Pacing Guide

Level 5 Module 3

SUN, EARTH, AND MOON SYSTEM

with Spotlight Lessons and a Capstone Project on Forces, Motion, and Energy

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 28 lessons plus 17 spotlight lessons and a Capstone Project on Forces, Motion, and Energy. Even with lesson splits and teacher choice days, this module should take no more than 51 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.

Sun, Earth, and Moon System

ANCHOR PHENOMENON:

Views from Earth and Space

ESSENTIAL QUESTION:

How can we explain our observations of the Sun, Moon, and stars from Earth?

Concept	Recommended Number of Days	TEKS Alignment	ELPS Alignment
Concept 1 (Lessons 1–7): Patterns of the Sun **Focus Question:** How can we explain our observations of the Sun? The apparent daily motion of the Sun across the sky can be explained by Earth's rotation. The daily pattern of daytime and nighttime on Earth can be explained by the exposure of different parts of Earth to the Sun at different times.	7–8 days	3.9A, 3.9B, 4.9B, 5.1A, 5.1B, 5.1C, 5.1D, 5.1E, 5.1F, 5.1G, 5.2A, 5.2B, 5.3A, 5.3B, 5.3C, 5.4A, 5.5A, 5.5B, 5.5D, 5.8C, 5.9	1A, 3B, 3E, 4A, 4D, 4F
Application of Concepts (Lessons 8–11): Science Challenge **Phenomenon Question:** How can we use the Earth-Sun system to tell time at different locations on Earth? The Sun's apparent motion from east to west across the sky can be used to tell time at different locations on Earth.	4 days	3.9A, 5.1B, 5.1E, 5.1G, 5.2A, 5.2B, 5.2D, 5.3A, 5.3B, 5.4A, 5.5A, 5.5B, 5.5D, 5.9	3D, 3E
Concept 1 (Lessons 12–13): Patterns of the Sun **Focus Question:** How can we explain our observations of the Sun? The apparent daily motion of the Sun across the sky can be explained by Earth's rotation. The daily pattern of daytime and nighttime on Earth can be explained by the exposure of different parts of Earth to the Sun at different times.	2 days	4.6A, 5.1D, 5.1E, 5.1G, 5.2A, 5.3A, 5.5B, 5.5D, 5.8C, 5.9	3F

Concept	Recommended Number of Days	TEKS Alignment	ELPS Alignment
Concept 2 (Lessons 14–19): Patterns of the Moon **Focus Question:** How can explain our observations of the Moon? The apparent daily motion of the Moon across the sky can be explained by Earth's rotation. The monthly pattern of changing moonrise times on Earth can be explained by the Moon's orbit around Earth.	6–8 days	3.9A, 4.9B, 5.1A, 5.1D, 5.1E, 5.1G, 5.2A, 5.2B, 5.2C, 5.3A, 5.5A, 5.5B, 5.5D, 5.8C, 5.9	1A, 3F, 4F
Concept 3 (Lessons 20–25): Patterns of the Stars **Focus Question:** How can we explain our observations of Stars? The apparent daily motion of stars across the sky can be explained by Earth's rotation. The yearly pattern of star visibility on Earth can be explained by Earth's orbit around the Sun.	6–7 days	3.9A, 5.1A, 5.1B, 5.1C, 5.1E, 5.1F, 5.1G, 5.2A, 5.2B, 5.3A, 5.4A, 5.5A, 5.5B, 5.5C, 5.5D, 5.8C, 5.9	2E, 3F, 3H
Applications of Concepts (Lessons 26–28): End-of-Module Socratic Seminar, Assessment, and Debrief **Essential Question:** How can we explain our observations of the Sun, the Moon, and stars from Earth? Earth's rotation on its axis, Earth's orbit around the Sun, and the Moon's orbit around Earth cause observable patterns in Earth's sky.	3–4 days	4.9B, 5.1B, 5.1E, 5.1G, 5.2B, 5.2C, 5.3A, 5.3B, 5.3C, 5.5A, 5.5B, 5.5D, 5.8C, 5.9	3F

