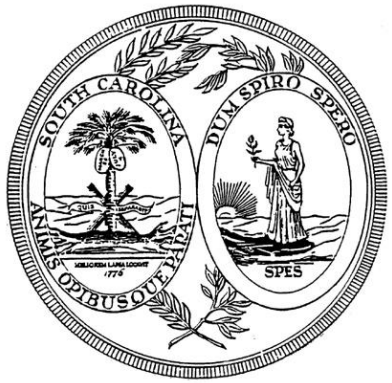
South Carolina Academic Standards and Performance Indicators for Science 2014



Instructional Unit Resource

8th Grade

South Carolina Academic Standards and Performance Indicators for Science 2014
Eighth Grade Science Instructional Unit Resource

As support for implementing the *South Carolina Academic Standards and Performance Indicators for Science 2014*, the standards for Eighth Grade have been grouped into possible units. In the Overview of Units below, the titles for those possible units are listed in columns. Refer to the Overview document to note these unit titles and how Standards, Conceptual Understandings, Performance Indicators, Science and Engineering Practices, and Crosscutting Concepts align. Following the Overview of Units, an Instructional Unit document is provided that delivers guidance and possible resources in teaching our new *South Carolina Academic Standards and Performance Indicators for Science 2014*. The purpose of this document is to provide guidance as to how all the standards in this grade may be grouped into units and how those units might look. Since this document is merely guidance, districts should implement the standards in a manner that addresses the district curriculum and the needs of students. This document is a living document and instructional leaders from around the state will continuously update and expand these resource documents. These documents will be released throughout the 2016-2017 school year with the intentionality of staying ahead of instruction. Teachers should also note that links to the Standards document, A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas, the SEP Support Document, and the Support Document 2.0 are embedded throughout the Instructional Unit format for reference.

Acknowledgments

Jean Baptiste Massieu, famous deaf educator, made a statement that is now considered a French proverb. “Gratitude is the memory of the heart. Indeed, appreciation comes when you feel grateful from the depths of your heart. The head keeps an account of all the benefits you received and gave. But the heart records the feelings of appreciation, humility, and generosity that one feels when someone showers you with kindness.” It is with sincere appreciation that we humbly acknowledge the dedication, hard work and generosity of time provided by teachers and instructional leaders across the state that have made and are continuing to make the Instructional Unit Resources possible.

Grade Eight Overview of Units

Unit 1	Unit 2	Unit 3	
Physical Science: Forces & Motion	Physical Science: Waves	Earth Science: Earth's Place in the Universe	
Standard	**Standard**	**Standard**	
8.P.2	8.P.3	8.E.4	
Conceptual Understanding	**Conceptual Understanding**	**Conceptual Understanding**	**Conceptual Understanding**
8.P.2A	8.P.3A	8.E.4A	8.E.4B
Performance Indicators	**Performance Indicators**	**Performance Indicators**	**Performance Indicators**
8.P.2A.1 8.P.2A.2 8.P.2A.3 8.P.2A.4 8.P.2A.5 8.P.2A.6 8.P.2A.7	8.P.3A.1 8.P.3A.2 8.P.3A.3 8.P.3A.4 8.P.3A.5 8.P.3A.6	8.E.4A.1 8.E.4A.2	8.E.4B.1 8.E.4B.2 8.E.4B.3 8.E.4B.4 8.E.4B.5 8.E.4B.6
Science and Engineering Practices	**Science and Engineering Practices**	**Science and Engineering Practices**	
8.S.1A.2 8.S.1A.3 8.S.1A.4 8.S.1A.5 8.S.1A.6	8.P.1A.2 8.P.1A.4 8.P.1A.6 8.P.1A.8	8.P.1A.2 8.P.1A.4 8.P.1A.6 8.P.1A.7 8.P.1A.8	
CrossCutting Concepts	**CrossCutting Concepts**	**CrossCutting Concepts**	
2, 4, 3,7	1, 2, 6	1, 2, 3, 4	

