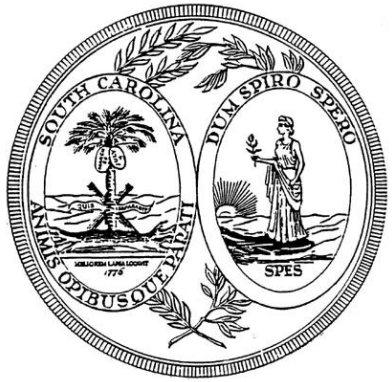
South Carolina Academic Standards and Performance Indicators for Science 2014



Instructional Units Resource

7th Grade

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

As support for implementing the *South Carolina Academic Standards and Performance Indicators for Science 2014*, the standards for Seventh 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 7 Overview of Units

Unit 1		Unit 2		Unit 3	Unit 4	
PHYSICAL SCIENCE: CLASSIFICATION AND CONSERVATION OF MATTER		LIFE SCIENCE: ORGANIZATION IN LIVING SYSTEMS		LIFE SCIENCE: HEREDITY – INHERITANCE AND VARIATION OF TRAITS	ECOLOGY: INTERACTIONS OF LIVING SYSTEMS AND THE ENVIRONMENT	
Standard		**Standard**		**Standard**	**Standard**	
7.P.2		7.L.3		7.L.4	7.EC.5	
Conceptual Understanding		**Conceptual Understanding**		**Conceptual Understanding**	**Conceptual Understanding**	
7.P.2A	7.P.2B	7.L.3A	7.L.3B	7.L.4A	7.EC.5A	7.EC.5B
Performance Indicators		**Performance Indicators**		**Performance Indicators**	**Performance Indicators**	
7.P.2A.1 7.P.2A.2 7.P.2A.3 7.P.2A.4	7.P.2B.1 7.P.2B.2 7.P.2B.3 7.P.2B.4 7.P.2B.5	7.L.3A.1 7.L.3A.2 7.L.3A.3 7.L.3A.4	7.L.3B.1 7.L.3B.2	7.L.4A.1 7.L.4A.2 7.L.4A.3 7.L.4A.4 7.L.4A.5 7.L.4A.6	7.EC.5A.1 7.EC.5A.2 7.EC.5A.3	7.EC.5B.1 7.EC.5B.2 7.EC.5B.3 7.EC.5B.4
***Science and Engineering Practices**		***Science and Engineering Practices**		***Science and Engineering Practices**	***Science and Engineering Practices**	
7.S.1A.2 7.S.1A.3 7.S.1A.4 7.S.1A.5 7.S.1A.6 7.S.1A.8		7.S.1A.2 7.S.1A.4 7.S.1A.7 7.S.1A.8		7.S.1A.2 7.S.1A.5 7.S.1A.6 7.S.1A.7 7.S.1A.8	7.S.1A.1 7.S.1A.2 7.S.1A.4 7.S.1A.7	
***CrossCutting Concepts**		***CrossCutting Concepts**		***CrossCutting Concepts**	***CrossCutting Concepts**	
1, 2, 3, 4, 5, 6, 7		2, 4, 6		1, 2, 4, 6, 7	1, 2, 3, 4, 5, 6, 7	

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

Unit Title
Physical Science: Classification & Conservation 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
7.P.2 The student will demonstrate an understanding of the structure and properties of matter and that matter is conserved as it undergoes changes.

Conceptual Understanding
7.P.2.A All substances are composed of one or more elements. Elements are pure substances which contain only one kind of atom. The periodic table organizes these elements based on similar properties. Compounds are substances composed of two or more elements. Chemical formulas can be used to describe compounds.
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 link below and further inquiry into the terms can be found there. http://ed.sc.gov/instruction/standards-learning/science/support-documents-and-resources/**

Element	Atoms	Subatomic particles	Protons	Neutrons
Electrons	Periodic table	Chemical symbol	Atomic number	Atomic mass
Period	Family	Metals	Metalloids	Nonmetals
Compounds	Heterogeneous mixture	Homogeneous mixture	Ionic bonds	Covalent bonds
Chemical formulas	Subscripts	Diatomic molecules		

Performance Indicators

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

7.P.2A.1 *Develop and use* simple atomic *models* to illustrate the components of elements (including the relative position and charge of protons, neutrons, and electrons).

