Shelby County Schools Science Vision

Shelby County Schools' vision of science education is to ensure that from early childhood to the end of the 12th grade, all students have heightened curiosity and an increased wonder of science; possess sufficient knowledge of science and engineering to engage in discussions; are able to learn and apply scientific and technological information in their everyday lives; and have the skills such as critical thinking, problem solving, and communication to enter careers of their choice, while having access to connections to science, engineering, and technology.

To achieve this, Shelby County Schools has employed The Tennessee Academic Standards for Science to craft meaningful curricula that is innovative and provide a myriad of learning opportunities that extend beyond mastery of basic scientific principles.

Introduction

In 2014, the Shelby County Schools Board of Education adopted a set of ambitious, yet attainable goals for school and student performance. The District is committed to these goals, as further described in our strategic plan, Destination 2025. In order to achieve these ambitious goals, we must collectively work to provide our students with high quality standards aligned instruction. The Tennessee Academic Standards for Science provide a common set of expectations for what students will know and be able to do at the end of each grade, can be located in the Tennessee Science Standards Reference. Tennessee Academic Standards for Science are rooted in the knowledge and skills that students need to succeed in post-secondary study or careers. While the academic standards establish desired learning outcomes, the curricula provides instructional planning designed to help students reach these outcomes. The curriculum maps contain components to ensure that instruction focuses students toward college and career readiness. Educators will use this guide and the standards as a roadmap for curriculum and instruction. The sequence of learning is strategically positioned so that necessary foundational skills are spiraled in order to facilitate student mastery of the standards.

Our collective goal is to ensure our students graduate ready for college and career. Being College and Career Ready entails, many aspects of teaching and learning. We want our students to apply their scientific learning in the classroom and beyond. These valuable experiences include students being facilitators of their own learning through problem solving and thinking critically. The Science and Engineering Practices are valuable tools used by students to engage in understanding how scientific knowledge develops. These practices rest on important "processes and proficiencies" with longstanding importance in science education. The science maps contain components to ensure that instruction focuses students toward understanding how science and engineering can contribute to meeting many of the major challenges that confront society today. The maps are centered around five basic components: the Tennessee Academic Standards for Science, Science and Engineering Practices, Disciplinary Core Ideas, Crosscutting Concepts, and Phenomena.

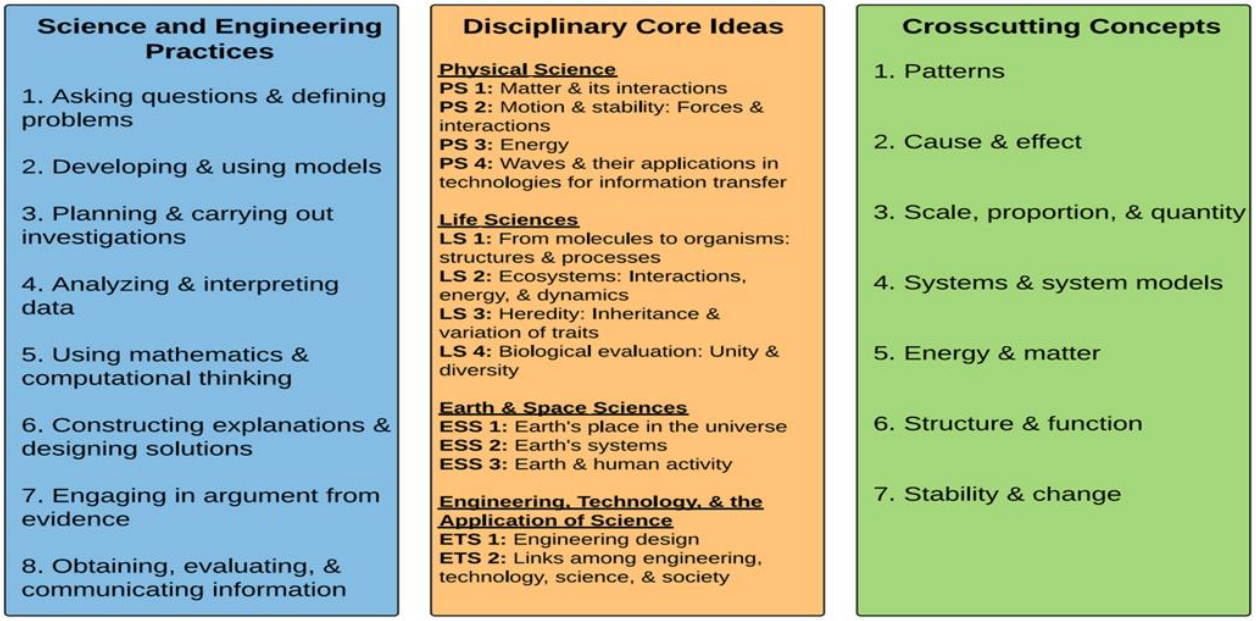
The Tennessee Academic Standards for Science were developed using the National Research Council's 2012 publication, A Framework for K-12 Science Education as their foundation. The framework presents a new model for science instruction that is a stark contrast to what has come to be the norm in science classrooms. Thinking about science had become memorizing concepts and solving mathematical formulae. Practicing science had become prescribed lab situations with predetermined outcomes. The framework proposes a three-dimensional approach to science education that capitalizes on a child's natural curiosity. The Science Framework for K-12 Science Education provides the blueprint for developing the effective science practices. The *Framework* expresses a vision in science education that requires students to operate at the nexus of three dimensions of learning: Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The *Framework* identified a small number of disciplinary core ideas that all students should learn with increasing depth and sophistication, from Kindergarten through grade twelve. Key to the vision expressed in the *Framework* is for students to learn these disciplinary core ideas in the context of science and engineering practices. The importance of combining Science and Engineering Practices, Crosscutting Concepts and Disciplinary Core Ideas is stated in the *Framework* as follows:

Standards and performance expectations that are aligned to the framework must take into account that students cannot fully understand scientific and engineering ideas without engaging in the practices of inquiry and the discourses by which such ideas are developed and refined. At the same time, they cannot learn or show competence in practices except in the context of specific content. (NRC Framework, 2012, p. 218)

To develop the skills and dispositions to use scientific and engineering practices needed to further their learning and to solve problems, students need to experience instruction in which they use multiple practices in developing a particular core idea and apply each practice in the context of multiple core ideas. We use the term "practices" instead of a term such as "skills" to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Students in grades K-12 should engage in all eight practices over each grade band**.** Crosscutting concepts have application across all domains of science. As such, they are a way of linking the different domains of science. Crosscutting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. There are seven crosscutting concepts that bridge disciplinary boundaries, uniting core ideas throughout the fields of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas and develop a coherent and scientifically based view of the world.

The map is meant to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional practice. In fact, our goal is not to merely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. Teachers who are knowledgeable about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-positioned to make decisions about how to support student learning toward such mastery.

Teachers are therefore expected--with the support of their colleagues, coaches, leaders, and other support providers--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related best practices. However, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning are non-negotiable. We must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful support of literacy and language learning across the content areas.



Learning Progression

At the end of the elementary science experience, students can observe and measure phenomena using appropriate tools. They are able to organize objects and ideas into broad concepts first by single properties and later by multiple properties. They can create and interpret graphs and models that explain phenomena. Students can keep notebooks to record sequential observations and identify simple patterns. They are able to design and conduct investigations, analyze results, and communicate the results to others. Students will carry their curiosity, interest and enjoyment of the scientific world view, scientific inquiry, and the scientific enterprise into middle school.

At the end of the middle school science experience, students can discover relationships by making observations and by the systematic gathering of data. They can identify relevant evidence and valid arguments. Their focus has shifted from the general to the specific and from the simple to the complex. They use scientific information to make wise decision related to conservation of the natural world. They recognize that there are both negative and positive implications to new technologies.

As an SCS graduate, former students should be literate in science, understand key science ideas, aware that science and technology are interdependent human enterprises with strengths and limitations, familiar with the natural world and recognizes both its diversity and unity, and able to apply scientific knowledge and ways of thinking for individual and social purposes.

Structure of the Standards

- Grade Level/Course Overview: An overview that describes that specific content and themes for each grade level or high school course.
- Disciplinary Core Idea: Scientific and foundational ideas that permeate all grades and connect common themes that bridge scientific disciplines.
- Standard: Statements of what students can do to demonstrate knowledge of the conceptual understanding. Each performance indicator includes a specific science and engineering practice paired with the content knowledge and skills that students should demonstrate to meet the grade level or high school course standards.

Purpose of Science Curriculum Maps

This map is a guide to help teachers and their support providers (e.g., coaches, leaders) on their path to effective, college and career ready (CCR) aligned instruction and our pursuit of Destination 2025. It is a resource for organizing instruction around the Tennessee Academic Standards for Science, which define what to teach and what students need to learn at each grade level. The map is designed to reinforce the grade/course-specific standards and content (scope) and provides *suggested* sequencing, pacing, time frames, and aligned resources. Our hope is that by curating and organizing a variety of standards-aligned resources, teachers will be able to spend less time wondering what to teach and searching for quality materials (though they may both select from and/or supplement those included here) and have more time to plan, teach, assess, and reflect with colleagues to continuously improve practice and best meet the needs of their students.

The map is meant to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional practice. In fact, our goal is not to merely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. Teachers who are knowledgeable about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-positioned to make decisions about how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, leaders, and other support providers--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related best practices. However, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning are non-negotiable. We must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful support of literacy and language learning across the content areas.

8th Grade Quarter 2 Curriculum Map					
Quarter 1		**Quarter 2**		Quarter 3	Quarter 4
Unit 1 Motion and Forces	Unit 2 Electricity and Magnetism	**Unit 3** **Waves**	Unit 4 Our Universe	Unit 5 Restless Earth	Unit 6 Change Over Time
4 weeks	5 weeks	**6 weeks**	3 weeks	9 weeks	9 weeks

UNIT 3: Waves (6 weeks)

Overarching Question(s)

How are waves used to transfer energy and information?

Unit 3, Lesson 1	Lesson Length	Essential Question	Vocabulary
Waves	3 days	What are waves?	wave, longitudinal wave, mechanical wave, medium, transverse wave, electromagnetic wave

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) PS4: Waves and Their Applications in Technologies for Information Transfer **Standard(s)** 8.PS4.2 Compare and contrast mechanical waves and electromagnetic waves based on refraction, reflection, transmission and absorption and their behavior through a vacuum and/or various media. **Explanation(s) and Support of Standard(s) from TN Science Reference Guide** 8.PS4.2 A wave is a means of transporting energy from a source to some other location. The interaction between waves and their transmitting	**Learning Outcomes** • Define wave. • Distinguish between a wave and its medium. • Differentiate between longitudinal and transverse waves. • Describe properties and give examples of mechanical waves. • Explain the major differences between mechanical and electromagnetic waves.	**Curricular Resources** HMH Tennessee Science TE, Unit 3, Lesson 1 pp. 164-176 Engage • Noticing Waves Everywhere Activity, TE p. 166 • Engage Your Brain #s 1 and 2, SE p. 133 • Active Reading #s 3 and 4, SE p. 133 • Making Waves Daily Demo, TE p. 167 Explore Mechanical Waves • Water Waves Quick Lab, TE p. 167 Explain What Is a Wave? • Active Reading #5, SE p. 134 • Visualize It! #6, SE p. 135

medium can result in a decrease in the energy of the wave. Models can be created to explain phenomena that occur as a result from the behaviors of either electrical or mechanical waves that result from interactions between the wave and the medium transmitting the wave. Additionally, students should note that electromagnetic (light) waves will interact at boundaries of matter, but are uniquely able to travel without a medium. At boundaries, light and mechanical waves may undergo changes that result from being refracted, reflected, transmitted or absorbed. For example, a mechanical wave will reflect and invert when it reaches the immobile end of its medium (e.g. a wave reflecting at the end of string that is tied in place), but will reflect without inverting if the end can move freely (e.g., a wave traveling through water in a tub that reflects off the side of the tub). Electromagnetic waves will reflect and travel in straight lines with predictable patterns for their angles of reflection.	**Suggested Phenomenon**  Click on the picture to view how waves can be created by a disturbance in a medium. Students can complete a See Think Wonder Template while watching the video.	• Visualize It! #s 7 and 8, SE p. 135 Classifying Waves • Active Reading #9, SE p. 136 • Visualize It! #10, SE p. 136 • Visualize It! #11, SE p. 137 • Categorize #12, SE p. 137 • Think Outside the Book #13, SE p. 137 Mechanical Waves • Visualize It! #14, SE p. 139 Electromagnetic Waves • Visualize It! #14, SE p. 139 <u>Extend</u> Reinforce and Review • Cluster Diagram Graphic Organizer, TE p. 170 • Visual Summary, SE p. 140 Going Further • Real World Connection, TE p. 170 • Earth Science Connection, TE p. 170 <u>Evaluate</u> Formative Assessment • Throughout TE • Reteach, TE p. 171 • Lesson Review, SE p. 141 Summative Assessment • What Are Waves Alternative Assessment, TE p. 171 • Lesson Quiz

Suggested Science and Engineering Practice(s)
Developing and Using Models 8.PS4.2
Students create models which are responsive and incorporate features that are not visible in the natural world, but have implications on the behavior of the modeled systems and can identify limitations of their models.

