Pacing Guide

Level 1 Module 1

PUSHES AND PULLS

with Spotlight Lessons on Weather Conditions

Each *PhD Science® Texas* Level 1 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 student needs. Choose one or more options for each lesson. Note that pacing options do not omit parts of lessons. Teacher choice days are also included in this pacing guide to allow for review, reteaching, assessment, and extension activities.

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.

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.

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

Module at a Glance

This module contains 24 lessons plus 7 spotlight lessons on Weather Conditions. Even with lesson splits and teacher choice days, this module should take no more than 45 days to complete. This maximum number of days ensures the implementation of all Level 1 modules within a school year that has 150 days of science instruction.

Pushes and Pulls

ANCHOR PHENOMENON:

Tugboats Moving Cargo Ships

ESSENTIAL QUESTION:

How do tugboats move cargo ships through a harbor?

Concept	Recommended Number of Days	TEKS Alignment	ELPS Alignment
Concept 1 (Lessons 1–9): Starting Movement **Focus Question:** What causes objects to start moving? Pushes and pulls can cause objects to start moving. The strength of the pushes and pulls can affect the speed of the objects.	9–14 days	1.1A, 1.1B, 1.1C, 1.1D, 1.1E, 1.1F, 1.1G, 1.2A, 1.2B, 1.3A, 1.3C, 1.5A, 1.5B, 1.5C, 1.7A, 1.7B	3D, 3G, 3H, 4A, 4D
Concept 2 (Lessons 10–16): Changing Movement **Focus Question:** What causes moving objects to change direction or stop? Pushes and pulls can cause moving objects to change direction or stop.	7–13 days	1.1A, 1.1B, 1.1C, 1.1D, 1.1E, 1.1F, 1.1G, 1.2A, 1.3A, 1.3B, 1.5B, 1.5C, 1.7A, 1.7B	1A, 2E, 3E, 3F
Application of Concepts (Lessons 17–21): Engineering Challenge **Focus Question:** How can we help a tugboat stop close to a dock? People can use the engineering design process to create a device that helps a tugboat stop close to a dock.	5 days	1.1A, 1.1B, 1.1C, 1.1D, 1.1E, 1.1F, 1.1G, 1.2B, 1.2C, 1.2D, 1.3A, 1.3B, 1.4A, 1.4B, 1.5B, 1.5F, 1.6A, 1.6C, 1.7A, 1.7B	3E, 3F, 4D
Applications of Concepts (Lessons 22–24): End-of-Module Socratic Seminar, Assessment, and Debrief **Essential Question:** How do tugboats move cargo ships through a harbor? Pushes and pulls can cause objects to start moving and can cause their movement to change.	3–4 days	1.1E, 1.1F, 1.1G, 1.2C, 1.3B, 1.3C, 1.5A, 1.5B, 1.5C, 1.6A, 1.6C, 1.7A, 1.7B	3E

Spotlight Lessons on Weather Conditions

Lesson Sets	Recommended Number of Days	TEKS Alignment	ELPS Alignment
Lessons 1–3: Describing and Recording Weather **Phenomenon Question:** How can we describe the weather? People use weather data to make choices about clothing and activities.	3–4 days	1.1C, 1.1D, 1.1E, 1.1F, 1.5A, 1.5G, 1.10D	1A, 3H, 4D
Lessons 4–5: Seasonal Patterns **Phenomenon Question:** What changes can we expect to observe from one season to the next? Changes in weather and environments occur in predictable patterns each year.	2 days	1.1E, 1.1F, 1.2B, 1.3B, 1.5A, 1.5G, 1.9, 1.10D	1A, 2E
Lessons 6–7: Seasonal Events **Phenomenon Question:** How can we predict when the cherry blossom trees in Washington, DC, will bloom? People can use weather data and seasonal weather patterns to make daily choices and plan for future events.	2–3 days	1.1E, 1.1F, 1.2B, 1.3A, 1.3B, 1.5A, 1.5B, 1.5G, 1.9, 1.10D	4F

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 5 days a week.

Module 1	Module 2	Module 3
August	November	February
September	December	March
October	January	April

MODULE 1

Pushes and Pulls

CONCEPT 1

What causes objects to start moving? 9–14 days

Lessons 1–3: Tugboats Moving Cargo Ships

TEKS 1.7A, 1.7B, 1.1A, 1.1G, 1.2A, 1.5A **ELPS** 3D, 4D

Lessons	Pacing Options
Lesson 1: Explore what tugboats do in harbors.	Use Differentiation note in Read About Tugboats.
Lesson 2: Construct an anchor model of a tugboat moving a cargo ship.	**Day 1:** Launch through Model Tugboats in New York Harbor **Day 2:** Develop Anchor Model through Land
Lesson 3: Ask questions about tugboats moving cargo ships.	Use Differentiation note in Build Driving Question Board.

