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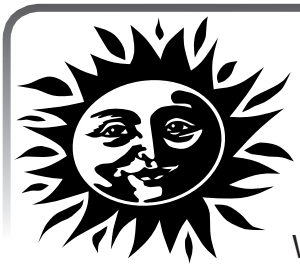
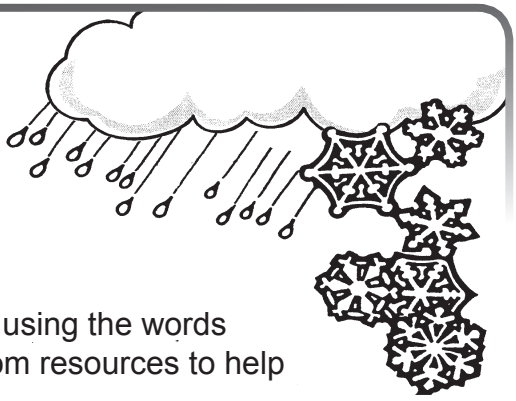


What is Weather?



Weather is what happens in the air, or the atmosphere, day-to-day. Write down what the weather is for a whole week using the words below. If you do not know what the words mean, use classroom resources to help you find out.

rain
snow
freezing rain
sleet
hail
stormy
sunny
cloudy
partly sunny
partly cloudy
dry
windy
hot – give the temperature
cold – give the temperature
humid

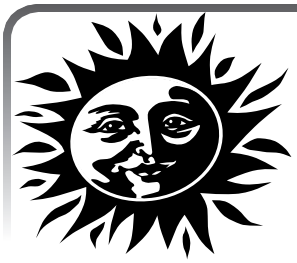
Results:

Day 1	Day 2	Day 3	Day 4	Day 5

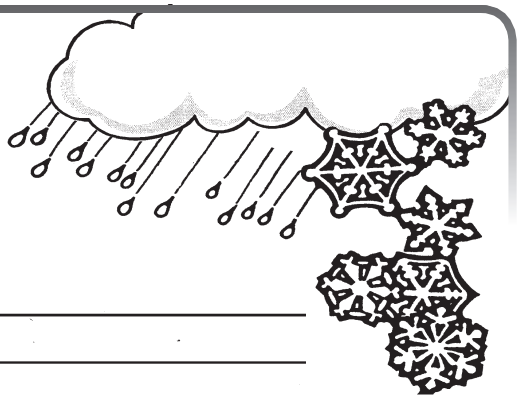
Questions:

1. Were the words above enough to describe all of the weather? What else did you use?

2. Compare your results to a newspaper or internet forecast. Did you agree? Why or why not?



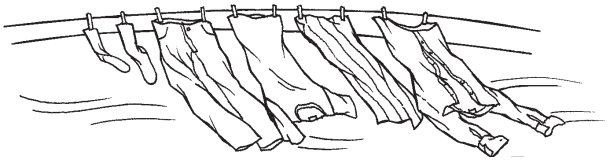
Climates of the World



1. a) Pretend it is July 15. Will you need a coat outside? _____
   b) Pretend it is January 15. Will you need a coat outside?_____
   c) How do you know?_____

We know that summer is hot and winter is cold. This is true of our climate. Day-to-day changes in conditions like temperature, precipitation (rain, snow), or wind, are weather. A climate is how the weather averages over many years. Climates can be generally described as hot, cold, wet, or dry. Other conditions like sunny or windy may also describe a climate. Usually a place's climate is a combination: tropical rain forests are hot and wet, mountain tops are often cold and dry.

We have different clothes for different climates to keep comfortable and healthy. You can see this if you look at what people around the world wear. For example, northern fishery workers wear raincoats and warm sweaters. Surfers in California wear shorts and sandals. Desert dwellers wear hats and loose clothing. Make a list of clothing that would be suitable for the climates listed below.



