

Pacing Guide

Level 1 Module 2

Light

Each *PhD Science® TEKS Edition* Level 1 lesson requires 35 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.

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 and 8 spotlight lessons about Weather. Even with lesson splits, this module should take no more than 40 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.

Light

Anchor Phenomenon: Wayang Shadow Puppetry Essential Question: How do puppeteers use light to tell stories during wayang shows?	Recommended Number of Days	TEKS and 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	1.2A, 1.2B, 1.2C, 1.2E, 1.3B, 1.3C, 1.4A, 1.5A, 1.6A, 1.8C ELPS: 2F, 3H, 4C
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	1.2A, 1.2B, 1.2C, 1.2E, 1.3A, 1.3B, 1.3C, 1.5A, 1.6A, 1.8B, 1.8C ELPS: 1A, 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	1.2A, 1.2B, 1.2C, 1.2D, 1.2E, 1.3B, 1.5A, 1.5C, 1.6A ELPS: 3D
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	1.2E, 1.3A, 1.3B, 1.5A, 1.5C, 1.6A ELPS: 3H
Application 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 days	1.2A, 1.2E, 1.5A, 1.5C, 1.6A ELPS: 3E, 3F

Spotlight Lessons on Weather

Lesson Sets	Recommended Number of Days	TEKS and ELPS Alignment
Lesson 1: Air Phenomenon Question: How can we describe air? Air is all around us, and moving air is called wind.	1 day	1.2B, 1.2E, 1.8D ELPS: 3G
Lessons 2–3: Describing Weather Phenomenon Question: How can we describe the weather? People can observe, describe, and record parts of weather.	2 days	1.1A, 1.4A, 1.8A ELPS: 1A, 3H
Lesson 4: Describing Seasons Phenomenon Question: What is the weather like during each season? Weather conditions are likely to be similar throughout each season of the year.	1 day	1.2D, 1.8C ELPS: 1C
Lessons 5–6: Changes at Night Phenomenon Question: What can we notice when we observe at night? At night, temperatures are cooler, and the positions of the Moon and stars change.	2 days	1.2D, 1.3B, 1.8B, 1.8C ELPS: 1C
Lessons 7–8: Heating and Cooling Phenomenon Question: What happens to ice cream when the temperature changes? Heating and cooling can cause changes in the properties of objects.	2 days	1.2B, 1.2C, 1.2E, 1.5A, 1.5B, 1.6 ^a ELPS: 1C, 3H






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 2: Light





Concept 1: Why do we need light to see objects?			9–12 days
Focus Standards			
1.5A Classify objects by observable properties such as larger and smaller, heavier and lighter, shape, color, and texture.			
1.6A Identify and discuss how different forms of energy such as light, thermal, and sound are important to everyday life.			
1.8C Identify characteristics of the seasons of the year and day and night.			
Lessons 1–3: Wayang Shadow Puppetry			Lessons 4–7: Light and Sight
Lesson 1: Observe shadows outside to identify the relationship between sunlight and shadows.	Lesson 2: Analyze observations of shadows and light sources to conclude that shadows appear in places with light.	Lesson 3: Develop an initial class model to show the parts that make up a wayang show.	Lesson 4: Observe models to determine which objects are visible in places with and without a light source.
 Use second Teacher Note in Explore Shadows Outside.	 Day 1: Launch through Search for Light Day 2: Observe Light Source Cards through Land	 Day 1: Launch through Develop Initial Models Day 2: Develop Anchor Model through Land	
Lessons 4–7: Light and Sight			Lessons 8–9: Sight
Lesson 5: Observe models to determine that objects are visible in places with a light source.	Lesson 6: Compare models to determine that objects are visible when a light source illuminates the objects.	Lesson 7: Use observations to confirm that objects are visible when light illuminates the objects or when the objects give off their own light.	Lesson 8: Use observations of photographs and videos to describe how light from glowworms makes parts of a cave visible.
		 Complete Launch and finish reading <i>Blackout</i> by John Rocco (2011) before the lesson.	 Day 1: Launch through Conceptual Checkpoint Day 2: Debrief Conceptual Checkpoint through Land
			Conceptual Checkpoint

