4th Grade Unit 4
9 weeks

Waves:
Waves and Information

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Essential Questions

What are waves?

How are waves used to transfer energy and information?

How are instruments that transmit and detect waves used to extend the human senses?

Waves: Waves and Information

Students who demonstrate understanding can:

4-PS4-1 Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. [Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.]

4-PS4-3 Generate and compare multiple solutions that use patterns to transfer information.* [Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1s and 0s representing black and white to send information about a picture, or using Morse code to send text.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Develop a model using an analogy, example, or abstract representation to describe a scientific principle. (4-PS4-1) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-PS4-3) **Connections to Nature of Science** **Scientific Knowledge is Based on Empirical Evidence** • Science findings are based on recognizing patterns. (4-PS4-1)	**PS4.A: Wave Properties** • Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. (4-PS4-1) • Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1) **PS4.C: Information Technologies and Instrumentation** • Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. (4-PS4-3) **ETS1.C: Optimizing The Design Solution** • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (4-PS4-3)	**Patterns** • Similarities and differences in patterns can be used to sort and classify natural phenomena. (4-PS4-1) • Similarities and differences in patterns can be used to sort and classify designed products. (4-PS4-3) **Connections to Engineering, Technology, and Applications of Science** **Interdependence of Science, Engineering, and Technology** • Knowledge of relevant scientific concepts and research findings is important in engineering. (4-PS4-3)

Waves

Background knowledge videos:

PS4.A Wave Properties

PS4.C Information Technologies and Instrumentation

These videos are designed to assist in providing background knowledge with the associated DCI. The information in the videos follows the progression through high school.

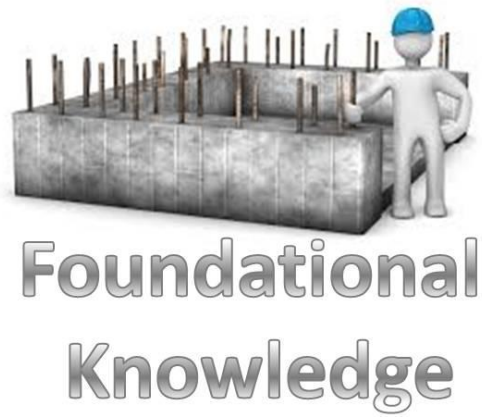
This is a great resource explaining what students need to understand.

Further Background Information for Waves PS4

From *Disciplinary Core Ideas: Reshaping Teaching and Learning*
by Ravit Golan Duncan, Joseph Krajcik, and Ann E. Rivet
**Rogers RPS30/Google Account needed to access*

Prior to 4th grade, students should have knowledge, understanding of, and experiences with the following ideas:

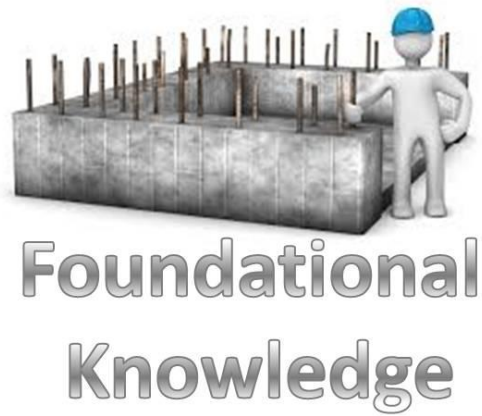
- ★ Waves in water spread out in circles. The surface of the water moves up and down while a wave spreads outward.
- ★ Sound can make matter vibrate, and vibrating matter can make sound.
- ★ Objects can be seen if light is available to illuminate them or if they give off their own light.
- ★ Light travels from place to place.
- ★ Some materials allow light to pass through them; others allow only some light through.



With the implementation of new standards, students may not have had opportunities to engage in these foundational understandings and ideas before 4th grade. You may need to provide opportunities for students to experience these ideas as you move forward.

Prior to 4th grade, students should have knowledge, understanding of, and experiences with the following ideas:

- ★ Some materials block all the light and create a dark shadow on any surface beyond them, where light cannot reach.
- ★ Mirrors can be used to redirect a light beam.
- ★ People use a variety of devices to communicate (send/receive information) over long distances.
- ★ People can detect light with their eyes, sound with their ears, and vibrations with their fingertips.



