# Teacher Edition

## Weather, Climates, and Natural Hazards

## Danny the Squirrel's First Winter

STEMTaught®

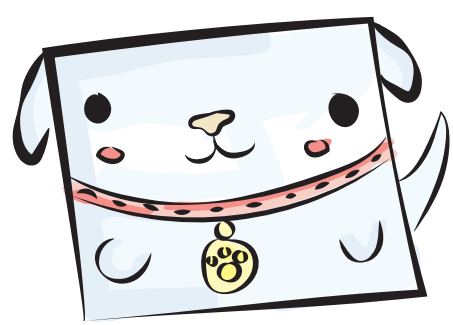
**SEEd Standards** 3.1.1 Typical weather conditions expected during a particular season. 3.1.2 Describe climate patterns in different regions of the world. 3.1.3 Design a solution that reduces the effects of a weather-related hazard.

Made with
recyclable paper
(Not ceramic coated)

## Beth and Jake Hunter

Earth Scientist, Mechanical Engineer

Beth and Jake collaborate with amazing authors of the STEMTaught Journal and research the lives of interesting people such as Maria Sibylla Merian, to bring you inspiring learning material. They recently found a grub worm and observed its metamorphosis and transformation into a beautiful Hawk Moth. Isn't nature amazing?





Published by STEMTaught

By Jake Hunter, Beth Hunter, Kristen Davis, Emma MacKie, and Aysha Imtiaz.

Artwork by Bell Hunter and Jake Hunter.

**Weather, Climates, and Natural Hazards: Danny the Squirrel's First Winter**

Student Edition SEEd ISBN 979-8-88987-155-2

Teacher Edition SEEd ISBN 979-8-88987-167-5

Edition 3


STEMTaught®

Utah Science with Engineering Education

## Strand 3.1: WEATHER AND CLIMATE PATTERNS

### SEEd Standard 3.1.1

Analyze and interpret data to reveal patterns that indicate typical weather conditions expected during a particular season. Emphasize students gathering data in a variety of ways and representing data in tables and graphs. Examples of data could include temperature, precipitation, or wind speed. (ESS2.D)

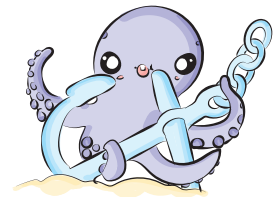
### SEEd Standard 3.1.2

Obtain and communicate information to describe climate patterns in different regions of the world. Emphasize how climate patterns can be used to predict typical weather conditions. Examples of climate patterns could be average seasonal temperature and average seasonal precipitation. (ESS2.D)

### SEEd Standard 3.1.3

Design a solution that reduces the effects of a weather-related hazard. Define the problem, identify criteria and constraints, develop possible solutions, analyze data from testing solutions, and propose modifications for optimizing a solution. Examples could include barriers to prevent flooding or wind-resistant roofs. (ESS3.B, ETS1.A, ETS1.B, ETS1.C)

Explore the Phenomenon!



Lesson Anchor

# Measure the Temperature Outside

Use a thermometer to measure the temperature outside. Observe, measure, and graph how the temperature changes throughout the day.

**What you'll need:**

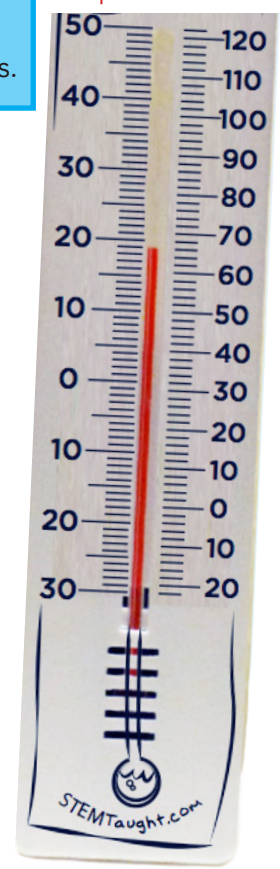
- a thermometer

**What you'll do:**

Measure the temperature outside to fill out the chart and make a graph.

**Science and Engineering Practices: Analyzing and Interpreting Data**
Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships.

Students represent data in tables and a graphical display to reveal patterns in daily temperature.




## The Temperature Outside

**Date:** Example: (Date of measurement)

| Time of Day | Temperature °F |
|---|---|
| Example: 8 am | Example: 76 °F |
| Example: 10 am | Example: 79 °F |
| Example: 1 pm | Example: 84 °F |

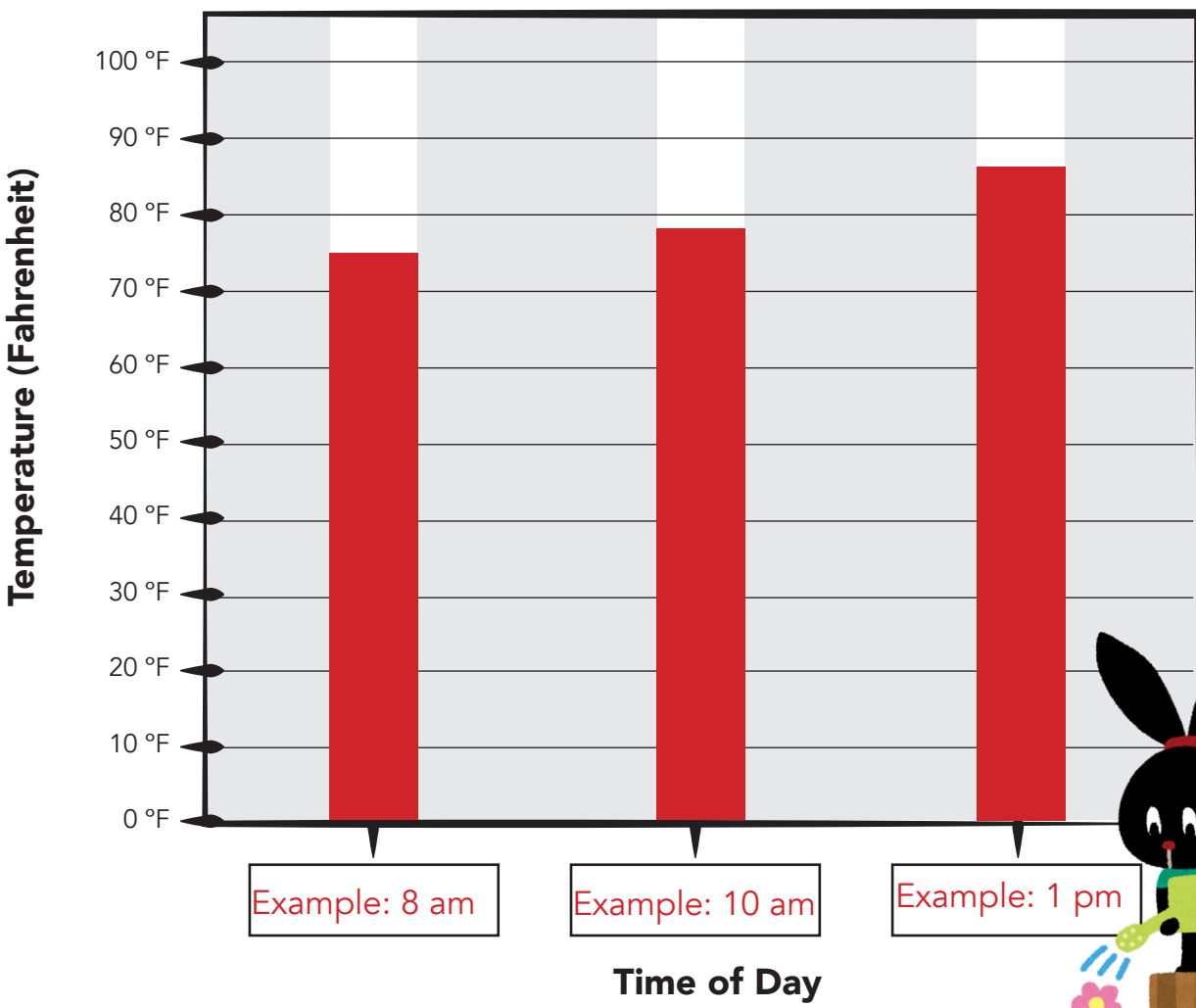
*This data table shows the temperature outside at three different times in one day.*

*It is a warm sunny day.*

*It is cold sunny day.*

*It is a cold snowy day.*

## Graph: The Temperature Outside Today




How did the temperature change throughout the day?

Answers will vary. Example: The temperature rose throughout the day because the sun was shining brightly.

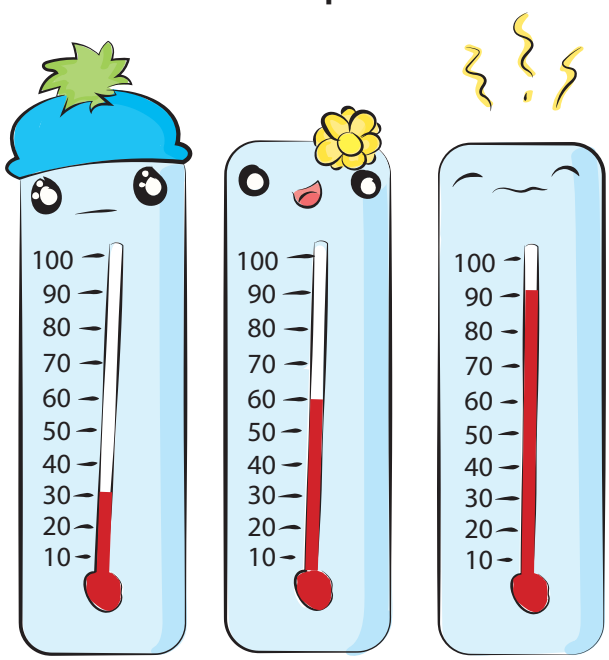
**3-ESS2-1. Earth's Systems**
Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

Students measure temperature data and graph it to represent the seasonal temperature of today.

# How do we describe the weather?

Whenever you walk outside you can see and feel things that help you describe the weather.

## Measure the temperature to describe the weather




You can feel the warm sun on your face or the cold chill of a winter day. Measuring the temperature helps us describe how warm or cold it is to others.

**3-ESS2-1. Earth's Systems**
Examples of data could include average temperature, precipitation, and wind direction.

Temperature, precipitation, and wind direction are introduced here.

## Explain how the wind blows to describe the weather


To explain how the wind blows, you can measure and describe the wind's direction and strength.

## Observe how the sky looks to describe the weather



Sunny

Partly Cloudy

Cloudy

Rainy

Stormy

Snowy

To explain how the weather looks and feels outside, you can observe the clouds in the sky and see whether it is sunny or if there is rain. You can tell a lot about the weather just by looking.

Sunny

Cloudy/Partly Overcast

Rainy

How would you describe the weather these birds are experiencing?

# How do we measure the temperature?

It is easy to feel how cold or hot it is outside because our skin can sense temperature. A thermometer is an instrument that can measure temperature. The red liquid inside a thermometer expands and rises in its tube as it gets warmer. We read the temperature at the top of the red liquid.

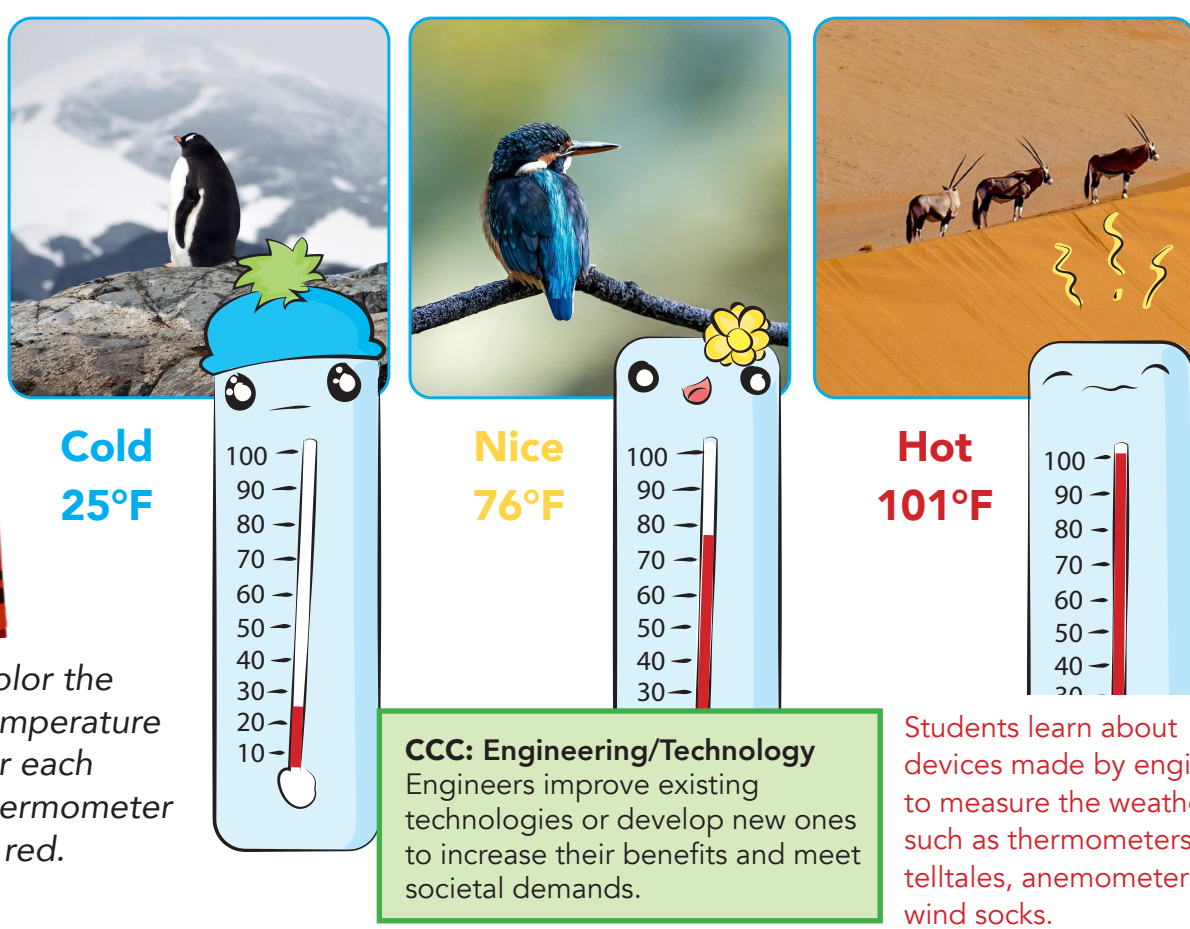
## Get familiar with temperatures in Fahrenheit

We measure temperature using a scale called Fahrenheit. Measuring temperatures makes it easier to share temperatures with others.

