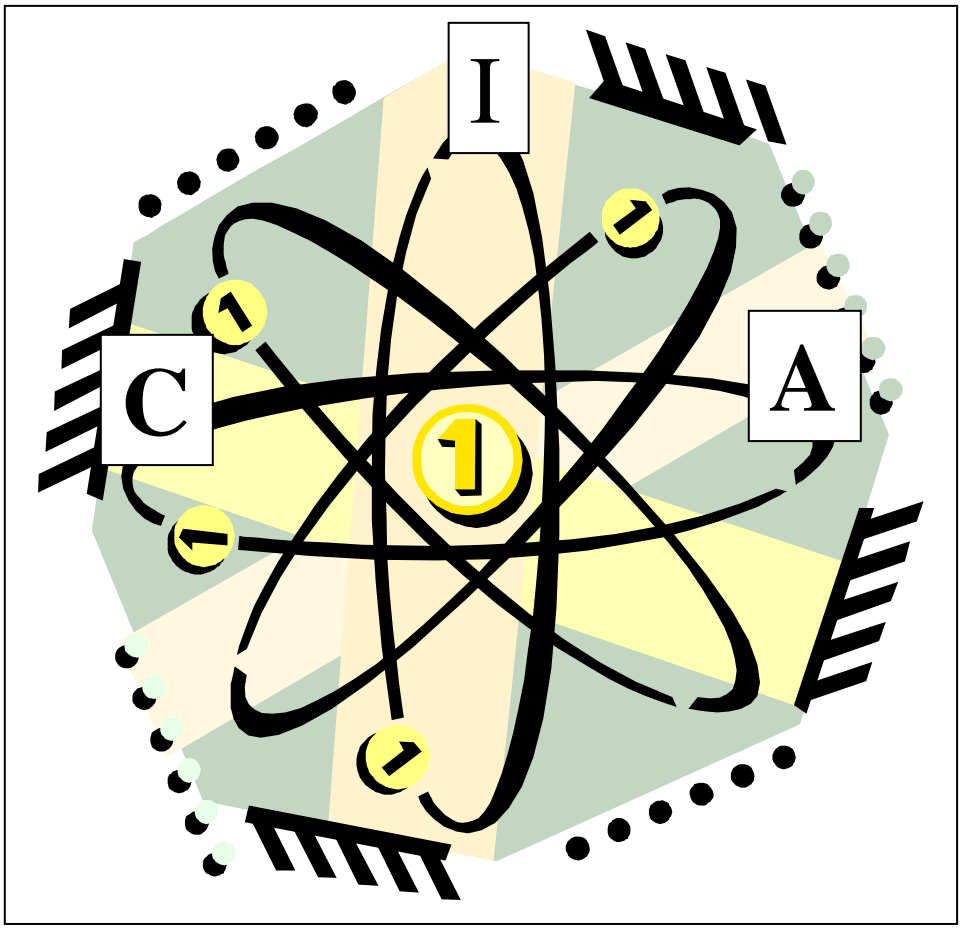
Curriculum, Instruction, Assessment (CIA) Alignment

Science, Grade 2
Unit 1: Weather

Task Analysis and Hands-on Investigations



Ronald Blocker, Superintendent
Orange County Public Schools
Orlando, Florida

2003-2004

Subject Area: Science
Strand D: Processes that Shape the Earth
Grade: 2

Bloom's Taxonomy

Level 1	**Level 2**
Knowledge	Application
Comprehension	Analysis
Application	Synthesis
	Evaluation

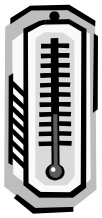
Benchmarks

SC.B.2.1.1: The student recognizes systems of matter and energy.

SC.D.1.1.3: The student recognizes patterns in weather.

TASK ANALYSIS **The student…**
WEATHER
• measures the effects of energy from the sun upon air, land, and water by using a thermometer.
• graphs temperature and precipitation during the year to observe patterns that tend to be high, medium, or low in certain months.
• measures the effects of energy from the sun resulting in water disappearing (evaporating) into the atmosphere.

WEATHER MEASURE



BENCHMARKS AND TASKS

SC.B.2.1.1 The student recognizes systems of matter and energy.
SC.D.1.1.3 The student recognizes patterns in weather.

