Shelby County Schools Science Vision

Shelby County Schools' vision of science education is to ensure that from early childhood to the end of the 12th grade, all students have heightened curiosity and an increased wonder of science; possess sufficient knowledge of science and engineering to engage in discussions; are able to learn and apply scientific and technological information in their everyday lives; and have the skills such as critical thinking, problem solving, and communication to enter careers of their choice, while having access to connections to science, engineering, and technology.

To achieve this, Shelby County Schools has employed The Tennessee Academic Standards for Science to craft meaningful curricula that is innovative and provide a myriad of learning opportunities that extend beyond mastery of basic scientific principles.

Introduction

In 2014, the Shelby County Schools Board of Education adopted a set of ambitious, yet attainable goals for school and student performance. The District is committed to these goals, as further described in our strategic plan, Destination 2025. In order to achieve these ambitious goals, we must collectively work to provide our students with high quality standards aligned instruction. The Tennessee Academic Standards for Science provide a common set of expectations for what students will know and be able to do at the end of each grade, can be located in the Tennessee Science Standards Reference. Tennessee Academic Standards for Science are rooted in the knowledge and skills that students need to succeed in post-secondary study or careers. While the academic standards establish desired learning outcomes, the curricula provides instructional planning designed to help students reach these outcomes. The curriculum maps contain components to ensure that instruction focuses students toward college and career readiness. Educators will use this guide and the standards as a roadmap for curriculum and instruction. The sequence of learning is strategically positioned so that necessary foundational skills are spiraled in order to facilitate student mastery of the standards.

Our collective goal is to ensure our students graduate ready for college and career. Being College and Career Ready entails, many aspects of teaching and learning. We want our students to apply their scientific learning in the classroom and beyond. These valuable experiences include students being facilitators of their own learning through problem solving and thinking critically. The Science and Engineering Practices are valuable tools used by students to engage in understanding how scientific knowledge develops. These practices rest on important "processes and proficiencies" with longstanding importance in science education. The science maps contain components to ensure that instruction focuses students toward understanding how science and engineering can contribute to meeting many of the major challenges that confront society today. The maps are centered around five basic components: the Tennessee Academic Standards for Science, Science and Engineering Practices, Disciplinary Core Ideas, Crosscutting Concepts, and Phenomena.

The Tennessee Academic Standards for Science were developed using the National Research Council's 2012 publication, A Framework for K-12 Science Education as their foundation. The framework presents a new model for science instruction that is a stark contrast to what has come to be the norm in science classrooms. Thinking about science had become memorizing concepts and solving mathematical formulae. Practicing science had become prescribed lab situations with predetermined outcomes. The framework proposes a three-dimensional approach to science education that capitalizes on a child's natural curiosity. The Science Framework for K-12 Science Education provides the blueprint for developing the effective science practices. The *Framework* expresses a vision in science education that requires students to operate at the nexus of three dimensions of learning: Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The *Framework* identified a small number of disciplinary core ideas that all students should learn with increasing depth and sophistication, from Kindergarten through grade twelve. Key to the vision expressed in the *Framework* is for students to learn these disciplinary core ideas in the context of science and engineering practices. The importance of combining Science and Engineering Practices, Crosscutting Concepts and Disciplinary Core Ideas is stated in the *Framework* as follows:

Standards and performance expectations that are aligned to the framework must take into account that students cannot fully understand scientific and engineering ideas without engaging in the practices of inquiry and the discourses by which such ideas are developed and refined. At the same time, they cannot learn or show competence in practices except in the context of specific content. (NRC Framework, 2012, p. 218)

To develop the skills and dispositions to use scientific and engineering practices needed to further their learning and to solve problems, students need to experience instruction in which they use multiple practices in developing a particular core idea and apply each practice in the context of multiple core ideas. We use the term "practices" instead of a term such as "skills" to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Students in grades K-12 should engage in all eight practices over each grade band**.** Crosscutting concepts have application across all domains of science. As such, they are a way of linking the different domains of science. Crosscutting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. There are seven crosscutting concepts that bridge disciplinary boundaries, uniting core ideas throughout the fields of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas and develop a coherent and scientifically based view of the world.

