

# The Pressure Is On: How Air Mass Movement Shapes Our Weather

Unit	Utah SEEd Standard / NGSS Performance Expectation	Estimated Lesson Time:
Utah SEEd 6.3.2  NGSS Correlation: MS-ESS2-5	Standard 6.3.2 <b>Investigate</b> the <b>interactions between air masses</b> that <b>cause</b> changes in <b>weather conditions</b> . <b>Collect and analyze weather data</b> to provide evidence for <b>how air masses flow from regions of high pressure to low pressure causing a change in weather</b> .  NGSS Correlation: MS-ESS2-5 (ESS2.C, ESS2.D)	45 - 50 min.

## LESSON OVERVIEW

### Learning Objective(s)

Students will **investigate** the interactions between air masses that cause changes in weather conditions by **analyzing data**.

### Anchor Phenomenon

Students will examine three different maps to **investigate and analyze data** related to high- and low-pressure systems and weather conditions in groups, making three observations and three questions to understand how air masses influence weather.

### Driving Question(s)

How do air mass interactions cause changes in the weather?

### Lesson Level Performance Expectations

Summative Assessment question: Investigate the weather map data using at least 3 conclusions (complete sentences) to explain to your parents how air masses (low and high pressures) cause changes to the weather in your city.

Students will use weather maps to collect data, investigate, and make observations that will help them ask questions to drive their understanding of why air masses cause changes in weather.

Students will answer questions and teach others as they read an article and watch a demonstration to explain the interactions of air masses that cause weather changes.

Students will be able to observe high and low air masses from map data to explain the cause of changes in weather.



# LESSON SNAPSHOT

## LESSON SUMMARY:

	Estimated Time	Section Overview	How are students answering the driving question or meeting the learning objectives? (Highlight SEPs, DCIs, and CCCs)
Experience the Phenomenon	10 min.	Students will observe and analyze weather maps, writing down their observations and questions.	<p>Analyzing and interpreting weather maps to see the cause-and-effect relationship of air masses and weather.</p> <p>Students will make observations and ask questions to investigate and analyze the data found on 3 different maps showing weather and High/Low pressures.</p>
Investigate the Phenomenon	13 min	<p>Students will read an article on how high- and low-pressure systems cause changes in weather.</p> <p>Students will connect what they learned from the maps with the article through discussion.</p>	<p>Analyzing information in the text to gain background information about the cause-and-effect relationship of air masses and weather, and connecting that to the interpretation of the weather maps.</p> <p>After reading an article, students will discuss the information gleaned to learn about the causes of high and low pressure and the weather associated with these pressure systems.</p>
Model the Phenomenon	12 Min	Students will observe the fish tank experiment to understand the movement of cool and warm air masses.	<p>Observing the cause and effects of cool and warm air masses interacting.</p> <p>Students will observe, take notes, and answer questions during the demonstration to gain a better understanding of high- and low-pressure systems and convection currents.</p>
Evaluate the Phenomenon	10 Min	<b>Students will take an assessment by analyzing a weather map similar to the phenomenon.</b>	<p>Showing their understanding of how the movement and interactions of air masses cause changes in weather by analyzing and interpreting a weather map.</p> <p>Students will answer the assessment question. Learning supports are available for students with IEPs and those who are low-achieving, as well as gifted learners.</p>

DISCIPLINARY CORE IDEAS	SCIENCE & ENGINEERING PRACTICES	CROSSCUTTING CONCEPTS
<p><a href="#">NGSS Appendix E</a></p> <p>(ESS2.C): The Roles of Water on Earth’s Surface Processes (ESS2.D): Weather and Climate</p> <p><b>Students know and apply the Disciplinary Core Idea (DCI) of (ESS2.C) The Roles of Water on Earth’s Surface Processes in their thinking and reasoning to communicate that:</b></p> <ul style="list-style-type: none"> <li>• The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns.</li> <li>• Global movements of water and its changes in form are propelled by sunlight and gravity.</li> </ul> <p><b>Students know and apply the Disciplinary Core Idea (DCI) of (ESS2.D) Weather and Climate in their thinking and reasoning to communicate that:</b></p> <ul style="list-style-type: none"> <li>• Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns.</li> </ul>	<p><a href="#">NGSS Appendix F</a></p> <p><b>Planning and Carrying Out Investigations:</b> Students will investigate the interactions between air masses that cause weather.</p> <p><b>Students do and use this Science and Engineering Practice (SEP) by:</b></p> <ul style="list-style-type: none"> <li>• Planning an investigation individually and collaboratively, and in the design: identifying independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how much data is needed to support a claim.</li> <li>• Conducting an investigation and/or evaluating and/or revising the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.</li> <li>• Evaluating the accuracy of various methods for collecting data.</li> <li>• Collecting data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.</li> <li>• Collecting data about the performance of a system under a range of conditions.</li> </ul>	<p><a href="#">NGSS Appendix G</a></p> <p><b>Cause and Effect:</b> Cause and effect relationships may be used to predict phenomena in natural systems.</p> <p><b>Students think and connect through this Crosscutting Concept (CCC) to reason that:</b></p> <ul style="list-style-type: none"> <li>• Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.</li> <li>• Cause and effect relationships may be used to predict phenomena in natural or designed systems.</li> <li>• Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.</li> </ul>

