prepare for winter. People gathered medicines and berries one last time, dried meat and fish to preserve it, collected firewood, and fixed up their toboggans, dog sleds, and dog harnesses. During spring break-up, people prepared for spring and summer. Trappers snared small game, such as muskrats, beavers, and rabbits. They traded furs for supplies and built boats and canoes.



Elders, hunters, and trappers look for weather and animal signs to predict the changing of the seasons and the weather during each season. The arrival of break-up is preceded by signs such as the return of birds and longer days. Squirrels preparing their winter nests is a clear sign that winter is arriving, and the coming of the north winds indicates cold weather.

It is especially important to know when the ice on a lake is thick enough to cross. A lot of snow on a lake's surface or brown spots over the forming ice means that the lake is not completely frozen. A build-up of ice chunks or ice needles means that the lake has begun to thaw.



The Dené still rely on traditional education, but they are cautious. They have noticed changes in animal behaviour. The weather has become more variable and unpredictable.

Research

1. How do you think knowledge and information from a meteorologist, a storm chaser, and an Elder can be combined to give us a better understanding of a storm?
2. What are some advantages of using human observations to tell about the weather? What are some advantages of using technology?

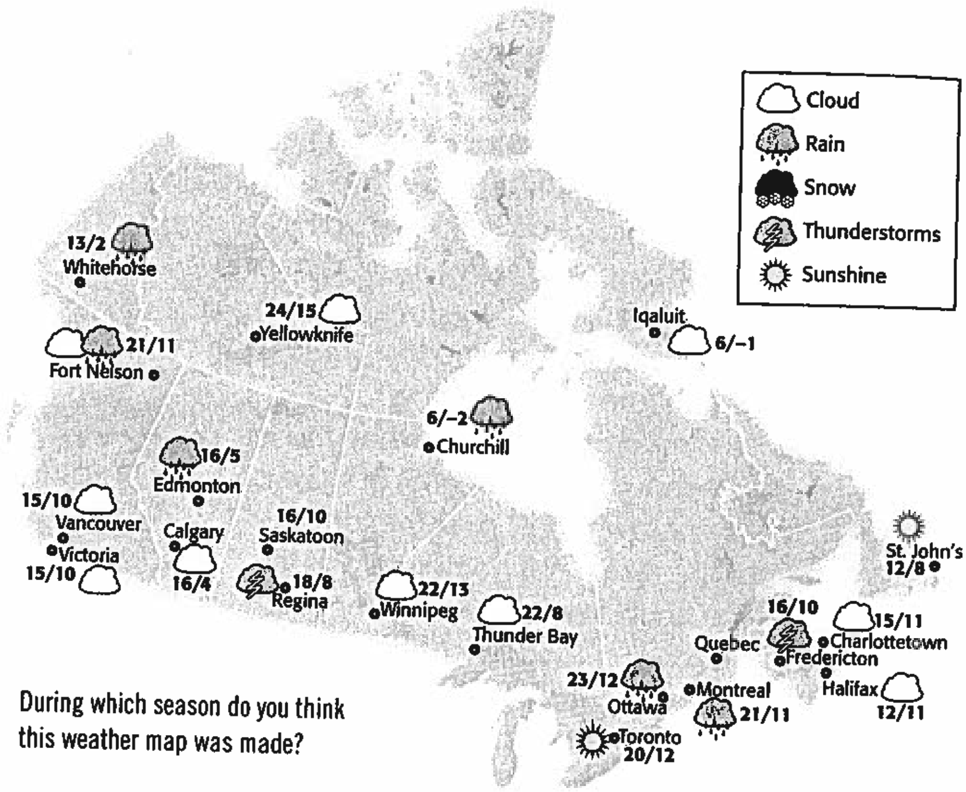
8 Can You Predict the Weather?

GOAL To observe and measure weather over time, and to look for patterns

GET STARTED

You have designed and made instruments to measure various weather conditions. It is time to use them all together! You will now measure and observe weather daily. You will need to keep detailed records of your measurements and observations. You will use your records to look for and predict weather patterns.

You will also create a weather map. A **weather map** summarizes information about the weather in different locations.



During which season do you think this weather map was made?

Work On It

Pair

Materials for each pair

- your weather instruments
- thermometer
- paper and drawing materials (markers, coloured pencils)

Procedure

1. Test your instruments and make sure they are all in working order. Fix or adjust your instruments as needed.

Work On It (continued)

2. Make a list of all the measurements you can take with your instruments and all the different kinds of observations you can make about the weather.

3. Work together to make one or several tables where you can record your measurements and observations. Leave enough room to draw cloud types and describe any rain or snow. You should also plan to record any Indigenous knowledge or sayings related to the weather that is occurring, and any other observations you make about the environment.

4. Take your measurements and make your observations at the same time each day for one week.

5. Decide what symbols you are going to use to represent the information you collected (temperature, cloud cover, wind speed and direction, rain or snow).

6. Draw or trace the outline of a weather map for your area or for Saskatchewan. On this map, show weather information for your location for one day only, using the symbols you chose. Remember to label your map with the day that the information is for.

7. Look up weather information for the same day for two or three other locations in your area or in Saskatchewan. Add the information you find to your map.

Communicate

Write

1. Look at your table and map. What did you discover about the weather in your area? Do you see any connections or patterns among the temperature, type of clouds, wind speed, or rain or snow? Explain.
2. Based on the patterns you discovered, what predictions can you make about the weather in your area for tomorrow? For next week?
3. After collecting weather information for your area, what new questions do you have about weather?

Build On What You Know

Compare your weather map to the weather map for another area or province on the same day. How is the weather different?

9 Severe Weather

GOAL To learn about the effects of severe weather

GET STARTED

Weather is always changing. A calm, sunny day can quickly change into a windy, rainy day ... or worse. Severe weather, such as a thunderstorm, is powerful and can even be dangerous. It can create problems for people, animals, and the environment.

Thunderstorms

On hot days, the air heats up and rises quickly. It meets cooler, drier air high in the sky. The water droplets or ice crystals that form there can gather together in big, grey cumulonimbus clouds. These clouds cause **thunderstorms**, which bring strong wind, rain, lightning, and thunder. Cumulonimbus clouds are the only clouds that produce lightning, thunder, tornadoes, waterspouts, funnel clouds, and hail.

Lightning that strikes trees can start forest fires. Lightning also often strikes power lines. When this happens, power to your home may go out. What other effects can a thunderstorm have?

> Many First Nations and Métis peoples view severe weather as a reminder of Creator's power. The Cree and other Algonquian First Nations believe that a great flood was part of how the world was created.

Floods

A **flood** can occur when a storm brings a large amount of rain in a short amount of time. When it rains very hard, very quickly the water has no place to go. The ground becomes saturated, which means it cannot soak up any more water. The sewer systems in a town or city fill so quickly with water that they cannot hold any more water. All the rainwater then floods streets, fields, and roads.

In the spring, a flood can occur when the snow melts too quickly or there is more snow than usual in an area. A flood can also occur when ice jams a river.

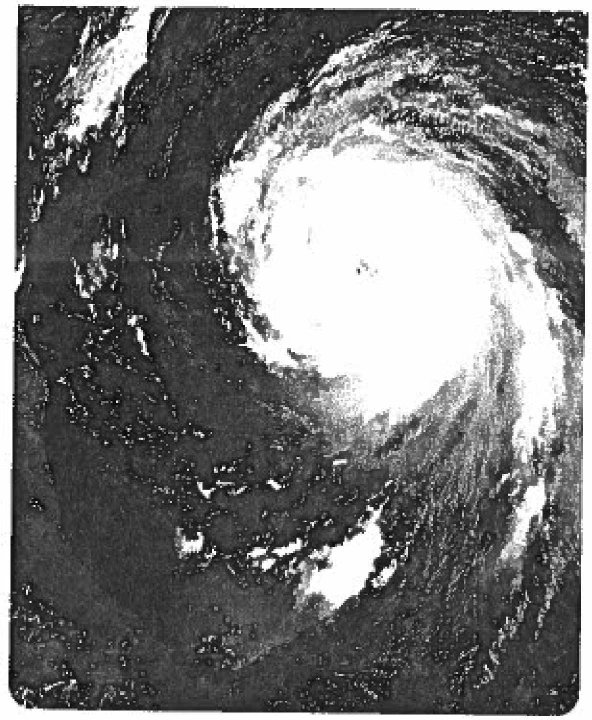
Drought affects everything that grows.

Drought

The opposite of a flood is a drought. A **drought** happens when an area receives less rain than usual over many months or even years. When an area is experiencing a drought, it is very difficult for anything to grow. Water has to be used carefully and shared. Animals may not have food to eat because plant life dries up. Low water levels in lakes and rivers may cause fish to die.

Hurricanes

Hurricanes are huge storms that form over the ocean. A hurricane starts out as a regular storm over warm ocean waters. It grows larger as it picks up heat and moisture from the ocean below. An average hurricane is about 650 km wide. In the middle of a hurricane there is a space where the air is calm and still. This is called the "eye" of the storm. Hurricanes travel over the ocean and eventually reach land.

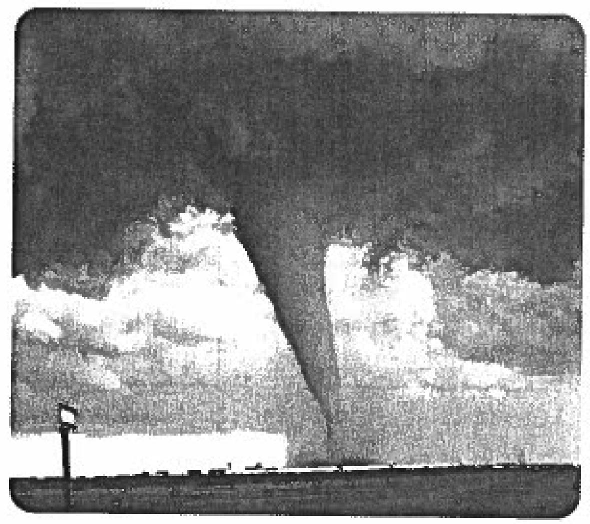


Can you see the eye of the hurricane in this satellite image?

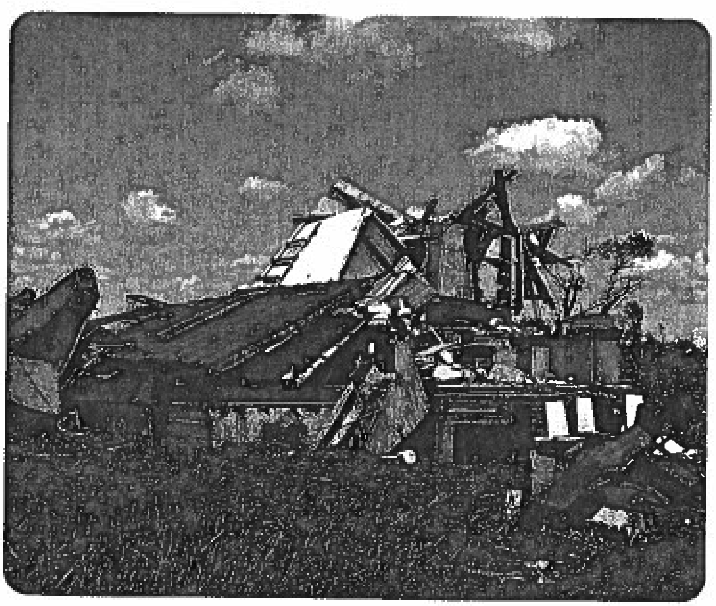
Tornadoes

A **tornado** is a violent, swirling tube of air. It forms a dark, funnel-shaped cloud that reaches down from a thundercloud and touches the ground.

Tornadoes can cause a lot of damage. When the bottom of the funnel cloud touches the ground it sucks up anything that it travels over. Objects are thrown into the air and then crash back down to the ground. A tornado is so powerful it can even pick up buildings, cars, and trees. Tornadoes happen quickly and often travel in a narrow path. This means that a house on one side of a street may be destroyed while a house on the other side may go untouched.



The wind in a tornado can reach speeds of 300 km/h.



Damage caused by a tornado in Raymore on July 2, 2010

> **!** One of the worst tornadoes in Canadian history touched down in Regina on June 30, 1912.

Blizzards

Winter snowstorms are called **blizzards.** They bring strong winds, cold temperatures, and heavy snowfall. As the snow falls, the wind whips it around creating low visibility. This means that it is very difficult to see.

During a blizzard, visibility is less than 400 m and wind speeds are 56 km/h or more.

Be Prepared and Stay Safe

Even though severe weather can happen very quickly there are ways to be prepared. In summer months, when storms are common, you should always listen to weather forecasts. They will tell you what to expect for the day. Environment Canada also sends out weather alerts when severe weather is developing. A **weather watch** means that severe weather could develop. A **weather warning** means severe weather is happening or is about to happen. You can also be watching the weather yourself. If you are outside and the sky gets darker or you notice large, dark clouds forming you should go inside right away.

