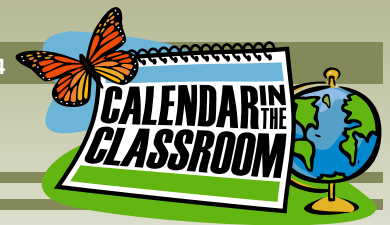




Measuring the Wind



Overview

Students explore the schoolyard and list evidence in their journals that indicates that the wind is blowing. Students will determine wind speed and direction using a compass, the Beaufort Wind Scale and bubble wands.

Background

Wind is moving air. Cooler, heavier air settles and pushes warmer, lighter air.

In the early history of ocean travel, ships were dependent on wind to fill the sails and power the boat. Sir Francis Beaufort, Admiral in the British Royal Navy, needed an accurate way to describe the ocean winds he encountered and record them in his meteorological journals. Some areas of the ocean have winds favorable for sailing and other areas have low or no winds. It was important for ship captains to be able to share this information with each other.

Admiral Beaufort began his nautical career at the age of 13 serving as a cabin boy. He was very observant and for most of his life kept journals about weather, describing the sky and clouds, precipitation, wind force and other important conditions.

In 1804, the admiral created the Beaufort Scale. It was a number scale based on observable effects of the wind on various objects in the ocean environment. It referred mostly to effects on ocean waves, sails, and other nautical conditions. Now the scale has been modified for use on land too. It describes environmental effects on things such as water, trees, dirt, smoke, buildings.

Activity

Day 1

1. Explain to the students that they will be going outside to study something they cannot see. The students will be observing what the wind can do. They will also use a compass to determine wind direction. Demonstrate the proper way to use a compass. Spend some time in the classroom with the students getting them familiar with the compasses prior to going outside and reviewing the 'land conditions' on the Beaufort scale. (See black line masters)
2. Have students take journals and assemble in an open space on the school ground. Explain that they have a few minutes to observe what the wind is doing. Use as many senses as possible and list the actions of the wind. Perhaps point out the school flag to start the observations.
3. Pull the group together and ask what evidence they have observed about the wind and what it is doing.
4. Now it is time to determine the direction the wind is blowing. Ask students to turn around until they feel the wind blowing directly into their faces. (Bubbles are another easy way to observe the direction of the wind.)

Time:

Day 1 - 30 min

Day 2 - 30 min

Skills:

Observing
Recording
Critical thinking
Interpreting
Predicting
Forecasting
Drawing conclusions

Vocabulary:

scale
compass
breeze
gale
Beaufort Scale
mph

Materials:

- *Minnesota WeatherGuide Environment™ Calendar*
- Beaufort Scale
- Compasses
- Bubble wand/soap
- *Wind (Simply Science)* by N.M. Rosinsky
- Oscillating fan
- feather
- Candle and match
- Student journals

· Facing the wind, turn the compass in your hand until north on the dial is under the red end of the needle. Now look at the compass to determine which direction you are facing relative to north.

· Have students record their data in their journals.

Day 1 Wrap Up & Assessment

Bring the students back inside and make some inferences as to what it means if there is a north wind, south wind, east or west wind. Did students use as many senses as possible to describe the wind? Can students demonstrate proper use of the compass?

Day 2

1. Ask students to review their journal entries from yesterday and share examples of evidence that the wind is blowing. Today they will measure the speed of the wind.

2. Make a list of as many words that the students can think of to describe the wind's speed or power -- such as light breeze, or high wind.

3. Guide students into giving physical descriptions of the words they listed. "What would we notice outside if the wind was calm?" (Smoke will rise vertically. Use a candle to demonstrate.) "What would we notice if it was a gentle breeze?" etc.

4. Use a small oscillating fan that has 3 speeds and a feather as examples of the wind and its work, demonstrate the different speeds and what happens to the feather during each speed.

