Pacing Guide

Level K Module 3

LIGHT

with Spotlight Lessons on the Sky

Each *PhD Science*® Texas Level K 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 11 spotlight lessons on Sky. 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 K modules within a school year that has 150 days of science instruction.

Light

ANCHOR PHENOMENON:

Wayang Shadow Puppetry

ESSENTIAL QUESTION:

How do puppeteers use light to tell stories during wayang shows?

Concept	Recommended Number of Days	TEKS Alignment	ELPS Alignment
Concept 1 (Lessons 1–9): Sight **Focus Question:** Why do we need light to see objects? People can see objects when light illuminates the objects or when the objects give off their own light.	9–12 days	K.1A, K.1C, K.1D, K.1E, K.1G, K.2A, K.2B, K.3A, K.3B, K.4B, K.5A, K.5B, K.5D, K.5E, K.5F, K.5G, K.6, K.8A, K.8B	2I, 3H, 4C, 4D, 4F, 5B
Concept 2 (Lessons 10–15): Interactions with Light **Focus Question:** How does light interact with different objects? Light interacts with different objects in different ways.	6–8 days	K.1A, K.1B, K.1C, K.1D, K.1E, K.1F, K.1G, K.2A, K.2B, K.3A, K.3B, K.4A, K.4B, K.5A, K.5B, K.5D, K.5E, K.5F, K.5G, K.6, K.8B, K.9A, K.9B, K.10B	1A, 3D, 3H
Application of Concepts (Lessons 16–19): Science Challenge **Phenomenon Question:** What materials work well as wayang screens? Different materials allow no light, some light, or all light to travel through them.	4–5 days	K.1A, K.1B, K.1C, K.1D, K.1E, K.1F, K.1G, K.2A, K.2B, K.2C, K.3B, K.3C, K.5A, K.5B, K.5C, K.5D, K.5E, K.6, K.8B	1E
Concept 2 (Lessons 20–21): Interactions with Light **Focus Question:** How does light interact with different objects? Light interacts with different objects in different ways.	2–4 days	K.1D, K.1G, K.2B, K.3A, K.3B, K.5A, K.5B, K.6, K.8B	1E

Concept	Recommended Number of Days	TEKS Alignment	ELPS Alignment
Applications of Concepts (Lessons 22–24): End-of-Module Socratic Seminar, Assessment, and Debrief **Essential Question:** How do puppeteers use light to tell stories during wayang shows? The way light interacts with objects affects what people see.	3–4 days	K.1E, K.1G, K.3A, K.3B, K.3C, K.5A, K.5B, K.5D, K.5G, K.6, K.8A, K.8B	3E, 3F, 3G

Spotlight Lessons on Sky

Lesson Sets	Recommended Number of Days	TEKS Alignment	ELPS Alignment
Lessons 1–4: Day and Night **Phenomenon Question:** What changes can we observe from day to night? The sky and objects in it change in different ways from day to night.	4 days	K.1E, K.1F, K.1G, K.2A, K.5A, K.5G, K.9A, K.9B	2D, 4D, 4G, 5B
Lessons 5–8: Seasons **Phenomenon Question:** How do changes in the weather affect the Congress Avenue Bridge bats? A season is a part of the year with a pattern of similar weather.	4 days	K.1E, K.1F, K.2B, K.2C, K.3A, K.5A, K.5G, K.10B, K.12B	4F
Lessons 9–11: Opossums During the Day and Night **Phenomenon Question:** When can we observe opossums? Opossums can change their active time of day in different seasons.	3–4 days	K.1E, K.1F, K.1G, K.2B, K.2C, K.3A, K.5A, K.5G, K.9A, K.9B, K.10B,	2I

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 3

Light

CONCEPT 1

Why do we need light to see objects? 9–12 days

Lessons 1–3: Wayang Shadow Puppetry

TEKS K.6, K.8A, K.8B, K.1A, K.1C, K.1E, K.1G, K.2B, K.3B, K.5A. K.5B, K.5D, K.5E, K.5F **ELPS** 2I, 3H, 4C

Lessons	Pacing Options
Lesson 1: Observe shadows outside to identify the relationship between sunlight and shadows.	Use sidebar Teacher Note in Explore Shadows Outside.
Lesson 2: Analyze observations of shadows and light sources to conclude that shadows appear in places with light.	**Day 1:** Launch through Search for Light **Day 2:** Sort Light Source Cards through Land Use first Teacher Note in Search for Light.
Lesson 3: Develop an initial class model to show the parts that make up a wayang show.	**Day 1:** Launch through Develop Initial Models **Day 2:** Develop Anchor Model through Land

