Week 9: Hurricanes Lesson

1. Show students slide show of images hurricane and ask students to reflect about their own personal experiences with hurricanes

2. Watch the video on hurricanes
   or animation of how a hurricane forms

3. Create a hurricane proof house: See hand out
   http://www.teachingchannel.org/videos/teaching-hurricanes-video

4. Review Hurricane Preparedness with students (see packet)
   - Ask students would they do to prepare for a hurricane
     - Play virtual game “Are you ready?”
   - Read Are you ready?
   - Do: Have students make hurricane preparedness cards to put on refrigerator
   - Do: FSN Create a table highlighting items needed hurricane preparedness. Have students bring in items for display
Additional resources:

Virtual simulations:

Create a hurricane simulation
http://www.nhc.noaa.gov/outreach/games/canelab.htm

Aim a hurricane
http://www.nhc.noaa.gov/outreach/games/movncane.htm

Hurricane activities and information:

Hurricane tracking: Live
http://www.nhc.noaa.gov/

Create a storm surge

http://secoora.org/classroom/virtual_hurricane/surge_of_the_storm#procedure

Most notable hurricanes

http://www.nhc.noaa.gov/outreach/history/
HURRICANE HOUSE CHALLENGE

PURPOSE
Students design, build, and test a house to withstand high winds in a hurricane simulation.

MATERIALS
For planning (teacher provides)
- 3 sheets of white paper
- pencil
- ruler
- calculator

For construction
- 4 sheets of construction paper, 8 ½” X 11”
- 4 straws
- glue stick
- ¾” cellophane tape
- Styrofoam plate

For testing (teacher provides)
- A wind source—leaf blower, hair dryer, very strong fan, etc. (A leaf blower will give you a Force 5 hurricane! It is recommended you use blower in an open gym or outside, not your class! ☹)

PROCEDURE
PLANNING
1. You must plan your house on paper before you begin construction. Draw a top and side view of the house (2 sheets of white paper). Your house can be any shape.
2. (Teachers: optional, for advanced students or if you want to add math to activity) Your home must have 2,000 cubic centimeters of space inside. Calculate the volume of the house after you create your plan on paper, and then adjust the dimensions of your design to meet this requirement.
   - Formulas you may need are below:
     - Formula for a rectangular solid or cylinder: Area of base x height.
     - Formula for a cone or pyramid: \((1/3) \times 3.14 \times r^2 \times h\)
     - Formula for a sphere: \((4/3) \times 3.14 \times r^3\)
3. (Teachers: optional) Carefully record all of your calculations on one of the three sheets of white paper. (They will be reviewed as part of the competition.)
4. After you have created your house plan on paper, add notes that describe those features you feel will make your house better able to resist a strong wind and what materials you will use for each part.

CONSTRUCTION
1. Construct your house using just the materials you have been provided.
2. Follow your plan.
3. Make sure your house is securely fastened to the Styrofoam “platform.” (the plate)
4. Remember, the wind will blow on your house from all sides, just like a hurricane would as it passes by.

THE CHALLENGE!
1. To test each house you should have a stopwatch and a significant source of wind.
2. Time how long each house stands at each distance of the wind source, and wind direction. Enter the time in each column. A house passes the test if it can stand for 5 seconds for each wind distance and direction. RECORD YOUR DATA IN YOUR DATA TABLE.
3. Start with the wind source at 10' (especially if it is a leaf blower). Move it gradually closer to the house at 2-foot intervals.
4. To change wind direction, simply turn the Styrofoam base. You may hold the Styrofoam base in place with your hands, but don’t get in the way of the wind. (Optionally, duct tape the plates down to a desk or the floor and move wind source.)
5. If you are competing, the house that stands the longest with the closest wind source will be the winner!
### Group Name:

<table>
<thead>
<tr>
<th>Distance (in Feet) from Wind Source</th>
<th>Time (in secs) House Withstood Wind from Front</th>
<th>Time (in secs) House Withstood Wind from Back</th>
<th>Time (in secs) House Withstood Wind from Right Side</th>
<th>Time (in secs) House Withstood Wind from Left Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Circle all times 5 seconds or greater. Congrats! Those passed the test!*
Are You Ready?

