BE A METEOROLOGIST!

BIG IDEA 7: EARTH SYSTEMS AND PATTERNS

BENCHMARKS AND TASK ANALYSES

SC.2.E.7.1 Compare and describe changing patterns in nature that repeat themselves, including temperature and precipitation, day to day and season to season.
The student:

- records long term observations of the seasons.
- records long term observations of weather, including precipitation and temperature.
- discusses patterns in nature (seasons/day and night).

SC.2.P.8.5 Measure and compare temperatures taken every day at the same time.
The student:

- measures temperature accurately using a thermometer.
- maintains a log of temperatures taken in the same outdoor location, at the same time each day to compare results over an extended period of time.

SC.2.N.1.1 Raise questions about the natural world, investigate them in teams through free exploration and systematic observations, and generate appropriate explanations based on those explorations.
The student:

- raises questions about the natural world.
- investigates questions in teams through free exploration and systematic observations.
- generates appropriate explanations based on those explorations.

SC.2.N.1.2 Compare the observations made by different groups using the same tool.
SC.2.N.1.6 Explain how scientists alone or in groups are always investigating new ways to solve problems.

KEY QUESTION

Does weather occur in patterns?

TEACHER BACKGROUND INFORMATION

A meteorologist is a weather scientist. Meteorologists study and record weather data. They make predictions about weather based on weather patterns and measurements of temperature, wind, and the moisture in the air.
The Sun warms the surface of the Earth which heats the air. The surface cools at night and cools the air.

MATERIALS

Teacher

weather chart
weather symbols wall chart
weather maps (from local newspapers)
transparencies of weather maps

Per student

1 Fahrenheit thermometer
activity sheets 1-2
crayons
copies of Sunday's weather map (optional)
construction paper strips (orange, yellow, green, blue)
1 index card
scissors
glue

science notebook

SAFETY

- Remind students of safety when using scissors.
- Caution students that thermometers are fragile and can break.

TEACHING TIPS

- Make two wall charts: Weather Symbols and the Weather Chart.
- Weather graphing should begin on Monday and continue daily for **at least 1 week**, but if possible, continue over a period of months to show a definite weather pattern.
- Prior to beginning the activity on Monday, cut out the weather page from Sunday's paper) and make a transparency or copies for each student.
- Identify a specific time for daily observation of weather conditions.
- Allow ample time for introducing weather symbols and coding prior to the first observation session.
- Student understanding of both **Celsius and Fahrenheit** is essential. Students will need to explore with both types of measurement but not simultaneously. Conversion is not appropriate at this age. Demonstrate how to properly hold a thermometer.
- Students need an understanding of how to read a thermometer before beginning this activity.

ENGAGE

1. Ask students if they have ever watched the daily weather report on television. Have several students recall details about the report.
2. Show a transparency or give the students a copy of the local newspaper weather map for Sunday. Focus on the information recorded in symbols on the map.
3. Ask the students to tell what the map tells us about Sunday's weather (temperatures, cloud cover, precipitation, etc.).
4. Tell the students that they will be meteorologists for the next week and at other times during the year.

EXPLORE

1. Tell the students that they will use special symbols to record weather conditions. Refer to the symbols on the Weather Symbols wall chart and on the Weather Chart.
2. Distribute activity sheet 1. Point out that this is a copy of the large Weather Chart. Tell the students to write Sunday's date on their activity sheet weather chart. Write the date on the wall chart.
3. Ask: *What was the temperature for Sunday*? Ask them to record this temperature in degrees Fahrenheit at the top of the *Temperature* space. Record the temperature on the wall chart.
4. Then ask students to look on their Weather Symbols chart under the word *temperature* to decide which color will represent the Sunday temperature. Have them color the circle in the Sunday *Temperature* space on their chart. Color the circle on the wall chart.
5. Repeat this procedure for cloud cover, wind, and other weather conditions you observed on Sunday. In each instance record the appropriate data on the individual charts and on the wall chart.
6. Point out that the other space on the chart includes fog, smog, frost, snow, rain, and a thunderstorm. Write these vocabulary words and the word *overcast* on the chalkboard and discuss the new terms.

7. Distribute an index card and a thermometer to each student. Proceed outdoors. Allow them to observe the weather conditions. (Observations can be recorded on a class chart if the students have limited language or writing skills.)
8. Ask: *What temperature did you read on your thermometer? Is it the same as the other groups? Why do you think it might be different?*
9. After returning to the classroom, instruct the students to use weather symbols to code Monday's weather conditions on activity sheet 1. Continue daily with this procedure.

