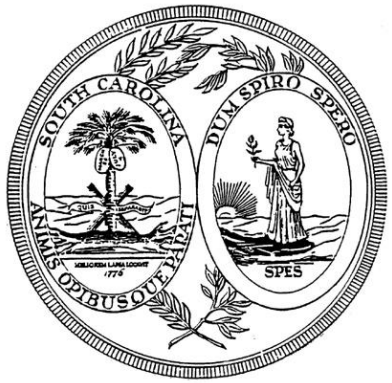
South Carolina Academic Standards and Performance Indicators for Science 2014



Instructional Units Resource

Chemistry

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

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

Chemistry Overview of Units

Unit 1		Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
ATOMIC STRUCTURE AND NUCLEAR PROCESSES		BONDING AND CHEMICAL FORMULAS	STATES OF MATTER	SOLUTIONS, ACIDS, AND BASES	CHEMICAL REACTIONS	THERMOCHEMISTRY AND CHEMICAL KINETICS
Standard		**Standard**	**Standard**	**Standard**	**Standard**	**Standard**
H.C.2		H.C.3	H.C.4	H.C.5	H.C.6	H.C.7
Conceptual Understanding		**Conceptual Understanding**	**Conceptual Understanding**	**Conceptual Understanding**	**Conceptual Understanding**	**Conceptual Understanding**
H.C.2A	H.C.2B	H.C.3A	H.C.4A	H.C.5A	H.C.6A	H.C.7A
Performance Indicators		**Performance Indicators**	**Performance Indicators**	**Performance Indicators**	**Performance Indicators**	**Performance Indicators**
H.C.2A.1 H.C.2A.2 H.C.2A.3	H.C.2B.1 H.C.2B.2 H.C.2B.3 H.C.2B.4	H.C.3A.1 H.C.3A.2 H.C.3A.3 H.C.3A.4 H.C.3A.5 H.C.3A.6 H.C.3A.7	H.C.4A.1 H.C.4A.2 H.C.4A.3	H.C.5A.1 H.C.5A.2 H.C.5A.3 H.C.5A.4	H.C.6A.1 H.C.6A.2 H.C.6A.3 H.C.6A.4	H.C.7A.1 H.C.7A.2 H.C.7A.3 H.C.7A.4
***Science and Engineering Practices**		***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.6 S.1A.4 S.1A.8 S.1A.5		S.1A.2 S.1A.6 S.1A.3 S.1A.4	S.1A.2 S.1A.3 S.1A.4	S.1A.4 S.1A.5 S.1A.8	S.1A.2 S.1A.3 S.1A.5	S.1A.2 S.1A.5 S.1A.3 S.1A.4
***Crosscutting Concepts**		***Crosscutting Concepts**	***Crosscutting Concepts**	***Crosscutting Concepts**	***Crosscutting Concepts**	***Crosscutting Concepts**
1, 2, 3, 4, 5, 6, 7		1, 4, 6	2, 4, 5	2, 3, 6	1, 2, 3, 4, 7	2, 3, 4, 6, 7

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

Unit Title
Chemistry: States of Matter
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.C.4 The student will demonstrate an understanding of the structure and behavior of the different states of matter.

Conceptual Understanding
H.C.4A Matter can exist as a solid, liquid, or gas, and in very high-energy states, as plasma. In general terms, for a given chemical, the particles making up the solid are at a lower energy state than the liquid phase, which is at a lower energy state than the gaseous phase. The changes from one state of matter into another are energy dependent. The behaviors of gases are dependent on the factors of pressure, volume, and temperature.
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.**

Solid	Liquid	Gas	Plasma	Phase Change
Melting Point	Boiling Point	Temperature (in terms of kinetic energy)	Kinetic Molecular Theory	Kelvin

Performance Indicators **Text highlighted below in *orange* and *italicized/underlined* shows connections to SEP's**
H.C.4A.1 *Develop and use models* to explain the arrangement and movement of the particles in solids, liquids, gases, and plasma as well as the relative strengths of their intermolecular forces. H.C.4A.2 *Analyze and interpret* heating curve graphs to explain that changes from one state of matter to another are energy dependent. H.C.4A.3 *Conduct controlled scientific investigations* and *use models to explain* the behaviors of gases (including the proportional relationships among pressure, volume, and temperature).
***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.**

H.C.1A.2 Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.

H.C.1A.3 Plan and conduct controlled scientific investigations to answer questions, test hypotheses, and develop explanations: (1) formulate scientific questions and testable hypotheses based on credible scientific information, (2) identify materials, procedures, and variables, (3) use appropriate laboratory equipment, technology, and techniques to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.