5. Using the *Minnesota WeatherGuide Environment™ Calendar*, show them the scale that can help determine the speed of the wind without any tools. Admiral Beaufort developed the scale in 1804 because he needed a way to describe the wind to other ship captains. Wind was very important to sailors because it filled the sails and powered the ships across the ocean.

6. Give each team of students a copy of the Beaufort Wind Scale and take them outside to observe, measure and record wind speed data in their journals.

Day 2 Wrap Up & Assessment

· How could we use both the scale and the compass to help us plan an outdoor event? We could use the Beaufort scale to help determine if it is safe to go boating, swimming or fishing. Wind conditions are especially important to boaters and sailors. High winter winds and cold temperatures also pose a danger. (This may be a good time to also discuss the Wind Chill Chart also found in the back of the calendar.)

· What other ways would people benefit from the knowledge that we learned today? Make a list with students containing activities like flying a kite or sailing.

Extension

· Engineering (4th Grade Science/Engineering Standard): Develop prototypes to prevent erosion include retaining walls, wind breaks, use of shrubs or other vegetation, and drainage systems.

· Engineering: Design and build a tool to show wind direction.

· Engineering: Design and build a kite.

· ELA: Ask students to use their imagination for a creative writing essay: If you were the wind, where would you go and what would you do?

Resources

· Albert, T. *Weather & Climate - Step by Step Science Series*, Grades K-3

· Rosinsky, N. *Wind*

· *Minnesota Weather Guide Environment™ Calendar*, see the Beaufort Scale and the windchill chart in the back section of the calendar. Online: <https://jeffersfoundation.org/programs/calendar-in-the-classroom/>

Minnesota Academic Standards

3-D Science Standards

Science Practices:

3. Planning and Carrying Out Investigations

4. Analyzing and Interpreting Data
5. Using Mathematics and Computational Thinking
8. Obtaining, Evaluating and Communicating Information

Crosscutting Concepts:

1. Patterns
2. Cause and Effect: mechanism and explanation
3. Scale, Proportion, and Quantity

Disciplinary Core Ideas:

ESS2: Earth's systems

2nd Grade: Describe weather conditions expected during a particular season

4th Grade: The speed of wind, effects on erosion

Integration of 3 Core Ideas within Extension:

ESS2: Earth's systems;

ETS1: Engineering Design;

ETS2: Links among Engineering, Technology, Science and Society

(4th Grade): Develop prototypes to prevent erosion include retaining walls, wind breaks, use of shrubs or other vegetation, and drainage systems

Beaufort Scale

The Beaufort scale is an empirical measure for the intensity of the weather based mainly on wind power. The scale was created by the British Admiral Francis Beaufort in the early 1800s.

Beaufort number	Wind speed MPH	Wind Speed Knots	Description	Sea conditions	Land conditions
0	<1	<1	Calm	Flat	Calm
1	1-3	1-3	Light air	Ripples without crests	Wind motion visible in smoke
2	4-7	4-6	Light breeze	Small wavelets	Leaves rustle
3	8-12	7-10	Gentle breeze	Large wavelets	Smaller twigs in constant motion
4	13-18	11-16	Moderate breeze	Small waves	Small branches begin to move
5	19-24	17-21	Fresh breeze	Moderate longer waves	Smaller trees sway
6	25-31	22-27	Strong breeze	Large waves with foam crests	Large branches in motion
7	32-38	28-33	Near gale	Sea heaps up and foam begins to streak	Whole trees in motion
8	39-46	34-40	Gale	Moderately high waves with breaking crests	Twigs broken from trees
9	47-54	41-47	Severe gale	High waves with dense foam	Light structure damage
10	55-63	48-55	Storm	Very high waves. The sea surface is white	Trees uprooted. Considerable structural damage
11	64-72	56-63	Violent storm	Exceptionally high waves	Widespread structural damage
12	73-82	64-71	Hurricane	Sea completely white with driving spray.	Massive and widespread damage to structure