Suggested Crosscutting Concept(s)
Structure and Function 8.PS4.2
Students begin to attribute atomic structure and interactions between particles to the properties of a material

At many sporting events, members of the crowd stand up and lift their hands in a pattern that people call "doing the wave." Click on the picture to watch a video clip. Instruct the students do the wave as a class.

Possible Guiding Questions:
What did you feel as you were doing the wave?
How do you think the way you were moving compares to the way particles in an ocean wave, waving flag, or sound wave move?
Do you think people "doing the wave" are a wave? Why or why not?

Additional Resources
- 8.PS4.2 Student Activity Sheet and Teacher Guide
- Waves and Currents STUDY JAMS! Video and Quiz
- Slinky in Hand Science Snack
- The Physics Classroom Waves Tutorial

ESL Supports and Scaffolds
WIDA Standard 4- The Language of Science

To support students in speaking refer to this resource:
WIDA Doing and Talking Science

When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates

Interactive Science Dictionary with visuals

Pre-teach Vocabulary: (Consider teaching this vocabulary in addition to vocabulary addressed in the standard to support Entering Level ELs)
medium, wave, property

To support students with the scientific explanation: Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing.

		Describe Sentence Frames: The _____ has____, and_____. How does the _____? Why did/didn't the _____? _____is located (prep phrase) the ____. The _____are usually _____. Describe Signal Words: For example, For instance, In support of this, In fact, As evidence Compare/Contrast Sentence Frames: This _____ is similar to that _____because both _____. This _____ is similar to that _____because both _____. _____ and _____ are different. _____ and _____ are similar. _____ goes with _____. _____ means the same as _____. _____ is similar to _____. _____ and _____ are _____. _____ is a _____. Signal Words: in like manner, likewise, similarly, as well as, compared to, in the same way, have in common, all are

		after all, for all that, on the other hand, although, this may be true, however, on the contrary, and yet, in contrast to this, still, at the same time, nevertheless, yet, but notwithstanding, as opposed to, conversely, even though, rather than, in spite of

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4 weeks	5 weeks	**6 weeks**	3 weeks	9 weeks	9 weeks

UNIT 3: Waves (6 weeks)

Overarching Question(s)

How are waves used to transfer energy and information?

Unit 3, Lesson 2	Lesson Length	Essential Question	Vocabulary
Properties of Waves	3 days	How can we describe a wave?	wave, wave period, wave speed, amplitude, frequency, wavelength, hertz

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) PS4: Waves and Their Applications in Technologies for Information Transfer **Standard(s)** 8.PS4.1 Develop and use models to represent the basic properties of waves including frequency, amplitude, wavelength and speed. 8.PS4.2 Compare and contrast mechanical waves and electromagnetic waves based on refraction, reflection, transmission and absorption and their behavior through a vacuum and/or various media.	**Learning Outcomes** • Describe the parts of a wave. • Describe how the energy of a wave varies over time. • Describe the relationship between the wavelength, frequency, and speed of a wave. • Explain how the properties of a medium affect the speed of a mechanical wave. • Compare and describe the speed of sound in air (at standard pressure and temperature) with speed of sound in other materials.	**Curricular Resources** HMH Tennessee Science TE, Unit 3, Lesson 2 pp. 180-192 Engage • Engage Your Brain #s 1 and 2, SE p. 145 • Active Reading #s 3 and 4, SE p. 145 Explore Explain Wave Properties • Visualize It! #s 5 and 6, SE p. 146 • Visualize It! #s 7 and 8, SE p. 146 • Making a Wave Activity, TE p. 182 • Exploring Longitudinal Waves Daily Demo, TE p. 182

Explanation(s) and Support of Standard(s) from TN Science Reference Guide 8.PS4.1 Waves transfer energy from the place where they form (source), to another place. Consider a rock thrown into a pond: Before the rock lands in the water, it has the energy of motion (kinetic energy). The water slows down the rock when the rock hits the water and some energy of motion is "lost." The energy "lost" by the rock because of the collision forms ripples (waves) on the surface of the pond. These ripples move across a pond carrying energy away from where the impact occurred. The behavior of the source of the wave determines the properties of the wave. The frequency of the wave is an outcome of patterns in the motion of the source. For example, speakers producing higher pitch sounds (high frequency) move back and forth at a faster rate. The amplitude of a wave is an outcome of the amount of energy being transferred from the source. A speaker moves back and forth as an electromagnetic force to pull back the speaker cone. When the electromagnet is turned off or reversed, the speaker cone snaps forward, creating one wave pulse. If more energy is used to push/pull the speaker cone further, the outcome is a wave with greater amplitude.	**Suggested Phenomenon**  A heart monitor, also known as an EKG, ECG, or electrocardiogram, displays the electrical activity of the heart in the form of a wave. A healthcare professional can determine information about a patient's heartbeat by analyzing characteristics of the wave. Students can complete a See Think Wonder Template after observing the picture. Possible Guiding Question(s): What differences do you see in the waves included on the EKG?	Wave Energy • Active Reading #9, SE p. 148 • Think Outside the Book #10, SE p. 148 • Inquiry #11, SE p. 149 • Visualize It! #12, SE p. 149 • Waves on a Spring Quick Lab, TE p. 182 • Investigate Wavelength Exploration Lab, TE p. 183 Behavior and Speed of Waves • Active Reading #s 13 and 14, SE p. 150 • Visualize It! #15, SE p. 150 • Types of Waves Discussion, TE p. 182 • Investigate Frequency Quick Lab, TE p. 183 What Are Waves and How Do They Behave? Virtual Lab, TE p. 183 Extend Reinforce and Review • Label, Measure, and Calculate Activity, TE p. 186 • Cluster Diagram Graphic Organizer, TE p. 186 • Visual Summary, SE p. 152 Going Further • Real World Connection, TE p. 186 Evaluate Formative Assessment • Throughout TE • Reteach, TE p. 186 • Lesson Review, SE p. 153

The wavelength of the sound wave generated by the speaker system is an outcome of how the distance a pulse has traveled away from the speaker before the next wave is created. Waves of identical frequencies will have different wavelengths if they are traveling through different mediums. This can be explained by a difference in velocity. Consider a pair of waves created by a pair of speakers creating compressions at identical, constant rates. If one speaker is transmitting through air, and the other water, the wave fronts will move away from the source at different rates. The wave traveling through water will travel 4x as fast. Before the speaker cone snaps back to create a second compression from each speaker, the initial compression of the wave traveling through the water will have traveled four times further from its source (speaker cone) than the wave front traveling through the air. Visualizing this pattern repeated over time, we see a wavelength that is four times greater in the water than in air. 8.PS4.2 A wave is a means of transporting energy from a source to some other location. The interaction between waves and their transmitting medium can result in a decrease in the energy of the wave. Models can be created to explain phenomena that occur as a result from the behaviors of either		Summative Assessment • Describing Wave Properties Alternative Assessment, TE p.187 • Lesson Quiz **Additional Resources** • 8.PS4.1 Student Activity and Teacher Guide • Earth's Systems: What are Waves? Newsela Article • The Physics Classroom Waves Tutorial **ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable- use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Re-teach vocabulary as needed. To support students with the scientific explanation: Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing.

electrical or mechanical waves that result from interactions between the wave and the medium transmitting the wave. Additionally, students should note that electromagnetic (light) waves will interact at boundaries of matter, but are uniquely able to travel without a medium. At boundaries, light and mechanical waves may undergo changes that result from being refracted, reflected, transmitted or absorbed. For example, a mechanical wave will reflect and invert when it reaches the immobile end of its medium (e.g. a wave reflecting at the end of string that is tied in place), but will reflect without inverting if the end can move freely (e.g., a wave traveling through water in a tub that reflects off the side of the tub). Electromagnetic waves will reflect and travel in straight lines with predictable patterns for their angles of reflection. **Suggested Science and Engineering Practice(s)** <u>Using Mathematics and Computational Thinking</u> 8.PS4.1 Students can use computing to process large amounts of data in order to develop mathematical representations (ratios, percentages, rates) that will help evaluate a scientific explanation.		Describe Sentence Frames: The _____ has____, and_____. How does the _____? Why did/didn't the _____? _____is located (prep phrase) the ____. The _____are usually _____. Describe Signal Words: For example, For instance, In support of this, In fact, As evidence Compare/Contrast Sentence Frames: This _____ is similar to that _____because both _____. This _____ is similar to that _____because both _____. _____ and _____ are different. _____ and _____ are similar. _____ goes with _____. _____ means the same as _____. _____ is similar to _____. _____ and _____ are _____. _____ is a _____.

Developing and Using Models 8.PS4.2 Students create models which are responsive and incorporate features that are not visible in the natural world, but have implications on the behavior of the modeled systems and can identify limitations of their models. **Suggested Crosscutting Concept(s)** Patterns 8.PS4.1 Students recognize, classify, and record patterns in data, graphs, and charts. Structure and Function 8.PS4.2 Students begin to attribute atomic structure and interactions between particles to the properties of a material.		Signal Words: in like manner, likewise, similarly, as well as, compared to, in the same way, have in common, all are, after all, for all that, on the other hand, although, this may be true, however, on the contrary, and yet, in contrast to this, still, at the same time, nevertheless, yet, but notwithstanding, as opposed to, conversely, even though, rather than, in spite of

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UNIT 3: Waves (6 weeks)			
Overarching Question(s)			
How are waves used to transfer energy and information?			
Unit 3, Lesson 3	**Lesson Length**	**Essential Question**	**Vocabulary**
Communication and Waves	3 days	How are waves used to communicate information?	communication, analog signal, digital signal, wave, frequency

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) PS4: Waves and Their Applications in Technologies for Information Transfer **Standard(s)** 8.PS4.3 Evaluate the role that waves play in different communication systems. **Explanation(s) and Support of Standard(s) from TN Science Reference Guide** 8.PS4.3 Digitizing is the process of converting information into a series of binary ones and zeroes representing either an on or off state. Once digitized, information can be transmitted as wave pulses and stored reliably and recreated at a later time. Devices that do not work digitally, function in	**Learning Outcomes** • Define communication. • Describe methods of communication. • Compare digital and analog signals. • Define radio waves. • Identify modern methods of communication. • Compare how waves are used to send information.	**Curricular Resources** HMH Tennessee Science TE, Unit 3, Lesson 3 pp. 194-208 Engage • Engage Your Brain #s 1 and 2, SE p. • Active Reading #s 3 and 4, SE p. Explore Methods of Communication • Try It Out!: Encode and Transmit a Message, SE pp. 160-161 • Investigate Digital Information S.T.E.M. Lab, TE p. 197 Explain Methods of Communication • Active Reading #5, SE p. 156 • Visualize It! #s 6 and 7, SE p. 156

analog. Analog devices can have infinite states. The difference between analog and digital is analogous to the difference between a light switch (digital) and a dimmer switch (analog).