EXPLAIN

1. Show the weather map for last Sunday. Ask: *Why is there such a difference in the two temperatures for the same day?* Point out the effects of the Sun's energy in the form of heat. See TEACHER BACKGROUND INFORMATION.
2. Have students study the large weather chart to look for temperature changes.
   Ask:
   How did Monday's weather compare with Saturday's?
   Did you notice any weather conditions that seem to go together? (e.g., wind and dark clouds seem to go with rain; Sunshine usually means warmer temperatures.)
3. Distribute Meteorologist activity sheet 2 and the paper strips. Have students pick out a strip of the appropriate color (e.g., yellow for 75° F - 84° F) to match the circle for Sunday's temperature reading. Have the students place the bottom of the strip on the base line on the graph and cut the strip off at the point opposite that day's temperature. (For temperatures below 35°F, a blue strip would extend below the 35° F line.) Have them paste the strip down and repeat for the other days.
4. Have students interpret their graph to find significant weather patterns. Discuss combinations of weather conditions.
   Ask: *How do meteorologists work together using weather patterns to predict the weather (e.g., hurricane predicting)?*

EXTEND AND APPLY

1. Have students describe in their science notebooks how their graphs clearly show weather patterns, trends, and generalizations.
2. Have students graph temperature, wind, clouds, and other data collected. Have them identify possible trends.

ASSESSMENT

Have students write in their notebooks answering the key question: *Does weather occur in patterns?*
It is important that students understand what they will be evaluated on during this activity. Tell them that you are interested in finding out:

- how they go about seeing weather changes and/or patterns.
- how clearly they describe their observations.
- what conclusions they draw from their observations.

Scoring Rubric (from activity sheets 1 & 2 and written response)

3 points	Detailed data have been collected and the observations are presented clearly in the chart. Conclusions drawn deal with patterns, trends or generalizations in the data or offer cause-and-effect explanations for the patterns observed.
2 points	Some data about weather changes may have been collected, but not presented clearly in their notebooks. Conclusions drawn may not follow from the data, and the report may reveal some significant misconceptions.
1 point	Some data about weather changes were collected. The observations are not clearly presented in the report. Conclusions are basic and may reveal some misconceptions.

Weather Symbols

TEMPERATURE F°

HOT
85ºF - 100ºF

WARM
75º F - 84ºF

COOL
33ºF - 74ºF

FREEZING
Below 0ºF - 32ºF

WIND

CALM
No air motion

BREEZY
Leaves in motion,
water rippled

WINDY
Tree limbs moving,
whitecaps on water

VERY WINDY
Tree trunks bend
water rough

CLOUDS

CLEAR
No clouds

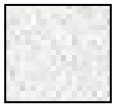
PARTLY CLOUDY
Less than half of
the sky covered

