Pacing Guide

Level 5 Module 2

ECOSYSTEMS

Each *PhD Science® Texas* Level 5 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 29 lessons on Ecosystems. Even with lesson splits and teacher choice days, this module should take no more than 43 days to complete. This maximum number of days ensures the implementation of all Level 5 modules within a school year that has 150 days of science instruction.

Ecosystems

ANCHOR PHENOMENON:

Life Around a Mangrove Tree

ESSENTIAL QUESTION:

How can trees support so much life?

Concept	Recommended Number of Days	TEKS Alignment	ELPS Alignment
Concept 1 (Lessons 1–7): Living Plant Matter **Focus Question:** How do plants grow? Plants get most of the matter they need for growth from air and water.	7–11 days	4.12A, 4.12B, 5.1A, 5.1B, 5.1C, 5.1D, 5.1E, 5.1G, 5.2B, 5.2D, 5.3A, 5.3B, 5.3C, 5.5B, 5.5D, 5.5E, 5.12A, 5.12B	2I, 3F, 3H, 4A
Concept 2 (Lessons 8–17): Life's Matter **Focus Question:** Where does life's matter come from? Plants and animals depend on matter for growth and survival. Life's matter moves between plants, animals, decomposers, and the environment as it cycles through an ecosystem.	10–16 days	3.12B, 3.13A, 4.12B, 4.13A, 4.13B, 5.1A, 5.1B, 5.1C, 5.1D, 5.1E, 5.1F, 5.1G, 5.2A, 5.2B, 5.3A, 5.3B, 5.3C, 5.5A, 5.5B, 5.5D, 5.5E, 5.5F, 5.12A, 5.12B, 5.12C, 5.13A, 5.13B	1A, 3C, 3E, 3H, 4A
Concept 3 (Lessons 18–22): Life's Energy **Focus Question:** Where does life's energy come from? Life's energy can be traced from the Sun to plants and then to animals and decomposers as it flows through an ecosystem.	5–7 days	3.13A, 3.13B, 4.12A, 5.1D, 5.1E, 5.2B, 5.2D, 5.3A, 5.3B, 5.3C, 5.5E, 5.5F, 5.12A, 5.12B, 5.13A	2E, 4C, 4F
Application of Concepts (Lessons 23–26): Engineering Challenge **Phenomenon Question:** How can we reduce the damage an invasive species causes to an ecosystem? Reducing the impact of invasive species can protect the health of an ecosystem.	4–5 days	3.12B, 4.12B, 5.1A, 5.1B, 5.1C, 5.2A, 5.3A, 5.3B, 5.3C, 5.4A, 5.5A, 5.5B, 5.5D, 5.5E, 5.5G, 5.12A, 5.12B, 5.12C	3E, 4F

Concept	Recommended Number of Days	TEKS Alignment	ELPS Alignment
Application of Concepts (Lessons 27–29): End-of-Module Socratic Seminar, Assessment, and Debrief **Essential Question:** How can trees support so much life? Ecosystems support the needs of living things as matter and energy move between organisms and the environment.	3–4 days	5.1E, 5.1F, 5.1G, 5.3A, 5.3C, 5.4A, 5.5B, 5.5E, 5.5F, 5.12A, 5.12B, 5.12C, 5.13A, 5.13B	3F

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 2

Ecosystems

CONCEPT 1

How do plants grow? 7–11 days

Lessons 1–2: Life Around One Tree

TEKS 4.12B, 5.12A, 5.1A, 5.1G, 5.3C, 5.5D **ELPS** 3H, 4A

Lessons	Pacing Options
Lesson 1: Observe an ecosystem containing a tree.	**Day 1:** Launch through Read About and Discuss Mangrove Tree Ecosystems **Day 2:** Explore Organism Interactions through Land Read *The Mangrove Tree* (Roth and Trumbore 2011) before the lesson.
Lesson 2: Develop a model of feeding interactions among organisms.	**Day 1:** Launch through Model Organism Interactions **Day 2:** Develop Anchor Model through Land Use Teacher Note in Develop Anchor Model.

