WEATHER STATION

WIND AND WEATHER UNIT

SHARLA BOARDMAN

Time Frame:	Standards:
This is a Unit that has 7 lessons. Each lesson could take a different amount of time. Also the lessons could be pulled apart and be taught stand alone. 4th Grade	• **4.S.1.2.1** Make and record observations then analyze and communicate the collected data. (588.02 a) • **5.S.1.2.1** Use observations and data as evidence on which to base scientific explanations and predictions.

Objectives:

- Students will be able to describe weather and understand how the weather affects their daily lives.
- Students will observe and record weather related data.
- Students will construct instruments for measuring weather.
- Students will be able to explain how each instrument is used to measure weather.
- Students will make predictions about weather using averages.

Background Information:

- Lesson 1: Understanding Meteorology
- Lesson 2: Temperature and Thermometers
- Lesson 3: Precipitation and Rain Gauge
- Lesson 4: Humidity and Hygrometer
- Lesson 5: Wind Direction and Wind Vane
- Lesson 6: Wind Speed and Anemometer
- Lesson 7: Air pressure and Barometer

This is a unit on wind and weather. The intent of this unit is to bring awareness of the wind and weather us. Students will be making observations and recording information. With this data the students will be able to predict what could happen next.

Time Frame:	Standards:
60 - 75 minutes 4th Grade	• **4.S.1.2.1** Make and record observations then analyze and communicate the collected data. (588.02 a) • **5.S.1.2.1** Use observations and data as evidence on which to base scientific explanations and predictions.

Objectives:

Students will be able to understand weather and how it affects their daily lives.
Students will understand the instruments a meteorologist uses.

Materials:

Lesson Material:

Teacher Preparation:

- Read through the Instructional Input/ Body for this lesson before teaching. You can find further information on the internet depending on your objectives.
- Locate the movie: *Weather for Children*: *All about Wind and Clouds* by Schlessinger Science Library or a clip from local news weather report.
- Locate or purchase an outdoor commercial thermometer.
- Purchase journals or notebooks for the students Weather Logs.
- Purchase materials and supplies for each weather instrument. These materials are located within each lesson of this unit.

Follow the instructions and make the six weather instruments within this unit to use as demonstration models. The instructions are located in the Guided Practice of each lesson.

Materials needed:

- Outdoor thermometer
- Pre-made instruments for display/demonstration: thermometer, wind vane, anemometer, rain gauge, barometer, hygrometer (the instructions are within the following lesson plans)
- Journals or notebooks for creating a Weather Log
- Movie to help students understand weather and wind: Example: *Weather for Children: All About Wind and Clouds* by Schlessinger Science Library or a clip from local news weather report.

Procedure:

Anticipatory Set/Opening:

- Questions to place on an overhead or chalkboard to ask the students: What is the forecast today? Will a hurricane strike today? How fast is the wind blowing outside? What is the name of our local meteorologist(s)? What do you think when you hear the word "weather"?
- Begin by leading a brief class discussion with the students on how weather affects their daily lives considering such factors as the kinds of clothes they wear and the outdoor activities that they can do.
- Introduce the weather instruments to the students.

Instructional Input/Body: (20-30 min)

- Weather is the state of the atmosphere at any given time and place. Some determining factors of weather are temperature, precipitation, fronts, clouds, and wind. Other more severe weather conditions are hurricanes, tornadoes, and thunderstorms. Weather occurs because the atmosphere is in constant motion from the Sun's energy reaching the surface.
- Lecture ideas the students should comprehend: Meteorology is the study of all changes in the atmosphere. A meteorologist is one who studies the weather and as one we know as the "weather man" on the news. Explain the importance for each weather instrument that a meteorologist would use.
- The anemometer is an instrument that helps the meteorologists read the wind speed of the area. The anemometer rotates at the same speed as the wind and can therefore collect data for the exact wind speed. We can understand wind speed in different categories without using an anemometer as being either calm air, gentle, moderate and strong breezes. Wind can be measured using the Beaufort Wind Scale which is a scale of 0-12 based on visual clues.
- Knowing the direction of the wind is an important part of predicting weather because wind brings us weather. The instrument for measuring wind direction, and probably the first weather instrument ever used, is called the wind vane or a weather vane. To determine wind direction, a wind vane spins and points in the direction in which the wind is coming.
- Temperature is measured with a thermometer. The temperature of the air is always changing as the air pressure changes. There are two basic temperature scales: Fahrenheit and Celsius. The Fahrenheit scale is used for household purposes. The Celsius scale, formerly called the centigrade scale, is universally used for scientific measurement.
- Meteorologists use a barometer to understand the air pressure that can cause changes in the weather. Air pressure is the result of the weight of tiny particles of air (air molecules) pushing down on an area. While invisible to the naked eye, they nevertheless take up space and have weight. Air expands because the air molecules take up space in your lungs, causing your chest to expand. Furthermore,

air can be compressed to fit in a smaller volume since there's a lot of empty space between the air molecules. When compressed, air is placed under high pressure which causes changes in the weather.
- A meteorologist uses a rain gauge to measure the amount of rain that falls during a period of a week or month. Once the measurement has been read, the meteorologist will empty it for the next reading.
- Humidity is the amount of water vapor, or moisture, in the air. Meteorologists usually report what is called "relative humidity," rather than actual humidity. You can figure out relative humidity with a hygrometer.