- The student graphs temperature and precipitation during the year to observe patterns that tend to be high, medium or low in certain months.
- The student measures the effects of energy from the sun upon air, land, and water by using a thermometer.

KEY QUESTION

What makes the air around us warm or cool?

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. The interaction between the sun's heat, 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
outdoor thermometer
hot plate
sauce pan
water
marker
chart paper
Our Sun (Benchmark Education Co.)

Per group
2 thermometers
red crayon
Temperature Testing record sheet
bowl of ice water
bowl of hot water
paper towels

TEACHING TIPS

1. If teacher has access to a microwave oven, this may be used in place of the hot plate and saucepan to heat water. You may also choose to bring hot water in a thermos. Be certain water is not too hot.
2. Caution students that thermometers are fragile and can break.
3. During the **ENGAGE** activity, tell students to place only the bulb (bottom portion) of the thermometer into the hot and cold water when measuring. They should hold onto the top so the thermometers do not fall into the water.
4. 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.
5. When outside, students may want to bring along a clipboard for recording.

ENGAGE

1. Form student groups. Ask:
   How would you describe today's weather?
   Is it hot, warm, cool or cold out today?
   What do we mean by "It" is hot?
   What is hot? (the air)
   What makes the air around us warm? cool? (Energy from the sun warms the land and water on our earth. The warm earth warms the air around it.)
   What will happen to a thermometer when the temperature rises?
   If science journals are used, questions can be answered there.
2. **Temperature** is the word we use to describe 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. 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?
3. Write their predictions on the chart paper.

EXPLORE Part 1

1. Have a student be responsible for distributing materials to each group. That student should get the *Temperature Testing* sheet, bowl of ice water, one empty bowl, a red crayon, and paper towels for the group.
2. Have students complete the top portion of the sheet by predicting the temperature of the water in each bowl.
3. While they are making their predictions, go to each table and pour hot water into the empty bowl.
4. Before checking the temperature, have students read both thermometers to see if they are showing about the same temperature.
5. Have students place one thermometer in the hot water bowl and one in the cold-water bowl. After a short interval, have students record the actual temperature of the water in each bowl. Tell students to use a red crayon to color each thermometer on the record sheet to match the real ones placed in hot/cold water.

EXPLAIN

Discuss the results with students. (There will be variations in the reading of the thermometers. Discuss reasons for these variations with the students. Reasons might include when the thermometers were read, how much they were handled, and how accurately they were read.) At this time, students can record their observations in their science journals. (optional)

EXPLORE Part 2

1. After comparing the predictions with the results of hot and cold temperatures, ask students to predict the temperatures in an outdoor, hot and sunny spot and in an outdoor, shady spot.
2. Have students write their predictions on the record sheet and go outside with thermometers, *Temperature Testing* sheets, and red crayons.

3. As a class, find a hot, sunny spot. Have each group read their thermometer, record the temperature, and then use the red crayon to color the thermometer to match the actual reading.
4. As a group, find a cool, shady place. Repeat the process used in the hot, sunny place.

EXPLAIN

1. Discuss student observations:
   What do you think causes the difference in temperatures?
   (Direct sunlight on the earth's surface warms the surface. The warm surface warms the air. Shade from an object blocks the direct sunlight from warming the earth.)
2. 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 much different?
3. Continue questioning to develop the concepts. The sun warms the earth; the warm earth heats the air above it.
4. If science journals are used, students may record some of these responses there.
5. Share *Our Sun.*

EXTEND/APPLY

Discuss:
What are some ways to find out about the weather?
Why is it important to know the temperature?
Why is it good to know the weather in advance?
What information do we get from a weather forecast?

EXTENSIONS

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. Explore weather lore:
   There's a pot of gold at the end of the rainbow.
   March comes in like a lion and goes out like a lamb.
   April showers bring May flowers.
   If the groundhog sees its shadow, there will be six more weeks of winter. If it doesn't see its shadow, spring is just around the corner.
4. Have students record in their journals how weather and temperature affect decisions we make.