Lessons 3–5: Seed to Tree

TEKS 4.12A, 5.12A, 5.12B, 5.1B, 5.1C, 5.1D, 5.1E, 5.2B, 5.2D, 5.3A, 5.3B, 5.5B **ELPS** 3F

Lessons	Pacing Options
Lesson 3: Design a fair test to determine factors that affect plant growth.	**Day 1:** Launch through Develop Initial Claim **Day 2:** Develop Fair Test Criteria through Land Use Differentiation note in Develop Initial Claim.
Lesson 4: Plan and conduct an experimental investigation to identify the sources of matter plants need for growth.	Weigh soil and place in bottles in Conduct Investigation before the lesson.
Lesson 5: Use evidence to argue that plants use matter from air and water to grow.	Use an alternative collaborative conversation routine in Gather Evidence of Plant Matter Sources.

Lessons 6–7: Gas Cycling

TEKS 4.12A, 4.12B, 5.12A, 5.12B, 5.1D, 5.1G, 5.2B, 5.3A, 5.5B, 5.5D, 5.5E **ELPS** 2I

Lessons	Pacing Options
Lesson 6: Analyze data to explain how gasses cycle between plants and the air in ecosystems.	None
Lesson 7: Observe and describe how gases cycle between plants, animals, and air in ecosystems.	**Conceptual Checkpoint**
Teacher Choice Day	Review, reteach, assess, or complete extension activities.

CONCEPT 2

Where does life's matter come from? 10–16 days

Lessons 8–9: Movement of Matter

TEKS 3.12B, 4.12B, 5.12A, 5.12B, 5.12C, 5.1A, 5.1B, 5.1G, 5.2A, 5.2B, 5.3A, 5.5A, 5.5B, 5.5D, 5.5E **ELPS** 3E

Lessons	Pacing Options
Lesson 8: Make a claim about how animals use matter from the environment.	**Day 1:** Launch through Develop Initial Claim **Day 2:** Examine Historical Yellowstone Data through Land Use Differentiation note in Develop Initial Claim.
Lesson 9: Model and predict the movement of matter in the environment from plants to animals.	**Day 1:** Launch through Model Feeding Interactions **Day 2:** Update Anchor Model through Land Use an alternative collaborative conversation routine in Trace Movement of Matter.

Lessons 10–12: Survival

TEKS 3.13A, 4.13A, 4.13B, 5.13A, 5.13B, 5.1A, 5.1E, 5.1F, 5.1G, 5.3B, 5.3C, 5.5A, 5.5F **ELPS** 1A, 3C

Lessons	Pacing Options
Lesson 10: Model organisms' characteristics to determine how they enable the animals to survive in their environment.	**Day 1:** Launch through Model Bird Beaks **Day 2:** Identify Animals' Environments through Land Prepare class chart with headings and wildlife photographs in Identify Animals' Environments before the lesson.
Lesson 11: Analyze organisms' characteristics to determine how they enable the organisms to survive in their environment.	Share videos and allow students to record observations and evidence in Analyze Organisms in Different Environments. Use Differentiation note in Land.
Lesson 12: Identify instinctual and learned behavior traits to explain how they enable animals to survive in their environment.	Think Aloud one animal card in Identify Inherited Traits.

Lessons 13–14: Decomposition

TEKS 4.12B, 5.12A, 5.12B, 5.1A, 5.1C, 5.1D, 5.3A, 5.3B, 5.5A, 5.5B, 5.5E **ELPS** 3E, 4A

Lessons	Pacing Options
Lesson 13: Make a claim supported by evidence about how mold grows.	None
Lesson 14: Explain how decomposers recycle matter in an ecosystem.	Use an alternative collaborative conversation routine in Land.

Lessons 15–16: Decomposers and the Environment

TEKS 4.12B, 5.12A, 5.12B, 5.1A, 5.1B, 5.1C, 5.1D, 5.1E, 5.3B, 5.5B, 5.5D, 5.5E **ELPS** 3E

Lessons	Pacing Options
Lesson 15: Use evidence to make a claim about the presence of decomposers in sand and soil.	None
Lesson 16: Gather and analyze data to compare the amount of nutrients in sand and soil.	**Day 1:** Launch through Explore Nutrient-Deficient Plants **Day 2:** Analyze Data through Land Use Differentiation note in Read About Nutrients and Growth.

Lesson 17: Matter Cycling

TEKS 4.12B, 4.13B, 5.12A, 5.12B, 5.13A, 5.13B, 5.1E, 5.1G, 5.2A, 5.3A, 5.3B, 5.3C, 5.5B, 5.5D, 5.5F **ELPS** 3H

Lessons	Pacing Options
Lesson 17: Model and explain how matter cycles among plants, animals, decomposers, and the environment.	**Day 1:** Launch through Model Movement of Matter **Day 2:** Update Anchor Model through Land **Conceptual Checkpoint**
Teacher Choice Day	Review, reteach, assess, or complete extension activities.