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What are waves?

How are waves used to transfer energy and information?

How are instruments that transmit and detect waves used to extend the human senses?

Big Ideas

- ★ Waves are regular patterns of motion, a disturbance that moves or spreads throughout space.
- ★ Waves can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place.
- ★ Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between the wave peaks).
- ★ Waves of different amplitudes transfer different amounts of energy.

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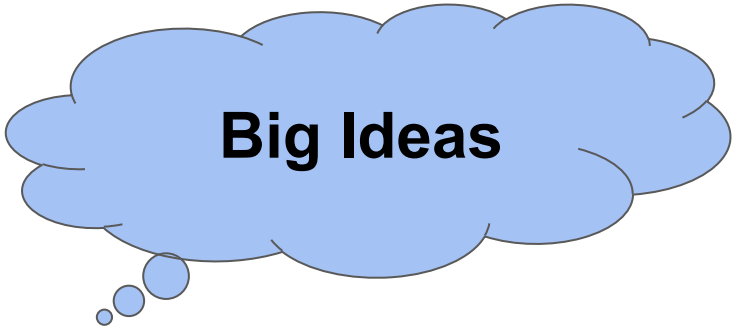

★ Patterns can be used to communicate information across a distance.

★ Information can be digitized and transmitted.

★ High-tech devices, such as computers or cell phones, can receive and decode information – convert it from digitized for to voice – and vice versa.

★ Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and constraints.

Waves: Waves and Information

Students who demonstrate understanding can:

4-PS4-1 Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves. Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.

Identify and CLARIFY the STANDARDS

Possible Student Misconceptions about Waves:

Misconception: When waves come into contact with a solid surface, the waves are destroyed.

When waves strike a solid surface, they cause the surface to vibrate, and this vibration can then be transmitted through the solid material. Wave energy can be reflected from or transmitted through any barrier.

Misconception: When a wave moves, particles always move with the wave from the point of transmission to the point of reception.

The particles in a medium vibrate and then return to their initial positions as wave energy is transmitted.

Misconception: Light travels in a wave-like path.

Light waves travel in straight lines, not wave-like paths.

Disciplinary Core Ideas

PS4.A: Wave Properties

- Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. (4-PS4-1)
- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1)

Possible Student Misconceptions about Sound Waves:

Misconception: The ability to make noise is a characteristic property of some objects.
Any vibrating object or substance can make noise.

Misconception: Sound is a "thing" that has the ability to move on its own.
Sound is a form of energy that must be transmitted from one place to another through vibration of particles.

Misconception: Sound cannot travel through liquids and solids.
Sound travels more quickly through liquids and solids than it does through gases.

Misconception: Sound travels as transverse waves that move matter up and down.
Sound travels as longitudinal waves: alternating compression and expansion of particles of matter.

Misconception: Sound waves are radio waves.
Radio waves are a form of light wave (electromagnetic wave).

Possible Student Misconceptions about Light:

Misconception: Light is only reflected away from shiny surfaces.
Light is reflected from any surface that does not absorb the energy of the radiation.

Misconception: A shadow is its own entity.
A shadow is the absence of light and is created when an object that light cannot pass through come between a light source and the surface that the light source is directed toward.

Misconception: Light travels in a wave-like path.
Light waves travel in straight lines, not wave-like paths.

Disciplinary Core Ideas

PS4.A: Wave Properties

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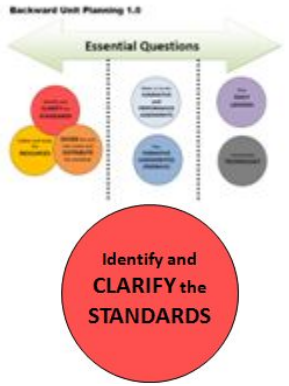
- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1)

Waves: Waves and Information

Students who demonstrate understanding can:

4-PS4-3 Generate and compare multiple solutions that use patterns to transfer information.*

Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1s and 0s representing black and white to send information about a picture, or using Morse code to send text.