ASSESSMENT

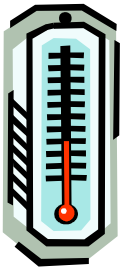
Teacher assessment through observation should include the following criteria:

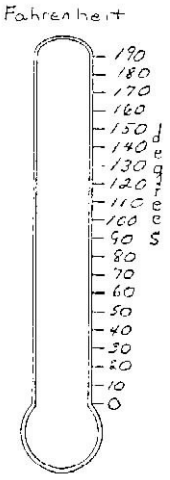
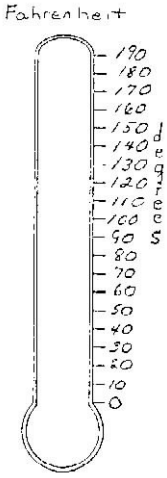
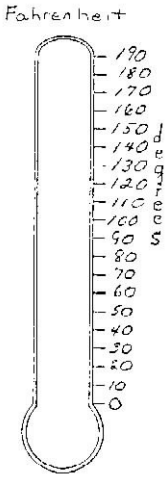
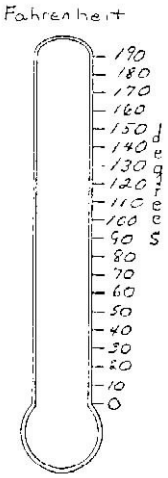
- Tasks have been completed by the student.
- Student demonstrates the ability to read a thermometer to the nearest number.
- Descriptions found in the *Temperature Testing* and student journal entries show growth and understanding.
- When looking in the journals, compare earlier and later entries for what they can tell you about the student's growth and understandings.

Student Scientists_____

_____

TEMPERATURE TESTING



BOWL OF HOT WATER	BOWL OF COLD WATER
Prediction: _____degrees F Actual: _____degrees F 	Prediction: _____degrees F Actual: _____degrees F 
SUNNY SPOT	**SHADY SPOT**
Prediction: _____degrees F Actual: _____degrees F 	Prediction: _____degrees F Actual: _____degrees F 

BE A METEOROLOGIST!

BENCHMARKS AND TASKS

SC.B.2.1.1 The student recognizes systems of matter and energy.
SC.D.1.1.3 The student recognizes patterns in weather.

- The student graphs temperature and precipitation during the year to observe patterns that tend to be high, medium, or low in certain months.
- The student measures the effects of energy from the sun upon air, land, and water by using a thermometer.

KEY QUESTION

Does weather occur in patterns?

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
Think About the Weather (Newbridge)
Benchmark Education Co. books:
Changing Weather
Clouds
The Big Snow

Per student

1 Fahrenheit thermometer
worksheets 1-3
crayons
copies of Sunday's weather map (optional)
construction paper strips (orange, yellow, green, blue)
1 index card
scissors
glue

TEACHING TIPS

1. Make two wall charts: one to look like the "Weather Symbols" worksheet, and the other to look like the "Weather Chart" worksheet.
2. 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.
3. Cut out the weather page from Sunday's paper (prior to the starting of the activity on Monday) and make a transparency or make copies for each student.
4. Identify a specific time for daily observation of weather conditions.
5. Allow ample time for introducing weather symbols and coding prior to the first observation session.

6. Students' 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.

ENGAGE

Ask students if they have ever watched the daily weather report on television. Have several students describe the report.
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.
Ask the students to tell what the map tells us about Sunday's weather (temperatures, cloud cover, precipitation, etc.).
Tell the students that they will be meteorologists for the next few days and at other times during the year.