CONCEPT 3

Where does life's energy come from? 5–7 days

Lessons 18–20: Food and Energy

TEKS 3.13A, 3.13B, 5.12B, 5.13A, 5.1E, 5.2B, 5.2D, 5.3A, 5.3B, 5.5E, 5.5F **ELPS** 2E, 4F

Lessons	Pacing Options
Lesson 18: Use evidence to support the claim that food is a source of both matter and energy.	Use second Differentiation note in Identify Relationships.
Lesson 19: Identify ways that animals use energy from food.	None
Lesson 20: Analyze data to determine that animals can store energy from food for later use.	None

Lessons 21–22: Sunlight

TEKS 4.12A, 5.12A, 5.12B, 5.1D, 5.1E, 5.3A, 5.3C, 5.5E **ELPS** 4C

Lessons	Pacing Options
Lesson 21: Gather evidence to support the claim that plants harness energy from sunlight.	Use an alternative collaborative conversation routine in Observe the Photosynthesis Process.
Lesson 22: Model the flow of energy through an ecosystem.	**Day 1:** Launch through Update Anchor Chart **Day 2:** Conceptual Checkpoint through Land **Conceptual Checkpoint**
Teacher Choice Day	Review, reteach, assess, or complete extension activities.

ENGINEERING CHALLENGE

How can we reduce the damage an invasive species causes to an ecosystem? 4–5 days

Lesson 23: Preparation for Engineering Challenge

TEKS 3.12B, 4.12B, 5.12B, 5.12C, 5.2A, 5.3A, 5.3C, 5.5A, 5.5B, 5.5G **ELPS** 4F

Lessons	Pacing Options
Lesson 23: Explain how an organism can affect the ability of other organisms to meet their needs.	**Day 1:** Launch through Learn About the Emerald Ash Borer **Day 2:** Analyze Ash Tree Data through Land **Engineering Challenge**

Lessons 24–26: Engineering Challenge

TEKS 3.12B, 4.12B, 5.12A, 5.12B, 5.12C, 5.1A, 5.1B, 5.1C, 5.3B, 5.4A, 5.5B, 5.5D, 5.5E, 5.5G **ELPS** 3E

Lessons	Pacing Options
Lesson 24: Apply the engineering design process to research, propose, and reflect on solutions to reduce the impact of an invasive species on an ecosystem.	**Engineering Challenge**
Lesson 25: Apply the engineering design process to research, propose, and reflect on solutions to reduce the impact of an invasive species on an ecosystem.	**Engineering Challenge**
Lesson 26: Apply the engineering design process to research, propose, and reflect on solutions to reduce the impact of an invasive species on an ecosystem.	Use second Teacher Note in Share a Solution. Use Differentiation note in Share a Solution. **Engineering Challenge**

APPLICATION OF CONCEPTS

How can trees support so much life? 3–4 days

Lessons 27–29: End-of-Module Socratic Seminar, Assessment, and Debrief

TEKS 5.12A, 5.12B, 5.12C, 5.13A, 5.13B, 5.1E, 5.1F, 5.1G, 5.3A, 5.3C, 5.4A, 5.5B, 5.5E, 5.5F **ELPS** 3F

Lessons	Pacing Options
Lesson 27: Explain how organisms survive and how matter and energy move through organisms and ecosystems.	Use English Language Development note in Engage in Socratic Seminar. **Socratic Seminar**
Lesson 28: Explain how organisms survive and how matter and energy move through organisms and ecosystems.	**End-of-Module Assessment**
Lesson 29: Explain how organisms survive and how matter and energy move through organisms and ecosystems.	**End-of-Module Assessment Debrief**
Teacher Choice Day	Review, reteach, assess, or complete extension activities. Optional Assessment: Benchmark 2

Texas Essential Knowledge and Skills (TEKS)

Content Standards

3.12 Organisms and environments. The student describes patterns, cycles, systems, and relationships within environments. The student is expected to

3.12B identify and describe the flow of energy in a food chain and predict how changes in a food chain such as removal of frogs from a pond or bees from a field affect the ecosystem.

3.13 Organisms and environments. The student knows that organisms undergo similar life processes and have structures that function to help them survive within their environments. The student is expected to

3.13A explore and explain how external structures and functions of animals such as the neck of a giraffe or webbed feet on a duck enable them to survive in their environment; and

3.13B explore, illustrate, and compare life cycles in organisms such as beetles, crickets, radishes, or lima beans.