Spotlight Lessons and a Capstone Project on Forces, Motion, and Energy

Lesson Sets	Recommended Number of Days	TEKS Alignment	ELPS Alignment
Lesson 1: Forces and Energy in DART Rail **Phenomenon Question:** How does DART Rail use forces and energy to move people from place to place? Engineers designed DART rail to help people move from place to place.	1 day	3.7B, 3.8A, 5.1A, 5.1E, 5.1G, 5.3A, 5.4A, 5.5A, 5.5D, 5.7A	2D, 2E
Lessons 2–4: Moving a Light Rail Train **Phenomenon Question:** How do light rail trains start moving? A stronger force can move an object faster than a weaker force can.	3 days	3.7A, 4.7, 4.8A, 5.1A, 5.1B, 5.1C, 5.1D, 5.1E, 5.1F, 5.2A, 5.2B, 5.2C, 5.3A, 5.5A, 5.5B, 5.5D, 5.5E, 5.7A, 5.7B	1A, 3E

Lesson Sets	Recommended Number of Days	TEKS Alignment	ELPS Alignment
Lesson 5: Stopping a Light Rail Train **Phenomenon Question:** How do light rail trains slow down and stop? Brakes slow and stop the light rail train by increasing the force of friction.	1 day	3.7A, 4.7, 5.1B, 5.1C, 5.1D, 5.1E, 5.2B, 5.3A, 5.5A, 5.5B, 5.7A, 5.7B	3D
Lessons 6–7: Electrical Circuits in a Light Rail System **Phenomenon Question:** How can electrical energy be used to move a light rail train? In a complete circuit, electrical energy flows through closed paths made of electrical conductors.	2 days	3.8A, 4.8A, 4.8C, 5.1C, 5.1D, 5.1E, 5.1G, 5.3A, 5.5E, 5.6A, 5.8A, 5.8B	3D
Lessons 8–9: Energy Forms in DART Rail **Phenomenon Question:** How does a light rail system use different forms of energy? Circuits can be arranged in different ways to transform electrical energy into other forms of energy.	2 days	3.8A, 4.8C, 5.1C, 5.1D, 5.1E, 5.1G, 5.2B, 5.5A, 5.5E, 5.8A, 5.8B	1D
Lesson 10: Thermal Energy in the DART Rail System **Phenomenon Question:** How does the DART Rail system insulate thermal energy to keep passengers warm? Electrical energy can transform into thermal energy, which passes through some materials faster than others.	1 day	3.8A, 4.8B, 5.1E, 5.1G, 5.2B, 5.3A, 5.5D, 5.5E, 5.5F, 5.6A, 5.8A, 5.8B	2C, 4G
Lessons 11–15: Capstone Project **Phenomenon Question:** How can we make a light rail train system more accessible? Science and engineering practices can improve the accessibility of a light rail train system.	5 days	3.7A, 3.7B, 3.8A, 4.7, 4.8A, 4.8C, 5.1A, 5.1B, 5.1C, 5.1D, 5.1E, 5.1F, 5.1G, 5.2B, 5.2D, 5.3A, 5.3B, 5.3C, 5.5A, 5.5B, 5.5D, 5.5E, 5.7A, 5.7B, 5.8A, 5.8B	3E
Lessons 16–17: Forces, Motion, and Energy **Phenomenon Question:** How do the parts of a 3D printer work together to make a new object? Three-dimensional printers transform energy to create objects.	2–3 days	3.8A, 4.8B, 4.8C, 5.1E, 5.1G, 5.2B, 5.3A, 5.5A, 5.5B, 5.5E, 5.6A, 5.7A, 5.7B, 5.8A, 5.8B	4C

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

Sun, Earth, and Moon System

CONCEPT 1

How can we explain our observations of the Sun? 7–8 days

Lessons 1–2: Views from Earth and Space

TEKS 3.9A, 4.9B, 5.9, 5.1A, 5.1D, 5.1E, 5.1F, 5.1G, 5.2A, 5.2B, 5.4A, 5.5A, 5.5D **ELPS** 4A, 4D, 4F

Lessons	Pacing Options
Lesson 1: Explain how humans can use observed patterns of celestial bodies for navigation.	**Day 1:** Launch through Explore Celestial Navigation **Day 2:** Identify Patterns through Land Use first Teacher Note in Identify Patterns.
Lesson 2: Develop an initial model to explain observations of the Sun, the Moon, and stars from Earth.	Use Differentiation note in Land.