Modeling:
Introduce the display weather equipments that are introduced in this unit.

Guided Practice with Monitoring: (30 min)
- Ask the students to repeat back the purpose for each weather instrument.
- Select an area outside to place the rain gauge, thermometer, wind vane, and anemometer. Select an area in the classroom to place the barometer.
- Create a Weather Learning Log for each student to chart the data from each weather instrument. Have the students try to read the display instruments as their first log. (Weather Logs can also be made among groups depending on your objectives.)

Closure: (15 min)
- *Making your Weather Log:* Write your name on the notebook (if you are working as a group, each member should put their name on it).

Discuss and answer the following questions. Record your answers in your Weather Log. What do you think of when you hear the word "weather"? How does weather affect our daily lives? (Ex. What kinds of clothes do you wear, outdoor activities that you can do, etc.) What kinds of things would you look for if you wanted to describe the weather of a particular day to someone else? What kinds of information are important to collect? How do meteorologists predict the weather and are they always right? (List examples when they were right or wrong.)

Assessment:

Independent Practice
Assign the students to find out tomorrow's forecast either on the news, the newspaper or the internet. Have them write a page in their Weather Learning Log about what they learned today and to write down tomorrow's forecast.

References:

Originally written by Sharla Boardman and revised and edited by Justin Taylor. Both were a part of the INL Educational Science writing team.

Lesson 2: Temperature and Thermometers

Time Frame:	Standards:
50 - 60 minutes 4th Grade	• **4.S.1.2.1** Make and record observations then analyze and communicate the collected data. (588.02 a) • **5.S.1.2.1** Use observations and data as evidence on which to base scientific explanations and predictions.

Objectives:

Students will learn how a thermometer works by making one and operating it.

Materials:

Lesson Material:
Teacher Preparation:

- Read through the Instructional Input/ Body for this lesson before teaching. You can find further information on the internet depending on your objectives.
- Gather materials for making the thermometer.
- Locate your thermometer that you made in the Lesson 1 Teacher materials.

Locate your outdoor commercial thermometer so you will be able to accurately record the outside weather.

Materials needed:

- Outdoor commercial thermometer
- Pre-made straw thermometer for an example
- Medicine bottle or small jar
- Cork to fit the bottle or jar
- Nail
- Glass straw or medicine dropper tube
- Water
- Food coloring
- Felt-tipped pen

Procedure:

Anticipatory Set/Opening:

- Show the students the display of the pre-made thermometer and tell them that their task today is to make their own thermometer (or within groups depending on your objectives) and understand how it is operated.

Instructional Input/Body: (20 min)

- Temperature is measured with a thermometer. Temperature is a measure of whether one object absorbs heat from or loses heat to another object. As the air gets hotter, the level of the liquid rises; as the air gets cooler, the level falls.
- Liquids expand when heated and contract when cooled. The liquid of the thermometer absorbs heat. It expands when it contacts anything warmer than itself, and contracts when contacting something cooler. Mercury and colored alcohol are usually used as the liquid in thermometers because they react so quickly.
- Makers of commercial weather thermometers use a sealed glass tube that has a little bulb at one end. They mark the thermometer's scale by placing its bulb in contact with melting ice. The point at which the liquid contracts is 32 degrees for a Fahrenheit scale and 0 degrees for a Centigrade scale. Then the bulb is placed in the steam from boiling water. The point at which it expands is marked 212 degrees F or 100 degrees C.
- You can make a scale for your thermometer by comparing its level with a commercial weather thermometer.
- Gabriel Fahrenheit, a German physicist devised the first commonly used scale in 1714. About 30 years later, a Swedish astronomer, Anders Celsius, established the centigrade scale, also known as the Celsius scale.
- The first thermometer was invented in 1593 by the Italian physicist Galileo.
- The temperature of the air is always changing. Air temperature is a very important part of weather measurement.

Modeling:

- Read the temperature on the commercial thermometer and make sure the students understand that during the thermometer reading, they should look straight at the thermometer at eye level.

Show a demonstration of how to build the thermometer (located in the Guided Practice). Perform test runs on this thermometer for the students to understand its purpose in meteorology.

Guided Practice with Monitoring: (20 min)

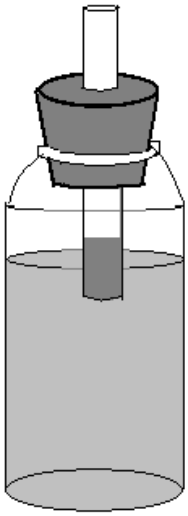
- Making the Thermometer: Dig out a hole in the cork with the nail and fit the straw or tube through it. Fill the bottle to the brim with water at room temperature. Color the water with two drops of food coloring and put the cork in securely. With

the felt-tipped pen mark a line where the water rises to in the straw or tube. Note the height of the water in the straw at room temperature and also at different times and places-on a sunny windowsill, in the refrigerator, in a pot of hot water.

