



Lesson 9 - Wind and Weather

Subjects: Math, Science, Art



Learning Outcomes:

1. The students will become familiar with the basic principals of wind.
2. The students will be able to visualize the concept of convection, wind speed, and wind direction by creating simple models.
3. The students will learn to read a thermometer and record temperature and wind direction.
4. The students will become familiar with the Beaufort Scale and measuring wind speed with a basic anemometer.
- 5.

Lesson Duration: 4 Days, recording over 5 days

Materials: Thermometers, Compass, Scissors, Pencils, Markers, Cardboard, Paper, Dixie cups, Plastic pop bottles, Straws, Shallow pan with rocks, Straight pins, card stock, brass fasteners.

WV Third Grade CSO's: MA.3.4.10, 3.5.1,3.5.4, SC.3.2.1, 3.2.4, 3.2.7, 3.3.3,

Background Information For Teachers:

If there wasn't any wind, there would be little or no day-to-day change in our weather. Wind is air moving horizontally. It is created by large scale differences in the air's density. This forces the air to move toward regions of lower pressure. For example if you stand with your back to the wind, an area of low pressure would be created off to your left and a high pressure area will then be on your right. The greater the differences in air pressure, the stronger the wind. Wind occurs when the flow of air over the Earth's surface is unevenly heated. Warm air expands, becoming lighter. When this happens, the air rises. As the warm air rises, cooler air rushes in to fill the space left by the rising warm air. This movement is called convection. Wind speed can be measured with an anemometer. At higher elevations, the air gets thinner and there is less air pressure. This reduction in air pressure reduces frictional drag and wind speed increases. The rotation of the Earth also affects wind. There are six major wind belts around the Earth (easterlies, westerlies, and trade winds in both the northern and southern hemispheres) that form by convection.

Procedures:

Day 1:

- ❑ Demonstrate how to read thermometer and practice taking temperature reading in various locations inside and outside the school building. Duplicate individual Wind and Temperature Chart for each student. The students will be responsible for recording the temperature for day of the week using this chart.
- ❑ Explain and discuss the key elements of wind and weather from the above background information and the information on given below about wind vanes.



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- ❑ Construct a wind vane, using the following directions. This made be done as a large group activities or several constructed in 4-5 small student groups.

Day 2:

- ❑ Record temperature and wind direction on individual charts.
- ❑ Duplicate copies of, Beaufort's Wind Speed Scale and discuss different speed levels. Share the fact that hot-air balloons normally do not fly in winds above 10 knots. Take a visual estimation of the wind's speed by observing the present weather conditions and using Beaufort's scale predict if balloons could fly on this day.
- ❑ Construct an Anemometer, to illustrate wind speed, using the following instructions. Help students roughly calculate (using the approximate RPM and circle circumference guidelines given in the directions) the present wind speed and compare it to the predictions already made using Beaufort's scale. Discuss the differences.

Day 3:

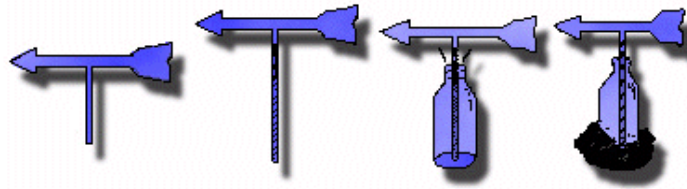
- ❑ Record temperature and wind direction on individual charts.
- ❑ Duplicate the Miami Museum of Science's Wind Scale disc on heavy paper (one/student).
- ❑ Have students construct the Wind Scale discs and compare this scale's descriptors to Beaufort's scale. Discuss which scale students would find more accurate and be able to support their conclusions.

Day 4:

- ❑ Record temperature and wind direction on individual charts.

Day 5:

- ❑ Take final temperature and wind direction reading and draw conclusions based on the generalizations discuss during Day 1's activities.



WIND VANE

Before You Start...

A weather vane is also called a wind vane. It is a tool for measuring wind direction. It spins on a rod and points in the direction from which the wind comes.

The weather vane is one of the oldest weather tools. The part of the vane that turns into the wind is usually shaped like an arrow. The other end is wide so it will catch the smallest breeze. The breeze turns the arrow until it catches both sides of the wide end equally. The arrow always points into the wind. The arrow tells you the direction from which the wind is coming.

Materials

paper and pencil
scissors
cardboard
compass
plastic soft drink bottle
plastic drinking straw
shallow pan filled with rocks
felt marking pen

Procedure

What is a weather vane? When have you seen weather vanes? Write down your answers. Draw a picture of a weather vane.

With the scissors, carefully cut an arrow with a tab from the tag board, as shown. Remember that scissors are sharp, so handle them carefully. Bend the tab slightly so the arrow turns easily when you put it in one end of the straw. Put the other end of the straw in the bottle. Remove enough rocks from the pan to make room for the bottle. Pile the rocks back around the bottle so it won't be blown over. (See illustrations above.)

