

Topic: Hurricane Prediction
Lesson Title: Hurricane Prediction Lab
(Swirling Vortices)
Grade Level: 6th-8th Grade
Science Domain: Earth Science

Connecting to the Next Generation Science Standards

ESS2.A – EARTH'S MATERIALS AND SYSTEMS: All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems.

The materials/lessons/activities outlined below are intended to help students reach the Performance Expectations listed below.

Performance Expectations:

Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

Connections to Classroom Activity

Students: Students will build a model of a hurricane.

Science and Engineering Practices

- Developing and using models
- Obtaining, evaluating, and communicating information

- Students will build a 3-D model of a hurricane.
- Students will use the NOAA website to gather information about the parts of a hurricane. Then, they will make a poster to display and communicate that information.

Disciplinary Core Idea

ESS 2-1: Earth's Systems
 Performance Expectation: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
 ESS 2-4: Develop a model to describe the cycling of water through Earth's

- Students will study hurricanes to understand how this storm is developed from uneven heating and convection as part of the water cycle. They will learn that this storm is part of a process in Earth's systems to cycle thermal

systems driven by energy from the Sun and by the force of gravity.	energy from one part of Earth to another.

Teacher Background Information

The main parts of a tropical cyclone are the eye, the eyewall, and the rain bands. Air spirals in a counter-clockwise rotation toward the center of a cyclone in the northern hemisphere and clockwise in the southern hemisphere. The swirling wind, around a relatively calm center, forms a vortex or vortices for plural. In the center of a cyclonic storm, the eye is mostly cloud free and calm. The eyewall, which is around the eye and further from the center, contains a ring of tall thunderstorms that produce heavy rain and the strongest winds of the cyclone. The outer part of the storm is the rain bands. The bands of rain that are spiraling and moving away from the eye and eyewall produce heavy bursts of rain and thunderstorms as well as tornadoes. In the North Atlantic Ocean, the Northeast Pacific Ocean, and the South Pacific Ocean, this cyclonic storm is called a hurricane. The same type of storm in the Southwest Pacific Ocean and the Southeast Indian Ocean is called a typhoon. In the Southwest Indian ocean this type of storm is called a tropical cyclone. Although hurricanes are some of the most destructive storms on Earth, they actually serve a purpose. Their role is to transfer heat from the ocean to the atmosphere where it can be carried away from the tropics and toward the poles. There the heat can keep the poles from becoming too cold while the removal of the heat energy cools the tropical regions. A helpful website for this topic is:

<http://www.srh.noaa.gov/jetstream/atmos/pressure.html>

Statement of Learning Objective: ABCs – Audience, Behavior, Condition

Students will design and build a model of a hurricane. They will research the parts and purpose of a hurricane and produce a poster to communicate the information that they gathered about hurricanes.

Common Learner Misconceptions:

1. Hurricanes are destructive and serve no purpose to Earth.

2. Hurricanes have similar characteristics throughout the structure of the storm.

Materials: (per group)

- (2) 2-liter bottles – remove labels and wash
- 1 – tornado tube (available at hobby shops or from science supply stores)
- small beads and/or small cubes (like small Unifix cubes)
- glitter
- water
- access to internet
- student sheets
- empty plastic tub to work over (to prevent water spills)
- poster board or poster paper
- markers, colored pencils, etc.

Vocabulary:

vortex, vortices, cyclone, hurricane, typhoon, eye, eye wall, rain bands

Safety:

Students should use caution when swirling their hurricane models.

Adaptations/Accommodations for Exceptional Students:

Exceptional students may need help with manipulating the model building materials. Also, the student information sheet may be highlighted to offer help in locating important details.

Literacy Connections:

The students will be using the NOAA internet site to research about the hurricanes. The following is a list of recommended books for middle school students about hurricanes:

- **Isaac's Storm: A Man, a Time, and the Deadliest Hurricane in History** by Erik Larson
- **Hurricanes** by Paul Kupperberg
- **Hurricane Katrina: Devastation on the Gulf Coast** by Debra Miller
- **Hurricane Force: Tracking America's Killer Storms** by Joseph B. Treaster
- **Storm Surge: The Science of Hurricanes** by Don Nardo

5E Instructional Process:

Engage:

Activity

What Do We Know About Hurricanes? Group and Classroom discussions.

- Ask students to discuss the following questions in their groups:
 1. What are the different parts of a hurricane?
 2. What purpose does a hurricane serve?
 3. How can we model a hurricane?
- Ask students to write their responses in their notebooks.
- After giving students time to write their responses, ask students to share their groups' ideas about hurricanes.
- Make a class poster and what the students know about hurricanes.
- Next, ask the class what they would like to learn more about on the subject of hurricanes.
- Make another poster or add a column to the original poster to record the students' questions about hurricanes.

Guiding Questions for the class discussion:

1. **What parts make up a hurricane?**
2. **What causes hurricanes to be different?**
3. **What ingredients are required for a hurricane to form?**
4. **What changes the strength of a hurricane?**
5. **Where to hurricanes begin?**

Explore:

- Show students the materials for the model hurricane.
- Instruct the students to fill one of their 2-liter bottles with 1.5 liters of water.
- Next, ask students to place about 2 spoons of beads and 8-10 small Unifix cubes into the 2-liter bottle with the water. Then, add about 1 teaspoon of glitter to the bottle.
- After adding the items to the bottle, the students are ready to screw the tornado tube onto the filled 2-liter bottle.
- Next, screw the empty 2-liter bottle into the other end of the tornado tube.
- Be sure students work over the plastic tub, as the tornado tubes must sometimes be readjusted to prevent leaking.

Instructions for operating the model:

1. Ask students to explore, with their hurricane model, rotating the water around to form a spiral.
2. Give each student time to explore using their model to simulate a hurricane.
3. Then, ask students what they notice about the center of the hurricane in their model.
4. Tell students that a swirling storm around a center is a vortex. Be sure to inform the students that a vortex can be formed from air as in a tornado or from water as in a hurricane.
5. Ask students to explore with their hurricane models in their groups and record their observations and ideas in their science notebooks. Their observations should include a response to the questions that follow.
 - What do you notice about the speed of the swirling water?
 - What happens to the beads and cubes as they get near the center of the model hurricane?
 - What do you think the center of this model represents in a real hurricane?
 - How is this model like a hurricane?
 - How is this model different from a hurricane?
6. After students complete their exploration, hold a class discussion about the questions above. (See Anticipated Answers at the end of this lesson.)

Explain:

Activity: Students will go to the NOAA website about hurricanes to gather information about hurricanes to use for their posters.

Instructions:

1. Pass out the student sheets titled, "The Structure of a Hurricane."
2. Group students in pairs for this activity.
3. Review the information that the students will be looking for in their research on the NOAA website.
4. Ask students to thoroughly answer all of the questions and to record any other information that is helpful for the poster that they will construct about hurricanes.
5. Next, ask students to make a poster that includes a picture of a hurricane with labels that identify the main parts of a hurricane as well as information about each of those parts. This activity may be individual, pairs, or small groups.

Elaborate:**Activity – Writing**

- Have students write a paper about the structure and function of a hurricane. Ask them to also write about a hurricane's role in the transfer of Earth's heat.

Evaluate:

1. Formative assessment should be done as students work with their models to insure that they distinguish the difference in the movement of the beads and cubes near the eye wall of their model hurricane.
2. Poster – Do students have three parts of the hurricane? Are the parts in correct approximate proportion relative to the parts of a real hurricane?
3. Writing – The writing should include the structure and function of each of the parts of a hurricane as well as how a hurricane helps to transfer energy from the tropics to the polar regions on Earth.