Name: _____   Date: _____

Student Exploration: Hurricane Motion

Vocabulary: air pressure, Coriolis effect, eye, hurricane, knot, meteorologist, precipitation

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)
A **hurricane** is a large, rotating tropical storm with wind speeds of at least 74 miles per hour.
Since 1990, **meteorologists** have regularly used satellite images to track hurricanes.

1. The satellite image at right shows Hurricane Katrina
   just before it hit New Orleans in 2005. Label the
   hurricane on the image.

2. How do you think meteorologists predicted the
   arrival of a hurricane before the 1990s?

   _____

   _____

Gizmo Warm-up
You can use data collected from weather stations to study the characteristics of hurricanes. The
Hurricane Motion Gizmo has three simulated weather stations. Turn on **Show weather station
data**. Make sure **Wind**, **Cloud cover**, and **Pressure** are all checked.

The tails on each station symbol point in the direction the wind is coming
from. The flags on the tail indicate wind speed, measured in **knots**. (One knot
is equal to 1.15 mph.) A short line extending from the tail indicates 5 knots of
wind. A longer line indicates 10 knots. A triangular flag indicates 50 knots.
Add all the flags together to get the wind speed.

The number in the station's upper right is the **air pressure**, which is measured in millibars (mb).

The circle symbol
indicates the
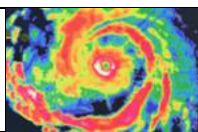percentage of cloud
cover, as shown in
the table at right.

Degree of Cloud Cover

Clear	1/8	1/4	3/8	1/2	5/8	3/4	7/8	Overcast
○	◍	◔	◑	◐	◕	◕	◖	●

Use the information above to complete this table for station **A** on the Gizmo.

Wind speed (knots)	Wind from	Cloud cover	Pressure (mb)

Activity A:	Get the Gizmo ready:
Hurricane characteristics	• Make sure **Practice**, **Show hurricane**, and **Show weather station data** are selected.

Introduction: Hurricanes form when an area of low pressure forms over warm water. Winds blow toward the low pressure, but are deflected by Earth's rotation. The **Coriolis effect** causes winds to curve to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. This results in a counterclockwise rotation for Northern Hemisphere hurricanes and a clockwise rotation for Southern Hemisphere hurricanes.

Question: What are some characteristics of hurricanes?

1. Observe: In which hemisphere is the hurricane shown on the Gizmo? _____

   How do you know? _____

2. Describe patterns: Under **Show hurricane**, make sure **Radar** is selected. Radar is used to determine where **precipitation**, such as rain, is falling. Blue indicates light rainfall. Heavier rain is shown with yellow and then orange. Red indicates the heaviest rainfall.

   A. Where within the hurricane is the lightest rainfall? _____

   B. Where within the hurricane is the heaviest rainfall? _____

   C. Describe any patterns you see in the distribution of a hurricane's rain. _____

      _____

3. Observe: Under **Show hurricane**, select **Satellite**. Satellite images are taken from cameras built into satellites orbiting Earth. These images are used to study cloud coverage over large areas, including the clouds associated with a hurricane.

   A. Which is larger, the area of rainfall or the area of cloud cover? _____

   B. Where is the cloud cover most dense? _____

   C. Where is the cloud cover least dense? _____

4. Identify: The center of rotation of a hurricane is called the **eye**. The eye of a hurricane is a core of warm, relatively calm air with low pressure and light winds. Label the eye on the hurricane at right.
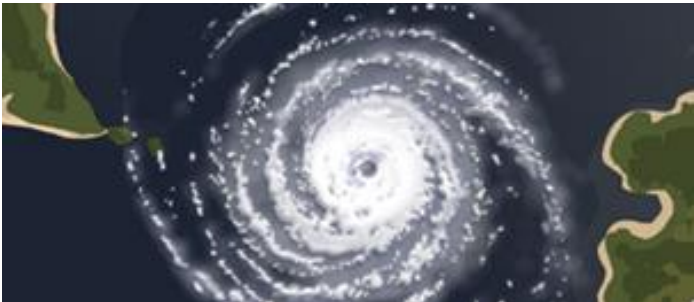
   (Activity A continued on next page)

Activity A (continued from previous page)

5. <u>Classify</u>: Hurricanes are categorized based on their wind speeds. The chart at right shows the five categories used to classify hurricanes.