**Teachers have the discretion to enhance the selected SEP's and CCC's.*

Grade Eight Overview of Units

Unit 4			Unit 5	
Earth Science: Earth Systems & Resources			Earth Science: Earth's History & Diversity of Life	
Standard			**Standard**	
8.E.5			8.E.6	
Conceptual Understanding	**Conceptual Understanding**	**Conceptual Understanding**	**Conceptual Understanding**	**Conceptual Understanding**
8.E.5A	8.E.5B	8.E.5C	8.E.6A	8.E.6B
Performance Indicators	**Performance Indicators**	**Performance Indicators**	**Performance Indicators**	**Performance Indicators**
8.E.5A.1 8.E.5A.2 8.E.5A.3 8.E.5A.4 8.E.5A.5	8.E.5B.1 8.E.5B.2 8.E.5B.3	8.E.5C.1	8.E.6A.1 8.E.6A.2 8.E.6A.3 8.E.6A.4 8.E.6A.5	8.E.6B.1 8.E.6B.2
Science and Engineering Practices			**Science and Engineering Practices**	
8.P.1A.2 8.P.1A.4 8.P.1A.6 8.P.1A.8 8.S.1B.1			8.P.1A.2 8.P.1A.4 8.P.1A.6 8.P.1A.7 8.P.1A.8 8.S.1B.1	
CrossCutting Concepts			**CrossCutting Concepts**	
1, 2, 3, 4, 6, 7			1, 2, 3, 4, 5, 7	

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Unit Title
Physical Science – Waves
Standard http://ed.sc.gov/scdoe/assets/file/agency/ccr/Standards-Learning/documents/South_Carolina_Academic_Standards_and_Performance_Indicators_for_Science_2014.pdf
8.P.3 The student will demonstrate an understanding of the properties and behaviors of waves.

Conceptual Understanding
8.P.3A Waves (including sound and seismic waves, waves on water, and light waves) have energy and transfer energy when they interact with matter. Waves are a repeating pattern of motion that transfers energy from place to place without overall displacement of matter. All types of waves have some features in common. When waves interact, they superimpose upon or interfere with each other resulting in changes to the amplitude. Major modern technologies are based on waves and their interactions with matter.
New Academic Vocabulary **Some students may need extra support with the following academic vocabulary in order to understand what they are being asked to understand and do. Teaching these terms in an instructional context is recommended rather than teaching the words in isolation. A great time to deliver explicit instruction for the terms would be during the modeling process. Ultimately, the student should be able to use the academic vocabulary in conversation with peers and teachers. These terms are pulled from the essential knowledge portion of the Support Doc 2.0 (http://ed.sc.gov/instruction/standards-learning/science/support-documents-and-resources/) and further inquiry into the terms can be found there.**

Waves	Speed (wave)	Interfere	Lens	Infrared radiation
Mechanical wave	Vacuum	Medium	Radio waves	Prisms
Electromagnetic Spectrum	Compressional waves	Light waves	Convex	Transmission
Rarefaction	Transverse waves	Longitudinal waves	Wavelength	Opaque
Frequency	Amplitude	Trough	Crest	Absorption
Diffraction Grating	Plane mirrors	Transparent	Translucent	Microwaves
Color filters	Sight	Cornea, Lens, Retina, Optic nerve	Vibration	Reflection

Performance Indicators

Text highlighted below in *orange* and *italicized/underlined* shows connections to SEP's

8.P.3A.1 *Construct explanations* of the relationship between matter and energy based on the characteristics of mechanical and light waves.
8.P.3A.2 *Develop and use models* to exemplify the basic properties of waves (including frequency, amplitude, wavelength, and speed).
8.P.3A.3 *Analyze and interpret data* to describe the behavior of waves (including refraction, reflection, transmission, and absorption) as they interact with various materials.
8.P.3A.4 *Analyze and interpret data* to describe the behavior of mechanical waves as they intersect.
8.P.3A.5 *Construct explanations* for how humans see color as a result of the transmission, absorption, and reflection of light waves by various materials.
8.P.3A.6 *Obtain and communicate information* about how various instruments are used to extend human senses by transmitting and detecting waves (such as radio, television, cell phones, and wireless computer networks) to exemplify how technological advancements and designs meet human needs.

