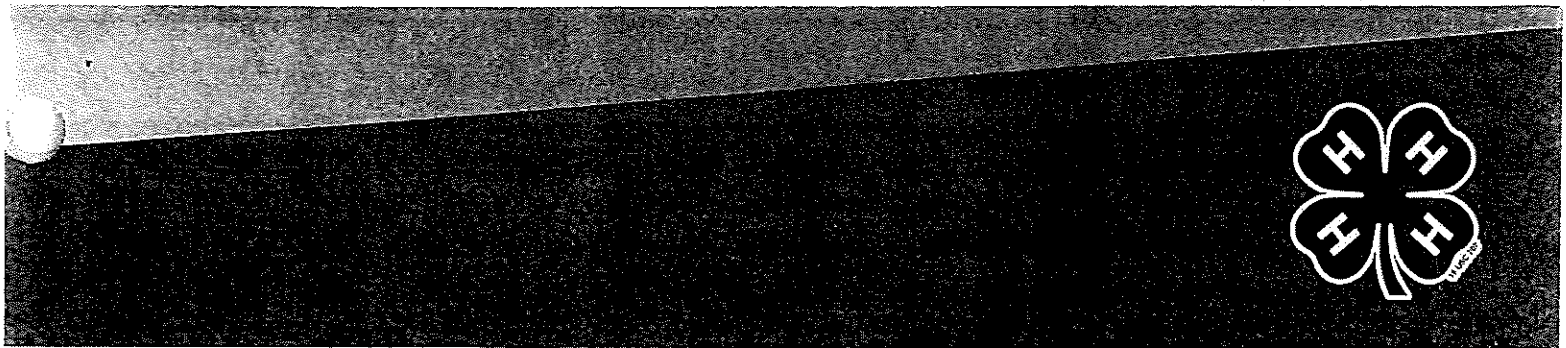
PURDUE EXTENSION

4-H-1023 LEVEL 1

WEATHER & CLIMATE SCIENCE

4-H Member Name_____

Club Name_____



WEATHER AND CLIMATE SCIENCE

Science • Level 1 • Grades 3–5

Note to the 4-H Member

Everyone seems interested in the weather. We need to know what the weather will be so we can dress appropriately. That helps us plan our day. Gardeners and farmers need to understand the area's climate. That helps them know what they can plant and what will grow. Homeowners also need to understand our climate. It helps them know which flowers and shrubs to plant around their houses. It also tells them what kind of furnace and air conditioner will work best in this area. And when stormy weather is predicted, people need to be prepared. It is important that they know how to be safe in bad weather, whether they are in their homes or outside.

LEARNING ABOUT WEATHER AND CLIMATE

The Level 1 4-H Weather and Climate Science manual introduces basic weather words and ideas. These activities focus on understanding the signs of weather around you. You will also begin to learn the difference between weather and climate and how these ideas are related.

When you are in grades 6-8, you will use the Level 2 manual. It will introduce you to more complex weather topics. You will learn about air pressure, winds, humidity, and fronts.

When you are in high school, you will use the Level 3 manual. It tells you even more about weather and climate science. This will help you prepare to fully understand weather all through your lifetime.

The two keys to learning in this — or any— 4-H project are to enjoy your studies and to learn at your own pace. We hope this project is just the start of a lifetime understanding the climate you live in and watching the weather!

WHAT YOU'LL LEARN

Weather is the state of the atmosphere at a particular place and time. The climate of the area and many local factors influence the weather.

Climate is the usual, long-term weather conditions for an area or for the entire planet.

Climate system is a complex process in which the earth's water and gas flow or change state because of the sun's energy.

KNOWING THE DIFFERENCE

Weather — The current weather condition of the atmosphere, including temperature, wind, cloudiness, precipitation, and relative humidity.

Climate — The average weather over time.

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You should be able to complete each activity in about 20–30 minutes. Some activities may take a shorter time. Some may also take longer, particularly when completing a Fly Higher activity.

COMPARING CLIMATES

How are four U.S. climate areas — temperate, desert, tropical, and tundra — the same, and how are they different?

Weather is the current condition of the **atmosphere**, including temperature, wind, cloudiness, **precipitation**, and **relative humidity**. Climate is the average weather over time. The local climate affects the clothes you wear, when we plant flowers and vegetables, and the crops that farmers grow. There are four climates in the United States: temperate, desert, tropical, and tundra.

A *temperate* climate has seasons with hot and cold weather, but not as hot or cold as in other climates. Indiana has a temperate climate. We also have rain and snow but, generally, not as much as in some other climates. The *desert* climate has very little rainfall and hot temperatures. *Tropical* climates have warm or hot conditions year-round. The *tundra* climate has extremely cold conditions most of the year. All of these climates have seasons, but the seasons are not always as noticeably different as the seasons we experience in Indiana. You will compare data from states in the four U.S. climate areas — temperate, desert, tropical, and tundra — and look for what is similar and what is different.

OBJECTIVE: Compare the four climates found in the United States.

Weather Tote

- ☐ Pencil
- ☐ Dictionary

1. Read the data in the chart below for each of the four climates.
2. Answer the questions about the four climates on the next page.
3. Answer the follow-up questions.

	January (winter)	July (summer)	yearly average
TEMPERATE CLIMATE			
average temperature	25.5°F	75.4°F	52.3°F
average precipitation	2.3"	4.5"	39.9"
DESERT CLIMATE			
average temperature	53.6°F	93.5°F	72.6°F
average precipitation	0.7"	0.8"	7.7"
TROPICAL CLIMATE			
average temperature	67.2°F	82.6°F	75.9°F
average precipitation	2.0"	5.7"	55.9"
TUNDRA CLIMATE			
average temperature	-10.1°F	62.5°F	26.9°F
average precipitation	0.5"	1.9"	10.9"

Graphic illustrations by Jessica Harsh

WHICH CLIMATE HAS:

temperate?

desert?

tropical?

tundra?