   Move the hurricane so that the center of the storm is almost directly over a weather station. Adjust the hurricane's position until the wind speed is maximized.

Category	Wind speed (mph)
1	74-95 mph
2	96-110 mph
3	111-130 mph
4	131-155 mph
5	greater than 155 mph

   A. What is the top wind speed, in knots? _____

   B. Remember one knot is equal to 1.15 miles per hour. What is the hurricane's highest

   wind speed in miles per hour? _____

   C. What category is this hurricane? _____

6. <u>Observe</u>: Move the hurricane towards another weather station. As you do this, observe the cloud cover, wind speed, and air pressure at the station.

   A. How does the cloud cover change? _____

   B. How does the wind speed change? _____

   C. How does the air pressure change? _____

7. <u>Collect data</u>: Move a hurricane north, east, south, and west of a weather station. In the table below, record the wind direction in each case.

Hurricane position in relation to weather station	Wind direction at weather station
North	
East	
South	
West	

8. <u>Analyze</u>: How can you tell the location of the hurricane relative to a weather station based

   on this information? _____

   _____

   _____

Activity B:	Get the Gizmo ready:
Predict hurricanes	• Select **Experiment** and click **Pause** (‖).

Question: How can you predict the location and path of a hurricane?

1. Observe: Click **Play** (▶), and wait until you see a hurricane approaching one of the weather stations. Click **Pause**. What changes indicate a hurricane is approaching?

   Cloud cover: _____   Air pressure: _____

   Wind speed: _____

2. Observe: Click **Play**, and wait for the hurricane to go over the land. What happens in the

   hours after landfall? _____

3. Collect data: Click **Reset** (↺). Turn off **Show hurricane**. Click **Play**. When the simulation reads **Day 1, 3:00 PM**, click **Pause** and record the data from each weather station.

Station	Wind speed (knots)	Wind from	Cloud cover	Pressure (mb)
A				
B				
C				

4. Interpret: Using the readings above, do you think a hurricane is nearby? Explain.

   _____

   _____

5. Run Gizmo: Allow the Gizmo to run until the weather station data indicates a hurricane is nearby and will soon make landfall. Click **Pause**.

   A. What weather station data indicated a hurricane would soon make landfall?

   _____

   _____

   B. Turn on **Show hurricane**. Was your prediction correct? Explain. _____

   _____

(Activity B continued on next page)

Activity B (continued from previous page)

6. <u>Gather data</u>: Turn off **Show hurricane**, and click **Reset**. Click **Play**. At 12:00 P.M. of day 1, click **Pause**. From the **Tools** menu, drag a pointer to the predicted position of the eye of the hurricane, and draw an arrow in the diagram below. Label this arrow "1."

Turn on **Show hurricane**, and mark a circle where the actual eye is located. Label this circle "1." Turn off **Show hurricane**, and then repeat this procedure every 12 hours to mark the predicted and actual path of the hurricane.

7. <u>On your own</u>: Practice predicting the current and future positions of hurricanes. From the **Tools** tray, drag an arrow to where you think the eye of the hurricane is located. Turn on **Show hurricane** to check your prediction. Click on **Tools** and select **screenshot** (📷). Right-click the image, and click "Copy Image." Take snapshots of the predicted and actual positions of the hurricane.

Paste your snapshots into a black document. Label each snapshot. Turn in your hurricane tracking document with this worksheet.

8. <u>Make connections</u>: As warm, moist air rises, water vapor in the air condenses and releases a great deal of heat energy. This energy powers a hurricane. How does this information explain what happens to hurricanes after they make landfall?

_____

_____

_____