

Module Overview

Essential Question

How did the cliff dwellings at Mesa Verde protect people from the weather?

Introduction

Nearly opposite [the two ranchers], half a mile away and just below the far mesa's brown caprock, was a long, deep opening in the cliff face. Mirage-like in the falling snow and outlined against the cave's darkest shadows, were ghostly traceries of the largest cliff dwelling either had ever seen. The walls rose and fell in broken terraces, pierced here and there by the black, sightless eyes of doorways. Near the center, rising austere in the afternoon's pale light, a tapering tower of three stories, beautifully round, dominated the entire ruin. It was all as compact, as complete and unreal as a crenelated castle.

—Frank McNitt (1966), on the moment in 1888 when ranchers discovered ancient ruins in the cliffs of Mesa Verde

Throughout the module, students study the anchor phenomenon, the cliff dwellings at Mesa Verde, and build an answer to the Essential Question: **How did the cliff dwellings at Mesa Verde protect people from the weather?** As students learn about each new concept, they develop and refine a model that represents a cliff dwelling and use the model to explore how cliff dwellings protected people from the weather. At the end of the module, students use their knowledge of weather to explain the anchor

phenomenon, and they apply their learning to a new context in an End-of-Module Assessment. Through these experiences, students begin to establish an enduring understanding of weather and its effects. Specifically, students develop an understanding of the parts of weather, the effects of weather on people and their surroundings, and the ways people prepare for severe weather.

Lessons 1 through 11 address the Concept 1 Focus Question: **What is weather?** In Lessons 1 and 2, students begin by building a tent and reflecting on why people build shelters. Students also learn about the anchor phenomenon, the cliff dwellings at Mesa Verde. They then create an anchor model and develop an initial explanation for how the cliff dwellings at Mesa Verde may have protected the Ancestral Pueblo people from the weather. In Lesson 3, students consider how the weather can affect their daily lives. They observe the day's weather and share weather-related questions that they then use to develop a driving question board. Students revisit the driving question board and the anchor model throughout the module to build a coherent understanding of how the cliff dwellings at Mesa Verde protected people from the weather. At the end of Lesson 3, students organize their descriptions of the weather to identify the parts of weather: sunlight, clouds, wind, rain and snow, and temperature. In Lessons 4 through 7, students use observations and measurements to describe the weather. Students begin by sorting photographs to compare the cloud cover as well as snow or rain in the same place at different times. Students then use thermometers to measure temperature and finally, engage in the engineering design process as they make tools for measuring the wind. At this point in the module, the class begins to observe, measure, and record the weather daily, a practice that continues through the remainder of the school year. In Lessons 8 and 9, students shift their focus to explore the effects of weather on people and their surroundings. Students investigate how wind and rain affect different materials and discover that materials feel warmer in direct sunlight than in the shade. In Lessons 10 and 11, students use their knowledge of weather to determine how shelters, such as houses and the cliff dwellings at Mesa Verde, protect people from various parts of weather. Students conclude Concept 1 by demonstrating their learning about weather during a Conceptual Checkpoint.

In Lessons 12 through 16, during the Engineering Challenge, students apply their understanding of the warming effect of sunlight to solve a problem. In Lesson 12, students consider a problem that archaeologists face—feeling too warm in the sunlight. Students determine that one solution is to design a shelter that provides shade to help the archaeologists stay cool. In Lesson 13,

students work in pairs to imagine and plan a shelter. They test different materials to identify which materials are best for creating shade. In Lessons 14 and 15, students use the materials they selected to build, test, and improve a model shelter. In Lesson 16, students share their shelters and view their classmates' shelters. Students conclude the Engineering Challenge by observing photographs of Casa Batlló, an eye-catching building in Barcelona, Spain, and discussing purposes of shelters, beyond protecting people from the weather.