MOSTLY CLOUDY
More than half of
the sky covered

OVERCAST
No blue sky can be seen

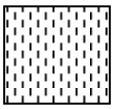
OTHER

FOG
SMOG

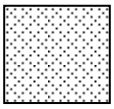


SMOG

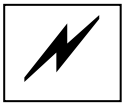
RAIN



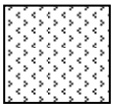
FROST



THUNDER-STORM



SNOW



Name_____ Activity Sheet 1

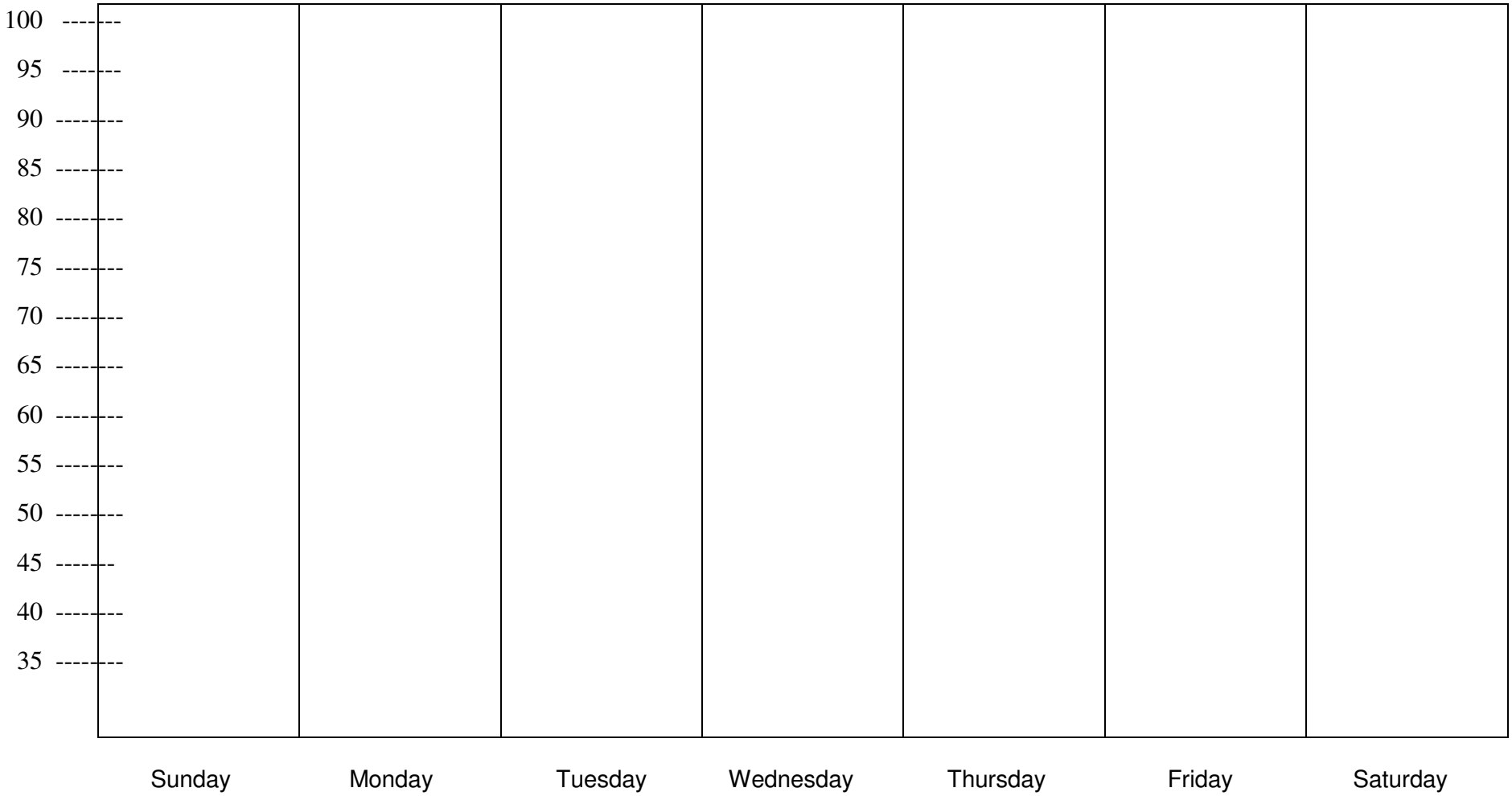
Weather Chart

Day Date	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
 Temperature	○	○	○	○	○	○	○
 Clouds	○	○	○	○	○	○	○
 Wind	|	|	|	|	|	|	|
  Other	□	□	□	□	□	□	□

Orange County Public Schools June 2009

Meteorologist Activity Sheet

Name: _____ Activity Sheet 2



WEATHER MEASURE

BIG IDEA 7: EARTH SYSTEMS AND PATTERNS

BENCHMARKS AND TASK ANALYSES

SC.2.E.7.2 Investigate by observing and measuring, that the Sun's energy directly and indirectly warms the water, land, and air.
The student:

- records temperatures of Sunny and shady areas outside (include water, land, and air temperatures in both Sunny and shady spots).
- compares the temperatures collected.

SC.2.P.8.5 Measure and compare temperatures taken every day at the same time.
The student:

- measures temperature accurately using a thermometer.
- maintains a log of temperatures taken in the same outdoor location, at the same time each day to compare results over an extended period of time.

SC.2.N.1.1 Raise questions about the natural world, investigate them in teams through free exploration and systematic observations, and generate appropriate explanations based on those explorations.
The student:

- raise questions about the natural world.
- investigates questions in teams through free exploration and systematic observations.
- generates appropriate explanations based on those explorations.

SC.2.N.1.2 Compare the observations made by different groups using the same tool.

KEY QUESTION

What makes the water, land, and air around us warm or cool?