The highest average temperature? _____ What is it? _____

The lowest average temperature_____ What is it? _____

The highest July temperature?_____ What is it? _____

The lowest July temperature? _____ What is it? _____

The highest January temperature? _____ What is it? _____

The lowest January temperature? _____ What is it? _____

The highest average precipitation?_____ What is it? _____

The lowest average precipitation? _____ What is it? _____

The highest July precipitation? _____ What is it? _____

The lowest July precipitation? _____ What is it? _____

The highest January precipitation? _____ What is it? _____

The lowest January precipitation? _____ What is it? _____

Look up the word *temperate* in the dictionary, and write the definition below:

_____

_____

_____

_____

The first question in the chart above asked you about climate extremes — highest and lowest of the averages. How many times did the temperate climate have the extreme data for one of the climates?

_____

SHARE WHAT HAPPENED:

- Were you surprised by the differences in the climates?
- What data surprised you?

APPLY:

- What do you think it would be like to live in each of the other climates?
- Which climate do you think that you would be happiest living in year-round? Why?
- How are flowers, plants, and agricultural crops affected by climate?

- Why doesn't Indiana have many extremes in temperature and rainfall?
- Temperature and rainfall are the major factors in a climate. What might some other factors be?

Fly Higher

- Calculate the difference in average temperature and average precipitation between January and July for each climate. What climate has the largest extremes for temperature? For precipitation?
- Keep track of temperature and rainfall in several different areas around the United States for a week or for one day during the first week of the months of January, April, July, and October.
- Explore what the climate is in five places around the world where you would like to go someday.

Notes

COUNTRY OF COLORS

What is a hardiness zone?

Buds, new leaves on trees, tulips, and daffodils tell us that spring is coming because the weather is warming up. These plants can survive our cold winter temperatures. But many flowers we enjoy need to be planted in the spring after the danger of frost has passed. In this activity, you will learn about **hardiness zones** and how they are determined.

The U.S. Department of Agriculture (USDA) publishes the Hardiness Zone Map to help gardeners and farmers plan what and when to plant. The map shows zones based on the **average annual extreme minimum temperatures** for a 30-year period in the United States. This is important information because many plants are very sensitive to cold temperatures and cannot survive freezing.

AVERAGE ANNUAL EXTREME MINIMUM TEMPERATURES

Average *the sum of all values divided by the number of years*

Annual *over a year*

Extreme *the lowest*

To find the average annual extreme minimum temperature, add the lowest temperature of each year for 30 years and divide the sum by 30. Areas with similar extreme minimum temperatures (within 10°F) are grouped together in zones. Areas with colder winter weather have lower zone numbers. Areas with warmer winters have higher zone numbers.

OBJECTIVE: Know Indiana's hardiness zones.

Question: Why do some flowers bloom year after year, while others need to be planted each year?

_____

_____

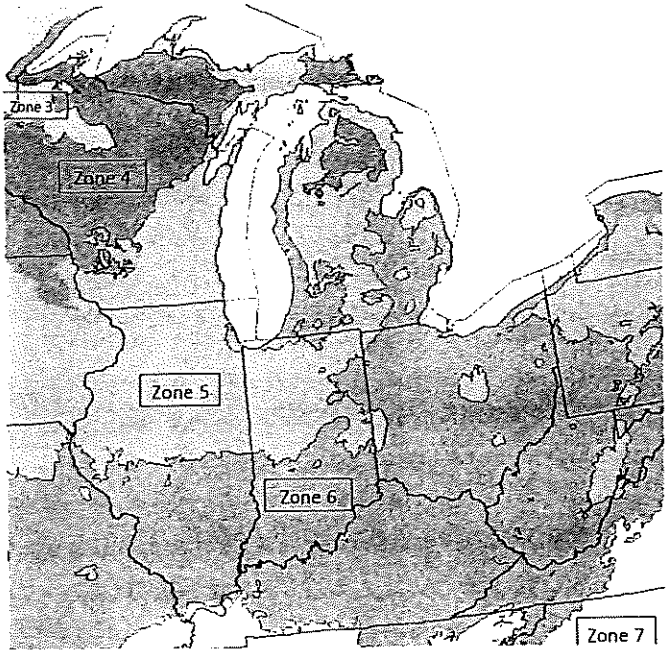
_____

Weather Tote

- ☐ Pencil
- ☐ Colored pencils, markers, or crayons
- ☐ Hardiness Zone Map (on next page)

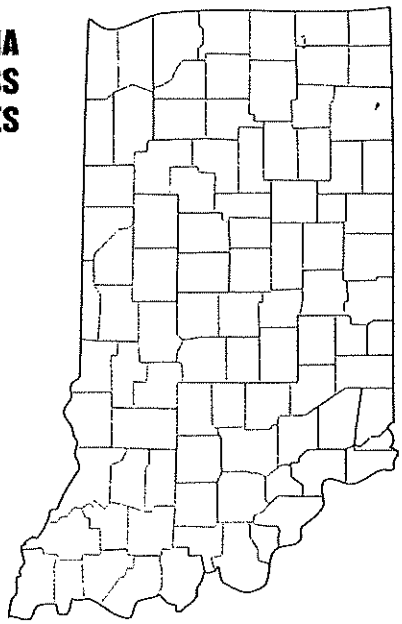
1. Draw a line between Indiana's hardiness zones.
2. Color each zone a different color.
3. Make a key that shows the color for each zone.
4. Place an "x" where you live.
5. List five garden plants (flowers or vegetables) that cannot overwinter — not survive a winter and need to be planted each year.

PLANT HARDINESS ZONES



Adapted from the USDA Hardiness Zone map, planthardiness.ars.usda.gov

INDIANA HARDINESS ZONES



Garden plants that cannot overwinter

1 _____

2 _____

3 _____

4 _____

5 _____

SHARE WHAT HAPPENED:

How many zones did you find in Indiana?

APPLY:

- What is the average annual extreme minimum temperature range where you live?
- What do you think would happen if you planted a hardy perennial flower, a plant that lives more than one year, in Hardiness Zone 9, which includes the warmest parts of the United States.

GENERALIZE TO YOUR LIFE: How do the hardiness zones affect what farmers grow?

Fly Higher

- Visit the USDA Plant Hardiness Zone Map online (and in color) at http://planthardiness.ars.usda.gov/PHZMWeb/Maps.aspx, or look at the map to the left. Then answer the following questions.

  Where are the warmest zones? What is their average minimum temperature?

  Where are the coldest zones? What is their average minimum temperature?

- Find a flower or vegetable seed catalog. Your parent or Extension Educator can help you.