**SEP: Analyzing and Interpret Data**
Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships.

Students color in thermometers as a type of graphical display to reveal patterns in daily temperatures.

Color in the thermometers to show the temperature of each day pictured.




*Color the temperature for each thermometer in red.*

**CCC: Engineering/Technology**
Engineers improve existing technologies or develop new ones to increase their benefits and meet societal demands.

Students learn about devices made by engineers to measure the weather such as thermometers, telltales, anemometers, and wind socks.

# How do we observe the wind?

There is more to describing the weather than just temperature. You can feel which direction the wind blows and how fast it is moving. People use all sorts of things to observe and measure the wind.


*A tassel at the top of a mast is called a telltale.*


*A wind sock shows us how strong the wind is.*


*This whale points in the direction of the wind*

Wind socks make it easy to see wind direction and speed.

Cut out the tiles and place them in order from least windy to most windy.

**No wind**
0 mph

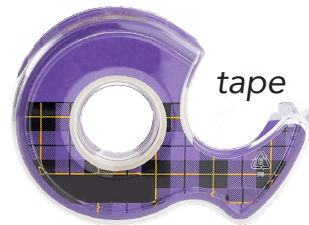
**Breezy**
6 mph

**Windy**
12 mph

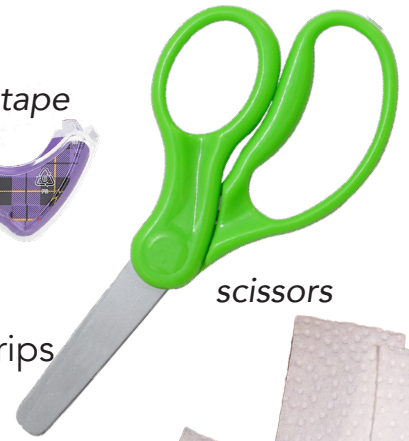
**Very windy**
18 mph

# Make a telltale

A piece of yarn or fabric that helps sailors see the direction of the wind is called a "telltale." Design and make a telltale to help you observe wind speed and direction. Have fun experimenting with your telltale outside.



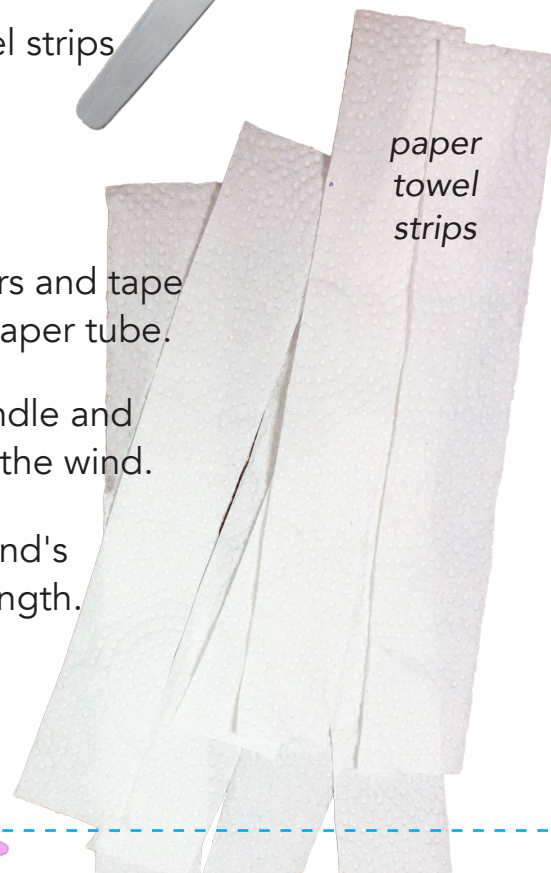
*tape*



*scissors*

**What you'll need:**

- a stick, Popsicle stick, or rolled paper tube
- crepe paper streamers or a cut paper towel strips
- scissors
- tape



*paper towel strips*

**What you'll do:**

1. Cut paper towel streamers and tape them to a stick or a rolled paper tube.
2. Use the stick as a handle and hold your telltale up to the wind.
3. Observe the wind's direction and strength.



If you don't have wind, just run around to make your own!

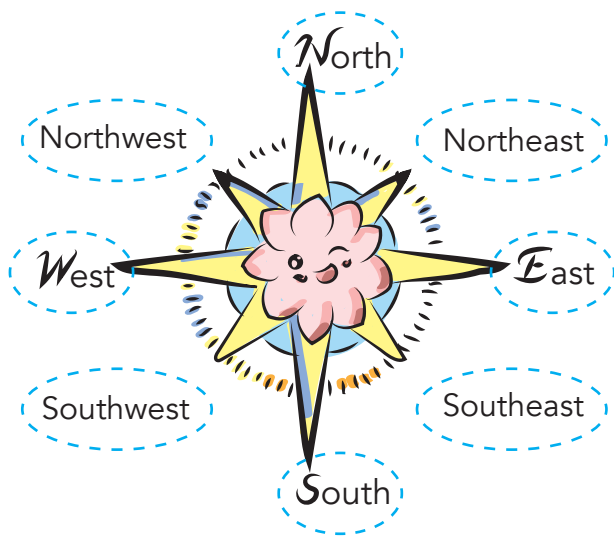
## Practice describing the wind today

Use your telltale to observe the wind. Ask an adult for help to determine which direction the wind is blowing. Observe the tassels to help you describe the wind as gentle, steady, or strong. If there is no wind today, just run to make your own.

## Today's Wind Conditions

Today's Date: _____

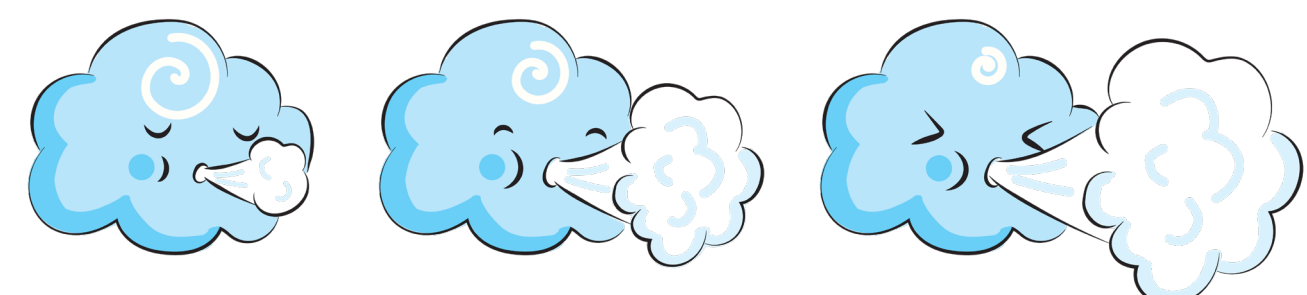
**Wind Direction:** Circle one.




**DCI ESS2.D: Weather/Climate**
Scientists record patterns of the weather across different times and areas so that they can make predictions about weather.

Students learn how to describe wind direction and wind speed with a simple telltale that they construct. They will describe and plot the weather conditions like a scientist.

**Wind Speed:** Circle one.



Gentle Breeze | Windy | Strong Wind

# Be a weather reporter

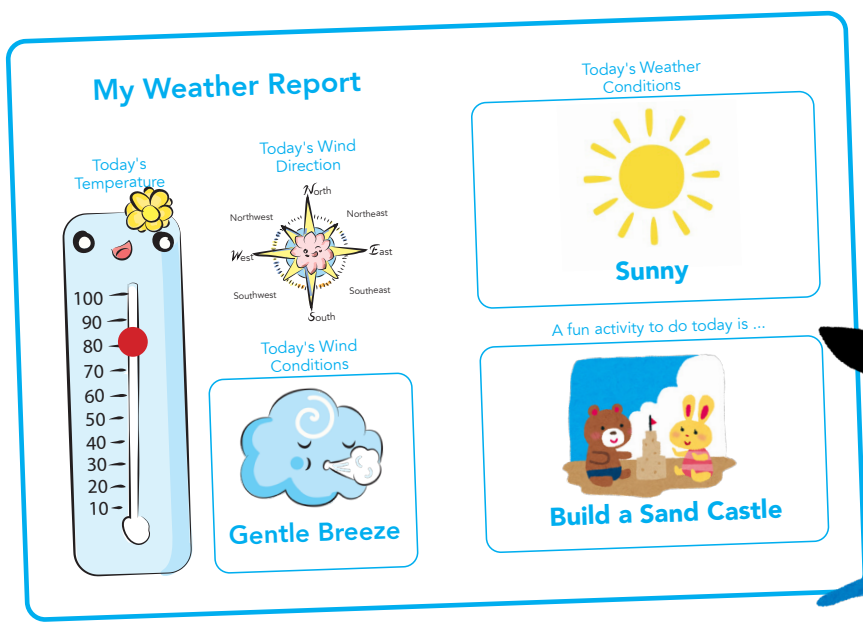
Create a daily weather report. Use your thermometer to measure the temperature. Use your telltale to observe the wind. Use your eyes to describe the weather conditions.

**What you'll need:**

- scissors
- tape
- a brad
- your weather report display chart


**What you'll do:**

1. Cut one weather report display chart as a class.
2. Cut out the wind direction pointer from the back cover of your book and attach it to your weather chart.
3. Cut out your weather chart icons.




4. To update your weather report, attach your icons to the chart with tape.

(Note: You only need to display one weather report chart per classroom. Invite one student to give the weather report to the whole class every morning.)

**Science and Engineering Practices: Analyzing and Interpreting Data**
Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships.

Students report on and take measurements of the weather which they will record and graph.

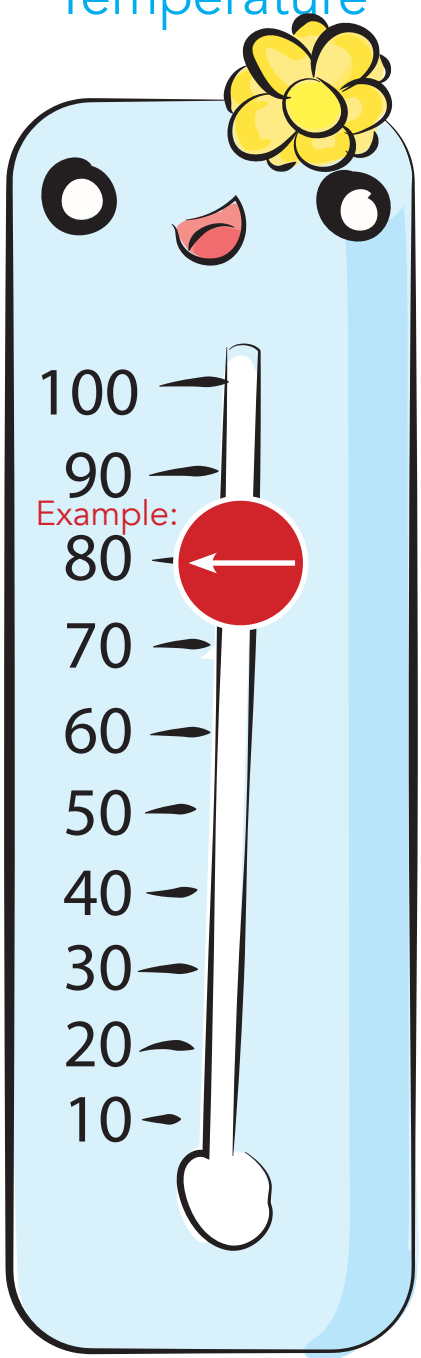
How would you describe the weather in this photo?


The weather in this photo appears cold and snowy. The sunlight is soft and dim, so it must be cloudy. I can see snow falling. The bird is keeping warm as it rests peacefully, so the wind must not be blowing or it is only blowing very gently.

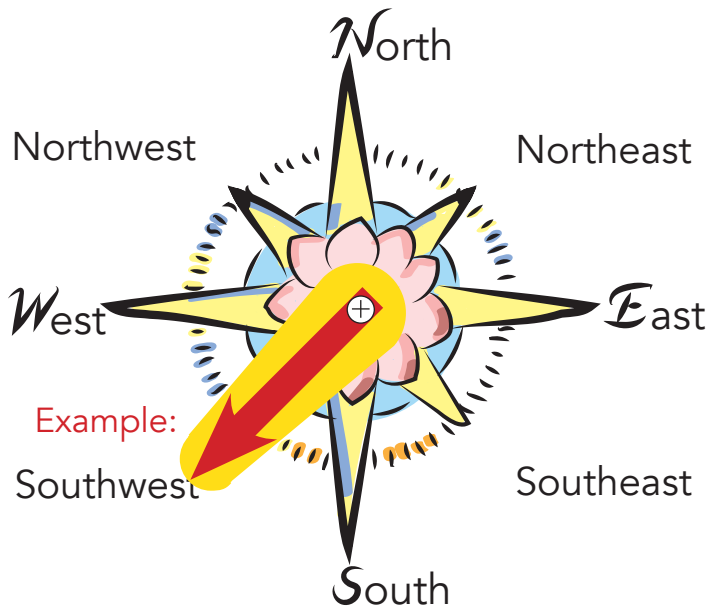
*This bird's feathers keep it warm in the cold winter air.*

# My Weather Report

## Today's Temperature




## Today's Wind Direction




## Today's Wind Conditions

Example:

Gentle Breeze

# Today's Weather Conditions

**Crosscutting Concepts:**
**Science is a Human Endeavor**
Science affects everyday life.

Scientists measure and study the weather every day as part of everyday life.

