Pacing Guide

Level 3 Module 1

Earth Changes with Spotlight Lessons on Matter

Each *PhD Science® TEKS Edition* Level 3 lesson requires 45 minutes of instructional time. This guide is intended for teachers who are providing in-person instruction. This guide presents lesson objectives and activities by concept and multiple pacing options to allow teachers to maximize instructional time while remaining responsive to the needs of their students. Choose one or more options for each lesson. Note that pacing options do not omit parts of lessons.

Pacing Option Key

Lesson Split: This symbol identifies single lessons teachers may split across 2 days.

Cross-Curricular Activity: This symbol identifies parts of lessons teachers may incorporate during instructional time for other content areas, such as English, math, social and emotional learning, and center time. Teachers may implement these parts before or after science instruction; for example, if the class reads a *PhD Science* core text during English instruction, students can discuss the core text during science instruction rather than reading the full text during that time.

Investigation Preparation: This symbol identifies preparation the teacher may do in advance of an investigation. This advance preparation does not interfere with student learning.

Instructional Routine: This symbol identifies opportunities to use alternative instructional routines. See the Implementation Guide for information on instructional routines.

Teacher Think Aloud: This symbol identifies activities that are appropriate for a teacher Think Aloud. Suggested primarily for use during station activities, this option allows completion of these activities as a class. During a teacher Think Aloud, the teacher assumes the role of a student and verbalizes the thought process of a student completing the activity to engage students with intentional questioning techniques. The teacher may also ask students to model appropriate procedures and participate in collaborative conversations.

Shared Media Experience: This symbol identifies media (e.g., videos, images) that the teacher may share with the whole class rather than having students view the media individually or in groups. After students observe the media as a class, they complete an activity.

Focal Point: This symbol identifies parts of lessons teachers should emphasize. For example, in an activity with multiple resources (e.g., videos, texts, charts), a focal point identifies the most important resources, thus ensuring the coherence of the lessons.

Instructional Note: This symbol identifies parts of lessons that have instructional notes that describe time-saving strategies. Examples of such instructional notes are Differentiation supports that provide sentence frames for writing assignments and Teacher Notes that suggest alternative activities.

Module at a Glance

This module contains 24 lessons with 7 spotlight lessons on Matter. Even with lesson splits, this module should take no more than 44 days to complete. This maximum number of days ensures the implementation of all Level 3 modules within a school year that has 150 days of science instruction.

Earth Changes

Anchor Phenomenon: Transformation of Surtsey **Essential Question: How can the island of Surtsey change shape over time?**	**Recommended Number of Days**	**TEKS and ELPS Alignment**
Concept 1 (Lessons 1–7): The Composition and Shape of Land **Focus Question:** How can we describe land? Land has shape and is made up of rocks, soil, and sand.	7–13 days	3.2A, 3.2B, 3.2C, 3.2D, 3.2E, 3.2F, 3.3A, 3.3B, 3.3C, 3.4, 3.5A, 3.5C, 3.5D, 3.7A, 3.7B ELPS: 2E, 3H, 4A
Concept 2 (Lessons 8–13): The Changing Shape of Land **Focus Question:** How can land change? Wind and water can shape land by moving material from one place to another.	6–10 days	3.2A, 3.2B, 3.2C, 3.2D, 3.2E, 3.2F, 3.3A, 3.3B, 3.3C, 3.4, 3.7A, 3.7B, 3.7C ELPS: 3H, 3J, 4A, 4E
Application of Concepts (Lessons 14–17): Engineering Challenge **Phenomenon Question:** How can we slow changes to the land of Montauk Point to protect the Montauk Point Lighthouse? People can apply knowledge of the natural world to slow or prevent land from changing.	4 days	3.2A, 3.2B, 3.2C, 3.2D, 3.2E, 3.2F, 3.3A, 3.3B, 3.3C, 3.4, 3.7C ELPS: 3E, 3H
Concept 3 (Lessons 18–21): Timescales of Changes to Land **Focus Question:** How long do changes to land take? Earth events change land over short and long time spans.	4–7 days	3.2A, 3.2B, 3.2C, 3.2D, 3.2F, 3.3A, 3.3B, 3.3C, 3.4, 3.7A, 3.7B, 3.7C ELPS: 3E, 3G, 4E
Application of Concepts (Lessons 22–24): End-of-Module Socratic Seminar, Assessment, and Debrief **Essential Question:** How can the island of Surtsey change shape over time? Natural events transform Earth's land as time passes.	3 days	3.2A, 3.2B, 3.2C, 3.2D, 3.2F, 3.3A, 3.3B, 3.3C, 3.7A, 3.7B ELPS: 3E, 3F