**Before the Hurricane Season**

- Determine safe evacuation routes inland.
- Learn locations of official shelters.
- Check emergency equipment, such as flashlights, generators and battery-powered equipment such as cell phones and your NOAA Weather Radio All Hazards receiver.
- Buy food that will keep and store drinking water.
- Buy plywood or other material to protect your home if you don’t already have it.
- Trim trees and shrubbery so branches don’t fly into your home.
- Clear clogged rain gutters and downspouts.
- Decide where to move your boat.
- Review your insurance policy.
- Find pet-friendly hotels on your evacuation route.

**During the Storm**

**When in a Watch Area...**

- Frequently listen to radio, TV or NOAA Weather Radio All Hazards for official bulletins of the storm’s progress.
- Fuel and service family vehicles.
- Inspect and secure mobile home tie downs.
- Ensure you have extra cash on hand.
- Prepare to cover all windows and doors with shutters or other shielding materials.
- Check batteries and stock up on canned food, first aid supplies, drinking water and medications.
- Bring in light-weight objects such as garbage cans, garden tools, toys and lawn furniture.

**When in a Warning Area...**

- Closely monitor radio, TV or NOAA Weather Radio All Hazards for official bulletins.
- Close storm shutters.
- Follow instructions issued by local officials. Leave immediately if ordered!
- Stay with friends or relatives at a low-rise inland hotel or at a designated public shelter outside the flood zone.
- DO NOT stay in a mobile or manufactured home.
- Notify neighbors and a family member outside of the warned area of your evacuation plans.
- Take pets with you if possible, but remember, most public shelters do not allow pets other than those used by used by people with disabilities. Identify pet-friendly hotels along your evacuation route.

**Plan to Leave if You...**

- Live in a mobile home. They are unsafe in high winds no matter how well fastened to the ground.
- Live on the coastline, an offshore island or near a river or a flood plain.
- Live in a high rise building. Hurricane winds are stronger at higher elevations.
Family Emergency Plan

Everyone needs to be prepared for the unexpected. You, as well as your family and friends, will most likely not be together when disaster strikes. How will you find each other? Will you know if your children or parents are safe? You may have to evacuate or be confined to your home. What will you do if water, gas, electricity or phone services are shut off?

Steps to Take

I Gather information about hazards. Contact your local National Weather Service office, emergency management office and American Red Cross chapter. Find out what type of emergencies could occur and how you should respond. Learn your community’s warning signals and evacuation plans. Assess your risks and identify ways to make your home and property more secure.

II Meet with your family to create an emergency plan. Pick two places to meet: a spot outside your home for an emergency, such as fire, and a place away from your neighborhood in case you can’t return home. Choose an out of state friend as your family’s point of contact for everyone to call if the family gets separated. Discuss what you would do if advised to evacuate.

III Implement your plan.
1. Post emergency telephone numbers by the phone.
2. Install safety features in your house, such as smoke alarms and fire extinguishers.
3. Inspect your home for items that can move, fall, break or catch fire and correct them.
4. Have your family learn basic safety measures, such as CPR and first aid, how to use a fire extinguisher, and how and when to turn off water, gas and electricity in your home.
5. Teach children how and when to call 911 or your local emergency number.
6. Keep enough supplies in your home for at least 3 days. Assemble an emergency supplies kit. Store these supplies in sturdy, easy-to-carry containers, such as backpacks or duffle bags. Keep important documents in a waterproof container. Keep a smaller emergency supplies kit in the trunk of your car.

An Emergency Supplies Kit Should Include:

- At least a 3-day supply of water (one gallon per person, per day)
- At least a 3-day supply of non-perishable food
- At least one change of clothing and shoes per person
- One blanket or sleeping bag per person
- First-aid kit
- Battery-powered NWR and a portable radio
- Emergency tools
- Flashlight, extra batteries
- Extra set of car keys
- Credit card and cash
- Special items for infant, elderly or disabled family members
- Prescription and non-prescription medicines

IV Practice and maintain your plan. Ensure your family knows meeting places, phone numbers and safety rules. Conduct drills. Test your smoke detectors and NWR monthly and change the batteries at least once each year. Test and recharge your fire extinguisher(s) according to manufacturer’s instructions. Replace stored water and food every 6 months.