Models of different systems of communication can unveil the benefits of digitizing information. Students might design a way that information can be digitized using only two states and transmit a message using their system, considering how accuracy and distance that the message can be transmitted increase as a result of the encoding process. For example, students might attempt to transmit a written message in speech or speaking into cup-on-a-string system (analog), as compared to encoding this information in a pattern of plucks of the string, array of illuminated lights, or flashes of a single light.

Students should explore similar applications of information transfer in the functioning of radios, televisions, cellphones, and wireless computer networks.

Suggested Science and Engineering Practice(s)
Constructing Explanations and Designing Solutions
8.PS4.3
Students form explanations using source (including student developed investigations) which show comprehension of parsimony, utilize quantitative

Suggested Phenomenon

Click on the link for more information on using this picture as a phenomenon.

The Role of Waves in Communication
- Visualize It! #8, SE p. 162

Extend
Reinforce and Review
- Visual Summary, SE p. 16

Going Further
Evaluate
Formative Assessment
- Reteach, TE p.
- Throughout TE
- Lesson Review, SE p.

Summative Assessment
- Alternative Assessment, TE p.
- Lesson Quiz

Additional Resources
- Analog World, Digital World: Encoding and Transmitting Information
- Modulated LED Science Snack

ESL Supports and Scaffolds
WIDA Standard 4- The Language of Science

To support students in speaking refer to this resource:
WIDA Doing and Talking Science

When applicable- use Home Language to build vocabulary in concepts. Spanish Cognates
Interactive Science Dictionary with visuals

and qualitative models to make predictions, and can support or cause revisions of a particular conclusion. **Suggested Crosscutting Concept(s)** Structure and Function 8.PS4.3 Students design systems, selecting materials for their relevant properties.		Pre-teach Vocabulary: (Consider teaching this vocabulary in addition to vocabulary addressed in the standard to support Entering Level ELs) Communicate, digital, analog, signal, Describe Sentence Frames: The _____ has____, and_____. How does the _____? Why did/didn't the _____? _____is located _(prep phrase)_the ____. The _____are usually _____. One of the key characteristics of _____ is _____. A secondary characteristic is _____. Describe Signal Words: For example, For instance, In support of this, In fact, As evidence Compare/Contrast Sentence Frames: This _____ is similar to that _____because both _____. This _____ is similar to that _____because both _____. _____ and _____ are different.

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UNIT 3: Waves (6 weeks)

Overarching Question(s)

How are waves used to transfer energy and information?

Unit 3, Lesson 4	Lesson Length	Essential Question	Vocabulary
Sound Waves and Hearing	3 days	What is sound?	pitch, sound wave, loudness, longitudinal wave, decibel, Doppler effect

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) PS4: Waves and Their Applications in Technologies for Information Transfer **Standard(s)** 8.PS4.1 Develop and use models to represent the basic properties of waves including frequency, amplitude, wavelength and speed. 8.PS4.2 Compare and contrast mechanical waves and electromagnetic waves based on refraction, reflection, transmission and absorption and their behavior through a vacuum and/or various media.	**Learning Outcomes** • Describe the properties of longitudinal waves. • Differentiate a sound wave as a type of longitudinal wave. • Explain that sound requires a medium in which to travel. • Describe how the human ear detects sound. • Explain how pitch depends on wave frequency. • Analyze and describe how sound loudness depends on amplitude. • Describe the effect of loud sounds on human hearing. • Describe how the Doppler effect changes the sound heard.	**Curricular Resources** HMH Tennessee Science TE, Unit 4, Lesson 1 pp. 222-235 Engage • Engage Your Brain #s 1 and 2, SE p. 177 • Active Reading #s 3 and 4, SE p. 177 Explore Explain Introduction to Sound Waves • Active Reading #5, SE p. 178 • Visualize It! #6, SE p. 178 • Active Reading #7, SE p. 179 • Sound Idea Exploration Lab, TE p. 225 Detection of Sound Waves • Active Reading #8, SE p. 180 • Analyze #9, SE p. 180

Explanation(s) Support of Standard(s) from TN Science Reference Guide 8.PS4.1 Waves transfer energy from the place where they form (source), to another place. Consider a rock thrown into a pond: Before the rock lands in the water, it has the energy of motion (kinetic energy). The water slows down the rock when the rock hits the water and some energy of motion is "lost." The energy "lost" by the rock because of the collision forms ripples (waves) on the surface of the pond. These ripples move across a pond carrying energy away from where the impact occurred. The behavior of the source of the wave determines the properties of the wave. The frequency of the wave is an outcome of patterns in the motion of the source. For example, speakers producing produce higher pitch sounds (high frequency) move back and forth at a faster rate. The amplitude of a wave is an outcome of the amount of energy being transferred from the source. A speaker moves back and forth as an electromagnetic force to pull back the speaker cone. When the electromagnet is turned off or reversed, the speaker cone snaps forward, creating one wave pulse. If more energy is used to push/pull the speaker cone further, the outcome is a wave with greater amplitude.	**Suggested Phenomenon**  Click on the picture to play the video clip of the guitar producing sound from the vibrations created by the player. Students can complete a See Think Wonder Template while watching the video.	• Predict #10, SE p. 181 • Sound Waves and Hearing Virtual Lab, TE p. 225 Characteristics and Properties of Sound Waves • Visualize It! #11, SE p. 182 • Active Reading #12, SE p. 183 • Sound Wave Diagrams Activity, TE p. 224 • Think Outside the Book #13, SE p. 184 The Doppler Effect • Active Reading #14, SE p. 185 • Visualize It! #15, SE p. 185 • Infer #16, SE p. 185 Extend Reinforce and Review • Combination Notes Graphic Organizer, TE p. 228 • Visual Summary, SE p. 186 Evaluate Formative Assessment • Throughout TE • Reteach, TE p. 229 • Lesson Review, SE p. 187 Summative Assessment • Sound Waves and Hearing Alternative Assessment, TE p. 229 • Lesson Quiz **Additional Resources** • Science vs. Music Video

The wavelength of the sound wave generated by the speaker system is an outcome of how the distance a pulse has traveled away from the speaker before the next wave is created. Waves of identical frequencies will have different wavelengths if they are traveling through different mediums. This can be explained by a difference in velocity. Consider a pair of waves created by a pair of speakers creating compressions at identical, constant rates. If one speaker is transmitting through air, and the other water, the wave fronts will move away from the source at different rates. The wave traveling through water will travel 4x as fast. Before the speaker cone snaps back to create a second compression from each speaker, the initial compression of the wave traveling through the water will have traveled four times further from its source (speaker cone) than the wave front traveling through the air. Visualizing this pattern repeated over time, we see a wavelength that is four times greater in the water than in air. 8.PS4.2 A wave is a means of transporting energy from a source to some other location. The interaction between waves and their transmitting medium can result in a decrease in the energy of the wave. Models can be created to explain phenomena that occur as a result from the behaviors of either		• Sound Waves and Music • Sound STUDY JAMS! Video and Quiz • Doppler Effect Science Snack • The Physics Classroom Sound Waves and Music Tutorial **ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable- use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals To support students with the scientific explanation: Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing. Classify Sentence Frames: We can classify _____ according to _____. A common characteristic of _____ and _____ is_____. A characteristic of _____ and _____ is_____.

electrical or mechanical waves that result from interactions between the wave and the medium transmitting the wave. Additionally, students should note that electromagnetic (light) waves will interact at boundaries of matter, but are uniquely able to travel without a medium. At boundaries, light and mechanical waves may undergo changes that result from being refracted, reflected, transmitted or absorbed. For example, a mechanical wave will reflect and invert when it reaches the immobile end of its medium (e.g. a wave reflecting at the end of string that is tied in place), but will reflect without inverting if the end can move freely (e.g., a wave traveling through water in a tub that reflects off the side of the tub). Electromagnetic waves will reflect and travel in straight lines with predictable patterns for their angles of reflection. **Suggested Science and Engineering Practice(s)** <u>Using Mathematical and Computational Thinking</u> 8.PS4.1 Students can use computing to process large amounts of data in order to develop mathematical representations (ratios, percentages, rates) that will help evaluate a scientific explanation.		One attribute of _____ is _____. _____ and _____ have the following traits in common: _____. _____ can be identified by _____. I grouped _____ and _____ together because _____. _____ is a member of _____ but _____ is not_____. I believe/think _____ is a member of _____ because ____. Describe Sentence Frames: The _____ has____, and_____. How does the _____? Why did/didn't the _____? _____is located (prep phrase) the ____. The _____are usually _____. One of the key characteristics of _____ is _____. A secondary characteristic is _____. Describe Signal Words: For example, For instance, In support of this, In fact, As evidence Compare/Contrast Sentence Frames: This _____ is similar to that _____because both _____.

Developing and Using Models 8.PS4.2 Students create models which are responsive and incorporate features that are not visible in the natural world, but have implications on the behavior of the modeled systems and can identify limitations of their models. **Suggested Crosscutting Concept(s)** Patterns 8.PS4.1 Students recognize, classify, and record patterns in data, graphs, and charts. Structure and Function 8.PS4.2 Students begin to attribute atomic structure and interactions between particles to the properties of a material.		This _____ is similar to that _____because both _____. _____ and _____ are different.

8th Grade Quarter 2 Curriculum Map					
Quarter 1		Quarter 2		Quarter 3	Quarter 4
Unit 1 Motion and Forces	Unit 2 Electricity and Magnetism	**Unit 3** **Waves**	Unit 4 Our Universe	Unit 5 Restless Earth	Unit 6 Change Over Time
4 weeks	5 weeks	**6 weeks**	3 weeks	9 weeks	9 weeks

UNIT 3: Waves (6 weeks)			
Overarching Question(s)			
How are waves used to transfer energy and information?			
Unit 3, Lesson 5	**Lesson Length**	**Essential Question**	**Vocabulary**
Interactions of Sound Waves	3 days	How do sound waves travel and interact?	echo, interference, resonance

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) PS4: Waves and Their Applications in Technologies for Information Transfer **Standard(s)** 8.PS4.1 Develop and use models to represent the basic properties of waves including frequency, amplitude, wavelength and speed. 8.PS4.2 Compare and contrast mechanical waves and electromagnetic waves based on refraction, reflection, transmission and absorption and their behavior through a vacuum and/or various media.	**Learning Outcomes** • Compare and describe the speed of sound in different states of matter. • Describe how the speed of sound depends on temperature. • Identify a reflected sound wave as an echo. • Describe ways that echoes can be reduced. • Compare constructive and destructive interference. • Explain how interference causes sonic booms. • Describe and Identify examples of resonance.	**Curricular Resources** HMH Tennessee Science TE, Unit 4, Lesson 2 pp. 236-249 Engage • Engage Your Brain #s 1 and 2, SE p. 189 • Active Reading #s 3 and 4, SE p. 189 Explore Explain Speed of Sound • Active Reading #5, SE p. 190 • Visualize It! #6, SE p. 190 • Apply #8, SE p. 191 Reflection • Active Reading #9, SE p. 192 • Visualize It! #10, SE p. 192 • Active Reading #11, SE p. 193