<ul style="list-style-type: none"> <li>Because these patterns are so complex, weather can only be predicted probabilistically.</li> </ul>		
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**This lesson could be one in a series of lessons building toward the following Performance Expectation(s):**

Utah Standard 6.2.  
 All Earth processes are the result of energy flowing and matter cycling within and among the planet’s systems. Heat energy from the Sun, transmitted by radiation, is the primary source of energy that affects Earth's weather and drives the water cycle. **Uneven heating across Earth's surface causes changes in density, which result in convection currents in water and air, creating patterns of atmospheric and oceanic circulation that determine regional and global climates.**

Standard 6.3.2  
**Investigate** the **interactions between air masses** that **cause** changes in **weather conditions**. **Collect and analyze weather data** to provide evidence of **how air masses flow from regions of high pressure to regions of low pressure, causing changes in weather patterns**.

NGSS Correlation: MS-ESS2-5 (ESS2.C, ESS2.D)

**Related knowledge and skills from prior grades**

<p>Disciplinary Core Idea:  <a href="#">NGSS Appendix E</a></p> <p><b>K-2</b> Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.</p> <p><b>3-5</b> Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.</p>	<p>Science and Engineering Practices  <a href="#">NGSS Appendix F</a></p> <p><b>K-2</b> With guidance, plan and conduct an investigation in collaboration with peers (for K).</p> <p>Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.</p> <p>Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question.</p> <p>Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons.</p> <p>Make observations (firsthand or from media) and/or measurements of a proposed object or tool or solution to determine if it solves a problem or meets a goal.</p> <p>Make predictions based on prior experiences.</p>	<p>Crosscutting Concept:  <a href="#">NGSS Appendix G</a></p> <p><b>K-2</b> Events have causes that generate observable patterns.</p> <p>Simple tests can be designed to gather evidence to support or refute student ideas about causes.</p> <p><b>3-5</b> Cause and effect relationships are routinely identified, tested, and used to explain change.</p> <p>Events that occur together with regularity might or might not be a cause and effect relationship.</p>
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	<p><b>3-5</b> Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.</p> <p>Evaluate appropriate methods and/or tools for collecting data.</p> <p>Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.</p> <p>Make predictions about what would happen if a variable changes.</p> <p>Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success.</p>	
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## Materials

[Access all the material for this lesson](#)

Student Materials	Teacher Materials	Lab Materials/Other Resources
<p><a href="#"><u>The Pressure Is On - Student Worksheet</u></a> (includes a rubric for grading the assessment) <a href="#"><u>Air Mass Movement Article (at grade level)</u></a> <a href="#"><u>Air Mass Movement Article (Spanish)</u></a> <a href="#"><u>Air Mass Movement Article (4th grade reading level)</u></a></p>	<p><a href="#"><u>Investigating Weather Conditions</u></a> <a href="#"><u>Teacher Slides</u></a> <a href="#"><u>Weather Map Slides (for Phenomena)</u></a></p>	<p>Material Preparation:</p> <ul style="list-style-type: none"> <li>- Fish tank</li> <li>- Aluminum loaf pan (nail to poke holes through the loaf pan)</li> <li>- Nail</li> <li>- 2 pipettes (plastic is fine)</li> <li>- Red food coloring</li> <li>- Blue food coloring</li> <li>- 2 Cups to mix a high concentration of food coloring with water.</li> <li>- Rock that is largish, meaning that it will be at the bottom corner of the fish tank and will need to be seen</li> <li>- Pan to boil rock (<a href="#"><u>Get a rock boiling in water at the beginning of the lesson</u></a>)</li> <li>- Hot plate</li> <li>- A rope to tie around the rock to lift and move it to the fish tank.</li> <li>- Liquid chalk markers (blue, red, yellow, black, white)</li> </ul>