Possible Student Misconceptions about Information Transfer:

Misconception: When you talk on a phone, sound waves travel through air or wires to the other telephone.
Sound waves travel to the microphone of the phone and are converted into electrical signals or electromagnetic waves, which travel to the other phone. When these signals reach the other phone, they are converted back into sound so that they can be understood.

Misconception: Radio waves are a form of sound.
Radio waves are a form of light, or electromagnetic waves. Radio waves are just like visible light, but they have a longer wavelength and carry less energy.

Misconception: Digital signals travel slowly through the air.
Digital signals that are carried by electromagnetic waves can travel at the speed of light, nearly 300,000 km/s.

Misconception: Fibers used in fiber optic cables are the same as the fibers used in clothing.
Fiber optic cables are made of glass or plastic, while clothing fibers are generally made of plant fibers or other synthetic fibers such as nylon.

Disciplinary Core Ideas

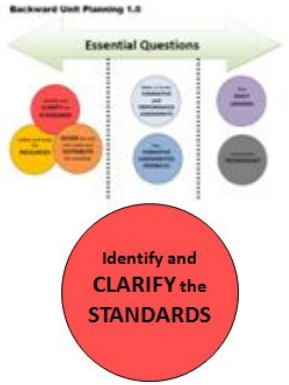
PS4.C: Information Technologies and Instrumentation

- Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. (4-PS4-3)

ETS1.C: Optimizing The Design Solution

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (4-PS4-3)

Energy
Students who demonstrate understanding can: **4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.**



****This standard was initiated in the previous unit of study on energy.**

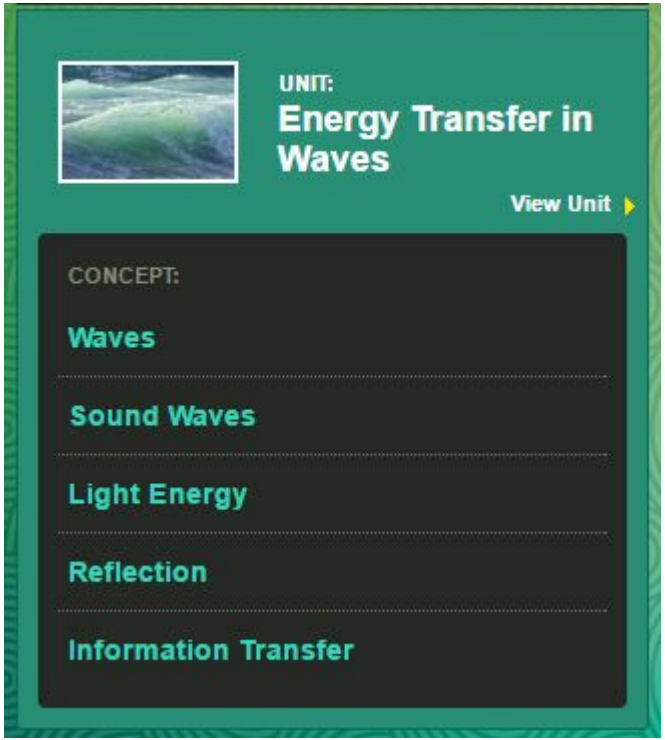
- Focus is on ideas around light and transfer of energy (waves)

Disciplinary Core Ideas

PS3.B: Conservation of Energy and Energy Transfer

- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4-PS3-2, 4-PS3-3)
- Light also transfers energy from place to place. (4-PS3-2)
- Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-2, 4-PS3-4)

Gather and study the RESOURCES



Discovery Education Science Techbook Units

Week	Performance Expectation/ DCI	5E Lesson Plan and Resources
1-2 **Part 1**	4-PS4-1 Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. *(building the foundational understanding of waves and their properties)* **Disciplinary Core Ideas** **PS4.A: Wave Properties** • Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. (4-PS4-1) • Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1)	**Options for Lessons: WAVES** Students will be exploring ideas about waves and the properties of amplitude and wavelength. Formal definitions of these terms comes after exploration. • *What are waves?* • *What are some examples of waves?* • *How do waves travel?* • *How does a wave break?* • *What is wave height? What is wavelength? What is frequency?* • *How do different amounts of force make waves?* You could use the following to help answer these guiding questions: Guiding questions handout Waves - explore and engage **KLEWS chart blank** **Engage:** Youtube videos to engage students in different types of waves and guiding questions above... *What do these videos have in common? What do you notice happening?* 1. Ultimate Drone videos of surfing - 2. Science vs. Music 3. Laser Light Show Additional videos and explorations for engagement and beginning understandings about waves: DE Video The Nature of Waves DE Video Vibrations and Waves DE Exploration Waves

