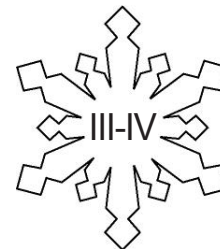


The Beaufort Scale: A Local Model

Levels



Grades 5-8

Overview:

The Beaufort Scale is a means of estimating winds speeds by observing effects of wind. In this lesson, students work as a class to develop a Beaufort scale for their village.

Objectives:

The student will:

- understand the Beaufort Scale; and
- adapt the Beaufort Scale to their village.

GLEs Addressed:

Science

- [5-8] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.
- [5] SA1.2 The student demonstrates an understanding of the processes of science by using quantitative and qualitative observations to create inferences and predictions.
- [5] SB4.1 The student demonstrates an understanding of motions, forces, their characteristics, relationships, and effects by investigating that the greater the force acting on an object, the greater the change in motion will be.
- [7] SD3.1 The student demonstrates an understanding of cycles influenced by energy from the sun and by Earth's position and motion in our solar system by describing the weather using accepted meteorological terms (e.g., pressure systems, fronts, precipitation).

Whole Picture:

Integrating western science with traditional Native knowledge creates science curriculum that is relevant to Alaskan youth. In the Yup'ik culture, for example, understanding the wind is a part of learning vital hunting and outdoor survival skills. By observing the environment, wind conditions can be identified without tools. For example, it is taught that "stretched clouds" indicated wind. In foggy conditions, a person who becomes lost should look to the ground for clues. Elders teach that grass usually lays in a southern direction, depending on the prevailing wind. It is also taught that at sea the waves move toward land and warmth in the air may be coming from land.

Western science uses instruments such as wind vanes and anemometers to measure wind speed and direction. The Beaufort Scale – devised by Sir Francis Beaufort (1777 – 1857) during his time as hydrographer for the British Royal Navy – uses visual cues to aid in identifying wind direction and speed.

Beaufort # (force)	Wind Speed in Knots	Wind Speed in MPH	Wave Height in Feet	*WMO Classification	Appearance on Water and Land
0	> 1	>1	0	Calm	Sea surface smooth like a mirror; on land smoke rises vertically.
1	1-3	1-3	.25	Light Air	Sea surface has scaly-looking ripples but no foam crests; on land wind vanes are still but smoke drift shows wind direction.
2	4-6	4-7	.5 - 1	Light Breeze	Sea has small wavelets but crests are glassy, not breaking; on land wind is felt on face, leaves rustle and vanes begin to move.
3	7-10	8-12	2 - 3	Gentle Breeze	Sea has large wavelets and crests begin to break, showing scattered whitecaps; on land leaves and small twigs constantly moving and small flags

4	11-16	13-18	3.5 – 5	Moderate Breeze	Small waves become longer with numerous whitecaps; on land dust and loose paper are lifted and small tree branches constantly moving.
5	17-21	19-24	6 - 8	Fresh Breeze	Moderate waves form with many whitecaps and some spray; on lands small trees sway.
6	22-27	25-31	9.5 – 13	Strong Breeze	Waves are larger with many whitecaps and some spray; on land large tree branches are moving and wind across wires creates whistling sound.
7	28-33	32-38	13.5 – 19	Near Gale	Sea heaps creating white foam streaks of breakers; on land entire trees are moving and resistance is felt walking against wind.
8	34-40	39-46	18 – 25	Gale	Moderately high waves begin to break; on land entire trees are moving and resistance is felt walking against wind.
9	41-47	47-54	23 – 32	Strong Gale	High waves form and spray may reduce visibility; on land slate blows off roofs and other slight structural damage can occur.
10	48-55	55-63	29 – 41	Storm	Very high wave with overhanging crests, heavy foam and heavy rolling with low visibility; on land considerable structural damage may occur, trees broken or uprooted.
11	56-63	64-72	37 – 52	Violent Storm	Exceptionally high waves create foam patches and visibility is even more reduced; on land major structural damage occurs.
12	<64	<73	Over 45	Hurricane	Air filled with foam, sea completely white, visibility virtually impossible; on land extreme devastation occurs.

Knowing the Beaufort Scale, or the cultural equivalent, is especially helpful if no measurement instruments are available.

Materials:

- *Climate Change* Interactive DVD
- STUDENT WORKSHEET: “A Local Beaufort Scale”

Activity Procedure:

1. Display the *Climate Change* Interactive DVD where all students can see it. Navigate to Unit 1 and then to the Air Pressure Section. Navigate to the Beaufort Scale page.
2. Explain that the Beaufort Scale is a means of estimating wind speed by observing the effects of the wind. The British Admiral Sir Francis Beaufort developed the Beaufort Scale in 1805. He developed the scale to help sailors estimate the winds.
3. Click through the Beaufort Scale force levels on the *Climate Change* Interactive DVD. At each force ask students to state whether or not the image represented can be observed in their village.
4. Distribute the STUDENT WORKSHEET: “A Local Beaufort Scale.” As a class, go through each force and name an alternate observation that can be viewed in the village. Instruct students to draw representations of the observations they listed for each force.

