



## Grade 7 Science – Course 2 Unit # 3 – Physical Science

### Topic 8 Waves and Electromagnetic Radiation – 20 Days

**Unit Overview** - Students will explore Physical Science topics of waves, electricity and magnetism, and information technologies. Students will examine and model different wave properties and investigate ways that waves can react when they strike materials and the interaction between waves. Students will learn about electrical forces and magnetic forces by identifying evidence that electrical force is exerted by invisible fields. Students will be able to differentiate between static electricity and current. Students will then ascertain evidence that magnetic force is exerted by invisible fields and pinpoint evidence of a planetary magnetic field around Earth. Students then will distinguish between three components of electric circuits and describe relationships among voltage, current, and resistance. Finally, students will describe possible ways information signals can be sent and encoded.

**Topic Essential Question:** What are the properties of mechanical and electromagnetic waves?

#### Lessons

- Topic Launch/Quest Kickoff
- Lesson 1 Wave Properties
- Lesson 2 Wave Interaction
- Lesson 3 Sound Waves
- Lesson 4 Electromagnetic Waves
- Lesson 5 Light
- Topic Close – Assessment, Quest Findings

#### NYSSLS Performance Expectations

**MS-PS4-1. Develop a model and use mathematical representations to describe waves that includes frequency, wavelength, and how the amplitude of a wave is related to the energy in a wave. [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] [Assessment Boundary: Assessment is limited to comparing standard repeating waves of only one type (transverse or longitudinal).]**

**MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, ray diagrams, simulations, and written descriptions. Materials could include plane, convex, and concave mirrors and biconvex and biconcave lenses.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]**

#### Topic Opener

**PE:** MS-ESS4-1

**SEP:** Developing and Using Models; Using Mathematics and Computational Thinking

**DCI:**

**PS4.A – Wave Properties**

- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)
- A sound wave needs a medium through which it is transmitted. (MS-PS4-2)

**CCC – Structure and Function**

#### Savvas

**Highlighted labs are important to the understanding of the instructional concepts in this lesson and must be completed during Science instructional time.**

- Topic Readiness Test
- ***u*Connect Lab – What Are Waves?**
- Quest Kickoff Video – How can you design a system to stop a thief?

#### CLRI Connections:

- [Ellen Ochoa Article \(Gale Database\)](#)

Ellen Ochoa is a retired American astronaut. After gaining degrees in electrical engineering, she joined NASA. She became a specialist in optical technology. She joined space flights in 1993, 1994, 1999, and 2002.

**Lesson 1 – Wave Properties**

**PE:**MS-PS4-1

**SEP:** Using Mathematics and Computational Thinking

**DCI:**

**PS4.A – Wave Properties**

- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)

**CCC:** Patterns

**Savvas**

**Guiding Objectives:**

- Students will evaluate evidence and claims that: Different types of waves transmit energy in different ways; waves share common properties that influence the waves' behavior.
- Students will analyze cause-and-effect relationships and determine how frequency, wavelength, and speed are related.
- Students will use patterns described in a simple mathematical model of waves to predict the behavior of a wave as it travels from one medium to another.

**Literacy Connection**

- Integrate Information

**Vocabulary**

- wave
- mechanical wave
- medium
- frequency
- electromagnetic radiation
- amplitude
- longitudinal wave
- wavelength
- transverse wave

**Academic Vocabulary**

- vacuum

**Connect - TE/SB p.392**

- Connect It!
- Quest Connection
- Poll: Reactive Ripples

**Investigate - TE/SB pp.392-395; 398**

- **uInvestigate Lab – Waves and Their Characteristics\***
- Video – Wave Properties
- Interactivity – Modeling Waves
- Interactivity – Making Waves
- Math Toolbox (p.398)
- Literacy Connection (p.395)
- Reading Checks (p.397)

**Synthesize - TE/SB pp. 395; 398-399**

- Interactivity – Describe the Properties of Waves
- Quest Check-In Interactivity – Light Behavior
- Quest Check-In
- Reading Check (p.395)

**Demonstrate – TE/SB p.399**

- Lesson 1 Check
- Lesson Quiz 1

\*Denotes accompanying lab video

**Lesson 2 – Wave Interaction**

**PE:** MS-PS4-2

**SEP:** Developing and Using Models

**DCI:**

**PS4.B** – Electromagnetic Radiation

- When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object’s material and the frequency (color) of the light. (MS-PS4-2)
- (NYSED) The path that light travels can be traced as straight lines, except when it hits a surface between different transparent materials (e.g., air and water, air and glass) obliquely where the light path bends. (MS-PS4- 2)
- A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2)
- (NYSED) However, because light can travel through space, it cannot be a mechanical wave, like sound or water waves. (MS-PS4-2)

**CCC:** Structure and Function

**Savvas**

**Guiding Objectives:**

- Students will make predictions based on models for: How waves change direction; how waves interact with other waves.
- Students will explain: The concepts of diffraction, refraction, and reflection; the ways that waves interact, including constructive and destructive interference.