Week	Performance Expectation/ DCI	5E Lesson Plan and Resources
1-2 **Part 2**	4-PS4-1 Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. *(building the foundational understanding of waves and their properties)* **Disciplinary Core Ideas** **PS4.A: Wave Properties** • Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. (4-PS4-1) • Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1)	**Explore:** Slinky Lab: each vary in depth of activity (choose an appropriate lab for you and your students): Brainpop Wave Video Watch video before exploring with the slinky lab: 1. Make Some Waves 2. Slinky and the Wave Lab 3. Slinky Waves You Tube video- Slinky Wave Lab - watch after completing a Slinky Lab for further explanation of what might have happened during the lab Brainpop Reading Passage - In Depth - Waves Brainpop Reading Passage - Real Life - Waves Brainpop Games - Wave Combinator Brainpop Games - Waves on a String Youtube videos for exploring ideas about waves and the different types: • Where do waves come from - • Light waves; visible and invisible • Science - Transmission of Sound **Explain:** • Review video before students complete the explanation: Brainpop Wave Video • Explanation of waves: Waves Activity Explain • Students start a Scientific Explanation (CER) answering: *What are waves?*

Week	Performance Expectation/ DCI	5E Lesson Plan and Resources
1-2 **Part 3**	4-PS4-1 Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. *(building the foundational understanding of waves and their properties)* **Disciplinary Core Ideas** **PS4.A: Wave Properties** • Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. (4-PS4-1) • Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1)	**Elaborate:** Making Water Waves: Hands on activity from DE: Teacher Guide Student Investigation Sheet *Students will examine the energy of waves in the water.* BetterLesson.com activities: • Pop Bottle Waves and Hair Dryer Ripples - Students will observe, draw, and think about how waves are shaped and how they move and what creates them. • Jam Jam Jam with a rubber band band - Students explore and create a stringed instrument that demonstrates their understanding of sound waves and how energy is transferred. • Making a Wave Machine - Students construct their own wave machine to investigate wave motion. • Who Turned Out the Lights - Students use lines, rays and diagrams to explain how light rays reflecting on an object help us see the object. **Evaluate:** Review guiding questions, types of waves, and part of waves. • *What are waves?* • *What are some examples of waves?* • *How do waves travel?* • *How does a wave break?* • *What is wave height? What is wavelength? What is frequency?* • *How do different amounts of force make waves?* Brainpop waves quiz DE Constructed Response Students finalize/refine their Scientific Explanation (CER) answering: *What are waves?*

Weeks	Performance Expectation/ DCI	5E Lesson Plan and Resources
3-4 **Part 1**	4-PS4-1 Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. [Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.]	**Options for Lessons: SOUND** **Guiding Questions** ● *How are sounds produced?* ● *How do sound waves travel?* ● *What's the difference when you speak loudly or softly?* ● *What does sound look like?* ● *How can we use our senses observe describe sound?* ● *Can you have sound without matter?* "Making Sense of Sound" from December 2016 issue of *Science and Children* **Engage:** Blue Man Group - First 3 Mins (Use video to intro/demonstrate how sound is created by a vibration, but don't say that yet) ● *What is causing the paint to move?* ● *What is creating the sound?* ● *What makes the paint go higher?* ● *What makes the paint go lower?* What is Energy - Types of Energy - Sound Youtube video **Explore:** Formative Assessment Probe: Making Sounds *Intranet Password Protected Page* Sound Explorations: ● All About that Sound - Sound Stations Explorations ● Sound Waves Board DE Board **Students can use TwistedWave Recorder to record sound waves during their explorations