7.P.2A.2 *Obtain and use information* about elements (including chemical symbol, atomic number, atomic mass, and group or family) to describe the organization of the periodic table.

7.P.2A.3 *Analyze and interpret data* to describe and classify matter as pure substances (elements or compounds) or mixtures (heterogeneous or homogeneous) based on composition.

7.P.2A.4 *Construct explanations* for how compounds are classified as ionic (metal bonded to nonmetal) or covalent (nonmetals bonded together) using chemical formulas.

***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.

7.S.1.A.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.

7.S.1.A.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.

7.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.

7.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 states, "Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them" (p. 84). *Matter can be classified on the basis of its composition and can be seen in the organization of the periodic table.*

3. Scale, Proportion and Quantity- The National Research Council states, "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). *The atom is composed of subatomic particles: protons, neutrons, and electrons. The proportion of the subatomic particles affect the properties of an atom.*

4. System and System Models- The National Research Council states that this includes "defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering" (p. 84). *The Law of Conservation of Matter supports the functioning system of a chemical reaction.*

6. Structure and Function- The National Research Council states, "the way in which an object or living thing is shaped and its substructure determine many of its properties and functions" (p. 84). *The atom is composed of subatomic particles: protons, neutrons, and electrons that affect the properties of an atom. Matter can be classified on the basis of its composition.*

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

Prior Knowledge

- 5.P.2B.1 Properties of Mixed Substances

Subsequent Knowledge

- H.C.2 Atomic Structure, Subatomic particles, Bohr models, Quantum mechanical models, Electron configuration, Absorption and emission spectrum, Nuclear processes: Fusion and Fission, Radioactive Decay, Half-Life and radioactive dating
- H.C.4 States of Matter, Phase Changes, Intermolecular Forces, Heating curves, Phase changes, Gas behaviors
- H.C.3 Properties of ionic and covalent/molecular bonding and compounds, Polyatomic ions, Periodic Table, Naming compounds and writing formulas, Oxidation numbers, Lewis Structure, Periodic Table

- H.C.5 Solutions, Processes of Dissolving, Colligative Properties, Effects of Temperature and Pressure on Solubility, Solubility of Compounds, Percent by Volume, Molarity, Acids: Arrhenius & Bronsted-Lowery, Bases: Arrhenius & Bronsted-Lowery
- H.C.6 Chemical reactions: movement of ions, protons, and electrons, Oxidation and Reduction

Possible Instructional Strategies/Lessons

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

- Atomic Structure: Use a variety of informational text sources to research atomic structure and create models that depict the appropriate subatomic particles for specific elements. Include element name, materials, and a summary of what is included in the model.

- Periodic Table of Elements: Use Periodic Table to obtain and identify specific information about elements. This resource can be found at http://www.pbslearningmedia.org/resource/phy03.sci.phys.matter.lp_pertable/the-periodic-table-of-the-elements/

- Steps for Classifying Matter: Teacher can create an anchor chart and provide the students with the following steps to refer to analyze and interpret data when classifying matter. More information concerning constructing anchor charts can be found at http://www.weareteachers.com/blogs/post/2015/11/12/anchor-charts-101.

Steps for Classifying Matter

Is it on the Periodic Table?

· If yes, it is an element. Stop here.
· If no, keep going.

Does it have a chemical formula?

· If yes, it is a compound. Stop here.
· If no, keep going.

Are the different parts visible?

· If yes, it is a heterogeneous mixture. Stop here.
· If no, it is a homogenous mixture. Stop here.

- Classification of Matter: In this activity, students are expected to classify matter based on analysis and interpretation of data providing evidence to support the classification. This resource can be found at https://middleschoolscience.com/2015/08/06/elements-compounds-and-mixtures-classification-activity/

- Steps for Translating Chemical Formulas: Create an anchor chart and provide students with steps for translating chemical formulas. Have students translate common chemical formulas of compounds to construct explanations to determine if they are ionic or covalent. More information concerning constructing anchor charts can be found at http://www.weareteachers.com/blogs/post/2015/11/12/anchor-charts-101.

Steps for Translating Chemical Formulas

1. Underline each capital letter.
2. Circle the subscripts.
3. Write a 1 for any symbol that doesn't have a subscript.
4. Use the PTE to find the element names and write your translation. Be sure to pay careful attention to the subscripts.
5. Determine if the compound is ionic or covalent and support with evidence.