Lessons 4–6: Making Objects Start to Move

TEKS 1.7A, 1.7B, 1.1B, 1.1C, 1.1D, 1.1E, 1.1F, 1.1G, 1.2A, 1.2B, 1.3A, 1.3C, 1.5A, 1.5B **ELPS** 4A

Lessons	Pacing Options
Lesson 4: Categorize actions as pushes or pulls.	**Day 1:** Launch through Explore Movement **Day 2:** Sort Actions through Land Think Aloud one toy in Explore Movement.
Lesson 5: Record and reflect on observations of pushes and pulls.	Use Differentiation note in Draw Pushes and Pulls.
Lesson 6: Apply new understanding of pushes and pulls to the anchor phenomenon.	Complete Launch before the lesson.

Lessons 7–8: Push and Pull Strength

TEKS 1.7A, 1.7B, 1.1B, 1.1C, 1.1E, 1.1F, 1.1G, 1.2A, 1.3A, 1.5B, 1.5C **ELPS** 3H

Lessons	Pacing Options
Lesson 7: Investigate stronger and weaker pushes.	**Day 1:** Launch through Investigate Pushes **Day 2:** Compare Results through Land Use second English Language Development note in Investigate Pushes.
Lesson 8: Apply knowledge of stronger and weaker pushes and pulls to the anchor phenomenon.	**Day 1:** Launch through Revisit Water Model **Day 2:** Update Anchor Chart through Land

Lesson 9: Starting Movement

TEKS 1.7A, 1.1A, 1.1F, 1.5B **ELPS** 3G

Lessons	Pacing Options
Lesson 9: Use knowledge of pushes and pulls to determine the outcome of a skateboard race.	**Day 1:** Launch through Conceptual Checkpoint Part B **Day 2:** Debrief Conceptual Checkpoint through Land Use second Teacher Note in Prepare for Conceptual Checkpoint. **Conceptual Checkpoint**

CONCEPT 2

What causes moving objects to change direction or stop? 7–13 days

Lessons 10–12: Changing Direction

TEKS 1.7A, 1.7B, 1.1A, 1.1B, 1.1E, 1.1F, 1.1G, 1.2A, 1.3B, 1.5B, 1.5C **ELPS** 3E, 3F

Lessons	Pacing Options
Lesson 10: Plan an investigation to determine how tugboats can turn a cargo ship.	**Day 1:** Launch through Create Direction Investigation Plan **Day 2:** Plan Tugboat Placement through Land Use Differentiation note in Create Direction Investigation Plan.
Lesson 11: Investigate how tugboats use pushes and pulls to turn a cargo ship.	Use Differentiation note in Investigate Direction.
Lesson 12: Apply new learning about changing the direction of an object's movement to the anchor model.	**Day 1:** Launch through Revisit Water Model **Day 2:** Update Anchor Model through Land Use first Teacher Note in Revisit Water Model. Use Differentiation note in Revisit Water Model.

Lessons 13–15: Slowing Down and Stopping

TEKS 1.7A, 1.7B, 1.1B, 1.1C, 1.1D, 1.1G, 1.2A, 1.5B, 1.5C **ELPS** 1A

Lessons	Pacing Options
Lesson 13: Plan an investigation to explore how a tugboat can make a cargo ship slow down and stop.	**Day 1:** Launch through Explore Difference Between Models **Day 2:** Plan Stopping Investigation through Land Use Teacher Note in Plan Stopping Investigation.
Lesson 14: Investigate how a tugboat uses pushes and pulls to make a cargo ship slow down and stop.	**Day 1:** Launch through Investigate Slowing Down and Stopping **Day 2:** Make Predictions with Water Model through Land
Lesson 15: Identify simultaneous pushes between a pair of objects.	**Day 1:** Launch through Explore Collisions with Water Model **Day 2:** Update Anchor Chart through Land

Lesson 16: Changing Movement

TEKS 1.7A, 1.1G, 1.3A, 1.5B **ELPS** 2E

Lessons	Pacing Options
Lesson 16: Identify how soccer players use pushes and pulls to change the movement of the ball.	**Day 1:** Launch through Conceptual Checkpoint Part B **Day 2:** Debrief Conceptual Checkpoint through Land **Conceptual Checkpoint**

APPLICATION OF CONCEPTS

How can we help a tugboat stop close to a dock? 5 days

Lesson 17: Preparation for Engineering Challenge

TEKS 1.6C, 1.1A, 1.1C, 1.1G, 1.4B, 1.5F **ELPS** 3E

Lessons	Pacing Options
Lesson 17: Take apart an object to identify a system and that system's parts.	Think Aloud one card in Observe and Compare Bicycles.

