

This segment (part 2 of 2) focuses on the unequal heating of the Earth's air, land, and water and the resulting weather/climate patterns.

Student Science Performance

6th Grade Earth Science

Title:

Topic: Weather and Climate

Sun and Water, How Do They Affect Earth?

Performance Expectation for GSE:

S6E3. Obtain, evaluate, and communicate information to recognize the significant role of water in Earth processes.

- c. Ask questions to identify and communicate, using graphs and maps, the composition, location, and subsurface topography of the world's oceans.
- d. Analyze and interpret data to create graphic representations of the causes and effects of waves, currents, and tides in Earth's systems.

S6E4. Obtain, evaluate, and communicate information about how the sun, land, and water affect climate and weather.

- a. Analyze and interpret data to compare and contrast the composition of Earth's atmospheric layers (including the ozone layer) and greenhouse gases.
(Clarification statement: Earth's atmospheric layers include the troposphere, stratosphere, mesosphere, and thermosphere.)
- b. Plan and carry out an investigation to demonstrate how energy from the sun transfers heat to air, land and water at different rates.
(Clarification statement: Heat transfer should include the processes of conduction, convection, and radiation.)
- c. Develop a model demonstrating the interaction between unequal heating and the rotation of the Earth that causes local and global wind systems.
- d. Construct an explanation of the relationship between air pressure, weather fronts, and air masses and meteorological events such as tornadoes and thunderstorms.
- e. Analyze and interpret weather data to explain the effects of moisture evaporating from the ocean on weather patterns and weather events such as hurricanes.

Performance Expectations for Instruction:

- Interpret data to compare and contrast the composition of the Earth's atmospheric layers, including the ozone and greenhouse gases.
- Engage, explore and explain the causes and effects of meteorological events which create weather and climate, specifically including tornadoes and thunderstorms.
- Construct an argument to support a claim of an impending weather event.
- Design a weather map to show how air pressure, weather fronts and air masses come together to cause meteorological events.

Materials:

Stove top popping corn and hot plate

Land Versus Water Lab: thermometers (2), clothespins/clips (2), beakers/cups (2), lamp with heat bulb and stand, sand/soil, water, stopwatch

Salinity and Deep Ocean Currents lab: 4 Baby food jars, 2 Laminated index cards, Table salt, 2 Colors of food coloring, Stir stick, Dish pan (for spills), Towels, Map of deep ocean currents, Map of sea surface temperature, Map of surface salinities

Students will continuously obtain, evaluate, and communicate information. This is not a linear process. Students will communicate through writing and discussions to allow for formative assessment. This benefits the teacher, student, and whole group to guide instruction to clarify misconceptions or extend content.

Engaging Learners

Phenomenon

Picture of a tornado

[Picture of a tornado](#) Use picture below if image will not load.

Teacher Notes: Use this picture as the start to this segment: Thunder and Lightning.



Obtaining/Evaluating/Communicating: Have students view the picture of the tornado and write down words, statements, and questions about the picture. After 3-5 minutes, take 3-5 more minutes to have students talk among their partners and see what words, statements and questions about the picture they have in common.

Teacher Notes: Give no clues or direction as the picture is displayed. This picture will provide a chance for students to develop questions about tornadoes and weather associated with them. As the students are discussing the picture, walk around the room and listen. Only interject into the conversations if students are totally off base and only by asking a guiding question to get the students back on track.

Once students have become engaged in the learning process on weather and climate, students will move into understanding atmosphere layers and be able to compare and contrast those levels. Students will need to understand the atmosphere and how and why weather occurs in the troposphere. Students will also gather information about the ozone layer and greenhouse gases during this unit of study. Hook them with the interest of a tornado and move into atmosphere and then onto tornadic activity in Georgia and hurricanes in Georgia.