**3-ESS2-1. Earth's Systems**
Examples of data could include average temperature, precipitation, and wind direction.

Data that the students observe and record include temperature, wind speed, wind direction, and precipitation.

Example:

**Sunny**

**Observable features of the student performance - Organizing data**
a. Students use graphical displays (e.g., table, chart, graph) to organize the given data by season using tables, pictographs, and/or bar charts, including: (i) Weather condition data from the same area across multiple seasons (e.g., average temperature, precipitation, wind direction).

Students organize measurements and pictures in their weather conditions chart daily to report on the weather.

# A fun activity to do today is ...

Example:

*surf*

*build a sand castle*

*hide-and-seek*

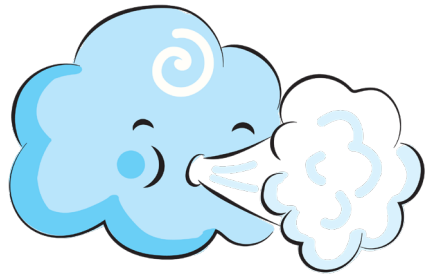
*water play*

*water slides*


The weather in this photo appears cold and cloudy. Leaves turn orange and fall from the trees in the fall when the weather turns cold just before winter. The light is soft and dim, so it must be cloudy. I think the weather appears wet like it rained recently because the water is flowing and the rocks appear to be shiny and wet.

*Leaves turn beautiful yellow, orange, and red colors before they fall to the ground during the autumn season.*

Gentle Breeze



Windy

Strong Wind



**Sunny**

**Rainy**

**Partly cloudy**

**Stormy**

**Snowy**

**Cloudy**

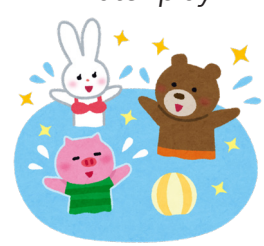
snowboard

water slides

play a board game

ride a bike

water play



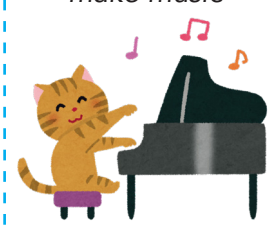
surf

build a sand castle

build a snowman

read a book

make music



ice skate

play in leaves

window watch

cook

hide-and-seek

Strong Wind

Windy

Gentle Breeze

**Partly Cloudy**

**Rainy**



**Sunny**

**Cloudy**

**Snowy**

**Stormy**

*water play*

*ride a bike*

*play a board game*

*water slides*

*snowboard*

*make music*

*read a book*

*build a snowman*

*build a sand castle*

*surf*

*hide-and-seek*

*cook*

*window watch*

*play in leaves*

*ice skate*

## The temperature where I live

Measure and record the temperature each day where you live.

## The place I live:

City: (The city where you live.)

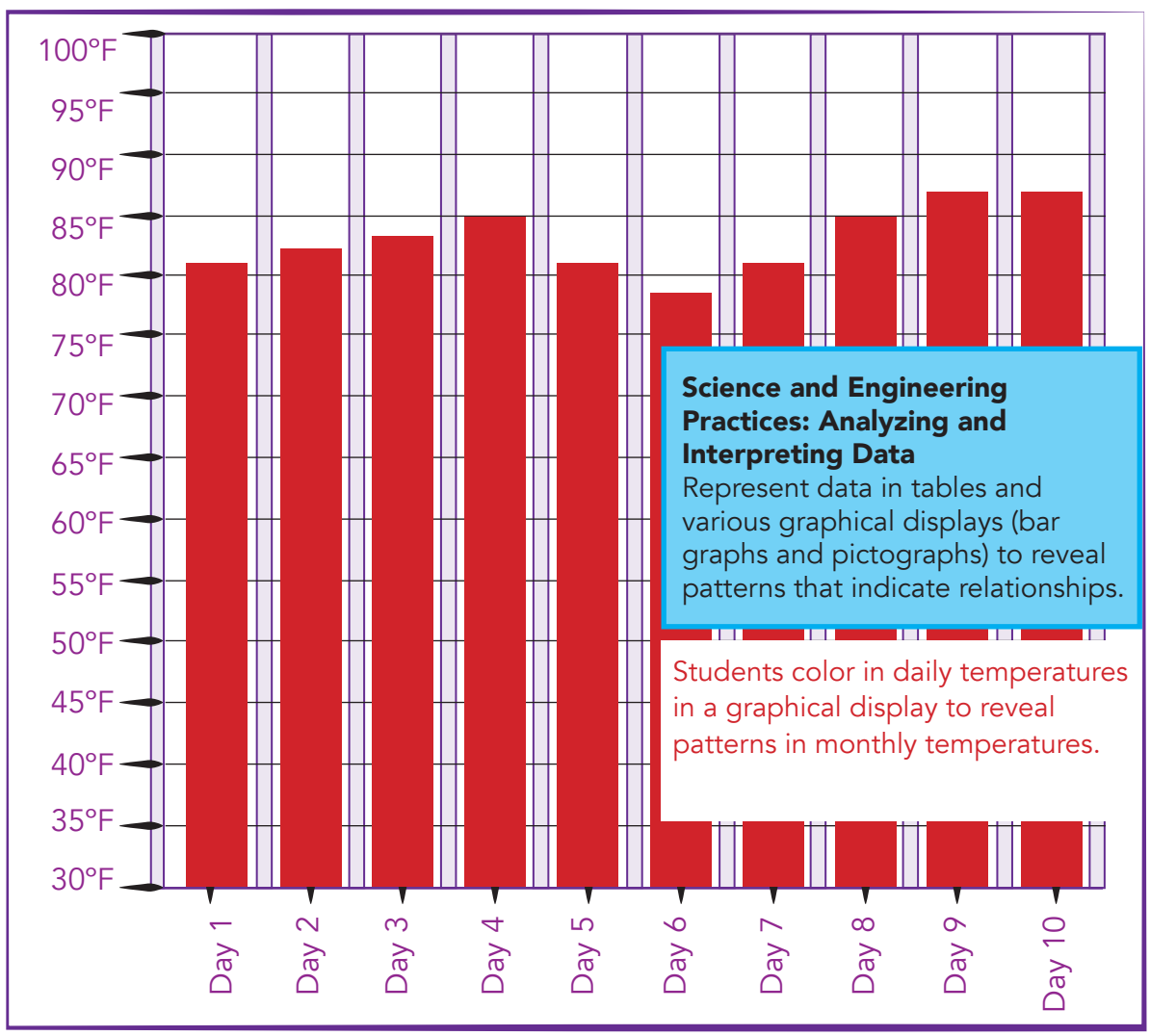
Country: (The country where you live.)

Time: (The time that you will take your measurement each day.)

(measure temperature at same time each day)

### Daily Temperature

**(Temperature over 10 days where I live)**




*(Note: To compare day-to-day temperatures, measure the temperature at the same time each day.)*

## Weather comes in seasons

The weather you see in a year changes with the seasons. In places with cold snowy winters, the seasons are spring, summer, fall, and winter.

### Seasons of the year

*In **spring**, flowers bloom and leaves start to grow.*

spring

*In **summer**, green leaves, seeds, and fruits grow.*

summer

*In **fall**, fruits are harvested and leaves fall to the ground.*

fall

*In **winter**, branches are bare and snow covers the ground.*

winter

How do you know when it is spring, summer, fall, or winter?


I know each season by its month because the seasons happen in the same pattern each year. I can also tell the season by how warm or cold it is and how the plants around me look.

## Warm and dry seasons

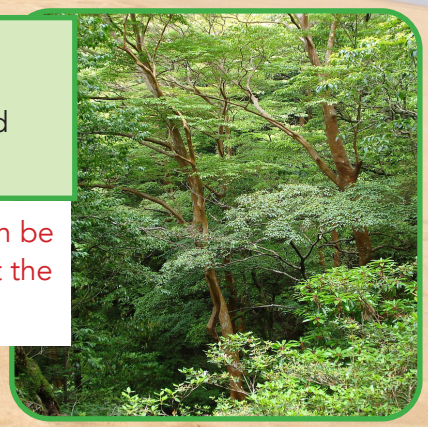
Warm deserts and tropical places that do not have snow usually only have two seasons. In these places, summers are warm and winter brings rain. Places like Hawaii have a warm summer and a rainy season.

What seasons do Hawaii and other warm places have?


Warm places that do not have snow or four seasons typically only have a rainy season and a drier summer season.

Rainy Season

Summer



**Crosscutting Concepts:**
**Patterns**
Patterns of change can be used to make predictions.

Seasonal patterns of change can be used to make predictions about the weather.

*Warm sand and sunshine make the beach a great place to go in the summertime and rainy season.*

## What's it like during spring?

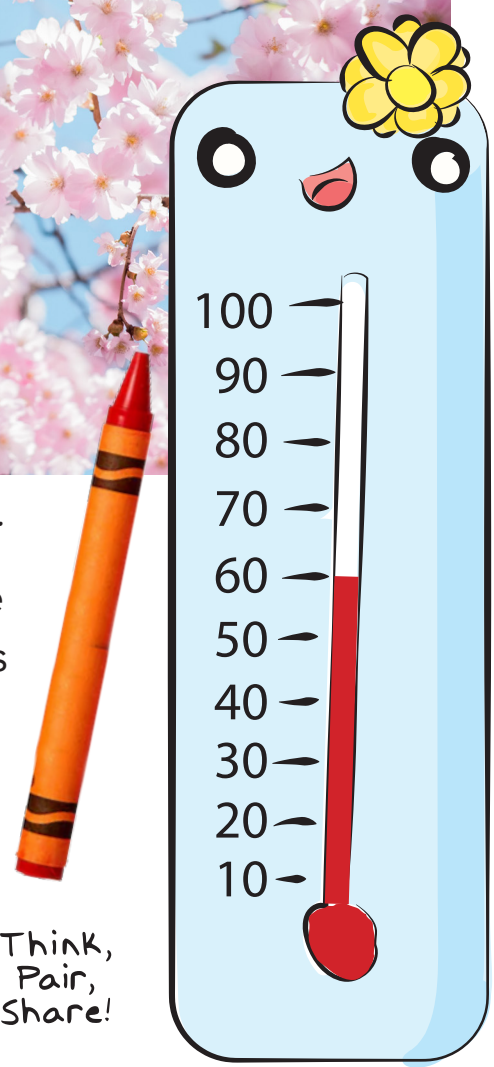
In spring, the snow begins to melt and the temperature outside begins to warm up. Rain is common. Animals begin to wake up from hibernation or come back from migration. Trees begin to grow leaves again.

**Spring sunshine and rain showers bring beautiful flowers**

*Beautiful cherry blossoms bloom in springtime.*

A typical spring temperature in a place with four seasons is around 60 degrees Fahrenheit.

Color red on the thermometer to 60°F.




What activities do people like to do in the spring?


In springtime, people like to garden and play sports because the weather is warming up.

## What's it like during summer?

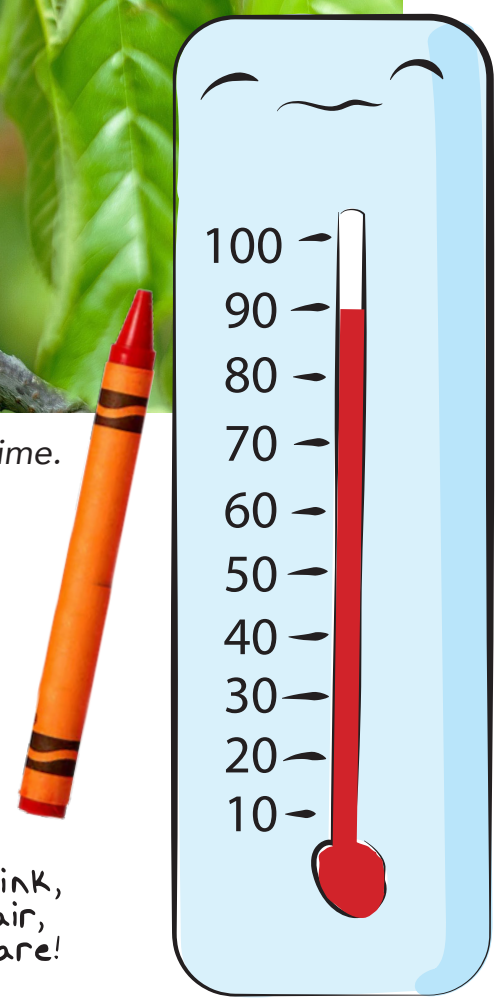
During summer, it is warm and sunny. Plants grow and animals have plenty to eat. Days are longest in the summertime.

### Summer brings sunshine and warmth

*Delicious cherries are ready to eat in the summertime.*

A typical summer temperature in a place with four seasons is around 90 degrees Fahrenheit.

Color red on the thermometer to 90°F.