Spotlight Lessons on Matter

Lesson Sets	Recommended Number of Days	TEKS and ELPS Alignment
Lessons 1–2: Properties of Objects and Materials **Phenomenon Question:** How can we describe different objects?	2 days	3.2B, 3.4, 3.5A, 3.5D ELPS:3E
Lessons 3–5: Matter **Phenomenon Question:** How do the properties of solids, liquids, and gases compare?	3 days	3.2D, 3.2F, 3.5A, 3.5B ELPS:3E, 4A
Lessons 6–7: Changes in Matter **Phenomenon Question** What happens to matter during heating and cooling?	2 days	3.2B, 3.2D, 3.2F, 3.4, 3.5A, 3.5B, 3.5C ELPS: 4A

Year at a Glance

This year at a glance chart shows where all three modules fit in a year. To ensure completion of each module, it is recommended to teach science five days a week.

Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Module 1			Module 2			Module 3				

Module 1: Earth Changes

Concept 1: How can we describe land? 7–13 days

Focus Standards

3.2A Plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world.

3.2B Collect and record data by observing and measuring using the metric system and recognize differences between observed and measured data.

3.2C Construct maps, graphic organizers, simple tables, charts, and bar graphs using tools and current technology to organize, examine, and evaluate measured data.

3.2D Analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations.

3.2F Communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion.

3.3B Represent the natural world using models such as volcanoes or the Sun, Earth, and Moon system and identify their limitations, including size, properties, and materials.

3.4 Collect, record, and analyze information using tools, including cameras, computers, hand lenses, metric rulers, Celsius thermometers, wind vanes, rain gauges, pan balances, graduated cylinders, beakers, spring scales, hot plates, meter sticks, magnets, collecting nets, notebooks, and Sun, Earth, and Moon system models; timing devices; and materials to support observation of habitats of organisms such as terrariums and aquariums.

3.5A Measure, test, and record physical properties of matter, including temperature, mass, magnetism, and the ability to sink or float.

3.5C Predict, observe, and record changes in the state of matter caused by heating or cooling such as ice becoming liquid water, condensation forming on the outside of a glass of ice water, or liquid water being heated to the point of becoming water vapor.

3.5D Explore and recognize that a mixture is created when two materials are combined such as gravel and sand or metal and plastic paper clips.

3.7A Explore and record how soils are formed by weathering of rock and the decomposition of plant and animal remains.

3.7B Investigate rapid changes in Earth's surface such as volcanic eruptions, earthquakes, and landslides.

Concept 1: How can we describe land? (continued)			
Lessons 1–2: Transformation of Surtsey		**Lessons 3–4: Land**	
Lesson 1: Observe land areas and describe their natural features.	**Lesson 2:** Develop an anchor model that begins to explain the formation and transformation of Surtsey.	**Lesson 3:** Investigate solid materials found at or near Earth's surface to describe the components of land.	**Lesson 4:** Investigate how rocks change by breaking into smaller pieces.
Day 1: Launch through Define Land **Day 2:** Explore Natural Features of Local Land through Land Use first Teacher Note in Explore Natural Features of Local Land. Use English Language Development note in Explore Natural Features of Local Land.	**Day 1:** Launch through Develop Initial Model **Day 2:** Develop Anchor Model through Land	**Day 1:** Launch through Observe Local Land Samples **Day 2:** Compare Land Samples through Land Think aloud one material in Observe Common Land Samples.	**Day 1:** Launch through Investigate Rocks **Day 2:** Construct an Argument About Rocks through Land Use second Teacher Note in Investigate Rocks. Finish writing observations and explanations in Construct an Argument About Rocks after the lesson.