Lessons 8–9: Sight
Lesson 9: Explain that people can see parts of a wayang show when light illuminates the parts.
Conceptual Checkpoint



<p>Concept 2: How does light interact with different objects?</p>		<p>6–8 days</p>	
<p>Focus Standards</p>			
<p>1.5A Classify objects by observable properties such as larger and smaller, heavier and lighter, shape, color, and texture.</p>			
<p>1.6A Identify and discuss how different forms of energy such as light, thermal, and sound are important to everyday life.</p>			
<p>1.8B Observe and record changes in the appearance of objects in the sky such as the Moon and stars, including the Sun.</p>			
<p>1.8C Identify characteristics of the seasons of the year and day and night.</p>			
<p>Lessons 10–13: Shadows</p>			
<p>Lesson 10: Compare shadows to identify the three parts that form a shadow: an object, a surface, and a light source.</p>	<p>Lesson 11: Use models to determine how objects, surfaces, and light sources interact to form shadows.</p>	<p>Lesson 12: Use observations of the way shadows form to update the anchor model.</p>	<p>Lesson 13: Use a model to determine that the Sun’s changing location affects the position of students’ shadows.</p>
<p> Use the sidebar Teacher Note in Launch.</p>	<p> Day 1: Launch through Visit Order of Parts Stations</p> <p>Day 2: Observe Interactions Between Objects, Surfaces, and Light Sources through Land</p> <p> Think aloud Stations 1 and 2 in Visit Order of Parts Stations.</p>	<p> Use the second sidebar Teacher Note in Learn.</p>	<p> Use the first sidebar Teacher Note in Learn.</p>
<p>Lessons 14–15: Mirrors</p>			
<p>Lesson 14: Observe the interaction between light and mirrors to determine that mirrors can redirect light.</p>	<p>Lesson 15: Use a model to determine how engineers in Rjukan used mirrors to redirect sunlight.</p>		
<p> Day 1: Launch through Introduce Solution</p> <p>Day 2: Observe Interaction Between Light and Mirrors through Land</p>			



<p>Science Challenge: What materials work well as wayang screens? 4–5 days</p> <p>Focus Standards</p> <p>1.5A Classify objects by observable properties such as larger and smaller, heavier and lighter, shape, color, and texture.</p> <p>1.5C Classify objects by the materials from which they are made.</p> <p>1.6A Identify and discuss how different forms of energy such as light, thermal, and sound are important to everyday life.</p>			
<p>Lessons 16–19: Science Challenge</p>			
<p>Lesson 16: Observe models and photographs to determine how light interacts with the screen in a wayang show.</p>	<p>Lesson 17: Investigate materials to determine that different materials allow no light, some light, or all light to travel through them.</p>	<p>Lesson 18: Use knowledge of different materials to select a material to use as a wayang screen.</p>	<p>Lesson 19: Present models to identify the kinds of materials that work well as wayang screens.</p>
<p>Science Challenge</p>	<p> Day 1: Launch through Test Materials by Observing Light</p> <p>Day 2: Test Materials by Using Light Meter through Land</p> <p> Use a penlight and think aloud one of the materials in Test Materials by Observing Light.</p>	<p> Use a penlight and light meter to demonstrate each material while students record observations in chart in Investigate Materials.</p>	<p> Use Content Area Connection note in Launch.</p>
	<p>Science Challenge</p>	<p>Science Challenge</p>	<p>Science Challenge</p>

Concept 2: How does light interact with different objects?

2–4 days


Focus Standards


- 1.5A** Classify objects by observable properties such as larger and smaller, heavier and lighter, shape, color, and texture.
- 1.5C** Classify objects by the materials from which they are made.
- 1.6A** Identify and discuss how different forms of energy such as light, thermal, and sound are important to everyday life.

Lessons 20–21: Interactions with Light

Lesson 20: Use models to determine that light can travel through holes in objects, creating holes in the objects’ shadows.