**Literacy Connection**

- Integrate Information

**Vocabulary**

- reflection
- diffraction
- interference
- resonance
- refraction
- absorption
- standing wave

**Academic Vocabulary**

- transmitted

**Connect** - TE/SB p. 402

- Connect It!
- Quest Connection
- Inquiry Warm-Up Lab: Follow the Bouncing Ball

**Investigate** - TE/SB pp. 403-409

- Video – Wave Interaction
- ***u*Investigate Lab – Standing Waves and Wave Interference**

- Interactivity – Model Wave Interactions
- Virtual Lab – Colors of the Sky
- Plan It! (p.404)
- Reading Check (pp.407; 409)
- Literacy Connection (p.405)

**Synthesize** - TE/SB pp. 409-410

- Interactivity – Use Models to Describe Wave Behavior
- Quest Check-In Interactivity – Virtual Optics
- Quest Check-In

**Demonstrate** – TE/SB p.310

- Lesson 2 Check
- Lesson 2 Quiz

**Lesson 3 – Sound Waves**

**PE:** MS-PS4-2

**SEP:** Develop and Using Models

**DCI:**

**PS4.A – Wave Properties**

- A sound wave needs a medium through which it is transmitted. (MS-PS4-2)

**CCC:** Structure and Function

**Savvas**

**Guiding Objectives:**

- Students will develop and use models to explain how sound waves interact with matter by processes of reflection, absorption, transmittal, and diffraction.
- Students will describe how stiffness, density, and temperature of materials affect the speed of sound.

**Literacy Connection**

- Integrate with visuals

**Vocabulary**

- loudness
- intensity
- decibel
- Doppler effect
- pitch

**Academic Vocabulary**

- differentiate

**Connect - TE/SB p.412**

- Connect It!
- Quest Connection
- Inquiry Warm-Up Lab – Amplitude and Loudness

**Investigate - TE/SB pp. 412 - 419**

- **Investigate Lab – Understanding Sound**

- Video – Sound Waves
- Interactivity – Reflection, Transmission, and Absorption of Sound Waves
- Interactivity – Sound
- Reading Check (pp.414; 416)
- Math Toolbox (p.418)

**Synthesize - TE/SB pp. 420**

- Interactivity – Doppler Effect
- Reading Check (p.420)
- Literacy Connection (p.420)

**Demonstrate – TE/SB p.421**

- Lesson 3 Check
- Lesson 3 Quiz

**Lesson 4 – Electromagnetic Waves**

**PE:** MS-PS3-4

**SEP:** Developing and Using Models

**DCI:**

**PS4.B** – Electromagnetic Radiation

- When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object’s material and the frequency (color) of the light. (MS-PS4-2)
- (NYSESED) The path that light travels can be traced as straight lines, except when it hits a surface between different transparent materials (e.g., air and water, air and glass) obliquely where the light path bends. (MS-PS4- 2)
- A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2)
- (NYSESED) However, because light can travel through space, it cannot be a mechanical wave, like sound or water waves. (MS-PS4-2)

**CCC:** Structure and Function

**Savvas**

**Guiding Objectives:**

- Students will identify the characteristics of electromagnetic waves.
- Students will compare models of electromagnetic wave behavior.
- Students will explore: The waves that make up the electromagnetic spectrum; how models describe the way that frequency and amplitude are related in waves.

**Literacy Connection**

- Translate Information

**Vocabulary**

- electromagnetic wave
- radio waves
- electromagnetic spectrum
- microwaves
- visible light
- ultraviolet rays
- infrared rays
- X-rays
- gamma rays

**Academic Vocabulary**

- transverse

**Connect** - TE/SB p.422

- Connect It!
- Quest Connection
- Class Discussion: White Life

**Investigate** - TE/SB pp. 423-428

- **Investigate Lab – Build a Wave\***
- Video – Electromagnetic Waves
- Interactivity – Build an Electromagnetic Wave
- Interactivity – Models of Light
- Reading Check (pp. 425; 426)
- Math Toolbox (p.427)
- Literacy Connection (p.426)

**Synthesize** - TE/SB pp. 429 - 430

- Interactivity – Describe Electromagnetic Waves
- Quest Check-In Interactivity – Optical Demonstration
- Reading Check (p.429)
- Quest Check-In

**Demonstrate** – TE/SB p.430

- Lesson 4 Check
- Lesson 4 Quiz

\*Denotes accompanying lab video

**Lesson 5 - Light**

**PE:** MS-PS4-2

**SEP:** Developing and Using Models

**DCI:**

**PS4.B** – Electromagnetic Radiation

- When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object’s material and the frequency (color) of the light. (MS-PS4-2)

**CCC:** Structure and Function

**Savvas**

**Guiding Objectives:**

- Students will develop a model of light-matter interactions that explains that: Transparent and translucent materials transmit light; opaque materials reflect and absorb light; an object reflects light that is the color of the object.
- Students will use a model of light rays reflecting from a smooth surface to determine how: Plan and convex mirrors create virtual images; concave mirrors create virtual and real images.
- Students will use a model of light rays refracting through a transparent material to determine how: Convex lenses create virtual and real images; concave lenses create virtual images.