The map is meant to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional practice. In fact, our goal is not to merely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. Teachers who are knowledgeable about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-positioned to make decisions about how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, leaders, and other support providers--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related best practices. However, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning are non-negotiable. We must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful support of literacy and language learning across the content areas.

Science and Engineering Practices

1. Asking questions & defining problems
2. Developing & using models
3. Planning & carrying out investigations
4. Analyzing & interpreting data
5. Using mathematics & computational thinking
6. Constructing explanations & designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, & communicating information

Disciplinary Core Ideas

Physical Science
PS 1: Matter & its interactions
PS 2: Motion & stability: Forces & interactions
PS 3: Energy
PS 4: Waves & their applications in technologies for information transfer

Life Sciences
LS 1: From molecules to organisms: structures & processes
LS 2: Ecosystems: Interactions, energy, & dynamics
LS 3: Heredity: Inheritance & variation of traits
LS 4: Biological evaluation: Unity & diversity

Earth & Space Sciences
ESS 1: Earth's place in the universe
ESS 2: Earth's systems
ESS 3: Earth & human activity

Engineering, Technology, & the Application of Science
ETS 1: Engineering design
ETS 2: Links among engineering, technology, science, & society

Crosscutting Concepts

1. Patterns
2. Cause & effect
3. Scale, proportion, & quantity
4. Systems & system models
5. Energy & matter
6. Structure & function
7. Stability & change

Learning Progression

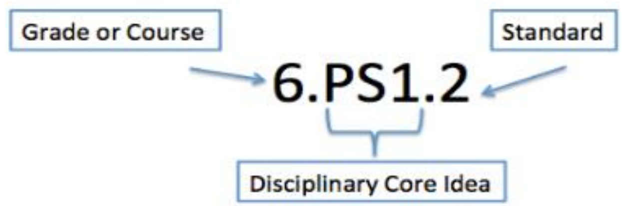
At the end of the elementary science experience, students can observe and measure phenomena using appropriate tools. They are able to organize objects and ideas into broad concepts first by single properties and later by multiple properties. They can create and interpret graphs and models that explain phenomena. Students can keep notebooks to record sequential observations and identify simple patterns. They are able to design and conduct investigations, analyze results, and communicate the results to others. Students will carry their curiosity, interest and enjoyment of the scientific world view, scientific inquiry, and the scientific enterprise into middle school.

At the end of the middle school science experience, students can discover relationships by making observations and by the systematic gathering of data. They can identify relevant evidence and valid arguments. Their focus has shifted from the general to the specific and from the simple to the complex. They use scientific information to make wise decision related to conservation of the natural world. They recognize that there are both negative and positive implications to new technologies.

As an SCS graduate, former students should be literate in science, understand key science ideas, aware that science and technology are interdependent human enterprises with strengths and limitations, familiar with the natural world and recognizes both its diversity and unity, and able to apply scientific knowledge and ways of thinking for individual and social purposes.

Structure of the Standards

- Grade Level/Course Overview: An overview that describes that specific content and themes for each grade level or high school course.
- Disciplinary Core Idea: Scientific and foundational ideas that permeate all grades and connect common themes that bridge scientific disciplines.
- Standard: Statements of what students can do to demonstrate knowledge of the conceptual understanding. Each performance indicator includes a specific science and engineering practice paired with the content knowledge and skills that students should demonstrate to meet the grade level or high school course standards.