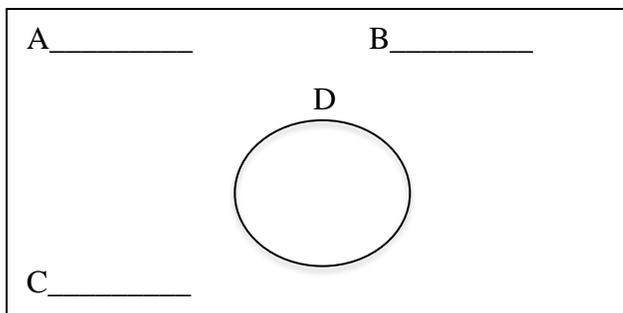
<p>Exploring</p>	<p>Obtain Students will explore and analyze the atmospheric layers of the earth using online and print resources. Potential sites: Peeling Back the Layers of the Atmosphere (NOAA) or Greenhouse Gases (Concord Consortium).</p> <p>Communicate/Evaluate Once the students understand the layers of the atmosphere and the causes and effects of the ozone and greenhouse effects, the students will present an illustration of the layers and be able to explain the makeup of the layers and the impact of the layers on each other. The students will communicate their understanding through table talks.</p>
<p>Explaining</p>	<p>Obtain Students will obtain information on weather fronts and vocabulary from the following presentation. Weather Prediction and Forecasting</p> <p>Communicate Students will complete the Weather Prediction and Forecasting handout while watching the presentation.</p> <p><i>Teacher Notes: Consider starting this part of the lesson by asking students about weather why weather forecasts can be wrong. Refer to the standard for necessary vocabulary. This presentation will provide additional information to all the elements of the standard plus a connection to the water cycle. The information presented in the video (search internet for weather prediction and forecasting) provides the necessary vocabulary for this unit. Encourage students to listen and jot down important words and ideas.</i></p> <p>Once students understand the atmosphere and fronts, the knowledge will be applied to the formation of tornadoes.</p> <p>Obtain Students will research the Tornado Alley of Georgia. Map of Georgia</p> <p><i>Teacher Notes: Give the students specific counties to research and have them plot where they were on individual Georgia maps. Then have students place their results on one large map of Georgia. This map can be cut and pasted on a computer program that makes a large poster for students to compile their individual information.</i></p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> • Why do tornadoes form? • Where do tornadoes form? • Do tornadoes follow the same path in the state of Georgia? • What evidence, or clues, will you provide for the students to make

	<p>sure the students understand the concept of the tornado alley in Georgia?</p> <p>Look for online articles to provide necessary information about the recent “discovery” of Georgia’s tornado alley.</p>
	<p>Communicate Students will present evidence on the tornado alley of Georgia. This evidence will be derived and communicated from the readings and research performed.</p> <p><i>Teacher Notes: Students will use the correct vocabulary to communicate their knowledge of the tornado alley in Georgia. Students will also communicate how air pressures change throughout the process.</i></p>
<p>Elaborating Applying Model to Solve a Problems</p>	<p>Phenomenon Show students pictures of hurricanes.</p> <p>Obtain Students will obtain information on hurricanes, specifically the hurricanes that have affected the state of Georgia. Students will state a claim about the cause of the hurricanes and why the impact of the hurricanes on the state of Georgia was so severe. A possible resource: Hurricanes and Wind</p> <p>Evaluate/Communicate Students will evaluate and communicate information about the hurricanes. Students will show understanding by communicating their knowledge of formation of hurricanes in the Atlantic Ocean and the Gulf of Mexico. Students will gather evidence about the claim to be able to communicate the reason for the claim they made. Students will communicate their findings on the interactions of wind and hurricanes. Students will present their findings to their group about how air pressure changes over water of different temperatures and the effects of currents.</p> <p><i>Teacher Notes: consider presenting students with a scenario of being a scientist that studies and predicts hurricanes. A potential source is Hurricane forecasting (NOAA).</i></p> <p>Researching “Hurricanes and Wind” will help gather information students will use in their reasoning to support the claim. This section will incorporate and link to the S6E3 (oceanography).</p> <p>Obtain: Students will also plan to carry out an investigation on conduction, convection, and radiation. The investigation should focus on how the sun transfers heat differently to air, land, and water. <i>One option for an experiment would be for students to design solar ovens to investigate heat transfer from the sun, including heat transfer to liquids and solids of</i></p>