Closure: (10 min)

- Have the students read their own thermometer.
- Ask the students what happens with the water. Answer: The water goes up the tube when the temperature is warm and goes down when it is cold.

Have the students' hypothesis the average temperatures for the different seasons.



Assessment:

Independent Practice:

The students can take daily, weekly, or monthly readings depending on your objective and record their data in their Weather Logs.

Answer the following questions in your Weather Log: What does temperature have to do with the weather? What's the difference between Fahrenheit and Celsius? Why does the water in the straw raise when it is hotter and drops when it is cooler?

References:

Originally written by Sharla Boardman and revised and edited by Justin Taylor. Both were a part of the INL Educational Science writing team.

Lesson 3: Precipitation and Rain Gauge

Time Frame:	Standards:
45 – 60 minutes 4th Grade	• **4.S.1.2.1** Make and record observations then analyze and communicate the collected data. (588.02 a) • **5.S.1.2.1** Use observations and data as evidence on which to base scientific explanations and predictions.

Objectives:

Students will learn how a rain gauge works by making one and operating it.

Materials:

Lesson Material:
Teacher Preparation:

- Read through the Instructional Input/ Body for this lesson before teaching. You can find further information on the internet depending on your objectives.
- Gather materials for making the rain gauge.

Locate your rain gauge that you made in the Lesson 1 Teacher materials.

Materials needed:

- Pre-made rain gauge
- Ruler
- Masking or adhesive tape
- Various empty containers (Examples: a jar, a coffee can, a cut-down milk carton)
- Pencil
- Paper

Procedure:

Anticipatory Set/Opening:
Show the students the display of the pre-made rain gauge and tell them that their task today is to make their own rain gauge (or within groups depending on your objectives).

Instructional Input/Body: (20 min)

- Precipitation is any form of water that falls to the Earth's surface. Different forms of precipitation include rain, snow, sleet, and freezing rain. Precipitation is important because it helps maintain the atmospheric balance. Without precipitation, all the land on the planet would be desert. Precipitation helps farmers grow crops and provides a fresh water supply for us to drink. Precipitation can also be damaging. Too much rain and snow can cause severe flooding and lots of traffic accidents. Hail can damage crops and cars. Freezing rain and sleet can destroy trees and power lines. The opposite of precipitation is evaporation.
- Raindrops form when millions of tiny water droplets collide together in clouds to form larger ones. Eventually, they become too heavy and fall out of the clouds as rain. Very small raindrops are called drizzle. The place with the greatest average yearly rainfall is on the island of Kauai in Hawaii.
- Snow falls when the air temperature is below freezing. Snow forms when water freezes in a cloud and turns into snowflakes as they fall through the cloud. No one has ever seen two identical snowflakes. The shapes of snowflakes depend on the temperature and height they were formed.
- A meteorologist uses a rain gauge to measure the amount of rain that falls during a period of a week or month. Once the measurement has been read, the meteorologist will empty the jar for the next reading.
- Meteorologists can then compare their results to other official statistics. They may not always agree. Sometimes, the amount of rain varies from one side of the street to the other.

Modeling:

- Read the rain gauge measurement and then empty the jar to begin a new reading.

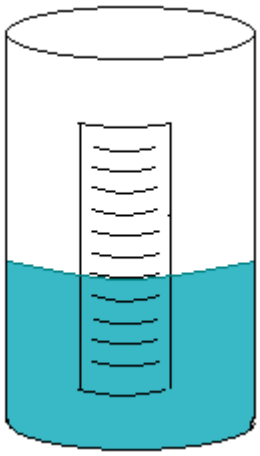
Show a demonstration of how to build the rain gauge (located in the Guided Practice).

Guided Practice with Monitoring: (15 min)

- Making the Rain Gauge: Using the ruler, measure off inches or centimeters on strips of masking or adhesive tape. Attach the tapes to the various containers that are see through.
- Put the containers on a flat, level surface outside. It may be wise to place the containers in a box to make sure they remain upright.

Closure:

Answer the following questions in your Weather Log: How can rain be measured? There are different types of precipitation. Name a minimum of three and describe them. What causes precipitation? Why could your measurements differ from the official measurements?



Assessment:

Independent Practice:

- Each time it rains, measure the amount of rain in the containers. The levels should be the same whatever the size of the container, provided that its sides are parallel. Record the amount and date.
- The students can take daily, weekly, or monthly readings depending on your objective and record their data in their Weather Logs.

Have the students compare measurements from one rainfall to the next throughout the year. Compare your measurements with those announced on the television or radio.

References:

Originally written by Sharla Boardman and revised and edited by Justin Taylor. Both were a part of the INL Educational Science writing team.

Lesson 4: Humidity and Hygrometer

Time Frame:	Standards:
45-60 minutes 4th Grade	• **4.S.1.2.1** Make and record observations then analyze and communicate the collected data. (588.02 a) • **5.S.1.2.1** Use observations and data as evidence on which to base scientific explanations and predictions.