Weeks	Performance Expectation/ DCI	5E Lesson Plan and Resources
3-4 **Part 2**	4-PS4-1 Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. [Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.]	**Options for Lessons: SOUND** **Explain:** Define sound waves and how we hear sound. • Study Jams: How do we hear sounds? What are sound waves? • DE Passage The Waves of the Present **Elaborate** Readworks Passages about sound. (To access questions type the title of the passage in the search bar) DE STEM Connection: Project: Sweet Spot Baseball Reading Students share their learning about sound through a presentation/project about sound: Resources they could use: • DE Board Builder • Google Slides, Prezi, PowerPoint, Padlet • ChatterPix, Blabberize (tutorial) - students use a picture and "make it talk" • PaperSlides Presentation - DE Spotlight on Strategies • Vocaroo (create audio recordings - could be saved to embed in part of presentation, etc) PDF directions **Evaluate** DE Constructed Responses: Assessment Tab of Sound Waves • Sound Waves Teacher's Guide • Sound Waves:Experiment Response Teacher's Guide • Observing Sound Waves Teacher's Guide

Weeks	Performance Expectation/ DCI	5E Lesson Plan and Resources
5-6 **Part 1**	4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. ● Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. ● Energy can be transferred in various ways and between objects. ● Energy can be moved from place to place by moving objects or through sound, light, or electric currents. ● Light also transfers energy from place to place.	**Options for Lessons:LIGHT and REFLECTION** DE Content Prep: *Light Energy 5-min Prep Video PPT Reflection 5-min Prep PPT* ***This concept was initiated in the previous unit on Energy. The focus in this unit on is Light and the transfer of light energy/waves.* **Engage:** *Ask students to brainstorm a list of ways they use light in everyday life.* Have them identify the source of the light in each instance. Introduction of Ideas: ● DE Video What is Light? Use video to discuss the nature and importance of light. You use light every day to see the world around you. But what is light, and how is it used? ● DE Video Waves from the Sun What is sunlight? ● DE Video What is Light? Defines Light and explains how light travels. What is light? How can light be described? How does light travel? **Explore:** *How are waves measured? What are the parts of a wave? What is the electromagnetic spectrum?* ● DE Video Properties of Light Describes some of the properties and characteristics of light. ● BrainPop video Electromagnetic Spectrum Graphic Organizer *What are two ways light reacts with the surface of an object? What is reflection? What is refraction?* ● DE Video Reflection and Refraction ● DE Student Exploration: Reflection Student Exploration Page Teacher Guide ● BrainPop Refraction Video ● Refraction Article (text from BrainPop Refraction Video FYIs)

Weeks	Performance Expectation/ DCI	5E Lesson Plan and Resources
5-6 **Part 2**	4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. ● Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. ● Energy can be transferred in various ways and between objects. ● Energy can be moved from place to place by moving objects or through sound, light, or electric currents. ● Light also transfers energy from place to place.	**Options for Lessons:LIGHT and REFLECTION** **Explain:** ● BrainPop Light video Graphic Organizer Vocabulary ● BrainPop Rainbow video Making a Rainbow Activity Graphic Organizer ● Students begin construction of a CER to answer each of the following questions: ○ *How does light transfer energy?* ○ *What are the varied effects of reflected light?* **Elaborate:** ● DE Student Exploration Light Energy Student Exploration Page Teacher Guide ● DE Board/Exploration Light Energy ● DE Fundamental Interactive Sound, Heat, and Light *(use the light portion of interactive)* ● DE Student Fun-damental Check-in *(use pages 5-6 on Light)* ● Student Investigation- Have students investigate shining the light from a flashlight in a dark box on different surfaces, such as a mirror, a block of wood, and a piece of clear plastic. Students should write their observations in their science journals. ● DE Hands-on Lab: Baking in the Sun - students will make a pizza box solar oven *(*Note: this or a similar STEM challenge may have been completed in the previous unit.)*

Weeks	Performance Expectation/ DCI	5E Lesson Plan and Resources
5-6 **Part 3**	4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. ● Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. ● Energy can be transferred in various ways and between objects. ● Energy can be moved from place to place by moving objects or through sound, light, or electric currents. ● Light also transfers energy from place to place.	**Options for Lessons:LIGHT and REFLECTION** **Evaluate:** **Light Energy** Review: *What is light? How can light be described? How does light travel? How does light change as it travels? What forms of energy can light be transformed into?* Light Energy: DE Assessments: ● Constructed Response ● Multiple Choice Transferring and Transforming Light Energy - DE Constructed Response **Reflection** Review: *What happens when light hits a surface?* Reflection DE Assessments: ● Constructed Response ● Multiple Choice Reflection and Color - DE Constructed Response Students complete construction of a Scientific Explanation (CER) to answer each of the following questions (started in explain phase): ○ *How does light transfer energy?* ○ *What are the varied effects of reflected light?*