Explanation(s) Support of Standard(s) from TN Science Reference Guide 8.PS4.1 Waves transfer energy from the place where they form (source), to another place. Consider a rock thrown into a pond: Before the rock lands in the water, it has the energy of motion (kinetic energy). The water slows down the rock when the rock hits the water and some energy of motion is "lost." The energy "lost" by the rock because of the collision forms ripples (waves) on the surface of the pond. These ripples move across a pond carrying energy away from where the impact occurred. The behavior of the source of the wave determines the properties of the wave. The frequency of the wave is an outcome of patterns in the motion of the source. For example, speakers producing produce higher pitch sounds (high frequency) move back and forth at a faster rate. The amplitude of a wave is an outcome of the amount of energy being transferred from the source. A speaker moves back and forth as an electromagnetic force to pull back the speaker cone. When the electromagnet is turned off or reversed, the speaker cone snaps forward, creating one wave pulse. If more energy is used to push/pull the speaker cone further, the outcome is a wave with greater amplitude.	**Suggested Phenomenon**  An echo is a sound that is repeated because the sound waves are reflected back. Sound waves can bounce off smooth, hard objects in the same way a rubber ball bounces off the ground. Although the direction of the sound changes, the echo sounds the same as the original sound. Echoes can be heard in small spaces with hard walls, like wells, or where there are lots of hard surfaces all around. That is why echoes can be heard in a canyon, cave, or mountain range. But sounds are not always reflected. If they meet a soft surface, such as a cushion, they will be absorbed and will not bounce back. Click on the picture to see a video clip of an echo being produced. Students can complete a See Think Wonder Template after watching the video.	• Describe #12, SE p. 193 Interference • Active Reading #13, SE p. 194 • Describe #14, SE p. 194 • Visualize It! #15, SE p. 195 Resonance • Active Reading #16, SE p. 196 • Active Reading #17, SE p. 197 • Think Outside the Book #18, SE p. 197 Extend Reinforce and Review • Card Responses Activity, TE p. 242 • Three-Panel Flip Chart Graphic Organizer, TE p. 242 • Visual Summary, SE p. 198 Going Further • Engineering Connection, TE p. 242 • Math Connection, TE p. 242 Evaluate Formative Assessment • Throughout TE • Reteach, TE p. 243 • Lesson Review, SE p. 199 Summative Assessment • Interactions of Sound Waves Alternate Assessment, TE p. 243 • Lesson Quiz

The wavelength of the sound wave generated by the speaker system is an outcome of how the distance a pulse has traveled away from the speaker before the next wave is created. Waves of identical frequencies will have different wavelengths if they are traveling through different mediums. This can be explained by a difference in velocity. Consider a pair of waves created by a pair of speakers creating compressions at identical, constant rates. If one speaker is transmitting through air, and the other water, the wave fronts will move away from the source at different rates. The wave traveling through water will travel 4x as fast. Before the speaker cone snaps back to create a second compression from each speaker, the initial compression of the wave traveling through the water will have traveled four times further from its source (speaker cone) than the wave front traveling through the air. Visualizing this pattern repeated over time, we see a wavelength that is four times greater in the water than in air. 8.PS4.2 A wave is a means of transporting energy from a source to some other location. The interaction between waves and their transmitting medium can result in a decrease in the energy of the wave. Models can be created to explain phenomena that occur as a result from the behaviors of either		**Additional Resources** • Sound Waves and Ocean Waves • Engineering Students Use Sound Waves to Extinguish Fires • Anti-Sound Spring Science Snack • Organ Pipe Science Snack • Pipes of Pan Science Snack • The Physics Classroom Sound Waves and Music Tutorial **ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable- use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals To support students with the scientific explanation: Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing.

electrical or mechanical waves that result from interactions between the wave and the medium transmitting the wave. Additionally, students should note that electromagnetic (light) waves will interact at boundaries of matter, but are uniquely able to travel without a medium. At boundaries, light and mechanical waves may undergo changes that result from being refracted, reflected, transmitted or absorbed. For example, a mechanical wave will reflect and invert when it reaches the immobile end of its medium (e.g. a wave reflecting at the end of string that is tied in place), but will reflect without inverting if the end can move freely (e.g., a wave traveling through water in a tub that reflects off the side of the tub). Electromagnetic waves will reflect and travel in straight lines with predictable patterns for their angles of reflection. **Suggested Science and Engineering Practice(s)** <u>Using Mathematical and Computational Thinking</u> 8.PS4.1 Students can use computing to process large amounts of data in order to develop mathematical representations (ratios, percentages, rates) that will help evaluate a scientific explanation.		Classify Sentence Frames: We can classify _____ according to _____. A common characteristic of _____ and _____ is_____. A characteristic of _____ and _____ is_____. One attribute of _____ is _____. _____ and _____ have the following traits in common: _____. _____ can be identified by _____. I grouped _____ and _____ together because _____. _____ is a member of _____ but _____ is not_____. I believe/think _____ is a member of _____ because ____. Describe Sentence Frames: The _____ has____, and_____. How does the _____? Why did/didn't the _____? _____is located (prep phrase)_the ____. The _____are usually _____.

Developing and Using Models 8.PS4.2 Students create models which are responsive and incorporate features that are not visible in the natural world, but have implications on the behavior of the modeled systems and can identify limitations of their models. **Suggested Crosscutting Concept(s)** Patterns 8.PS4.1 Students recognize, classify, and record patterns in data, graphs, and charts. Structure and Function 8.PS4.2 Students begin to attribute atomic structure and interactions between particles to the properties of a material.		One of the key characteristics of _____ is _____. A secondary characteristic is _____. Describe Signal Words: For example, For instance, In support of this, In fact, As evidence Compare/Contrast Sentence Frames: This _____ is similar to that _____because both _____. This _____ is similar to that _____because both _____. _____ and _____ are different.

8th Grade Quarter 2 Curriculum Map					
Quarter 1		Quarter 2		Quarter 3	Quarter 4
Unit 1 Motion and Forces	Unit 2 Electricity and Magnetism	**Unit 3** **Waves**	Unit 4 Our Universe	Unit 5 Restless Earth	Unit 6 Change Over Time
4 weeks	5 weeks	**6 weeks**	3 weeks	9 weeks	9 weeks

UNIT 3: Waves (6 weeks)			
Overarching Question(s)			
How are waves used to transfer energy and information?			
Unit 3, Lesson 6	**Lesson Length**	**Essential Question**	**Vocabulary**
Sound Technology	3 days	How does sound technology work?	echolocation, ultrasound, sonar

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) PS4: Waves and Their Applications in Technologies for Information Transfer **Standard(s)** 8.PS4.3 Evaluate the role that waves play in different communication systems. **Explanation(s) and Support of Standard(s) from TN Science Reference Guide** 8.PS4.3 Digitizing is the process of converting information into a series of binary ones and zeroes representing either an on or off state. Once digitized, information can be transmitted as wave pulses and stored reliably and recreated at a later time. Devices that do not work digitally, function in analog. Analog devices can have infinite states. The	**Learning Outcomes** • Describe echolocation. • Describe how people use echolocation technology including ultrasound and sonar to study or locate objects that sometimes cannot be directly observed. • Explain how telephones are used to transmit sound over long distances. • Explain why sound recordings are useful. • Identify ways that sound can be recorded and played back.	**Curricular Resources** HMH Tennessee Science TE, Unit 4, Lesson 3 pp. 252-264 Engage • Sound Technology Activity, TE p. 254 • Engage Your Brain #s 1 and 2, SE p. 203 • Active Reading #s 3 and 4, SE p. 203 Explore Telephone Technology • Hear It! Activity, TE p. 254 • Making an AM Radio Transmitter, TE p. 255Explain Echolocation • Active Reading #5, SE p. 204 • Visualize It! #6, SE p. 204 • Visualize It! #7, SE p. 204 • Visualize It! #8, SE p. 205

difference between analog and digital is analogous to the difference between a light switch (digital) and a dimmer switch (analog). Models of different systems of communication can unveil the benefits of digitizing information. Students might design a way that information can be digitized using only two states and transmit a message using their system, considering how accuracy and distance that the message can be transmitted increase as a result of the encoding process. For example, students might attempt to transmit a written message in speech or speaking into cup-on-a-string system (analog), as compared to encoding this encoding this information in a pattern of plucks of the string, array of illuminated lights, or flashes of a single light. Students should explore similar applications of information transfer in the functioning of radios, televisions, cellphones, and wireless computer networks. **Suggested Science and Engineering Practice(s)** <u>Constructing Explanations and Designing Solutions</u> 8.PS4.3 Students form explanations using source (including student developed investigations) which show comprehension of parsimony, utilize quantitative and qualitative models to make predictions, and	**Suggested Phenomenon**  Echolocation is the use of sound waves and echoes to determine where objects are in space. Bats use echolocation to navigate and find food in the dark. To echolocate, bats send out sound waves from their mouth or nose. When the sound waves hit an object they produce echoes. The echo bounces off the object and returns to the bats ears. Bats listen to the echoes to figure out where the object is, how big it is, and its shape. Click on the picture to see a bat using echolocation to capture a moth for food. Students can complete a See Think Wonder Template after watching the video.	Telephone Technology • Active Reading #9 • Think Outside the Book, SE p. 206 Sound Playback and Recording Technology • Active Reading #14, SE p. 208 • Visualize It! #15, SE p. 208 • Summarize #16, SE p. 209 <u>Extend</u> Reinforce and Review • Key-Term Fold Graphic Organizer • Visual Summary, SE p. 210 Going Further • Language Arts Connection, TE p. 258 • Why It Matters, SE p. 259 <u>Evaluate</u> Formative Assessment • Throughout TE • Reteach, TE p. 259 • Lesson Review, SE p. 211 Summative Assessment • Sound Technology Alternative Assessment, TE p. 259 • Lesson Quiz • Unit 4 Big Idea, SE p. 212 • Unit 4 Review, SE p. 213-216 **Additional Resources** Using Waves to Communicate Lesson

can support or cause revisions of a particular conclusion. **Suggested Crosscutting Concept(s)** Structure and Function 8.PS4.3 Students design systems, selecting materials for their relevant properties.		**ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals To support students with the scientific explanation: Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing. Classify Sentence Frames: We can classify _____ according to _____. A common characteristic of _____ and _____ is_____. A characteristic of _____ and _____ is_____. One attribute of _____ is _____. _____ and _____ have the following traits in common: _____. _____ can be identified by _____.

		I grouped _____ and _____ together because _____. _____ is a member of _____ but _____ is not_____. I believe/think _____ is a member of _____ because ____. Describe Sentence Frames: The _____ has____, and_____. How does the _____? Why did/didn't the _____? _____is located (prep phrase) the ____. The _____are usually _____. One of the key characteristics of _____ is _____. A secondary characteristic is _____. Describe Signal Words: for example, for instance, in support of this, in fact, as evidence Compare/Contrast Sentence Frames: This _____ is similar to that _____because both _____. This _____ is similar to that _____because both _____.

8th Grade Quarter 2 Curriculum Map					
Quarter 1		**Quarter 2**		Quarter 3	Quarter 4
Unit 1 Motion and Forces	Unit 2 Electricity and Magnetism	**Unit 3** **Waves**	Unit 4 Our Universe	Unit 5 Restless Earth	Unit 6 Change Over Time
4 weeks	5 weeks	**6 weeks**	3 weeks	9 weeks	9 weeks

UNIT 3: Waves (6 weeks)

Overarching Question(s)

How are waves used to transfer energy and information?