  How are the hardiness zones listed for different flowers or vegetables?

  What flowers or vegetables did you find that are not recommended for where you live?

DEFINING WEATHER WORDS

What words do I need to know to study and understand the weather?

Do you know what the four H's stand for in "4-H?" Sometimes people use words that others don't know. Do you have a favorite sport that uses words some of your friends don't know? Scientists who study weather and climate use both common words and special terms that others may not know. This activity will help you get started learning weather words.

OBJECTIVE: Learn common weather words.

Weather Tote

☐ Pencil

1 Rearrange the scrambled letters on the next page to make weather words. Use the Word Bank *only* if you cannot figure out the words. Then describe each weather word in your own words.

- Did you use the Word Bank, or did you do this activity without looking at the Word Bank?
- Were some words harder to unscramble than others?
- Were some words harder to define than others?

HELP: How does knowing weather words help you talk about the weather?

- Describe how you dress when it is raining.
- How do you dress when it is snowing?
- How do you dress when it is hot outside?

Fly Higher

- Compare your weather definitions to the ones you find in a dictionary.

ahrewet

rai

tarew

athe

miudtihy

nsu

herta

nwid

nswo

nria

lhia

scoldu

ateuprrmeet

etamilc

Word Bank

- ☐ air
- ☐ climate
- ☐ clouds
- ☐ earth
- ☐ hail
- ☐ heat
- ☐ rain
- ☐ snow
- ☐ sun
- ☐ water
- ☐ weather
- ☐ wind
- ☐ humidity
- ☐ temperature

Notes

EARTH'S SURFACES

How will the energy from sunlight heat up different-colored surfaces?

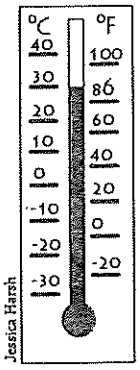
Sunlight warms the surfaces of earth. Look around you. Do all of earth's surfaces look the same? Earth has many natural surfaces, including grass, trees, sand, water, mountains, and ice. Humans create many surfaces, including roofs, sidewalks, and roads of concrete or asphalt.

When surfaces are warmed by sunlight, they warm the air above them. Different surfaces may warm the air at different rates or to a higher or lower degree. Surface warming can affect our weather.

Study how the color of a surface influences how fast an object warms up.

Weather Tote

- ☐ Indoor thermometer, with a bulb that can safely touch the paper
- ☐ Desk lamp with a 40-watt or 60-watt bulb
- ☐ Clock or watch with a second hand
- ☐ One sheet each of white, black, brown, green, and blue construction paper



Jessica Harsh

1. Record the room's temperature on the thermometer as the beginning temperature in the chart on the next page.
2. Place the white sheet of paper on top of the thermometer.
3. Put the desk lamp 6 inches above the paper at the bulb end of the thermometer.
4. Turn on the light, and wait 5 minutes.
5. Record the temperature on the thermometer as the ending temperature on the chart.
6. Calculate the change in temperature by subtracting the first temperature from the second one. Record it on the chart.
7. Allow the thermometer to cool for 5 minutes.
8. Repeat the steps for the other colors of paper, and fill in your results in the chart.

- Which color did you think would heat the most?
- Which color did heat the most?
- Which color heated the least?
- What surfaces on earth would match the colors used in your experiment?
- Which surfaces would heat the air above them the most? The least?

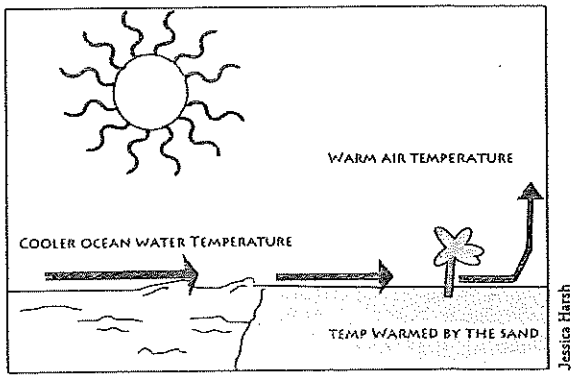
Why does the sun's uneven heating of oceans and land surfaces cause breezes?

Hint: Have you ever been to a sandy beach on a hot, sunny day? What happens if you go barefoot on the sand? How does it feel when you sink your feet in the water? Both surfaces — sand and water — receive the same amount of sunlight, but each heats up much differently.

Look at the arrows in the diagram in column 2 that show a sea breeze. Then answer the questions.

- Why is the air over the land rising?
- What is causing the sea breeze?
- How does the surface affect breezes?

SUN'S HEAT AND SEA BREEZES



Adapted from http://blogs.kxan.com/2013/06/12/what-is-a-sea-breeze/

Think of places that have two different surfaces, like a plowed field next to a forest or a large parking lot next to a city park.

- How might the different surfaces affect the wind in each place?
- How might humans change the earth's surfaces and affect the local weather?

Fly Higher

Take an outdoor thermometer outside on a sunny, calm day. Put the thermometer on several different surfaces to see how the sunlight is causing these surfaces to warm. Use something to shade the thermometer (like an umbrella) so that the sunlight does not affect the thermometer.

Surface Color	Beginning Temperature	Ending Temperature	Temperature Change
White			
Black			
Brown			
Green			
Blue			

H_2O

What causes water to condense out of the air?

Water is important for all life on earth. It plays a big part in determining the weather. Water has three forms — solid, liquid, and gas. Water on earth's surfaces **evaporates** into the air as a gas, forms clouds in the sky, and creates **precipitation**. It might be snow, rain, or **water vapor**. When water falls from the sky as rain, it can soak into the ground. It can run along the surface to form streams and rivers. It can collect in areas and form ponds and lakes. It can travel to the ocean. Plants, people, and other animals also use water. During all of these possible journeys, the water can evaporate back into the air, and what we call the water cycle starts all over again.

Recognize how water forms precipitation.

Weather Tote

- ☐ Two glass jars (about pint sized) with lids
- ☐ Water
- ☐ Ice cubes

PART 1

1. Fill a jar with water at about room temperature, and put on the lid.
2. Fill the second jar with ice cubes. Then completely fill the jar with cold water. Put the lid back on.
3. Observe the two jars for about 5 minutes.