**Literacy Connection**

- Evaluate Media

**Vocabulary**

- transparent
- translucent
- opaque
- diffuse reflection
- convex
- focal point
- concave

**Academic Vocabulary**

- compare

**Connect** - TE/SB p.432

- Connect It!
- Quest Connection
- Write” Reflecting on Reflections

**Investigate** - TE/SB pp. 432 - 440

- **Investigate Lab – Light Interacting with Matter**
- Video – Light
- Interactivity – Describe the Behavior of Light
- Interactivity – Blinded by the Light
- Reading Check (pp. 434; 438; 440)
- Model It! (p.438)
- Literacy Connection (p.435)

**Synthesize** - TE/SB pp. 440 - 441

- Interactivity – Predict the Behavior of Light Rays
- **Quest Check-In Lab – An Optimal Optical Solution: Design to Stop a Thief**
- Quest Check-In

**Demonstrate** – TE/SB p.441

- Lesson 4 Check
- Lesson 4 Quiz

<p><b>Topic Close</b></p> <ul style="list-style-type: none"> <li>• Topic 8 Assessment and Remediation TE/SB pp. 442-445</li> <li>• Quest Finding and Reflection TE/SB p. 445</li> </ul>	<p><b>Topic 8 Enrichment</b></p> <p><b>Topic 8 - Lesson 1 Enrichment</b></p> <ul style="list-style-type: none"> <li>• Enrichment – Measuring Ocean Waves</li> <li>• Case Study – Sound and Light at the Ballpark (pp.400-401)</li> </ul> <p><b>Topic 8- Lesson 2 Enrichment</b></p> <ul style="list-style-type: none"> <li>• Enrichment – Mapping with Sonar</li> <li>• Engineering Design Notebook – A Camera Without a Lens (p.411)</li> </ul> <p><b>Topic 8 - Lesson 3 Enrichment</b></p> <ul style="list-style-type: none"> <li>• Enrichment – Violins and Sound</li> </ul> <p><b>Topic 8 - Lesson 4 Enrichment</b></p> <ul style="list-style-type: none"> <li>• Enrichment – Space Radiation</li> <li>• Career – Lighting Designer (p.430)</li> </ul> <p><b>Topic 8 - Lesson 5 Enrichment</b></p> <ul style="list-style-type: none"> <li>• Enrichment – Light and Color</li> </ul>
<p><b>English Language Learners (ELL) Enhancements</b> To access <a href="#">hyperlinked</a> material, you must be logged into your BPS Google Drive</p>	<p><b>Listening</b></p> <ul style="list-style-type: none"> <li>• <b><a href="#">Cross- Linguistic Practices</a></b>: Gives students opportunities to make connections between what they hear and their home language (For example, allow students to listen to a passage and identify cognates).</li> <li>• <b><a href="#">Activating Prior Knowledge</a></b> Activating prior knowledge means both eliciting from students what they already know and building initial knowledge that they need in order to access upcoming content.</li> <li>• <b><a href="#">Visuals</a></b> - GIFs, pictures- will assist students in understanding what they are listening to. Use <b><a href="#">visual thinking strategies</a></b> to set the lens for learning.</li> <li>• Video to review or introduce a topic – use <b><a href="#">closed captioning</a></b> to help students see the words and pronunciations while they listen to the content.</li> <li>• <b><a href="#">Word stretching / Vowel stretching</a></b> when instructing allows student to listen closely to the pronunciation of the word.</li> <li>• <b><a href="#">Performance Level Descriptors</a></b> this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of listening. Scroll for grade 7.</li> </ul> <p><b>Speaking</b></p> <ul style="list-style-type: none"> <li>• <b><a href="#">Sentence Stems/Frames</a></b> - to begin a sentence - such as <i>Evolution is...</i> or <i>I think that evolution is...</i></li> <li>• <b><a href="#">Academic Conversation Starters</a></b>: Have a visual of a list of academic sentence starters that students can refer to in a discussion.</li> <li>• <b><a href="#">Choral Reading</a></b> - To build fluency, self-confidence and motivation with <b><a href="#">reading/speaking</a></b>.</li> <li>• Create <b><a href="#">movement</a></b> to go with the word. Movement can be a motivating factor, as well as a kinesthetic tool for conceptualizing the rhythm and flow of fluent reading while triggering brain function for optimal learning.</li> <li>• <b><a href="#">Performance Level Descriptors</a></b> This document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of speaking. Scroll for grade 7.</li> </ul>