Objectives:

Students will learn how a hygrometer works by making one and operating it.

Materials:

Lesson Material:
Teacher Preparation:

- Read through the Instructional Input/ Body for this lesson before teaching. You can find further information on the internet depending on your objectives.
- Gather materials for making the hygrometer.

Locate your hygrometer that you made in the Lesson 1 Teacher materials.

Materials needed:

- Pre-made hygrometer
- 2 room thermometers
- Small piece of carton material
- Thread
- Quart milk carton
- Rubber bands
- Scissors
- Water

Procedure:

Anticipatory Set/Opening:
Show the students the display of the pre-made hygrometer and tell them that their task today is to make their own hygrometer (or within groups depending on your objectives).

Instructional Input/Body: (30 min)

- Humidity is the amount of water vapor, or moisture, in the air. Meteorologists usually report what is called "relative humidity," rather than actual humidity. Relative humidity is a figure they come to by comparing the moisture in the air to the amount of moisture the air can hold. That amount will change according to the temperature of the air. High humidity combined with high temperatures makes most people uncomfortable.
- For the homemade hygrometers, water evaporating from the thermometer with the moist cloth uses up heat. Therefore, the temperature drops. The water in the cloth around the wet-bulb thermometer will keep on evaporating as long as the air can hold more water vapor. Dry air can take on more water vapor than air that is already filled with moisture. The drier the air (the lower the humidity), the further apart the two temperature readings will be. When the temperatures are exactly the same, the humidity is 100 percent. The higher the temperature, the more water vapor the air can hold. At any particular temperature, the relative humidity can be 100 percent, and it could be foggy or raining or snowing.

Modeling:
Show a demonstration of how to build the hygrometer and operate it (located in the Guided Practice).

Guided Practice with Monitoring: (15 min)

- Making the Hygrometer: Check the two thermometers to make sure they register the same temperature.
- Cover the bulb of one of the thermometers with a 2 inch scrap of cotton material (you can use an old handkerchief). Tie it on with thread and leave a "tail" on the bottom of one of the thermometers.
- Using rubber bands, attach the thermometers to two sides of the milk carton. Cut a small hole in the carton just below the thermometer with the covered bulb. Push the tail of cotton through the hole. Fill the carton with water up to the level of the hole so the cotton can be kept wet. Read the dry bulb and wet bulb thermometers. The temperature of the wet bulb thermometer is always lower.

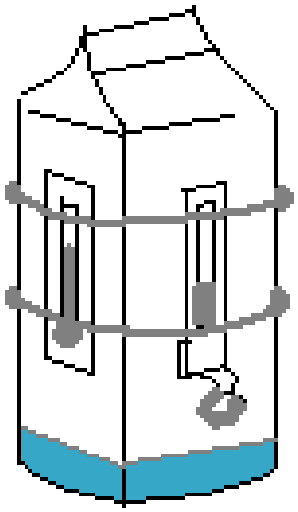
Closure:

- Have the students read their own hygrometer
- Introduce the Relative Humidity Table

Relative Humidity Table

DIFFERENCE BETWEEN DRY-BULB AND WET-BULB TEMPERATURES																			
DRY BULB TEMPERATURE F°		1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24
	10	78	56	34	13														
	15	82	64	46	29	11													
	20	85	70	55	40	26	12												
	25	87	74	62	49	37	25	13	1										
	30	89	78	67	56	46	36	26	16	6									
	35	91	81	72	63	54	45	36	27	19	10	2							
	40	92	83	75	68	60	52	45	37	29	22	15	7						
	45	93	86	78	71	64	57	51	44	38	31	25	18	6					
	50	93	87	80	74	67	61	55	49	43	38	32	27	16	5				
	55	94	88	82	76	70	65	79	54	49	43	38	33	23	14	5			
	60	94	89	83	78	73	68	63	58	53	48	43	39	30	21	13	5		
	65	95	90	85	80	75	70	66	61	56	42	48	44	35	27	20	12	5	
	70	95	90	86	81	77	72	68	64	59	55	51	48	40	33	25	19	12	6
	75	96	91	86	82	78	74	70	66	62	58	54	51	44	37	30	24	18	12
	80	96	91	87	83	79	75	72	68	64	61	57	54	47	41	35	29	23	18
	90	96	92	89	85	81	78	74	71	68	65	61	58	52	47	41	36	31	26

	100	96	93	89	86	83	80	77	73	70	68	65	62	56	51	46	41	37	33



Assessment:

Independent Practice:
The students can take daily, weekly, or monthly readings depending on your objective and record their data in their Weather Logs.

References:

Originally written by Sharla Boardman and revised and edited by Justin Taylor. Both were a part of the INL Educational Science writing team.

Lesson 5: Wind Direction and Wind/Weather Vane

Time Frame:	**Standards:**
60 minutes 4th Grade	• **4.S.1.2.1** Make and record observations then analyze and communicate the collected data. (588.02 a) • **5.S.1.2.1** Use observations and data as evidence on which to base scientific explanations and predictions.