Safety and preparedness material is online at:
American Red Cross: www.redcross.org
NOAA National Weather Service: www.weather.gov/safety.php
If Staying in a Home...
✓ Turn refrigerator to maximum cold and keep it closed.
✓ Turn off utilities if told to do so by authorities.
✓ Turn off propane tanks.
✓ Unplug small appliances.
✓ Fill bathtub and large containers with water in case clean tap water is unavailable. Use water in bathtubs for cleaning and flushing only. Do NOT drink it.

If Winds Become Strong...
✓ Stay away from windows and doors, even if they are covered. Take refuge in a small interior room, closet or hallway.
✓ Close all interior doors. Secure and brace external doors.
✓ If you are in a two-story house, go to an interior first floor room.
✓ If you are in a multi-story building and away from water, go to the 1st or 2nd floor and stay in the halls or other interior rooms away from windows.
✓ Lie on the floor under a table or other sturdy object.

Be Alert For...
✓ Tornadoes—they are often spawned by hurricanes.
✓ The calm "eye" of the storm—it may seem like the storm is over, but after the eye passes, the winds will change direction and quickly return to hurricane force.

What to Bring to a Shelter

What to Bring to a Shelter
- First aid kit
- Medicines, prescriptions
- Baby food and diapers
- Canned food, books, music players with headphones
- Blankets
- Battery-powered radio and cell phone
- Flashlights
- Extra batteries
- A blanket or sleeping bag for each person
- Identification
- Copies of key items such as insurance policies
- Cash, credit card

REMINDER: If you are told to leave your home, do so immediately.

After the Storm
✓ Keep listening to radio, TV or NOAA Weather Radio All Hazards.
✓ Wait until an area is declared safe before entering.
✓ Watch for closed roads. If you come upon a barricade or a flooded road, Turn Around Don't Drown™
✓ Stay on firm, dry ground. Moving water only 6 inches deep can sweep you off your feet. Standing water may be electrically charged from power lines.
✓ Never use a generator indoors.
✓ Avoid weakened bridges and washed out roads.
✓ Once home, check gas, water and electrical and appliances for damage.
✓ Use a flashlight to inspect damage. Never use candles and other open flames indoors.
✓ Wear proper shoes to prevent cutting feet on sharp debris.
✓ Do not drink or prepare food with tap water until officials say it is safe.
✓ Avoid electrocution by not walking in areas with downed power lines.
Ways to Stay Informed

NOAA Weather Radio All Hazards

The National Weather Service (NWS) continuously broadcasts warning, watches, forecasts and non-weather related hazard information on NOAA Weather Radio All Hazards (NWR). The average range of the 1000+ NWR transmitters is 40 miles, depending on topography. For the best performing NWR receivers, NWS suggests you look at devices certified to Public Alert™ standards.

These radios meet specific technical standards and come with many features such as Specific Area Message Encoding (SAME), a battery backup, both audio and visual alarms, selective programming for the types of hazards you want to be warned for, and the ability to activate external alarm devices for people with disabilities. Similar to a smoke detector, an NWR can wake you up in the middle of the night to alert you of a dangerous situation.
What To Listen For

- **HURRICANE WATCH:** An announcement that hurricane conditions (sustained winds of 74 mph or higher) are possible within the specified area in association with a tropical, subtropical, or post-tropical cyclone. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the hurricane watch is issued 48 hours in advance of the anticipated onset of tropical storm-force winds. During a Watch, prepare your home and review your plan for evacuation in case warnings are issued. Listen closely to instructions from local officials.

- **TROPICAL STORM WATCH:** An announcement that tropical storm conditions (sustained winds of 39 to 73 mph) are possible within the specified area within 48 hours in association with a tropical, subtropical, or post-tropical cyclone. During a Watch, prepare your home and review your plan for evacuations in case warnings are issued. Listen closely to instructions from local officials.

- **HURRICANE WARNING:** An announcement that hurricane conditions (sustained winds of 74 mph or higher) are expected somewhere within the specified area in association with a tropical, subtropical, or post-tropical cyclone. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the hurricane warning is issued 36 hours in advance of the anticipated onset of tropical storm-force winds. The warning can remain in effect when dangerously high water or a combination of dangerously high water and waves continue, even though winds may be less than hurricane force.

- **TROPICAL STORM WARNING:** An announcement that tropical storm conditions (sustained winds of 39 to 73 mph) are expected somewhere within the specified area within 36 hours in association with a tropical, subtropical, or post-tropical cyclone.