TEACHER BACKGROUND INFORMATION

Weather describes what is going on in the air that surrounds our Earth. The Sun warms the Earth. The warm Earth heats the air above it. Shade from an object blocks the direct Sunlight from warming the Earth. The interaction between the heat of the Sun and air and water creates an energy source. This energy source puts air into motion and contributes to the weather (temperature, wind, moisture in the air). This drives the water cycle. The conditions of the atmosphere at a particular time and place are called weather. The weather is due to four atmospheric factors: winds, air pressure, heat energy, and moisture.

MATERIALS

Teacher
thermometer
marker
chart paper
timer

Per student
science notebook

Per group
2 thermometers
red crayon
Temperature Testing record sheet water
2 cups of sand
2 cups of water
paper towels

SAFTEY

Caution students that thermometers are fragile and can break.

TEACHING TIPS

- The temperatures of 3 different materials are taken during this lesson. You may want to introduce the activity and take the temperature reading of one material on the first day. On Day 2 revisit the concepts, take the other two readings, and discuss the data.
- Students need an understanding of how to read a thermometer before beginning this activity.
- Demonstrate how to properly hold a thermometer during the **ENGAGE** activity. Tell students to place only the bulb (bottom portion) of the thermometer into water and sand when measuring. They should hold onto the top so the thermometers do not fall into the water.
- Students should double-check each thermometer reading with a partner and be sure to record the temperature accurately. Explain that scientists make very careful observations and record their data accurately in order to draw the right conclusions.
- When outside, students may want to bring along a clipboard for recording.

ENGAGE

1. Ask: *How would you describe today's weather?*
   Is it hot, warm, cool or cold out today?
   What is air?
   What makes the air around us warm? cool? (Energy from the Sun warms the land and water on the Earth. The heat from the Earth warms the air around it.)
   What will happen to a thermometer when the temperature rises?
   Have students record responses in science notebooks.
2. Explain that temperature is the word we use to measure how hot or cold something is. Show the students a thermometer. Ask:
   What does a thermometer measure? (how much heat energy something has)
   Thermometers are tools that measure temperature in degrees Fahrenheit or degrees Celsius. Distribute thermometers to groups and demonstrate the proper handling of a thermometer. Talk about the numbers on the scale and point out the liquid in the bulb. Read the room's air temperature and record it on chart paper. Ask the students to make predictions as you ask: *What do you think will happen to the thermometer when an object is hot? Cold?* Write their predictions on the chart paper.

EXPLORE Part 1 (Air)

1. Have students predict the temperatures of the air outside in a Sunny spot and a shady spot.
2. Have students place a thermometer in the Sunny spot and the shady spot and set the timer for 5 minutes.
3. Record temperatures on Temperature Testing Chart.

EXPLORE Part 2(Sand)

1. Have students place one cup of sand in the sunny spot and one cup of sand in the shady spot used before.
2. Have students predict the temperatures of the sand in each area.
3. Have students place the thermometers in the cups of sand and set the timer for 5 minutes.
4. Record temperatures on Temperature Testing Chart.

EXPLORE Part 3 (Water)

1. Have students place one cup of water in the sunny spot and one cup of water in the shady spot used before.
2. Have students predict the temperature of the water in each area.

3. Have students place the thermometers in the cups of water and set timer for 5 minutes
4. Record the temperatures on the Temperature Testing Chart.

EXPLAIN

1. Discuss student observations:
   What do you think causes the difference in temperatures?
   Encourage each group to share their observations with the whole class.
   Explain why there is such a difference in the two temperature readings.
   How would the results be different if we came outside on a cooler day? Overcast day?
   Would the two temperatures be different?
2. Lead students to compare the temperatures in the shady spots for air, sand and water. Then compare all the temperatures taken in the Sunny spots.
3. Continue questioning to develop the concepts. The Sun warms the Earth; the warm Earth heats the air above it.
4. Students should record their conclusions in their science notebooks.

EXTEND AND APPLY

1. Encourage students to watch a weather forecast on TV and discuss the information with their parents. Have students draw a picture that illustrates the forecast.
2. Ask students to clip a weather forecast from the newspaper and share it with a family member or with the class. Discuss what information that forecast provides.
3. Have students record in their notebooks how weather and temperature affect decisions we make.
4. Make a weather book related to how the Sun warms the water, land, and air.

ASSESSMENT

Teacher assessment through observation should include the following criteria:

- Tasks have been completed by the student.
- Student demonstrates the ability to read and a thermometer and record the temperature to the nearest degree.