Lessons 17 through 21 address the Concept 2 Focus Question: **What does weather data reveal?** Students learn that measuring, describing, and recording weather over time may reveal patterns that help people forecast and prepare for future weather. In Lesson 17, students analyze several days of local weather data to describe patterns in daily temperature changes. Their analysis reveals predictable changes in temperature over the course of a day. In Lessons 18 and 19, students undertake a deeper analysis of weather data by using counting and numbers to look for patterns in weather data for the first month of school. Students organize the data into a monthly weather summary that shows the weather conditions that were most common during the month. The class will continue to summarize monthly weather data and look for patterns throughout the year. In Lesson 20, students explore how meteorologists predict the weather. Students then interpret a weather forecast and share the forecast with others. In Lesson 21, students turn their attention back to Mesa Verde for a Conceptual Checkpoint as they consider the activities that the Ancestral Pueblo people may have engaged in throughout the day. Students analyze weather data from Mesa Verde to determine how people may have used the cliff dwellings for protection from the weather at different times of day.

Lessons 22 through 27 address the Concept 3 Focus Question: **How does severe weather affect us?** In Lessons 22 through 24, students observe various kinds of severe weather and develop an understanding of how weather can be harmful. In Lessons 25 and 26, students compare severe weather data for several cities, including their own, to determine that in each location, some kinds of severe weather are more likely to happen than others. In addition, students learn about how communities prepare for and

respond to severe weather. In Lesson 27, students apply their knowledge to the anchor phenomenon in a Conceptual Checkpoint as they describe how the cliff dwellings may have protected the Ancestral Pueblo people from severe weather.

Lessons 28 through 30 conclude the module. In Lesson 28, students participate in a Socratic Seminar and use their learning from throughout the module to answer the Essential Question: **How did the cliff dwellings at**

Mesa Verde protect people from the weather? In Lesson 29, students apply their conceptual understandings in an End-of-Module Assessment. Finally, the class debriefs the End-of-Module Assessment in Lesson 30 to clarify misconceptions, and students reflect on their work throughout the module to reveal how they built their knowledge.

Module Map

<p>Anchor Phenomenon: Cliff Dwellings at Mesa Verde <i>Essential Question: How did the cliff dwellings at Mesa Verde protect people from the weather?</i> Weather affects people and their surroundings.</p>				
<p>Concept 1: Parts of Weather <i>Focus Question: What is weather?</i> Weather is the combination of sunlight, clouds, wind, rain and snow, and temperature in a particular place at a particular time. Different parts of weather have different effects on people and their surroundings.</p>				
Science Topic	Phenomenon Question	Student Learning	Texas Essential Knowledge and Skills for Science	English Language Proficiency Standards
Cliff Dwellings at Mesa Verde	How could people who lived at Mesa Verde protect themselves from the weather?	<p>Shelters can protect people from the weather.</p> <ul style="list-style-type: none"> Lesson 1: Build a tent to explore the purpose of shelters. Lesson 2: Develop an anchor model of a Mesa Verde cliff dwelling. 	<p>1.2A 1.3C 1.8A</p>	<p>3J 4A 4C</p>

Local Weather	What can we do outside today?	<p>Weather has many parts. These parts include sunlight, clouds, wind, rain and snow, and temperature.</p> <ul style="list-style-type: none"> Lesson 3: Examine and sort photographs of outdoor activities and ask questions about the weather. 	<p>1.2A 1.2D 1.8A 1.8B</p>	<p>1C 3E</p>
Describing Weather	How can we describe the weather?	<p>People can observe or measure cloud cover, rain and snow, temperature, and wind to describe the weather.</p> <ul style="list-style-type: none"> Lesson 4: Record observations of cloud cover, rain, and snow. Lesson 5: Learn how to use a thermometer to measure temperature. Lesson 6: Design a tool to measure the wind. Lesson 7: Create, improve, and share a wind measuring tool. 	<p>1.2B 1.2C 1.2D 1.2E 1.3A 1.3C 1.4A 1.4B 1.5A 1.6C 1.8A 1.8B 1.8D</p>	<p>1C 4A</p>
Effects of Weather	How does the weather affect us when we play at the playground?	<p>Sunlight, wind, and rain can affect people and their surroundings.</p> <ul style="list-style-type: none"> Lesson 8: Model the effects of sunlight, wind, and rain on playground materials. Lesson 9: Investigate temperature differences between areas in sunlight and areas in shade. 	<p>1.2A 1.2B 1.2C 1.2D 1.2E 1.4A 1.4B 1.5B 1.6A 1.8A</p>	<p>3C 3G</p>