- On which jar did water **condense** on the outside?
- Where do you think the condensed water came from?
- Why did water only condense on the jar with the ice cubes?

PART 2

1 Take the first jar, the one without ice, and empty most of the water. Leave about a centimeter (½ inch) of water in the bottom of the jar.

2 Put on the lid, and shake the jar for a full minute. This will force water to **evaporate** in the jar.

3 Set the jar down, and leave it alone for another minute.

4 Observe what the jar looks like.

5 With the lid on tight, hold the first jar sideways over a sink.

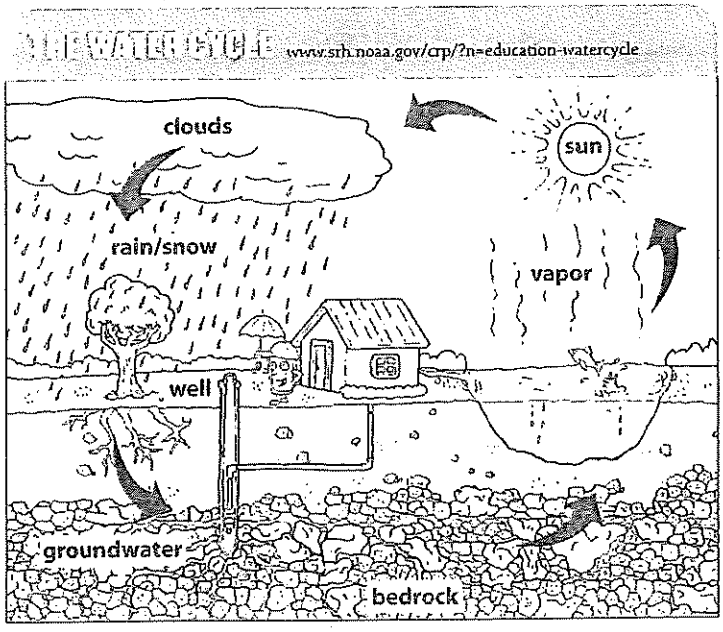
6 Carefully pour the ice water from the second jar down the side of the first jar.

7 Observe the inside of the first jar.

- What did you observe on the inside of the jar at each step?
- What happens to the temperature of the air when water condenses?

Study the picture of the water cycle. How does what you learned about precipitation relate to the water cycle?

- When does dew form? When does frost form? Would you ever expect dew or frost to form when a surface is warming up?
- Have you ever watched clouds on a sunny day? What do they look like?



INVISIBLE AIR

How do we know air is there?

Air is one of many things we know exists, but that we cannot see. Earth is covered with a layer of air called the **atmosphere**. Weather occurs in the atmosphere. When the air interacts with the sun's energy and earth's surface, it creates weather. So you need to understand the properties of air to understand weather.

OBJECTIVE: Understand that warm air rises and cool air sinks.

PART 1

Question: Does air take up space?

Weather Tote

- ☐ Glass
- ☐ Clear bowl
- ☐ Water
- ☐ Towel
- ☐ Ruler

1 Place the clear bowl on the towel.

2 Add water so the bowl is about ¾ full.

3 Measure the height of the water:

_____

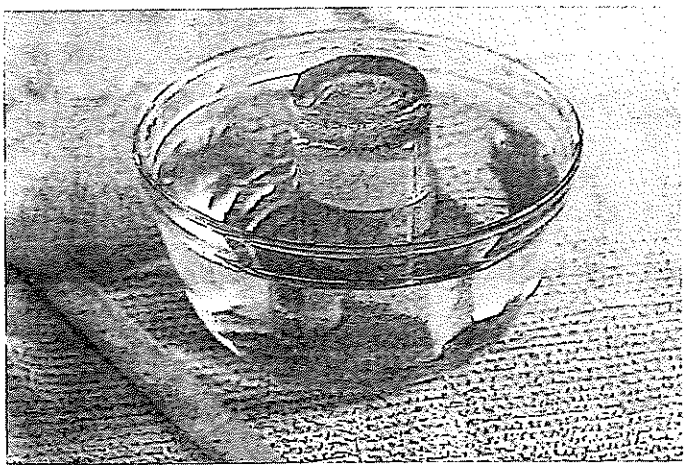
4 Turn the glass upside down, and push it straight down into the water.

5 Measure the height of the water again:

_____

6 Record the difference in the height of the water before (3) and after (5):

_____



GUESS WHAT HAPPENED:

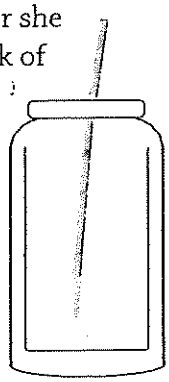
- What happened to the water in the bowl when you inserted the upside-down glass?
- What kept the water from entering the glass?

PART 2

Question: How does temperature change the amount of space that air occupies?

Weather Tote

- ☐ Glass jar (not plastic) with a metal screw-on lid (pint or similar size will work)
- ☐ Clear skinny plastic straw, like some restaurants use
- ☐ Hot glue gun and glue stick or Play-Doh
- ☐ Food coloring
- ☐ Ice cubes or freezer cold packs
- ☐ Towel
- ☐ **Also Needed:** Ask an adult to drill a hole in the center of the metal lid. Using a drill bit the same size as the diameter of the straw, he or she should place the metal lid on the block of wood, hold the lid and drill a hole in the center.



What do you think will happen when air is cooled?

To help you answer this question, construct a testing jar using the following steps:

1. Place the lid on the jar, and put the straw through the hole so that the bottom of the straw is about ½" from the bottom of the jar.
2. Seal the straw to the top of the lid, using hot glue or Play-Doh.
3. Remove the lid from the jar, and seal the straw to the bottom of the lid for an airtight seal.
4. Place about 1" of water in the jar, and add one drop of food coloring.
5. Place the lid with the straw firmly on the jar.
6. Put the jar on the towel to avoid a mess from spilling water.
7. Rub two ice cubes or freezer cold packs against the outside of the jar to cool the air inside the jar.
8. Observe what happens in the straw as the air inside the jar cools.
9. Now warm the air in the jar by wrapping your hands around the jar.
10. Observe what happens in the straw as the air inside the jar warms up.

- What did you observe when you cooled the air in the jar with the straw?
- What did you observe when you warmed the air in the jar with the straw?