Lessons 3–5: Apparent Motion of the Sun

TEKS 5.8C, 5.9, 5.1A, 5.1B, 5.1C, 5.1D, 5.1E, 5.1F, 5.1G, 5.2B, 5.3A, 5.3B, 5.5A, 5.5B **ELPS** 1A, 3B

Lessons	Pacing Options
Lesson 3: Plan to investigate how the angle and direction of light affect shadows.	Use the fourth Teacher Note in Develop a Light Model.
Lesson 4: Investigate how the angle, distance, and direction of a light source affect shadows.	Use Differentiation note in Launch. Use an alternative collaborative conversation routine in Launch.
Lesson 5: Use observed shadow patterns to determine the apparent east-to-west motion of the Sun.	Use first Teacher Note in Launch. Use second Teacher Note in Determine the Direction of the Sun's Apparent Motion.

Lessons 6–7: Sunrise and Sunset

TEKS 3.9B, 5.9, 5.1E, 5.1G, 5.3A, 5.3B, 5.3C, 5.4A, 5.5A, 5.5D **ELPS** 3E

Lessons	Pacing Options
Lesson 6: Develop a model to explain the apparent east-to-west motion of the Sun.	Think Aloud one light model in Develop an Initial Earth-View Student Model. Use Differentiation note in Read About Galileo. Use an alternative instructional routine in Read About Galileo.
Lesson 7: Use a space-view model to support claims about the locations on Earth experiencing daytime and nighttime.	Use Differentiation note in Make a Claim About Daytime and Nighttime. Use an alternative collaborative conversation routine in Update Anchor Model.

SCIENCE CHALLENGE

How can we use the Earth-Sun system to tell time at different locations on Earth? 4 days

Lessons 8–11: Science Challenge

TEKS 3.9A, 5.9, 5.1B, 5.1E, 5.1G, 5.2A, 5.2B, 5.2D, 5.3A, 5.3B, 5.4A, 5.5A, 5.5B, 5.5D **ELPS** 3D, 3E

Lessons	Pacing Options
Lesson 8: Model how humans can use the apparent position of the Sun to tell time.	**Science Challenge**
Lesson 9: Model how sundials track time around the world.	Prepare space-view sundial models in Model Space-View Sundial before the lesson. **Science Challenge**
Lesson 10: Prepare to share models to explain how the Earth-Sun system affects time around the world.	Use a timer to pace presentations in Share Models and Explanations. Use Differentiation note in Share Models and Explanations. **Science Challenge**
Lesson 11: Present models of how the Earth–Sun system affects time around the world.	**Science Challenge**

CONCEPT 1

How can we explain our observations of the Sun? 2 days

Lessons 12–13: Apparent Sunrise

TEKS 4.6A, 5.8C, 5.9, 5.1D, 5.1E, 5.1G, 5.2A, 5.3A, 5.5B, 5.5D **ELPS** 3F

Lessons	Pacing Options
Lesson 12: Gather evidence to determine that refraction of light causes apparent sunrise to differ from actual sunrise.	None
Lesson 13: Model and explain how light refracts when it enters Earth's atmosphere.	**Conceptual Checkpoint**

CONCEPT 2

How can we explain our observations of the Moon? 6–8 days

Lesson 14: The Moon

TEKS 3.9A, 4.9B, 5.9, 5.1A, 5.1E, 5.1G, 5.3A, 5.5A, 5.5D **ELPS** 3F

Lessons	Pacing Options
Lesson 14: Develop a model to explain the Moon's apparent motion from east to west across Earth's sky.	**Day 1:** Launch through Observe and Infer Patterns **Day 2:** Model Moonrise and Moonset through Land

Lessons 15–16: The Moon's Orbit

TEKS 4.9B, 5.9, 5.1A, 5.1G, 5.2A, 5.2B, 5.2C, 5.3A, 5.5A, 5.5D **ELPS** 1A

Lessons	Pacing Options
Lesson 15: Analyze moonrise and moonset times to determine when the Moon is overhead.	Think Aloud January 1 data in Analyze Moonrise and Moonset Times.
Lesson 16: Model the Moon's orbit around Earth to explain changing moonrise and moonset times.	**Day 1:** Launch through Analyze Moonrise and Moonset Data **Day 2:** Model the Moon's Orbit through Land Think Aloud January data in Analyze Moonrise and Moonset Data.