Parts of Weather	What is the weather like at Mesa Verde?	<p>Weather is the combination of sunlight, clouds, wind, rain and snow, and temperature in a particular place at a particular time. Different parts of weather have different effects on people and their surroundings.</p> <ul style="list-style-type: none"> Lesson 10: Recognize that different homes are shelters that can protect people from the weather. Lesson 11: Describe how the cliff dwellings at Mesa Verde protected people from the weather. 	<p>1.2C 1.2D 1.4A 1.4B 1.5B 1.6A 1.8A 1.8B</p>	<p>2F 3F</p>
Application of Concepts				
Task	Phenomenon Question	Student Learning	Texas Essential Knowledge and Skills for Science	English Language Proficiency Standards
Engineering Challenge	How can we help archaeologists feel cooler when they work?	<p>People can use the engineering design process to create shelters for shade.</p> <ul style="list-style-type: none"> Lessons 12–16: Apply the engineering design process to create a shelter that helps archaeologists feel cooler when they are working in the sunlight. 	<p>1.2A 1.2B 1.2C 1.2E 1.3A 1.3C 1.4A 1.4B 1.5A 1.5B 1.6A</p>	<p>1C 2F 2I</p>

Concept 2: Weather Data <i>Focus Question: What does weather data reveal?</i> Analyzing weather data can reveal patterns.				
Science Topic	Phenomenon Question	Student Learning	Texas Essential Knowledge and Skills for Science	English Language Proficiency Standards
Local Weather Data	What can we find out by looking at weather data?	Weather data collected over time may reveal patterns. <ul style="list-style-type: none"> Lesson 17: Use weather data to identify and describe patterns in daily temperature changes. Lesson 18: Summarize monthly temperature data. Lesson 19: Summarize monthly weather data. Lesson 20: Explore how meteorologists predict weather and develop weather forecasts. 	1.2C 1.2D 1.3B 1.3C 1.8A 1.8B 1.8C	3H 4A 4E
Weather Data	What can we find out about Mesa Verde by looking at weather data?	Analyzing weather data can reveal patterns. <ul style="list-style-type: none"> Lesson 21: Use data to describe daily temperature patterns at Mesa Verde. 	1.2D 1.3B 1.6A 1.8A 1.8B 1.8C	2F 4C



Concept 3: Severe Weather <i>Focus Question: How does severe weather affect us?</i> Meteorologists can predict severe weather so that communities can prepare.				
Science Topic	Phenomenon Question	Student Learning	Texas Essential Knowledge and Skills for Science	English Language Proficiency Standards
Effects of Severe Weather	How can weather be harmful?	Severe weather can be harmful to communities. <ul style="list-style-type: none"> Lesson 22: Observe and record information about different kinds of severe weather. Lesson 23: Share information about different kinds of severe weather. Lesson 24: Describe how severe weather affects communities. 	1.2A 1.2D 1.2E 1.8A 1.8B	2F 4A
Preparing for Severe Weather	How can we prepare for severe weather?	Meteorologists use patterns to forecast severe weather so that communities can prepare and respond. <ul style="list-style-type: none"> Lesson 25: Use data to identify and describe severe weather patterns. Lesson 26: Describe how communities prepare for and respond to severe weather. 	1.2A 1.2D 1.3B 1.3C 1.6A	2F 3E
Severe Weather	How did severe weather affect people at Mesa Verde?	People can predict severe weather so that communities can prepare. <ul style="list-style-type: none"> Lesson 27: Describe how severe weather may have affected the Ancestral Pueblo people at Mesa Verde. 	1.2D 1.3B	2E