- **EXTREME WIND WARNING:** Extreme sustained winds of a major hurricane (115 mph or greater), usually associated with the eyewall, are expected to begin within an hour. Take immediate shelter in the interior portion of a well-built structure.

Additional Watches and Warnings are issued to provide detailed information on specific threats such as floods and tornadoes. Local National Weather Service offices issue Flash Flood/Flood Watches and Warnings as well as Tornado Warnings.

---

**National Hurricane Center and Central Pacific Hurricane Center Products**

**PUBLIC ADVISORIES** offer critical hurricane watch, warning and forecast information.

**FORECASTS/ADVISORIES** provide detailed hurricane track and wind field information.

**PROBABILITIES OF HURRICANE/TROPICAL STORM CONDITIONS** offer locally specific chances of experiencing tropical storm, strong tropical storm and hurricane force winds out to 5 days to better know if one will be impacted and when these conditions may occur.

**Local National Weather Service Office Products**

**HURRICANE LOCAL STATEMENTS** give greater detail on how the storm will impact your area.

**NON-PRECIPITATION WEATHER PRODUCTS** provide High Wind Watches and Warnings for inland areas that could experience strong winds.

*Use all of the above information to make an informed decision on your risk and what actions to take. Listen to recommendations of local officials on TV, radio and other media and to NOAA Weather Radio All Hazards for the latest tropical cyclone information.*
TITLE OF LESSON PLAN:
Hurricane!

LENGTH OF LESSON:
Two class periods

GRADE LEVEL:
6-8

SUBJECT AREA:
Weather

CREDIT:
Frank Weisel, science teacher, Tilden Middle School, Rockville, Maryland.

OBJECTIVES:
Students will understand the following:

1. Wind speed increases the height of ocean waves,

2. Higher waves occur in shallower water.

MATERIALS:
Provide the following materials for each group:

9" × 13" baking dish
Flexible straw
Duct tape
Water
Ruler
PROCEDURE:

1. Review with your students what they have learned about the causes and characteristics of hurricanes. Tell them they are going to do an experiment to discover the effects of wind speed and water depth on the height of waves in a hurricane.

2. Divide your class into pairs or small groups. Demonstrate how to set up the experiment as follows:

3. - Place the baking dish on a desktop.
   - Bend the straw so that it forms an L shape.
   - Place the straw inside the baking dish in the middle of one of the 9-inch sides, so that the shorter end faces straight up, touching the side of the dish, and the longer end is suspended about half an inch over the bottom of the dish. One open end of the straw will stick straight up, and the other will face the opposite 9-inch side of the dish.
   - Tape the straw to the inside of the dish to hold it in place.
   - Pour water into the dish until it reaches just below the straw.

4. One partner or group member should blow very gently into the end of the straw that is sticking straight up, creating "wind" over the water in the dish.

5. Another student should observe the water at the opposite end of the straw and mark the wave height on the outside of the dish.

6. Have students measure and record the wave heights, beginning their measurements from the desktop.

7. Students should repeat the procedure two more times, blowing harder each time, and record their measurements to assess the effect of wind speed on the height of waves.
8. Have students remove the water from the dish, move the straw up near the top of the dish, and refill the dish with water until it reaches just under the straw. Then they can repeat the procedure to compare wave height in deeper and shallower water.

9. Have each student write a report describing the experiment in detail, reporting the results, and stating the conclusions he or she drew from the results.

ADAPTATIONS:

Adaptations for Older Students:
Have students do research to find scientific explanation for the effects of wind speed and water depth on the height of ocean waves.

DISCUSSION QUESTIONS:

1. Describe the mechanics of the development of a hurricane.

2. Storm surge water height over open water is not as high as when it reaches land. Assuming the pressure in the eye of the hurricane is the same for both instances, why is this so?

3. Many years ago, there were no laws that forced people to evacuate before a hurricane struck. Now there are mandatory evacuation laws in place. Is this good? Why?

4. Study a cross section of a hurricane and write a journal entry describing what you would see if you actually flew through one. Be sure to include details about any changes you observe within the hurricane itself.

5. Would you like to be a Hurricane Hunter and fly through a hurricane? Why or why not?

EVALUATION:

You can evaluate your students on their reports using the following three-point rubric:

- **Three points**: complete description of all steps of experiment; accurate, detailed reporting of results; clear statement of conclusions