Hurricanes
3–5

Hurricane Science

LESSON PLAN 2

Hurricane Hazards: Wind

Seeing that the wind and the storm surge can be studied and measured is a first step to understanding the power of hurricanes.

Key Terms and Concepts

anemometer	revolution	tides
Beaufort wind scale	storm surge	wind speed

Purpose

To give the students and their families an understanding of the hazards of wind and storm surge during a hurricane

Objectives

The students will—

- Create a wind scale for a fan to illustrate the effects of changes in wind speeds.
- Use the activity sheet *Beaufort Wind Scale* to discuss the effectiveness of a universal wind scale; afterward, compare and analyze local wind observations.
- Work with their families to identify the strongest winds they have experienced based on the Beaufort wind scale. (Home Connection)
- Use *Building an Anemometer* to assemble a device to measure wind and compare instrument measurements with observation measurements. (Linking Across the Curriculum)
- Turn recorded wind speeds into descriptive weather reports based on the Beaufort wind scale. (Linking Across the Curriculum)
- Describe the dangers of hurricane winds with comparatives and superlatives. (Linking Across the Curriculum)
- Build a model to demonstrate storm surge.
- Analyze the relationships among storm surge, tides and wind.
- Write journal entries that describe the experience of being in a hurricane, using adjectives and adverbs to paint word pictures. (Linking Across the Curriculum)
- Create vivid imagery in a poem or short story about hurricanes with analogies and similes. (Linking Across the Curriculum)
- Research major hurricanes to find which hazards caused the greatest damage. (Linking Across the Curriculum)
- Create a pie graph to illustrate and compare hurricane damage based on earlier research. (Linking Across the Curriculum)

American Red Cross

Visit the American Red Cross Web site at *www.redcross.org/disaster/masters*

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Hurricane Hazards: Wind

- Research state or federal programs designed to mitigate the effects of storm surges. (Linking Across the Curriculum)

Activities

"Measuring the Wind"

"Storm Surge"

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Hurricane Hazards: Wind

Materials

- 3-speed electric fan
- Small stack of paper
- *Beaufort Wind Scale*, 1 copy per student
- *Building an Anemometer*, 1 copy per team (Linking Across the Curriculum)

American Red Cross

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"Measuring the Wind"

SET UP 15 minutes **CONDUCT** one 30-minute class for discussion; four 5-minute classes for observation

Science: Inquiry and Earth Science

Lead a class discussion about the ways the students know that the wind is blowing faster one day than another. (The effect on trees, effect on air temperature, an increased whooshing sound, etc.)

1. Place the stack of paper on a table in front of the fan. Turn the fan on at low speed. Ask the students to describe the effect on the papers. (How far, how fast and how high did they blow? How many blew?) Turn the fan to medium speed and then to high speed; ask the students to describe the effects of the different settings.

2. As a class, create a wind scale for a fan with FW1 as the low wind speed, FW2 as the medium and FW3 as the high. Which speed causes the greatest damage? What would FW0 describe? What about FW4?

3. Distribute *Beaufort Wind Scale* to the students. Discuss the effectiveness of a universal scale to measure and report wind speeds.

4. Over the next week, have the students make wind observations to complete the activity sheet. On completion, ask them if they observed a pattern in the wind and what role the wind plays in weather conditions.

Wrap-Up

Have the students share and compare their wind speed logs.

- How does the Beaufort wind scale make comparison possible?
- What are the possible reasons for differences in the recorded wind speeds?
- Does the wind change at different times of the day?
- What role does the wind play in changing weather conditions?

Home Connection

Have the students ask adults at home to use the Beaufort wind scale to describe the most powerful wind they can remember observing. What evidence did they see? Where does it fit on the scale?

Linking Across the Curriculum

Science: Earth Science and Technology

For this activity, each team will require a ping-pong ball (or a cotton ball or small pom-pom), 2 feet (60 centimeters) of string, tape and a protractor.

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Hurricane Hazards: Wind

Wind speed can be measured by observation and by instruments called anemometers. Have the students build anemometers and compare their measurements with their observations.