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 A
Day 2: Debrief Conceptual Checkpoint Part A through Land

 **Day 1:** Launch through Conceptual Checkpoint Part B
Day 2: Debrief Conceptual Checkpoint Part B through Land





Conceptual Checkpoint

Conceptual Checkpoint



<p>Application of Concepts: How do puppeteers use light to tell stories during wayang shows? 3 days</p> <p>Focus Standards</p> <p>1.5A Classify objects by observable properties such as larger and smaller, heavier and lighter, shape, color, and texture.</p> <p>1.5C Classify objects by the materials from which they are made.</p> <p>1.6A Identify and discuss how different forms of energy such as light, thermal, and sound are important to everyday life.</p>		
<p>Lessons 22–24: Wayang Shadow Puppetry</p>		
<p>Lesson 22: Explain how puppeteers use light to tell stories during wayang shows.</p>	<p>Lesson 23: Explain how lighthouses help mariners find their way.</p>	<p>Lesson 24: Explain how light interacts with objects and affects what people see.</p>
<p> Use Teacher Note in Engage in Socratic Seminar.</p>	<p>End-of-Module Assessment</p>	<p> Use English Language Development note in Reflect on Crosscutting Concepts in Module Learning.</p>
<p>Socratic Seminar</p>		<p>End-of-Module Debrief</p>

Spotlight Lessons: Weather

Focus Standards			8 days	
<p>1.5A Classify objects by observable properties such as larger and smaller, heavier and lighter, shape, color, and texture.</p> <p>1.5B Predict and identify changes in materials caused by heating and cooling.</p> <p>1.6A Identify and discuss how different forms of energy such as light, thermal, and sound are important to everyday life.</p> <p>1.8A Record weather information, including relative temperature such as hot or cold, clear or cloudy, calm or windy, and rainy or icy.</p> <p>1.8B Observe and record changes in the appearance of objects in the sky such as the Moon and stars, including the Sun.</p> <p>1.8C Identify characteristics of the seasons of the year and day and night.</p> <p>1.8D Demonstrate that air is all around us and observe that wind is moving air.</p>				
Lessons 1: Air		Lessons 2–3: Describing Weather		Lessons 4: Describing Seasons
<p>Lesson 1: Demonstrate that air is all around us and observe that wind is moving air.</p>		<p>Lesson 2: Describe types of wind, amounts of cloud cover, and whether it is raining or snowing.</p>		<p>Lesson 3: Describe temperature and record the local weather conditions.</p>
<p> Use first Teacher Note in Investigate Air.</p>				<p> Use second Teacher Note in Collect and Record Weather Data.</p>
Lessons 5–6: Changes at Night		Lessons 7–8: Heating and Cooling		
<p>Lesson 5: Use weather data to describe patterns and predict changes in daily temperature.</p>		<p>Lesson 6: Observe photographs of the sky to notice that the positions of the Moon and stars change throughout the night.</p>		<p>Lesson 7: Predict and identify changes in the properties of ice cream caused by heating.</p>
<p> Use Differentiation Note in Compare Temperatures in Different Months.</p>		<p> Use Teacher Note in Observe the Stars.</p>		

Texas Essential Knowledge and Skills (TEKS)

Focus Standards	
1.5	<p>Matter and energy. The student knows that objects have properties and patterns. The student is expected to</p> <ul style="list-style-type: none"> 1.5A classify objects by observable properties such as larger and smaller, heavier and lighter, shape, color, and texture; 1.5B predict and identify changes in materials caused by heating and cooling; and 1.5C classify objects by the materials from which they are made.
1.6	<p>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</p> <ul style="list-style-type: none"> 1.6A identify and discuss how different forms of energy such as light, thermal, and sound are important to everyday life
1.8	<p>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</p> <ul style="list-style-type: none"> 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.
Investigation and Reasoning Standards	
1.1	<p>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</p> <ul style="list-style-type: none"> 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	<p>Scientific investigation and reasoning. The student develops abilities to ask questions and seek answers in classroom and outdoor investigations. The student is expected to</p> <ul style="list-style-type: none"> 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.