Weather Records

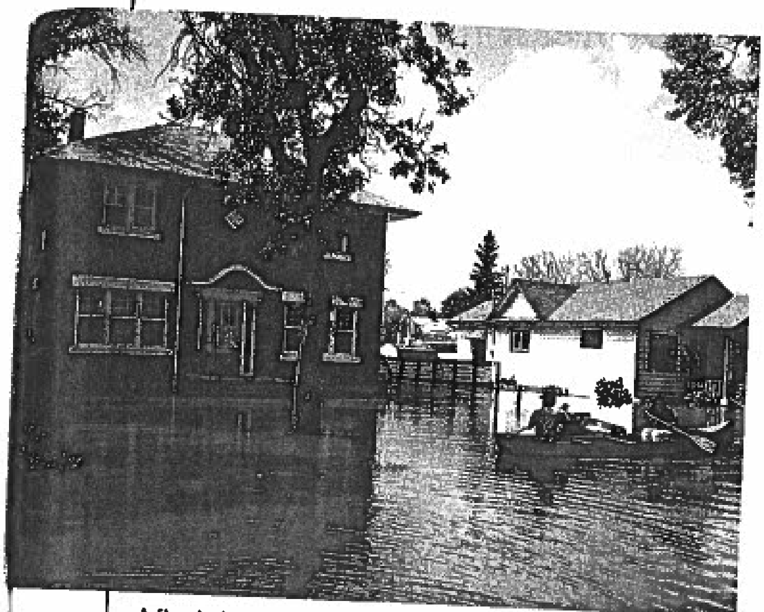
Record	Canada	World
Highest temperature	45°C Midale and Yellowgrass, SK July 5, 1937	57.8°C El Azizia, Libya September 13, 1922
Lowest temperature	−63°C Snag, YT February 3, 1947	−89.2°C Vostok Station, Antarctica 21 July 1983
Greatest precipitation in one year	9 479 mm Henderson Lake, BC 1997	26.47 m Cherrapunji, India August 1860–July 1861
Least precipitation	12.7 mm in 1 year Arctic Bay, NT 1949	0 mm in 14 years Arica, Chile October 1903–January 1918
Greatest seasonal snowfall	2446.5 cm Revelstoke/Mount Copeland, BC 1971–72	2896 cm Mt. Baker, Washington, USA 1998–99
Highest wind speed	201.1 km/h Cape Hopes Advance (Quaqtaq), QC November 18, 1931	407 km/h Barrow Island, Australia April 10, 1996
Heaviest hailstone	290 g Cedoux, SK August 27, 1973	1020.58 g Gopalganj District, Bangladesh April 14, 1986

These are some weather records in Canada and the world. What other weather records would you like to find out about?

Work On It

Single

Severe weather can affect people's lives for a short time or a long time. Research a severe weather event to find out how it changed people's lives.



A flooded street in Yorkton after a rainstorm on July 1, 2010

Materials

- the Internet, books, and other sources

Procedure

1. Research a severe weather event anywhere in Saskatchewan or in Canada. Here are some questions to help guide your research:
   - What happened in this location?
   - What kinds of damage or loss did the weather event cause?
   - How did people's lives change because of the weather?
   - Are people still affected today? How?
2. Present the impact of the weather event on people to your classmates in an interesting way.

Communicate

Write

1. Find and mark the places in the Weather Records table on a map or globe. Explain how the location of each place on Earth and its geography (surface material, height) might affect the weather there. Explain any patterns that you see.
2. Imagine that you have to teach a younger student about severe weather. What do you think would be the most important things to say about thunderstorms, floods, droughts, hurricanes, tornadoes, and blizzards?
3. List at least three problems that severe weather can create for each of the following: people, communities, and the environment. Which problem do you think is the most important and why?
4. What severe weather should you be aware of and prepared for in Saskatchewan? How can you stay safe if you ever experience these severe weather conditions? Explain.

10 Weather Protection Every Day

GOAL To learn about wind chill and the UV Index

GET STARTED

Storms, droughts, and hurricanes are not the only weather conditions that can cause harm. The Sun on a sunny day and the wind on a cold winter day can also be surprisingly dangerous.

Wind Chill

You may have noticed that on a windy, cold day you feel colder than on a calm, cold day. This is because the wind blows the warm air that surrounds your body away from you, making you feel colder. This effect is called **wind chill**. Winter forecasts in Saskatchewan almost always include the temperature with the wind chill. For example, you may hear that the temperature is −25°C but the wind chill makes it feel like −33°C.

If you know the temperature and the wind speed, you can use this table to estimate the wind chill.

Wind speed (km/h)	Air Temperature (°C)									
	0	**−5**	**−10**	**−15**	**−20**	**−25**	**−30**	**−35**	**−40**	**−45**
10	−3	−9	−15	−21	−27	−33	−39	−45	−51	−57
20	−5	−12	−18	−24	−30	−37	−43	−49	−56	−62
30	−6	−13	−20	−26	−33	−39	−45	−52	−59	−65
40	−7	−14	−21	−27	−34	−41	−48	−54	−61	−68
50	−8	−15	−22	−29	−35	−42	−49	−56	−63	−69
60	−9	−16	−23	−30	−36	−43	−50	−57	−64	−71

Some clothes can protect your skin from UV rays.

Ultraviolet Rays

About 45 percent of the energy from the Sun that travels to Earth reaches us as light. The rest is invisible to humans. Some of this invisible solar energy is in the form of **ultraviolet rays**, or UV rays. UV rays have more energy than rays of light and can cause sunburns and skin cancer.

The Ozone Layer

The **ozone layer** is a thin layer of ozone gas high up in the atmosphere. It absorbs UV rays and prevents them from reaching Earth's surface. The thicker the ozone layer is, the more UV rays are absorbed.

Scientists have discovered that the ozone layer is becoming thinner. This means that more UV rays are reaching Earth's surface. The thinning of the ozone layer is happening because of chemicals that humans use. These chemicals go into the atmosphere and cause the ozone to break apart.

Work On It

Pair

In 1992, Environment Canada designed a UV Index. The UV Index shows how UV rays of different intensities affect human skin and how people should protect themselves. You are going to research the UV Index and present your information to help others understand about harmful UV rays.

Materials for each pair

- the Internet, books, and other sources

Procedure

1. Research Environment Canada's UV Index. Here are some questions to guide your research:
   - What is the UV Index, and how is it used?
   - What do the numbers in the UV Index mean?
   - How do Canadians find out about the UV Index?
   - How can people protect themselves, based on the information in the UV Index?
2. Who needs to know about the UV Index and why? Choose one group of people (such as children, athletes, or construction workers) who should know about the UV Index.
3. Take all of your research and decide how you will present it to the group you choose. Here are three ideas: create a brochure, create a skit, or write a story.

Communicate

Write

1. How does knowing about wind chill and the UV Index help you prepare for being outdoors?
2. Winter weather in Saskatchewan often includes very low temperatures with the wind chill. Sunny days in summer or winter can mean a high UV index number. How do these highs and lows affect your life? Have they ever prevented you from doing something outdoors or made you change your plans? Explain.

11 Weather Affects Our Lives

GOAL To examine how weather affects humans and animals

GET STARTED

Weather affects more than our plans for the day. It influences the food we eat, the clothes we wear, the homes we build, the vehicles we drive, the work we do, and the plants and animals that share our planet.

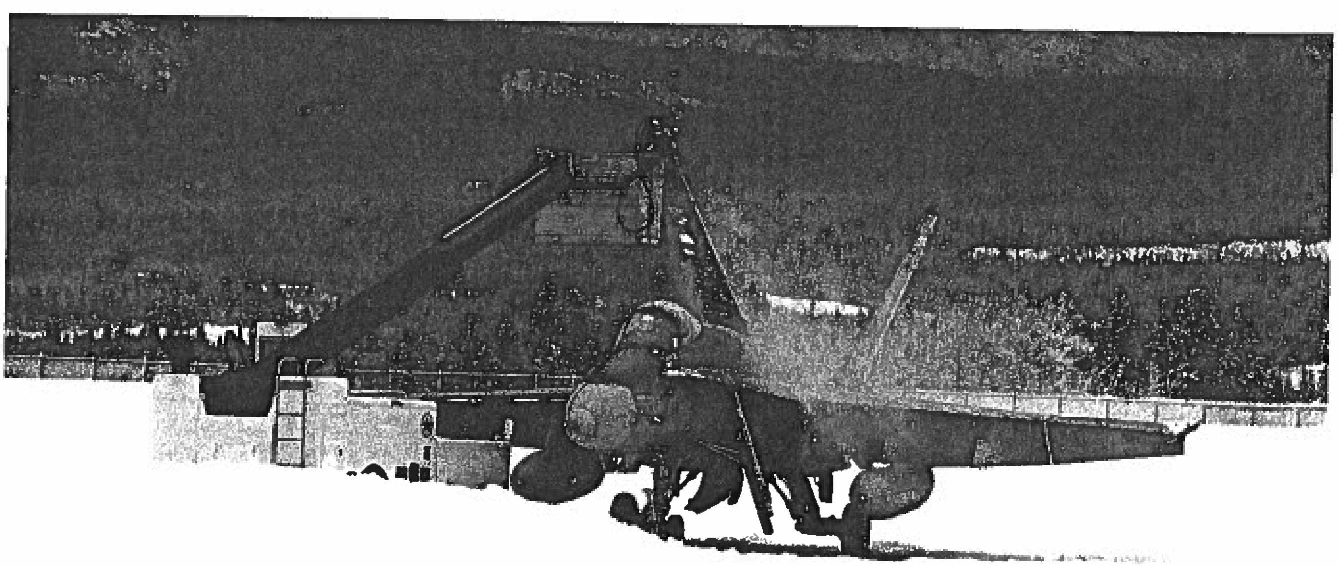
Cabbage plants damaged by frost

Food

Much of the food we eat relies on the right amount of sunlight and rain to grow. A late or rainy spring can delay planting, which affects the amount and quality of the crops that will grow. An early frost or snowfall can destroy the crops before they are harvested. Flooding can cause seeds or plants to rot. The wrong weather at the wrong time can mean huge losses for farmers, as well as fewer choices and higher prices for consumers.

Work

Farmers are not the only people whose work is affected by the weather. On a clear, warm day, a landscaper can plant a flower bed, a painter can paint a house, and a construction worker can put shingles on a roof or pour concrete for a driveway. None of these people can work during a thunderstorm or on a snowy winter day.



De-icing an airplane in Whitehorse, Yukon, before takeoff.

Clothing and Shelter

We wear different types of clothing to stay dry, warm, or cool. We make many decisions about what to wear based on what the weather is going to be like. Think about the different types of clothing that you own for different seasons and weather conditions. What materials are they made of? What parts or features do they have to keep you warm or cool?

New materials for clothing have been created to help protect us from the weather. Jackets are now often made of windproof fabrics. Such fabrics stop the wind from going through the jacket, which helps to keep you warmer. Other fabrics are designed to help keep you warm without being too heavy. These light fabrics work to keep your body heat trapped close to you.

Now think about your home. You can be sitting in your living room during a blizzard and stay warm and dry. Stucco, bricks, siding, and other materials on the outside of a home help keep wind and precipitation out. Insulation in the walls and airtight windows and doors help keep the warm air in and the cold air out. During the summer months, the warm air stays out and the cold air stays in.

Some winter sweaters and jackets have zippers on the front or under the arms. You can open the zippers to cool down if you get too warm.

Transportation

Vehicles are also designed with the weather in mind. Windshield wipers and heaters keep our windows clear so we can drive in the rain or snow. Winter tires are designed to have more grip so that it is easier to drive on snow and ice.

Winter tires have more and deeper slits, or grooves. More slits means more edges that can bite into snow and ice where the tire touches the road. Deep slits help move snow and slush away from where the tire touches the road.