Concept 1: How can we describe land? (continued)

Lessons 5–6: Landforms		Lesson 7: The Composition and Shape of Land
Lesson 5: Observe images of different landforms to describe their shapes.	**Lesson 6:** Examine maps to describe the locations of landforms on Earth.	**Lesson 7:** Use evidence from observations of landforms to describe Surtsey's land.
Day 1: Launch through Observe Features of National Parks and Lands **Day 2:** Describe the Shape of Land through Land Use Differentiation note in Describe the Shape of Land.	**Day 1:** Launch through Examine Landform Maps of North America **Day 2:** Examine Landform Maps of Earth's Continents through Land Use an alternative terminology learning routine in Examine Landform Maps of North America. Think aloud one landform map in Examine Landform Maps of Earth's Continents.	Use an alternative collaborative conversation routine in Debrief Conceptual Checkpoint. **Conceptual Checkpoint**

Concept 2: How can land change? 6–10 days

Focus Standards

3.7A Explore and record how soils are formed by weathering of rock and the decomposition of plant and animal remains.

3.7B Investigate rapid changes in Earth's surface such as volcanic eruptions, earthquakes, and landslides.

3.7C Explore the characteristics of natural resources that make them useful in products and materials such as clothing and furniture and how resources may be conserved.

Lessons 8–9: Water and Land Interactions		Lessons 10–12: Wind and Land Interactions	
Lesson 8: Observe water and land interactions to describe how water can change the shape of land.	**Lesson 9:** Compare solutions to problems caused by water changing the shape of land.	**Lesson 10:** Plan an investigation to gather evidence about how wind and land interact.	**Lesson 11:** Observe wind and land interactions to describe how wind can change the shape of land.
Day 1: Launch through Investigate Water and Land Interactions **Day 2:** Analyze Data through Land Use an alternative collaborative conversation routine in Analyze Data.	Think aloud one poster in Share Information About Landslide Solutions.	**Day 1:** Launch through Read About the Sphinx **Day 2:** Prepare for Wind Investigation through Land Read *World Traveler: The Sphinx* by Catherine Schmidt and Molly O'Halloran (2018) before the lesson in Read About the Sphinx.	**Day 1:** Launch through Investigate Wind and Land Interactions **Day 2:** Construct an Argument About Wind and Land through Land Use Teacher Note in Investigate Wind and Land Interactions. Finish written observations and explanations in Construct an Argument About Wind and Land after the lesson.

Concept 2: How can land change? (continued)	
Lessons 10–12: Wind and Land Interactions	**Lesson 13: The Changing Shape of Land**
Lesson 12: Compare solutions to problems caused by wind changing the shape of land.	**Lesson 13:** Construct an argument with evidence to support a claim about wind and water changing the shape of Surtsey's land.
 Share photographs in Observe Images of Wind Changing Land.  Use alternative collaborative conversation routine in Identify Solutions to Problems Caused by Wind Changing Land.	 **Day 1:** Launch through Conceptual Checkpoint **Day 2:** Debrief Conceptual Checkpoint through Land
	Conceptual Checkpoint

<table>
<tr><td colspan="4">Engineering Challenge: How can we slow changes to the land of Montauk Point to protect the Montauk Point Lighthouse? 4 days

Focus Standards

3.7C Explore the characteristics of natural resources that make them useful in products and materials such as clothing and furniture and how resources may be conserved.</td></tr>
<tr><td colspan="4">Lessons 14–17: Engineering Challenge</td></tr>
<tr><td>Lesson 14: Apply the engineering design process to develop, build, and test a solution for protecting the Montauk Point Lighthouse.</td><td>Lesson 15: Apply the engineering design process to develop, build, and test a solution for protecting the Montauk Point Lighthouse.</td><td>Lesson 16: Apply the engineering design process to develop, build, and test a solution for protecting the Montauk Point Lighthouse.</td><td>Lesson 17: Apply the engineering design process to develop, build, and test a solution for protecting the Montauk Point Lighthouse.</td></tr>
<tr><td rowspan="2">Engineering Challenge</td><td>Use Differentiation note in Plan a Shoreline Protection System.</td><td rowspan="2">Engineering Challenge</td><td>Use Teacher Note in Prepare for a Presentation.</td></tr>
<tr><td>Conceptual Checkpoint</td><td>Conceptual Checkpoint</td></tr>
</table>