Resources

- Periodic Table and the Elements: A free online resource for students to learn more about the organization of the Periodic Table. This resource can be found at http://www.chem4kids.com/files/elem_intro.html

- Periodic Table: A free online resource for students to learn more about the organization of the Periodic Table. This resource can be found at http://www.ducksters.com/science/periodic_table.php

- Inquiry in Action: A free online resource that provides a variety of instructional strategies as well as best practices for science education. This resource can be found at http://www.inquiryinaction.org/

- Mr. Lee's Chemistry Rap: Includes information about atoms, elements, compounds, mixtures, and chemical reactions. This resource can be found at https://www.youtube.com/watch?v=B0d-fzj9oMQ

- Elements, Compounds, Substances, and Mixtures: A resource that provides students with background information on the topic. This resource can be found at http://www.eschooltoday.com/science/elements-mixtures-compounds/introduction-to-elements-compounds-and-mixtures.html

- What in the World Isn't Chemistry?: An abundance of resources that teachers can adapt to fit the needs of their students. This resource can be found at http://ems.goddardusd.com/page/57823_4

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 links (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf)

- Create a model of an atom that depicts the structures that compose an atom. Model must include materials, element name, labels and explanations. Students should be able to communicate their ideas and model construction to others.

- Use the Periodic Table to obtain and identify all relevant information for a specific element including the element name, chemical/element symbol, period, family, atomic number and atomic mass. For example, students identify relevant information about zinc or provide students with an atomic number and have them provide other information about that element.

- Classify a substance as an element, compound, heterogeneous, or homogeneous mixture based on analysis and interpretation of its composition. For example, students can refer to the steps to classify sweet tea as a homogeneous mixture.

- Construct an explanation for classifying a compound as ionic or covalent based on chemical formula translations. For example, students would classify salt as ionic because it is composed of a metal (sodium) and a nonmetal (chlorine) chemically bonded to form a new substance.

Unit Title

Physical Science: Classification & Conservation 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

7.P.2 The student will demonstrate an understanding of the structure and properties of matter and that matter is conserved as it undergoes changes.

Conceptual Understanding

7.P.2B. Substances (such as metals or acids) are identified according to their physical or chemical properties. Changes to substances can either be physical or chemical. Many substances react chemically with other substances to form new substances with different properties. According to the

law of conservation of matter, total mass does not change in a chemical reaction.

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 link below and further inquiry into the terms can be found there. http://ed.sc.gov/instruction/standards-learning/science/support-documents-and-resources/

Physical properties	Chemical properties	Luster	Conductor	Conductivity
Nonconductor	Malleable	Ductile	Density	Dull
Brittle	Melting point	Boiling point	Burning	Rusting
pH	Acids(acidic)	Bases(basic)	Neutrals	Neutralization
Indicators	Litmus paper	Phenolphthalein	pH paper	Physical change
Chemical change	Precipitate	Chemical reaction	Reactant	Product
Chemical equation	Yields	Coefficient	Law of Conservation of Matter	Balanced Chemical Equation

Performance Indicators

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

7.P.2B.1 *Analyze and interpret data* to describe substances using physical properties (including state, boiling/melting point, density, conductivity, color, hardness, and magnetic properties) and chemical properties (the ability to burn or rust).
7.P.2B.2 *Use mathematical and computational thinking* to describe the relationship between the mass, volume, and density of a given substance.
7.P.2B.3 *Analyze and interpret data* to compare the physical properties, chemical properties (neutralization to form a salt, reaction with metals), and pH of various solutions and classify solutions as acids or bases.
7.P.2B.4 *Plan and conduct controlled scientific investigations* to answer questions about how physical and chemical changes affect the properties of different substances.

7.P.2B.5 *Develop and use models* to explain how chemical reactions are supported by the law of conservation of matter.

***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.

7.S.1.A.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.

7.S.1.A.3 Plan and conduct controlled scientific investigations to answer questions, test hypotheses, and develop explanations: (1) formulate scientific questions and testable hypotheses, (2) identify materials, procedures, and variables (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate forms. Use appropriate safety procedures.

7.S.1.A.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.