Application of Concepts				
Task	Phenomenon Question	Student Learning	Texas Essential Knowledge and Skills for Science	English Language Proficiency Standards
End-of-Module Socratic Seminar, Assessment, and Debrief	How did the Blizzard of 1978 affect people in Boston?	Weather affects people and their surroundings. <ul style="list-style-type: none"> Lesson 28: Explain how the cliff dwellings at Mesa Verde protected people from the weather. (Socratic Seminar) Lessons 29: Describe the weather during the Blizzard of 1978 in Boston, and explain how the storm affected people there. (End-of-Module Assessment) Lesson 30: Explain how the weather affects people and their surroundings. (End-of-Module Debrief) 	1.2E 1.8A 1.8B 1.8C 1.8D	2H 3E 3F

Focus Standards*

Texas Essential Knowledge and Skills for Science

- 1.1 Scientific investigation and reasoning. The student conducts classroom and outdoor investigations following home and school safety procedures and uses environmentally appropriate and responsible practices. The student is expected to
 - 1.1A *identify, discuss, and demonstrate safe and healthy practices as outlined in Texas Education agency-approved safety standards during classroom and outdoor investigations, including wearing safety goggles or chemical splash goggles,* *as appropriate, washing hands, and using materials appropriately; and*
 - 1.1B *identify and learn how to use natural resources and materials, including conservation and reuse or recycling of paper, plastic, and metals.*
- 1.2 Scientific investigation and reasoning. The student develops abilities to ask questions and seek answers in classroom and outdoor investigations. The student is expected to

* The bold text identifies standards that students should master in this module. The italicized text identifies standards that students will develop knowledge of in this module and should master in later modules. Some italicized standards are part of the assessments in this module, but they will be assessed throughout the year.



- 1.2A *ask questions about organisms, objects, and events observed in the natural world;*
- 1.2B *plan and conduct simple descriptive investigations;*
- 1.2C *collect data and make observations using simple tools;*
- 1.2D *record and organize data using pictures, numbers, and words; and*
- 1.2E *communicate observations and provide reasons for explanations using student-generated data from simple descriptive investigations.*
- 1.3 Scientific investigation and reasoning. The student knows that information and critical thinking are used in scientific problem solving. The student is expected to
- 1.3A *identify and explain a problem and propose a solution;*
- 1.3B *make predictions based on observable patterns; and*
- 1.3C *describe what scientists do.*
- 1.4 Scientific investigation and reasoning. The student uses age-appropriate tools and models to investigate the natural world. The student is expected to
- 1.4A collect, record, and compare information using tools, including computers, hand lenses, primary balances, cups, bowls, magnets, collecting nets, notebooks, and safety goggles or chemical splash goggles, as appropriate; timing devices; non-standard measuring items; weather instruments such as demonstration thermometers and wind socks; and materials to support observations of habitats of organisms such as aquariums and terrariums; and
- 1.4B *measure and compare organisms and objects using non-standard units.*
- 1.5 Matter and energy. The student knows that objects have properties and patterns. The student is expected to
- 1.5A *classify objects by observable properties such as larger and smaller, heavier and lighter, shape, color, and texture; and*
- 1.5B **predict and identify changes in materials caused by heating and cooling.**
- 1.6 Force, motion, and energy. The student knows that force, motion, and energy are related and are a part of everyday life. The student is expected to
- 1.6A **identify and discuss how different forms of energy such as light, thermal, and sound are important to everyday life; and**
- 1.6C demonstrate and record the ways that objects can move such as in a straight line, zig zag, up and down, back and forth, round and round, and fast and slow.
- 1.8 Earth and space. The student knows that the natural world includes the air around us and objects in the sky. The student is expected to
- 1.8A record weather information, including relative temperature such as hot or cold, clear or cloudy, calm or windy, and rainy or icy;
- 1.8B **observe and record changes in the appearance of objects in the sky** such as the Moon and stars, **including the Sun;**
- 1.8C *identify characteristics of the seasons of the year and day and night; and*
- 1.8D *demonstrate that air is all around us and* **observe that wind is moving air.**