	<p><i>different colors; resources can be found online. Students could also investigate urban “heat islands” by measuring temperature above various surfaces around the school grounds and the impact this has in different places. Solar beads and chenille stems are optional materials for these investigations.</i></p> <p>Communicate Students will carry out an investigation on conduction, convection and radiation. The investigation will use how to cook popcorn in three ways to show conduction, convection and radiation.</p> <p><i>Teacher Notes: Teacher will search “conduction, convection, and radiation using popcorn” to provide an activity sheet for this experiment. Stove top popping corn can be in stores or online and is a great way to show convection. Conduction can be shown with a regular pan with a lid that touches a hot plate and slides back and forth. Microwave popcorn uses radiation.</i></p> <p>Evaluation Discuss questions and conclusions from the investigations of heat transfer.</p>
<p>Evaluation</p>	<p>Phenomenon: What to Wear and Drink: Weather Patterns and Climatic Regions</p> <p><i>"The source of this material is the TeachEngineering digital library collection at www.TeachEngineering.org. All rights reserved."</i></p> <ul style="list-style-type: none"> ● How does our climate affect us? ● How do we decide what to wear each day? ● What factors determine if our clothing choices are comfortable? ● What is the source of our water? ● Students explore characteristics that define climatic regions. <p>Obtain: Students will obtain information about the current weather maps. This evaluation will allow students to put into practice knowledge gained during the other segments. This evaluation will include predicting the weather for the following week based on the maps presented by the teacher. Weather patterns, along with fronts and atmospheric conditions, will be determined and presented to class via interactive technology.</p> <p><i>Teacher Notes: Be sure that a discussion on how fronts affect weather as well and high and low pressures. Teacher should collect a variety of local weather maps. (preferably over a two-week period). Students will use the maps to “forecast” the next week’s weather. A variety of maps will be used and should include tornadic activity and hurricane activity.</i></p> <p>Evaluate/Communicate: Each group of students will evaluate the obtained information to create a local weather map. Through this evaluation students will show air pressure, fronts, and air masses on their map. Students will present weather map to the class and the class will evaluate based on the communication of correct</p>

	terminology. Students will understand unequal atmosphere heating patterns and how those patterns cause weather phenomena. The students will communicate their understanding of these events in their forecast.
Engage	Students will plan and carry out an experiment demonstrating how the energy from the sun transfers heat differently for air, land, and water. Example of Lab
Evaluate	Handouts from this lab will provide evaluation for understanding.
Engage & Explore	To engage students with ocean floor topography, post the question: What would it look like if we drained the oceans? Exploring Seafloor Topography is another potential source; others can be found online.
	Salinity and deep ocean currents and Sea level slopes and surface currents , These two lessons/labs will provide students will the opportunity to see how salinity affects not only surface but deep ocean currents.
SEP, CCC, DCI	Science Essentials
Science and Engineering Practices	<ul style="list-style-type: none"> ● Asking questions and defining problems ● Developing and using models ● Constructing explanations ● Analyzing and interpreting data ● Planning and carrying out investigations
Crosscutting Concepts	<ul style="list-style-type: none"> ● Patterns ● Cause and Effect ● Systems and System Models ● Stability and Change
Disciplinary Core Ideas	From A Framework for K-12 Science Education: <ul style="list-style-type: none"> ● ESS2.C: The Roles of Water in Earth’s Surface Processes ● ESS2.D: Weather and Climate ● ESS3.B: Natural Hazards

1. What are the parts of a Weather Station Model?



What does each letter indicate?

A _____

B _____

C _____

D _____

What does the “flag” that is attached to the circle indicate?

2. Draw and label on the map what the four different types of fronts look like on a weather map.





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