***Science and Engineering Practices**

Support for the guidance, overviews of learning progressions, and explicit details of each SEP can found in the Science and Engineering Support Doc (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf). It is important that teachers realize that the nine science and engineering practices are not intended to be used in isolation. Even if a performance indicator for a given standard only lists one of the practices as a performance expectation, scientists and engineers do not use these practices in isolation, but rather as part of an overall sequence of practice. When educators design the learning for their students, it is important that they see how a given performance expectation fits into the broader context of the other science and engineering practices. This will allow teachers to provide comprehensive, authentic learning experiences through which students will develop and demonstrate a deep understanding of scientific concepts.

S.1.A.2 Develop and use models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
S.1A.4 Analyze and interpret data from informational texts, observations, measurements, or investigations using a range of methods (such as tabulation, graphing, or statistical analysis) to (1) reveal patterns and construct meaning or (2) support hypotheses, explanations, claims, or designs.
S.1.A.6 Construct explanations of phenomena using (1) primary or secondary scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.
S.1.A.8 Obtain and evaluate scientific information to (1) answer questions, (2) explain or describe phenomena, (3) develop models, (4) evaluate hypotheses, explanations, claims, or designs or (5) identify and/or fill gaps in knowledge. Communicate using the conventions and expectations of scientific writing or oral presentations by (1) evaluating grade-appropriate primary or secondary scientific literature, or (2) reporting the results of student experimental investigations.

***Cross Cutting Concepts** (http://www.nap.edu/read/13165/chapter/8)

The link above provides support from the Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (2012) The text in blue and *italicized/underlined* below provides a brief explanation of how the specific content ties to the CCC's.

1. Patterns: The National Research Council (2012) states that "observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them" (p. 84). *A wave is a repeating pattern of motion that transfers energy from place to place without overall displacement of matter.*

2. Cause and effect: The National Research Council (2012) states that "events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts" (p. 84). *The behavior of waves (refraction, reflection, transmission, and absorption) is dependent on the manner in which the interact with various materials. Waves also interact, either superimposing or interfering with each other causing changes in amplitude.*

6. Structure and function: The National Research Council (2012) states that "the way in which an object or living thing is shaped and its substructure determine many of its properties and functions " (p. 84). *The structure of a wave determines its properties. Waves are mechanical (compressional or longitudinal and transverse) and electromagnetic (light).*

**Teachers have the discretion to enhance the selected SEP's and CCC's.*

Prior Knowledge

- 1.P.2 The student will demonstrate an understanding of the properties of light and how shadows are formed.
- 4.P.4 The student will demonstrate an understanding of the properties of light and sound as forms of energy.

Subsequent Knowledge

- H.P.3D.1 Develop and use models (such as drawings) to exemplify the interaction of mechanical waves with different boundaries (sound wave interference) including the formation of standing waves and two-source interference patterns.

- H.P.3F.2 Plan and conduct controlled scientific investigations to determine the interaction between the visible light portion of the electromagnetic spectrum and various objects (including mirrors, lenses, barriers with two slits, and diffraction gratings) and to construct explanations of the behavior of light (reflection, refraction, transmission, interference) in these instances using models (including ray diagrams).

- H.P.3F.5 Obtain information to communicate the similarities and differences among the different bands of the electromagnetic spectrum (including radio waves, microwaves, infrared, visible light, ultraviolet, and gamma rays) and give examples of devices or phenomena from each band.

- H.P.3F.6 Obtain information to construct explanations on how waves are used to produce, transmit, and capture signals and store and interpret information (including ultrasound imaging, telescopes, cell phones, and bar code scanners).

Possible Instructional Strategies/Lessons
Strategies and lessons that will enable students to master the standard and/or indicator.

8.P.3A.1, 2, and 4:

- Model waves: You may begin the lesson with strumming a guitar, striking a tuning fork, and watching video and then asking students to brainstorm how they think waves travel. This resource can be found here: https://www.youtube.com/watch?v=UywaW9EzTJI

- Waves and wave properties: Students explain properties of waves. The Wave Properties activity from Teach Engineering includes both the lesson plan and links to the student activity sheets to show the differences between the characteristics of mechanical and electromagnetic waves. This resource can be found at: https://www.teachengineering.org/lessons/view/clem_waves_lesson02

- Waves with Bill Nye: Students watch Bill Nye the Science Guy's Waves video on waves. This resource can be found here:http://www.dailymotion.com/video/x3jyuvj_bill-nye-the-science-guy-season-3-episode-11-waves_shortfilms

