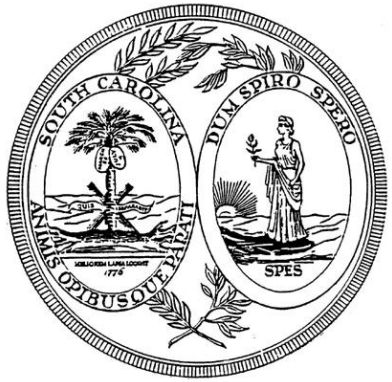
South Carolina Academic Standards and Performance Indicators for Science 2014



Instructional Unit Resource

Earth Science

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

As support for implementing the *South Carolina Academic Standards and Performance Indicators for Science 2014*, the standards for Earth Science 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.

Earth Science Overview of Units

Unit 1		Unit 2		Unit 3	Unit 4	UNIT 5
EARTH SCIENCE: Astronomy		EARTH SCIENCE: Earth's Geosphere		EARTH SCIENCE: Paleobiosphere	EARTH SCIENCE: Atmosphere-Weather and Climate	EARTH SCIENCE: Hydrosphere
Standard		**Standard**		**Standard**	**Standard**	**Standard**
H.E.2		H.E.3		H.E.4	H.E.5	H.E.6
Conceptual Understanding		**Conceptual Understanding**		**Conceptual Understanding**	**Conceptual Understanding**	**Conceptual Understanding**
H.E.2.A	H.E.2.B	H.E.3A	H.E.3B	H.E.4A	H.E.5A	H.E.6A
Performance Indicators		**Performance Indicators**		**Performance Indicators**	**Performance Indicators**	**Performance Indicators**
H.E.2A.1 H.E.2A.2 H.E.2A.3 H.E.2A.4 H.E.2A.5	H.E.2B.1 H.E.2B.2 H.E.2B.3 H.E.2B.4	H.E.3A.1 H.E.3A.2 H.E.3A.3 H.E.3A.4 H.E.3A.5 H.E.3A.6 H.E.3A.7 H.E.3A.8	H.E.3B.1 H.E.3B.2 H.E.3B.3 H.E.3B.4 H.E.3B.5	H.E4.A.1 H.E.4A.2 H.E.4A.3 H.E.4A.4 H.E.4A.5 H.E.4A.6 H.E.4A.7	H.E.5A.1 H.E.5A.2 H.E.5A.3 H.E.5A.4 H.E.5A.5 H.E.5A.6 H.E.5A.7 H.E.5A.8	H.E.6A.1 H.E.6A.2 H.E.6A.3 H.E.6A.4 H.E.6A.5 H.E.6A.6 H.E.6A.7 H.E.6A.8
***Science and Engineering Practices**		***Science and Engineering Practices**		***Science and Engineering Practices**	***Science and Engineering Practices**	***Science and Engineering Practices**
S.1A.2 S.1A.7 S.1A.4 S.1A.8 S.1A.5 S.1A.6		S.1A.2 S.1A.6 S.1A.3 S.1A.7 S.1A.4 S.1A.8 S.1A.5 S.1B.1		S.1A.2 S.1A.8 S.1A.5 S.1A.6 S.1A.7	S.1A.2 S.1A.4 S.1A.6 S.1A.7	S.1A.1 S.1A.8 S.1A.2 S.1A.3 S.1A.4
***Crosscutting Concepts**		***Crosscutting Concepts**		***Crosscutting Concepts**	***Crosscutting Concepts**	***Crosscutting Concepts**
1,2,3,4,5,7		1,2,4,6,7		1,2,3,4,5	1,2,5,6	2,3,4,5

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

Unit Title
Atmosphere: Weather and Climate
Standard http://ed.sc.gov/scdoe/assets/file/agency/ccr/Standards-Learning/documents/South_Carolina_Academic_Standards_and_Performance_Indicators_for_Science_2014.pdf
H.E.5 The student will demonstrate an understanding of the dynamics of Earth's atmosphere.