1. Divide the students into teams.
2. Distribute *Building an Anemometer* and the materials to each team.
3. After the teams build their anemometers and record their findings, have each team appoint a representative to report the results to the class.

Language Arts: Writing

Have the students turn their recorded wind speeds into descriptive weather reports based on the Beaufort wind scale.

Have the students write descriptions of winds of hurricane proportions. The students will then use comparatives and superlatives to make their descriptions more accurately describe the dangers of high winds.

American Red Cross

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LESSON PLAN 2

Hurricane Hazards: Wind

"Storm Surge"

SET UP 30 minutes **CONDUCT** 35 minutes

Science: Physical Science and Inquiry

TEACHING NOTE You can present this as a teacher-led demonstration to the whole class or assign a team of students to act as hurricane experts who will illustrate the power of a storm surge.

Materials

- Electric fan
- Paper (to encircle the fan)
- Grease pencil
- Scissors
- Tape
- Water and dishpan
- Plastic covering (to put under and around the fan)
- Chalkboard and chalk or chart paper and markers

Use the demonstration below to describe the creation and impact of a storm surge. Use information on storm surges in the Hurricane Science section in the Background to this module to help the students analyze the demonstration.

1. Put the terms "storm surge," "waves" and "tides" on the board. Make sure students can describe each term.
2. Make a funnel from the paper and tape its wide end to fit over the fan to concentrate the wind.
3. Fill the dishpan with water to about 2 inches (5 centimeters) below the brim. Mark the water level at one end with the grease pencil, and position the fan so that it will blow across the water toward the mark.
4. Turn on the fan. Ask students to describe what happens to the water when the wind blows across its surface. (The water builds up into a storm surge.)
5. Tilt the dishpan to raise the water level at the end you marked, creating high tide. How does the height of the tide affect the storm surge?
6. Tilt the pan back and forth in rapid motion to create waves. Then, turn on the fan to create a storm surge on top of the waves. Does this make a difference in the strength of the storm surge? Why or why not?
7. How do wind and waves affect the power of the storm surge?

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Wrap-Up

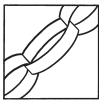
Challenge students to use this demonstration and the following facts to explain why the greatest amount of damage in a hurricane may be caused by a storm surge.

Fact: A cubic yard of water weighs about 1,700 pounds (770 kilograms)—almost one ton.

Fact: Hurricane Katrina (2005)—a category 3 hurricane—had a storm surge of 26 feet (8 meters) above sea level.

TEACHING NOTE For a list of the most destructive hurricanes, refer to—

- Billion Dollar U.S. Weather Disasters from the National Climatic Data Center at *www.ncdc.noaa.gov/oa/reports/billionz.html*
- Historical Hurricanes at *www.hurricaneville.com/historic.html*



Linking Across the Curriculum

Language Arts: Writing

Have the students write journal entries about what it would be like to experience a hurricane. Encourage the students to use vivid adjectives and adverbs to paint precise pictures of the fierce storm.

As a class or in small groups, have the students use analogies and similes to create vivid images in hurricane poems or in dialogues for a story (for example, winds howling like..., or, as dark as...).

Social Studies: History; Language Arts: Research

Divide the class into groups and assign one or two major hurricanes to each group to research the damage their hurricane caused.

- What percentage of the overall hurricane damage was attributed to storm surge?
- What percentage was attributed to wind damage or flooding caused by rain?
- Were there any deaths in the hurricane? If so, what caused them?

Mathematics: Charts and Graphs

Create a pie graph using the hurricane damage research from the social studies activity above to illustrate the most damaging hazard of a hurricane.

Social Studies: Government

Assign the students to research state or federal programs designed to mitigate the effects of storm surges.

American Red Cross

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Beaufort Wind Scale

Name _____

In 1805, British Admiral Sir Francis Beaufort developed this wind scale to help sailors estimate the speed of the wind using visual observations. The scale starts with 0 and extends to a force of 12.