Objectives:

Students will learn how a wind vane works by making one and operating it.

Materials:

Lesson Material:
Teacher Preparation:

- Read through the Instructional Input/ Body for this lesson before teaching. You can find further information on the internet depending on your objectives.
- Gather materials for making the wind vane.

Locate your wind vane that you made in the Lesson 1 Teacher materials.

Materials needed:

- Pre-made weather vane
- Drinking straw
- Scissors
- Index card or piece of light cardboard
- Straight pin
- Pencil with an eraser
- Red marker or crayon

- Compass
- Thin wire
- Shallow flowerpot full of dirt or a lump of clay

Procedure:

Anticipatory Set/Opening:

- Show the students the display of the pre-made weather vane and tell them that their task today is to make their own wind vane and to learn how it works (or within groups depending on your objectives).

Instructional Input/Body: (25 min)

- Knowing the direction of the wind is an important part of predicting weather because wind brings us our weather. A wind vane, also called a weather vane, is a tool for measuring wind direction and was probably one of the first weather instruments ever used.
- To determine wind direction, a wind vane spins and points in the direction from which the wind is coming and generally has two parts, or ends: one that is usually shaped like an arrow and turns in to the wind an one end that is wider so that it catches the breeze. The arrow will point to the direction the wind is blowing from so if it is pointing to the east, it means the wind coming from the east. Additionally, wind direction is where the wind is blowing from. Therefore a west wind is blowing from the west.
- In the northern hemisphere, a wind that shifts in a counterclockwise direction usually brings a low pressure system and stormy weather along with it. West winds generally bring rain, East winds clearing, depending where you are located. North winds mean cold weather, and south winds heat. In the southern hemisphere, it is exactly the opposite for every direction.

Modeling:

- Determine the direction of the wind using the pre-made weather vane.

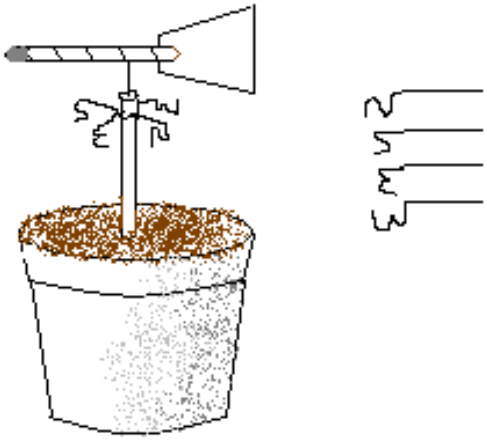
Show a demonstration of how to build the wind vane and operate it (located in the Guided Practice).

Guided Practice with Monitoring: (15 min)

- Making the Wind Vane: Make a 1 inch (2.5 cm) vertical slit in one end of the drinking straw. Using the index card or other piece of cardboard, cut out an arrow tail and glue it into the cut end of the straw. Mark the other end of the straw with the red marker or crayon. Insert the straight pin through the straw about 2 inches (5 cm) from the arrow. Push the pin into the eraser end of the pencil. Be sure that the straw con move freely.

- Form the letters N, S, E and W from pieces of wire. Wind them around the pencil, 1 inch (2.5 cm) below the arrow. Prop the pencil up by its point using the clay or soil in the flowerpot. Use a compass to make sure your letters are set up correctly.
- Put the weather vane in a place where the wind is not blocked by buildings.
- To read the wind vane: Look at the direction the arrow tip is pointing to according to N, S, E, and W. If the arrow is between two directions such as N and E, then your reading of the wind vane should be NE.

Closure: (5-10 min)
Have the students test their wind vane.



Assessment:

Independent Practice:

- The students can take daily, weekly, or monthly readings depending on your objective and record their data in their Weather Logs.

Answer the following questions in your Weather Log: How can you describe wind? Can you tell where the wind is blowing to? How?

References:

Originally written by Sharla Boardman and revised and edited by Justin Taylor. Both were a part of the INL Educational Science writing team.

Lesson 6: Wind Speed and Anemometer

Time Frame:	Standards:
60 minutes 4th Grade	• **4.S.1.2.1** Make and record observations then analyze and communicate the collected data. (588.02 a) • **5.S.1.2.1** Use observations and data as evidence on which to base scientific explanations and predictions.

Objectives:

Students will learn how an anemometer works by making one and operating it.

Materials:

Lesson Material:
Teacher Preparation:

- Read through the Instructional Input/ Body for this lesson before teaching. You can find further information on the internet depending on your objectives.
- Gather materials for making the anemometer.
- Locate your anemometer that you made in the Lesson 1 Teacher materials.
- Make an overhead of the Beaufort Wind Scale Table (located online at http://en.wikipedia.org/wiki/Beaufort_scale).