PART 3

Questions:

1. Which is heavier (denser) — warm or cold air? Circle your guess:

   WARM COLD

2. If the air in a balloon is cooled, how will the balloon's weight (**density**) change? Circle your guess.

   BECOMES HEAVIER (denser)

   BECOMES LIGHTER (less **dense**)

   NO CHANGE

Weather Tote

- ☐ Yardstick or similar board
- ☐ Two rubber bands
- ☐ Two balloons
- ☐ Ice cubes or freezer cold packs
- ☐ Masking tape
- ☐ Towel

1. Blow up the balloons, and attach them to each end of the yardstick with the rubber bands.
2. Balance the yardstick on the back of a chair. Tape the balancing point of the yardstick to the chair back.
3. Rub ice cubes on one of the balloons, or put one of the balloons in the freezer or a bowl of ice water for five minutes. Put it back in the same place on the yardstick. If you use ice, avoid a mess by keeping the towel under the melting ice.
4. Observe how the balance changes.

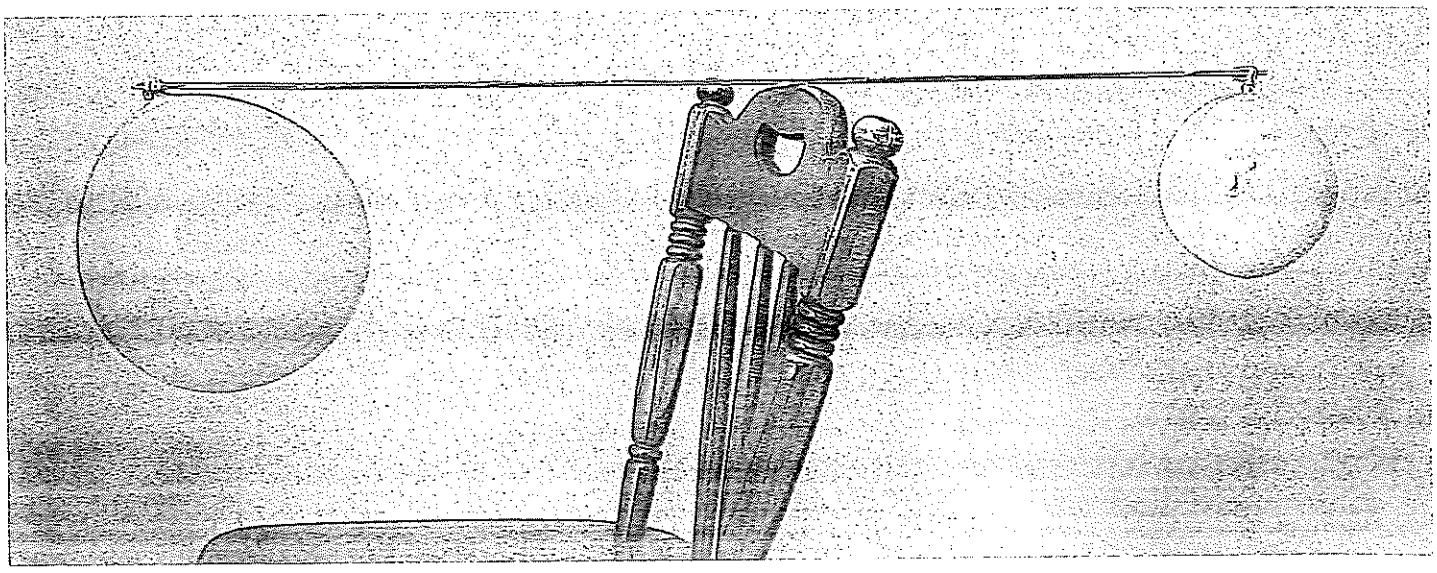
Did the balloons on the yardstick stay balanced when you cooled one of the balloons?

Why does cooled air sink? Why does warmed air rise?

- Is there a breeze outside today? How might changes in the air temperature have caused that breeze?
- Have you ever seen a hot air balloon? How do you think a hot air balloon works?

Fly Higher

- Using an indoor thermometer, compare the temperature of the air in a room near the floor and near the ceiling. If your house has two or more floors, compare the floor and ceiling temperatures in an upstairs room.
- If you have a garage or barn, compare the two temperatures in that building on a warm day.
- How can you explain any differences?



READING ABOUT WILD WEATHER

What damage can severe weather cause?

The Wild Weather series by Scholastic includes books on tornadoes, blizzards, floods, and lightning. In this activity, you will choose one of these books to read and learn more about weather. These books can be found in libraries or from an online book source. The following information will help you find these books.

- Hopping, Lorraine Jean, and Jody Wheeler. *Wild Weather: Tornadoes!* New York: Scholastic, 1994. Print. ISBN: 0-590-46338-1
- Hopping, Lorraine Jean, and Jody Wheeler. *Wild Weather: Blizzards!* New York: Scholastic, 1998. Print. ISBN: 0-590-39730-3
- Hopping, Lorraine Jean, and Jody Wheeler. *Wild Weather: Floods!* New York: Scholastic, 2000. Print. ISBN: 0-439-08757-0
- Hopping, Lorraine Jean, and Jody Wheeler. *Wild Weather: Lightning!* New York: Scholastic, 1999. Print. ISBN: 0-590-52285-X

OBJECTIVE: Read a book about severe weather events, become familiar with that type of severe weather event, and describe how to prepare for severe weather.

Weather Tote

☐ One book from Scholastic's Wild Weather series

- Read the book you have chosen.
- Report one thing you learned in each chapter:

Chapter 1: _____

_____

_____

Chapter 2: _____

_____

_____

Chapter 3: _____

_____

_____

Chapter 4: _____

_____

_____

Chapter 5: _____

_____

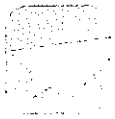
_____

- Discuss the Chat questions.

- What was the most interesting fact you learned in each of the five chapters?
- Each Wild Weather book introduces a scientist who studies a weather event. Who was the scientist you read about, and what kind of work does he or she do?

What kind of conditions can cause the weather event you read about? How can you protect yourself during this type of weather event?

- Have you had a personal experience with the wild weather event you read about?
- What have you read or heard from news reports about this type of weather event?