Conceptual Understanding
H.E.5A. Weather is the condition of the atmosphere at a particular location at a particular time. Weather is primarily determined by the angle and amount (time) of sunlight. Climate is the general weather conditions over a long period of time and is influenced by many factors.
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.**

Weather	Climate	Troposphere	Stratosphere	Mesosphere	Thermosphere
Ozone	Greenhouse gases	Coriolis effect	Greenhouse effect	Trade winds	Westerly winds
Polar winds	Air mass	Pressure system	Front	Isobar	Chinook wind
Monsoon	Ice age	Interglacial period	Ozone depletion	Global warming	Acid precipitation
Photochemical smog	Chlorofluorocarbon	Climate change	pH		

Performance Indicators **Text highlighted below in *orange* and *italicized/underlined* shows connections to SEP's.**
H.E.5A.1 *Develop and use models* to describe the thermal structures (including the changes in air temperature due to changing altitude in the lower troposphere), the gaseous composition, and the location of the layers of Earth's atmosphere. H.E.5A.2 *Develop and use models* to predict and explain how the angle of solar incidence and Earth's axial tilt impact (1) the length of daylight, (2) the atmospheric filtration, (3) the distribution of sunlight in any location, and (4) seasonal changes.

H.E.5A.3 *Analyze and interpret data* to predict local and national weather conditions on the basis of the relationship among the movement of air masses, pressure systems, and frontal boundaries.
H.E.5A.4 *Analyze and interpret data* of pressure differences, the direction of winds, and areas of uneven heating to explain how convection determines local wind patterns (including land/sea breezes, mountain/valley breezes, Chinook winds, and monsoons.
H.E.5A.5 *Construct explanations* for the formation of severe weather conditions (including tornadoes, hurricanes, thunderstorms, and blizzards) using evidence from temperature, pressure and moisture conditions.
H.E.5A.6 *Develop and use models* to exemplify how climate is driven by global circulation patterns.
H.E.5A.7 *Construct scientific arguments to support claims* of past changes in climate caused by various factors (such as changes in the atmosphere, variations in solar output, Earth's orbit, changes in the orientation of Earth's axis of rotation, or changes in the biosphere).
H.E.5A.8 *Analyze scientific arguments* regarding the nature of the relationship between human activities and climate change.

***Science and Engineering Practices**

Support for the guidance, overviews of grade level progressions, and explicit details of each SEP can be 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.

H.E.1A.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.
H.E.1A.4 Analyze and interpret data from informational texts and data collected from investigations using a range of methods (such as tabulation, graphing, or statistical analysis) to (1) reveal patterns and construct meaning, (2) support or refute hypotheses, explanations, claims, or designs, or (3) evaluate the strength of conclusions.
H.E.1A.6 Construct Explanations - 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.
H.E.1A.7 Engage in Scientific Argument from Evidence - Construct and analyze scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.

***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). *The direction of airflow within the frontal region influences the direction of frontal movement which determines the characteristic cloud formations and weather patterns that result from each frontal boundary.*

2. Cause and effect: Mechanism and explanation: The National Research Council states "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). *Natural and human activities impact global climate change. Notably, the emissions of carbon dioxide and other greenhouse gases are currently causing global warming, which affects temperatures, precipitations, and sea levels worldwide.*

5. Energy and matter: Flows, cycles, and conservation: The National Research Council states "Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations" (p. 84). *Uneven distribution of energy from the sun heats the atmosphere causing high and low pressure systems.*

6. Structure and function: The National Research Council (2012) states "The way in which an object or living thing is shaped and its substructure determine many of its properties and functions (p. 84). *Local climate conditions vary based on the topographic structures as well as latitude and proximity to water. Functions of the atmospheric layers are determined by their composition and structure as elevation increases.*

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

Prior Knowledge
• 6.E.2 Atmospheric layers, global winds, air masses, high and low pressure systems, frontal boundaries, solar energy and convection, climate (latitude, elevation, distance from water), weather (wind speed, air temperature, humidity, cloud time, and air pressure) • 7P.2B.3 / H.C.5 Acids • 8.E.4 Tilt of Earth's axis, seasons, length of day, solar output
Subsequent Knowledge
• H.B.6B Global climate

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

- H.E.5A.1
  - Stacking Up the Atmosphere: Students will illustrate and model the major layers of the atmosphere. This resource can be found at https://www.climate.gov/teaching/resources/stacking-atmosphere

  - Layers of the Atmosphere: Students will analyze and interpret data as they plot points and evaluate where the boundaries for each layer of the atmosphere may be based on thermal properties. This resource can be found at http://www.myips.org/cms/lib8/IN01906626/Centricity/Domain/8123/Layers_of_Atmosphere_6-12.pdf

- H.E.5A.2
  - Global Winds: Students will analyze global wind patterns, analyze data, make predictions, and evaluate scientific ideas. This resource can be found at http://education.gsfc.nasa.gov/ess/Units/Unit2/U2L10A.html