Make copies of the Beaufort scale for the students to glue in their Weather Logs (located in Instructional Input/Body or online)

Materials needed:

- Pre-made anemometer
- 2 pieces of heavy cardboard
- Scissors
- Staples or tracks
- 4 individual metal-foil muffin pans

- Paint
- Sharp, thin nail
- Large needle
- Pencil with eraser
- Spool of thread
- Clay or paper towels
- Glue or cord
- Block of wood or flat stone
- Copies of the Beaufort scale for the students to glue in their Weather Logs (located in Instructional Input/Body or online)

Procedure:

Anticipatory Set/Opening:

- Show the students the display of the pre-made anemometer and tell them that their task today is to make their own anemometer and to learn how it works (or within groups depending on your objectives).

Instructional Input/Body: (30 min)

- Wind is the horizontal movement of air. The instrument used to measure wind speed is called an anemometer, which is an indicator that will spin in the wind. The anemometer rotates at the same speed as the wind. It gives a direct measure of the speed of the wind.
- Wind Speed is measured by using the Beaufort Wind Scale which is a scale of 0-12 based on visual clues.
- Explain the Beaufort Scale

Beaufort scale number	Wind Speed Average	Description	Sea conditions	Land conditions
0	1 mph	Calm	Flat.	Calm.
1	2 mph	Light air	Ripples without crests.	Wind motion visible in smoke.
2	6 mph	Light breeze	Small wavelets.	Wind felt on exposed skin. Leaves rustle.
3	11 mph	Gentle breeze	Large wavelets.	Leaves and smaller twigs in constant motion

4	15 mph	Moderate breeze	Small waves.	Dust and loose paper raised. Small branches begin to move.
5	22 mph	Fresh breeze	Moderate (1.2 m) longer waves. Some foam and spray.	Smaller trees sway.
6	27 mph	Strong breeze	Large waves with foam crests and some spray.	Large branches in motion. Umbrella use becomes difficult.
7	35 mph	Near gale	Sea heaps up and foam begins to streak.	Whole trees in motion. Effort to walk against the wind.
8	42 mph	Gale	Moderately high waves with breaking crests forming spindrift. Streaks of foam.	Twigs broken from trees.
9	50 mph	Severe gale	High waves (2.75 m) with dense foam. Wave crests start to roll over. Considerable spray.	Light structure damage.
10	60 mph	Storm	Very high waves. the sea surface is white and there is considerable tumbling. Visibility is reduced.	Trees uprooted. Considerable structural damage.
11	69 mph	Violent storm	Exceptionally high waves.	Widespread structural damage.
12	73 mph and higher	Hurricane	Huge waves. Air filled with foam and spray. Sea completely white with driving spray. Visibility very greatly reduced.	Massive and widespread damage to structures.

http://en.wikipedia.org/wiki/Beaufort_scale

- You can use the Beaufort scale to determine if locations with high wind speeds are adequate for devices that utilize the wind such as anemometers and wind turbines.
- Wind is a natural source of energy. Energy can not be created nor destroyed; therefore, wind turbines will take the wind's energy and converts it into an

electrical current by using a generator. This electrical current is used within an electrical circuit. When a light bulb is placed in an electrical circuit, electrical energy is transferred to light and heat energy. Therefore, wind is used for renewable energy.

Modeling:
Show a demonstration of how to build the anemometer and operate it (located in the Guided Practice).

Guided Practice with Monitoring: (20 min)

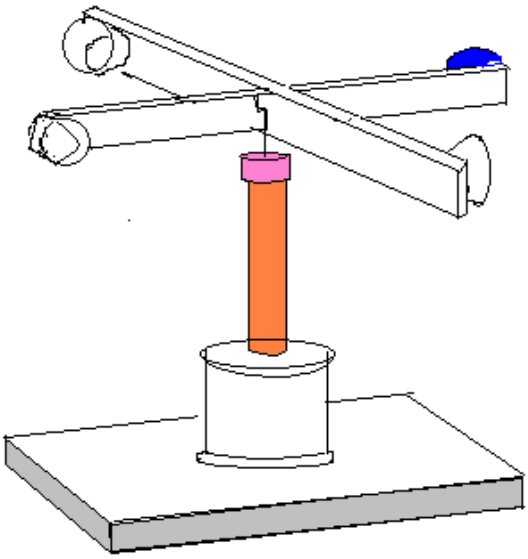
- Making the anemometer: Cut out two strips of heavy cardboard, approximately 2 inches x 18 inches (15 cm x 45 cm). Make a slit in the middle of each one so that they fit together to make a cross.
- Staple or tack a small metal-foil muffin pan to each end of the cross. If you don't have any muffin pans, you can make them by cutting down paper cups. Paint one of the pans a bright color. Make a hole through the center of the cross with the sharp thin nail or a large needle.
- To make a base, stick the eye of the needle into the pencil eraser. Fit the pointed end of the pencil into the hole of a spool. (You may need the clay or paper towels to make it snug.) Glue or tie the spool to a block of wood or a flat stone.
- Attach the cross to the base by placing it on the point of the needle. Blow on the cups. If the cross does not turn easily, make the hole in the crossed strips larger.
- Place the base outdoors on a box about 3 feet (1 m) above the ground.
- Reading the anemometer: Keep a record of the number of revolutions it makes per minute. You can do this easily by counting how many times the colored pan passes you. The more revolutions per minute, the greater the wind velocity.