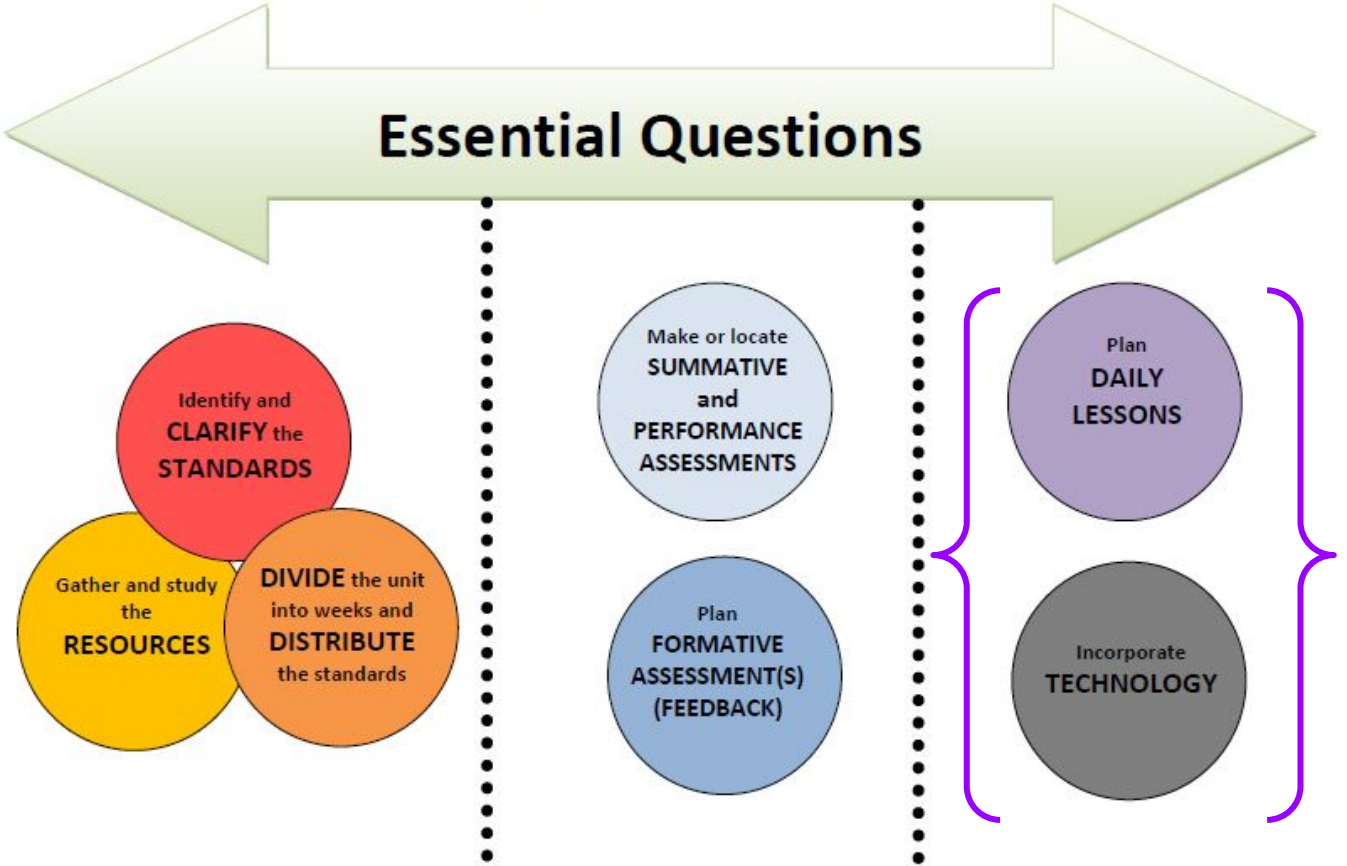
Week	Performance Expectation/ DCI	5E Lesson Plan and Resources
7-9 **Part 1**	**4-PS4-3** **Generate and compare multiple solutions that use patterns to transfer information.** **Essential Questions:** How are waves used to transfer information? How are instruments that transmit and detect waves used to extend the human senses?	**Options for Lessons: INFORMATION TRANSFER** Further Background Information for Waves PS4 - Information Technologies excerpts are very helpful. DE Model Lesson **Engage** ● DE Hands On: Make a Telephone ● DE Image: Satellites in Outer Space Discussion Point: A satellite can not be connected to Earth by wires. *How does it transfer information?* ● DE Video Segment:Lockheed Martin Space Systems ● DE Explore:Communicating Over Long Distances ○ Video Communication Evolution ○ Text GPS ● DE Video Segment:Transmitting Signals ○ "Communicate" Song Version 1 ○ "Communicate" Song Version 2 ● DE Video Segments: Remote Controlling a Real Plane Remote Controlling Mining Trucks **Explore** ● DE Hands On Investigation: Can You Hear Me Now? ● DE Project: Fiber Optics ● DE Video Segment: Transmitting Television Signals DE Investigation: Television Signals ● DE Video Segment: How Remotes Work DE Image: Remote Control