A compass always point north. Use your compass to find north, and then mark the four sides of the bottle E, W, N, and S with a felt pen.

Set your weather vane in a high place such as the top of a playhouse or a slide. Make sure it does not wobble or tilt, and that it catches the slightest breeze.

Watch your weather vane closely and then describe how it works. Test it on windy days and again when there is just a light breeze.



Background Information

A weather vane is a tool used to tell which direction the wind is coming from. Weather vanes are usually found on top of buildings so they will catch an open breeze. Look for them on top of barns, houses, weather stations, hardware stores, and other places that sell or use weather tools. The part of the vane that turns into the wind is usually shaped like an arrow. The other end is wide so it will catch the smallest breeze. Sometimes a metal rooster or other animal sits on top of the weather vane.

You have made a weather vane! If the wind is blowing from the south, the wind is usually warm. If the wind is blowing from the north, the wind is usually cooler.

Some weather vanes have directional strips underneath the arrow to make it easier to read. Your markings on the bottle do the same thing.

The breeze turns the arrow on the weather vane until it catches both sides of the wide equally. The arrow always points into the wind.

It is easier to see how the energy from the wind moves your weather vane if it is up high and in an open area. You might also want to experiment by putting it on the ground.

A weather vane is one of the oldest weather tools. It is still used today to measure the direction of the wind. Weather vanes can only measure wind direction a few yards (meters) off the ground. Large, helium-filled weather balloons are used to measure winds high above the earth's surface. The balloons move with the same speed and direction as the wind.

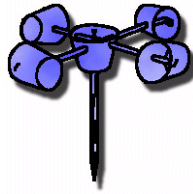


Scott Truesdell's

BEAUFORT SCALE WEATHER PAGE

The Beaufort Scale was originally developed as a system for estimating wind strengths without the use of instruments. It is currently still in use for this same purpose as well as to tie together various components of weather (wind strength, sea state, observable effects) into a unified picture. I use it for estimating wind strength when I'm out sailing on my boat because my boat does not have wind instruments. [Jim Croft's Beaufort page](#) has a more complete introduction on the establishment and utility of the Beaufort system.

Code No.	Description	Pressure lbs per square foot	Wind Speed miles per hour	Wind Speed knots	Observable Effects on the Environment
0	Calm	0	less than 1	less than 1	Smoke will rise vertically.
1	Light Air	0.01	1-3	1-3	Rising smoke drifts, weather vane is inactive.
2	Light Breeze	0.02	4-7	4-6	Leaves rustle, can feel wind on your face, weather vane is inactive.
3	Gentle Breeze	0.28	8-12	7-10	Leaves and twigs move around. Light weight flags extend.
4	Moderate Breeze	0.67	13-18	11-16	Moves thin branches, raises dust and paper.
5	Fresh Breeze	1.31	19-24	17-21	Trees sway.
6	Strong Breeze	2.30	25-31	22-27	Large tree branches move, open wires (such as telegraph wires) begin to "whistle", umbrellas are difficult to keep under control.
7	Moderate Gale	3.60	32-38	28-33	Large trees begin to sway, noticeably difficult to walk.
8	Fresh Gale	5.40	39-46	34-40	Twigs and small branches are broken from trees, walking into the wind is very difficult.
9	Strong Gale	7.70	47-54	41-47	Slight damage occurs to buildings, shingles are blown off of roofs.
10	Whole Gale	10.50	55-63	48-55	Large trees are uprooted, building damage is considerable.
11	Storm	14.00	64-75	55-65	Extensive widespread damage. These typically occur only at sea, and rarely inland.
12	Hurricane	above 17	above 75	above 65	Extreme destruction.



ANEMOMETER

Materials

five 3 ounce paper Dixie cups
two straight plastic soda straws
a pin
scissors
paper punch
small stapler
sharp pencil with an eraser

Procedure

Take four of the Dixie cups. Using the paper punch, punch one hole in each, about a half inch below the rim.

Take the fifth cup. Punch four equally spaced holes about a quarter inch below the rim. Then punch a hole in the center of the bottom of the cup.

Take one of the four cups and push a soda straw through the hole. Fold the end of the straw, and staple it to the side of the cup across from the hole. Repeat this procedure for another one-hole cup and the second straw.

Now slide one cup and straw assembly through two opposite holes in the cup with four holes. Push another one-hole cup onto the end of the straw just pushed through the four-hole cup. Bend the straw and staple it to the one-hole cup, making certain that the cup faces in the opposite direction from the first cup. Repeat this procedure using the other cup and straw assembly and the remaining one-hole cup.

Align the four cups so that their open ends face in the same direction (clockwise or counterclockwise) around the center cup. Push the straight pin through the two straws where they intersect. Push the eraser end of the pencil through the bottom hole in the center cup. Push the pin into the end of the pencil eraser as far as it will go. Your anemometer is ready to use.