Unit 3, Lesson 7	Lesson Length	Essential Question	Vocabulary
The Electromagnetic Spectrum	3 days	What is the relationship between various EM waves?	radiation, electromagnetic spectrum, ultraviolet, infrared

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) PS4: Waves and Their Applications in Technologies for Information Transfer **Standard(s)** 8.PS4.1 Develop and use models to represent the basic properties of waves including frequency, amplitude, wavelength and speed. 8.PS4.2 Compare and contrast mechanical waves and electromagnetic waves based on refraction, reflection, transmission and absorption and their behavior through a vacuum and/or various media.	**Learning Outcomes** • Describe properties of electromagnetic radiation. • Describe the relationship between color and wavelength frequency of visible light. • Describe the order of EM radiation by wavelength frequency. • Describe how the energy of the sun reaches Earth in the form of EM radiation. • Compare the energy levels of different parts of the EM spectrum.	**Curricular Resources** HMH Tennessee Science TE, Unit 5, Lesson 1 pp. 278-291 Engage • Engage Your Brain #s 1 and 2, SE p. • Active Reading #s 3 and 4, SE p. Explore Explain EM Radiation • Active Reading #5, SE p. 222 • Synthesize #6, SE p. 222 • Visualize It! #7, SE p. 222 • Visualize It! #8, SE p. 223 • Select #9, SE p. 223 The EM Spectrum

Explanation(s) and Support of Standard(s) from TN Science Reference Guide 8.PS4.1 Waves transfer energy from the place where they form (source), to another place. Consider a rock thrown into a pond: Before the rock lands in the water, it has the energy of motion (kinetic energy). The water slows down the rock when the rock hits the water and some energy of motion is "lost." The energy "lost" by the rock because of the collision forms ripples (waves) on the surface of the pond. These ripples move across a pond carrying energy away from where the impact occurred. The behavior of the source of the wave determines the properties of the wave. The frequency of the wave is an outcome of patterns in the motion of the source. For example, speakers producing produce higher pitch sounds (high frequency) move back and forth at a faster rate. The amplitude of a wave is an outcome of the amount of energy being transferred from the source. A speaker moves back and forth as an electromagnetic force to pull back the speaker cone. When the electromagnet is turned off or reversed, the speaker cone snaps forward, creating one wave pulse. If more energy is used to push/pull the speaker cone further, the outcome is a wave with greater amplitude.	**Suggested Phenomenon**  A trichroic prism splits light into three beams of light with different wavelengths (or colors). These prisms are used in some video cameras to send different colors of light to different color sensors. The prisms are coated with special coatings to filter and transmit different wavelengths of light. Click on the picture to view a video of the beautiful light produced by the prism. Students can complete a See Think Wonder Template after watching the video.	• Think Outside the Book #10, SE p. 225 • Comparing EM Wavelengths Daily Demo, SE p. 281 Energy in the EM Spectrum • Active Reading #11, SE p. 226 • Visualize It! #12, SE p. 226 • Hypothesize #13, SE p. 227 • Active Reading #14, SE p. 228 • Think Outside the Book #15, SE p. 228 Extend Reinforce and Review • Combination Notes Graphic Organizer, SE p. 284 • Visual Summary, SE p. 230 Going Further • Earth Science Connection, TE p. 284 • Why It Matters, SE p. 229 Evaluate Formative Assessment • Throughout TE • Reteach, TE p. 285 • Lesson Review, SE p. 231 Summative Assessment • The Electromagnetic Spectrum Alternative Assessment, TE p. 285 • Lesson Quiz **Additional Resources**

The wavelength of the sound wave generated by the speaker system is an outcome of how the distance a pulse has traveled away from the speaker before the next wave is created. Waves of identical frequencies will have different wavelengths if they are traveling through different mediums. This can be explained by a difference in velocity. Consider a pair of waves created by a pair of speakers creating compressions at identical, constant rates. If one speaker is transmitting through air, and the other water, the wave fronts will move away from the source at different rates. The wave traveling through water will travel 4x as fast. Before the speaker cone snaps back to create a second compression from each speaker, the initial compression of the wave traveling through the water will have traveled four times further from its source (speaker cone) than the wave front traveling through the air. Visualizing this pattern repeated over time, we see a wavelength that is four times greater in the water than in air. 8.PS4.2 A wave is a means of transporting energy from a source to some other location. The interaction between waves and their transmitting medium can result in a decrease in the energy of the wave. Models can be created to explain phenomena that occur as a result from the behaviors of either		• What's the Frequency, Roy G. Biv? Lab • Light Wave cK-12 Simulation • Electromagnetic Waves cK-12 Article • Electromagnetic Spectrum cK-12 Article • Light STUDY JAMS! Video and Quiz • CD Spectroscope Science Snack • The Physics Classroom Light Waves and Color Tutorial **ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals To support students with the scientific explanation: Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing. Classify Sentence Frames: We can classify _____ according to _____.

electrical or mechanical waves that result from interactions between the wave and the medium transmitting the wave. Additionally, students should note that electromagnetic (light) waves will interact at boundaries of matter, but are uniquely able to travel without a medium. At boundaries, light and mechanical waves may undergo changes that result from being refracted, reflected, transmitted or absorbed. For example, a mechanical wave will reflect and invert when it reaches the immobile end of its medium (e.g. a wave reflecting at the end of string that is tied in place), but will reflect without inverting if the end can move freely (e.g., a wave traveling through water in a tub that reflects off the side of the tub). Electromagnetic waves will reflect and travel in straight lines with predictable patterns for their angles of reflection. **Suggested Science and Engineering Practice(s)** <u>Using Mathematical and Computational Thinking</u> 8.PS4.1 Students can use computing to process large amounts of data in order to develop mathematical representations (ratios, percentages, rates) that will help evaluate a scientific explanation.		A common characteristic of _____ and _____ is_____. A characteristic of _____ and _____ is_____. One attribute of _____ is _____. _____ and _____ have the following traits in common: _____. _____ can be identified by _____. I grouped _____ and _____ together because _____. _____ is a member of _____ but _____ is not_____. I believe/think _____ is a member of _____ because ____. Describe Sentence Frames: The _____ has____, and_____. How does the _____? Why did/didn't the _____? _____is located (prep phrase) the ____. The _____are usually _____. One of the key characteristics of _____ is _____. A secondary characteristic is _____. Describe Signal Words: For example, For instance, In support of this, In fact, As evidence

Developing and Using Models 8.PS4.2 Students create models which are responsive and incorporate features that are not visible in the natural world, but have implications on the behavior of the modeled systems and can identify limitations of their models. **Suggested Crosscutting Concept(s)** Patterns 8.PS4.1 Students recognize, classify, and record patterns in data, graphs, and charts. Structure and Function 8.PS4.2 Students begin to attribute atomic structure and interactions between particles to the properties of a material.		Compare/Contrast Sentence Frames: This _____ is similar to that _____because both _____.

8th Grade Quarter 2 Curriculum Map					
Quarter 1		**Quarter 2**		Quarter 3	Quarter 4
Unit 1 Motion and Forces	Unit 2 Electricity and Magnetism	**Unit 3** **Waves**	Unit 4 Our Universe	Unit 5 Restless Earth	Unit 6 Change Over Time
4 weeks	5 weeks	**6 weeks**	3 weeks	9 weeks	9 weeks

UNIT 3: Waves (6 weeks)

Overarching Question(s)

How are waves used to transfer energy and information?

Unit 3, Lesson 8	Lesson Length	Essential Question	Vocabulary
Interactions of Light	3 days	How does light interact with matter?	transparent, translucent, opaque, absorption, reflection, refraction, scattering

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) PS4: Waves and Their Applications in Technologies for Information Transfer **Standard(s)** 8.PS4.2 Compare and contrast mechanical waves and electromagnetic waves based on refraction, reflection, transmission and absorption and their behavior through a vacuum and/or various media. **Explanation(s) and Support of Standard(s) from TN Science Reference Guide** 8.PS4.2 A wave is a means of transporting energy from a source to some other location. The interaction between waves and their transmitting	**Learning Outcomes** • Explain that light can be reflected, refracted, or absorbed. • Explain what determines the color of a (nonradiating) object. • Explain how scattering occurs. • Describe what happens to the speed of EM waves in media. • Describe what happens to the direction of EM waves in media.	**Curricular Resources** HMH Tennessee Science TE, Unit 5, Lesson 2 pp. 292-304 Engage • Engage Your Brain #s 1 and 2, SE p. 233 • Active Reading #s 3 and 4, SE p. 233 Explore Light in Media • Observing Matter through a Medium Daily Demo, TE p. 294 • Refraction with Water Quick Lab, TE p. 295 Explain Light Can Interact with Matter • Active Reading #5, SE p. 234 • Think Outside the Book #6, SE p. 234 • Visualize It! #7, SE p. 235

medium can result in a decrease in the energy of the wave.

Models can be created to explain phenomena that occur as a result from the behaviors of either electrical or mechanical waves that result from interactions between the wave and the medium transmitting the wave. Additionally, students should note that electromagnetic (light) waves will interact at boundaries of matter, but are uniquely able to travel without a medium.

At boundaries, light and mechanical waves may undergo changes that result from being refracted, reflected, transmitted or absorbed. For example, a mechanical wave will reflect and invert when it reaches the immobile end of its medium (e.g. a wave reflecting at the end of string that is tied in place), but will reflect without inverting if the end can move freely (e.g., a wave traveling through water in a tub that reflects off the side of the tub). Electromagnetic waves will reflect and travel in straight lines with predictable patterns for their angles of reflection.

Suggested Science and Engineering Practice(s)
Developing and Using Models 8.PS4.2
Students create models which are responsive and incorporate features that are not visible in the natural world, but have implications on the

Suggested Phenomena

The windows in this picture allow different colors of light to pass through. The colorful pattern is then reflected off the floor inside the building. Students can complete a See Think Wonder Template after observing the picture.

- Visualize It! #8, SE p. 235
- Think Outside the Book! #9, SE p. 236
- Visualize It! #10, SE p. 237

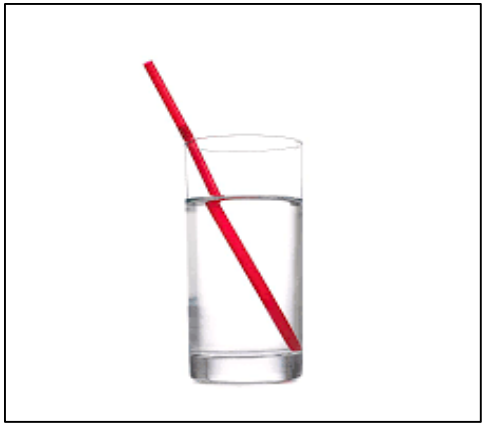
Light in Media
- Think Outside the Book! #11, SE p. 238
- Synthesize #12, SE p. 238
- Active Reading #13, SE p. 239

Extend
Reinforce and Review
- Visual Summary, SE p. 240

Evaluate
Formative Assessment
- Throughout TE
- Reteach, TE p. 299
- Lesson Review, SE p. 241

Summative Assessment
- Interactions of Light Alternative Assessment, TE p. 299
- Lesson Quiz

Additional Resources
- Bending Light Lab
- Light Absorption, Reflection, & Refraction STUDY JAMS! Video and Quiz
- Blue Sky Science Snack
- Critical Angle Science Snack
- Disappearing Glass Rods Science Snack
- On the Fringe Science Snack
- Soap Film on a Can Science Snack

behavior of the modeled systems and can identify limitations of their models. **Suggested Crosscutting Concept(s)** Structure and Function 8.PS4.2 Students begin to attribute atomic structure and interactions between particles to the properties of a material.	 A straight object, such as the straw in the picture above, looks bent or broken when part of it is underwater. Light from the straw changes direction when it passes from water to glass and from glass to air. Students can complete a See Think Wonder Template after observing the picture.	• Soap Film Interference Model Science Snack • The Physics Classroom Light Waves and Color Tutorial **ESL Supports and Scaffolds** WIDA Standard 4- The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable- use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals To support students with the scientific explanation: Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing. Classify Sentence Frames: We can classify _____ according to _____. A common characteristic of _____ and _____ is_____. A characteristic of _____ and _____ is_____. One attribute of _____ is _____.

		_____ and _____ have the following traits in common: _____. _____ can be identified by _____. I grouped _____ and _____ together because _____. _____ is a member of _____ but _____ is not_____. I believe/think _____ is a member of _____ because ____. Describe Sentence Frames: The _____ has____, and_____. How does the _____? Why did/didn't the _____? _____is located _(prep phrase)_the ____. The _____are usually _____. One of the key characteristics of _____ is _____. A secondary characteristic is _____. Describe Signal Words: for example, for instance, in support of this, in fact, as evidence Compare/Contrast Sentence Frames:

		This _____ is similar to that _____ because both _____.