2. a) **Hot** _____
   _____

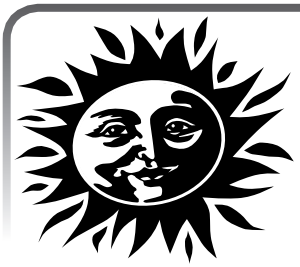
   b) **Cold** _____
   _____

   c) **Wet** _____
   _____

   d) **Dry** _____
   _____

   e) **Sunny** _____
   _____

   f) **Windy** _____
   _____



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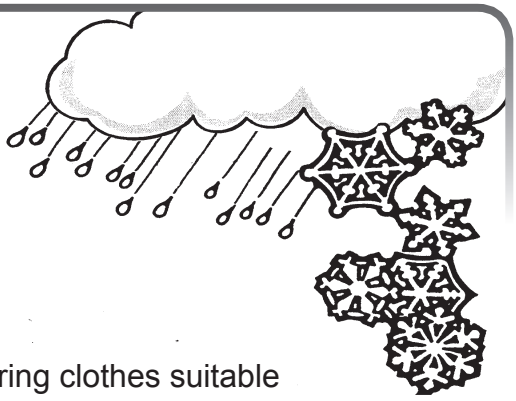


Packing for a Trip:

3. When you are traveling to a different place, you have to bring clothes suitable for its climate. Can you think of ways to figure out a place's climate?

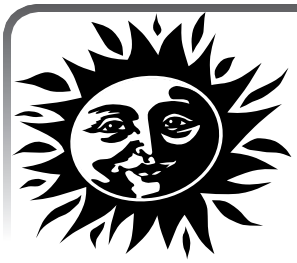
4. In groups or on your own, choose a city or destination from the list provided by your teacher. Imagine that you are going to visit there for all of next week. What clothing should you pack?

Questions:

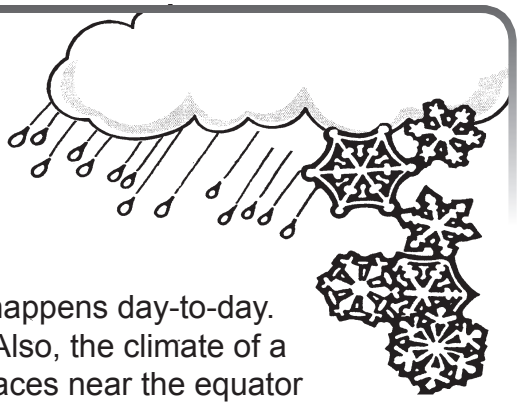
5. Your teacher will give you some information on your destination. Check your answers. How well prepared for your trip were you? What changes would you make?

6. In the introduction, it was said that you would need a coat in the winter but not the summer. Will this always be true? Explain your answer.

7. What is the best way to plan for a trip? Explain your answer.



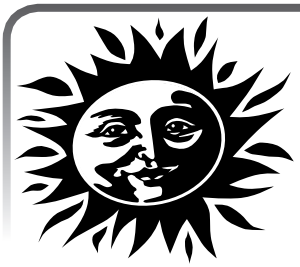
Weather or Climate?



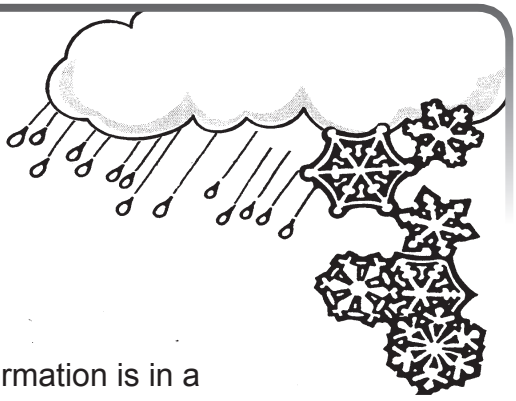
What will it be like outside on a given day? Weather is what happens day-to-day. Climate is the average of weather over long periods of time. Also, the climate of a place will depend on where it is in the world. For example, places near the equator have hot climates, and places near the poles are cold.

Some of the statements below are about weather – put a 'W' in the box next to them. Others are about climate – put a 'C' in the box next to them. Some might be both – write 'WC' next to them.

	The year 1976 was one of the coldest winters on record.
	The year 1992 was one of the coldest summers on record.
	Cities near the ocean tend to be wet.
	Florida is hotter than Alaska.
	It might snow in Florida tomorrow.
	El Niño warms the ocean west of Peru every few years.
	In 1998, two scientists reported that it rains more on weekends on the east coast of the USA.
	It rained on October 10.
	It rains every October.
	It is supposed to be sunny in Phoenix next week.
	It is supposed to rain this weekend.
	The daytime high was 32°F (0°C).
	The normal daytime high is 40°F (5°C).
	Today it was colder than usual.
	Last week was hotter than this week.
	La Niña cools the ocean west of Peru every few years.
	Libya is a hot country.
	Northern Africa is hot.
	November is usually cloudy.
	On July 4, 1956, it rained 1.23" (31.2 mm) in one minute in Unionville, MD.
	Parts of the Atacama Desert in Chile can go several years without rain.
	Phoenix, AZ, can have over 300 days of sun a year.
	Sometimes it snows in late April.
	It is a La Niña year, so I guess it will snow a lot next week.
	Summer is hot.
	The highest recorded temperature of all time was 136°F (58°C), in Libya.
	The lowest recorded temperature for Africa was -11°F (-24°C) in Morocco.
	Winter is cold.
	Yesterday it was cold, so it will probably be cold today.