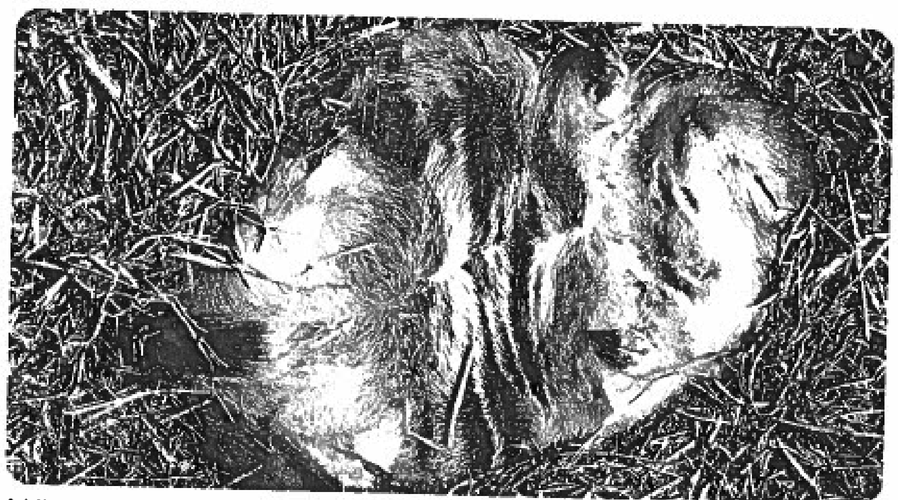
Being Prepared

Saskatchewan has always had harsh winters and extreme summers. Traditionally, First Nations and Métis people had to design clothing and shelter using only the plants and animals that lived around them. First Nations and Métis people always had to be planning ahead so that they would be prepared when the weather changed. For example, they used animal hides and fur to make winter clothing. However, animals have the thickest fur in the winter. The people would trap animals in winter, tan their hides, and use them to make clothing for the next winter. How does your family prepare for changes in the weather?

Animals and the Weather

Animals are affected by the weather, too. The body heat of cold-blooded animals, such as snakes, lizards, and frogs, changes with the weather. On cold days they are cold, while on warm days they are warm. Since their muscles are cold on cold days, these animals do not move around much. On warm days, however, their muscles are warm and they move around more.

Some animals **migrate** or travel to warmer places before the weather gets cold. Other animals **hibernate** or sleep through the cold winter months. Even animals who do not migrate or hibernate are not as active in the cold weather. They save their energy to keep warm. Some animals huddle together for warmth. Others put on more fat, grow more feathers, or grow more fur to keep warm during cold winters.



A hibernating ground squirrel

A polar bear

Extreme weather and changing weather patterns are changing how animals live. On hot summer days in Saskatchewan, lakes and rivers also heat up. There have been years when the temperature of the water warmed too much, causing different types of fish to die. First Nations and Métis hunters have noticed that deer, which usually live in southern Saskatchewan, are appearing in northern Saskatchewan. Moose and cougars, which used to be found only in northern Saskatchewan, are moving south and closer to cities. In the Arctic, warmer weather is causing the ice to melt. Polar bears hunting for seals have to swim longer distances to get from one sheet of floating ice to the next.

Work On It

Single

Make It Better

What products do you use in different kinds of weather? How could you make one of the products you use better?

Procedure

1. Think about the products you read about in this lesson. What other products do you use in different weather conditions? Make a list of all the products you can think of.
2. Choose one product from your list that you feel could be improved. How would you change it so that it works even better in the weather condition it was designed for? Write about and illustrate your ideas in your notebook.
3. Share your ideas with your classmates. In what other countries or parts of the world would the products you improved be useful? Where might they not be useful?

Communicate

Write Discuss

1. Find out about the weather in another country. Then, find photographs of people and places in that country. Study the photographs carefully. Look at the clothes, homes, tools, and other products pictured. Think about how weather affects what people use and what people do in that country. Create a poster to share what you learn.
2. Create a table with the following headings: "Cold Winter Weather," "Rainy Weather," and "Hot Weather." How do these weather conditions affect life in a positive way? In a negative way? List all the effects you can think of.
3. Choose an animal and research how it is affected by weather.
4. Being able to predict the weather is as important for survival today as it was in the past. Do you agree or disagree with this statement? Discuss your ideas with a partner.

Build On What You Know

Make a list of jobs that rely on the weather. Choose one and think about how different weather conditions affect the person doing that job. If you had that job, what kind of weather would you prefer in the place where you live and work?

In your last Exploration, you saw how Earth's spin affects its winds. Earth also orbits the sun. How does this yearly journey around the sun affect Earth's atmosphere?

Seasons and Climates

More solar energy reaches a place on Earth if the sun is directly overhead than if it is closer to the horizon. You may feel this during the course of a day. The slanting rays of early morning and late afternoon light are not as warm as the hot glare of the midday sun. You can see how this works by shining a flashlight at a piece of paper. Hold the flashlight pointing straight down, and draw a line around the circle of light hitting the paper. Now tilt the flashlight, being careful to stay the same distance from the paper, and draw a line around the oval patch of light cast by the flashlight. **Try it!** The amount of light energy is the same in both cases, but the amount of surface area that gets that energy changes. Slanting rays spread out over a larger area, and each bit of land gets relatively less energy.

If Earth's axis were straight up and down in relation to the sun, the amount of the sun's energy to reach each part of Earth would be the same all year long. There would be no seasons. However, Earth's axis tilts, and the direction of the tilt does not change. And the surface of Earth is curved. The sun's energy rays strike different places at different angles during the year. During the winter months, the North Pole is tilted away from the sun, and during the summer months, it is tilted toward the sun. When does the southern half of Earth get the most direct sun?

Some places are usually hot or cold, or wet or dry—from year to year, there is a general weather pattern you can count on. This pattern is known as the **climate**. Climate is determined by the amount of the sun's energy the place gets, its distance from the oceans, wind patterns, and the shape of the land. What climate region do you live in? If you live near the equator, the imaginary line that circles the globe like a belt around a basketball, it is hot all year long. At the North and South poles, it is always cold. Which region do you think gets the most direct sunlight, the equator or the poles? Why?

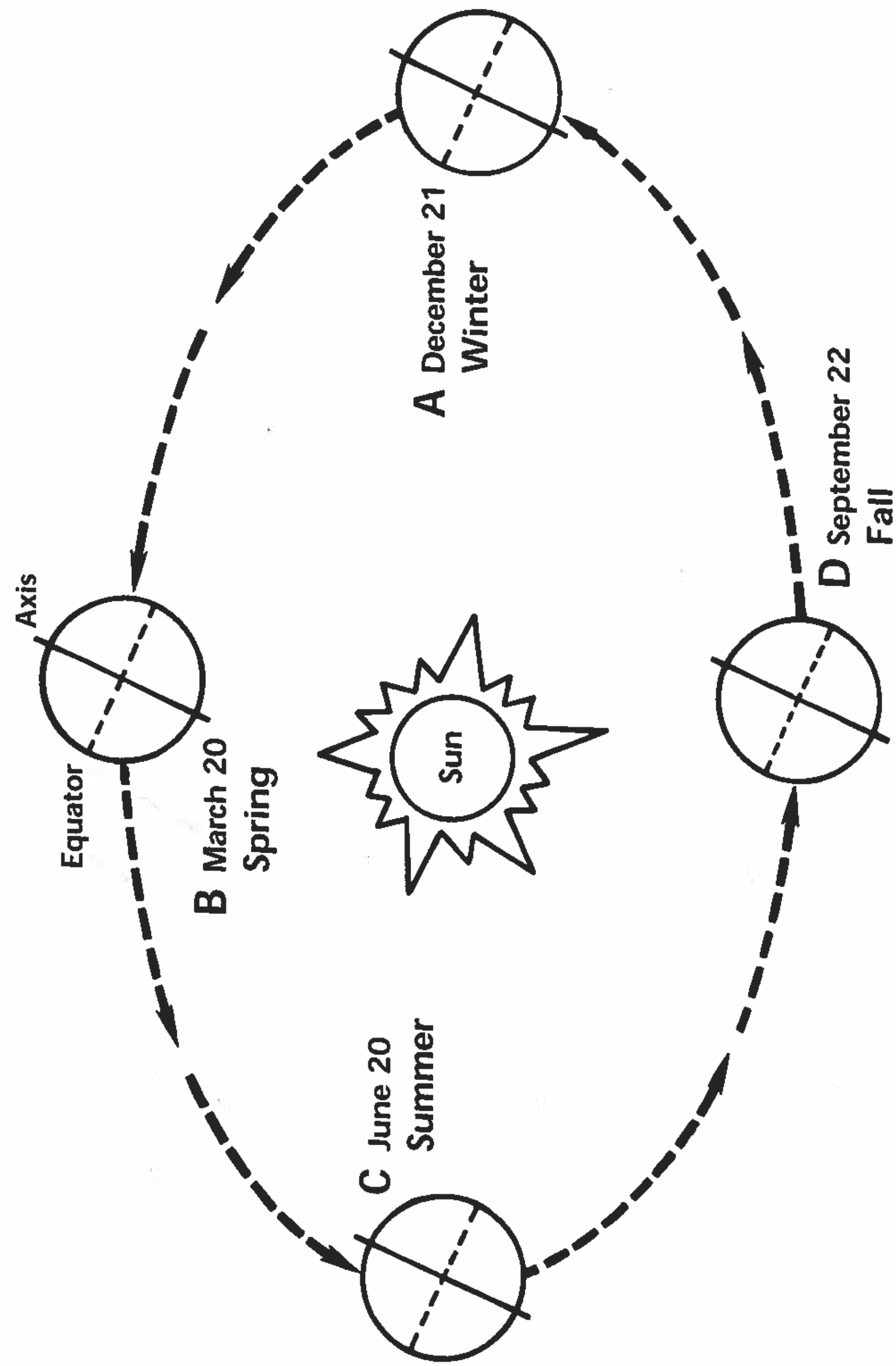
In the temperate regions of the world, weather conditions change as Earth, tilted on its axis, orbits the sun. These changes are the seasons. If you live in Canada, you expect it to get colder in winter, when the North Pole is tilted away from the sun, and the land gets less of the sun's energy. In the summer, the North Pole is tilted toward the sun. Look at a globe. Where else do you think the seasons change during the year? No matter where you live, Earth's rotation, the tilt of its axis, and its year-long orbit around the sun have an effect on your weather and climate.

Name ______________________________ Date ________________

WEATHER

SUN AND THE EARTH

The tilt of the Earth's axis and Earth's revolution around the Sun cause the amount of sunlight striking the Earth to change continually from day to day.



Heating the Earth

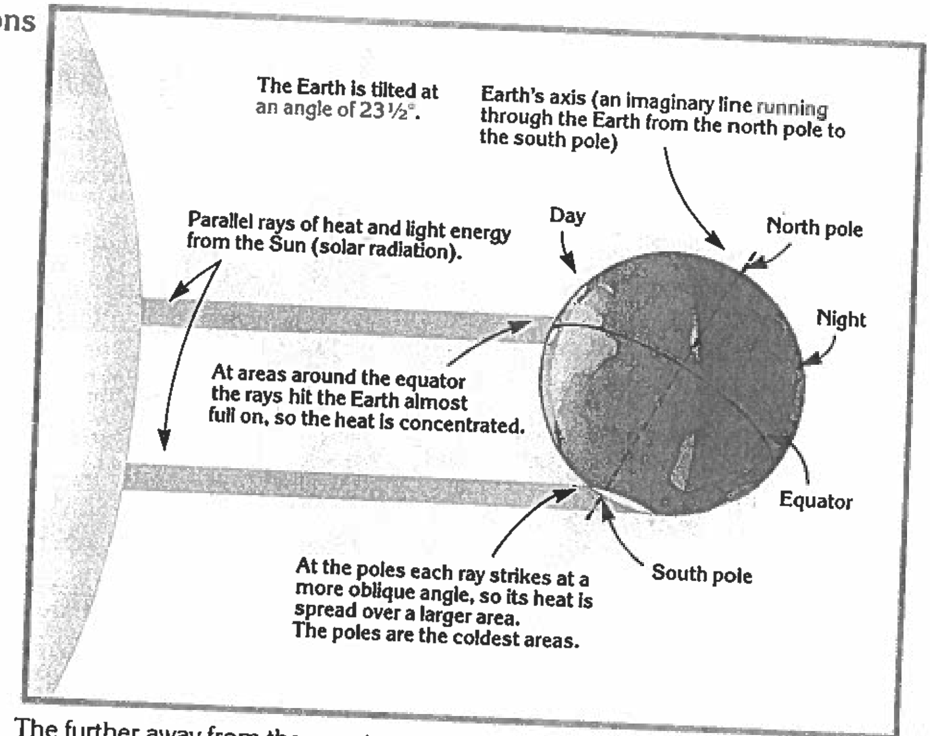
The way that the Sun's rays strike the surface of the Earth is important in determining the temperature of an area. In turn, the amount of heat received by any given area has a direct influence on the weather, as it affects the temperature of the air lying immediately above it.