## LESSON PREPARATION

**Material Preparation:**

*Get a rock boiling in water at the beginning of the lesson.*

**Required Previous Knowledge:**

-Density of Matter

**Supports students will need/adaptations:**

- Reading Partners
- Understanding a Map Key

## EXPERIENCE THE PHENOMENON/PROBLEM (ENGAGE)

What Students Are Doing	Teacher Tips
<p>Slide 1: Title slide.</p> <p>Slide 2: Reading the objective and driving questions.</p> <p>Slide 3: Review the three dimensions (SEP, CCC, &amp; DCI).</p> <p>Slide 4: Phenomenon - Students will work with a partner, examine three different weather maps marked with high and low pressures, and record three observations and three questions about the maps.</p> <p>Slide 4: Students will turn and talk with another partner about their observations and questions.</p> <p>Slide 5: Students will discuss their observations and questions as a class.</p>	<p>Give the students about 7 minutes to observe the maps.</p> <p>Slide 2: Go over prior knowledge of investigating data and cause and effect in previous lessons.</p>
What Teachers Are Doing	Teacher Tips
<p><b>START BOILING THE ROCK SO IT IS READY FOR LATER</b></p> <p>Slide 1: Title slide.</p> <p>Slide 2: Go over the objective and driving questions.</p> <p>Slide 3: Review the three dimensions (SEP, CCC, &amp; DCI).</p>	<p>While walking around, observe the students' comments to select a few to call on during the discussion. Look for things related to high and low pressure and weather.</p>

<ul style="list-style-type: none"> <li>- SEP: Investigate – The teacher asks questions about other lessons where students investigate phenomena and provide examples of prior lessons. Alternatively, if investigating is new to your students, explain what it entails. Students investigate when they ask ‘why’ questions.</li> <li>- CCC: Cause and effect – Teacher asks questions to relate to other lessons where they used cause and effect, or when students want to understand how something works.</li> <li>- DCI: Density and molecules have been discussed. Students understand that weather changes in their everyday lives.</li> </ul> <p>Slide 4: Phenomenon – The Teacher will walk around and observe the students as they look at the three maps.</p> <p>Slide 5: The Teacher will have the students turn and talk with another partner about their observations and questions.</p> <p>Slide 5: The Teacher will lead a discussion on what students observed and what questions they had.</p>	
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<h2 style="margin: 0;">INVESTIGATE THE PHENOMENON (EXPLORE)</h2>	
What Students Are Doing	Teacher Tips
<p>Slide 6: Students read the article and answer questions based on the article and their observations of the phenomenon.</p> <ul style="list-style-type: none"> <li>- Students read the article “Air Mass Movement Shapes Our Weather.”</li> <li>- Students can read silently or as partners</li> <li>- Annotate the article to find the key details and ideas (ELA cross-curriculum)</li> <li>- After reading, students will answer questions 1-3 on the worksheet.</li> </ul> <p>Slide 7: Students will share their answers in a ‘turn and talk’ activity. A teacher can also have students stand up, raise their hands, pair up to find, and then share with a different partner. (Kagan activity)</p>	<p>Partner reading, where two students take turns reading a paragraph and then deciding together if there is a key idea or detail in the paragraph. (Discuss with the ELA teacher on annotating methods used in the student’s language arts class.)</p> <p>Ask questions as needed to help students with annotating their work.</p>
What Teachers Are Doing	Teacher Tips
<p>Slide 6: Reading the article:</p> <ul style="list-style-type: none"> <li>- Make sure to ask students to answer the questions based on the phenomena and what they read in the article to answer questions 1-3 on the worksheet.</li> <li>- The teacher uses a reading technique/method for students to read and annotate the article.</li> <li>- Teacher has students answer questions 1-3 with their reading partner.</li> <li>- The teacher may want students to answer the questions with their reading group.</li> </ul>	<p>The teacher checks for understanding while walking around the classroom, observing what is being annotated, discussing the questions, and asking questions to stimulate thinking.</p>