Lessons 4–7: Light and Sight

TEKS K.8A, K.1C, K.1D, K.1E, K.1G, K.2A, K.2B, K.3A, K.3B, K.4B, K.5B, K.5E, K.5G **ELPS** 3H, 4D, 4F

Lessons	Pacing Options
Lesson 4: Observe models to determine which objects are visible in places with and without a light source.	Use Differentiation note in Observe Bedroom Models.
Lesson 5: Observe models to determine that objects are visible in places with a light source.	None
Lesson 6: Compare models to determine that objects are visible when a light source illuminates the objects.	None
Lesson 7: Use observations to confirm that objects are visible when light illuminates the objects or when the objects give off their own light.	Complete Launch and finish reading *Blackout* (Rocco 2011) before the lesson.

Lessons 8–9: Sight

TEKS K.8A, K.1A, K.1D, K.1E, K.2B, K.3A, K.3B, K.5B, K.5E **ELPS** 4C, 5B

Lessons	Pacing Options
Lesson 8: Use observations of photographs and videos to describe how light from glowworms makes parts of a cave visible.	**Day 1:** Launch through Conceptual Checkpoint **Day 2:** Debrief Conceptual Checkpoint through Land **Conceptual Checkpoint**
Lesson 9: Explain that people can see parts of a wayang show when light illuminates the parts.	None

CONCEPT 2

How does light interact with different objects? 6–8 days

Lessons 10–13: Shadows

TEKS K.6, K.8B, K.9A, K.9B, K.1A, K.1B, K.1C, K.1D, K.1E, K.1F, K.1G, K.2A, K.2B, K.3A, K.5A, K.5B, K.5D, K.5F, K.5G

ELPS 1A, 3D

Lessons	Pacing Options
Lesson 10: Compare shadows to identify the three parts that form a shadow: an object, a surface, and a light source.	Use sidebar Teacher Note in Launch.
Lesson 11: Use models to determine how objects, surfaces, and light sources interact to form shadows.	**Day 1:** Launch through Visit Order of Parts Stations **Day 2:** Observe Interactions Between Objects, Surfaces, and Light Sources through Land Think Aloud Stations 1 and 2 in Visit Order of Parts Stations.
Lesson 12: Use observations of the way shadows form to update the anchor model.	Use inline Teacher Note in Observe Shade. Use second sidebar Teacher Note in Observe Shade.
Lesson 13: Use a model to determine that the Sun's changing location affects the position of students' shadows.	Use first sidebar Teacher Note in Launch.

Lessons 14–15: Mirrors

TEKS K.6, K.8B, K.10B, K.1B, K.1C, K.1D, K.1E, K.1G, K.2A, K.2B, K.3A, K.3B, K.4A, K.4B, K.5B, K.5E **ELPS** 3H

Lessons	Pacing Options
Lesson 14: Observe the interaction between light and mirrors to determine that mirrors can redirect light.	**Day 1:** Launch through Introduce Solution **Day 2:** Observe Interaction Between Light and Mirrors through Land
Lesson 15: Use a model to determine how engineers in Rjukan used mirrors to redirect sunlight.	Share different mirror placements in one model as students observe whether light reaches the sticky note in Observe Town Model with Mirror.

APPLICATION OF CONCEPTS: SCIENCE CHALLENGE

What materials work well as wayang screens? 4–5 days

Lessons 16–19: Science Challenge

TEKS K.6, K.8B, K.1A, K.1B, K.1C, K.1D, K.1E, K.1F, K.1G, K.2A, K.2B, K.2C, K.3B, K.3C, K.5A, K.5B, K.5C, K.5D, K.5E
ELPS 1E

Lessons	Pacing Options
Lesson 16: Observe models and photographs to determine how light interacts with the screen in a wayang show.	None
Lesson 17: Investigate materials to determine that different materials allow no light, some light, or all light to travel through them.	**Day 1:** Launch through Test Materials by Observing Light **Day 2:** Test Materials by Using Light Meter through Land Use first Teacher Note in Test Materials by Using Light Meter. Use Differentiation note in Test Materials by Using Light Meter.
Lesson 18: Use knowledge of different materials to select a material to use as a wayang screen.	Think Aloud first two materials in Investigate Materials.
Lesson 19: Present models to identify the kinds of materials that work well as wayang screens.	Use Content Area Connection note in Launch. Prepare Active Listening steps chart before the lesson.