Weather or Climate?



Questions:

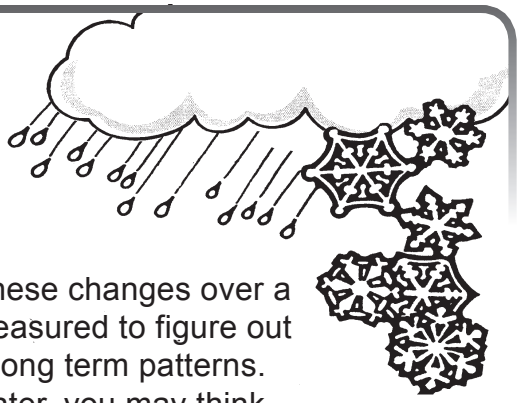
1. Compare statements with similar words. What kind of information is in a weather statement? In a climate statement?

2. Draw a picture in the space below that shows the difference between weather and climate.

3. Libya and Morocco are both in northern Africa. Look at the statements about these countries and northern Africa. Explain how all the statements can be true. Use classroom resources including a map to help you answer the question.

4. Which would be more surprising: a sudden change in the weather, or a sudden change in the climate? Explain.

Weather Patterns Make Climates



Weather is day-to-day changes. Climate is the average of these changes over a long time. This means lots of days of weather have to be measured to figure out climate. Sometimes early patterns will look nothing like the long term patterns. For example, if you measure the temperature only in the winter, you may think that the climate is very cold. If you measure rainfall during a storm, you may think that the climate is very wet.

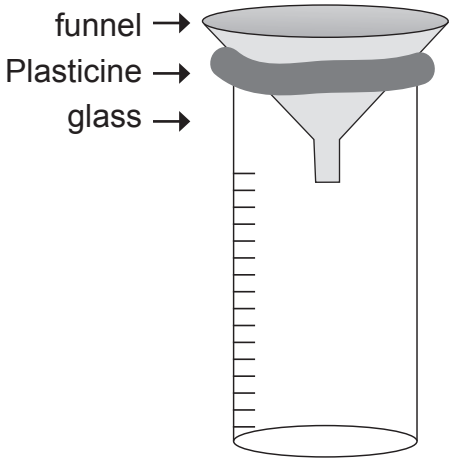
Before further exploring climate, measure some weather to see what patterns exist.

Equipment:

- ✪ two tall glasses with straight sides
- ✪ funnel with mouth wider than glass
- ✪ permanent marker
- ✪ ruler
- ✪ Plasticine

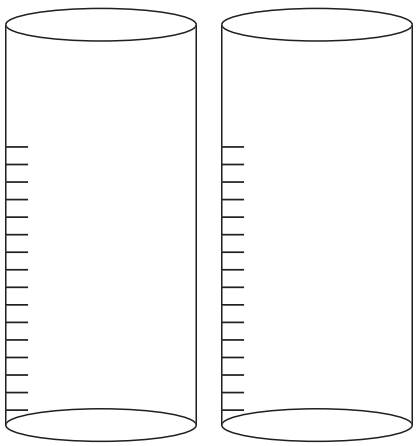
Procedure:

Make a Rain/Snow Gauge



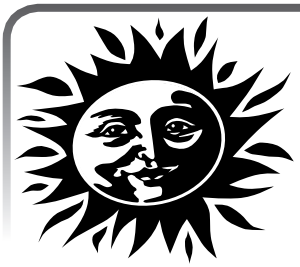
1. Using the ruler, mark off each 1/8" (2 mm) going up the glass at least 6" (15 cm).
2. Put the funnel over the top of the glass. Secure it with the Plasticine.
3. Place the rain gauge outside.
4. For one week, measure the height of water in the gauge **at the same time every day**. Empty the glass after measuring.