The Sun's heat and the seasons

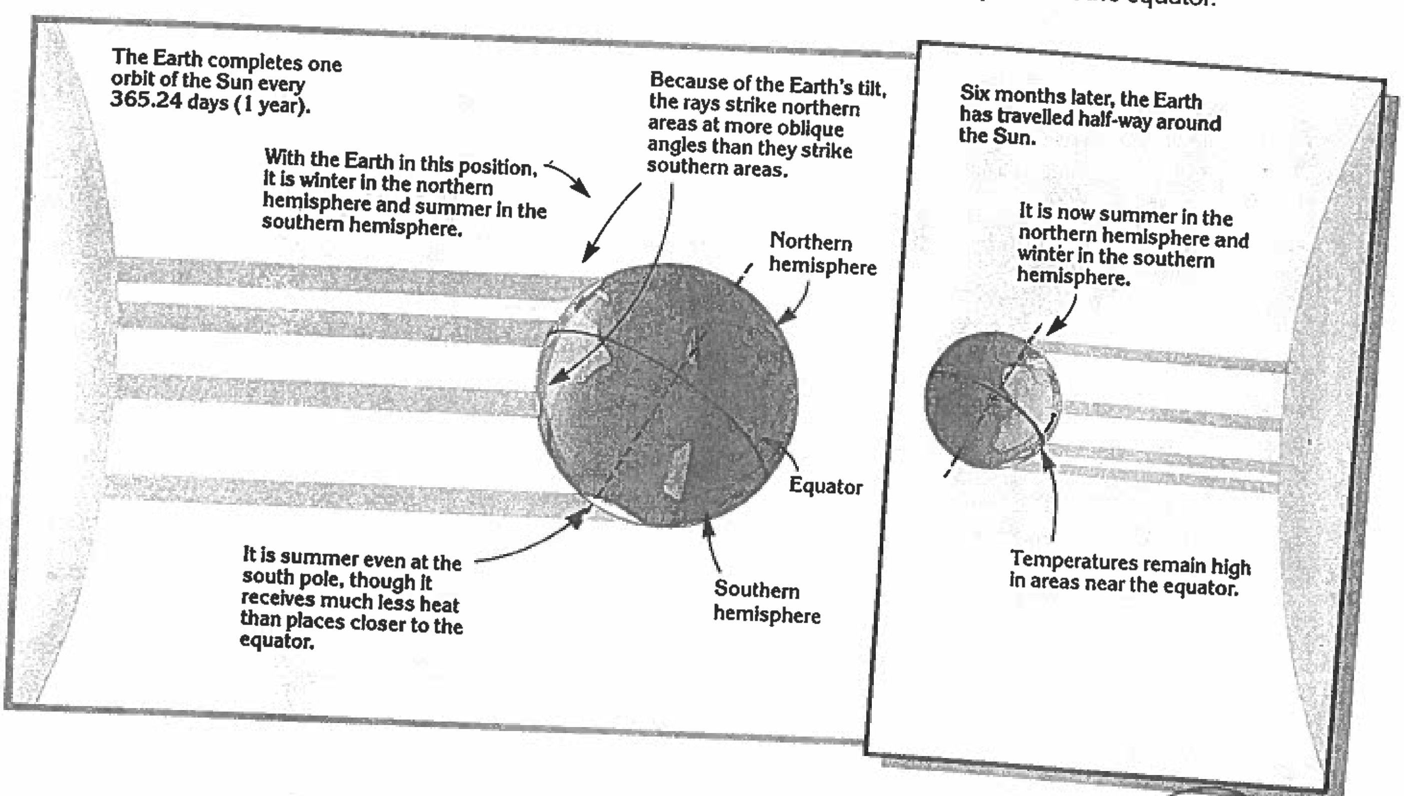
Not all places on the Earth's surface receive the same amount of heat from the Sun. The Earth is tilted at an angle, and its surface is curved, so the parallel rays of the Sun strike some areas full on, and others at more oblique angles.

As the Earth travels around the Sun in its orbit, the effect of its tilt is gradually to change the area which receives the most direct heat. At the start of each orbit, one hemisphere is tilted towards the Sun. After half the orbit (6 months later), the opposite hemisphere is in that position. The change in temperature due to this effect causes the seasons.

Near the equator, the seasons do not have great differences in temperature. The Sun's rays strike almost full-on all year round, so the temperature remains high.



The further away from the equator a place is, the lower its summer and winter temperatures in comparison with places at the equator.



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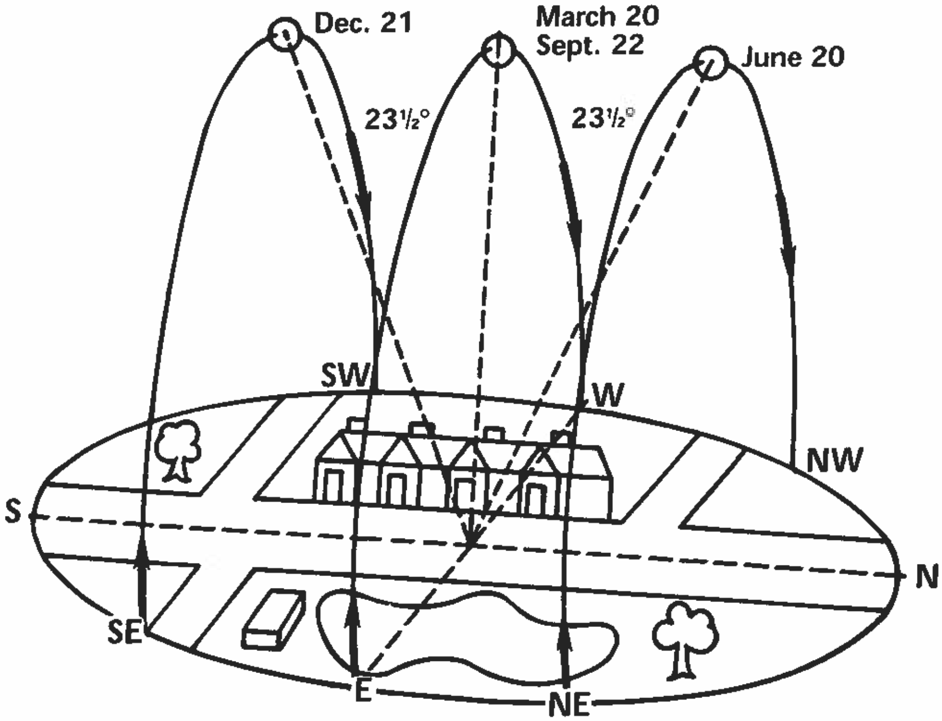
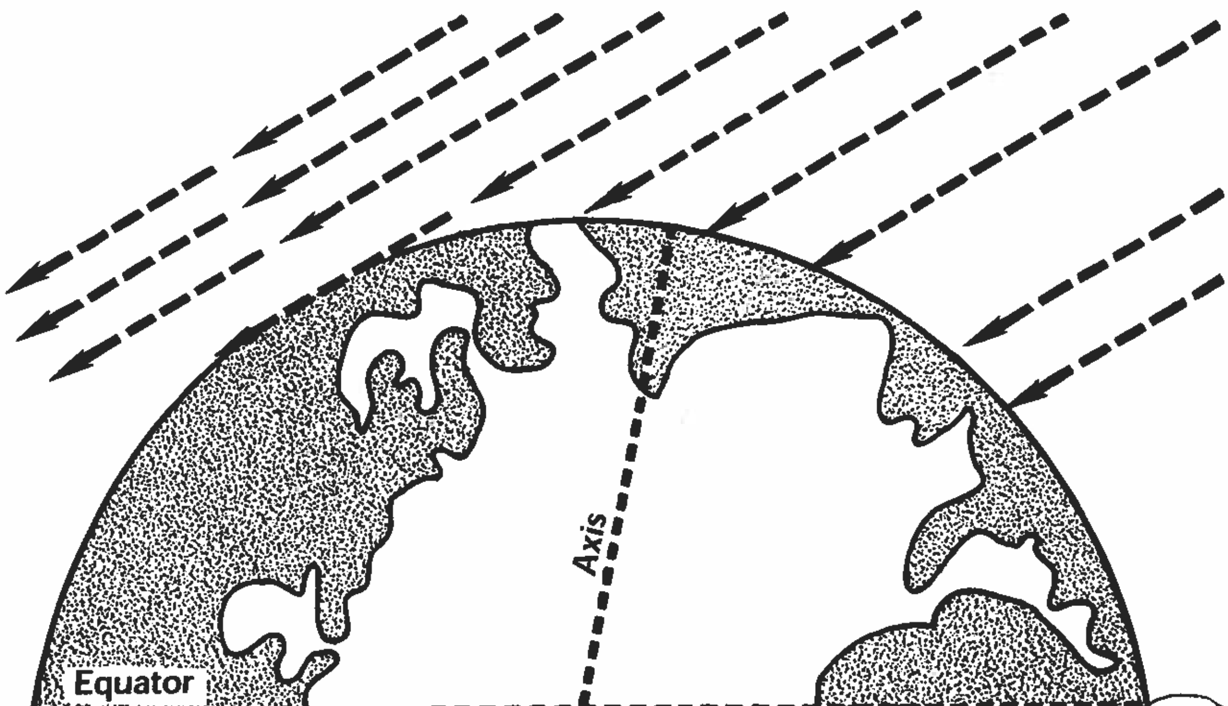
Name ______________________________ Date ______________

Curvature and Characteristics of Earth



Curvature and characteristics of Earth result in uneven heating from the Sun's rays.



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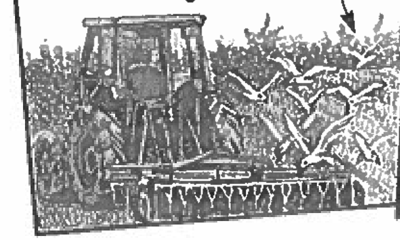
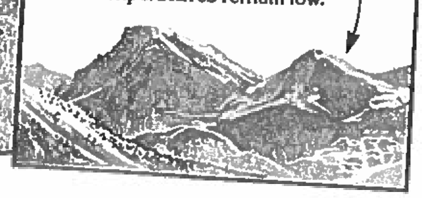
Surface temperatures

As well as some places receiving more solar radiation than others, there are also differences in the amount of this radiation which is absorbed by different surfaces. Forests, sand and bare soil absorb more radiation than surfaces such as snow and ice, which reflect most of it. The temperature of the air in contact with a surface depends on the temperature of that surface.


Bare soil, such as a ploughed field, absorbs a large amount of radiation, heating the surface.


Snow and ice absorb very little solar radiation. Most of it is reflected into the atmosphere.

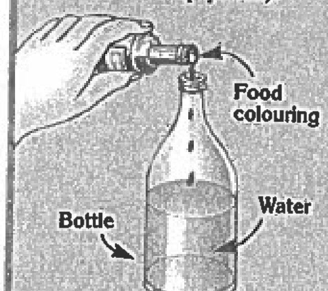
Air temperatures remain low.

A bottle fountain

A bottle fountain shows how heated air expands. To make one, you will need a glass bottle with a plastic screw-top, a corkscrew, some food colouring, a straw, some sticky putty* and a needle.

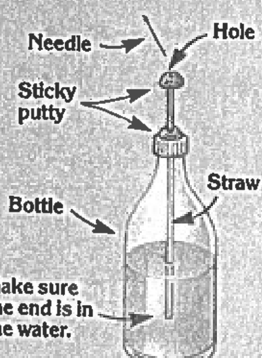
What to do

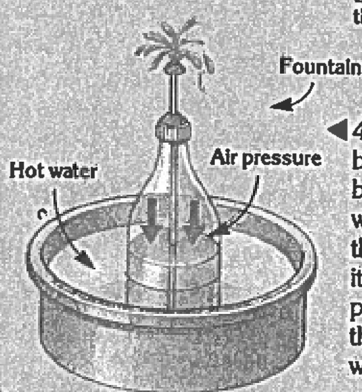
1. Make a hole in the bottle top using a corkscrew (be careful with the sharp point). ▶



◀ 2. Half fill the bottle with cold water. Add a few drops of food colouring.

3. Screw the top tightly onto the bottle. Push the straw through the hole and seal around it with some sticky putty. Make a plug of sticky putty in the top of the straw. Use a needle to pierce a hole down through the plug. ▶





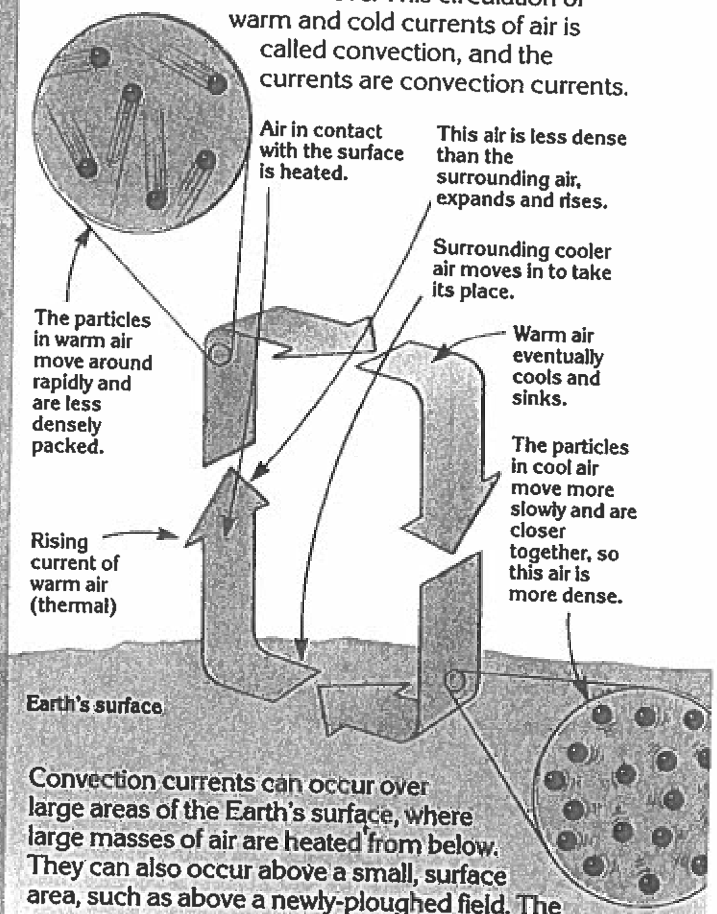
◀ 4. Carefully put the bottle in a deep bowl of very hot water. As the air in the bottle is heated, it expands and pushes down on the water, forcing water out of the straw.