8th Grade Quarter 2 Curriculum Map					
Quarter 1		**Quarter 2**		Quarter 3	Quarter 4
Unit 1 Motion and Forces	Unit 2 Electricity and Magnetism	**Unit 3** **Waves**	Unit 4 Our Universe	Unit 5 Restless Earth	Unit 6 Change Over Time
4 weeks	5 weeks	**6 weeks**	3 weeks	9 weeks	9 weeks

UNIT 3: Waves (6 weeks)			
Overarching Question(s)			
How are waves used to transfer energy and information?			
Unit 3, Lesson 9	**Lesson Length**	**Essential Question**	**Vocabulary**
Light Technology	3 days	How can light be used?	incandescent light, laser, fluorescent light, optical fiber, LED

Standards and Related Background Information	**Instructional Focus**	**Instructional Resources**
DCI(s) PS4: Waves and Their Applications in Technologies for Information Transfer **Standard(s)** 8.PS4.3 Evaluate the role that waves play in different communication systems. **Explanation(s) and Support of Standard(s) from TN Science Reference Guide** 8.PS4.3 Digitizing is the process of converting information into a series of binary ones and zeroes representing either an on or off state. Once digitized, information can be transmitted as wave pulses and stored reliably and recreated at a later time. Devices that do not work digitally, function in	**Learning Outcomes** • Describe examples of ways of producing light. • Compare and contrast incandescent lights, fluorescent lights, LEDs, and lasers. • Explain ways that people have developed technologies that use light. • Describe examples of technologies that help people see in different ways. • Describe the advantages of these technologies.	**Curricular Resources** HMH Tennessee Science TE, Unit 5, Lesson 3 Engage • Engage Your Brain #s 1 and 2, SE p. 247 • Active Reading #s 3 and 4, SE p. 247 Explore Explain Sources of Light • Compare #6, SE p. 248 • Infer #7, SE p. 249 • Critical Angle Daily Demo, TE p. 313 Light Technology • Active Reading #8, SE p. 250 • Visualize It! #9, SE p. 250 • Compare #10, SE p. 251 • Active Reading #11, SE p. 252

analog. Analog devices can have infinite states. The difference between analog and digital is analogous to the difference between a light switch (digital) and a dimmer switch (analog).

Models of different systems of communication can unveil the benefits of digitizing information. Students might design a way that information can be digitized using only two states and transmit a message using their system, considering how accuracy and distance that the message can be transmitted increase as a result of the encoding process. For example, students might attempt to transmit a written message in speech or speaking into cup-on-a-string system (analog), as compared to encoding this encoding this information in a pattern of plucks of the string, array of illuminated lights, or flashes of a single light.

Students should explore similar applications of information transfer in the functioning of radios, televisions, cellphones, and wireless computer networks.

Suggested Science and Engineering Practice(s)
Constructing Explanations and Designing Solutions
8.PS4.3
Students form explanations using source (including student developed investigations) which show comprehension of parsimony, utilize quantitative

Suggested Phenomenon

The bar code scanner's head shines a laser light or LED light onto the barcode. The light reflects off the barcode to a photoelectric cell, which is an electronic component that detects light. The black areas reflect small amounts of light, while the white lines reflect the most. As you move the scanner across the barcode, the photoelectric cell generates an on-off pulse pattern that corresponds with the barcode's white and black stripes.
The scanner's electronic circuit converts the pulses into zeroes and ones, (binary numbers), which are sent to a computer. Those digits refer to a particular item, and scanning the numbers and bars pulls up an entry in the database with further information such as the price, how many of this item in stock, a description of the item and possibly a picture for reference. Students can complete a

- Active Reading #12, SE p. 253
- Infer #13, SE p. 253
- Light Technology in Color Monitors Quick Lab, TE p. 313

Optical Instruments
- Active Reading #14, SE p. 254
- Visualize It! #15, SE p. 254
- Think Outside the Book #16, SE p. 255

Extend
Reinforce and Review
- Cluster Diagram Graphic Organizer, TE p. 316
- Visual Summary, SE p. 256

Going Further
- Social Studies Connection, TE p. 316
- Health Connection, TE p. 316

Evaluate
Formative Assessment
- Throughout TE
- Reteach, TE p. 317
- Lesson Review, SE p. 257

Summative Assessment
- Light Technology Alternative Assessment, TE p. 317
- Lesson Quiz

Additional Resources
- Light Up Your Life Lesson
- Personal Pinhole Theater Science Snack

and qualitative models to make predictions, and can support or cause revisions of a particular conclusion. **Suggested Crosscutting Concept(s)** Structure and Function 8.PS4.3 Students design systems, selecting materials for their relevant properties.	See Think Wonder Template after observing the picture.	**ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals To support students with the scientific explanation: Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing. Classify Sentence Frames: We can classify _____ according to _____. A common characteristic of _____ and _____ is_____. A characteristic of _____ and _____ is_____. One attribute of _____ is _____. _____ and _____ have the following traits in common: _____.

		_____ can be identified by _____. I grouped _____ and _____ together because _____. _____ is a member of _____ but _____ is not_____. I believe/think _____ is a member of _____ because ____. Describe Sentence Frames: The _____ has____, and_____. How does the _____? Why did/didn't the _____? _____is located _(prep phrase)_the ____. The _____are usually _____. One of the key characteristics of _____ is _____. A secondary characteristic is _____. Describe Signal Words: for example, for instance, in support of this, in fact, as evidence Compare/Contrast Sentence Frames: This _____ is similar to that _____because both _____.

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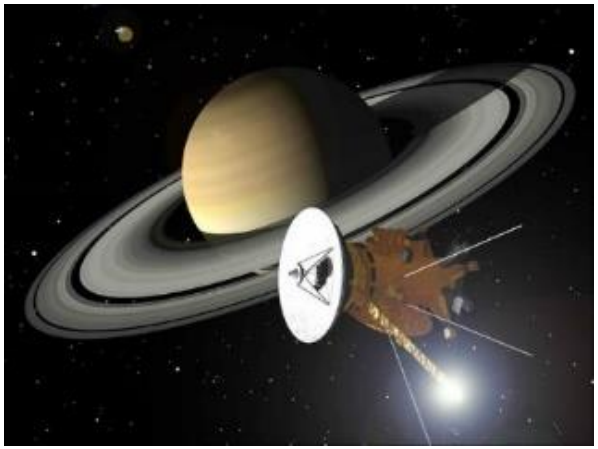
Quarter 1		Quarter 2		Quarter 3	Quarter 4
Unit 1 Motion and Forces	Unit 2 Electricity and Magnetism	Unit 3 Waves	**Unit 4 Our Universe**	Unit 5 Restless Earth	Unit 6 Change Over Time
4 weeks	5 weeks	6 weeks	**3 weeks**	9 weeks	9 weeks

UNIT 4: Our Universe (3 weeks)			
Overarching Question(s)			
How do engineers solve problems? What is the universe, and what is the Earth's place in it?			
Unit 4, Lesson 1	**Lesson Length**	**Essential Question**	**Vocabulary**
Technology for Space Exploration	3 days	How do we explore space?	space shuttle, lander, probe, rover, orbiter, artificial satellite

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) ETS1: Engineering Design **Standard(s)** 8.ETS1.2 Research and communicate information to describe how data from technologies (telescopes, spectroscopes, satellites, and space probes) provide information about objects in the solar system and universe. **Explanation(s) and Support of Standard(s) from TN Science Reference Guide** 8.ETS1.2 The increases in scientific knowledge facilitating technological advances have enabled dynamic views of our universe. Early astronomers were limited to observing patterns in the motion of	**Learning Outcomes** • Identify and describe the two types of technology that are used by humans to explore space. • Describe a technology that allows spacecraft to travel into space. • Identify and describe crewed technologies used for exploring space. • Describe problems that humans who live space experience. • Identify and describe unscrewed technologies that are used to explore space. • Describe how satellites are used to learn about space and about Earth.	**Curricular Resources** HMH Tennessee Science TE, Unit 7, Lesson 1 pp. 454-471 Engage • Engage Your Brain #s 1 and 2, SE p. 367 • Active Reading #s 3 and 4, SE p. 367 Explore Explain Introduction to the Technology of Space Exploration • Active Reading #5, SE p. 368 Crewed Exploration of Space • Active Reading #6, SE p. 369 • Visualize It! #7, SE p. 369 Uncrewed Exploration of Space

the cosmos to make measurements using principles of geometry. Modern tools such as spectroscopes allow us to determine the types of elements making up distant stars by observing patterns in the color of light given off by the stars. Examples may include the types of data/information that come from each of the various listed technologies and their uses. For example, how the Hubble Space telescope allows for imaging at greater distances than terrestrial-based telescopes. Emphasis is on tool selection and its alignment with function as it embeds with the content standard. Students should discuss the development of each technology and be able to rudimentarily explain how each gathers information. Students should be able to connect the type of data (e.g. emission spectra vs transit times for planets) to the general types of information that can be gathered from that data (e.g. composition vs time required to orbit sun). **Suggested Science and Engineering Practice(s)** Obtaining, Evaluating, and Communicating Information 8.ETS1.2 (O/E) Students can evaluate text, media, and visual displays of information with the intent of clarifying claims and reconciling explanations. (C) Students	**Suggested Phenomenon**  Space probes similar to what's pictured visit distant planets in our solar system and transmit data back to Earth. Students can complete a See Think Wonder Template after examining the picture.	• Active Reading #8, SE p. 370 • Visualize It! #9, SE p. 371 • Active Reading #10, SE p. 371 • Designing a Rover Activity, TE p. 456 • Exploring with Spacecraft Virtual Lab, TE p. 457 Artificial Satellites • Active Reading #11, SE p. 372 • Inquiry #12, SE p. 372 • Visualize It! #13, SE p. 373 • Think Outside the Book #14, SE p. 374 • Active Reading #18, SE p. 376 • Explain #19, SE p. 376 • Visualize It! #20, SE p. 377 • Satellite Debate Activity, TE p. 456 • Explain It!, SE pp. 378-381 Extend Reinforce and Review • Cluster Diagram Graphic Organizer, TE p. 460 • Visual Summary, SE p. 382 Going Further • Environmental Science Connection, TE p. 460 • Real World Connection, TE p. 460 • Why It Matters, SE p. 375 Evaluate Formative Assessment • Throughout TE • Lesson Review, SE p. 383 • Reteach, TE p. Summative Assessment

can communicate scientific information in writing utilizing embedded tables, charts, figures, graphs. **Suggested Crosscutting Concept(s)** Scale, Proportion, and Quantity 8.ETS1.2 Students develop models to investigate scales that are beyond normal experiences.		• Technology for Space Exploration Alternative Assessment, TE p. 461 • Lesson Quiz **Additional Resources** 5 Space Telescopes You Should Know About Besides Hubble **ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Classify Sentence Frames: We can classify _____ according to _____. A common characteristic of _____ and _____ is_____. A characteristic of _____ and _____ is_____. One attribute of _____ is _____. _____ and _____ have the following traits in common: _____. _____ can be identified by _____.

		I grouped _____ and _____ together because _____. _____ is a member of _____ but _____ is not_____. I believe/think _____ is a member of _____ because ____. Describe Sentence Frames: The _____ has____, and_____. How does the _____? Why did/didn't the _____? _____is located _(prep phrase)_the ____. The _____are usually _____. One of the key characteristics of _____ is _____. A secondary characteristic is _____. Describe Signal Words: for example, for instance, in support of this, in fact, as evidence Compare/Contrast Sentence Frames: This _____ is similar to that _____because both _____.