Building Content Knowledge

In Concept 1, students establish what weather is. Students begin the concept by considering how weather affects people as they learn about the anchor phenomenon, the cliff dwellings at Mesa Verde. In Lesson 3, students ask questions about the weather that drive their learning throughout the first concept. In Lessons 4 through 7, students determine how to measure and describe parts of weather such as temperature, cloud cover, rain and snow, and wind. Students begin to observe, measure, describe, and record daily weather conditions (1.8A, 1.8B), and they will continue to collect this data throughout the school year. Students create a wind-measuring device in Lessons 6 and 7 to use throughout the year to record wind conditions as they begin to explore the idea that wind moves air (1.8D). In Lessons 8 and 9, students observe and record how weather can affect materials on Earth's surface, and specifically how thermal energy from the Sun warms rocks. Students then investigate and discuss how shade can reduce sunlight in an area and therefore reduce the warming effect of sunlight (1.5B, 1.6A). In a Conceptual Checkpoint in Lesson 11, students observe and describe their local weather and compare it to weather at Mesa Verde (1.8A, 1.8C). Students reflect on how the cliff dwellings at Mesa Verde protect people from weather.

During the Engineering Challenge in Lessons 12 through 16, students follow the engineering design process as they build a model of a shelter at a dig site that would protect archaeologists from the warming effect of the Sun. As students create a shelter, they classify the materials used based on their properties (1.5A).

In Concept 2, students look for patterns in the weather data they have collected. In Lessons 17 through 20, students begin by analyzing morning, afternoon, and night temperature data to identify patterns in daily temperature (1.8B). Students consider whether they can make predictions based on the patterns observed in their data (1.3B). Students then summarize one month of weather data, which they will revisit at the end of the school year when they look for long-term weather patterns and describe weather changes over seasons in the last module of the school year (1.8A, 1.8B). Students then learn how meteorologists use weather data to make predictions about future weather. In a Conceptual Checkpoint in Lesson 21, students analyze weather data to notice patterns in daily temperature changes at Mesa Verde (1.8A, 1.8B) and identify how the cliff dwellings at Mesa Verde protected people from daily temperature changes.

In Concept 3, students develop an understanding of severe weather. In Lessons 22 through 24, students observe the parts of weather that make up different kinds of severe weather (1.8A). In Lessons 25 through 26, students use data to identify and describe the pattern that some kinds of severe weather are more likely to occur in a particular area (1.2B). Students then learn how to prepare for one kind of severe weather that can occur in their area. In a Conceptual Checkpoint in Lesson 27, students describe patterns of severe weather at Mesa Verde (1.8B). At the end of the module, students learn about a new phenomenon, the Blizzard of 1978 in Boston. In the End-of-Module Assessment, students describe weather during the Blizzard of 1978 and consider how people can prepare for a blizzard (1.8A, 1.8B).

Why

Why do students record the weather throughout the year?

In this module, students explore weather and climate by observing, measuring, and recording their local weather each day. By analyzing data throughout this module, students gather evidence for changing or repeating weather conditions over relatively short periods of time (e.g., a day, a week, a month). After observing, measuring, and recording daily weather throughout the year, students will have an opportunity to look for patterns and trends in weather over longer periods of time.

Why do students learn about shelter in a module about weather?

In each *PhD Science*® module, students explore a rich anchor phenomenon that motivates instruction throughout the module. In this module, students develop the enduring understanding that weather affects people and their surroundings, as students explore how the cliff dwellings at Mesa Verde protected the Ancestral Pueblo people from the weather. The phenomenon of shelter is accessible and familiar to students. Throughout the module, students use what they know from their own experiences with shelters to deepen their explanation of how the cliff dwellings protected the Ancestral Pueblo people. Students are motivated to find out why people need to know about the weather and how the weather shapes everyday decisions, such as what clothes to wear and what to do during the day, as well as decisions that

have longer-term implications, such as how to build shelters to protect people from local weather.

Why don't students identify patterns in weekly or monthly weather data?

This module defines patterns as repeating information that people can use to make predictions. When students look at temperature data recorded for several days in the morning, in the afternoon, and at night, they see that the temperature changes throughout the day and that it is usually warmer in the afternoon than it is in the morning or at night. This is an example of a predictable pattern. A meteorologist might refer to several sunny days in a row as a sunny weather pattern. However, students cannot use observations of repeated sunny days to predict that it will be sunny in the future because weather is unpredictable from day to day. Additionally, to make predictions and forecasts, meteorologists use scientific data that are not accessible to students. In this module, students find that they cannot use repeated information in their collected weather data for a single month to predict future weather. This motivates students to continue to collect weather data throughout the year to look for longer-term trends and patterns.