CONCEPT 2

How does light interact with different objects? 2–4 days

Lessons 20–21: Interactions with Light

TEKS K.6, K.8B, K.1D, K.1G, K.2B, K.3A, K.3B, K.5A, K.5B **ELPS** 1E

Lessons	Pacing Options
Lesson 20: Use models to determine that light can travel through holes in objects, creating holes in the objects' shadows.	**Day 1:** Launch through Conceptual Checkpoint Part A **Day 2:** Debrief Conceptual Checkpoint Part A through Land **Conceptual Checkpoint Part A**
Lesson 21: Use a model to determine that a mirror placed in the path of light from a spotlight can redirect the light onto a wayang puppet.	**Day 1:** Launch through Conceptual Checkpoint Part B **Day 2:** Debrief Conceptual Checkpoint Part B through Land **Conceptual Checkpoint Part B**

APPLICATION OF CONCEPTS:
END-OF-MODULE SOCRATIC SEMINAR, ASSESSMENT, AND DEBRIEF

How do puppeteers use light to tell stories during wayang shows? 3–4 days

Lessons 22–24: Wayang Shadow Puppetry

TEKS K.6, K.8A, K.8B, K.1E, K.1G, K.3A, K.3B, K.3C, K.5A, K.5B, K.5D, K.5G **ELPS** 3E, 3F, 3G

Lessons	Pacing Options
Lesson 22: Explain how puppeteers use light to tell stories during wayang shows. (Socratic Seminar)	Use an alternative instructional routine in Launch. Use Teacher Note in Engage in Socratic Seminar. **Socratic Seminar**
Lesson 23: Explain how lighthouses help mariners find their way. (End-of-Module Assessment)	**End-of-Module Assessment**
Lesson 24: Explain how light interacts with objects and affects what people see. (End-of-Module Debrief)	Use first Differentiation note in Reflect on Crosscutting Concepts in Module Learning. Use second Differentiation note in Reflect on Crosscutting Concepts in Module Learning. **End-of-Module Assessment Debrief**
Teacher Choice Day	Review, reteach, assess, or complete extension activities.

SPOTLIGHT LESSONS ON THE

Sky

When can we observe bats at Congress Avenue Bridge? 11–12 days

Lessons 1–4: Day and Night

TEKS K.9A, K.9B, K.1E, K.1F, K.1G, K.2A, K.5A, K.5G **ELPS** 2D, 4D, 4G, 5B

Lessons	Pacing Options
Lesson 1: Obtain information and ask questions about the bats at Congress Avenue Bridge.	Share videos from stations while students record observations in Observe Bats at Congress Avenue Bridge.
Lesson 2: Identify distinguishing features of day and night.	Think Aloud set B sky cards in Sort Additional Sky Cards.
Lesson 3: Describe changes in the sky from dusk to dawn.	Use Differentiation note in Watch Time-Lapse Videos.
Lesson 4: Model times of day when people can observe bats at Congress Avenue Bridge.	Use Differentiation note in Model the Sky at Different Times.

Lessons 5–8: Seasons

TEKS K.10B, K.12B, K.1E, K.1F, K.2B, K.2C, K.3A, K.5A, K.5G **ELPS** 4F

Lessons	Pacing Options
Lesson 5: Compare monthly weather data to identify that different months can have different weather conditions.	Use second Differentiation note in Compare Temperature Data. Use Differentiation note in Compare Weather Data.
Lesson 6: Analyze monthly weather data to describe how the weather changes throughout the year.	Use Differentiation note in Analyze Monthly Temperature Data.
Lesson 7: Compare monthly weather data to describe seasonal weather conditions.	Think Aloud one of the stations in Describe Seasons.
Lesson 8: Compare seasonal weather conditions in different locations to determine that different places can have different seasonal weather.	None

Lessons 9–11: Opossums During the Day and Night

TEKS K.9A, K.9B, K.10B, K.1E, K.1F, K.1G, K.2B, K.2C, K.3A, K.5A, K.5G **ELPS** 2I

Lessons	Pacing Options
Lesson 9: Explain why opossums change their active time of day in different seasons. (End-of-Spotlight Assessment Part A)	 Use an alternative instructional routine in Launch.  Use Teacher Note in Complete End-of-Spotlight Assessment Part A. **End-of-Spotlight Assessment Part A**
Lesson 10: Explain why opossums change their active time of day in different seasons. (End-of-Spotlight Assessment Part B)	**End-of-Spotlight Assessment Part B**
Lesson 11: Explain why opossums change their active time of day in different seasons. (End-of-Spotlight Assessment Debrief)	 Use differentiation note in Reflect on Recurring Themes and Concepts in Spotlight Learning. **End-of-Spotlight Debrief**
Teacher Choice Day	Review, reteach, assess, or complete extension activities.