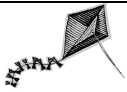
EXPLORE

1. Tell the students that they will use special symbols to record weather conditions. Indicate these symbols on the Weather Symbols wall chart and on the Weather Chart.
2. Distribute worksheet 1 and crayons to each student. Point out that this is a copy of the large weather symbols chart. Instruct the students to color the circles in the temperature ranges with the appropriate colors. Color in the code on the large weather symbols wall chart. Discuss the four weather components on the worksheet and be sure students understand each symbol.
3. Distribute worksheet 2. Point out that this is a copy of the large Weather Chart. Tell the students to write Sunday's date on their worksheet weather chart. Write the date on the wall chart.
4. 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.
5. 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.
6. 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.
7. 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.
8. When the students are aware of how to classify and code weather conditions, tell them to use their weather symbols chart (worksheet 1) to help them describe today's weather.
9. Distribute an index card and a thermometer to each student. The students should also bring worksheet 1 and a pencil. Proceed outdoors. Allow them to observe the weather conditions and jot down their observations on the index cards. (Observations can be recorded on a class chart if the students have limited language or writing skills.)
10. After returning to the classroom, instruct the students to use weather symbols to code Monday's weather conditions on worksheet 2. 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 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? (Wind and dark clouds seem to go with rain; sunshine usually means warmer temperatures.)
3. Distribute worksheet #3 "Meteorologist Worksheet" 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. (The more weather data recorded on the Weather Chart, the more patterns will emerge.)
   Ask:
   How does the sky look when the temperature rises? (clear and hazy)
   Was the wind stronger or lighter when the temperature was lower? (usually stronger)
   How do you think people on television use weather patterns to predict the weather?
   (Changing temperatures may mean storms; high wind may mean thunderstorms, etc.)

Weather Chart:

Day Date	Sun. 8	Mon. 9	Tues. 10	Wed. 11	Thurs. 12	Fri. 13	Sat. 14
 Temperature	73ºF	74ºF	75ºF	75ºF	77ºF	80ºF	81ºF
 Clouds	●	○	●	○	○	○	○
 Wind							
Other							

EXTEND/APPLY

1. Have students describe in written response how their graphs clearly show weather patterns, trends, and generalizations.
2. Choose and share from the suggested books listed in the Materials for Teachers.

EXTENSIONS

1. Have students make graphs of wind, clouds, and other chart data.
2. Have a team of students measure and record outdoor temperatures at recess time for several months. Have them graph the data to identify possible trends.

ASSESSMENT

Have students write in their journal 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 worksheets 2 & 3 and written response)

Low Response:
Some data about weather changes may have been collected, but not presented clearly in their journal. Conclusions drawn, if any, may not follow from the data, and the report may reveal some significant misconceptions.

Medium Response:
Some data about weather changes have been collected, and the observations are clearly presented in the report. Conclusions drawn are fairly basic and may reveal some misconceptions.

High Response:
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.

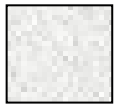
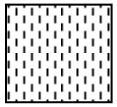
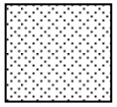
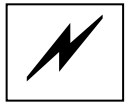
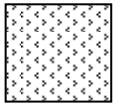
Name_____ Worksheet 1

Weather Symbols

TEMPERATURE F°		
HOT	orange	85ºF - 100ºF
WARM	yellow	75º F - 84ºF
COOL	green	33ºF - 74ºF
FREEZING	blue	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 the sky covered
MOSTLY CLOUDY		More than half of the sky covered
OVERCAST		No blue sky can be seen