Key Terms

In this module, students learn the following terms through investigations, models, explanations, class discussions, and other experiences.

- Data
- Engineer
- Engineering design process
- Forecast
- Scientist
- Severe weather

- Shelter
- Temperature
- Thermometer
- Weather

Advance Materials Preparation

Several activities in this module require advance preparation. See the lesson resources for more details on material preparation and instructions.

Lesson Set	Time in Advance	Investigation	Description
4–7	2 days	Wind Measuring Tool Activity	Arrange for an adult to operate the fan and hair dryer during Lessons 6 and 7.
17–20	1 month	Monthly Temperature Data Analysis	Take a class photograph outside during the first week of school.

Safety Considerations

The safety and well-being of students are of utmost importance in all classrooms, and educators must act responsibly, prudently, and proactively to safeguard students. Science investigations frequently include activities, demonstrations, and experiments that require extra attention to safety measures. Educators must do their best to ensure a safe classroom environment.

The hands-on, minds-on activities of this module involve working near electrical devices, working outside, and working with materials such as plants, rocks, and soil. Some of the more important safety aspects to implement in this module follow.

1. **Teachers must explain all safety considerations to students and review all safety expectations with them before each activity.**
2. **Students must carefully listen to and follow all teacher instructions.** Instructions may be oral, on classroom postings, or written in the Science Logbook or other handouts.
3. **Students must demonstrate appropriate classroom behavior (e.g., no running, jumping, or pushing) during science investigations.** Students must handle all supplies and equipment carefully and respectfully. Additionally, students should do their best to avoid touching their face during investigations.
4. **Students and teachers must put away all food and drinks during science investigations.** Investigation materials can easily contaminate food and drinks. Also, spilled food or drinks can disrupt investigations.
5. **Students must never place materials in their mouth during a science investigation.**

6. **Students and teachers must wear personal protective equipment (e.g., safety goggles) during investigations that require this equipment.** Students and teachers must wear safety goggles whenever they work with objects with sharp points (e.g., wires, toothpicks), materials made up of tiny pieces (e.g., sand), glass, projectiles (objects that move through the air), and liquids other than pure water.
7. **Students must immediately inform teachers of any spills, breakages, or materials falling to the floor. Students must then follow all teacher instructions for cleaning up, including allowing teachers to clean up spills, breakages, and other materials that may be dangerous.** During investigations, items can fall to the floor even when everyone is careful. Immediate removal of debris from the floor is essential to help prevent injury.
8. **Students must follow teacher instructions regarding cleanup at the end of each investigation.** Teachers may ask students to return materials to specific storage locations in the classroom or to clean the surfaces of their desks with provided materials (e.g., water and paper towels). After completion of the investigation and cleanup, students must thoroughly wash their hands.

9. **Teachers must monitor student activity on the internet.** If students must access the internet for science research purposes, teachers must monitor students' activity to ensure conformation with school and district policies.

Because this module is the first of the school year, stressing the importance of safety and setting safety procedures with students are critical tasks. To help ensure safe science experiences, schools are encouraged to have students and their parents or guardians sign a science safety contract that outlines rules and procedures. Administration of a safety quiz also is recommended to assess comprehension of the rules and procedures. Teachers may use the sample contract and quiz in Appendix A: Module Resources or create their own.

More information on safety in the elementary science classroom appears in the Implementation Guide. Teachers should always follow the health and safety guidelines of their school or district. For additional information on safety in the science classroom, consult the Texas Education agency-approved safety standards (TEKS 1.1A).

Additional Reading for Teachers

Mesa Verde National Park: Life Earth Sky by Susan Lamb

“Discussion Supports Sense-Making Within and Across Lessons” by Tanya S. Wright, JoAnne West, Amelia Wenk Gotwals, and Christa Haverly (in *Science and Children*)

“Mesa Verde Education Packet” resource from the National Park Service website: <http://phdsci.link/1574>