Fly Higher

- Write your own wild weather story about an experience you and your family or friends have had.
- Read other books in the Wild Weather series.

NOTES

'TIS THE SEASON

How do the changing seasons affect the way we live?

The weather in Indiana changes with the four seasons. These changes cause people to wear different clothes and do different outdoor activities. The seasons also affect the plants and animals that live outside.

OBJECTIVE: Identify the effects of changing seasons.

Show how seasons are different by drawing in the boxes what you or others like to see, hear, or do during each season. You might show the clothes people wear outside or the outdoor sports and activities they play, the view outside your window, or how plants change.

SPRING

SUMMER

FALL

WINTER

- Was it hard to decide how to draw the seasons?
- Was one season more difficult to show than others?

What is your favorite season? Why?

- How does the season affect what you wear?
- How does the season affect what you do outside?
- How does the season affect plants?

Fly Higher

Take photographs, make a video, or find pictures in magazines or on the Internet that show the different seasons. Use your pictures or photos to teach younger children about the seasons.

VATCHING THE WIND

Question: How can you estimate wind speed?

More than 200 years ago, in 1806, Sir Francis Beaufort of Great Britain's Royal Navy developed a method for ıtimating wind speed by making observations. His ʻstem is known as the Beaufort Wind Scale. Because ɜ was part of the navy, Sir Beaufort observed the ırface of the sea. Over the years, scientists have lapted and modernized his method to produce a ɜry reliable way to estimate the wind speed just by atching the weather outside a window.

JECTIVE: Estimate the current wind speed by ɜing the Beaufort Wind Scale.

Veather Tote

] Beaufort Wind Speed Scale (Table 1)

] Radio, TV with Weather Channel access, or Internet — visit www.noaa.gov/wx.html

Many youth will only be able to observe land conditions to determine the wind speed. You may not be able to make sea observations like Sir Beaufort, unless you live (or vacation) near the ocean or a large lake.

1 Record the date and time in the first two columns of the Wind Speed Data table (Table 2).

2 Study the Beaufort Wind Speed Scale (Table 1) to determine which conditions most closely resemble the wind conditions you see at your home.

3 Enter the wind speed (column 3) in your Wind Speed Data table.

4 Check your weather source immediately after recording your data, and enter the reported wind speed in column 4 of the Wind Speed Data table.

5 Take one to three readings each day.

6 Allow at least 4 hours between readings.

7 Take a total of 15 to 20 wind-speed readings before discussing the questions with your 4-H leader.

- Was it difficult to use the Beaufort Wind Scale?
- How did your readings compare to the actual wind speeds reported from your weather source?
- Do you think the Beaufort Wind Scale is useful?

What are some other objects that are affected by the wind that could help you in estimating wind speed?

Beaufort Number	Wind Description	Wind Speed	Water and Sea Surfaces	Land Conditions
0	Calm	0-1 mph*	Smooth, mirror-like	Calm • Smoke rises vertically
1	Light Air	2-3 mph	Ripples without crests	Smoke drift indicates wind direction Leaves and wind vanes are stationary
2	Light Breeze	4-7 mph	Small wavelets • Crests of glassy appearance, not breaking	Wind felt on exposed skin • Leaves rustle Wind vanes begin to move
3	Gentle Breeze	8-12 mph	Large wavelets • Crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	Moderate Breeze	13-17 mph	Small waves with breaking crests • Fairly frequent whitecaps	Dust, leaves and loose paper lifted Small branches begin to move
5	Fresh Breeze	18-24 mph	Moderate waves of some length • Many whitecaps Small amounts of spray	Branches of a moderate size move Small trees begin to sway
6	Strong Breeze	25-30 mph	Long waves begin to form • White foam crests are frequent Some airborne spray	Large branches in motion Whistling heard in overhead wires Umbrella use difficult • Empty plastic bins tip
7	Near Gale	31-38 mph	Some foam from waves is blown into streaks Moderate amounts of airborne spray	Whole trees in motion Effort needed to walk against wind
8	Gale	39-46 mph	Moderately high waves with breaking crests Well-marked streaks of foam • Considerable airborne spray	Twigs broken from trees • Cars driving on roads affected Walking is difficult
9	Strong Gale	47-54 mph	High waves with crests rolling over • Dense foam blowing Large amounts of airborne spray reduce visibility	Some branches break off trees, and some small trees blow over Construction and other temporary signs and barricades blow over
10	Storm	55-63 mph	Very high waves and large patches of foam Considerable tumbling of waves Large amounts of airborne spray reduce visibility	Trees are broken off or uprooted Structural damage is possible
11	Violent Storm	64-73 mph	Exceptionally high waves • Very large patches of foam Very large amounts of airborne spray severely reduce visibility	Widespread vegetation and structural damage is likely
12	Hurricane Force	>73 mph	Huge waves • Sea is completely white with foam and spray Air is filled with driving spray, greatly reducing visibility	Severe widespread damage to vegetation and structures Debris and unsecured objects are blown about

*mph = miles per hour

CONNECTIONS TO YOUR LIFE: When would it be useful for you to estimate the wind speed? Are there particular places or situations where this knowledge might come in handy?

Table 2 is on the next page.

Fly Higher

Develop your own scale for estimating wind speed by observing a flag on a pole. You might also experiment with different sized flags or pieces of fabric or by placing the flags (or fabric) at different heights.

WIND SPEED DATA SHEET

Date	Time	Beaufort Scale Wind Speed	Actual Wind Speed

WEATHER AFFECTS PLANS

How does the weather affect your plans?

It is helpful to know the weather forecast before you leave home every day. If rain is expected, you may wish to wear a raincoat or take an umbrella. If it is going to be very hot, you might take a bottle of cold water. If it is cold, you'll probably wear a warm coat with a hat, boots, and mittens or gloves. In this activity, you will collect weather data and list the type of outdoor activities you can do.

Collect weather data.

Weather Tote

- ☐ Your choice for the local weather report — radio, TV, or Internet
- ☐ Weekly Weather Chart (Table 1)

1 Use your weather source to obtain the local high and low temperature each day for one week.

Recommended website:
NOAA, www.noaa.gov/wx.html.
Enter your zip code or your city's name and state abbreviation in the Search window in the left-hand sidebar on the home page.