OTHER			
FOG		**SMOG**	
RAIN		**FROST**	
THUNDER-STORM		**SNOW**	

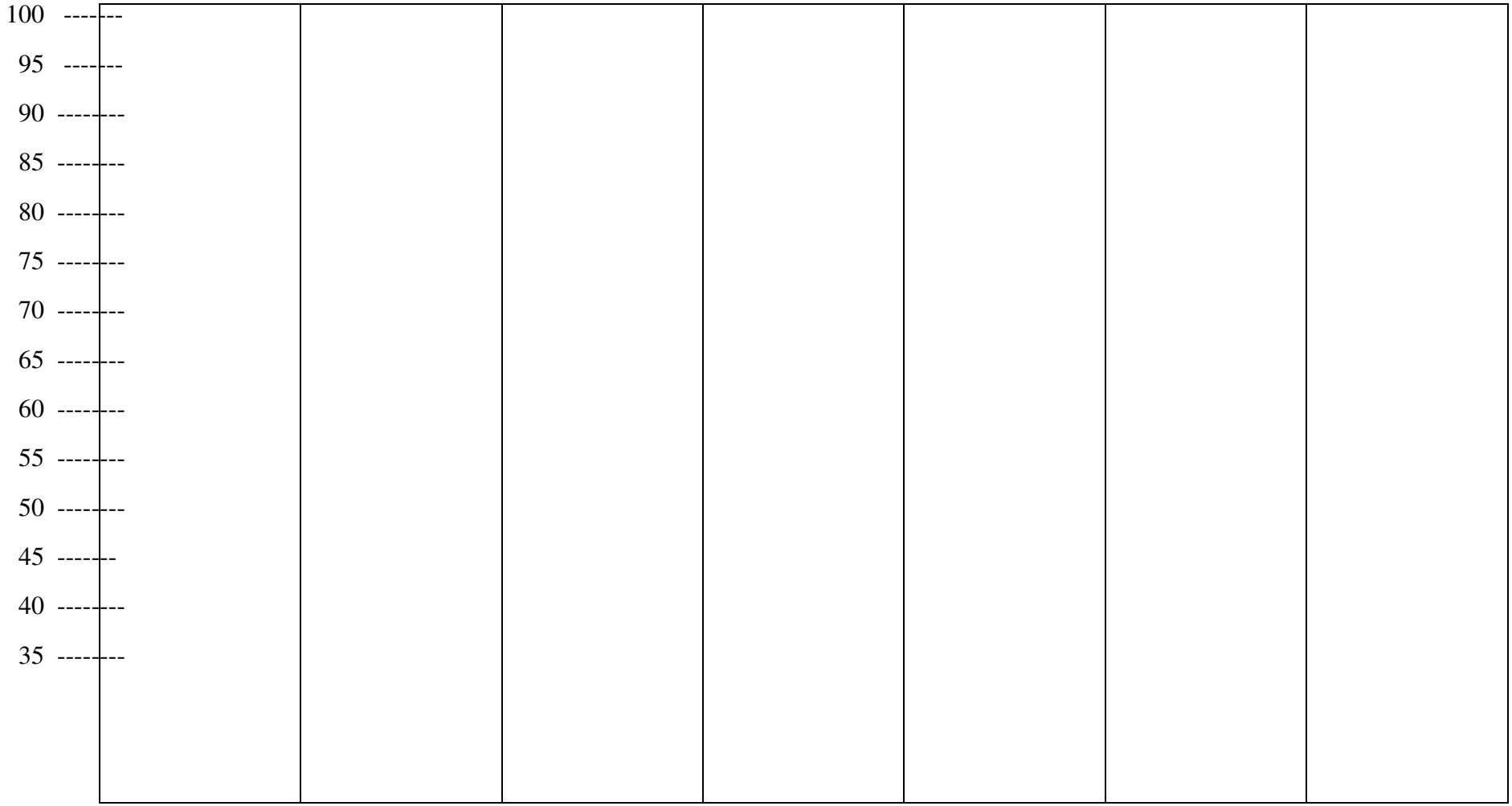
Name_____ Worksheet 2

Weather Chart

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

Meteorologist Worksheet

Name: _____ Worksheet #3



WHERE DID IT GO?

BENCHMARKS AND TASKS

SC.B.2.1.1 The student recognizes systems of matter and energy.
SC.D.1.1.3 The student recognizes patterns in weather.

- The student measures the effects of energy from the sun upon air, land, and water by using a thermometer.
- The student measures the effects of energy from the sun resulting in water disappearing (evaporating) into the atmosphere.

KEY QUESTION

What happens to the mass of a wet paper towel when it is left out for a long period of time?

BACKGROUND INFORMATION

Evaporation is happening around us all of the time. Water evaporates from lakes, rivers, puddles, and the ocean. It evaporates from the bathtub after we bathe and from our skin when we sweat. Evaporation takes place when a liquid that's below its boiling point changes into a gas. When a liquid, like water, is warmed by the sun, or other heat source, some of the water molecules at the water's surface vibrate fast enough to escape into the surrounding air. These molecules form a vapor. The warmer the temperature, the faster the liquid will evaporate.

Wind also speeds up the evaporation process. Evaporation slows down and may stop when the air can no longer absorb molecules from the liquid. So on a very humid day a puddle will evaporate more slowly than on a less humid or dry day.