7.S.1.A.5 Use mathematical and computational thinking to (1) use and manipulate appropriate metric units, (2) collect and analyze data, (3) express relationships between variables for models and investigations, or (4) use grade-level appropriate statistics to analyze data.

***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 states "Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them" (p. 84). *Substances (such as metals or nonmetals) are identified according to their physical or chemical properties and these patterns can be seen on the organization of the periodic table.*

2. Cause and effect- 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). *Many substances react chemically with other substances to form new substances with different properties.*

3. Scale, Proportion and Quantity- The National Research Council states "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). *Varying the proportions of the reactants in a chemical reaction affects the products.*

4. System and System Models- The National Research Council states that this includes "defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering" (p. 84). *The law of conservation of matter can be represented through balancing chemical equations*.

5. Energy and Matter: Flows, Cycles, and Conservation- The National Research Council states that "tracking fluxes of energy and matter into, out of, and within systems help one understand the systems' possibilities and limitations" (p.84). *According to the law of conservation of matter, total mass does not change in a chemical reaction.*

6. Structure and Function- The National Research Council 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). *Properties of elements provide the basis for human use.*

7. Stability and Change- The National Research Council states that "for natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study" (p.84). *Matter can be altered by either physical or chemical changes which have varying degrees of stability and change.*

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

Prior Knowledge
● 5.P.2B.4 Concentrations of Solutions, Solute and Solvent ● 5.P.2A.1 Properties of solids, liquids, and gases
Subsequent Knowledge
● H.C.4 States of Matter ● H.C.6 Chemical Reactions, Oxidation and Reduction, Movement of ions, protons, and electrons ● H.C.5 Acids: Arrhenius & Bronsted-Lowery, Bases: Arrhenius & Bronsted-Lowery, Salts, pH, pOH, Neutralization ● H.C.3 Ionic & Molecular/Covalent Bonding, Properties of Ionic and Covalent Compounds, Hydrocarbons, Isomers

- H.C.7 Law of Conservation of Energy

Possible Instructional Strategies/Lessons

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

- Mystery Substance: To help students understand how properties can be used to classify and/or identify substances, create an activity that requires them to identify a mystery substance based on the properties of the substance. There are many resources for this on the web. Here is one example http://www.cfep.uci.edu/cspi/docs/lessons_secondary/Mystery%20Powder.pdf

- Calculating Density: Use appropriate tools to calculate the mass, volume, and density of substances. Use the calculated density to identify the substances.

- Density: Sink or Float for Liquids: Students will determine if a substance will sink or float by comparing its density with the density of water. This resource can be found at http://www.middleschoolchemistry.com/lessonplans/chapter3/lesson5

- Making Sense of Density: Video that will help students have a deeper understanding of density. This resource can be found at https://www.teachingchannel.org/videos/teaching-density

- Manifest Density: This is a unit that provides a variety of activities that allow students to investigate density, mass, and volume. Teachers can modify to fit the needs of their students. This resource can be found at https://www.usi.edu/media/1751795/density.pdf

- pH Lab: Investigate the properties of acids, bases, and neutrals using indicators. Materials include litmus paper, pH paper, phenolphthalein and a variety of substances (orange juice, shampoo, dish soap, lotion, milk, water, toothpaste, antacids, etc.)

- Balanced or Unbalanced?: "Fruit Loop Equations" - Students use fruit loops and the equation for photosynthesis to create a model that illustrates the law of conservation of matter. This resource can be found at http://century.adams12.org/classrooms/174/events/2015-02-27-170114/balancing-chem-equations-fruit-loops

- Using Gradual Release Model and Anchor charts for Balancing Chemical Equations: Use this lesson to help students understand how to balance chemical Equations. The Gradual Release Model is when a teacher models for students as a whole group, has them practice in a small group, and then work independently (Hollingsworth & Ybarra, 2009) Gradually Balancing Chemical Equations. More information concerning constructing anchor charts can be found at http://www.weareteachers.com/blogs/post/2015/11/12/anchor-charts-101. A video explaining the gradual release model can be found at https://www.teachingchannel.org/videos/improving-teacher-practice.