H.C.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.

***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.

2. 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). *Ice is a crystal lattice pattern of water molecules held together by hydrogen bonds.*

4. Systems and system models: The National Research Council (2012) states that "in considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance" (p. 84). *Changes in states of matter can be studied using phase change graphs.*

5. Energy and matter: Flows, cycles, and conservation. The National Research Council (2012) states "Fully develop energy transfers. Introduce nuclear substructure and conservation laws for nuclear processes" (p. 84). *Energy is required to change from one state of matter to another.*

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

Prior Knowledge
● 3.P.2A Properties of matter ● 5.P.2A Properties of matter ● 5.P.2B Properties of Mixtures and Solutions ● 7.P.2B.2 Chemical and Physical Properties
Subsequent Knowledge
● N/A

Possible Instructional Strategies/Lessons

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

- States of Matter This investigation allows students to explore the different states of matter. This resource is available from https://authoring.concord.org/activities/1074/single_page/35e4121e-76b4-4e5c-ab43-ec745313d946

- Phase Change This simulation allows students to explore what happens to the movement of atoms during phase changes. This resource is available from https://concord.org/stem-resources/phase-change-0

- Three Station Gas Lab Conduct an investigation to investigate the relationships between pressure, volume and temperature of a gas. This resource is available from: https://www.teachchemistry.org/content/aact/en/classroom-resources/high-school/gases/gas-laws/three-station-gas-lab.html

- States of Matter PhET simulation that allows students to develop and use models to explain the arrangement and movement of particles in different states of matter as well as their intermolecular forces. Teacher made lessons are available for this simulation. This resource is available from https://phet.colorado.edu/en/simulation/legacy/states-of-matter

- Investigating Gas Laws Mini-Lab Students will investigate Charles' and Boyle's Laws in an introductory lab. The lab is designed to be carried out before any information about gases and the relationship between variables is given. This resource is available from http://serc.carleton.edu/sp/mnstep/activities/35031.html

- Gas Law Popsicle Stick Manipulative Have students write P, T, and V on a popsicle stick, as pictured below. Students place a finger on the variable being held constant and move the manipulated variable up or down and then make observations regarding the response of the remaining variable. This activity provides hands on modeling of the relationships between pressure, volume and temperature.

- Inquiry and the Collapsing Can Use the collapsing can demonstration as an inquiry lesson. Perform the demonstration once. Then have the students ask questions that can then be tested. This is available from: http://www.nsta.org/publications/news/story.aspx?id=51859#Anchor-49575

Resources

- Molecular View of a Gas: This simulation models the molecular structure of a gas. This is available from https://concord.org/stem-resources/molecular-view-gas
- Molecular View of a Liquid: This simulation models the molecular structure of a liquid. This is available from https://concord.org/stem-resources/molecular-view-liquid
- Molecular View of a Solid: This simulation models the molecular structure of a solid. This is available from https://concord.org/stem-resources/molecular-view-solid
- The Temperature-Pressure Relationship: This simulation models a gas and the relationship between temperature and pressure. This resource is available from https://concord.org/stem-resources/temperature-pressure-relationship
- The Temperature-Volume Relationship: This simulation models a gas and the relationship between temperature and volume. This resource is available from https://concord.org/stem-resources/temperature-volume-relationship
- The Volume-Pressure Relationship: This simulation models a gas and the relationship between volume and pressure. This resource is available from https://concord.org/stem-resources/volume-pressure-relationship
- Gases: Kinetic Molecular Theory: Video explaining the basics of the kinetic molecular theory. This resource is available from https://www.youtube.com/watch?v=xG0qJhh2FSo

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)

- 1 finger - solid, 2 fingers - liquid, 3 fingers - gas, or 4 fingers - plasma: Teachers can call out characteristics for different phases of matter. Students will hold up the appropriate number of fingers for the state of matter represented by the characteristic.
- Tree Map or foldable of the four states of matter. Include description of motion or particles and illustration of particle arrangement.
- Whiteboard sketches - molecule drawings of states of matter, different phase change graphs
- Quick write or exit slip questions: Examples
  - Explain what is happening at the atomic level when a substance changes from a liquid to a gas.
  - Describe what happens at the atomic level when you increase the pressure of a gas while maintaining a constant temperature.
  - Why is it important to check the air pressure in your car tires when the seasons change?
- Gas Laws Foldable - Include definition, graph of relationship, formula and examples of each gas law.
- Analogy Illustrations - Have students create an illustration that is an analogy to explain how energy is involved in changes of state.

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