Evaporation is the process by which a liquid changes into a gas. When water evaporates, it changes to an invisible, odorless gas called water vapor. Changes in states of matter require a transfer of energy. Energy from the sun can cause this **evaporation**, as well as other heat sources (e.g., a light, a person's hand).

MATERIALS

Teacher
clock

Per student
science journal

Per group
balance
mass set
graduated cylinder
paper towel
water
Where Did it Go? worksheet

TEACHING TIPS

1. This activity may take an entire day for the water to evaporate.
2. You may want to assign different students certain times to check the mass of the paper towel rather than disrupting the entire class.
3. If your balances have deep pans, you may want to put a paper plate on each pan (their masses will cancel out each other) in order to elevate the wet paper towel. This will allow more surface area to be exposed and increase the evaporation rate.

4. The paper towel should not be dampened to the dripping stage. All groups should use the same amount of water.

ENGAGE

1. Place a small bowl of water at each table (enough to dip paintbrushes in several times). Give each student a paintbrush and a piece of drawing paper. Ask students to paint their names with their wet paintbrush and set aside.
2. While waiting for "paintings" to dry, have students wash their hands at the sink, but tell them **not** to dry them. Tell them to time how long it takes for their hands to dry. Ask them what things caused their hands to dry more rapidly…more slowly.
3. Wipe a damp cloth across the chalkboard. Draw a circle around the area. Have students observe what happens and discuss where the moisture may be going. Discuss that evaporation is taking place.
4. Have students check their "paintings".
   Ask:
   Can you still see your name? Why not?
   What has happened to the moisture?
   Allow for discussion as students describe what has happened to the moisture.
5. Explain to students that they have just witnessed the **results** of evaporation, and that in this lesson we will explore the different rates of evaporation.

EXPLORE

1. Put students in groups. Have one student from each group be responsible for distributing the materials for his/her group.
2. Go over directions for setting up the experiment. Determine as a class how much water to use to dampen the paper towel without bringing it to the dripping stage (about 10 ml). Determine as a class, the time interval that will be used between measurements. (You might want to start out with 30 minute intervals, and adjust if necessary.)
3. Have students predict what will happen to the mass of a wet paper towel if left on the balance over a period of time. Allow time for discussion about what variables might affect the evaporation. **Predictions can be written in science journals. (optional)
4. First, have students level the balances. Place a paper plate on each pan. Then place a paper towel on one side of the balance. Add enough grams to the other side to create a balance. Record the mass of the dry paper towel.
5. Have students use the graduated cylinder to measure the predetermined amount of water. Then SLOWLY pour the water onto the paper towel. Add enough grams to again create a balance.
6. Have students record the starting time and the mass on the *Where Did it Go?* worksheet. (Note: There will be no "Difference in Mass" data collected for the first measurement.)
7. After the determined time interval, have students check the balances. (Balance should be lower on the mass side as paper towel begins to dry.) Have students remove a gram, one at a time until the balance is equalized. Record the new data on the *Where Did it Go?* worksheet.
8. Continue this procedure until the paper towel is dry.

EXPLAIN

Discuss students' observations.
Ask:
What happens to the mass of a paper towel when you wet it? (It becomes heavier)
How do you know this?
How many milliliters of water did you use to dampen the paper towel?
What was the starting mass of the wet paper towel?
What was the ending mass?
What was the difference in the two measurements?
What caused the difference?

EXTEND/APPLY

Ask:
What variables do you think affected the rate of drying?
Where did the water go?
What is this process called? (**evaporation**)
These questions and answers may be recorded in student science journals.

EXTENSIONS

1. Ask students to think of other ideas they might try.
   Ask:
   What would happen if we placed some of the balances outside on a windy day?
   What if we placed some of the balances inside and some outside on a sunny day?
   What if some of the paper towels were folded and some were opened?
2. If students want to test different variables (e.g., outside; near a window; cloudy day; sunny day) have them share their strategies with the entire class so that all but their specific variable is held constant.
3. Discuss the process of **evaporation** in the **water cycle**. Be sure to mention the role of the sun's energy in the form of heat.