* Sticky putty is used for sticking paper or posters to walls.

Air temperatures

The Earth's surface is mainly heated by the absorption of solar radiation (see page 4). Where areas of the surface are warmer than the layer of air immediately above them, this air is heated.

Warmed air expands, becomes less dense and rises. Surrounding cooler air moves in to replace the rising warm air. The warm air cools as it rises, becomes denser again and eventually stops rising. It sinks back to Earth, where it may be heated again if the surface is still warmer than the air above. This circulation of warm and cold currents of air is called convection, and the currents are convection currents.



Convection currents can occur over large areas of the Earth's surface, where large masses of air are heated from below. They can also occur above a small, surface area, such as above a newly-ploughed field. The currents of rising warm air are called thermals.

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Factors of Weather: Air Pressure

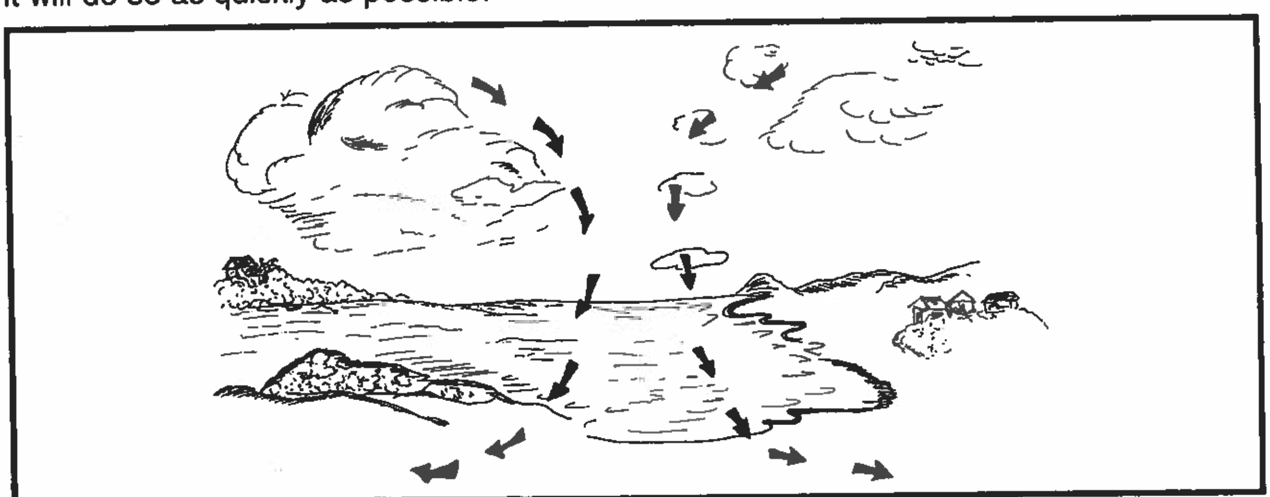
Weather is the condition of the air around the Earth. It develops in the atmosphere that surrounds the Earth. Weather changes from day to day and even from hour to hour. There are several factors that determine the weather. Let's take a look at one of these factors: air pressure.

Remember that air is matter. All matter has mass and takes up space, so air has mass and takes up space. (You proved that fact if you did the experiment on page 6.) Weight is the measure of gravity acting on matter. Gravity acts on air by pulling it and holding it as close to the Earth's surface as possible. The weight of the air being pulled down on an area of the Earth's surface is called air pressure.

Air pressure is affected by two things. First, it is affected by the amount of air above it. Imagine that you are lying on the floor. Someone puts a book on your stomach (a science book, of course). You feel the weight of the book. We will call that "book pressure." If someone adds two more books, you feel more "book pressure." If someone adds ten more books, you feel a lot more "book pressure." The same idea is true for air pressure. If you are at the top of a mountain, there is not much air above you, so the air pressure is low. If you move down into a valley, there is a lot more air above you, so the air pressure is greater.

Air pressure is also affected by temperature. Warm air weighs less than the same amount of cold air because the particles of air are farther away from each other. Cold air weighs more than the same amount of warm air because the particles of air are closer to each other. Because warm air weighs less, warm air has less air pressure. Because cold air weighs more, cold air has greater air pressure.

Air pressure changes, sometimes very quickly. Imagine that you are in a very small room with many classmates. You are all standing elbow-to-elbow, pushed against each other and against the walls. You are in an area of high pressure. Suddenly, someone opens a door to a very large room. You would want to move into the larger room where you would have enough space to be comfortable. You would want to move to an area with less pressure, and the sooner you could get there the better! The same idea is true for air particles. Air wants to move from an area of high pressure to an area of low pressure, and it will do so as quickly as possible.

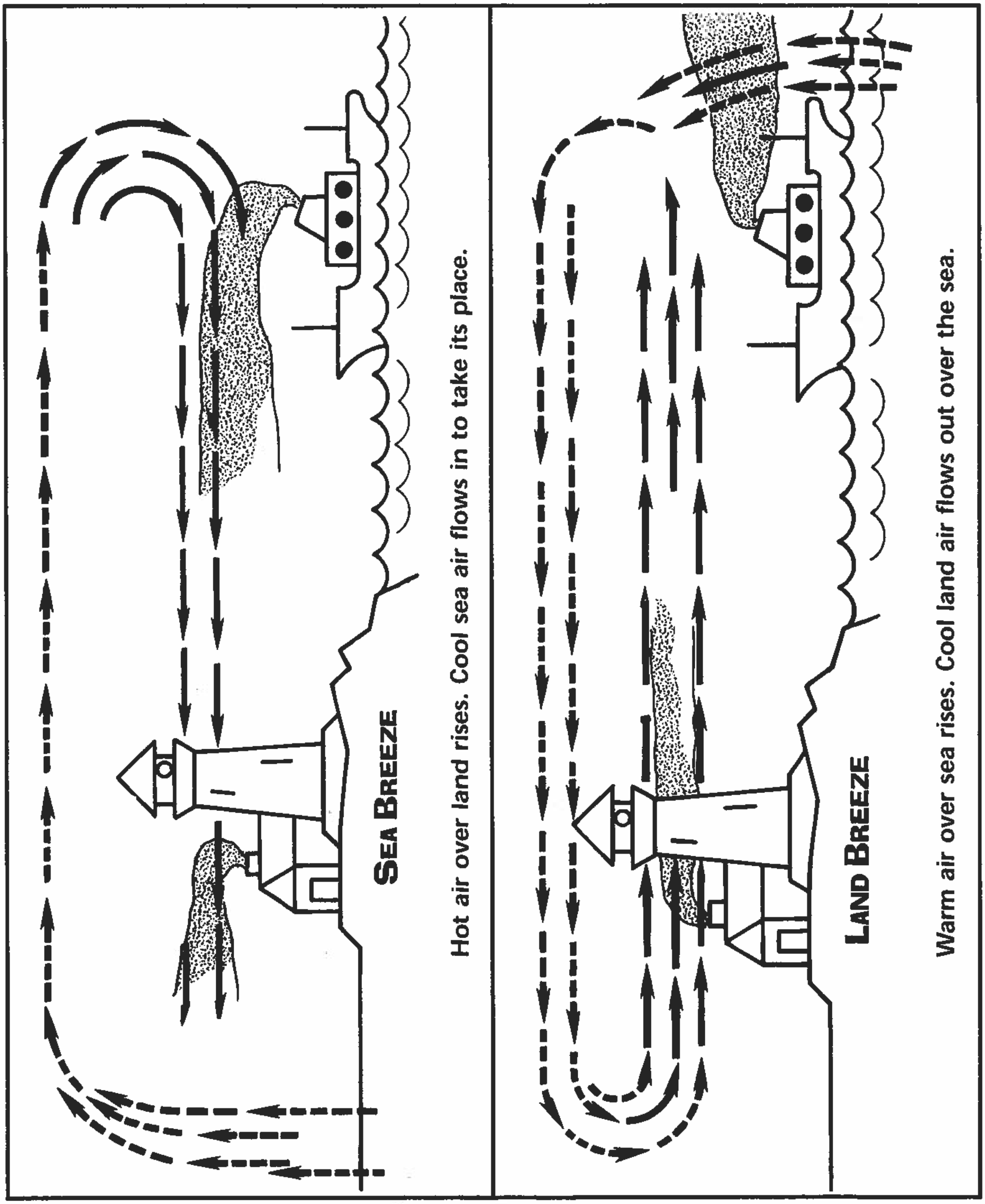


Air moves from an area of high pressure (top) to an area of lower pressure (bottom).

Name ______________________________ Date ______________________

WEATHER

SEA AND LAND BREEZES



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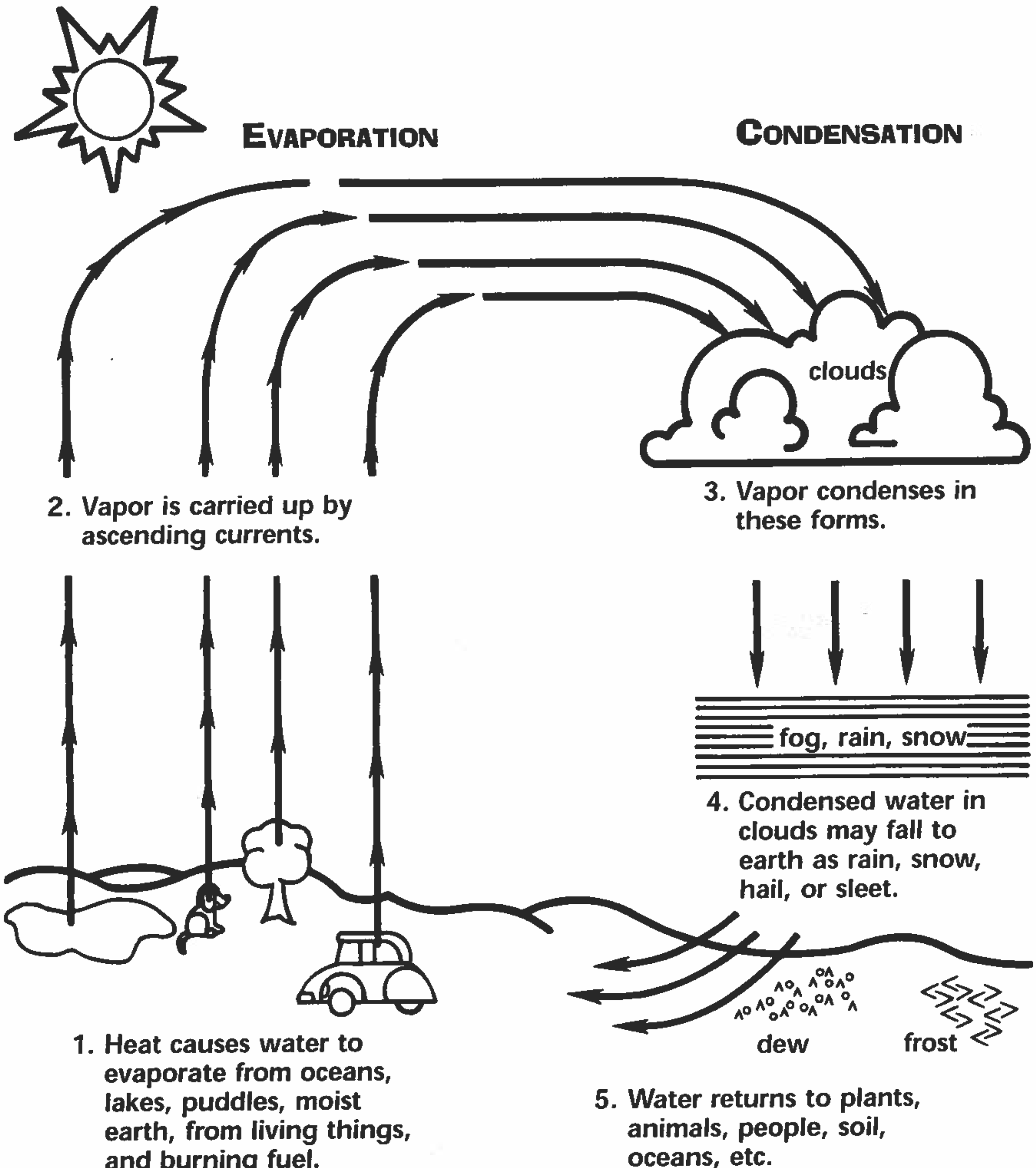
WEATHER