  - The Reason for the Seasons: Students will model the impact the Sun has on heating Earth's surface, which causes global wind patterns and effects our seasons. This resource can be found at http://nationalgeographic.org/activity/the-reason-for-the-seasons/

- H.E.5A.3
  - Track Weather Like a Meteorologist: Students will collect and analyze data through observations and reading meteorological instruments and compare it to weather resources from the Internet. This resource can be found at http://www.ciese.org/curriculum/weatherproj2/en/lesson3.shtml

- H.E.5A.4
  - Lab 5: All About Air Pressure: Short pressure stations that will allow students to view first-hand what occurs when there are differences in air pressures. Differentiation opportunities allow for predictions. http://serc.carleton.edu/earthlabs/hurricanes/5.html

- H.E.5A.5
  - Tornado in a Bottle: This lesson will allow the students to construct a model of a funnel similar to a tornado and explain how it is similar to an actual tornado in pressure differences. http://oceanservice.noaa.gov/education/for_fun/TornadoBottle.pdf

- H.E.5A.6
  - Ocean Currents and Sea Water Temperature: The students will develop models to exemplify the link between ocean temperatures and currents and how it is related to our concern for current climate change.http://mynasadata.larc.nasa.gov/docs/e_lessons/OceanCurrentsandSeaSurfaceTemperatures.pdf

- H.E.5A.7
  - Reflecting on Reflectivity: Students will construct arguments discussing the changes in the Earth's albedo and its possible effects on global climate change. This resource can be found at http://lasp.colorado.edu/home/wp-content/uploads/2011/08/Reflecting-on-Reflectivity.pdf

  - You're As Cold As Ice: Addresses glacial formation and effects on Earth's surface as well as the natural cycles that occur between ice ages and interglacial periods. This resource can be found at http://scetv.pbslearningmedia.org/resource/nat08.earth.geol.eros.lpcoldice/youre-as-cold-as-ice/

- H.E.5A.8
  - Human Impact on Global Warming: PBS lesson plan allowing students to view videos and develop arguments regarding man-made global warming issues. This resource can be found at http://www-tc.pbs.org/now/classroom/global-warming-lesson-plan.pdf

  - Effect of Acid Precipitation on Plants: Students can evaluate the impact of (acid) pH levels on living organisms (plants). This resource can be found at https://www.arm.gov/education/teacher-tools/lessons/acid-rain

Resources

- How High Is It: A lesson plan site by NASA that has numerous resources, including many ways to understand and model the height and layers of the atmosphere. Useful for differentiated learning and can be expanded upon for high school learners. This resource can be found at http://er.jsc.nasa.gov/seh/How.High.Is.It.Educator.Guide.pdf

- Climate Science Investigations: A look at climate and atmosphere before and after the industrial revolution as well as resources to study the atmosphere conditions. This resource can be found at http://www.ces.fau.edu/nasa/module-3/regional-temperature/investigation-4.3.php

- Lab Activities on Global Winds: Multiple lab lessons that focus on global wind patterns. This resource can be found at http://www.csuchico.edu/~abykerk-kauffman/courses/geos142/packet/pdf/65GlobalWindsLab.pdf

- Global Winds: This is a great source for Global wind pattern maps and Ocean currents. It also includes a blank world map. This resource can be found at http://education.gsfc.nasa.gov/ess/Units/Unit2/U2L10A.html

- Weather Interactives: Web-based interactives that cover many aspects of the atmosphere, meteorology, and weather. This resource can be found at http://www.learner.org/interactives/weather/

- NASA Educator Resource for Meteorology: A collection of information for educators focused on multiple meteorology standards. This resource can be found at https://www.nasa.gov/pdf/288978main_Meteorology_Guide.pdf

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)

- Present students with common or predictable misconceptions about global warming. Ask them whether they agree or disagree and explain why. The misconception check can also be presented in the form of a written quiz.

- Give students index cards and ask them answer a question on each side. Side 1 -What is the Main idea of the work we have done today? Side 2--What did you not understand?

- Quick Write- asks learners to respond in 2–10 minutes to an open-ended question or prompt posed by the teacher before, during, or after reading.

- Community Awareness - Discuss possible severe weather risks of your area, and then have students develop safety plans and supply lists to be ready for an emergency. An extension could involve sharing the information with the community.

- The Climate Change Debate formative assessment. This resource can be found at https://www.e-education.psu.edu/earth111/node/1023

- The Twitter Post-- Have the students create a fake (could be real if you make an account for your class) twitter post in 140 characters or less answering a question or summarizing the lesson.

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