Closure: (5 min)

- Keep a record of the number of revolutions it makes per minute. You can do this easily by counting how many times the colored pan passes you in a minute.
- Look at the weather conditions outside using the Beaufort scale. [Depending on your objectives, the students can make their own table for their anemometer by recording different wind speeds (using Beaufort scale) and adjusting how many revolutions their anemometer takes in a minute.]

Pass out a Beaufort Wind Scale Table for the students to glue in their Weather Logs.

Credit: http://en.wikipedia.org/wiki/Beaufort_scale &
http://www.stormfax.com/beaufort.htm



Assessment:

Independent Practice:

- The students can take daily, weekly, or monthly readings depending on your objective and record their data in their Weather Logs.

Answer the following questions in your Weather Log: Using the Beaufort Scale Table, list at least three different types of wind and describe their characteristics. Can you measure how fast the wind is blowing? If the wind speed was 50mph, how would you describe the wind? If the wind was blowing 6 mph, what would the sea conditions be like?

References:

Originally written by Sharla Boardman and revised and edited by Justin Taylor. Both were a part of the INL Educational Science writing team.

Lesson 7: Air Pressure and Barometer

Time Frame:	Standards:
45 – 60 minutes 4th Grade	• **4.S.1.2.1** Make and record observations then analyze and communicate the collected data. (588.02 a) • **5.S.1.2.1** Use observations and data as evidence on which to base scientific explanations and predictions.

Objectives:

Students will learn how a barometer works by making one and operating it.

Materials:

Lesson Material:
Teacher Preparation:

- Read through the Instructional Input/ Body for this lesson before teaching. You can find further information on the internet depending on your objectives.
- Gather materials for making the barometer.

Locate your barometer that you made in the Lesson 1 Teacher materials.

Materials needed:

- Saucer
- Water
- Plastic soda bottle
- Index card
- Tape

Pre-made barometer

Procedure:

Anticipatory Set/Opening:

- Show the students the display of the pre-made barometer and tell them that their

task is to make their own barometer and to learn how it works (or within groups depending on your objectives).

Instructional Input/Body: (30 min)

- The layer of air surrounding the earth exerts a pressure of more than 114 pounds on every square inch. More than 300 years ago Evangelista Torricelli, an Italian physicist, first figured out a way to measure this atmospheric pressure. He balanced a column of mercury with a column of air.
- A meteorologist uses a barometer to measure the air pressure. When there is an increase in air pressure, the water rises in the barometer. When the air pressure decreases, the water level drops. When the water in the bottle drops down, you can expect warmer, wetter weather.
- High pressure occurs when air is sinking. Under these conditions, good, clear weather is the result because the air is stable. Low pressure area is associated with unsettled weather conditions such as clouds, storms and wind. This happens because air rises when it is unstable.
- The lowest barometric pressure ever recorded was 25.59 inches on October 12, 1979, about 300 miles west of Guam in the Pacific Ocean, during a typhoon. The highest barometric pressure recorded was 32 inches in Agata, Siberia, in Russia, on December 31, 1968.
- Air pressure is usually lower on stormy days than it is on clear, dry days. So, when air pressure falls, it often indicates that a storm is approaching. A change in pressure of one-tenth of an inch or more in 6 hours means there is going to be a fast change in the weather.

Modeling:
Show a demonstration of how to build the barometer and how to operate it (located in the Guided Practice).

Guided Practice with Monitoring: (15 min)

- Making the Barometer: Fill the saucer halfway with water. Pour water into a bottle until it is about three-quarters full. Keeping your thumb on the mouth of the bottle, turn the bottle upside down over the saucer. Then remove your thumb and quickly put the mouth of the bottle into the saucer of water. Tape a strip of the index card on the outside of the bottle on the bottom edge and tape it straight up towards the mouth of the bottle.
- Mark the index card at the point where the water settles, and you will be able to chart whether the water goes up or down in the bottle.
- Have the students read their own barometer.

Closure:

- The students can take daily, weekly, or monthly readings depending on your

objective and record their data in their Weather Logs.
Answer the following questions in your Weather Log: What is air pressure? Why should we measure it? What does air pressure have to do with weather? What does a change in lowering the pressure cause?

Independent Practice:

- Use this Data Table to record air pressure in your Weather Log:

Data Table

Date	Time	Weather Conditions	Air Pressure

Sample Data Table

Date	Time	Weather Conditions	Air Pressure
June 4, 2003	9:30 am	Clear and Sunny	4
June 4, 2003	2:30 pm	Cloudy	3
June 5, 2003	9:30 am	Rainy	1