TEMPERATURE TESTING

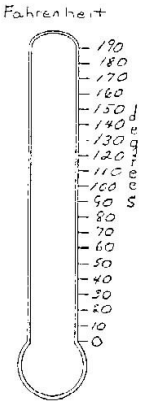
Air in Sun

Prediction:

_____degrees F

Actual:

_____degrees F



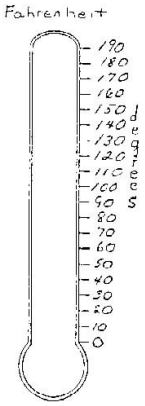
Air in Shade

Prediction:

_____degrees F

Actual:

_____degrees F



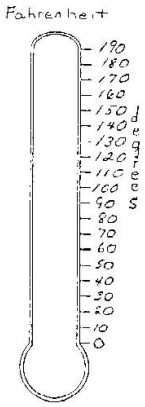
Sand in Sun

Prediction:

_____degrees F

Actual:

_____degrees F



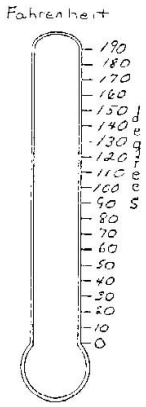
Sand in Shade

Prediction:

_____degrees F

Actual:

_____degrees F



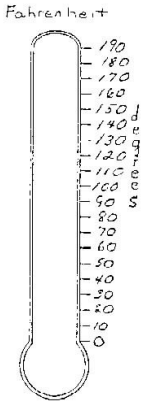
Water in Sun

Prediction:

_____degrees F

Actual:

_____degrees



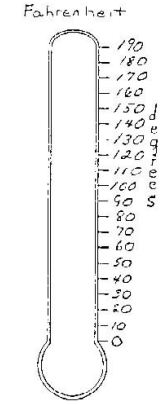
Water in Shade

Prediction:

_____degrees F

Actual:

_____degrees



WHERE DOES WATER GO?

BIG IDEA 7: EARTH SYSTEMS AND PATTERNS

BENCHMARKS AND TASK ANALYSES

SC.2.E.7.3 Investigate, observe and describe how water left in an open container disappears (evaporates), but water in a closed container does not disappear (evaporate).
SC.2.P.8.4 Observe and describe water in its solid, liquid, and gaseous states.
SC.2.N.1.1 Raise questions about the natural world, investigate them in teams through free exploration and systematic observations, and generate appropriate explanations based on those explorations.
The student:

- raises questions about the natural world.
- investigates questions in teams through free exploration and systematic observations.
- generates appropriate explanations based on those explorations.

SC.2.N.1.3 Ask "how do you know?" in appropriate situations and attempt reasonable answers when asked the same question by others.

- asks "how do you know?" in appropriate situations.
- attempts reasonable answers when asked the same question by others.

KEY QUESTION

What happens to water left in an open container?

TEACHER BACKGROUND INFORMATION

Two thirds of our planet is covered with water. Much of the water is found in lakes, rivers, and oceans. Water exists on our Earth in three forms: solid, liquid, and gas. The water in lakes, rivers, and oceans is in liquid form. However, every day some of this liquid turns to gas. As the Sun shines, some of the water evaporates. Evaporation means turning from water to water vapor.

What happens to the water vapor in the air? Some of it mixes with the air near the ground. Some of it rises into the sky where the air is cooler. In this cooler area, the water vapor turns back into little droplets of water. This is called condensation. The droplets of water form clouds. As the water droplets get larger and heavy they fall from the clouds as rain. Or if it is cold enough, snow. This is called precipitation. Rain and snow are the most common forms of precipitation.

Evaporation is happening around us all the time. Water evaporates from the ocean, rivers, lakes, and puddles. Water evaporates from the bathtub after we bathe and from our skin as we sweat. Evaporation takes place when a liquid changes into a gas. When water is heated by the Sun or other source, some of the water molecules vibrate fast enough to go into the air. The warmer the temperature, the faster the liquid will evaporate. Wind and surface area also speed up the process of evaporation.

MATERIALS

Teacher

chalk
2 containers, of the same size, one with a lid
water
measuring cup
data chart
rulers

Per student

Q-tip
piece of dark colored construction paper
cup of water
science notebooks

marker or grease pencil

SAFTEY

Always follow OCPS science safety guidelines.