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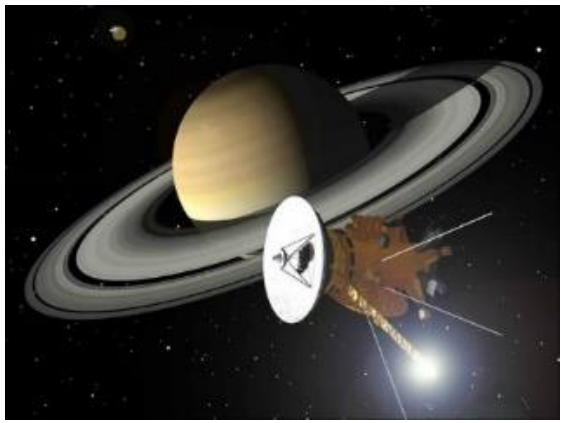
4 weeks	5 weeks	6 weeks	**3 weeks**	9 weeks	9 weeks

UNIT 4: Our Universe (3 weeks)			
Overarching Question(s)			
How do engineers solve problems? What is the universe, and what is the Earth's place in it?			
Unit 4, Lesson 2	**Lesson Length**	**Essential Question**	**Vocabulary**
Observing the Universe	1 week	What can we learn from space images?	wavelength, electromagnetic spectrum, spectrum

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) ETS1: Engineering Design **Standard(s)** 8.ETS1.2 Research and communicate information to describe how data from technologies (telescopes, spectroscopes, satellites, and space probes) provide information about objects in the solar system and universe. **Explanation(s) and Support of Standard(s) from TN Science Reference Guide** 8.ETS1.2 The increases in scientific knowledge facilitating technological advances have enabled dynamic views of our universe. Early astronomers were limited to observing patterns in the motion of the cosmos to make measurements using	**Learning Outcomes** • Describe the electromagnetic spectrum and its parts. • Explain how types of EM radiation are related in terms of wavelength, frequency, and energy. • Describe two uses of EM radiation in astronomy. • Describe how observations are made from a distance. • Explain visible spectra. • Describe the roles of EM radiation in remote viewing. • Describe how different types of telescopes are used in space science. • Describe what can be learned from space images.	**Curricular Resources** HMH Tennessee Science TE, Unit 7, Lesson 2 pp. 474-489 Engage • Engage Your Brain #s 1 and 2, SE p. 387 • Active Reading #s 3 and 4, SE p. 387 Explore The Electromagnetic Spectrum • Using Visible Light, TE p. 476 • Splitting White Light, TE p. 477 Telescopes and Detectors • Making a Telescope S.T.E.M. Lab, TE p. 476 Explain The Electromagnetic Spectrum • Active Reading #5, SE p. 388 • Analyze #6, SE p. 388

principles of geometry. Modern tools such as spectroscopes allow us to determine the types of elements making up distant stars by observing patterns in the color of light given off by the stars. Examples may include the types of data/information that come from each of the various listed technologies and their uses. For example, how the Hubble Space telescope allows for imaging at greater distances than terrestrial-based telescopes. Emphasis is on tool selection and its alignment with function as it embeds with the content standard. Students should discuss the development of each technology and be able to rudimentarily explain how each gathers information. Students should be able to connect the type of data (e.g. emission spectra vs transit times for planets) to the general types of information that can be gathered from that data (e.g. composition vs time required to orbit sun) **Suggested Science and Engineering Practice(s)** Obtaining, Evaluating, and Communicating Information 8.ETS1.2 (O/E) Students can evaluate text, media, and visual displays of information with the intent of clarifying claims and reconciling explanations. (C) Students	**Suggested Phenomenon**  Space probes similar to what's pictured visit distant planets in our solar system and transmit data back to Earth. Students can complete a See Think Wonder Template after examining the picture.	• Complete #7, SE p. 389 • Summarize #8, SE p. 390 • Visualize It! #11, SE p. 392 • Analyze #12, SE p. 393 Remote Viewing • Active Reading #9, SE p. 391 • Explain #10, SE p. 391 • Visualize It! #19, SE 398 Telescopes and Detectors • Active Reading #13, SE p. 394 • Contrast #14, SE p. 395 • Explain #15, SE p. 395 • Visualize It! #16, SE p. 396 • Think Outside the Book #17, SE p. 396 • Active Reading #18, SE p. 397 Extend Reinforce and Review • Combination Notes Graphic Organizer, TE p. 480 • Visual Summary, SE p. 400 Going Further • Technology Connection, SE p. 480 • Fine Arts Connection, SE p. 480 Evaluate Formative Assessment • Throughout TE • Reteach, TE p. 481 • Lesson Review, SE p. 401 Summative Assessment

can communicate scientific information in writing utilizing embedded tables, charts, figures, graphs. **Suggested Crosscutting Concept(s)** Scale, Proportion, and Quantity 8.ETS1.2 Students develop models to investigate scales that are beyond normal experiences.		• Observing the Universe Alternative Assessment, TE p. 481 • Lesson Quiz **Additional Resources** Hubble Study Video **ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Classify Sentence Frames: We can classify _____ according to _____. A common characteristic of _____ and _____ is_____. A characteristic of _____ and _____ is_____. One attribute of _____ is _____. _____ and _____ have the following traits in common: _____. _____ can be identified by _____.

		I grouped _____ and _____ together because _____. _____ is a member of _____ but _____ is not_____. I believe/think _____ is a member of _____ because ____. Describe Sentence Frames: The _____ has____, and_____. How does the _____? Why did/didn't the _____? _____is located _(prep phrase)_the ____. The _____are usually _____. One of the key characteristics of _____ is _____. A secondary characteristic is _____. Describe Signal Words: for example, for instance, in support of this, in fact, as evidence Compare/Contrast Sentence Frames: This _____ is similar to that _____because both _____.

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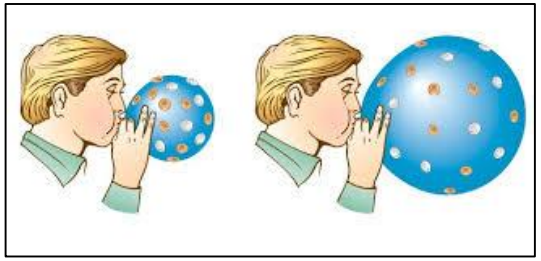
UNIT 4: Our Universe (3 weeks)			
Overarching Question(s)			
How do engineers solve problems? What is the universe, and what is the Earth's place in it?			
Unit 4, Lesson 3	**Lesson Length**	**Essential Question**	**Vocabulary**
The Origin of the Universe	1 week	How did the universe begin?	universe, redshift, Big Bang Theory, cosmic microwave background (CMB)

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) ESS1: Earth's Place in the Universe **Standard(s)** 8.ESS1.1 Research, analyze, and communicate that the universe began with a period of rapid expansion using evidence from the motion of galaxies and composition of stars. **Explanation(s) and Support of Standard(s) from TN Science Reference Guide** 8.ESS1.1 Multiple lines of evidence support that the universe began with a period of rapid expansion. This standard introduces two specific lines: the composition of stars and the motion of galaxies. These two ideas are introduced in this	**Learning Outcomes** • Describe the relationship between space, matter, and energy to the universe. • Describe the structure of the universe. • Explain what Sir Isaac Newton thought about the universe. • Describe how Newton's idea of the universe was challenged. • Describe how the redshift of galaxies provided evidence that the universe is expanding. • Describe how George Gamow explained the early formation of light elements. • Summarize the Big Bang. • Describe evidence that supports the Big Bang theory.	**Curricular Resources** HMH Tennessee Science TE, Unit 7, Lesson pp. 492-507 Engage • Engage Your Brain #s 1 and 2, SE p. 405 • Active Reading #s 3 and 4, SE p. 405 • Doppler Effect and Redshift Daily Demo, TE p. 495 Explore The Expanding Universe • How Old Is Our Universe?, TE p. 495 Explain Introduction to the Universe • Active Reading #5, SE p. 406 • Visualizing It! #6, SE p. 407

grade due the connections to standards within the 8.PS4 disciplinary core ideas. Stars give off light based on what elements are being fused at the core of this star. To explain, if we pretend that a star existed that was made of Neon, then it would shine the same red color as a lit up neon sign. Every element has its own characteristic color, much like a fingerprint in light. From this "fingerprint" of light, scientists can look at our sun or other stars and know what elements they are made of. We also know that stars of similar size have similar composition. This "fingerprint" is properly called an emission spectrum. Looking at galaxies, it is possible to determine the sizes of stars and to use the light they emit to determine their composition. All of the colors (frequencies) of light emitted by these galaxies are shifted to longer wavelengths than what is normally observed than the elements that make up the stars in that galaxy. This lengthening of the light emitted by these stars is known as a red shift, because all of the colors shift towards the red (longer) wavelengths of light. The motion of the stars emitting the waves is "stretching" the wavelengths of the light as the stars move away. Students will have experienced phenomena caused by this Doppler effect if they have ever heard the	• Explain the expansion of the universe and how light elements in the universe, the cosmic microwave background, and conditions in the early universe support the Big Bang theory. • Explain how scientists estimate the age of the universe. **Suggested Phenomenon**  Astronomers believe that the universe is expanding. All points in the universe are getting farther apart all the time. It's not that stars and galaxies are getting bigger; rather, the space between all objects is expanding with time. The galaxies within our universe are moving away from each other. Students can complete a See Think Wonder Template after examining the picture.	The Expanding Universe • Active Reading #7, SE p. 408 • Explain #8, SE p. 409 The Big Bang Theory • Active Reading #10, SE p. 410 • Room for New Ideas? Discussion, TE p. 494 • Visualize It! #12, SE p. 411 • Visualize It! #13, SE p. 411 • Piece Together the Evidence Activity, TE p. 494 • Active Reading #14, SE p. 412 • Inquiry #15, SE p. 412 • Explain #16, SE p. 413 Extend Reinforce and Review • Mind Map Graphic Organizer, TE p. 498 • Visual Summary, SE p. 418 Going Further • Life Science Connection, TE p. 498 • Language Arts Connection, TE p. 498 Evaluate Formative Assessment • Throughout TE • Reteach, TE p. 499 • Lesson Review, SE p. 419 Summative Assessment • The Origin of the Universe Alternative Assessment, TE p. 499 • Lesson Quiz • Explain It!, SE pp. 414-417

change in the sound of a siren as the source passes them. We observe this same red shift in all galaxies, indicating that all galaxies are in motion away from each other. This is the opposite of what we would expect from gravity, which would pull the galaxies together. Furthermore, we observe that the galaxies that are the most distant, have the greatest degree of a red shift, indicating that they are traveling away from us at the fastest rate. Put together, these pieces of evidence support that all galaxies are moving away from a central point, and must have been set onto this outward trajectory by some initial force. **Suggested Science and Engineering Practice(s)** Constructing Explanations and Designing Solutions 8.ESS1.1 Students form explanations using source (including student developed investigations) which show comprehension of parsimony, utilize quantitative and qualitative models to make predictions, and can support or cause revisions of a particular conclusion.		**Additional Resources** • The Universe STUDY JAMS! Video and Quiz • What is The Big Bang? Video • How do we know the Universe is expanding? Video • EVERYDAY MYSTERIES: What does it mean when they say the universe is expanding? **ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals To support students with the scientific explanation: Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing. Classify Sentence Frames: We can classify _____ according to _____.

Suggested Crosscutting Concept(s) Energy and Matter 8.ESS1.1 Students track energy changes through transformations in a system.		A common characteristic of _____ and _____ is_____. A characteristic of _____ and _____ is_____. One attribute of _____ is _____. _____ and _____ have the following traits in common: _____. _____ can be identified by _____. I grouped _____ and _____ together because _____. _____ is a member of _____ but _____ is not_____. I believe/think _____ is a member of _____ because _____. Describe Sentence Frames: The _____ has____, and_____. How does the _____? Why did/didn't the _____? _____is located _(prep phrase)_the ____. The _____are usually _____. One of the key characteristics of _____ is _____. A secondary characteristic is _____. Describe Signal Words: for example, for instance, in support of this, in fact, as evidence

		Compare/Contrast Sentence Frames: This _____ is similar to that _____because both _____.

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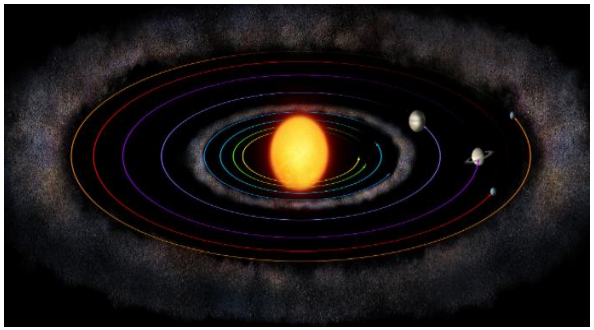
UNIT 4: Our Universe (3 weeks)

Overarching Question(s)

What is the universe, and what is Earth's place in it?