Lessons 18–21: Engineering Challenge

TEKS 1.6A, 1.6C, 1.7A, 1.7B, 1.1A, 1.1B, 1.1C, 1.1D, 1.1E, 1.1F, 1.1G, 1.2B, 1.2C, 1.2D, 1.3A, 1.3B, 1.4A, 1.4B, 1.5B **ELPS** 3F, 4D

Lessons	Pacing Options
Lesson 18: Apply the engineering design process to create a model cushion that helps a tugboat stop close to a dock.	**Engineering Challenge**
Lesson 19: Apply the engineering design process to create a model cushion that helps a tugboat stop close to a dock.	Use second Teacher Note in Imagine Dock Cushions. Use fifth Teacher Note in Imagine Dock Cushions. Use Differentiation note in Plan Dock Cushions. **Engineering Challenge**
Lesson 20: Apply the engineering design process to create a model cushion that helps a tugboat stop close to a dock.	Use inline Teacher Note in Improve Dock Cushions. **Engineering Challenge**
Lesson 21: Apply the engineering design process to create a model cushion that helps a tugboat stop close to a dock.	**Engineering Challenge**

APPLICATION OF CONCEPTS

How do tugboats move cargo ships through a harbor? 3–4 days

Lessons 22–24: End-of-Module Socratic Seminar, Assessment, and Debrief

TEKS 1.6A, 1.6C, 1.7A, 1.7B, 1.1E, 1.1F, 1.1G, 1.2C, 1.3B, 1.3C, 1.5A, 1.5B, 1.5C **ELPS** 3E

Lessons	Pacing Options
Lesson 22: Explain how tugboats use pushes and pulls to help move cargo ships. (Socratic Seminar)	 Use an alternative collaborative conversation routine in Launch.  Use Teacher Note in Engage in Socratic Seminar.  Use Differentiation note in Land. **Socratic Seminar**
Lesson 23: Explain how people use pushes and pulls to play carnival games. (End-of-Module Assessment)	**End-of-Module Assessment**
Lesson 24: Explain how pushes and pulls can start, stop, or change the direction of an object's movement. (End-of-Module Debrief)	 Use an alternative collaborative conversation routine in Debrief End-of-Module Assessment. **End-of-Module Assessment Debrief**
Teacher Choice Day	Review, reteach, assess, or complete extension activities.

SPOTLIGHT LESSONS ON

Weather Conditions

How can weather data help us make daily choices? 7–9 days

Lessons 1–3: Describing and Recording Weather

TEKS 1.10D, 1.1C, 1.1D, 1.1E, 1.1F, 1.5A, 1.5G **ELPS** 1A, 3H, 4D

Lessons	Pacing Options
Lesson 1: Describe wind, amounts of cloud cover, and whether it is raining or snowing.	**Day 1:** Launch through Describe Wind **Day 2:** Describe Cloud Cover through Land Use Teacher Note in Create Class Weather Chart.
Lesson 2: Describe temperature and record the local weather.	Use second Teacher Note in Collect and Record Weather Data. Use third Teacher Note in Collect and Record Weather Data. Use Teacher Note in Land.
Lesson 3: Identify appropriate clothing and activities for observed weather.	None

Lessons 4–5: Seasonal Patterns

TEKS 1.9, 1.10D, 1.1E, 1.1F, 1.2B, 1.3B, 1.5A, 1.5G **ELPS** 1A, 2E

Lessons	Pacing Options
Lesson 4: Analyze weather data to identify patterns in seasonal weather changes.	Use an alternative collaborative conversation routine in Analyze Yearly Weather Data. Use first Teacher Note in Land.
Lesson 5: Observe a time-lapse video to identify differences between seasons in a forest environment.	None

Lessons 6–7: Seasonal Events

TEKS 1.9, 1.10D, 1.1E, 1.1F, 1.2B, 1.3A, 1.3B, 1.5A, 1.5B, 1.5G **ELPS** 4F

Lessons	Pacing Options
Lesson 6: Explain that cherry blossom trees in Washington, DC, bloom in spring each year. (End-of-Spotlight Assessment)	Use an alternative collaborative conversation routine in Launch. **End-of-Spotlight Assessment**
Lesson 7: Explain that cherry blossom trees in Washington, DC, bloom in spring each year. (End-of-Spotlight Debrief)	Use Differentiation note in Reflect on Recurring Themes and Concepts in Spotlight Learning. **End-of-Spotlight Assessment Debrief**
Teacher Choice Day	Review, reteach, assess, or complete extension activities.

Texas Essential Knowledge and Skills (TEKS)

Content Standards

1.6 Matter and its properties. The student knows that objects have physical properties that determine how they are described and classified. The student is expected to

- **1.6A** classify objects by observable physical properties, including, shape, color, and texture, and attributes such as larger and smaller and heavier and lighter; and
- **1.6C** demonstrate and explain that a whole object is a system made of organized parts such as a toy that can be taken apart and put back together.