Lessons 17–19: Appearance of the Moon

TEKS 4.9B, 5.8C, 5.9, 5.1D, 5.1E, 5.1G, 5.2A, 5.3A, 5.5B, 5.5D **ELPS** 4F

Lessons	Pacing Options
Lesson 17: Gather evidence to explain how objects that do not emit light are seen.	Use an alternative instructional routine in Explore Reflection.
Lesson 18: Explain why the Moon is visible from Earth.	None
Lesson 19: Explain how the Moon's orbit around Earth makes the Moon appear to change shape.	Color black half of each Moon in Explore Apparent Shape of the Moon before the lesson. **Conceptual Checkpoint**

CONCEPT 3

How can we explain our observations of stars? 6–7 days

Lessons 20–21: Appearance of Stars

TEKS 3.9A, 5.8C, 5.1B, 5.1C, 5.1E, 5.1F, 5.1G, 5.2A, 5.3A, 5.4A, 5.5A, 5.5B, 5.5C **ELPS** 2E

Lessons	Pacing Options
Lesson 20: Research the characteristics of stars, and model how distance affects a star's apparent size.	Use Differentiation note in Compare Objects in the Sky.
Lesson 21: Model how distance affects a star's apparent brightness.	**Day 1:** Launch through Investigate the Effect of Distance on Apparent Brightness **Day 2:** Model the Apparent Brightness of Stars through Land Complete Land after the lesson.

Lessons 22–23: Apparent Motion of Stars

TEKS 5.9, 5.1A, 5.1G, 5.3A, 5.5A, 5.5D **ELPS** 3F

Lessons	Pacing Options
Lesson 22: Model the apparent motion of stars.	Think Aloud Earth-view student model in Model the Apparent Motion of Stars.
Lesson 23: Use a model to explain why Polaris appears to be stationary from the perspective of Earth.	Place stars for Earth-view student models in Model the Location of Polaris before the lesson. Use Fishbowl routine to model Earth-view student model in Model the Location of Polaris.

Lessons 24–25: Changes in Star Visibility

TEKS 5.8C, 5.9, 5.1A, 5.1B, 5.1E, 5.1F, 5.1G, 5.2B, 5.3A, 5.5A, 5.5B **ELPS** 2E, 3H

Lessons	Pacing Options
Lesson 24: Analyze star maps from different times of the year to identify patterns in star visibility.	Record 6 months of star map data in the class data table in Analyze Star Maps before the lesson. Focus on students completing 6 months of star map data in Analyze Star Maps.
Lesson 25: Develop a model to explain the positions of stars at different times of the year.	Place month labels in Model Earth's Orbit around the classroom before the lesson. **Conceptual Checkpoint**

APPLICATION OF CONCEPTS

How can we explain our observations of the Sun, the Moon, and stars from Earth? 3–4 days

Lessons 26–28: End-of-Module Socratic Seminar, Assessment, and Debrief

TEKS 4.9B, 5.8C, 5.9, 5.1B, 5.1E, 5.1G, 5.2B, 5.2C, 5.3A, 5.3B, 5.3C, 5.5A, 5.5B, 5.5D **ELPS** 3F

Lessons	Pacing Options
Lesson 26: Explain how Earth's rotation on its axis, Earth's orbit around the Sun, and the Moon's orbit around Earth cause observable patterns in Earth's sky. (Socratic Seminar)	Use English Language Development note in Engage in Socratic Seminar. **Socratic Seminar**
Lesson 27: Explain how Earth's rotation on its axis, Earth's orbit around the Sun, and the Moon's orbit around Earth cause observable patterns in Earth's sky. (End-of-Module Assessment)	**End-of-Module Assessment**
Lesson 28: Explain how Earth's rotation on its axis, Earth's orbit around the Sun, and the Moon's orbit around Earth cause observable patterns in Earth's sky. (End-of-Module Assessment Debrief)	**End-of-Module Assessment Debrief**
Teacher Choice Day	Review, reteach, assess, or complete extension activities.

SPOTLIGHT LESSONS AND A CAPSTONE PROJECT ON

Forces, Motion, and Energy

How does a light rail train system work? 17–18 days

Lesson 1: Forces and Energy in DART Rail

TEKS 3.7B, 3.8A, 5.7A, 5.1A, 5.1E, 5.1G, 5.3A, 5.4A, 5.5A, 5.5D **ELPS** 2D, 2E

Lessons	Pacing Options
Lesson 1: Develop an initial model to show how a DART Rail train system moves.	None

Lessons 2–4: Moving a Light Rail Train

TEKS 3.7A, 4.7, 4.8A, 5.7A, 5.7B, 5.1A, 5.1B, 5.1C, 5.1D, 5.1E, 5.1F, 5.2A, 5.2B, 5.2C, 5.3A, 5.5A, 5.5B, 5.5D, 5.5E
ELPS 1A, 3E

Lessons	Pacing Options
Lesson 2: Plan an investigation to explore how forces with different strengths affect the speed of a light rail train.	Use Differentiation note in Develop Initial Claim. Prewrite the spring scale procedure on white board in Develop Investigation Plans before the lesson.
Lesson 3: Investigate how forces with different strengths affect the speed of a light rail train.	None
Lesson 4: Investigate how forces of equal strength affect the speed of light rail trains with different masses.	Use Differentiation note in Plan and Conduct Mass Investigation.