<ul style="list-style-type: none"> <li>- The teacher is encouraged to have students do a turn-and-talk to discuss their answers and give students a chance to learn how to listen and share their thoughts.</li> <li>- The teacher has the students share their answers to clarify any misconceptions about low and high pressures.</li> <li>- The teacher asks students about what they learned in the article, and if they can explain more about the phenomenon.</li> </ul>	<p>The teacher clarifies misconceptions as they walk around and/or when students share their answers.</p> <p>Students will often confuse low and high pressures. Low is lousy weather, while high is happy weather. (This 'memory' phrase will be introduced in the next activity.)</p>
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## MODEL THE PHENOMENON (EXPLAIN)

What Students Are Doing	Teacher Tips
<p>Slide 8: Students will observe the teacher demonstrating high- and low-pressure simulations of air mass movement within a fish tank.</p> <ul style="list-style-type: none"> <li>- Students will make observations and write questions.</li> <li>- Students will answer questions 5, 6, and 7 on the worksheet.</li> </ul>	
What Teachers Are Doing	Teacher Tips
<p>The teacher will begin the demonstration.</p> <ul style="list-style-type: none"> <li>- Add ice to the pan on one side of the fish tank and mark molecule density with markers.</li> <li>- Add the hot rock on the other side.</li> <li>- Next, add blue food coloring to the side with ice and red food coloring on the hot rock.</li> <li>- Let students observe the rotation of the food coloring.</li> <li>- Ask students where the low and high pressure would go.</li> <li>- Mark molecule density with markers; let students observe the rotation of the food coloring.</li> <li>- Mark High and Low pressure:</li> <li>- <b>Low</b> pressure: Stormy weather = '<b>Lousy</b>'; <b>High</b> pressure: Sunny weather = '<b>Happy</b>'</li> <li>- Draw in the sun and clouds.</li> </ul> <p>Slide 9: Review what students saw in the tank and how the cold air slips under the warm air and the warm air rises.</p> <p>On the worksheet, there is an extension for early finishers to apply their learning to other weather maps and identify areas of high and low pressure.</p>	<p><b>Get a rock boiling in water at the beginning of the lesson so it will be hot at this point.</b></p> <p>Do not dilute the food coloring; use a generous amount.</p> <p>Watch the YouTube video at the end of the presentation to prepare you to reenact the demonstration for your students.</p> <p>Low pressure: less density; there isn't any pressure keeping the hot water down, so the molecules are farther apart.</p> <p>High Pressure: More dense – there is pressure keeping the cold water down; molecules are closer together at the bottom due to the cold.</p>

## EVALUATE THE PHENOMENON (EVALUATE)

What Students Are Doing	Teacher Tips
<p><b>Final Assessment.</b> At the end of the student worksheet is a rubric.</p> <p>Students are given a weather map and instructions to “Investigate the weather map data using at least 3 conclusions (complete sentences) to explain to your parents how air masses (low and high pressures) cause changes to the weather in your city.”</p> <p>Possible Adaptation: IEP/ELL/Low Readers Make a T-chart for students to list characteristics of high/low pressure. Accommodated assessment is located beneath the final assessment in the student “Pressure is On” worksheet. Examples of IEP modifications for high pressure: High pressure is characterized by less dense air, rising temperatures, and sunny days. Low pressure has denser air that sinks and is associated with clouds, snow, or rain.</p>	<p>Use the support for IEP/ELL/Low readers.</p> <p>Gifted or high-achieving students use the maps to identify patterns in the high- and low-pressure areas.</p> <p>Use the Rubric included in the student worksheet to grade student responses.</p> <p>The teacher may choose to have students grade their own answers using the rubric.</p>
What Teachers Are Doing	Teacher Tips
<p>While students work on their worksheets, teachers should walk around the room and conduct formative assessments to identify and correct misconceptions.</p>	

## POSSIBLE EXTENSIONS/ALTERNATIVE ADAPTATIONS

<p>IEP/ELL/Low readers' alternative adaptation for the summative assessment can be found under “Evaluate the Phenomenon.”</p> <p>Real Time Maps</p> <p>Transparency Maps can be found at the end of the “Weather Map” slides.</p>
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