TEACHING TIPS

- This is a long-term lab. It would be best to set it up in an area where it can remain for a few weeks for observation.
- Have paper towels available for possible spills.
- Do not do this lab on a rainy day.

ENGAGE

1. Pour one cup of water out on a sidewalk in a sunny area and trace around the puddle with chalk. Revisit the puddle in 20-40 minutes and see how the puddle has changed? Ask: *What happened to the water we poured out earlier?*
2. Have students write their names on a piece of dark construction paper with a Q-tip and water. Place the papers in a sunny area. Revisit the papers in 20-40 minutes and observe the change.

EXPLORE

1. Decide on an amount of water to add to each container and measure out the exact amount for each container.
2. Mark the side of the container with a marker or grease pencil to show the starting water level. You can also tape a ruler to side of each container and mark the ruler with the starting level.
3. Place a tight fitting lid on one of the containers, leave the other uncovered.
4. Have students record in their science notebooks the date and the starting level of water.
5. Place both containers in the same location where they will not be disturbed.
6. Observe the water levels daily for an extended period of time until all of the water has evaporated. Have students record the water levels in their notebooks.

EXPLAIN

1. Ask students:
   What happened to the water in the open container?
   Where did the water go? (the water becomes water vapor in the air)
   How do you know?
2. Have students explain in their notebooks what happened to the water.

EXTEND AND APPLY

1. Repeat the procedures in the Explore section in different areas of the classroom.
2. Repeat the procedures in the Explore section with different liquids (soapy water, salty water, juice, etc.

ASSESSMENT

Scoring Rubric (from activity sheets 1 & 2 and written response)

3 points	Detailed data about water level changes have been collected and the observations are presented clearly in the chart. Explanations demonstrate an understanding of water evaporation.
2 points	Some data about water level changes may have been collected, but not presented clearly in their notebooks. Conclusions drawn may not follow from the data and the explanations may reveal some significant misconceptions.
1 point	Some data about water level changes have been collected and the observations are clearly presented in the explanation. Conclusions drawn are fairly basic and may reveal some misconceptions.

WHICH WAY DOES THE AIR BLOW?

BIG IDEAS 7: EARTH SYSTEMS AND PATTERNS

BENCHMARKS AND TASK ANYLASES

SC.2.E.7.4 Investigate that air is all around us and that moving air is wind.
SC.2.N.1.1 Raise questions about the natural world, investigate them in teams through free exploration and systematic observations, and generate appropriate explanations based on those explorations.
The student:

- raises questions about the natural world.
- investigates questions in teams through free exploration and systematic observations.
- generates appropriate explanations based on those explorations.

KEY QUESTION

What is wind?

TEACHER BACKGROUND INFORMATION

Wind is moving air. It can go in many directions and it can be measured. Meteorologists use anemometers to measure the speed of wind and weather vanes to observe the direction the wind is coming from. Wind cannot be seen, but the effect of wind can be seen.

MATERIALS

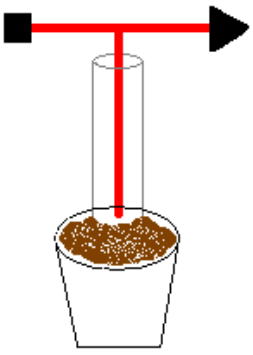
Teacher	Per student
transparency of the data sheet	scissors
chart paper	data sheet
dirt/sand	big mouth straw (like the one at Panera or McDonalds)
stapler	2 coffee stirrers
bubbles	construction paper or card stock
	plastic cups (1 per student, 10 to 16 oz.)
	science notebook

SAFETY

- Show students how to handle scissors and staplers correctly.
- Do not run with scissors in your hand.
- Do not put straws in your mouth.

TEACHING TIPS

- Display a picture of a weather vane.
- Make one weather vane ahead of time for students to see. Only the big mouth straw should be inserted into the dirt/sand.
- Create a KWL Chart ahead of time, (What we already know, What we want to know, What we have learned).
- This activity works best on mildly windy days.



ENGAGE

1. Complete the K and W portions of the KWL chart with the children.
   Record student responses to the questions, *what do you know about wind?* and *what do you want to know about wind?*

2. Ask students:
   How can you tell what direction the wind is blowing?
   What makes clouds move?
   What makes trees sway?
   Does the wind always blow in the same direction?
3. Take students outside. As the teacher blows bubbles, tell the students to observe the bubbles.
   Ask students:
   What is happening to the bubbles?
   What causes the bubbles to move?
   Can the direction of the bubbles movement be changed? Predict the direction they will move.