Lesson 5: Stopping a Light Rail Train

TEKS 3.7A, 4.7, 5.7A, 5.7B, 5.1B, 5.1C, 5.1D, 5.1E, 5.2B, 5.3A, 5.5A, 5.5B **ELPS** 3D

Lessons	Pacing Options
Lesson 5: Explore how friction slows down and stops a light rail train.	None

Lessons 6–7: Electrical Circuits in a Light Rail System

TEKS 3.8A, 4.8A, 4.8B, 5.6A, 5.8A, 5.8B, 5.1C, 5.1D, 5.1E, 5.1G, 5.3A, 5.5E **ELPS** 3D

Lessons	Pacing Options
Lesson 6: Develop a circuit model to demonstrate the flow of electrical energy in a light rail system.	Use inline Teacher Note in Explore Energy Sources. Use Differentiation note in Develop Light Rail Circuit Model. Use an alternative instructional routine in Compare Models.
Lesson 7: Determine the locations of electrical conductors and insulators in a pantograph.	Use Differentiation note in Investigate Pantograph Materials. Use first Teacher Note in Investigate Pantograph Materials.

Lessons 8–9: Energy Forms in DART Rail

TEKS 3.8A, 4.8C, 5.8A, 5.8B, 5.1C, 5.1D, 5.1E, 5.1G, 5.2B, 5.5A, 5.5E **ELPS** 1D

Lessons	Pacing Options
Lesson 8: Observe circuits to identify patterns in energy transformation.	Use second Teacher Note in Prepare to Visit Device Stations. Use an alternative collaborative conversation routine in Land.
Lesson 9: Compare different types of circuits containing multiple devices.	None

Lessons 11–15: Capstone Project

TEKS 3.7A, 3.7B, 3.8A, 4.7, 4.8A, 4.8C, 5.7A, 5.7B, 5.8A, 5.8B, 5.1A, 5.1B, 5.1C, 5.1D, 5.1E, 5.1F, 5.1G, 5.2B, 5.2D, 5.3A, 5.3B, 5.3C, 5.5A, 5.5B, 5.5D, 5.5E **ELPS** 3E

Lessons	Pacing Options
Lesson 11: Apply the engineering design process to design and test solutions to make a light rail train system more accessible.	Use Differentiation note in Launch before the lesson. **Capstone Project**
Lesson 12: Apply the engineering design process to design and test solutions to make a light rail train system more accessible.	Use first sidebar Teacher Note in Ask About, Imagine, and Plan Solutions.
Lesson 13: Apply the engineering design process to design and test solutions to make a light rail train system more accessible.	Use Teacher Note in Propose and Create Solutions. **Capstone Project**
Lesson 14: Apply the engineering design process to design and test solutions to make a light rail train system more accessible.	**Capstone Project**
Lesson 15: Apply the engineering design process to design and test solutions to make a light rail train system more accessible.	Use Differentiation note in Share Accessible Designs. Finish presentations in Share Accessible Designs after the lesson. **Capstone Project**

Lessons 16–17: Forces, Motion, and Energy

TEKS 3.8A, 4.8B, 4.8C, 5.6A, 5.7A, 5.7B, 5.8A, 5.8B, 5.1E, 5.1G, 5.2B, 5.3A, 5.5A, 5.5B, 5.5E **ELPS** 4C

Lessons	Pacing Options
Lesson 16: Explain how energy moves through a 3D printer to change plastic filaments into new objects.	**End-of-Spotlight Assessment**
Lesson 17: Explain how energy moves through a 3D printer to change plastic filaments into new objects.	**End-of-Spotlight Assessment Debrief**
Teacher Choice Day	Review, reteach, assess, or complete extension activities. Optional Assessment: Benchmark 3

Texas Essential Knowledge and Skills (TEKS)

Content Standards

3.7 Forces, motion, and energy. The student knows the nature of forces and the patterns of their interactions. The student is expected to

3.7A demonstrate and describe forces acting on an object in contact or at a distance, including magnetism, gravity, and pushes and pulls; and

3.7B plan and conduct a descriptive investigation to demonstrate and explain how position and motion can be changed by pushing and pulling objects such as swings, balls, and wagons.