What activities do people like to do in the summer?


In the summer, I like to swim and play because it is hot outside.

## What's it like during fall?

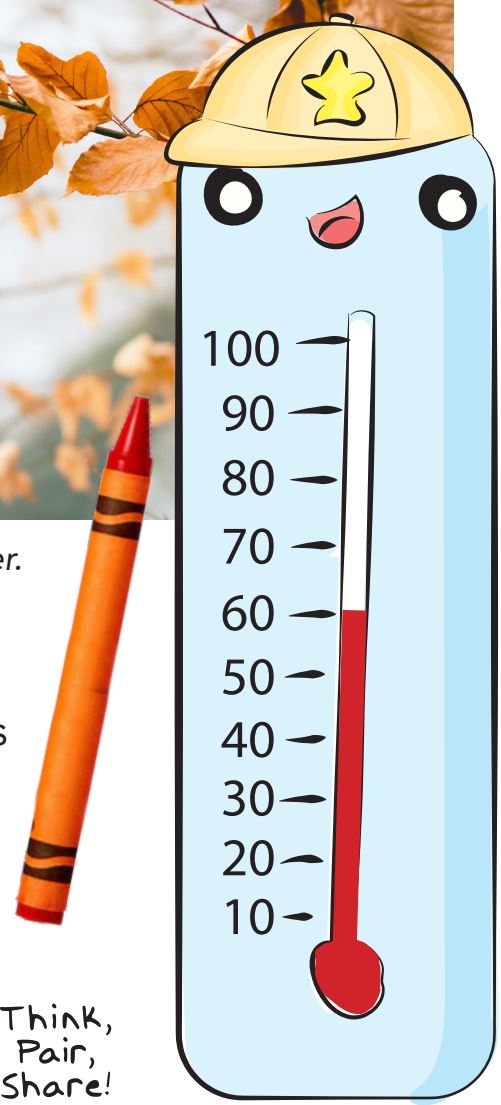
During the fall, leaves start to turn different colors and fall from the trees. The weather becomes colder and the days become shorter again.

### Cold autumn weather brings us vibrant fall colors

*Fall is the season to harvest crops before winter.*

A typical fall temperature in a place with four seasons is around 60 degrees Fahrenheit.

Color red on the thermometer to 60°F.




What activities do people like to do in the fall?




In fall, people like to harvest crops and play sports in cool weather.

## What's it like during winter?

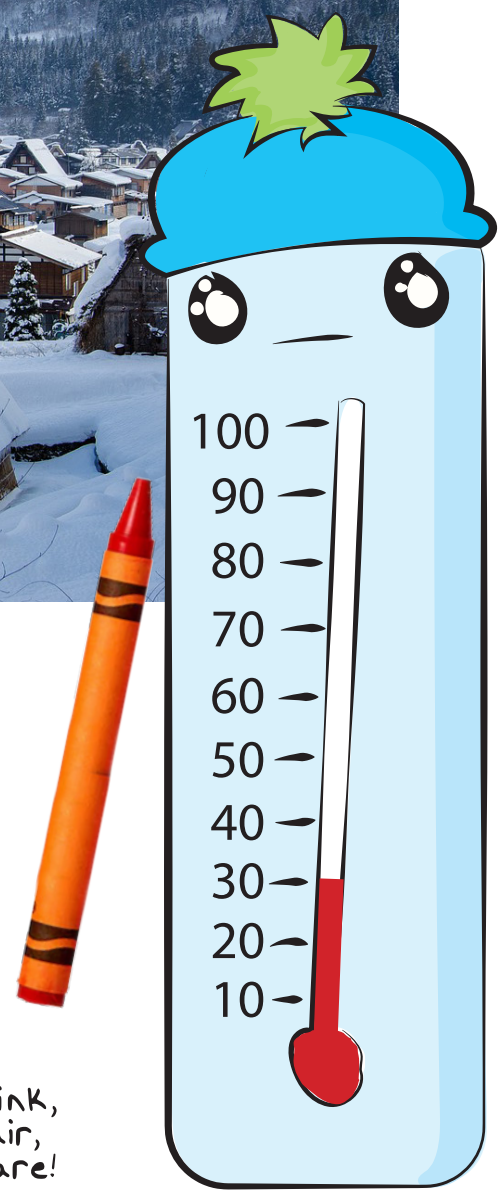
During winter it is cold. In some places, the temperature gets cold enough that water freezes and snow falls. In the winter, many mammals including bears hibernate, and many types of birds migrate to warmer places.

### A cold winter can bring snow

*Cold winter weather can bring snow and ice.*

A typical winter temperature in a place with four seasons is around 30 degrees Fahrenheit.

Color red on the thermometer to 30°F.




What activities do people like to do in the winter?


In the winter, people like to ski, snowboard, and ice skate because it is cold outside.

# Weather comes in seasons

The weather we see in a year changes with the seasons. The seasons are spring, summer, fall, and winter.

Use the photos to label the spring, summer, fall, and winter seasons to see in which months they occur in the United States and the Northern Hemisphere.

## Seasons of the year

spring

summer

fall

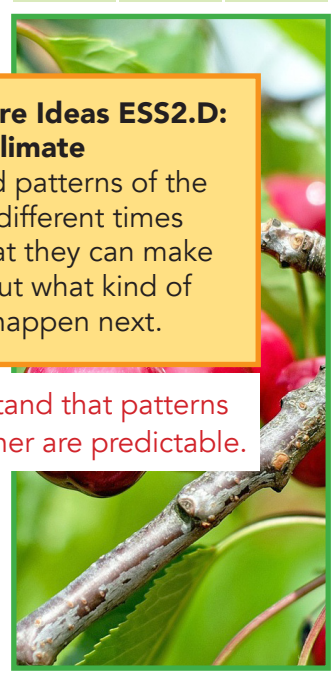
winter

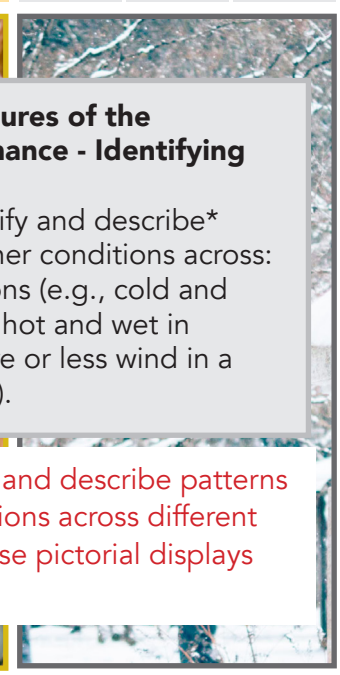
March April May

June July August

September October November

December January February





**Disciplinary Core Ideas ESS2.D: Weather and Climate**
Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.

Scientists understand that patterns of seasonal weather are predictable.

**Observable features of the student performance - Identifying relationships:**
a. Students identify and describe* patterns of weather conditions across: (i) Different seasons (e.g., cold and dry in the winter, hot and wet in the summer; more or less wind in a particular season).

Scientists identify and describe patterns of weather conditions across different seasons using these pictorial displays and a bar chart.

What months do spring, summer, fall, and winter occur in? What season is your birthday in?




Spring happens during March, April, and May. Summer happens during June, July, and August. Fall happens during September, October, and November. Winter happens during December, January, and February.

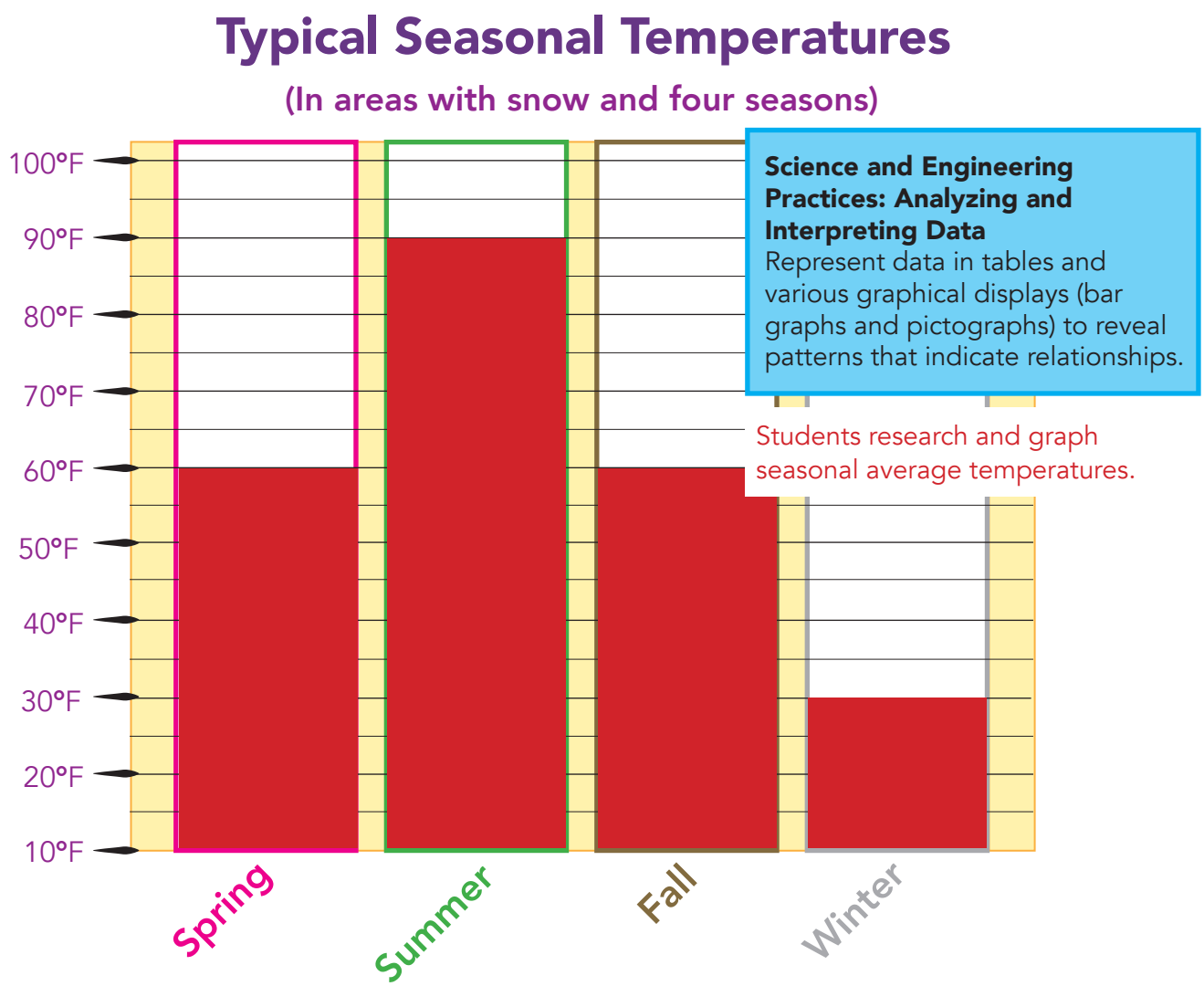
## How does temperature change in a year?

Temperatures change with the seasons. Each year, it gets warmer and cooler in a cycle that repeats itself.

Use the data to graph the typical seasonal temperatures for areas with snow and four seasons.

**Typical Seasonal Temperatures Data Table** (In areas with snow and four seasons)

| | Spring | Summer | Fall | Winter |
|---|---|---|---|---|
| Daylight | 60°F | 90°F | 60°F | 30°F |




**Science and Engineering Practices: Analyzing and Interpreting Data**
Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships.

Students research and graph seasonal average temperatures.

## Research temperatures in your area

Look up temperatures where you live to fill out the chart.

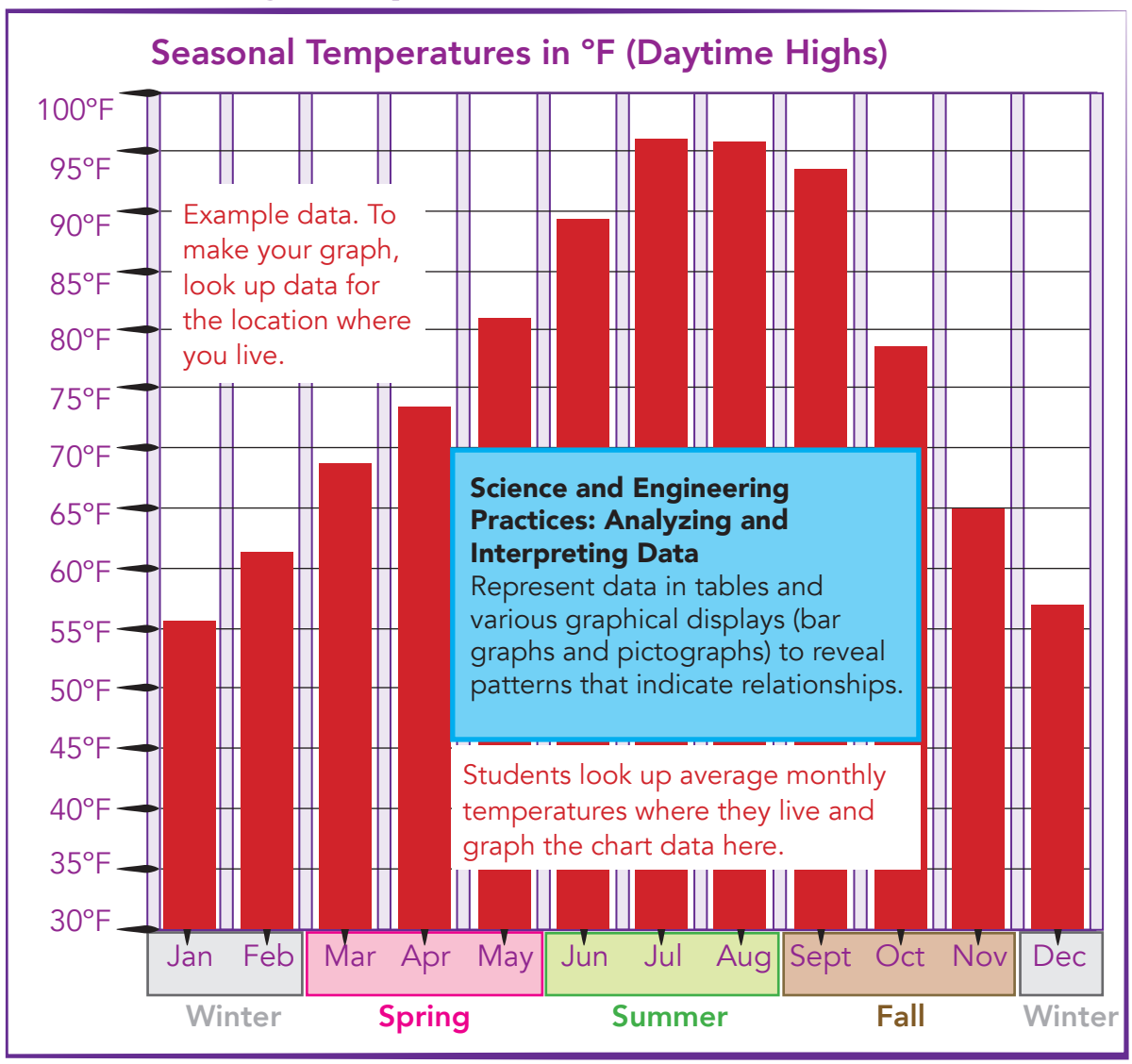
## The Place I Live:

City: (The city where you live)  Country: (The country where you live)

Zip Code: (The zip code where you live)

With the help of a teacher or parent, look up and graph the monthly temperatures where you live.