Unit 4, Lesson 4	Lesson Length	Essential Question	Vocabulary
Gravity and the Solar System	2.5 days	Why is gravity important in the solar system?	gravity, perihelion, planetesimal, orbit, centripetal force, aphelion, solar nebula

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) ESS1: Earth's Place in the Universe **Standard(s)** 8.ESS1.2 Explain the role of gravity in the formation of our sun and planets. Extend this explanation to address gravity's effect on the motion of celestial objects in our solar system and Earth's ocean tides. **Explanation(s) and Support of Standard(s) from TN Science Reference Guide** 8.ESS1.2 Gravity is the force that attracts all forms of matter towards one another. Even a pair of atoms will exert a pull on each other. In space, atoms of hydrogen or helium pull on one another and as a result move together (8.PS2.4). As time	**Learning Outcomes** • Define gravity. • Explain Kepler's first, second, and third laws of planetary motion. • Explain Newton's law of universal gravitation. • Define centripetal force. • Describe the formation of the solar system.	**Curricular Resources** HMH Tennessee Science TE, Unit 7, Lesson 4 pp. 508-523 Engage • Engage Your Brain #s 1 and 2, SE p. 421 • Active Reading #s 3 and 4, SE p. 421 The Laws of Planetary Motion • Walk the Elliptical Path Activity, TE p. 510 Universal Gravitation • Force of Attraction Daily Demo, TE p. 510 • Gravity and the Orbit of a Planet Quick Lab, TE p. 511 Explore Universal Gravitation • Weights on Different Celestial Bodies Exploration Lab, TE p. 511

goes on, more particles are drawn together, and create a position in space with a large cluster of atoms, together producing an increasingly significant gravitational field. As the field increases, atoms that are drawn into the growing crowd of atoms will move into the group with ever-increasing speeds. Initially, the mutual repulsion positive charges of each nuclei keep particles from colliding as they get near each other in the imminent cloud of gas. However, at some point, the inbound atoms move with such speed that the repulsion of the nuclei cannot prevent two atoms from colliding. The outcome is an enormous explosion, but moreover the birth of a new element. What began as a pair of hydrogen nuclei each with one proton, is now a helium nuclei with those two original protons fused in a single nucleus. This event marks the birth of a star such as our sun. Enormous stars eventually explode and the tremendous energy released is able to fuse larger nuclei leading to the formation of the heavier elements on the periodic table. In the collapse of a nebula, dust and gas are drawn together by mutual gravitational attraction. As each particle has some initial velocity, the centrally directed force of gravity causes the particles to begin to swirl, accumulate, and compress into a large flat disk like a spinning disk of pizza dough. Planets accumulate	**Suggested Phenomenon**  Gravity is what holds the planets in orbit around the sun and what keeps the moon in orbit around Earth. Students can complete a See Think Wonder Template after examining the picture.	• Weights on Different Celestial Bodies Exploration Lab, TE p. 511 Explain Gravity Overview • Active Reading #5, SE p.422 The Laws of Planetary Motion • Visualize It! #6, SE p. 423 • Active Reading #7, SE p. 423 • Active Reading #8, SE p. 424 • Summarize #9, SE p. 424 Universal Gravitation • Visualize It! #11, SE p. 426 Formation of the Solar System • Active Reading #12, SE p. 427 • Visualize It! #13, SE p. 428 • Visualize It! #14, SE p. 428 • Visualize It! #15, SE p. 429 • Visualize It! #16, SE p. 430 • Visualize It! 317, SE p. 431 Extend Reinforce and Review • Sequence Diagram Graphic Organizer, TE p. 514 • Visual Summary, SE p. 432 Going Further • Technology Connection, TE p. 514 Evaluate Formative Assessment

within these spinning protoplanetary disks. This process occurred in our solar system long, long ago. By observing patterns in other distant nebula we are able to reconstruct the history of our own solar system. Tides are significant because they are an observable event that provides evidence that gravity can act over tremendous distances. The ability of gravity to act at great distances is a requirement to support that the sun and planets formed from the influence of gravity. Students should be able to address the changing distribution of water in tidal patterns for spring and neap tides. **Suggested Science and Engineering Practice(s)** Developing Models and Using Models 8.ESS1.2 Students create models which are responsive and incorporate features that are not visible in the natural world, but have implications on the behavior of the modeled systems and can identify limitations of their models **Suggested Crosscutting Concept(s)** Systems and System Models 8.ESS1.2 Students evaluate the sub-systems that may make up a larger system.		• Throughout TE • Reteach, TE p. 515 • Lesson Review, SE p. 433 Summative Assessment • Gravity and the Solar System Alternative Assessment, TE p. 515 • Lesson Quiz **Additional Resources** • Gravity and Orbits • Space Place in a Snap: The Solar System's Formation Video **ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals To support students with the scientific explanation: Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing.

		Classify Sentence Frames: We can classify _____ according to _____. A common characteristic of _____ and _____ is_____. A characteristic of _____ and _____ is_____. One attribute of _____ is _____. _____ and _____ have the following traits in common: _____. _____ can be identified by _____. I grouped _____ and _____ together because _____. _____ is a member of _____ but _____ is not_____. I believe/think _____ is a member of _____ because _____. Describe Sentence Frames: The _____ has_____, and_____. How does the _____? Why did/didn't the _____? _____is located (prep phrase) the _____. The _____are usually _____. One of the key characteristics of _____ is _____. A secondary characteristic is _____.

		Describe Signal Words: For example, For instance, In support of this, In fact, As evidence Compare/Contrast Sentence Frames: This _____ is similar to that _____because both _____.

8th Grade Quarter 2 Curriculum Map					
Quarter 1		Quarter 2		Quarter 3	Quarter 4
Unit 1 Motion and Forces	Unit 2 Electricity and Magnetism	Unit 3 Waves	**Unit 4 Our Universe**	Unit 5 Restless Earth	Unit 6 Change Over Time
4 weeks	5 weeks	6 weeks	**3 weeks**	9 weeks	9 weeks

UNIT 4: Our Universe (3 weeks)

Overarching Question(s)

What is the universe, and what is Earth's place in it?

Unit 4, Lesson 5	Lesson Length	Essential Question	Vocabulary
Earth's Tides	2.5 days	What causes tides?	tide, neap tide, tidal range, spring tide

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) ESS1: Earth's Place in the Universe **Standard(s)** 8.ESS1.2 Explain the role of gravity in the formation of our sun and planets. Extend this explanation to address gravity's effect on the motion of celestial objects in our solar system and Earth's ocean tides. **Explanation(s) and Support of Standard(s) from TN Science Reference Guide** 8.ESS1.2 Gravity is the force that attracts all forms of matter towards one another. Even a pair of atoms will exert a pull on each other. In space, atoms of hydrogen or helium pull on one another and as a result move together (8.PS2.4). As time goes on, more particles are drawn together, and	**Learning Outcomes** • Define tides. • Explain high tide and low tide. • Explain what causes tides on Earth. • Describe tidal range, spring tide, and neap tide. • Explain the alignment of Earth, the moon, and the sun that causes spring tide. • Explain the alignment of Earth, the moon, and the sun that causes a neap tide. • Explain how Earth's rotation and the revolution of the moon around Earth affect the timing of Earth's tides.	**Curricular Resources** HMH Tennessee Science TE, Unit 7, Lesson 5 pp. 524-540 Engage • Engage Your Brain #s 1 and 2, SE p. 435 • Active Reading #s 3 and 4, SE p. 435 Tides and Their Causes • Global Effect Daily Demo, TE p. 527 Explore Tides and Their Causes • Demonstrating Tides Activity, TE p. 526 • A Model Relationship Activity, TE p. 526 Explain Tides and Their Causes • Active Reading #5, SE p. 436 • Visualize It! #6, SE p. 437 • Predict #7, SE p. 437

create a position in space with a large cluster of atoms, together producing an increasingly significant gravitational field. As the field increases, atoms that are drawn into the growing crowd of atoms will move into the group with ever-increasing speeds. Initially, the mutual repulsion positive charges of each nuclei keep particles from colliding as they get near each other in the imminent cloud of gas. However, at some point, the inbound atoms move with such speed that the repulsion of the nuclei cannot prevent two atoms from colliding. The outcome is an enormous explosion, but moreover the birth of a new element. What began as a pair of hydrogen nuclei each with one proton, is now a helium nuclei with those two original protons fused in a single nucleus. This event marks the birth of a star such as our sun. Enormous stars eventually explode and the tremendous energy released is able to fuse larger nuclei leading to the formation of the heavier elements on the periodic table. In the collapse of a nebula, dust and gas are drawn together by mutual gravitational attraction. As each particle has some initial velocity, the centrally directed force of gravity causes the particles to begin to swirl, accumulate, and compress into a large flask disk like a spinning disk of pizza dough. Planets accumulate within these spinning protoplanetary	**Suggested Phenomenon**  Tides are the rise and fall of sea levels caused by the combined effects of the gravitational forces exerted by the Moon and the Sun, and the rotation of the Earth. Click on the picture to view a time lapse video of the change from ultra-low (greater than - 5 ft) tide to high tide at Tutka Bay Lodge dock, Tutka Bay, Alaska. Students can complete a See Think Wonder Template while watching the video.	Tidal Ranges • Active Reading #8, SE p. 438 • Inquiry #9, SE p. 438 • Venn Diagram #10, SE p. 439 • Tides in the Water Probing Question, TE p. 526 Tidal Cycles • Think Outside the Book #11, SE p. 440 • Predict #12, SE p. 440 • What If…? Probing Questions, TE p. 526 Extend Reinforce and Review • Supporting Main Ideas, TE p. 530 • Visual Summary, SE p. 444 Going Further • Engineering Connection, TE p. 530 • Real World Connection, TE p. 530 • Why It Matters, SE p. 441 Evaluate Formative Assessment • Throughout TE • Reteach, TE p. 531 • Lesson Review, SE p. 445 Summative Assessment • Earth's Tides Alternative Assessment, TE p. 531 • Lesson Quiz • Unit 7 Big Idea, SE p. 446 • Unit 7 Review, SE p. 447-450 **Additional Resources**

disks. This process occurred in our solar system long, long ago. By observing patterns in other distant nebula we are able to reconstruct the history of our own solar system. Tides are significant because they are an observable event that provides evidence that gravity can act over tremendous distances. The ability of gravity to act at great distances is a requirement to support that the sun and planets formed from the influence of gravity. Students should be able to address the changing distribution of water in tidal patterns for spring and neap tides. **Suggested Science and Engineering Practice(s)** Developing Models and Using Models 8.ESS1.2 Students create models which are responsive and incorporate features that are not visible in the natural world, but have implications on the behavior of the modeled systems and can identify limitations of their models **Suggested Crosscutting Concept(s)** Systems and System Models 8.ESS1.2 Students evaluate the sub-systems that may make up a larger system		• Tides STUDY JAMS Video and Quiz • The Moons Relation to Ocean Tides • Tides and Water Levels • The Action of the Tides Video **ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language do build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals To support students with the scientific explanation: Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing. Classify Sentence Frames: We can classify _____ according to _____. A common characteristic of _____ and _____ is_____. A characteristic of _____ and _____ is_____. One attribute of _____ is _____.

		_____ and _____ have the following traits in common: _____. _____ can be identified by _____. I grouped _____ and _____ together because _____. _____ is a member of _____ but _____ is not_____. I believe/think _____ is a member of _____ because ____. Describe Sentence Frames: The _____ has_____, and_____. How does the _____? Why did/didn't the _____? _____is located (prep phrase) the ____. The _____are usually _____. One of the key characteristics of _____ is _____. A secondary characteristic is _____. Describe Signal Words: for example, for instance, in support of this, in fact, as evidence Compare/Contrast Sentence Frames: This _____ is similar to that _____ because both _____.