For Snow:

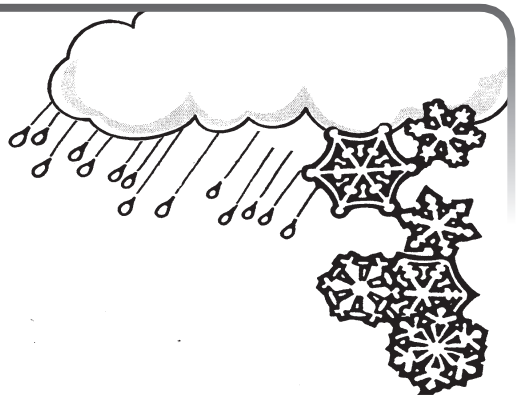


1. Using the ruler, mark off each 1/8" (2 mm) going up the glass at least 6" (15 cm). Do this with **two glasses**.
2. Place the snow gauge outside (no funnel).
3. For one week, measure the height of snow in the gauge **at the same time every day**. Replace the measured glass with the other empty one.
4. Melt the snow completely to water then measure the height of the water.

Use the next page to collect and graph your data.



Weather Patterns Make Climates



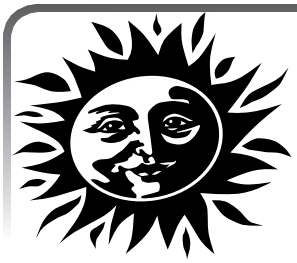
	Day 1	Day 2	Day 3	Day 4	Day 5
Rainwater (in/mm)					
Snow (in/mm)					
Melted Snow (in/mm)					

Plot your results using a **bar graph**. Remember to label your graph!

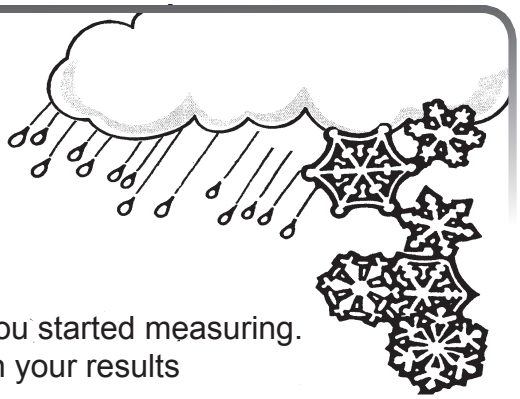
Questions:

1. Looking at your graph, do you live in a wet or dry climate? Explain.

2. Is the above question fair? Explain.



Weather Patterns Make Climates



Find precipitation values in your area for all 21 days before you started measuring. Make a new graph including the previous measurements with your results (26 days total).

3. Looking at the graph above, do you live in a wet or dry climate? Explain. _____

_____

4. Is the above question fair? Explain. _____

_____

_____

5. Using classroom resources, find out the average precipitation for the month that most overlaps with your results: _____

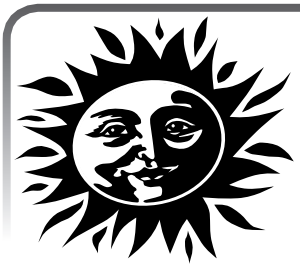
6. Compare this average to the results for that month for the previous 30 years. Based on this information, do you live in a wet or dry climate? Explain. _____

_____

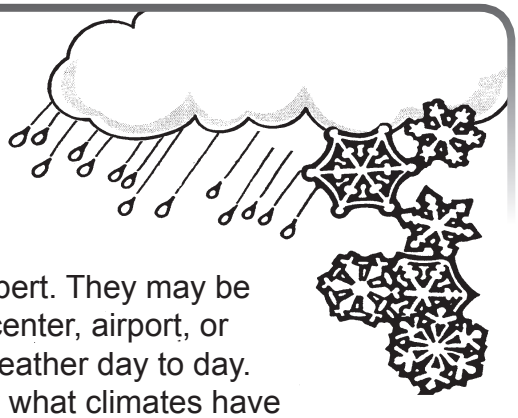
7. Is the above question fair to decide what climate you live in? Explain. _____

_____

_____



Ask an Expert



As a class, meet with a local weather expert. They may be a meteorologist with a local news organization, government center, airport, or university. These experts use measurements to predict the weather day to day. Another kind of expert is a climatologist. These experts study what climates have done over history and predict how they may change. Ask the expert the following questions:

How does the expert measure the weather to decide what climate you live in?

Is there anything weird about the local weather or climate?

What training did the expert need to become a meteorologist or climatologist?

What technology helps with weather forecasting or climate modeling?