## The Monthly Temperatures Where I Live



How would you describe the weather in this photo?


The weather in this photo appears to be cool springtime weather. I can see snow on the mountain, but the flowers are in bloom. The cold winter is over and the warm summer is coming. The sky looks clear and sunny.

**Observable features of the student performance - Organizing data**
a. Students use graphical displays (e.g., table, chart, graph) to organize the given data by season using tables, pictographs, and/or bar charts, including: (ii) Weather condition data from different areas (e.g., hometown and nonlocal areas, such as a town in another state).

Students use this graphical display to chart seasonal temperatures throughout a year in their hometown.

**Observable features of the student performance - Interpreting data**
a. Students use patterns of weather conditions in different seasons and different areas to predict: (i) The typical weather conditions expected during a particular season (e.g., "In our town in the summer it is typically hot, as indicated on a bar graph over time, while in the winter it is typically cold; therefore, the prediction is that next summer it will be hot and next winter it will be cold.").

Lead your students in a discussion to recognize patterns of weather conditions in different seasons in your home town to predict typical weather conditions expected during a particular season.

*Wild flowers bloom during the spring season.*

# Danny the Squirrel's First Winter

**Part 1:**

## Danny's best season

In a tiny, forested town lives a family of squirrels. One of the young squirrels named Danny likes being outside and exploring all around the park. He loves summertime! Danny collects the most nuts from all of the trees and make his sisters jealous.

Why do you think Danny the squirrel collects nuts during summer?


Danny collects nuts during the summertime because nuts grow on trees during warm summer weather.

Danny loves summer, but he also loves fall because his fur gets thicker and makes him look stronger—he shows off to all his friends. Danny does not like winter because he has to stay inside the nest for such a long time!

## Why do you think Danny the squirrel likes the fall weather?


Danny's fur grows thicker during the cold fall weather and makes him look stronger.

All the squirrels got cozy in their tree nest for the cold winter weather. Danny asked his mom if he could stay outside the tree instead.

“Now, Danny!" she said. "You know that winter weather is too cold for squirrels! There isn’t any food out there for us. It’s much nicer in our tree where we have all the nuts we saved! In our nest, we have a warm shelter from the snow.”

**Part 2:**

## Winter is cold!

One winter day, Danny decided he had spent enough time being crammed in a tree. He wanted to go outside and run around. When Danny's parents were napping, he stepped out into the cold snow. Everything was white and it was very cold. Snow was piled high on the tree branches and no one was around to play with.

Danny decided he wanted to stay inside. He returned to his tree, snuggled back up with his mom, and waited patiently for spring. Danny would have to wait for spring to play in the warm sunlight. For now, Danny would enjoy the beautiful, cold, snuggly winter because each season behaves as it always does and always will.

# The End




Why was Danny finally okay with snuggling down in the nest for winter?

Danny finally wanted to snuggle in the warm nest when he realized it was too cold to play outside in the cold snowy winter.

## What climates exist around the world?

Different places in the world have different climates. **Climate** is the usual pattern of weather in a place over a long time. It includes things like temperature, rain, and wind. Climate affects how plants grow, how animals live, and how much water and food is in an area.


**Disciplinary Core Ideas ESS2.D: Weather and Climate**
Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.

Climate is defined here.



Areas that get more rainfall appear greener in color. Dry deserts appear brown.

## Some climates are warm and some are dry

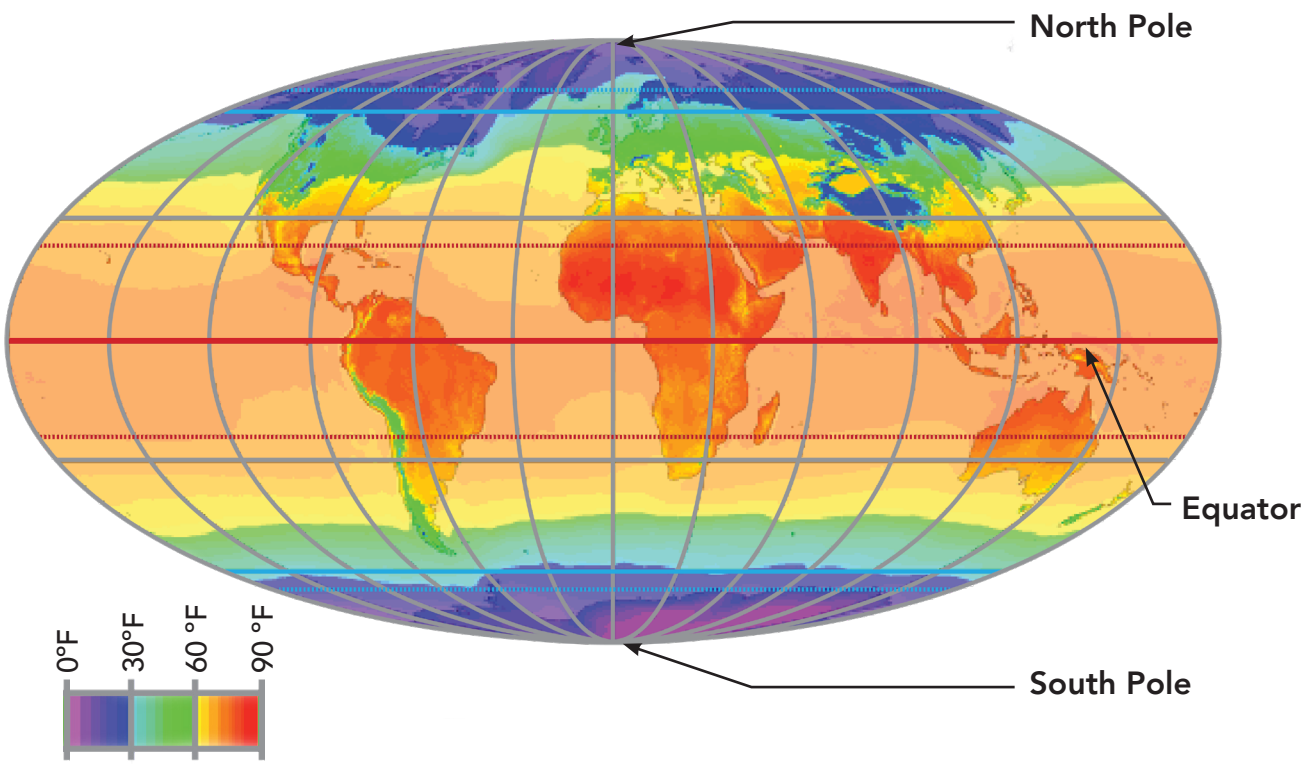
Unlike weather, which can change daily, an area's climate describes what the weather is typically like over many years. Climates around the world include deserts, forests, grasslands, tundras, and polar regions.


*There are many different types of climates. Some are warm and some are cold.*

## Earth is warmest at its equator

Earth's equator is located along the center of the globe. Earth is warmest along its equator because it receives the most direct sunlight there. Hot deserts and tropical rain forests are located on Earth's equator. Earth's poles are cold and icy because they recieve very little direct sunlight.

### Annual Average Temperature Around the World




**Fahrenheit Temperature Scale**

Describe the patterns you see in Earth's temperatures around the world.

Answers will vary. Example: It is warmer near the equator and colder near the poles.

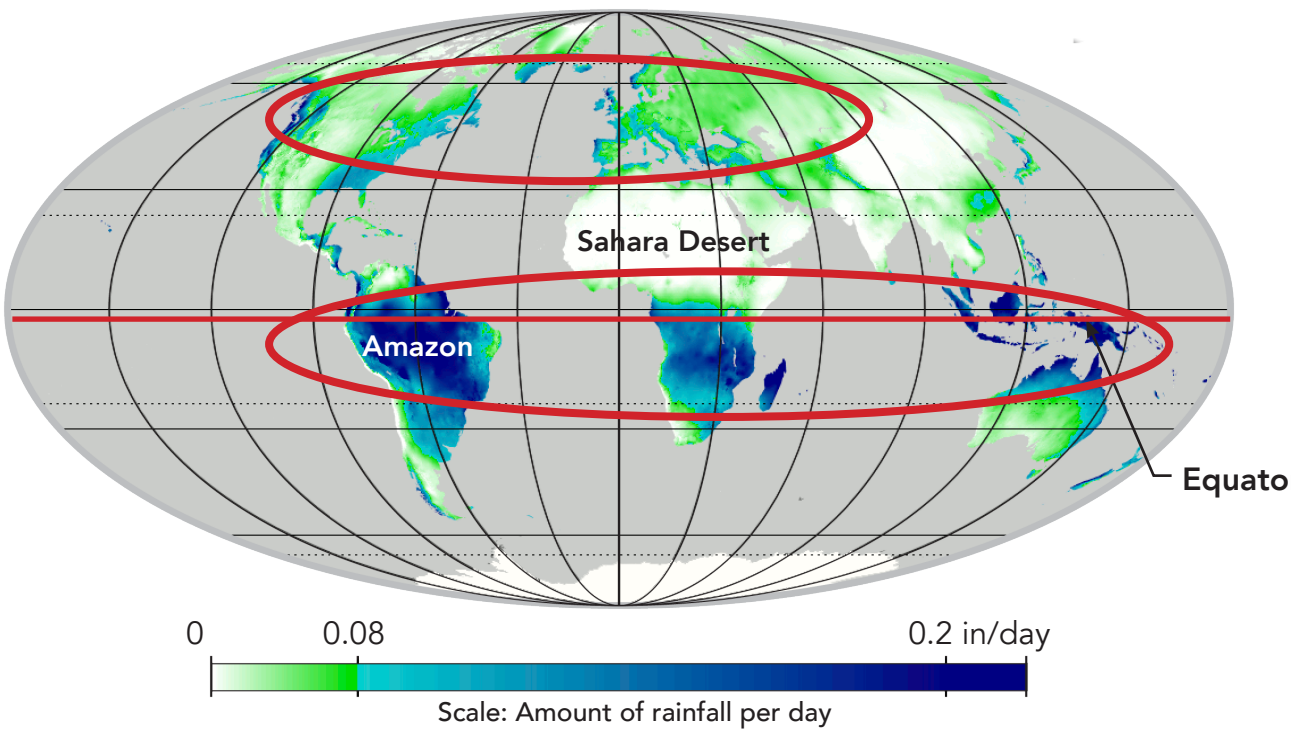
**Features of student performance - Obtaining information**
a. Students gather information about:
i. Climates in different regions of the world (e.g., equatorial, polar, coastal, mid-continental).

Students look at the temperature plot to describe temperatures around the world. They should notice that the warmest temperatures on Earth are near the equator.

## Some areas are dry and others are wet

How far north or south a place is on the Earth affects how much rainfall it will get. Places directly on Earth's equator such as the Amazon rainforest get lots of rainfall. Places such as the Sahara Desert of Africa are hot and dry and get very little rainfall.

### Annual Average Rainfall Around the World




Circle the areas that get the most rainfall. Describe what areas on Earth get the most rainfall?

Answers will vary. Example: The most rain falls near the equator and just below (south) of it. Some areas in the north get a lot of rainfall too.

**3-ESS2-2. Earth's Systems**
Obtain and combine information to describe climates in different regions of the world.

Students look at a plot of average annual rainfall around the world to describe how much rain falls in different places around the world. They should notice that the most rain falls on the blue and green areas of the chart.

## Rainforests get lots of rain

Rainforests get the most rain of any place on Earth. Tropical rainforests are warm and are found near Earth's equator. Rainforests in cooler climates can be found between the equator and the poles.

**Science and Engineering Practices: Obtaining, Evaluating, and Communicating Information**
Obtain and combine information from books and other reliable media to explain phenomena.