1.7 Force, motion, and energy. The student knows that forces cause changes in motion and position in everyday life. The student is expected to

- **1.7A** explain how pushes and pulls can start, stop, or change the speed or direction of an object's motion and
- **1.7B** plan and conduct a descriptive investigation that predicts how pushes and pulls can start, stop, or change the speed or direction of an object's motion.

1.9 The student knows that the natural world has recognizable patterns. The student is expected to

- **1.9** Describe and predict the patterns of seasons of the year such as order of occurrence and changes in nature.

1.10 The student knows that the natural world includes earth materials that can be observed in systems and processes. The student is expected to

- **1.10D** Describe and record observable characteristics of weather, including hot or cold, clear or cloudy, calm or windy, or rainy or icy and explain their impact on daily choices.

Scientific and Engineering Practices

1.1 Scientific and engineering practices. The student asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to

- **1.1A** ask questions and define problems based on observations or information from text, phenomena, models, or investigations;
- **1.1B** use scientific practices to plan and conduct simple descriptive investigations and use engineering practices to design solutions to problems;
- **1.1C** identify, describe, and demonstrate safe practices during classroom and field investigations as outlined in Texas Education Agency–approved safety standards;
- **1.1D** use tools, including hand lenses, goggles, heat-resistant gloves, trays, cups, bowls, beakers, sieves/sifters, tweezers, primary balance, notebooks, terrariums, aquariums, stream tables, soil samples (loam, sand, gravel, rocks, and clay), seeds, plants, windsock, pinwheel, student thermometer, demonstration thermometer, rain gauge, straws, ribbons, non-standard measuring items, flashlights, sandpaper, wax paper, items that are magnetic, non-magnetic items, a variety of magnets, hot plate, aluminum foil, Sun-Moon-Earth model, and plant and animal life cycle models to observe, measure, test, and compare;
- **1.1E** collect observations and measurements as evidence;
- **1.1F** record and organize data using pictures, numbers, words, symbols, and simple graphs; and
- **1.1G** develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem.

1.2 Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to

- **1.2A** identify basic advantages and limitations of models such as their size, properties, and materials;
- **1.2B** analyze data by identifying significant features and patterns;
- **1.2C** use mathematical concepts to compare two objects with common attributes; and
- **1.2D** evaluate a design or object using criteria to determine if it works as intended.

1.3 Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to

- **1.3A** develop explanations and propose solutions supported by data and models;
- **1.3B** communicate explanations and solutions individually and collaboratively in a variety of settings and format; and
- **1.3C** listen actively to others' explanations to identify important evidence and engage respectfully in scientific discussion.

1.4 Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation for society. The student is expected to

- **1.4A** explain how science or an innovation can help others; and
- **1.4B** identify scientists and engineers such as Katherine Johnson, Sally Ride, and Ernest Just and explore what different scientists and engineers do.

Recurring Themes and Concepts

1.5 Recurring themes and concepts. The student uses recurring themes and concepts to make connections across disciplines. The student is expected to

- **1.5A** identify and use patterns to describe phenomena or design solutions;
- **1.5B** investigate and predict cause-and-effect relationships in science;
- **1.5C** describe the properties of objects in terms of relative size (scale) and relative quantity;
- **1.5F** describe the relationship between structure and function of objects, organisms, and systems; and
- **1.5G** describe how factors or conditions can cause objects, organisms, and systems to either change or stay the same.

English Language Proficiency Standards (ELPS)

1A Use prior knowledge and experiences to understand meanings in English.

2E Use visual, contextual, and linguistic support to enhance and confirm understanding of increasingly complex and elaborated spoken language.

3D Speak using grade-level content area vocabulary in context to internalize new English words and build academic language proficiency.

3E Share information in cooperative learning interactions.

3F Ask and give information ranging from using a very limited bank of high-frequency, high-need, concrete vocabulary, including key words and expressions needed for basic communication in academic and social contexts, to using abstract and content-based vocabulary during extended speaking assignments.

3G Express opinions, ideas, and feelings ranging from communicating single words and short phrases to participating in extended discussions on a variety of social and grade-appropriate academic topics.

3H Narrate, describe, and explain with increasing specificity and detail as more English is acquired.

4A Learn relationships between sounds and letters of the English language and decode (sound out) words using a combination of skills such as recognizing sound-letter relationships and identifying cognates, affixes, roots, and base words.

4D Use prereading supports such as graphic organizers, illustrations, and pretaught topic-related vocabulary and other prereading activities to enhance comprehension of written text.

4F Use visual and contextual support and support from peers and teachers to read grade-appropriate content area text, enhance and confirm understanding, and develop vocabulary, grasp of language structures, and background knowledge needed to comprehend increasingly challenging language.