2 Record the temperatures in columns 2 and 3 in the Weekly Weather Chart (Table 1).

3 Indicate if you had any precipitation at your home (columns 4-6).

4 List any outdoor activities that you did each day (column 7).

- What was the highest temperature during the week you collected data?
- What was the lowest temperature during the week you collected data?

- Did the weather affect your outdoor activities? Why or why not?
- When is the weather most likely to affect your outdoor activities?
- When has the weather affected your family's plans?

	Temperature		Precipitation			Outdoor Activities
	High	Low	Rain	Snow	Other	
Sunday						
Monday						
Tuesday						
Wednesday						
Thursday						
Friday						
Saturday						

What effect does weather have on vacation plans? On building a house? On walking a trail or hiking?

Fly Higher

- Collect weather data for a week during a different season. How do your results compare with the data in Table 1?
- List the outdoor activities that you like to do during Indiana's four seasons: winter, spring, summer, and fall.
- Visit the NOAA website, www.noaa.gov/wx.html, and enter your zip code (or city and state) on the Weather.gov Forecast search box on the left-hand side. Click Go.

  Read the forecast.

  Scroll down to the hourly weather graph on the lower right-hand side of the forecast page.

  Click on the graph.

  Use the five graphs that appear to review the weather predictions for the next 24 hours, including:

  1 Heat index/dew point/temperature
  2 Wind/gusts
  3 Relative humidity/precipitation potential/ sky cover
  4 Rain (**NOTE:** The bars show the likelihood of rain; the totals are given for various time spans across the bottom of the graph.)
  5 Thunder
- Use the data shown to summarize the detailed weather forecast for the next 24 hours for your 4-H club members, your parents, or your friends.

WEATHER ALERTS

What are NWS alerts?

The *National Weather Service* (NWS) watches the weather for us. When bad weather is approaching, the NWS sends alerts to radio, TV, and Internet sources so that we can prepare to protect ourselves and our property. The three kinds of NWS alerts are an *advisory*, a *watch*, and a *warning*. It is important to understand what these words mean. A storm advisory means that a storm is anticipated. A storm watch means that a storm is expected. A storm warning means that a storm is in your area and you must take cover. You will learn the definitions for hazardous weather terms that may be involved in an NWS alert.

Learn the definitions for common weather words.

Weather Tote

☐ Pencil

1 Find each word in the Word Bank in the word-search puzzle on the next page.

2 Match each word to the definition in the Weather Alerts Data Sheet as best as you can.

3 Discuss your answers with your 4-H facilitator.

From the National Weather Service

STORM ADVISORY An advisory is issued when a hazardous weather event is occurring, imminent, or likely. Advisories are for less serious conditions than warnings. Advisory conditions may cause significant inconvenience, and if caution is not exercised, could lead to situations that may threaten life or property.

STORM WATCH A watch is used when the risk of a hazardous weather event has increased significantly, but its occurrence, location, or timing is still uncertain. It is intended to provide enough lead time so those who need to set their plans in motion can do so. A watch means that hazardous weather is possible. People should have a plan of action in case a storm threatens, and they should listen for later information and possible warnings, especially when planning travel or outdoor activities.

STORM WARNING A warning is issued when a hazardous weather event is occurring, imminent, or likely. A warning means weather conditions pose a threat to life or property. People in the path of the storm need to take protective action.

WORD SEARCH PUZZLE

	q	u	i	t	j	h	u	h	f	r	l	p
	a	f	u	h	k	g	y	i	e	t	o	z
	z	o	i	u	b	l	i	z	z	a	r	d
	w	g	k	n	l	f	c	o	v	g	t	x
	s	n	l	d	p	d	e	p	w	b	i	c
blizzard	x	b	o	e	o	s	t	a	c	i	k	v
flash flood	c	g	p	r	i	a	r	z	d	n	n	b
fog	f	l	a	s	h	f	l	o	o	d	m	d
heat												
ice	d	t	j	t	u	q	w	x	e	h	j	n
thunderstorm	e	r	v	o	t	o	r	n	a	d	o	m
tornado	r	f	w	r	y	s	e	s	w	y	u	l
wind												
winter	f	v	e	m	z	w	i	n	t	e	r	k

Weather Alert	**Kind of Weather from Word Bank list**
Winds of 58 mph or higher with hail of 1" in diameter or more with dangerous lightning	
Winds of 40 mph or higher or wind gusts of 58 mph or higher for one hour or more	
Imminent danger of rapid flooding in low-lying areas	
Blowing snow reducing visibility to a quarter mile or less for 3 hours or longer and sustained winds of 35 mph or greater or frequent gusts to 35 mph or greater	
A tornado is imminent	
¼ inch or more of ice accumulation	
The heat index value is expected to reach or exceed 110 degrees within the next 12–24 hours	
Reduced visibility to a quarter mile or less over a large area for an extended period (2 or more hours)	
A significant combination of hazardous winter weather is occurring or imminent	

- What are the NWS alerts?
- Which alert means that you need to take immediate action?

- Have you recently heard or seen a warning, watch, or advisory? If so, for what weather event was the warning, watch or advisory?
- Have you ever experienced a warning when you took action? If so, what was the action you took?

- Does your family have a plan or preparations made for storm warnings? If so, what are the plans or preparations?
- Why might a family have a NOAA (National Oceanic and Atmospheric Administration) Public Alert Weather Radio?

Fly Higher

Create a plan for your family to prepare for a tornado warning and another plan for a winter storm warning.

NOTES

WEATHER OR CLIMATE?

What is the difference between weather and climate?

People often say climate and weather as if they mean the same thing. They do not. The temperature today is considered part of today's *weather,* but the average temperature over the last 30 years is considered part of our climate. Weather is the day-to-day changes in the **atmosphere** and describes a single occurrence, such as the current temperature. An example of weather is a temperature reading of 85 degrees Fahrenheit on the 4th of July. An example of climate would be the average high temperature for your city or town on the 4th of July.

OBJECTIVE: Describe the difference between weather and climate.