THE WATER CYCLE

HOW WATER ENTERS AND LEAVES THE ATMOSPHERE



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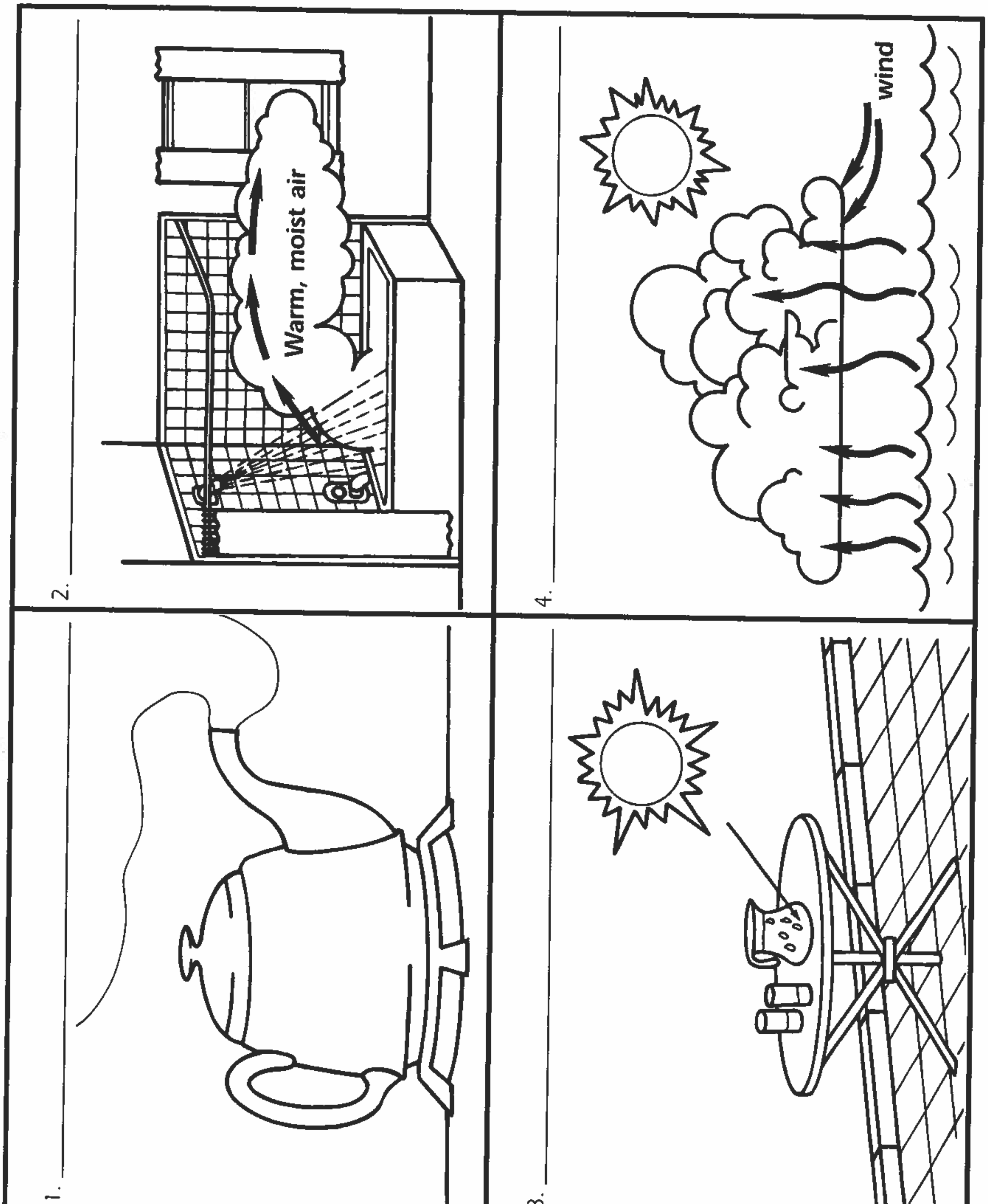
WEATHER

Causes of Evaporation and Condensation

Label each picture as an example of either evaporation or condensation.



Factors of Weather: Moisture
Basic Types of Clouds

Clouds are collections of tiny droplets of water or particles of ice that float in the air. Clouds form when water vapor molecules condense.

Meteorologists classify clouds into three basic groups according to their shapes and the heights at which they form: stratus, cumulus, and cirrus.

Stratus clouds form at altitudes below two kilometers. They are flat layers of gray clouds that are made of water droplets. Stratus clouds may be only a few hundred meters thick, but they may cover great distances. Stratus clouds do not form individual cloud units. They seem to blanket the Earth, allowing almost no sunshine to get through. These clouds may be responsible for long periods of drizzling rain or snow.

A stratus cloud that forms close to the ground is called fog. Fog is common near large bodies of water, which, of course, contain large amounts of moisture. If the air temperature falls below the dew point and the air is still, the water vapor condenses and becomes fog. Fog may also form when warm, moist air layers move over cold surfaces.

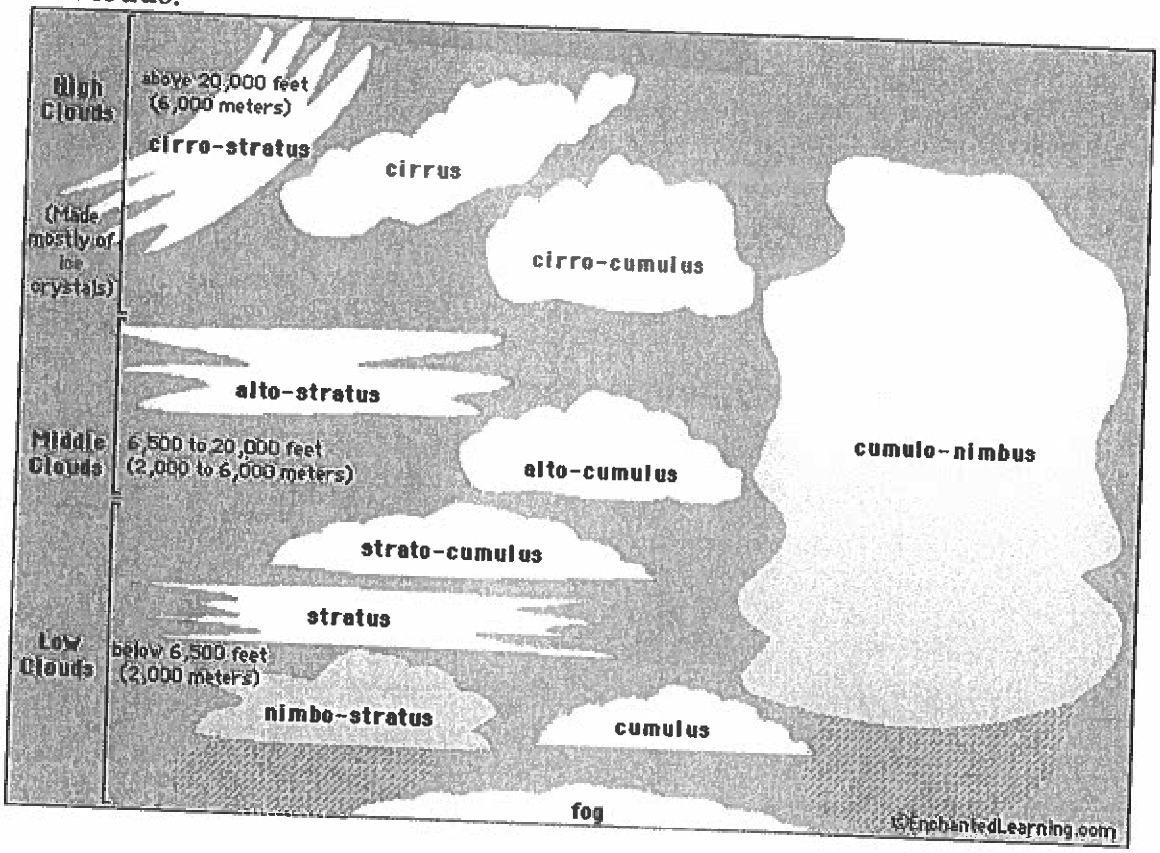
Cumulus clouds are large, puffy, white clouds that may have gray centers. They have bases that form below two kilometers, but they may go upwards for thousands of meters into the atmosphere. Cumulus clouds often have interesting shapes that change continuously. Cumulus clouds may be associated with fair weather or with snow showers and thunderstorms.

The highest clouds are known as cirrus clouds. They are feathery, white clouds made of ice crystals. They form above six kilometers in the atmosphere and may be seen during any season. They are usually associated with fair weather.

Any cloud that produces precipitation is called a nimbo or nimbus. Some clouds are combinations of the three basic cloud types. Cirrocumulus clouds are puffy clouds found at high altitudes. Cumulonimbus clouds are puffy "thunderheads" that produce thunderstorms. Stratocumulus clouds are large, rounded cloud masses found close to the ground.

Cumulonimbus clouds, sometimes called "thunderheads," produce thunderstorms that precipitate large amounts of rain, and often, hail.

Types of Clouds:



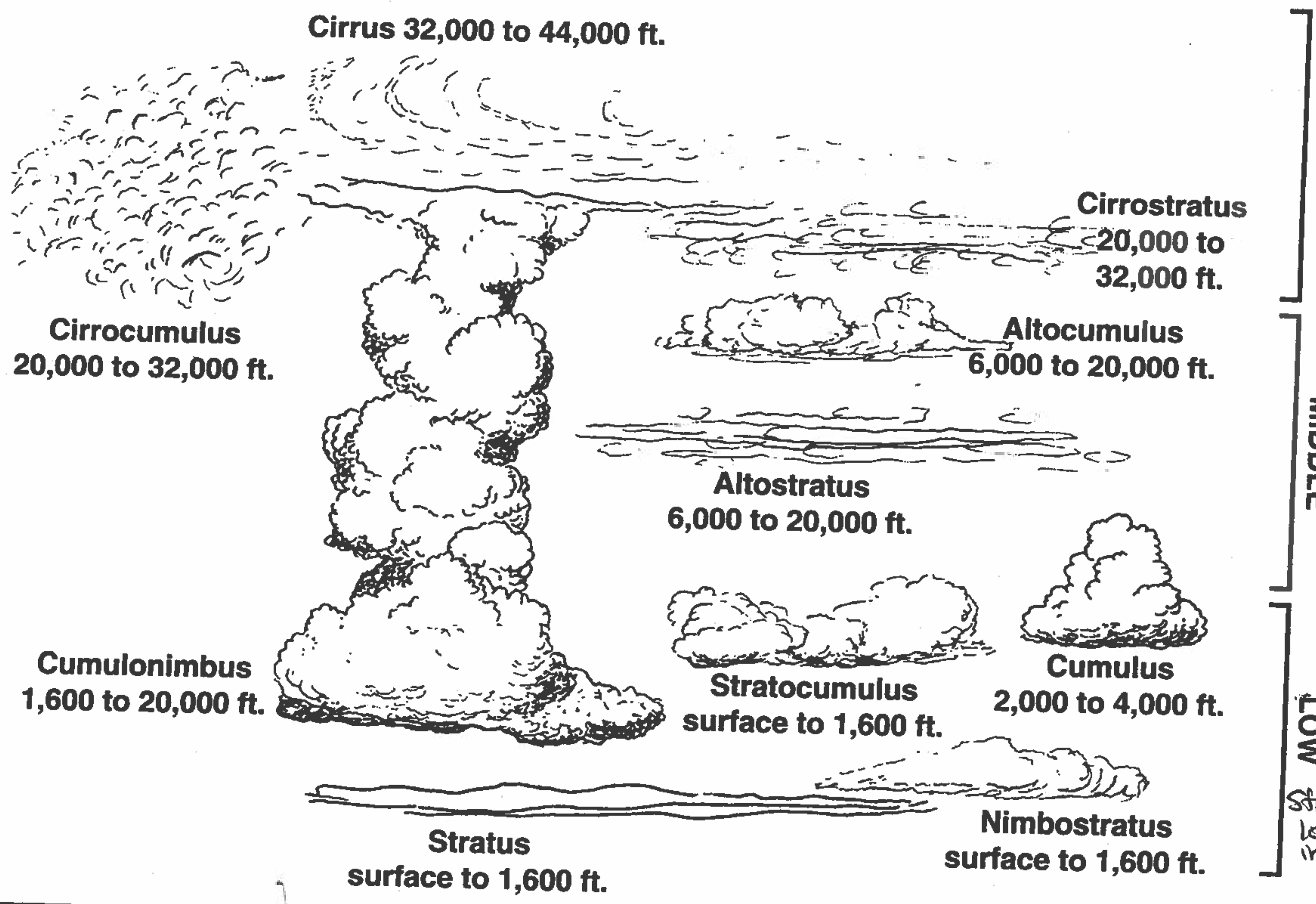
Prefixes and Suffixes Used to Describe Clouds:
Clouds are defined by both the way they look and how high they are in the atmosphere. For example, **cirro** (meaning "wisp of hair") is a prefix given to high-altitude clouds (above 20,000 feet). **Alto** (meaning "high") is a prefix given to mid-altitude clouds (between 6,000 and 20,000 feet). There is no prefix for low-altitude clouds. When clouds are by the ground we call them fog.