Texas Essential Knowledge and Skills (TEKS)

Content Standards

K.6 The student knows that objects have physical properties that determine how they are described and classified. The student is expected to

- **K.6** identify and record observable physical properties of objects, including shape, color, texture, and material, and generate ways to classify objects.

K.8 The student knows that energy is everywhere and can be observed in everyday life. The student is expected to

- **K.8A** communicate the idea that objects can only be seen when a light source is present and compare the effects of different amounts of light on the appearance of objects; and
- **K.8B** demonstrate and explain that light travels through some objects and is blocked by other objects, creating shadows.

K.9 The student knows that there are recognizable patterns in the natural world and among objects in the sky. The student is expected to

- **K.9A** identify, describe, and predict the patterns of day and night and their observable characteristics; and
- **K.9B** observe, describe, and illustrate the Sun, Moon, stars, and objects in the sky such as clouds.

K.10 The student knows that the natural world includes earth materials and systems that can be observed. The student is expected to

- **K.10B** observe and describe weather changes from day to day and over seasons.

K.12 The student knows that plants and animals depend on the environment to meet their basic needs for survival. The student is expected to

- **K.12B** Observe and identify the dependence of animals on air, water, food, space, and shelter.

Scientific and Engineering Practices

K.1 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

- **K.1A** ask questions and define problems based on observations or information from text, phenomena, models, or investigations;
- **K.1B** use scientific practices to plan and conduct simple descriptive investigations and use engineering practices to design solutions to problems;
- **K.1C** identify, describe, and demonstrate safe practices during classroom and field investigations as outlined in Texas Education Agency–approved safety standards;
- **K.1D** use tools, including hand lenses, goggles, trays, cups, bowls, sieves or sifters, notebooks, terrariums, aquariums, samples (rocks, sand, soil, loam, gravel, clay, seeds, and plants), windsock, demonstration thermometer, rain gauge, straws, ribbons, non-standard measuring items, blocks or cubes, tuning fork, various flashlights, small paper cups, items that roll, noise makers, hot plate, opaque objects, transparent objects, foil pie pans, foil muffin cups, wax paper, Sun-Moon-Earth model, and plant life cycle model to observe, measure, test, and compare;
- **K.1E** collect observations and measurements as evidence;
- **K.1F** record and organize data using pictures, numbers, words, symbols, and simple graphs; and
- **K.1G** develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem.

K.2 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

- **K.2A** identify basic advantages and limitations of models such as their size, properties, and materials;
- **K.2B** analyze data by identifying significant features and patterns; and
- **K.2C** use mathematical concepts to compare two objects with common attributes.

K.3 The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to

- **K.3A** develop explanations and propose solutions supported by data and models;
- **K.3B** communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and
- **K.3C** listen actively to others' explanations to identify important evidence and engage respectfully in scientific discussion.

K.4 The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to

- **K.4A** explain how science or an innovation can help others; and
- **K.4B** identify scientists and engineers such as Isaac Newton, Mae Jemison, and Ynés Mexía and explore what different scientists and engineers do.

Recurring Themes and Concepts

K.5 The student uses recurring themes and concepts to make connections across disciplines. The student is expected to

- **K.5A** identify and use patterns to describe phenomena or design solutions;
- **K.5B** investigate and predict cause-and-effect relationships in science;
- **K.5C** describe the properties of objects in terms of relative size (scale) and relative quantity;
- **K.5D** examine the parts of a whole to define or model a system;
- **K.5E** identify forms of energy and properties of matter;
- **K.5F** describe the relationship between the structure and function of objects, organisms, and systems; and
- **K.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.

1E Internalize new basic and academic language by using and reusing it in meaningful ways in speaking and writing activities that build concept and language attainment.

2D Monitor understanding of spoken language during classroom instruction and interactions and seek clarification as needed.

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.

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.

4C Develop basic sight vocabulary, derive meaning of environmental print, and comprehend English vocabulary and language structures used routinely in written classroom materials.

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.

4G Demonstrate comprehension of increasingly complex English by participating in shared reading, retelling or summarizing material, responding to questions, and taking notes commensurate with content area and grade level needs.

5B Write using newly acquired basic vocabulary and content-based grade-level vocabulary.