EXPLORE

Give each student a piece of construction paper and instruct them to:

1. Cut out a square and triangle. Shapes need to be proportional to the size of the stirrers.
2. Staple the square and triangle to the opposite ends so it looks like an arrow.
3. Staple the arrow to the first stirrer.
4. Take the second stirrer and staple it to the middle of the arrow so it looks like a "T" (weather vane).
5. Place the "T" inside the big mouth straw. Based on the type of straws you used, you may need to cut an inch off the big mouth straw. The "T" would then stick up an inch so it turns when the wind blows.
6. Place the big mouth straw in the middle of the plastic cup and pack the sand or dirt into the cup to hold it in place.
7. Insert the "T" into the big mouth straw.
8. Then have the students take their weather vanes outside and set it on the ground to see which direction the wind is blowing.
9. Document their observations several times that same day to see if the wind direction changed.

EXPLAIN

1. Ask students:
   What observations did you make about the weather vane while outside?
   What caused the change?
2. Revisit the KWL chart and determine whether the questions in the What do we want to know section were answered. If not, discuss.

EXTEND AND APPLY

1. Compare a homemade weather vane to a commercial one.
2. Observe your weather vane in the classroom and compare your observations to those from outside.
3. Test other moving air sources (e.g., blowing, a fan, a hair dryer) in the classroom and compare your observations to those from outside.

ASSESSMENT

Have the students complete the L of the KWL chart in their science notebooks. Discuss what the students wrote in their notebooks and add to the class KWL chart.

Scoring Rubric (from activity sheets 1 & 2 and written response)

3 points	Accurately identifies wind as moving air, thoroughly explains why a weather vane is used and how it operates.
2 points	Identifies wind as moving air, explains why a weather vane is used and how it operates with some details.
1 point	Uses limited information to identify wind as moving air, does not accurately explain why a weather vane is used and how it operates.

PREPARING FOR SEVERE WEATHER

BIG IDEAS 7: EARTH SYSTEMS AND PATTERNS

BENCHMARKS AND TASK ANYLASES

SC.2.E.7.5 State the importance of preparing for severe weather, lightening, and other weather related events.
The student:

- identifies types of severe weather (e.g., thunderstorms, lightening, hurricanes, tornadoes).
- explains the danger of severe weather.
- understands how to prepare for severe weather situations.
- practices safety measures for severe weather.

SC.2.N.1.3 Ask "how do you know?" in appropriate situations and attempt reasonable answers when asked the same question by others.

KEY QUESTION

What should you do to prepare for severe weather?

TEACHER BACKGROUND INFORMATION

There are many forms of severe weather including thunderstorms, lightening, hurricanes, and tornadoes. In severe weather conditions, there are inherent dangers which require you to take precautions to remain safe. Families should create severe weather preparedness plans and discuss and practice them.

MATERIALS

Teacher	Per student
chart paper	science notebook
	drawing paper
	crayons
	envelope

SAFETY

Always follow OCPS science safety guidelines.

TEACHING TIPS

Prepare tree map on chart paper prior to beginning lesson.

ENGAGE

1. Ask students what types of severe weather they are familiar with and record their responses on a tree map.
2. Discuss characteristics of each type and record responses on the tree map.

EXPLORE

1. Assign each group a type of severe weather. Have groups create a list of safety precautions they should take during their assigned weather.
2. Have groups share their list with the class. Identify common precautions and discuss why there are similarities and differences between the lists.
3. Ask: *What does it mean to evacuate? Under what circumstances would your family be asked to evacuate? What would your family need to take in an evacuation?*

4. Have each student write a list in their science notebook of items his/her family would need to create a severe weather supply kit. Ask: *How do you know your family would need those items?*

EXPLAIN

1. Ask: *How many items do you have in your severe weather supply kit? Are they all necessities? Which items could your family do without?*
2. Have students prioritized their severe weather supply kit items.
3. Students create picture cards representing the items their family would need in a severe weather supply kit. Give students an envelope to hold the picture cards.

EXTEND AND APPLY

1. Students discuss their severe weather safety precautions and supply kit items with their families.

ASSESSMENT

Scoring Rubric

3 points	Severe weather supply kit includes cards representing all prioritized items.
2 points	Severe weather supply kit includes cards representing some of the prioritized items.
1 point	Severe weather supply kit includes cards representing a few prioritized items.