Concept 3: How long do changes to land take? 4–7 days

Focus Standards

3.7A Explore and record how soils are formed by weathering of rock and the decomposition of plant and animal remains.

3.7B Investigate rapid changes in Earth's surface such as volcanic eruptions, earthquakes, and landslides.

<table>
<tr><th colspan="2">Lessons 18–19: Earth Events</th><th>Lesson 20: Slow Earth Events</th><th>Lesson 21: Timescales of Changes to Land</th></tr>
<tr><td>Lesson 18: Compare Earth events that change land to develop initial ideas about the time spans over which the events occur.</td><td>Lesson 19: Describe Earth events that change land as happening rapidly or slowly.</td><td>Lesson 20: Use a model to show that some Earth events change land over time spans longer than one person can observe.</td><td>Lesson 21: Use evidence to support a claim comparing the time spans of Earth events that have formed and shaped yardangs with those that have formed and shaped Surtsey.</td></tr>
<tr><td>Use a modified Whip Around routine in Sort Earth Event Cards. Allow one student group to share while other groups use nonverbal signals to indicate whether they agree or disagree.

Use Teacher Note in Order Earth Event Cards.</td><td>Day 1: Launch through Read About Time Spans of Earth Events
Day 2: Compare Earth Events to Human Events through Land

Complete Compare Earth Events to Human Events after the lesson.</td><td>Day 1: Launch through Compare Time Spans of Events
Day 2: Discuss Evidence of Change through Land

Focus on two statements in Discuss Evidence of Change.</td><td>Day 1: Launch through Conceptual Checkpoint
Day 2: Debrief Conceptual Checkpoint through Land

Conceptual Checkpoint</td></tr>
</table>

<table>
<tr><td colspan="3">Application of Concepts: How can the island of Surtsey change shape over time? — 3 days

Focus Standards

3.7A Explore and record how soils are formed by weathering of rock and the decomposition of plant and animal remains.

3.7B Investigate rapid changes in Earth's surface such as volcanic eruptions, earthquakes, and landslides.</td></tr>
<tr><td colspan="3">Lessons 22–24: Transformation of Surtsey</td></tr>
<tr><td>Lesson 22: Explain how the island of Surtsey can change shape over time.</td><td>Lesson 23: Explain how a headland changes shape over time to become a sea stack.</td><td>Lesson 24: Explain how land changes over time.</td></tr>
<tr><td>  Use first Teacher Note in Engage in Socratic Seminar.</td><td rowspan="3">End-of-Module Assessment</td><td>  Use English Language Development note in Reflect on Stability and Change in Module Learning.</td></tr>
<tr><td>Socratic Seminar</td><td>End-of-Module Debrief</td></tr>
</table>

Spotlight Lessons: Matter

Focus Standards — 7 days

3.5A Measure, test, and record physical properties of matter, including temperature, mass, magnetism, and the ability to sink or float.

3.5B Describe and classify samples of matter as solids, liquids, and gases and demonstrate that solids have a definite shape, and that liquids and gases take the shape of their container.

3.5C Predict, observe, and record changes in the state of matter caused by heating or cooling such as ice becoming liquid water, condensation forming on the outside of a glass of ice water, or liquid water being heated to the point of becoming water vapor.

3.5D Explore and recognize that a mixture is created when two materials are combined such as gravel and sand or metal and plastic paper clips.