Write down some of your own questions for the expert and include the answers given.

Draft a thank you letter to the expert. After your teacher checks it, mail your letter with your classmates' to the expert.

Climate Change Curriculum Map

Learning Expectations:

Understanding concepts

- Understand that weather is day-to-day
- Understand that climate is the long term average of weather
- Learn how to detect and measure change
- Recognize patterns and trends in order to predict
- Explain how trapped air heats up upon exposure to light (the greenhouse effect)
- Understand and explain how climate change can cause both heating and cooling
- Understand how climate change can alter weather patterns including precipitation
- Suggest various methods of preparing for and/or minimizing the effects of climate change

Skills of inquiry, design, and communication

- Demonstrate an awareness of the scientific method
- Classify and sort concepts
- Observe with the senses and instruments

Work with others

- Listen, record, and compare others' observations
- Make predictions
- Record observations, findings, and measurements using drawing, tables, and written descriptions
- Communicate the procedure and results of investigations using drawing and written descriptions
- Connect various ideas from observations and previous knowledge to understand new concepts

Relating science and technology to the outside world

- Relate scientific concepts to objects in their environment

Teaching Instructions Includes:

- At A GlanceTM – List of Skills
- Teacher Assessment Rubric
- Student Achievement and Effort Rubric
- Introduction
- Bibliography
- Materials
- Vocabulary

Lesson Topics:

Topic 1: Weather and Climate

Weather and Climate gets students thinking about the temporal and spatial scale of climates in order to confront the concept of global changes.

- What is Weather?
- Climates of the World
- Weather or Climate?
- Weather Patterns Make Climates
- Ask an Expert
- Teacher Notes and Answer Key

Topic 2: Measuring Change

Measuring Change builds students' observational and data analysis skills that will aid in their extracting meaning from the subsequent experiments and concept-teaching questions. This section will be of use to any curricular content for which tracking change is necessary.

- Measuring Change
- Ideas of Change
- Short Term Change and Long Term Change
- Temperature Trends
- Watering Changes
- Teacher Notes and Answer Key

Topic 3: The Greenhouse Effect

The Greenhouse Effect focuses on the dominant issue of present concern for climate change. While certainly not the only issue, the groundswell of attention garnered by global warming means that a generation of students will need to understand this concept that is already driving social change. Every effort was made to present the effect accurately without complicating its explanation. The intent is for students to "discover" the greenhouse effect as opposed to blindly applying dogmatic knowledge in token demonstrations. Myriad studies in science education have shown that an inquiry/discovery approach allows students to take ownership of their learned knowledge while building scientific skills. Once they have developed their own comprehension of how greenhouses work, the conceptualization of infrared radiation interacting with atmospheric molecules will be better retained.

- Air Inventory
- Can We Control Climate?
- How Does a Greenhouse Work?
- Clouds Over the Greenhouse

- Greenhouses are Traps
- Humidity
  - a) What is Humidity?
  - b) Measuring Humidity
- Air in the Greenhouse
- Carbon Dioxide and Greenhouses
- A Natural Greenhouse
- Teacher Notes and Answer Key

Topic 4: Heating and Cooling the Earth

Heating and Cooling the Earth combines the first three parts and has students begin to apply their accrued knowledge. Much of these activities and thought experiments concern water and ice, as that is where the lion's share of evidence for present climate change exists. Class discussions upon completing the activities can therefore be well augmented by current affairs.

- The Color of Earth
- Will the Earth Heat Evenly?
- Water and Ice and Heat
- Feedback
- Moving Water in the Oceans
- Changing the Current
- Rising Seas and Shores
- Icebergs and Sea Level
- Glaciers and Sea Level
- Teacher Notes and Answer Key

Topic 5: The Push and Pull of Climate Change

The Push and Pull of Climate Change collates students' abstract thinking skills to synthesize their fundamental understanding of climate change. The activities encourage debate and prediction within the context of global warming. Students will therefore be better able to weigh risks and propose solutions to myriad problems, both generally and specifically to climate change. It is hoped that in using this resource to augment your lessons, students will come away with the ability to problem solve and think critically rather than regurgitate countless facts. Climate change has occurred and continues to take place; today's students need to be prepared to make the most of our future.

- Relative Impact
- Local Affects Global
- Natural and Artificial
- Sources and Sinks

- Debating Pollution
- *An Inconvenient Truth* Graphing
- Are Clouds Good or Bad?
- Cities and Climate
- Teacher Notes and Answer Key