Your anemometer is useful because it rotates with the wind. To calculate the velocity at which your anemometer spins, determine the number of revolutions per minute (RPM). Next calculate the circumference (in feet) of the circle made by the rotating paper cups. Multiply your RPM value by the circumference of the circle, and you will have an approximation of the velocity of at which your anemometer spins (in feet per minute). (Note: Other forces, including drag and friction, influence the calculation but are being ignored for this elementary illustration. The velocity at which your anemometer spins is not the same as wind speed.)

The anemometer is an example of a vertical-axis wind collector. It need not be pointed into the wind to spin. (Note: This paper cup anemometer will produce a reasonable approximation of circumferential velocity, but should not be used for any purpose other than elementary illustration.)



MIAMI SCIENCE CENTER'S WIND SCALE

Measuring Wind Speed

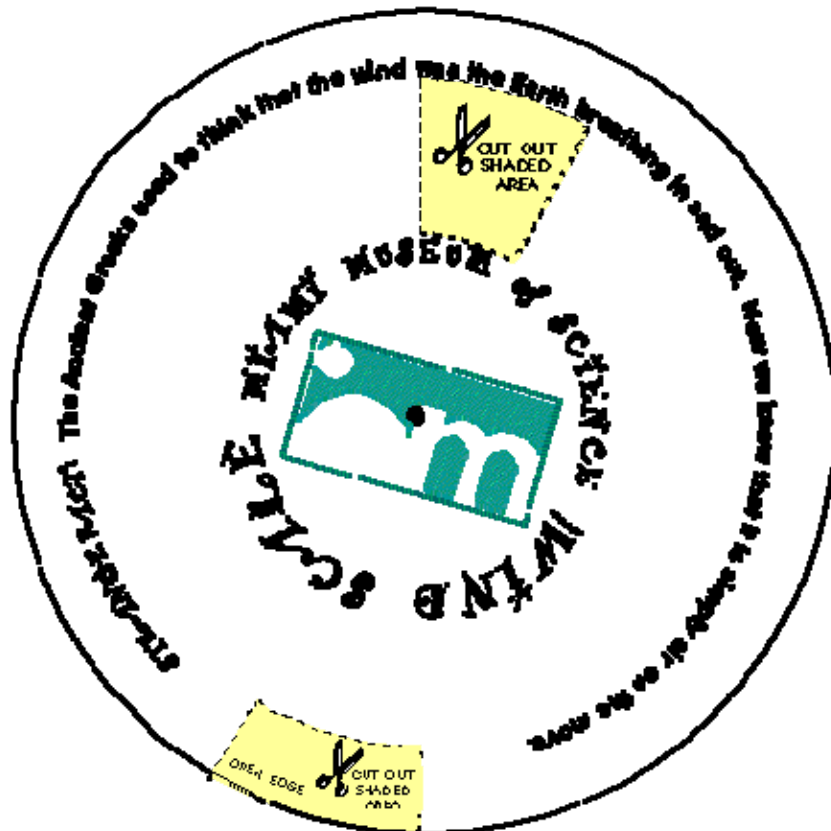
Watch a flag as it billows in the wind. Can you use the flag to estimate how fast that wind is moving? Use the wind scale below to find out.

Materials

- a printed copy of "Wind Scale #1", below
- a printed copy of "Wind Scale #2", below
- scissors
- sharpened pencil
- brad paper fastener
- colored pencils or crayons

Instructions

1. CUT OUT each Wind Scale along the outside circle and COLOR each Wind Scale if desired.
2. CUT OUT both shaded areas on Wind Scale #1.
3. With a sharpened pencil, PUNCH a hole through the black dot in the center of each circle.
4. PLACE Wind Scale #1 on top of Wind Scale #2.
5. PUSH the brad fastener through the center hole of both circles.
6. FLIP your Wind Scale over and spread open the fastener.
7. SPIN the wheel to make sure it moves freely. USE your new Wind Scale to see how fast the outside wind is moving.



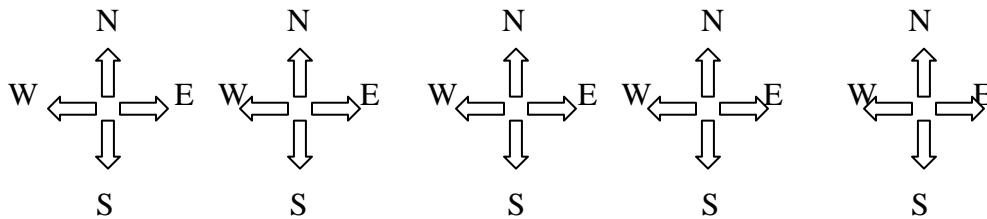


Windscale 2



DAILY WIND AND TEMPERATURE CHART

	<i>Days of the Week</i>				
Temperature	Monday	Tuesday	Wednesday	Thursday	Friday
100					
90					
80					
70					
60					
50					
40					
30					
20					
10					
0					



Highlight the arrow to show the direction of wind for each day.

Name _____

Date _____