Force	Description	Winds	Signs
0	Calm	0 mph (0 kph)	Smoke rises vertically.
1	Light air	1–3 mph (1–5 kph)	Smoke drifts, but wind vanes or flags do not move.
2	Slight breeze	4–7 mph (6–11 kph)	Leaves rustle and wind vanes move.
3	Gentle breeze	8–12 mph (12–19 kph)	Leaves and small twigs are in constant motion; flags are extended.
4	Moderate breeze	13–18 mph (20–29 kph)	Dust and loose paper blow; small branches move in trees.
5	Fresh breeze	19–24 mph (30–39 kph)	Small leafy trees begin to sway.
6	Strong breeze	25–31 mph (40–50 kph)	Large branches are in motion; whistling is heard in utility wires.
7	Moderate gale	32–38 mph (51–61 kph)	Whole trees are in motion; it is difficult to walk against the wind.
8	Fresh gale	39–46 mph (62–74 kph)	Twigs break from trees.
9	Strong gale	47–54 mph (75–87 kph)	Roof shingles blow free; slight structural damage can occur.
10	Whole gale	55–63 mph (88–101 kph)	Trees are broken or uprooted; considerable structural damage occurs.
11	Storm	64–73 mph (102–118 kph)	Widespread damage occurs; trees blow a distance.
12	Hurricane	74+ mph (119+ kph)	Extreme destruction occurs; buildings are destroyed, trees and utilities are down.

Beaufort Wind Scale

WIND SPEED LOG

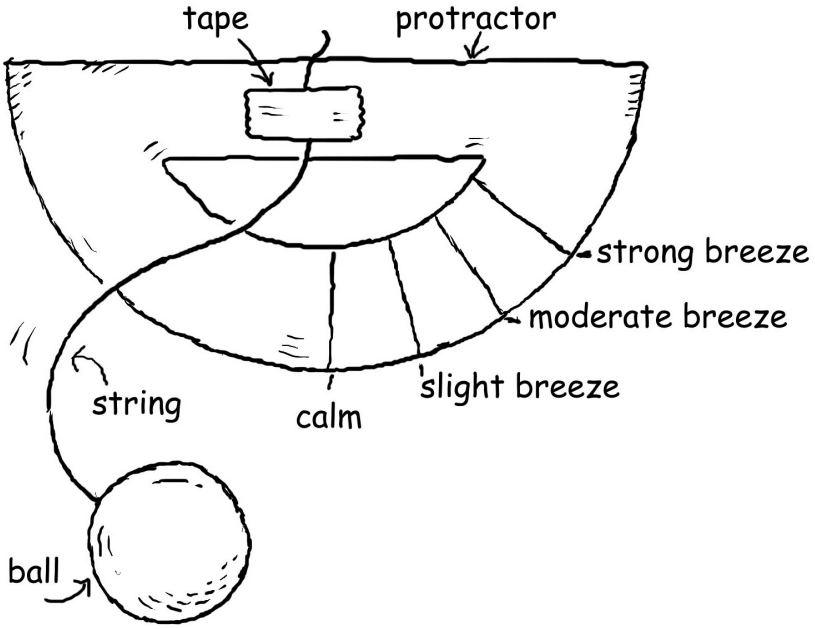
Directions: Observe the wind several times a day. Describe the speed based on the Beaufort wind scale.

Date	Time of Day	Observation	Wind Speed

American Red Cross

Building an Anemometer

Name _____



Note: Observation is an excellent wind measurement tool. However, for more accurate wind reading, meteorologists use anemometers.

To make your anemometer you will need—

- Ping-pong ball, cotton ball or small pom-pom
- 2 feet of string
- Tape
- Protractor

1. Use tape to label your protractor according to the picture.
2. Tape one end of the string to the ball.
3. Tape the other end to the center point on the base of the protractor.

Building an Anemometer

Directions: Use your anemometer to track the wind regularly over several days.

Date	Time of Day	Wind Speed	Weather Conditions

Compare your measurements to your Beaufort wind scale observations.