4.12 Organisms and environments. The student describes patterns, cycles, systems, and relationships within environments. The student is expected to

4.12A investigate and explain how most producers can make their own food using sunlight, water, and carbon dioxide through the cycling of matter; and

4.12B describe the cycling of matter and flow of energy through food webs, including the roles of the Sun, producers, consumers, and decomposers.

4.13 Organisms and environments. The student knows that organisms undergo similar life processes and have structures that function to help them survive within their environments. The student is expected to

4.13A explore and explain how structures and functions of plants such as waxy leaves and deep roots enable them to survive in their environment; and

4.13B differentiate between inherited and acquired physical traits of organisms.

5.12 Organisms and environments. The student describes patterns, cycles, systems, and relationships within environments. The student is expected to

5.12A observe and describe how a variety of organisms survive by interacting with biotic and abiotic factors in a healthy ecosystem;

5.12B predict how changes in the ecosystem affect the cycling of matter and flow of energy in a food web; and

5.12C describe a healthy ecosystem and how human activities can be beneficial or harmful to an ecosystem.

5.13 Organisms and environments. The student knows that organisms undergo similar life processes and have structures and behaviors that help them survive within their environments. The student is expected to

5.13A analyze the structures and functions of different species to identify how organisms survive in the same environment; and

5.13B explain how instinctual behavioral traits such as turtle hatchlings returning to the sea and learned behavioral traits such as orcas hunting in packs increase chances of survival.

Scientific and Engineering Practices

5.1 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

- **5.1A** ask questions and define problems based on observations or information from text, phenomena, models, or investigations;
- **5.1B** use scientific practices to plan and conduct descriptive and simple experimental investigations and use engineering practices to design solutions to problems;
- **5.1C** demonstrate safe practices and the use of safety equipment during classroom and field investigations as outlined in Texas Education Agency–approved safety standards;
- **5.1D** use tools, including calculators, microscopes, hand lenses, metric rulers, Celsius thermometers, prisms, concave and convex lenses, laser pointers, mirrors, digital scales, balances, spring scales, graduated cylinders, beakers, hot plates, meter sticks, magnets, collecting nets, notebooks, timing devices, materials for building circuits, materials to support observations of habitats or organisms such as terrariums and aquariums, and materials to support digital data collection such as computers, tablets, and cameras to observe, measure, test, and analyze information;
- **5.1E** collect observations and measurements as evidence;
- **5.1F** construct appropriate graphic organizers used to collect data, including tables, bar graphs, line graphs, tree maps, concept maps, Venn diagrams, flow charts or sequence maps, and input-output tables that show cause and effect; and
- **5.1G** develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem.

5.2 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

- **5.2A** identify advantages and limitations of models such as their size, scale, properties, and materials;
- **5.2B** analyze data by identifying any significant features, patterns, or sources of error; and
- **5.2D** evaluate experimental and engineering designs.

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

- **5.3A** develop explanations and propose solutions supported by data and models;
- **5.3B** communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and
- **5.3C** listen actively to others' explanations to identify relevant evidence and engage respectfully in scientific discussion.

5.4 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

- **5.4A** explain how scientific discoveries and innovative solutions to problems impact science and society.

Recurring Themes and Concepts

5.5 Recurring themes and concepts. The student understands that recurring themes and concepts provide a framework for making connections across disciplines. The student is expected to

- **5.5A** identify and use patterns to explain scientific phenomena or to design solutions;
- **5.5B** identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems;
- **5.5D** examine and model the parts of a system and their interdependence in the function of the system;
- **5.5E** investigate how energy flows and matter cycles through systems and how matter is conserved;
- **5.5F** explain the relationship between the structure and function of objects, organisms, and systems; and
- **5.5G** explain how factors or conditions impact stability and change in objects, organisms, and systems.

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.
- **2I** Demonstrate listening comprehension of increasingly complex spoken English by following directions, retelling or summarizing spoken messages, responding to questions and requests, collaborating with peers, and taking notes commensurate with content and grade-level needs.
- **3C** Speak using a variety of grammatical structures, sentence lengths, sentence types, and connecting words with increasing accuracy and ease as more English is acquired.
- **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.
- **3H** Narrate, describe, and explain with increasing pecificity 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.
- **4C** Develop basic sight vocabulary, derive meaning of environmental print, and comprehend English vocabulary and language structures used routinely in written classroom materials.
- **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.