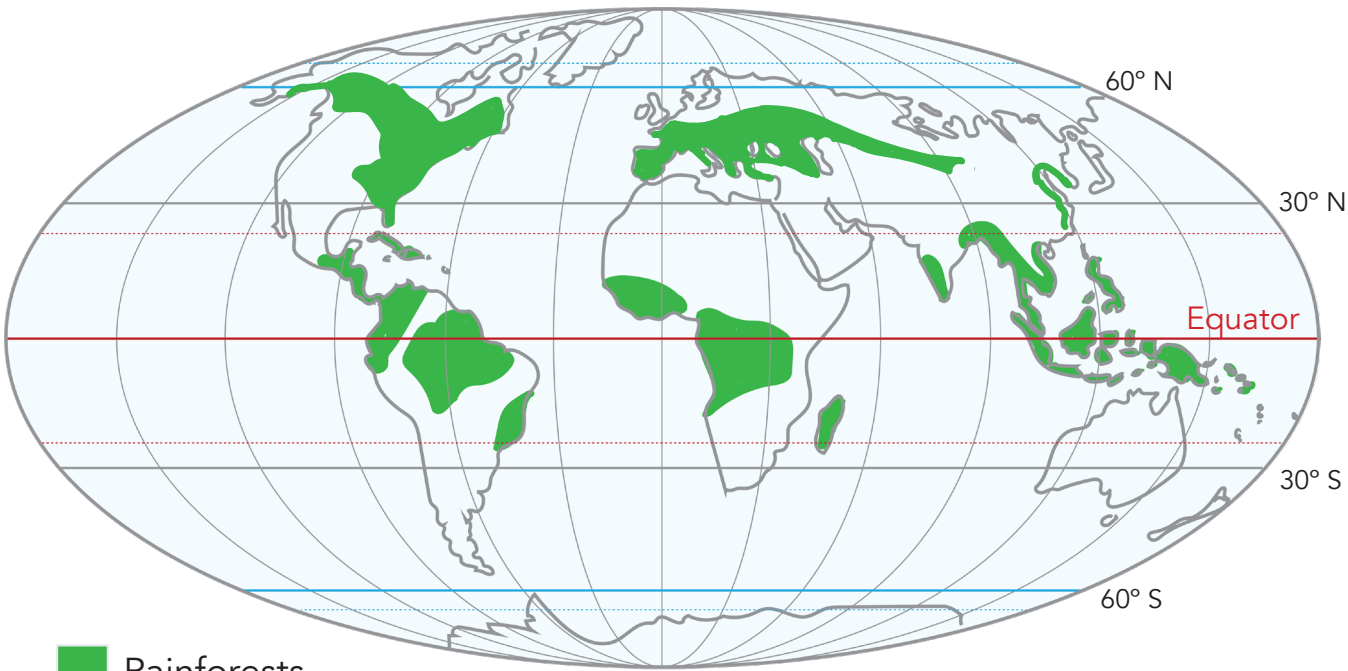
Students look at global climate trends to see where the most precipitation falls.

*Trees in tropical rainforests produce much of Earth's oxygen.*

Where can rainforests be found on Earth?


Tropical rainforests are found near the equator but rainforests in cooler climates can be found between the equator and the poles.

# Tropical Rainforests of the World




Describe where you see rainforests around the world.

Answers will vary. Example: Tropical rainforests are found near the equator but rainforests in cooler climates can be found between the equator and the poles too.

**Observable features of the student performance - Identifying relationships:**
a. Students identify and describe* patterns of weather conditions across: Different areas (e.g., certain areas (defined by location, such as a town in the Pacific Northwest), have high precipitation, while a different area (based on location or type, such as a town in the Southwest) have very little precipitation).

Students identify and describe patterns of weather conditions and rainfall across the globe.

**3-ESS2-2. Earth's Systems**
Obtain and combine information to describe climates in different regions of the world.

Students look at areas of the globe that are covered by rainforests.

## Desert life needs very little water

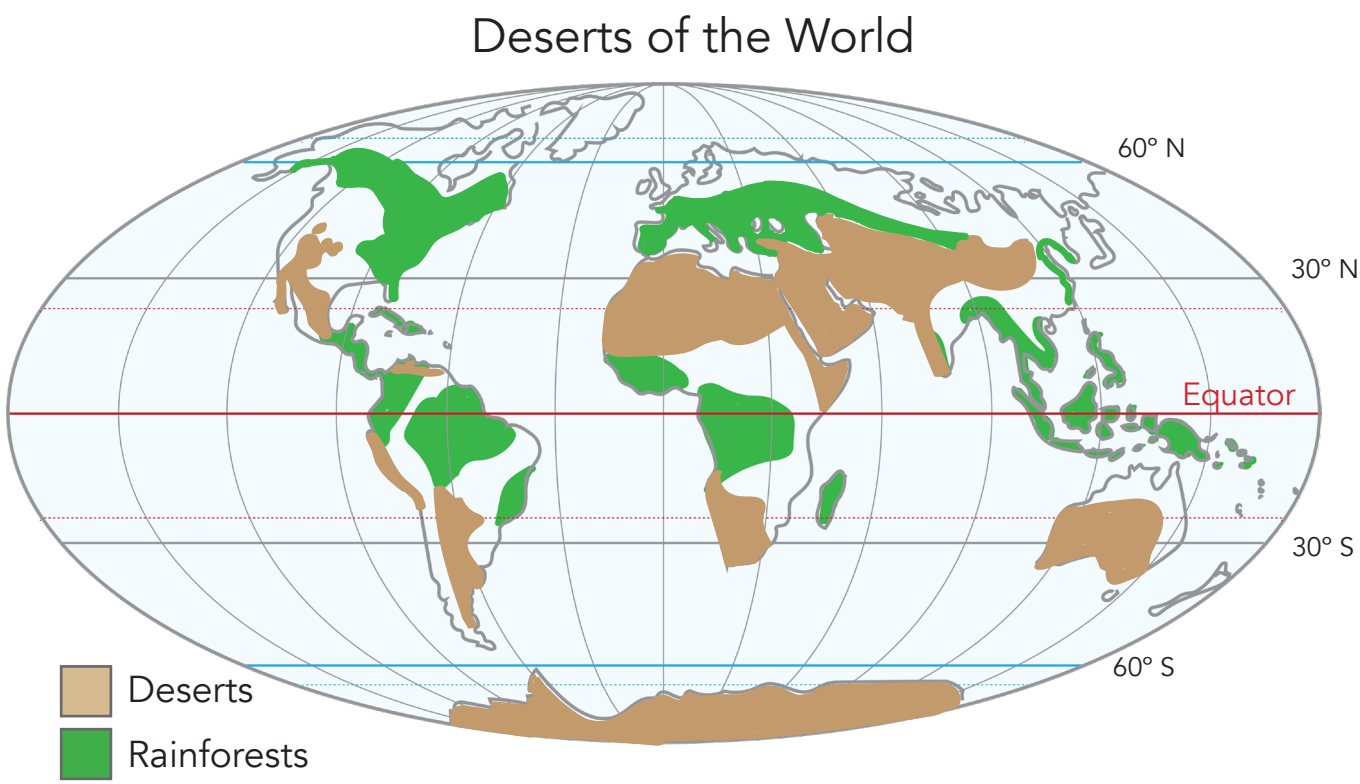
Some of the world's hottest, driest deserts are found near the equator where direct sunlight shines brightly. Rainforests are found above and below these deserts.

*Both the cactus and the camel are experts at conserving water in dry climates.*

## Desert Life Needs Very Little Water

How do living things survive in places that are extremely hot and dry? Plants and animals that live in dry deserts must not use much water and can sometimes even store water. Camels, for example, store fat in their humps that they can break down into water and nutrients when needed. They also don’t sweat—another way we lose water.

A cactus stores water in it when it rains. A cactus has thick waxy skin that keeps water inside it. Some animals, such as kangaroo rats, never need a drink of water. They are able to get all the water they need from their food. Many animals feed at night so that they can stay out of the sun.




Describe where deserts are found on Earth.

Answers will vary. Example: Deserts are found in between Earth's rainforests and at the poles.

## Tundras are found far to the north

Tundras are cold climates found near polar regions. They are usually covered in snow in the winter, and by grass and shrubs in the summer. There aren't many trees in the tundra. Although the ground is frozen for most of the year, the top few inches of ground warm up in the summer.

*In the Arctic tundras of Alaska, the climate is cold and there are no trees.*

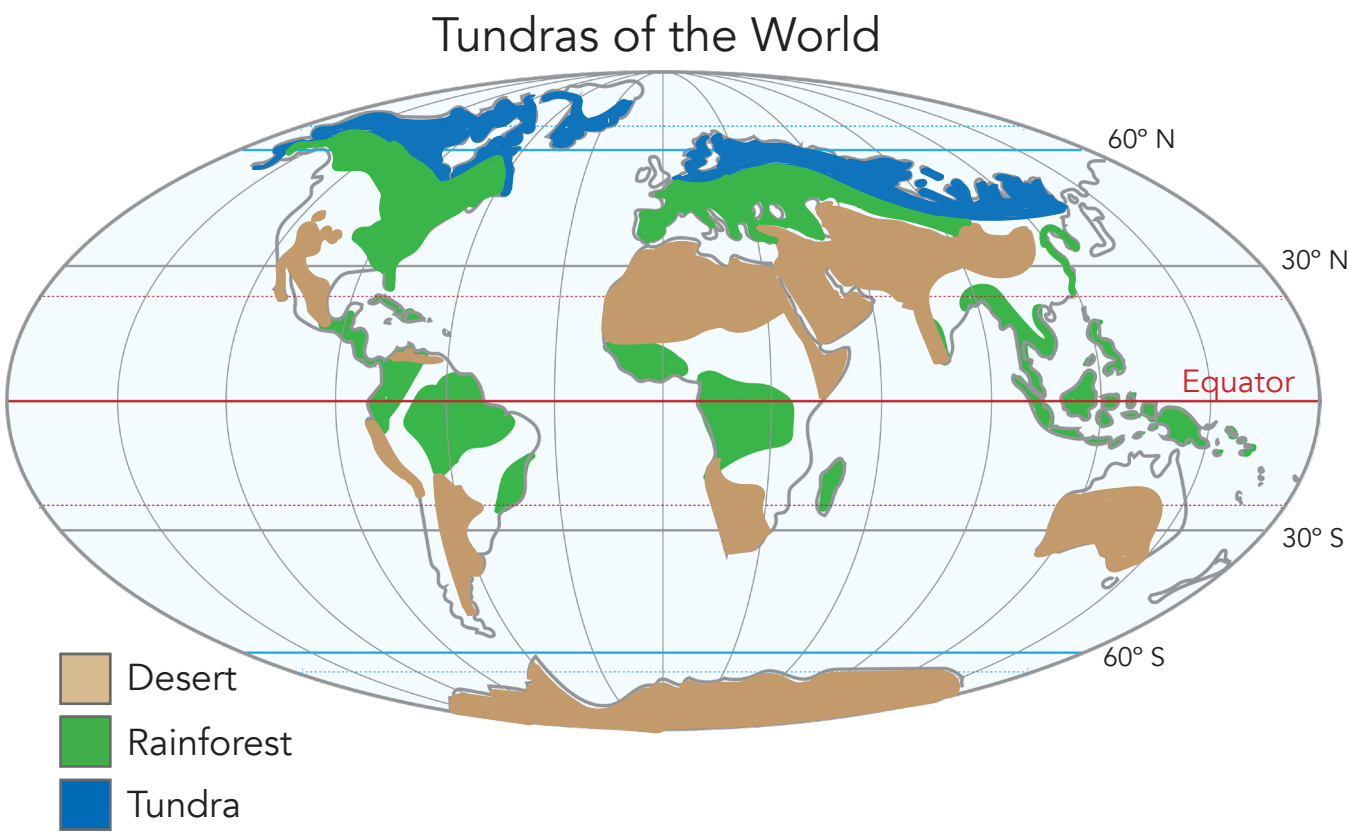


*An Arctic fox naps on the tundra.*

Where can Arctic tundras be found on Earth?


Arctic tundras are found in the far northern reaches of the globe in the arctic regions near the North Pole.

The tundra is home to animals such as Arctic foxes, Arctic hares, polar bears, caribou and marmots.




Describe where tundras are found on Earth.

Answers will vary. Example: Arctic tundras are found in the far northern reaches of the globe in the Arctic regions near the North Pole.