Weather Tote

- ☐ Pencil
- ☐ Tables 1 and 2
- ☐ *Optional:* A resource on weather and climate, such as the Internet, a book, or a person

1. Imagine that you will spend the day outside today. Look or listen to today's weather report, and choose the clothes you will wear from the list of clothes given in Table 1, Dressing for Weather. Put an X next to the clothes that you choose to wear outside today.
2. You might hear any of the statements in Table 2 on your radio or TV. Read each statement in the first column of Table 2.
   - Indicate if the statement is an example of weather or climate by placing an X in one of the Example columns (2 or 3).
   - Explain your reason for your answer by placing an X in one of the Reason columns (4 or 5).

DRESSING FOR THE WEATHER [TABLE 1]

T-shirt	Shorts	Gym shoes
Tank top	Jeans or long pants	Snow boots
Long-sleeve shirt	Heavy socks	Light jacket
Sweatshirt	Light socks	Raincoat
Hoodie	Sandals	Winter coat
Swimsuit	Flip-flops	Hat and gloves

Announcer's Statement	Example		Reason	
	Weather	Climate	Single Occurrence	An Average
Yesterday the high was 55°F and the low was 43°F.				
Today we are expecting a high of 61°F.				
That is 10 degrees above the normal high of 51°F for this date.				
We will have clear skies today with no rain forecasted for the next three days.				
We usually would have four inches of rain this month.				
Hurricane season is beginning in the tropics.				
A tropical storm is developing in the Atlantic Ocean.				
To the north, a massive snowstorm is on its way.				
We do not normally see a snowstorm like this at this time of year.				
Tornado season is upon us, and we must be prepared.				
We usually expect four or five tornado outbreaks to occur this month.				
This morning a tornado damaged a building on High Street downtown.				

SHARE WHAT HAPPENED:

- Did you find it difficult to decide which of the statements in Table 2 were about weather and which were about climate?
- Are the clothes you wear today determined by the weather? Or the climate?
- Are the clothes you keep in your closet and dresser determined by the weather? Or the climate?
- Do you have clothes you don't wear very much? If so, why?

APPLY: Pick another time of year. What clothes from Table 1 would you wear outside at that time of year?

GENERALIZE TO YOUR LIFE:

- Would you keep all the same clothes if you lived in Hawaii? What would be different?
- Would you keep all the same clothes if you lived in Alaska? What would be different?

Fly Higher

Do you have a friend or relative who lives in another climate area — for example, Florida or Georgia; Arizona or California; Washington or Idaho; Maine or Vermont? Contact them, and compare the kind and number of types of clothes they keep and wear.

WHERE IS THE HEAT?

Why is it warmer in the summer than the winter?

Summers are warmer than winters. The amount of difference in the temperature partly depends on the climate **zone** that you live in — temperate, desert, tropical, or tundra. It also depends on your current weather conditions, including temperature, wind, cloudiness, precipitation, and **relative humidity**. We get heat from the sun, but how does the position of earth, in relation to the sun, affect the temperature? You will explore that relationship in this activity.

Study how the angle of the sun affects earth's temperatures.

Weather Tote

- ☐ Flashlight
- ☐ Paper
- ☐ Ruler
- ☐ Pennies
- ☐ Pencil

PART 1

Question: If you shine a flashlight on the center of a piece of paper from two different places, will the shape of the lighted area stay the same?

1. Mark the center of a piece of paper by drawing an X from the corners of the paper.
2. Using the ruler as a guide, hold a flashlight 6 inches above the center of the paper, and turn on the flashlight.
3. Draw the shape of the light on the paper. Ask someone to hold the flashlight, if you need help.
4. Keep the flashlight 6 inches above your paper, and move the flashlight to the bottom of the paper. Shine the flashlight back toward the center of the paper.
5. Draw the shape of the newly lighted area.
6. Count the number of pennies you can fit in each of the shapes you drew.

PART 2

Question: How does the amount of daylight change over the year?

Calculate the total daylight hours for the first day of each season, using the data given in Table 1. Enter your calculation in the last column.

- What happened to the shape of the light when you moved the flashlight?
- How many pennies could you fit in each shape?
- How will the angle of the light affect the temperature?

- Which season has the shortest amount of daylight?
- Which season has the longest amount of daylight?
- Why would the amount of daylight make a difference in the seasons?
- Which season had the most direct sunlight?

What effect do you think the angle of the sun has on temperature?

How does the amount and direction of sunlight your area receives affect what you wear in January? In June?

Fly Higher

- Compare the location of the sun when it rises and sets in January and July at your house.
- Compare the length of a shadow outside and close to your house at about noon during different seasons throughout the year.
- Do people living south of the equator have seasons at the same time we do? Do you know why? If not, research to find the answers.
- Ask someone to help you calculate the area of each shape you drew in Part 1. Are the areas different? If so, why do you think they are different?
- Graph the average length of daylight for Indianapolis, using the data in the Table 2.

DAYLIGHT HOURS [TABLE 1]

NOTE: Sunrise, sunset, and daylight hours data is from NOAA. Use the search box and keywords: sunrise, sunset, and daylight hours.

	Sunrise	Sunset	Daylight Hours
Winter	8:06 a.m.	5:23 p.m.	
Spring	7:50 a.m.	8:00 p.m.	
Summer	6:17 a.m.	9:21 p.m.	
Fall	7:35 a.m.	7:46 p.m.	

INDIANAPOLIS'S DAYLIGHT HOURS [TABLE 2]

Month	Daylight Hours	Month	Daylight Hours	Month	Daylight Hours
January	9.7	May	14.4	September	12.4
February	10.7	June	14.9	October	11.1
March	11.6	July	14.6	November	10.0
April	13.3	August	13.7	December	9.4

GLOSSARY

Atmosphere A layer of gases surrounding the earth and held in place by gravity

Average annual extreme minimum temperatures The sum of the lowest temperature each year for 30 years, divided by 30

Condense To change the state of a gas to a liquid

Dense When the parts of a material are packed closer together, resulting in a heavy mass or weight

Density A measurement of the amount of space a material occupies

Evaporate To change the state of a liquid to a gas

Hardiness The ability of a plant to withstand cold temperatures

Precipitation The deposit on earth of forms of water, such as hail, mist, rain, sleet, and snow

Relative humidity The ratio of the amount of water vapor in the air compared to the amount of water vapor if that air is saturated, given as a percentage

Water vapor An invisible, colorless gas, like air; water in a gaseous state

Zone An area of similar temperature and precipitation conditions

NOTES

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