Week	Performance Expectation/ DCI	5E Lesson Plan and Resources

7-9
Part 2
	4-PS4-3
	Generate and compare multiple solutions that use patterns to transfer information.
	
	Essential Questions:
	How are waves used to transfer information?
	
	How are instruments that transmit and detect waves used to extend the human senses?
		Options for Lessons:INFORMATION TRANSFER
		
		Explain
		• DE Interactive Glossary Communication System *Scroll down toward middle of page
		• DE Video Segments:How Cell Phones Work Cell Phone Signals
		• DE STEM in Action: How Cell Phones Work - Text
		• DE Video Segment: Cell Towers
		• DE Assessment/Activity: Cell Phone Antenna Placement
		• DE Explore: How Do We Communicate Over Long Distances?
		• DE Explore:Transferring Information: Digital vs. Analog
		  ○ DE Passage Digital vs. Analog
		  ○ DE Board Digital vs. Analog Signals
		• DE Video Segment: What are Radio Waves?
		• DE Passage:Fiber Optic Information Transfer

Week	Performance Expectation/ DCI	5E Lesson Plan and Resources
7-9 **Part 3**	**4-PS4-3** **Generate and compare multiple solutions that use patterns to transfer information.** **Essential Questions:** **How are waves used to transfer information?** **How are instruments that transmit and detect waves used to extend the human senses?**	**Options for Lessons:INFORMATION TRANSFER** **Elaborate** *No computers are needed for the following activities..* • Robotic Friends - Video and information Robotic Friends Lesson Plan • Emotion Machine - Students can program a card robot face to show different emotions. • Tour Guide Activity - Devise a tour that gets a tourist from their hotel to all the city sights and back to their hotel. • Graph-Paper Programming Lesson Plan *Computers will be needed for these activities.* • Binary Code: Binary Alphabet Binary Numbers Binary Clock Binary Bracelets • Binary Baubles - Traveling Circuits • Write Your Name in Binary Code Binary Text Conversion Sheet - Word Doc • See Your Name in Binary on Screen - Type your name into the box and see your name on screen. Binary and the process used to convert to binary are explained. • Binary to Text (ASCII) Conversion - Type a message to encode/decode. • Hour of Code - This one hour tutorial is designed for all ages with lots of engaging coding activities at varying interest and experience levels On the left side of screen, scroll down for additional multi-level lesson planning resources. • Animate Your Name - using Scratch programming • CS Tech Jam - Programming language and concepts **Evaluate** DE Assessments: Explaining Information Transfer Constructed Response, Teacher's Version Unit Review, Unit Assessment Advertisement for a Communication Device Aspire-Inspired Unit Assessment: Waves Student Assessment Teacher Guide

Backward Unit Planning 1.0



Now you're ready to plan your daily lessons!