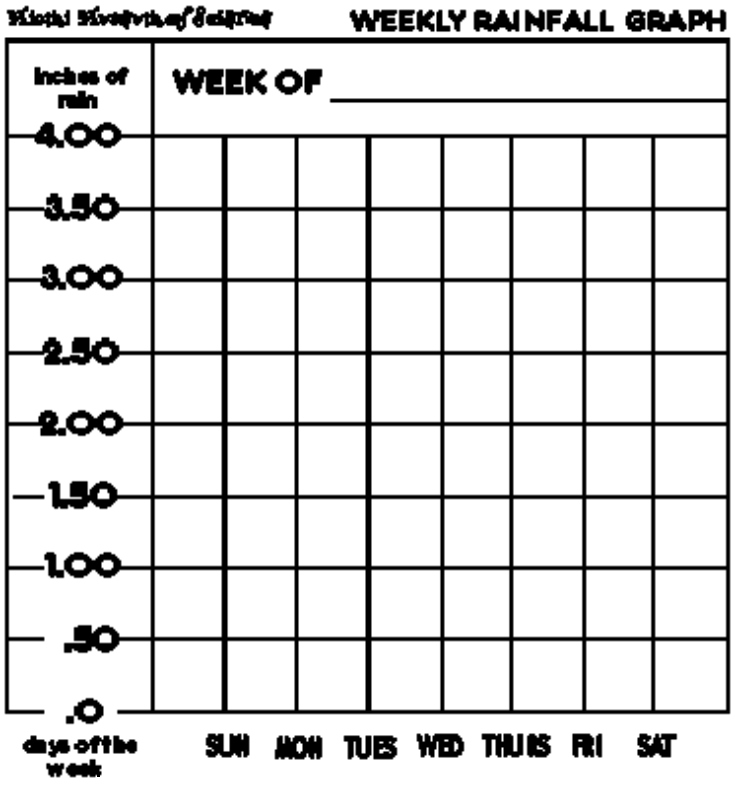
Assessment:

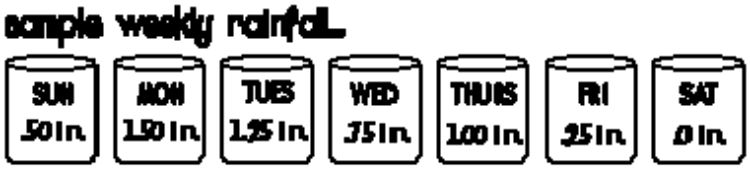
Student Assessment for the Unit:

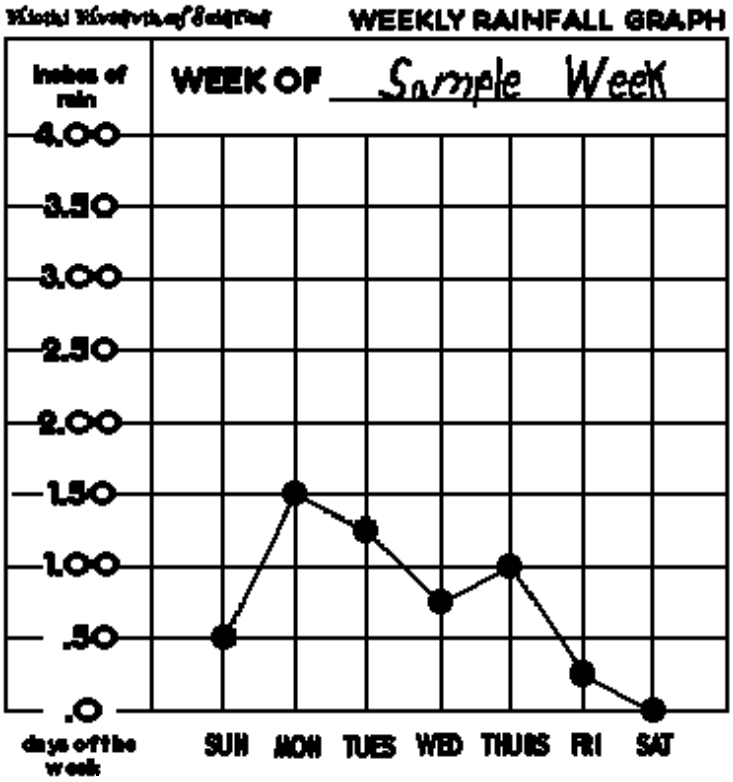
- Have the students make predictions of the weekly weather using the averages they recorded in their Weather Logs. Then, check the newspaper or Internet to determine your accuracy.
- Answer the following questions in their Weather Logs: Do you think the weather instruments you made are as accurate as those used by professional meteorologists? Why or why not? How could you make them more accurate? What problems did you run into? What could have made this experiment better? What errors did you make? Could you have avoided those errors? Did you notice any patterns in your data?

Examples for recording data in the students Weather Log:

	Date	Date	Date	Date	Date	Date
Temperature						
Precipitation						
Wind Dir.						
Wind Speed						
Humidity						
Pressure						







Bibliography for Information and Charts

365 Simple Science Experiments by: Churchill, Loeschnig and Mandell
http://www.philadelphiainstrument.com/facts.asp?index=9
http://www.teachervision.fen.com/page/331.html?for_printing=1
http://en.wikipedia.org/wiki/Beaufort_scale
http://www.stormfax.com/beaufort.htm
http://www.windows.ucar.edu/tour/link=/earth/Atmosphere/weather.html

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