3.8 Forces, motion, and energy. The student knows that energy is everywhere and can be observed in cycles, patterns, and systems. The student is expected to

3.8A identify everyday examples of energy, including light, sound, thermal and mechanical.

3.9 Earth and space. The student knows there are recognizable objects and patterns in Earth's solar system. The student is expected to

3.9A construct models and explain the orbits of the Sun, Earth, and Moon in relation to each other; and

3.9B identify the order of the planets in Earth's solar system in relation to the Sun.

4.6 Matter and energy. The student knows that matter has measurable physical properties that determine how matter is identified, classified, changed, and used. The student is expected to

4.6A classify and describe matter using observable physical properties, including temperature, mass, magnetism, relative density (the ability to sink or float in water), and physical state (solid, liquid, gas).

4.7 Forces, motion, and energy. The student knows the nature of forces and the patterns of their interactions. The student is expected to

4.7 plan and conduct descriptive investigations to explore the patterns of forces such as gravity, friction, or magnetism in contact or at a distance on an object.

4.8 Forces, motion, and energy. The student knows that energy is everywhere and can be observed in cycles, patterns, and systems. The student is expected to

4.8A investigate and identify the transfer of energy by objects in motion, waves in water, and sound.

4.8B identify conductors and insulators of thermal and electrical energy; and

4.8C demonstrate and describe how electrical energy travels in a closed path that can produce light and thermal energy.

4.9 Earth and space. The student recognizes patterns among the Sun, Earth, and Moon system and their effects. The student is expected to

4.9B collect and analyze data to identify sequences and predict patterns of change in the observable appearance of the Moon from Earth.

5.6 Matter and energy. The student knows that matter has measurable physical properties that determine how matter is identified, classified, changed, and used. The student is expected to

5.6A compare and contrast matter based on measurable, testable, or observable physical properties, including mass, magnetism, relative density (sinking and floating using water as a reference point), physical state (solid, liquid, gas), volume, solubility in water, and the ability to conduct or insulate thermal energy and electric energy.

5.7 Forces, motion, and energy. The student knows the nature of forces and the patterns of their interactions. The student is expected to

- **5.7A** investigate and explain how equal and unequal forces acting on an object cause patterns of motion and transfer of energy; and
- **5.7B** design a simple experimental investigation that tests the effect of force on an object in a system such as a car on a ramp or a balloon rocket on a string.

5.8 Force, motion, and energy. The student knows that energy is everywhere and can be observed in cycles, patterns, and systems. The student is expected to

- **5.8A** investigate and describe the transformation of energy in systems such as energy in a flashlight battery that changes from chemical energy to electrical energy to light energy; and
- **5.8B** demonstrate that electrical energy in complete circuits can be transformed into motion, light, sound, or thermal energy and identify the requirements for a functioning electrical circuit.
- **5.8C** demonstrate and explain how light travels in a straight line and can be reflected, refracted, or absorbed.

5.9 Earth and space. The student recognizes patterns among the Sun, Earth, and Moon system and their effects. The student is expected to

- **5.9** demonstrate that Earth rotates on its axis once approximately every 24 hours and explain how that causes the day/night cycle and the appearance of the Sun moving across the sky, resulting in changes in shadow positions and shapes.

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;
- **5.2C** use mathematical calculations to compare patterns and relationships; 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;
- **5.5C** use scale, proportion, and quantity to describe, compare, or model different systems;
- **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; and
- **5.5F** explain the relationship between the structure and function of objects, organisms, and systems.

English Language Proficiency Standards (ELPS)

- **1A** Use prior knowledge and experiences to understand meanings in English.
- **1D** Speak using learning strategies such as requesting assistance, employing non-verbal cues, and using synonyms and circumlocution (conveying ideas by defining or describing when exact English words are not known).
- **2C** Learn new language structures, expressions, and basic and academic vocabulary heard during classroom instruction and interactions.
- **2D** Monitor understanding of spoken language during classroom instruction and interactions and seek clarification as needed.
- **2E** Use visual, contextual, and linguistic support to enhance and confirm understanding of increasingly complex and elaborated spoken language.
- **3B** Expand and internalize initial English vocabulary by learning and using high-frequency English words necessary for identifying and describing people, places, and objects, by retelling simple stories and basic information represented or supported by pictures, and by learning and using routine language needed for classroom communication.
- **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.
- **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.
- **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.