	<p><b><u>Reading</u></b></p> <ul style="list-style-type: none"> <li>● Supplementary Text to help reinforce concepts.</li> <li>● <b><u>Visual Aids</u></b> - Pictures or models to support vocabulary words and concepts</li> <li>● Video to review or introduce a topic - use <b><u>closed captioning</u></b> to help students read along while they listen to the content.</li> <li>● <b><u>4 Square / Frayer models</u></b> to help students gain a deeper understanding of vocabulary.</li> <li>● <b><u>Highlighting</u></b> important text to assist students in answering questions after the reading.</li> <li>● <b><u>Chunking</u></b>-Break reading of text into chunks or paragraphs</li> <li>● <b><u>Vocabulary Morphology</u></b>- Morphology relates to the segmenting of words into affixes (prefixes and suffixes) and roots or base words, and the origins of words. Understanding that words connected by meaning can be connected by spelling can be critical to expanding a student’s vocabulary.</li> <li>● <b><u>Performance Level Descriptors</u></b> this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of reading. Scroll for grade 7.</li> </ul> <p><b><u>Instructional Accommodations (depending on the student’s needs)</u></b></p> <ul style="list-style-type: none"> <li>● <b>Extended time</b> for tests in class, projects and assignments</li> <li>● <b>Directions read.</b> Broken down as necessary</li> <li>● <b>Model</b> how to complete the activity in the lesson</li> <li>● <b>Oral simplification</b> of directions or questions</li> <li>● <b>Translated version</b> of test when available. Student may have both version English and native language version</li> <li>● Use of <b><u>approved bilingual glossaries</u></b> from NYS in each subject</li> </ul>
<p><b>Special Education Modifications</b></p> <p>Special Education students must have accommodations as per Individual Educational Plan (IEP)</p>	<p><b><u>Instructional</u></b></p> <ul style="list-style-type: none"> <li>● <b>Pre-teach</b> vocabulary</li> <li>● Use <b>picture vocabulary</b></li> <li>● Scaffold <b>Depth of Knowledge</b> questions</li> <li>● Provide copy of notes/<b>notes in “cloze”</b> form</li> <li>● Use of <b>Think, Pair, and Share</b> strategy to help process information</li> <li>● <b>Scaffold</b> written assignments with the use of <b>graphic organizers</b></li> <li>● Allow for <b>multiple ways to respond</b> (verbal, written, response board)</li> <li>● Provide <b>model of performance task</b></li> <li>● <b>Modify informational text</b> to fit the needs of the students</li> <li>● Provide a digital or paper <b>interactive notebook</b></li> <li>● Present complex <b>tasks in multiple ways</b></li> <li>● Provide <b>mnemonic strategies</b> for scientific concepts</li> </ul> <p><b><u>Technology:</u></b></p> <ul style="list-style-type: none"> <li>● <b>Audio</b> reading of text</li> <li>● <b>Text to type</b> functions</li> <li>● <b>Videos</b> to clarify/visualize science concepts</li> <li>● <b>Record class lecture/discussions</b> and make accessible to student</li> <li>● <b>Nearpod-</b> interactive presentations of notes</li> </ul> <p><b><u>In Class Assessments</u></b></p> <ul style="list-style-type: none"> <li>● Provide <b>multiple options</b> for projects</li> <li>● <b>Use of timer</b> in class</li> <li>● Break all complex tasks into chunks</li> </ul>



<p><b>Step Up to Writing</b> Step Up to Writing Materials can be found in BPS Science K-12 Schoology Folder Grade 5 Resources Grade 5 SUTW materials</p>	<ul style="list-style-type: none"><li>● Easy Two-Column Notes</li><li>● Breaking Down Definitions</li><li>● Paragraph Frame- What I Learned</li><li>● <a href="#">Performance Level Descriptors</a> this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of writing. Scroll for grade 7.</li></ul>
<p><b>Culturally and Linguistically Responsive Teaching (CLRT) in the Science Classroom</b></p>	<ul style="list-style-type: none"><li>● Materials, resources, and/or discussions address diverse cultural backgrounds and real-world applications</li><li>● Artifacts (posters, charts, etc.) in the science classroom are representative of the cultures of the student population</li><li>● All students are given an opportunity to engage in science discourse</li><li>● Teacher demonstrates high expectations for all students</li></ul>