Resources

- Alien Juice Bar Lab: Allows students to virtually use cabbage juice to test the pH of different substances to produce the appropriate pH substances for their customers. http://static.lawrencehallofscience.org/scienceview/scienceview.berkeley.edu/html/showcase/flash/juicebar.html

- Mr. Lee's Chemistry Rap: Includes information about atoms, elements, compounds, mixtures, and chemical reactions. https://www.youtube.com/watch?v=B0d-fzj9oMQ

- Inquiry in Action: A free online resource that provides a variety of instructional strategies as well as best practices for science education. http://www.inquiryinaction.org/

- What in the World Isn't Chemistry?: An abundance of resources that teachers can adapt to fit the needs of their students. http://ems.goddardusd.com/page/57823_4

Sample Formative Assessment Tasks/Questions

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- Provide students with an unknown substance and time to analyze and interpret data about the properties of the substance to identify the unknown substance.

- Calculate the density of substances by using mathematical and computational thinking for a variety of substances. Students can also calculate density using the provided mass and volume.

- Classify substances as acids, bases or neutrals based on analysis and interpretation of data collected through the use of indicators and informational text sources.

- Plan and conduct a controlled scientific investigation that answers student-generated questions about physical and chemical changes. For example, students may wonder if certain substances will react chemically or if the amount of the substances impacts the rate of the reaction. These questions would lead students to plan and carry out an investigation to answer these questions.

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7th Grade – Classification and Conservation of Matter

Gradually Balancing Chemical Equations
(Using Gradual Release and Anchor Charts)

Materials:

- Chart Paper
- Writing Utensils
- Whiteboards (if possible)

Procedure:

Determining if an equation supports the law of conservation of matter can be difficult for students. Using the gradual release model and providing steps can increase student achievement. The gradual release model consists of a teacher model/think-aloud, guided practice, closure to ensure mastery before the independent practice, followed by independent practice (Hollingsworth, 14). The use of white boards or some other tool that can be used for every student to show their work will maximize student engagement and understanding.

Using the steps listed below, create an anchor chart for the classroom and make copies for each student. Have them put the steps in a journal or other place so that they will have them when needed.

- Teacher Model: Model the steps, stopping along the way to ask students questions about what the teacher is doing only. Do not ask them what comes next. Stick with questions that require them to reflect on what the teacher is doing. For example, the teacher should be referring to the steps throughout the process and talking through his/her thought process.
- Guided Practice: Students begin to work with the teacher to determine if the equation supports the law of conservation of matter. The teacher may ask students to complete the first step on their white boards and show them. The teacher may also ask students to share what step comes next. This should be repeated until most of the students are comfortably completing each step with teacher support.
- Closure: At this point, the teacher provides students with an equation. As each student finishes, the teacher checks student work. If 80% or more of the students successfully, the students are ready for independent practice.
- Independent Practice: Students complete steps to determine if equations support the law of conservation of matter independently. Teacher should work with students in small groups who were not ready for independent practice.

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Steps:

1. Underline every capital letter.
2. Circle the subscripts.
3. Draw a box around the coefficients.
4. List the symbols of each element on BOTH sides of the arrow.
5. Multiply the coefficient by the subscript.
6. Record the total number of each type of element on both sides of the arrow.
7. Determine if the equation supports the law of conservation of matter providing evidence to support your answer.

Standard
7.P.2 The student will demonstrate an understanding of the structure and properties of matter and that matter is conserved as it undergoes changes.

Conceptual Understanding
7.P.2B. Substances (such as metals or acids) are identified according to their physical or chemical properties. Changes to substances can either be physical or chemical. Many substances react chemically with other substances to form new substances with different properties. According to the law of conservation of matter, total mass does not change in a chemical reaction.

Performance Indicator
7.P.2B.5 *Develop and use models* to explain how chemical reactions are supported by the law of conservation of matter.

Science and Engineering Practice
7.S.1.A.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.

Cross Cutting Concepts:
2. Cause and effect- 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). *Many substances react chemically with other substances to form new substances with different properties.*
3. Scale, Proportion and Quantity- The National Research Council states "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). *Some properties can be used to identify substances regardless of the size or amount of the substance.*
4. System and System Models- The National Research Council states that this includes "defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering" (p. 84). *The law of conservation of matter can be represented through models of chemical reactions.*
7. Stability and Change- The National Research Council states that "for natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study" (p.84). *A balanced chemical equation supports the law of conservation of matter.*

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