Nimbo (meaning "rain") as a prefix, or nimbus added as a suffix, in a cloud name indicates that the cloud can produce precipitation (rain, snow, or other forms of falling water). **Cumulo** (meaning "heap") refers to piled-up clouds. **Strato** (meaning "layer") refers to flat wide layered clouds.

alto-cumulus - Middle-level, medium-sized puffy clouds.
alto-stratus - Middle-level, layered clouds.
cirro-cumulus - High-altitude, small, wispy, patchy, puffy clouds.
cirro-stratus - High-altitude, thin, wispy clouds in layers.
cirrus - High-altitude, thin, wispy clouds.
cumulo-nimbus- Large, dense, towering clouds that cause thunderstorms.
cumulus - Low, puffy clouds.
fog - Ground-hugging clouds.
nimbo-stratus - Low, dark, rain cloud.
stratus - Low, layered, horizontal, wispy clouds with a flat base.
strato-cumulus - Low clouds, broad and flat on the bottom, puffy on top

* Nimbus–
clouds with the word nimbus in ... air name bring precipitation.

A Diagram: Basic Types of Clouds



Cumulus– look puffy, like a pile of cotton balls, and have flat bottoms (clear days with blue skies)
Cirrus– are thin and look like curls of hair, they are usually high in the sky (usually means change of weather

Changes in Weather: Fronts

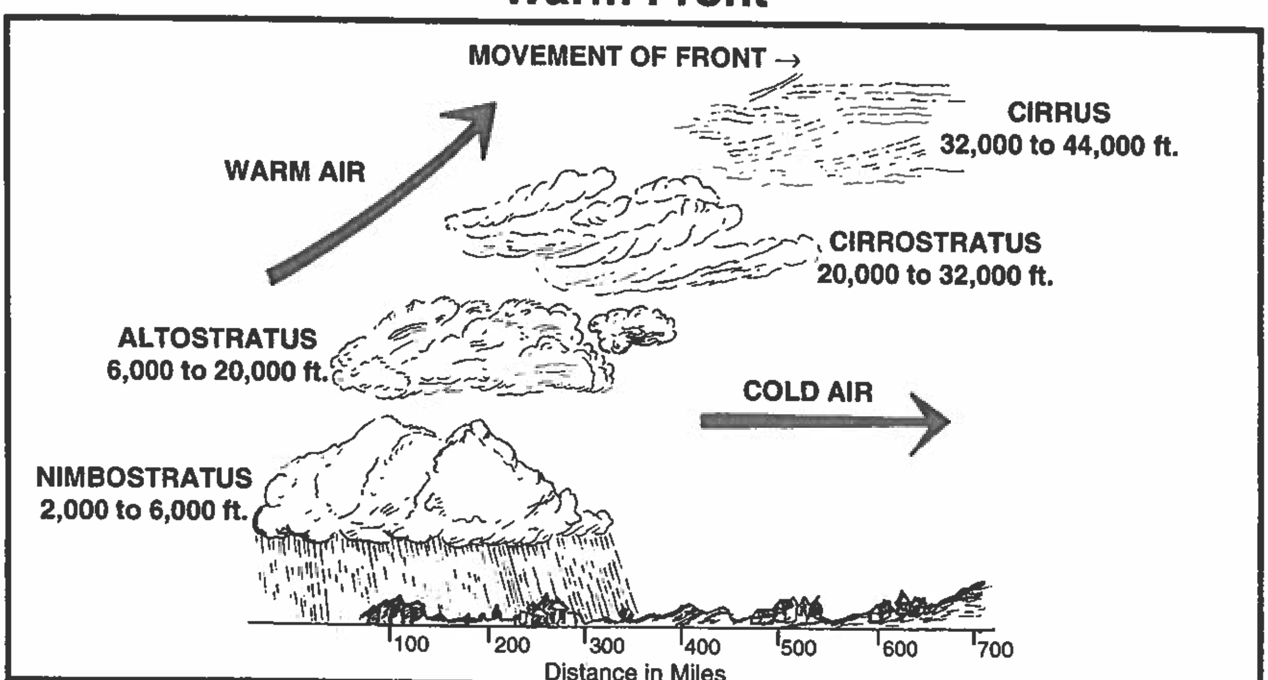
Air masses are large bodies of air that form over land or oceans. Air masses take on the characteristics of the areas over which they form. Air masses move, but they do not mix. The boundary where two different air masses meet is called a front. There are three basic kinds of fronts: a warm front, a cold front, and an occluded front. Fronts are usually associated with bad weather, clouds, and precipitation.

When a warm air mass meets up with a cold air mass, a warm front is formed. Because the warm air is less dense than the colder air, the warm air mass rises above the cold air mass in a gently sloping effect. The first indicator of an arriving warm front may be cirrus clouds forming high in the sky. As the warm, rising air begins to cool, thicker and lower clouds may move into the area. There may be extended periods of snow or rain falling from nimbostratus clouds. As the warm front passes through, temperatures may rise.

When a cold air mass meets up with a warm air mass, a cold front is formed. The denser, cooler air entering the area pushes the warmer air upwards at a rapid pace. The quickly rising, warm, moist air may form cumulus and cumulonimbus clouds. These clouds may produce relatively short periods of severe rain or snow. As the cold front passes through, temperatures may drop, winds may change directions, and the barometer may begin to rise.

Cold fronts move more quickly than warm fronts. They may even be twice as fast. Sometimes a cold front may overtake a warm front. When these fronts collide, they form an occluded front. Weather in this occluded front has some characteristics of both a warm front and a cold front. Periods of heavy thunderstorms and snowstorms may follow behind light rain or snow.

Warm Front



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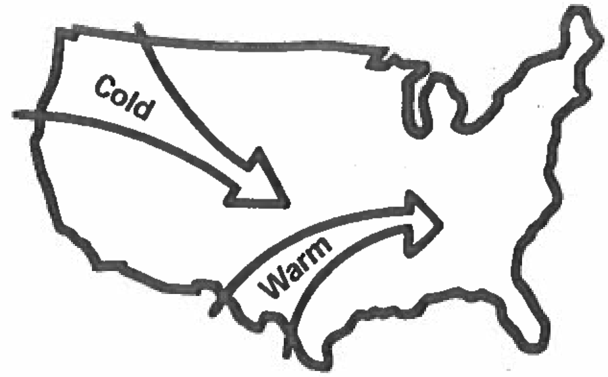
WEATHER

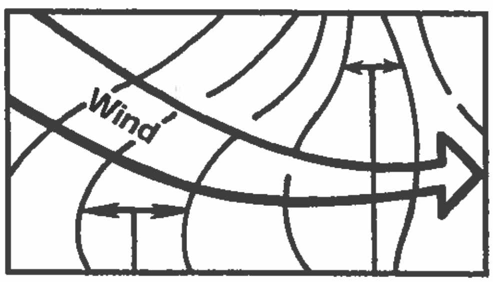
Weather Map Symbols

Weather moves from west to east, about 500 miles a day. It moves faster in the winter.



High, cold air travels faster than low, warm air. Both follow the general paths shown here.

Isobars: Lines drawn through points of equal barometric pressure.



Isobars far apart mean mild winds

Isobars close mean strong winds

Rain — Scattered Showers

Snow — Flurries

○ clear ● cloudy (H) high pressure area

◑ partly cloudy (R) rain (L) low pressure area

Fronts

A cold air mass is moving in the direction of the arrows. It often brings storms and cooler weather.

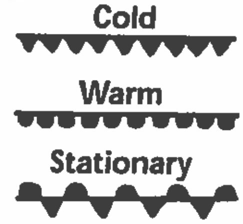
A warm air mass moving in the direction of half circles is usually preceded by rain or snow.

A line between two air masses when there is little or no movement means unsettled weather—often prolonged rain.

Low pressure cells move in a counterclockwise direction. They usually forecast cloudiness and precipitation.

High pressure cells move in a clockwise direction. They usually forecast clear skies.

The line of contact between air masses of different temperatures is a front.



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Weather Forecasting: Weather Maps

The National Weather Service issues weather forecast maps. They develop national weather maps, continental weather maps, and global weather maps.

There are different kinds of weather maps. Surface weather maps provide information about the present weather conditions for an area. These weather maps locate and identify fronts, areas of high and low pressure, and temperatures. Isotherms are lines drawn on a weather map connecting places with the same temperature. Isobars are lines on a weather map that connect areas with the same air pressure. The isobars on a weather map correlate to wind strength. When isobars are close together, the winds are strong. When the isobars are spaced farther apart, the winds are much gentler.

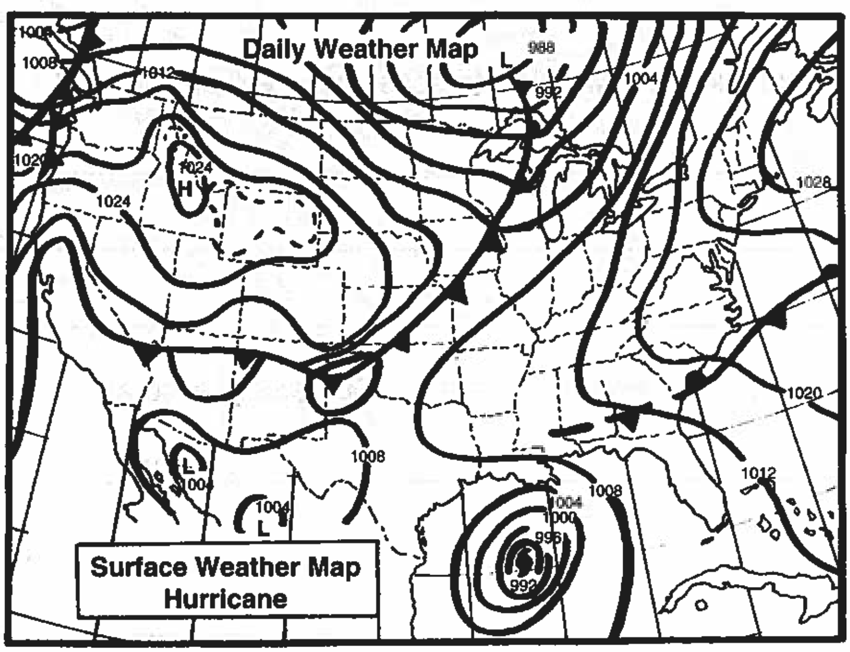
Surface weather maps also include data from weather station reports. These stations use internationally accepted symbols to represent such factors as wind speed and direction, temperature, types of clouds and amount of cloud cover, types and amounts of precipitation, and barometric tendancy.

Forecast weather maps are used to demonstrate the predicted changes in the weather. Computers generate many of these maps after carefully analyzing weather data using complex formulas.

There are short term and long term weather forecast maps. Short term forecasts indicate the weather for the following 18–36 hours. This information is updated often to include the most accurate information possible.