ASSESSMENT

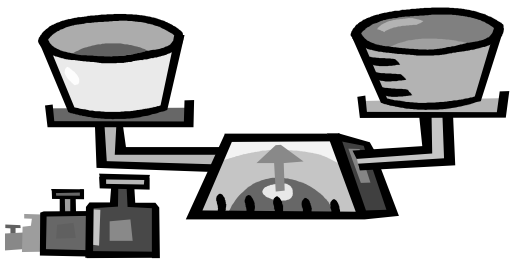
Teacher assessment through observation should include the following criteria:

- Tasks have been completed by the student.
- Student demonstrates ability to: calibrate a balance, read a balance to the nearest number and move grams on and off of balance to show a measurement of balanced weight.
- Student's journal entries should show growth and understanding.
- Student's answers to questions should show evidence of conceptual knowledge.
- Acquired vocabulary should appropriately demonstrate understanding.
- Student's questions should be probing, on task, or reflect the processing of an essential understanding.

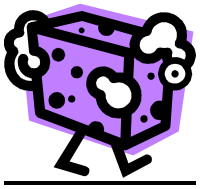
Where Did it Go?

Name _____

Time	Mass (g)	Difference in Mass (g)



THE MYSTERIOUS DISAPPEARANCE



BENCHMARKS AND TASKS

SC.B.2.1.1 The student recognizes systems of matter and energy.
SC.D.1.1.3 The student recognizes patterns in weather.

- The student measures the effects of energy from the sun upon air, land, and water by using a thermometer.
- The student measures the effects of energy from the sun resulting in water disappearing (evaporating) into the atmosphere.

KEY QUESTION

Where does water go?

BACKGROUND INFORMATION

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.

Mass is a measure of the amount of matter in an object. Weight measures the pull of gravity on an object and changes when the gravitational pull changes. For example, your weight measurement on earth would not be the same measurement if you went to the moon. Your amount of matter remains the same so your mass would be the same.

MATERIALS

Per group

3 identical plastic plates
3 different colored sponges of the same size
water
balance
metric weights
graduated cylinder
The Puddle by David McPhail

Per student

Disappearing Water activity sheet
pencil

TEACHING TIPS

1. Do not do this activity on a rainy day.

2. 4" x 6" sponges cut in half work very well. 30 mL of water is an appropriate amount for each sponge.

ENGAGE

Read *The Puddle* and ask the students to tell why the puddle disappeared. They should use the term *evaporation*.

Tell the students they will be discovering what factors speed up or slow down evaporation.

EXPLORE

1. Give students a copy of the *Disappearing Water* activity sheet and the materials for each group.
2. Tell them to record the color of their three sponges on the chart. Then place one sponge and plate outside, one at the inside of a window, and one in a closet.
3. Take students outside to record the temperature and weather conditions on the *Disappearing Water* activity sheet.
4. Measure 30 mL of water and pour on one of the sponges. Repeat for the two other sponges.
5. Measure the mass of each of the wet sponges and plates and record on the activity sheet.
6. Tell the students to place the sponges and plates in the locations according to the colors they have written.
7. Check the plates after 24 hours.
8. Have students find the mass of the sponges and plates, find the difference between the beginning measurement and after 24 hours, and record on their sheet.

EXPLAIN

Ask:

Where did the water go?
From which sponge did the greatest amount of water evaporate?
Why do you think that happened?
From which sponge did the least amount of water evaporate?
Why do you think that happened?
What were the weather conditions in all three of the locations?
How does weather affect evaporation?

EXTEND/APPLY

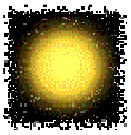
Tell students to picture themselves at a swimming pool or on the beach. They're diving in to enjoy the water for a while. After swimming, the students lie on a lounge chair and read a book. They notice after a short period of time that they are dry and their bathing suits are just a little damp.

Ask:

What happened to the water on your body and your bathing suit?
Where did the water go?

THE DISAPPEARING WATER

Weather observations
Temperature: _____

☐ Sunny 

☐ Partly cloudy 

☐ Windy 

Other observations: _____

_____

Data Collection Chart

Measurements	**Outside** Sponge color _____	**Near Window** Sponge Color _____	**Closet** Sponge color _____
Volume of water added			
Mass of wet sponge and plate			
Mass of sponge and plate after 24 hours			
Difference between beginning of experiment and after 24 hours			