Lessons 1–2: Properties of Objects and Materials		**Lessons 3–5: Matter**	
Lesson 1: Describe properties of materials and objects.	**Lesson 2:** Describe properties of objects before and after mixing.	**Lesson 3:** Investigate solids and liquids and observe their properties.	**Lesson 4:** Define matter and identify those solids, liquids, and gases are types of matter.
	Use alternative written response routine in Reflect on Observations.	Use Differentiation note in Explore Solids and Liquids.	Use first Teacher note in Define Volume.
Lessons 3–5: Matter	**Lessons 6–7: Changes in Matter**		
Lesson 5: Investigate the behavior of gas.	**Lesson 6:** Investigate and identify changes to properties of matter before and after heating.	**Lesson 7:** Investigate changes to properties of water during heating and cooling to identify and describe state changes.	

Texas Essential Knowledge and Skills (TEKS)

Focus Standards	
3.5	Matter and energy. The student knows that matter has measurable physical properties and those properties determine how matter is classified, changed, and used. The student is expected to
	3.5A measure, test, and record physical properties of matter, including temperature, mass, magnetism, and the ability to sink or float;
	3.5B Describe and classify samples of matter as solids, liquids, and gases and demonstrate that solids have a definite shape and that liquids and gases take the shape of their container.
	3.5C predict, observe, and record changes in the state of matter caused by heating or cooling such as ice becoming liquid water, condensation forming on the outside of a glass of ice water, or liquid water being heated to the point of becoming water vapor; and
	3.5D explore and recognize that a mixture is created when two materials are combined such as gravel and sand or metal and plastic paper clips.
3.7	Earth and space. The student knows that Earth consists of natural resources and its surface is constantly changing. The student is expected to
	3.7A explore and record how soils are formed by weathering of rock and the decomposition of plant and animal remains;
	3.7B investigate rapid changes in Earth's surface such as volcanic eruptions, earthquakes, and landslides; and
3.7C	explore the characteristics of natural resources that make them useful in products and materials such as clothing and furniture and how resources may be conserved.

Investigation and Reasoning Standards	
3.1	Scientific investigation and reasoning. The student conducts classroom and outdoor investigations following home and school safety procedures and environmentally appropriate practices. The student is expected to
	3.1A demonstrate safe practices as described in Texas Education Agency–approved safety standards during classroom and outdoor investigations using safety equipment as appropriate, including safety goggles or chemical splash goggles, as appropriate, and gloves; and
	3.1B make informed choices in the use and conservation of natural resources by recycling or reusing materials such as paper, aluminum cans, and plastics.
3.2	Scientific investigation and reasoning. The student uses scientific practices during laboratory and outdoor investigations. The student is expected to
	3.2A plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world;
	3.2B collect and record data by observing and measuring using the metric system and recognize differences between observed and measured data;
	3.2C construct maps, graphic organizers, simple tables, charts, and bar graphs using tools and current technology to organize, examine, and evaluate measured data;
	3.2D analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations;
	3.2E demonstrate that repeated investigations may increase the reliability of results; and
	3.2F communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion.
3.3	Scientific investigation and reasoning. The student knows that information, critical thinking, scientific problem solving, and the contributions of scientists are used in making decisions. The student is expected to
	3.3A analyze, evaluate, and critique scientific explanations by using evidence, logical reasoning, and experimental and observational testing;
	3.3B represent the natural world using models such as volcanoes or the Sun, Earth, and Moon system and identify their limitations, including size, properties, and materials; and
	3.3C connect grade-level appropriate science concepts with the history of science, science careers, and contributions of scientists.
3.4	Scientific investigation and reasoning. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to
	3.4 collect, record, and analyze information using tools, including cameras, computers, hand lenses, metric rulers, Celsius thermometers, wind vanes, rain gauges, pan balances, graduated cylinders, beakers, spring scales, hot plates, meter sticks, magnets, collecting nets, notebooks, and Sun, Earth, and Moon system models; timing devices; and materials to support observation of habitats of organisms such as terrariums and aquariums.

Works Cited

Schmidt, Catherine, and Molly O'Halloran (illustrator). 2018. *World Traveler: The Sphinx*. *Geodes*®, Level 1. Washington, DC: Great Minds.