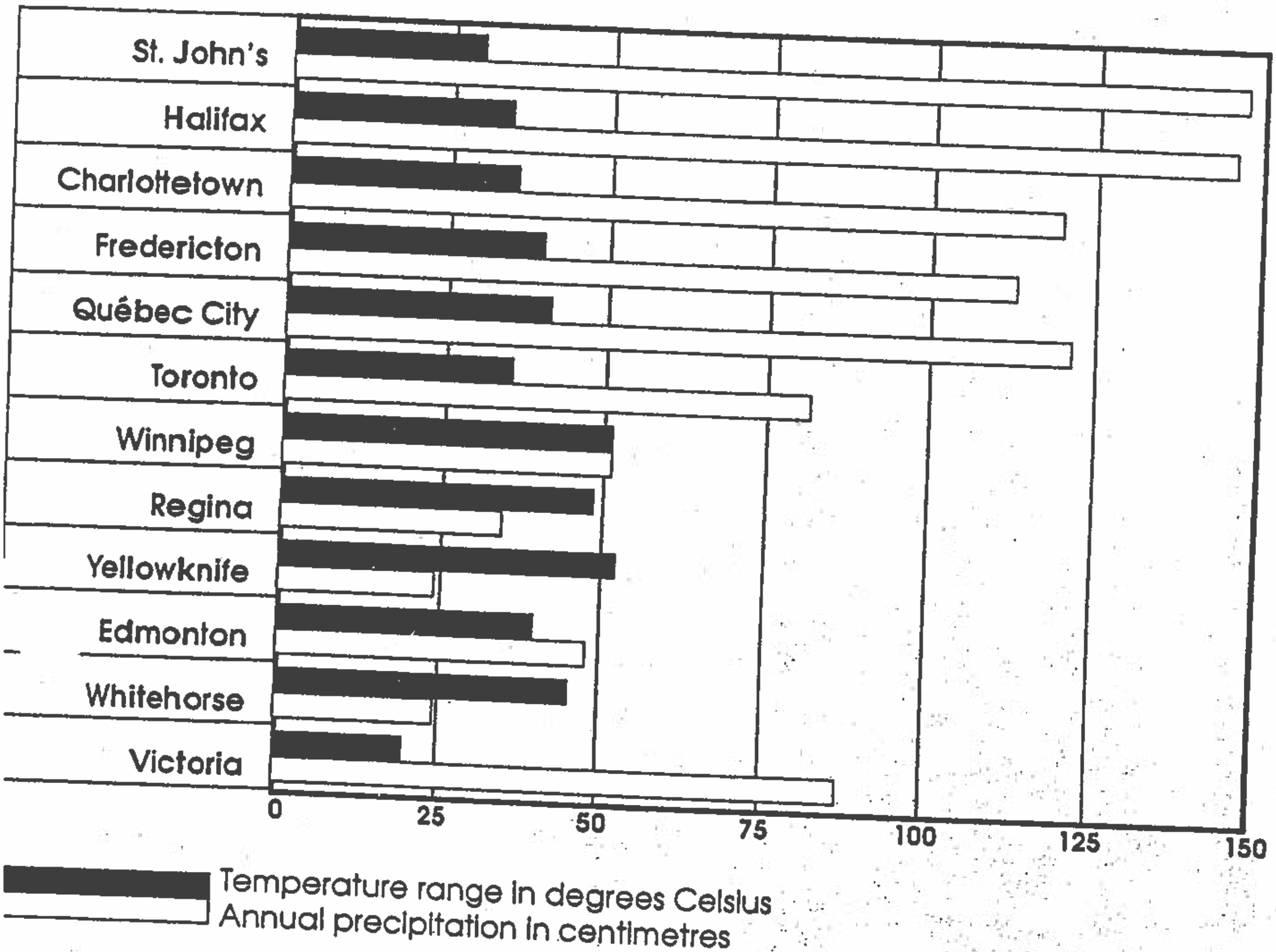
Long range forecasts may be for the following five days. These maps are updated daily. They may also cover the weather for the following 6–10 days. This information is updated three times a week. Meteorologists also develop 30-day forecasts, which are updated twice a month.

Weather maps are important tools for developing and explaining weather forecasts. Weather conditions, however, change very rapidly, so weather forecasts may not always be accurate. They are, at best, close guesses of what the weather should be for a certain period of time. The shorter that period of time, the more accurate the forecast should be.



#14b Worksheet PRECIPITATION AND TEMPERATURE

The bar graph below shows the precipitation and temperature ranges for most of the capital cities of Canada.



Weather Forecasting: The Tools

Weather forecasts have become an important part of the lives of many people. They are able to plan their clothing, their activities, their work, and their travel based on the forecasts. How do meteorologists develop these forecasts? They collect weather information from three basic sources: observation stations, weather balloons, and satellites.

Observation stations are set up all around the world. There are more than 3,500 such stations. On an hourly basis, special instruments are used to collect weather data. Thermometers measure air temperature, barometers measure air pressure, and weather vanes and anemometers measure wind direction and speed. Hygrometers measure relative humidity, while rain gauges measure precipitation in the form of rainfall. Radar may also be used to track precipitation. It will indicate the direction and speed at which storms are traveling. Radar is also helpful in determining the type of precipitation.

There are more than 800 stations that send up two weather balloons each on a daily basis. These balloons contain hydrogen or helium and carry radiosondes to measure air temperature, air pressure, and humidity at various levels in the atmosphere. Wind direction and speed may also be determined by tracking the weather balloons. These balloons rise to approximately 90,000 feet (27,000 meters), and then they burst. Small parachutes open and bring the radiosondes back to Earth.

Many weather satellites are equipped with television cameras. They are able to photograph cloud patterns as well as large areas of snow and ice. Satellite data is analyzed to identify hurricanes and other dangerous storms as they develop. Satellites are also able to gather data on temperature and humidity. They are able to follow cloud movements to determine wind directions and speeds.

There are two types of weather satellites: polar-orbitting and geosynchronous or geostationary. Polar-orbitting satellites maintain an altitude of 500–900 miles (800–1400 kilometers) above the Earth's surface. They orbit the poles and view different parts of the planet with each orbit. Geosynchronous satellites are in orbit at an altitude of approximately 22,300 miles (35,890 kilometers). These satellites move along with the Earth, always focusing on the same portion of the planet. At that height, only four correctly placed satellites are needed to view the entire surface of the planet.

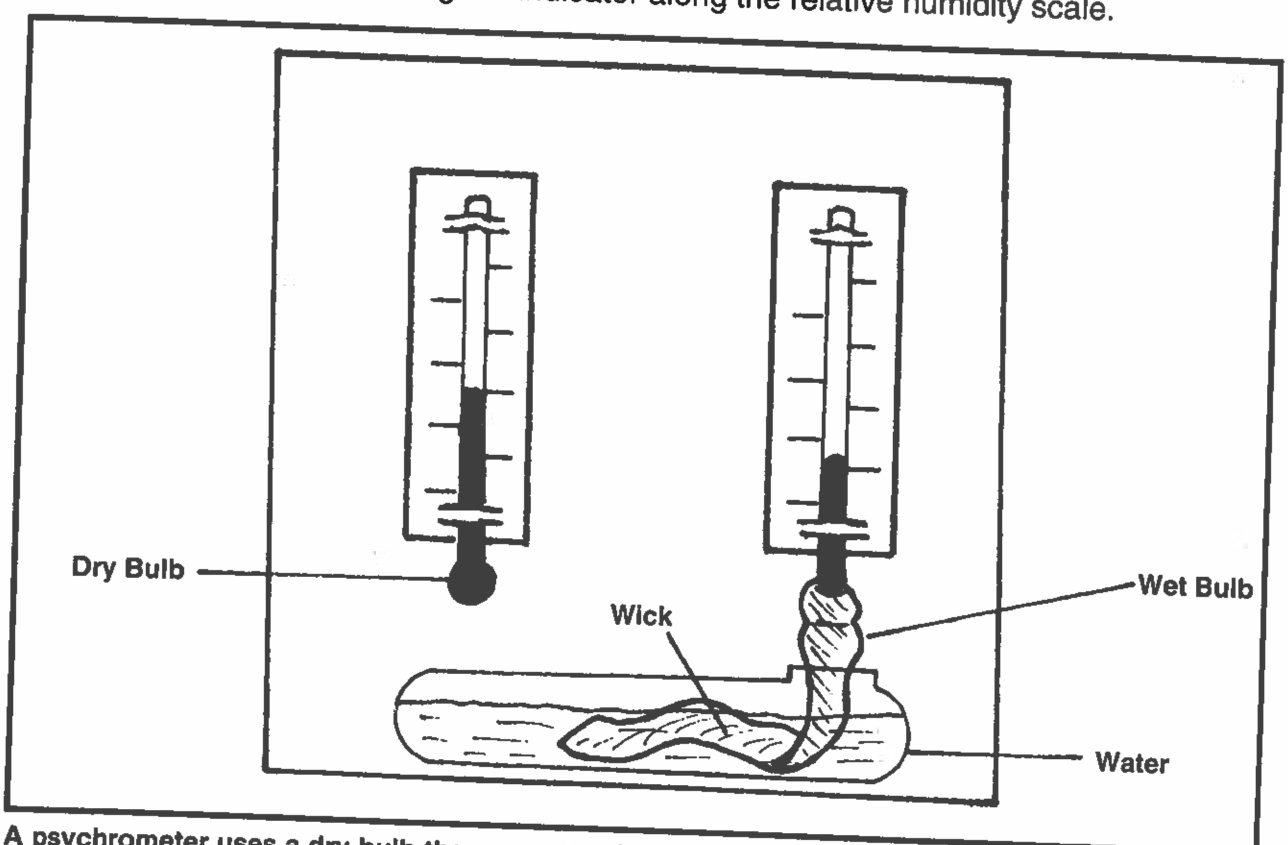
Meteorologists may also use weather planes and ships to gather important data for developing their forecasts.

Measuring Moisture: A Hygrometer

Relative humidity is the amount of water vapor a volume of air is holding, compared to the total amount it could hold at that temperature. Relative humidity can be determined with an instrument called a hygrometer. There are two basic types of hygrometers: a psychrometer and a hair hygrometer.

A psychrometer consists of two thermometers attached to the same frame. One thermometer bulb is covered with a tightly fitted cloth sack that is moistened, usually with water. This is known as the wet bulb. The other thermometer is known as the dry bulb. A psychrometer is either whirled through the air or set by a fan. The air movement causes the moisture in the cloth wrapped around the wet bulb to evaporate. The rate at which the water evaporates depends on the humidity of the area. In dry areas, the water will evaporate more quickly, cooling the bulb. Moist areas will cause the water to evaporate more slowly, also slowing the cooling process. Unless the air is saturated—100 percent humidity—the wet bulb will record a lower temperature than the dry bulb. A special chart can be used to convert the wet/dry bulb thermometer readings to relative humidity.

A hair hygrometer uses a bundle of human hairs that are attached to a lever. The lever moves an indicator along a scale. As human hairs absorb moisture, they lengthen. When human hairs lose moisture, they shorten. (Think about your hair after you have washed it. As your hair dries, it seems to shorten up!) When the hairs lengthen or shorten, the lever rises or falls, moving the indicator along the relative humidity scale.



A psychrometer uses a dry bulb thermometer and a wet bulb thermometer to measure the relative humidity in the air.

Weather Unit Glossary

Wind: the natural movement of air parallel to the Earth's surface.

Atmosphere: the layers of the air that surrounds the earth.

Weather: the condition of the air around the earth (atmosphere).

Temperature: a measure of how hot or cold something is.

Thermometer: a tool used to measure temperature.

Clouds: a large mass of water droplets or ice crystals in the air.

Humidity: a measure of the amount of water vapour in the air.

Precipitation: water that falls from the sky either in liquid or solid form: rain, snow, sleet, or hail.

Cirrus: clouds that are this and look like curls of hair.

Cumulus: clouds that look puffy with flat bottoms.

Stratus: clouds that are flat and form layers low in the sky.

Fog: stratus clouds that are on the ground.

Meteorology: the scientific study of weather.

Forecast: a prediction of what the weather may be in advance or ahead of time.

Weather vane: a device that shows wind direction.

Wind rose: a graph that illustrates the direction and speed of the wind in an area.

Anemometer: a weather tool used to measure wind speed.

Equinox: when the sun is directly over the equator it is called an equinox; this happens twice a year at the beginning of fall and spring seasons

Solstice: When the sun is directly over the Tropic of Cancer (northern hemisphere) or Tropic of Capricorn (southern hemisphere) it is called the solstice; this begins the summer or winter seasons.

Air pressure: the weight of the air pushing downward on the Earth. This is air pressure.

Barometer: a weather tool that measures air pressure.

Weather balloons: a thin, large balloon that is released into the sky to gather information about the weather and send it to weather stations.

Radar: a device that uses radio waves to locate objects and determine their speeds.

Weather satellites: a device that is launched into space that orbits and takes pictures of the earth; it shows where the clouds are and how they are moving.

Weather map: a map that summarizes information about weather across various locations.

Thunderstorms: a storm with strong winds, rain, lightening, and thunder.

Flood: an overflow of water that occurs when a large amount of rain falls in a short period of time, when there is more snow than usual or snow melts too quickly, or when ice jams a river.

Drought: occurs when an area receives less rain than usual over many months or years.

Hurricanes: a severe storm that forms over an ocean; has violent winds and heavy rain.

Tornado: a violent storm of whirling winds that often includes a funnel-shaped cloud.

Weather watch: an alert that severe weather could develop in an area.

Weather warning: an alert that severe weather is happening or about to happen.

Wind chill: when air temperature feels lower than it actually really is because of cold winds blowing warm air away from the body.

Ozone layer: the thin layer of ozone gas in Earth's atmosphere which protects the Earth From ultra violet rays.