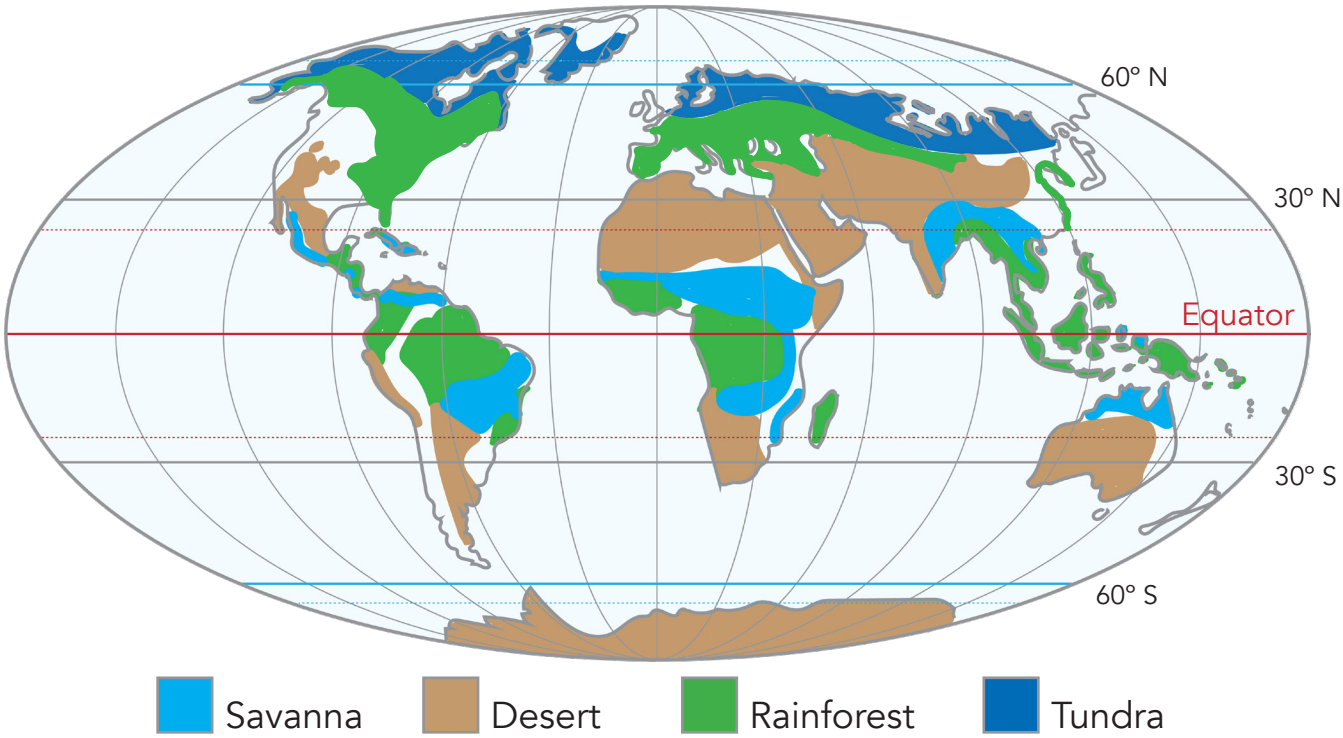
## Animals in savannas travel to water

Savanna grasslands can be found between deserts and rainforests. The savanna is dry most of the year. The savannas of Africa receive rain all at once during a rainy season.

*These zebra and wildebeest share a grazing area in the savanna.*

Animals in the savanna must travel long distances to get water. Gazelles, elephants, wildebeest, rhinos, and zebras migrate in herds to reach watering holes. These animals often share watering holes with many different species.

# Climates of the World




Where are savannas located in relation to deserts and rainforests?

Answers will vary. Example: Savanna grasslands are usually found between deserts and rainforests.

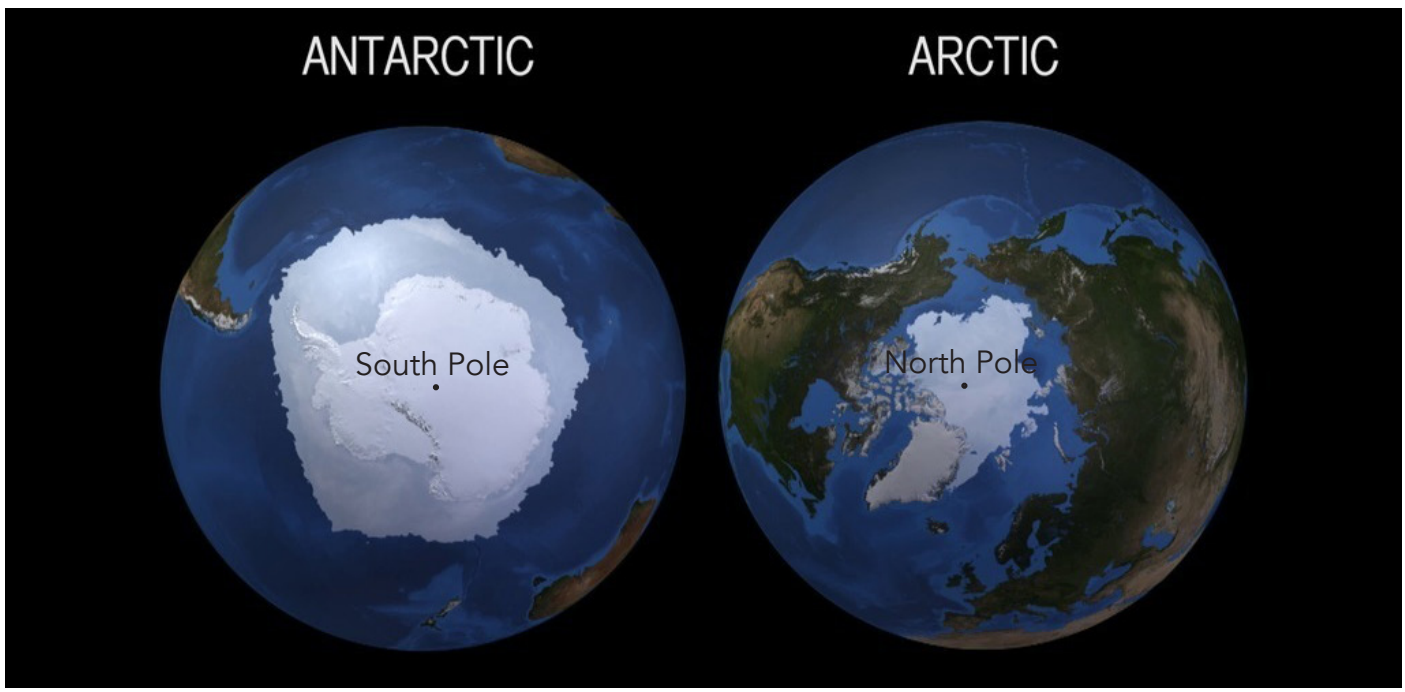
**Observable features of the student performance:**
**1. Obtaining information**
a. Students use books and other reliable media to gather information about:
ii. Variations in climates within different regions of the world (e.g., variations could include an area's average temperatures and precipitation during various months over several years or an area's average rainfall and temperatures during the rainy season over several years).

Students look at these charts to gather information about variations in climates within different regions of the world.

**Observable features of the student performance:**
**3. Communicating information**
a. Students use the information they obtained and combined to describe*:
i. Climates in different regions of the world.

## The ice caps are extreme climates

The most extreme climates on Earth are polar regions. Polar habitats are large formations of ice at the North and South Poles. At the North Pole, the ice cap covers the Arctic Ocean, Greenland, and the edges of a few other countries. At the South Pole, the ice cap has formed over Antarctica.




*These maps show the ice cap over Antarctica (left) and the ice cap over the North Pole (right). Image by NASA.*

Because the North and South Pole receive little sunlight, polar ice stays frozen year round and can be up to two miles thick!

Why is it so cold at Earth's poles?


Earth's polar regions contain frozen ice year round because very little sunlight shines on the North and South Poles.

## Water brings nutrients to the ocean

There are nearly no plants in polar regions. How do animals survive in these landscapes of ice? They use the ocean! Water from melted ice flows over rocks and brings nutrients and minerals into the ocean. These minerals are good for krill, plankton, and fish, which are food for penguins, seals, and whales.

*Penguins in Antarctica use the ocean to feed on fish and krill.*

Where are polar climates found on Earth?


Polar climates are found in the far northern reaches of the globe at the North and South Poles.

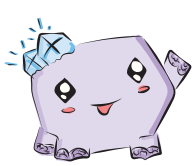
## Weather can be hazardous

There are many types of harsh weather conditions that can be dangerous or cause damage. While rain, snow, and wind are all normal weather conditions, when any one of them become extreme, they can become hazardous or dangerous. Dangerous weather conditions are called natural hazards.

**3-ESS3-1. Earth and Human Activity**
Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.*

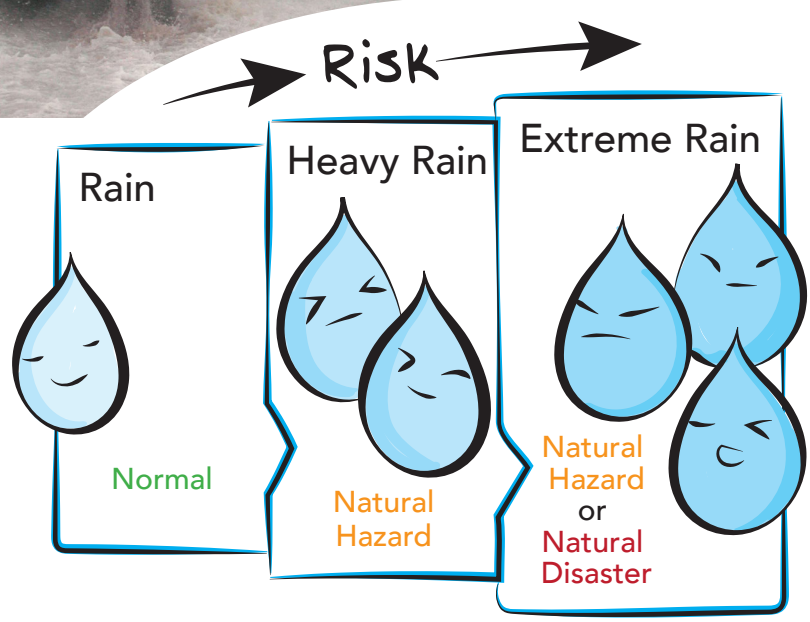
Natural hazards are introduced here.

*Strong winds and rain from this hurricane cause damage. This storm is an example of a natural disaster.*



Think, Pair, Share!

What natural hazards are present where you live?



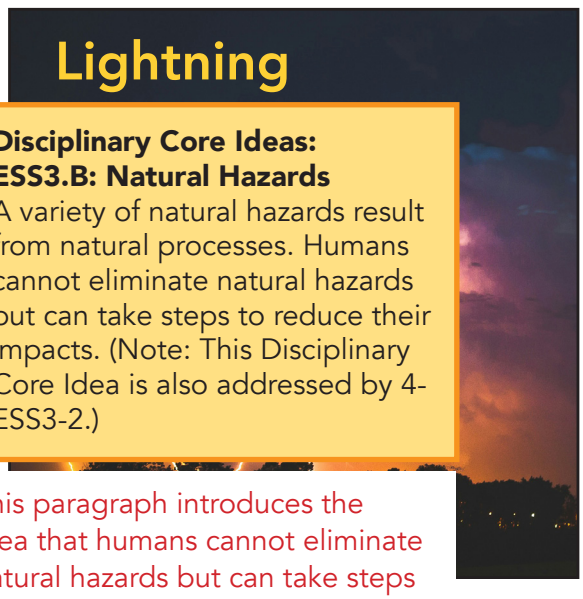

*Wind and rain can become a hazard or a disaster depending on how strong it is.*

Discuss with your class which types of natural disasters can occur where you live.

## Weather-related hazards cause problems

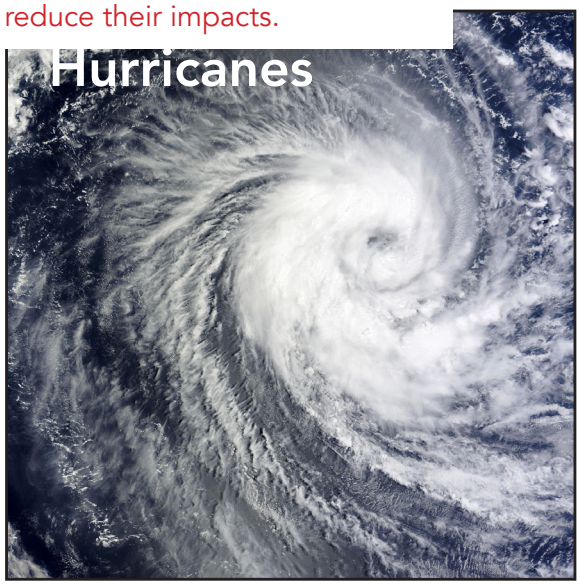
When a natural hazard causes a lot of damage, it is called a natural disaster. There are many common types of natural weather related hazards including lightning, flooding, hurricanes, and tornadoes. Although we can't control when a natural hazard occurs, people can be ready for it.

### Common Weather Related Hazards




**Disciplinary Core Ideas:**
**ESS3.B: Natural Hazards**
A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (Note: This Disciplinary Core Idea is also addressed by 4-ESS3-2.)

This paragraph introduces the idea that humans cannot eliminate natural hazards but can take steps to reduce their impacts.

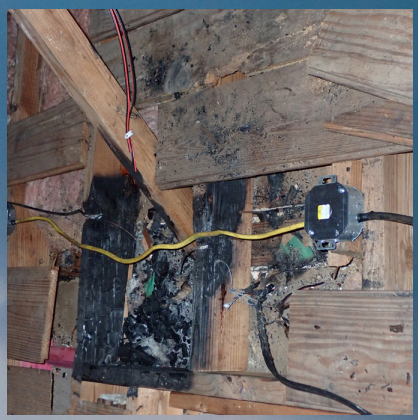


*Lightning, floods, hurricanes, and tornadoes are all weather hazards that can become natural disasters.*

## Lightning can cause fires

Bolts of lightning strike the ground during thunderstorms. Lightning strikes can cause serious injuries to people caught out in the open. Lightning strikes can also cause fires.

*Lightning struck this tree and split it in half.*



*Lightning struck this house and started a small fire.*

*Lightning struck dry brush and started this forest fire.*


How can we protect people and property from lightning strikes?

Answers will vary. Lightning rods can protect buildings from lightning strikes. Your students may have other ideas too. In general, to protect yourself from lightning, do not remain in a high area such as a mountain peak or hill. Getting inside a car is a safe place to remain during a lightning storm. Managing forests and keeping them clear of brush, using controlled burns, can protect communities from fires. Keeping grass and brush trimmed near houses can also reduce risk of fire damage.