Critical Thinking Question: Discussion Method: As a class, discuss the following: How does the wind affect the environment at each stage of the Beaufort scale? Can human activity make the wind’s movement more or less severe?

Extension Idea:

As a class, monitor the wind speed for one month. (This could be done in conjunction with the Weather Observation Journal activity.) As each force of the Beaufort Scale is observable, have students

take photographs of the phenomena they listed on their Local Beaufort Scale. At the end of the month, develop the photographs and use them to make a display of the Beaufort Scale which can be posted in the classroom, school, or elsewhere in the community. (NOTE: Some forces will not be observable. Those spots can be filled in with drawings. If very few forces are viewed, the activity can be extended.)

Answers to Student Questions:

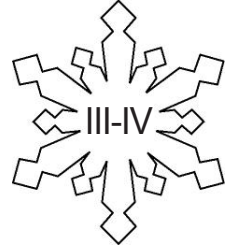
- | | | |
|---|---|---|
| 1. A. 0 mph
B. calm
C. answers will vary
D. answers will vary | 6. A. 19-24 mph
B. fresh breeze
C. answers will vary
D. answers will vary | 11. A. 55-63 mph
B. whole gale
C. answers will vary
D. answers will vary |
| 2. A. 1-3 mph
B. light air
C. answers will vary
D. answers will vary | 7. A. 25-31 mph
B. strong breeze
C. answers will vary
D. answers will vary | 12. A. 64-72 mph
B. storm
C. answers will vary
D. answers will vary |
| 3. A. 4-7 mph
B. light breeze
C. answers will vary
D. answers will vary | 8. A. 32-38 mph
B. moderate gale
C. answers will vary
D. answers will vary | 13. A. 73 + mph
B. hurricane
C. answers will vary
D. answers will vary |
| 4. A. 8-12 mph
B. gentle breeze
C. answers will vary
D. answers will vary | 9. A. 39-46 mph
B. fresh gale
C. answers will vary
D. answers will vary | |
| 5. A. 13-18 mph
B. moderate breeze
C. answers will vary
D. answers will vary | 10. A. 47-54 mph
B. strong gale
C. answers will vary
D. answers will vary | |

Name: _____

A Local Beaufort Scale

Student Worksheet (page 1 of 3)

Levels



Directions: For each force, fill in the equivalent wind speed and description based on the *Climate Change* Interactive DVD. Then, write an observation that can be made locally and draw a picture of that observation.

1.) Force = 0	2.) Force = 1	3.) Force = 2	4.) Force = 3
A.) Equivalent Wind Speed =	A.) Equivalent Wind Speed =	A.) Equivalent Wind Speed =	A.) Equivalent Wind Speed =
B.) Description:	B.) Description:	B.) Description:	B.) Description:
C.) Observation:	C.) Observation:	C.) Observation:	C.) Observation:
D.) Drawing of Observation:	D.) Drawing of Observation:	D.) Drawing of Observation:	D.) Drawing of Observation:

Name: _____

A Local Beaufort Scale Student Worksheet (page 2 of 3)

5.) Force = 4	6.) Force = 5	7.) Force = 6	8.) Force = 7	9.) Force = 8
A.) Equivalent Wind Speed =	A.) Equivalent Wind Speed =	A.) Equivalent Wind Speed =	A.) Equivalent Wind Speed =	A.) Equivalent Wind Speed =
B.) Description:	B.) Description:	B.) Description:	B.) Description:	B.) Description:
C.) Observation:	C.) Observation:	C.) Observation:	C.) Observation:	C.) Observation:
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
D.) Drawing of Observation:	D.) Drawing of Observation:	D.) Drawing of Observation:	D.) Drawing of Observation:	D.) Drawing of Observation:
_____	_____	_____	_____	_____

Name: _____

A Local Beaufort Scale Student Worksheet (page 3 of 3)

10.) Force = 9	11.) Force = 10	12.) Force = 11	13.) Force = 12
A.) Equivalent Wind Speed =	A.) Equivalent Wind Speed =	A.) Equivalent Wind Speed =	A.) Equivalent Wind Speed =
B.) Description:	B.) Description:	B.) Description:	B.) Description:
C.) Observation: _____ _____ _____ _____ _____	C.) Observation: _____ _____ _____ _____ _____	C.) Observation: _____ _____ _____ _____ _____	C.) Observation: _____ _____ _____ _____ _____
D.) Drawing of Observation: _____ _____	D.) Drawing of Observation: _____ _____	D.) Drawing of Observation: _____ _____	D.) Drawing of Observation: _____ _____