- Quiz Waves with Bill Nye: Students describe the behavior of waves in this quiz after watching video to get the basic content covered. This resource can be found here: http://mmckinnonscience.weebly.com/uploads/8/5/8/9/8589077/waves_video.pdf

- Slinky Lab: A great way to wrap up the lesson is with a Slinky Lab, which explains the basic characteristics of waves and also has students calculate the speed of both transverse and longitudinal/compression waves. This resource can be found at: http://www.mrschamberlain.com/PHYS/WAVESandCOSMOS/Slinky%20lab.pdf

8.P.3A.5

- The following is a progressive lesson. Begin the lesson with showing the students an apple or other large fruit. Ask them to tell you what they think they will see in dim light and then, in the dark. Write these responses on the board. Then dim the lights and then cut off the lights and have them observe again. Turn the lights back on and see which predictions were most accurate. To complete the lesson, implement the following activities.

1. Hands-on Activity: Exploring Light: Absorb, Reflect, Transmit or Refract? Have students explore how light is reflected, refracted, absorbed, or transmitted in this station-based hands-on lab. This resource can be found at https://www.teachengineering.org/activities/view/van_troll_lesson02_activity1
2. Light Absorption, Reflection, and Transmission: Have students take notes on this video: https://www.youtube.com/watch?v=DOsro2kGjGc
3. Characteristics of Waves: Have students take notes on this PowerPoint: http://mrsj.exofire.net/ipc/ppt/wavechar_pres.ppt
4. How do our eyes work?: Have students take notes on this video: http://www.sciencemadesimple.co.uk/curriculum-blogs/biology-blogs/how-do-our-eyes-work.
5. Sight and Light: Demonstrate the parts of the eye using this demonstration resource: http://www.discoveryeducation.com/teachers/free-lesson-plans/sight-and-light.cfm.
6. Light 3: All Those Seeing Color, Say Eye: Lesson 3 of this three part lesson allows students to construct explanations about the interaction between the eye and light emitted or reflected by an object. http://sciencenetlinks.com/lessons/light-3-all-those-seeing-color-say-eye/.
7. Light Refraction - Fun, Independent Experiments: Refraction can be separately explored with this station-based lab. This resource can be found at: http://www.teachinginroom6.com/2012/04/light-refraction-fun-independent.html.

8.P.3A.6

This indicator could be addressed as a unit project.

- Extending Human Senses Allow students to research how various instruments are used to extend human senses by transmitting and detecting waves and creating either a presentation (video, slideshow, or other type of multi-media presentation) OR
- Wave Blockers: Create a scientific method based investigation to collect data, such as suggested here: http://www.sciencebuddies.org/science-fair-projects/project_ideas/MatlSci_p036.shtml.

Resources

- The Science of Waves - This is a youtube video discusses what waves are, types of waves, and parts of waves. This video is available at https://www.youtube.com/watch?v=ggU95E_wlYY

- Electromagnetic radiation: This website provides information explaining EMG radiation. This resource can be found at: http://clarkscience8.weebly.com/waves.html

- Newton's Eye Poke Experiment - AAPT Films: This video explains how the eye processes images. This video can be found at: https://www.youtube.com/watch?v=W0HP0oEKOUE

Sample Formative Assessment Tasks/Questions

Additional sample formative assessment tasks/questions for grade bands are located at the end of each of the SEP Support Doc (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf)

- Why is it unrealistic for an author to write about a spacecraft traveling faster than the speed of light?
- What is the relation between the frequency of electromagnetic waves and their wavelength?
- Is the speed of light the same in any material? Why or why not?
- Give an example of what is meant by the statement "Waves transmit energy, but not matter."
- Why can you see a clear image of a tree in a lake on a calm day but not on a windy day?
- Explain the law of reflection.
- Raul's little sister, Sarah, wants to know why she can see herself in a mirror, but she can see through a window. What should Raul tell his sister to explain the differences between mirrors and windows?
- Give evidence that light behaves like a wave.
- Why can you see a clear image of a tree in a lake on a calm day, but not on a windy day?
- Why is it difficult to reach into an aquarium and pick up something in the bottom?
- How do we know that light does not need a medium in which to travel?

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