*Lightning strikes the ground in this community.*

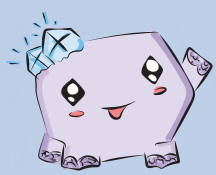
**Science and Engineering Practices: Engaging in Argument from Evidence**

Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.

Students can cite evidence from the reading that lightning rods are effective at redirecting electricity safely to the ground because the rod is positioned higher than the building. If a building is struck, its lightning rod will be struck first. Because the rod is made of a conductive metal, electricity can easily pass through it.

# Lightning Rods Keep us Safe

To protect buildings from lightning, we use a lightning rod. A lightning rod is a metal rod that is placed above the highest part of a building. Since the rod is made of conductive metal, it allows the lightning bolt to pass straight through it into the ground. This helps prevent fires and damage to buildings.



Think, Pair, Share!

**How well do you think a lightning rod can protect us from lightning?**

Answers will vary: Example: Lightning strikes the highest part of the building, so the lightning rod is set up higher than everything else. The lightning rod is made from a conductive metal so the electricity can flow through it easily to the ground where the lightning won't hurt anyone.

**3-ESS3-1. Earth and Human Activity**
[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lighting rods.]

A lightning rod is given as an example of a design solution here.

**Crosscutting Concepts:**
**Science is a Human Endeavor**
Science affects everyday life.

Lightning rods can be seen on building all around us in everyday life.

Lightning rod

*Lightning always makes contact with the tallest nearby object. This lightning rod is connected to the ground by a big wire that allows the lightning's electricity to flow to the ground without causing damage to the building.*

**3-ESS3-1. Earth and Human Activity**
Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.*

In answering the Think, Pair, Share prompt, students make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard—a lightning strike.

**3-ESS3-1. Earth and Human Activity**
[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lighting rods.]

A barrier to prevent flooding is given as an example of a design solution here.

**Science and Engineering Practices: Engaging in Argument from Evidence**
Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.

Students can cite evidence from the reading that flood barriers can be effective at redirecting water around structures.

**3-ESS3-1. Earth and Human Activity**
Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.*

In answering the Think, Pair, Share prompt, students make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard such as a flood.

**Crosscutting Concepts: Cause and Effect**
Cause and effect relationships are routinely identified, tested, and used to explain change.

Ask: How do flood walls help reduce the impact of flooding, and what factors affect how well they work?
Example answer: Flood walls help reduce the impact of flooding by acting as barriers that block or redirect water away from buildings. Since water flows downhill and settles in low areas, making an artificial high area can protect homes.

## Heavy rain can cause flooding

Rain is not normally a natural hazard. However, heavy rain can cause flooding hazards. The flood becomes a natural disaster when it hurts people or damages property.

How can we protect ourselves from flooding?

Think, Pair, Share!

Answers will vary: Example: To protect ourselves from flooding, we can avoid building structures in flood zones. People also build flood barriers and drainages to get rid or flood waters.

**Observable features of the student performance:**
**1. Supported claims**
a. Students make a claim about the merit of a given design solution that reduces the impact of a weather-related hazard.

Answers will vary: Example: It looks like the flood wall is effectively protecting this house now, but if the flood waters rise a few more feet, the house may flood. It would be better to just not allow people to build in a flood zone.

Think, Pair, Share!

**How well do you think a flood wall or levy can protect this house from flooding?**

Flood barrier or levy

## Flood barriers keep us safe from floods

The easiest way to protect communities from flooding is to not allow people to build in low areas that have flooded in the past. If a house exists in a flood zone, building the ground higher or making a flood barrier can help keep high waters out.

## Hurricane winds can damage communities

When strong winds circulate over the ocean they can form a hurricane. Hurricane paths are very wide and can affect entire states or countries. A hurricane's winds can damage homes. Rain and waves from a hurricane can cause flooding and mud slides too.


How well do you think things like storm shutters, low roofs, and raised houses can protect against hurricanes?

Answers will vary: Example: Storm shutters can protect windows from easily breaking, low roofs are less likely to be damaged, and raising a house can protect it from flooding, but if the hurricane is too strong, the house can still be severely damaged by strong winds.

**Hurricane Irene**

**Florida**

*Destructive hurricane winds can blow as fast as 100 to 250 miles per hour.*

**3-ESS3-1. Earth and Human Activity**
Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.*

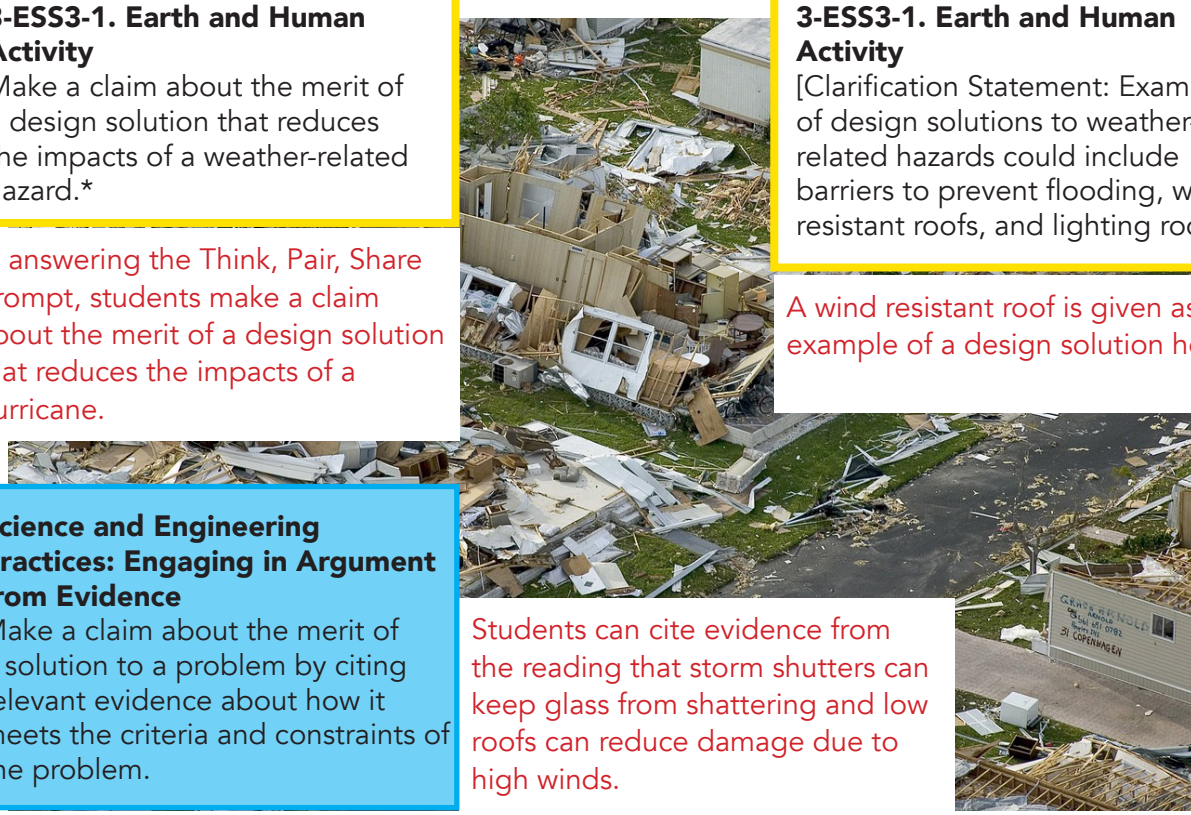
In answering the Think, Pair, Share prompt, students make a claim about the merit of a design solution that reduces the impacts of a hurricane.

**3-ESS3-1. Earth and Human Activity**
[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lighting rods.]

A wind resistant roof is given as an example of a design solution here.

**Science and Engineering Practices: Engaging in Argument from Evidence**
Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.

Students can cite evidence from the reading that storm shutters can keep glass from shattering and low roofs can reduce damage due to high winds.



*Hurricane winds can blow strong enough to damage homes.*

## People protect their homes from hurricanes

To protect houses from being damaged by strong winds people build low roofs and window covers. To protect against hurricane floods people build on high ground or raise their houses up on stilt-like supports.

*Raising a house can protect it from flooding.*

*Building a low roof lets air flow over it easier.*

*Window covers can protect glass from breaking.*

# Tornadoes can damage homes

Tornadoes form when warm, moist air near the ground meets cold, dry air higher up. As the air moves up, it starts to swirl and move very fast. This causes a tornado. Tornadoes have narrow, destructive paths that can cause severe damage to homes.


*This photo shows the narrow path of destruction that a tornado leaves behind.*

*This storm cellar is an underground room that can keep people safe during a tornado.*

**3-ESS3-1. Earth and Human Activity**
[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lighting rods.]

Draw lines on the photo above to label the destructive path of the tornado.

A storm cellar is given as an example of a design solution here.

# People can stay safe from tornadoes

To stay safe from tornadoes, people build storm shelters underground or in the basement of a home. Even if the house is damaged above, a strong storm shelter made underground can keep people safe inside.

How well do you think a storm cellar can protect people from tornadoes?


**3-ESS3-1. Earth and Human Activity**
Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.*

In answering the Think, Pair, Share prompt, students make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard: a tornado.

**Science and Engineering Practices: Engaging in Argument from Evidence**
Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.

Students can cite evidence from the reading that storm cellars can keep people safe underground during a destructive tornado.

**Crosscutting Concepts: Influence of Engineering, Technology, and Science on Society and the Natural World**
Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.

Ask: How do storm cellars help protect people during a tornado, and what factors affect how well they work?
Example answer: Storm cellars protect people during a tornado by providing a safe, underground space that shields them from strong winds and flying debris. Since tornadoes generate extreme winds above ground, being underground reduces the risk of injury.

*This is the funnel of a tornado. Its destructive winds can move between 100 to 250 miles per hour.*

## How well can a design reduce weather damage?

Choose a natural disaster to study for your analysis. Circle one.

Lightning

Floods

Hurricanes

Tornadoes

Describe the weather conditions of the natural hazard you chose and explain what types of problems it can cause.

Answers will vary. Students should describe the weather conditions and problems involved in the natural hazard they chose above.

**Observable features of the student performance:**
**2. Identifying scientific evidence**
a. Students describe*:
i. The given weather-related hazard (e.g., heavy rain or snow, strong winds, lightning, flooding along river banks).

**Observable features of the student performance:**
**2. Identifying scientific evidence**
a. Students describe*:
ii. Problems caused by the weather related hazard (e.g., heavy rains cause flooding, lightning causes fires).

How do people protect themselves or their property from this natural hazard?

Answers will vary. Students should describe a solution to protecting people and property from damage by the natural hazard and make a claim for how well they think the solution works.

**Observable features of the student performance:**
**2. Identifying scientific evidence**
a. Students describe*:
iii. How the proposed solution addresses the problem (e.g., dams and levees are designed to control flooding, lightning rods reduce the chance of fires) [note: mechanisms are limited to simple observable relationships that rely on logical reasoning].

How well do you think this solution works to protect people and property from the natural disaster?

Answers will vary. Students should evaluate and express their opinion for how well they think the proposed solution addresses the problem, including the impact of the weather related hazard after the design solution has been implemented.

**Observable features of the student performance:**
**3. Evaluating and critiquing evidence**
a. Students evaluate:
i. How the proposed solution addresses the problem, including the impact of the weather related hazard after the design solution has been implemented.

What problems could this solution have?

Answers will vary. Although your students express their opinions on the effectiveness of a solution to protecting people from a natural hazard, no solution is perfect. Ask your students to consider risks that still exist even when the solution is implemented such as, a levy might not be high enough for severe flooding.

**Observable features of the student performance:**
**3. Evaluating and critiquing evidence**
a. Students evaluate the evidence using given criteria and constraints to determine:
iii. The benefits and risks a given solution poses when responding to the societal demand to reduce the impact of a hazard.

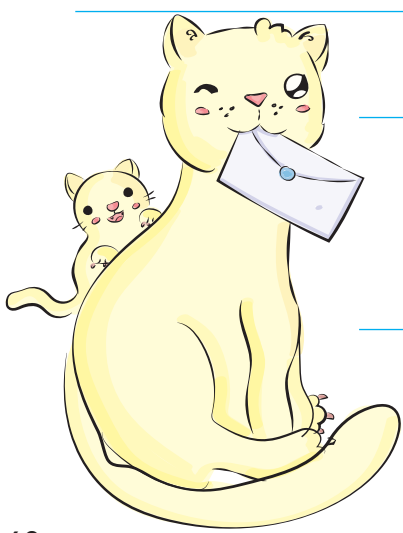
# Can you explain it?

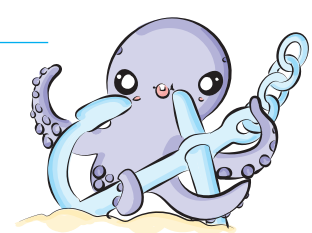
Describe the weather, climate, and natural hazards that occur where you live. Use science concepts and vocabulary from this unit to explain your answer.

Answers will vary. Students should describe the weather, climate, and natural hazards that occur where they live.

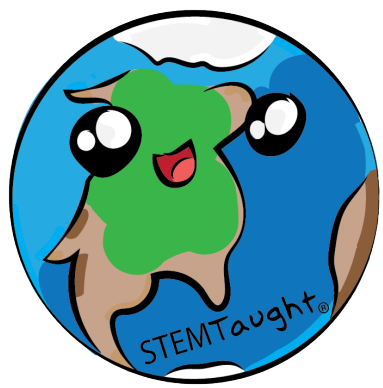
Official Use Only:

Royal STEMTaught Letterhead





Explain the Phenomenon!




I ♥ STEM Taught®

I ♡ STEMTaught®

**Weather Comes in Seasons:**
**Danny the Squirrel's First Winter**

Teacher Edition NGSS

ISBN 9798889870197