Purpose of Science Curriculum Maps

This map is a guide to help teachers and their support providers (e.g., coaches, leaders) on their path to effective, college and career ready (CCR) aligned instruction and our pursuit of Destination 2025. It is a resource for organizing instruction around the Tennessee Academic Standards for Science, which define what to teach and what students need to learn at each grade level. The map is designed to reinforce the grade/course-specific standards and content (scope) and provides *suggested* sequencing, pacing, time frames, and aligned resources. Our hope is that by curating and organizing a variety of standards-aligned resources, teachers will be able to spend less time wondering what to teach and searching for quality materials (though they may both select from and/or supplement those included here) and have more time to plan, teach, assess, and reflect with colleagues to continuously improve practice and best meet the needs of their students.

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Chemistry Quarter 3 Curriculum Map Curriculum Map Feedback Survey					
Quarter 1		**Quarter 2**	**Quarter 3**		**Quarter 4**
Unit 1 Atomic Structure	Unit 2 Interactions of Matter Part I	Unit 3 Interactions of Matter Part II	Unit 4 Interactions of Matter Part III	Unit 5 Matter and Energy	Unit 6 Acid & Bases and Nuclear Chemistry
5 weeks	4 weeks	9 weeks	3 weeks	**6 weeks**	9 weeks

Unit 3: Interactions of Matter Part III (3 Weeks)

Overarching Question(s)

How can one explain the structure, properties, and interactions of matter?

Unit, Lesson	Lesson Length	Essential Question	Vocabulary
Unit 4 Interactions of Matter Part III	**7 Days**	• How do particles combine to form the variety of matter one observes? • What are the parts of solution? • What are the types of saturations?	Soluble, solution, solvent, solute, suspension, colloid, electrolyte, nonelectrolyte, solution equilibrium, saturated solution, supersaturated solution, solubility, hydration, immiscible, miscible, effervescence, solvated, enthalpy of solution, concentration, molarity, molality

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI CHEM1.PS1 Matter and Its Interactions **Standard** **CHEM1.PS1.7** Analyze solutions to identify solutes and solvents, quantitatively analyze concentrations (molarity, percent composition, and ppm), and perform separation methods such as evaporation, distillation, and/or chromatography and show conceptual understanding of distillation. Construct arguments to justify the use of certain methods under different conditions. **Explanation** In seventh grade, students developed an understanding that chemical and physical properties of a sample of matter could be used to identify a substance. Building on this understanding, students	**Learning Outcomes (*Possible Objectives)*** • Calculate molarity. • Using grams, calculate moles then molarity. • Separate the parts of a solution. **Phenomenon** Rock Candy Making rock candy is an excellent phenomenon for exploring the effect of temperature on the solubility of sugar in water. The rock candy simulation can be used to (1) explore saturation point, (2) identify and compare unsaturated, saturated, and supersaturated solutions (3) solubility increases with temperature. (4) reading solubility curves, and (5) how crystals form. **Investigative Phenomenon** **Suggestions for Classroom Use:** How does a sugar solution become rock candy? Students create a solution of water and sugar and it cool it to create rock	**Curricular Resources** **Engage** Modern Chemistry Teacher Resources Why It Matters: Solutions: successful distillation of fresh water from seawater. https://www.ck12.org/Chemistry/Mixture/ https://phet.colorado.edu/en/simulation/concentration https://phet.colorado.edu/en/simulation/sugar-and-salt-solutions http://www.rsc.org/learn-chemistry/resource/res00001434/concentration-simulation?cmpid=CMP00003367 **Explore** Modern Chemistry Teacher Resources The Mixtures Lab – interactive activity in which you separate mixtures based on properties of the substances in each

now explore the use of these physical and chemical properties to separate mixtures. Analysis of the substances is performed to aid in further discussion and facilitate further quantitative analysis. **Misconceptions** Many students think solvents must be liquids. Remind them that many solutions do not involve a liquid solvent. For example, metal alloys. **Science and Engineering Practice** **Asking questions (for science) and defining problems (for engineering)** Questions should facilitate empirical investigation. **Cross Cutting Concepts** **Structure and Function** Students apply patterns in structure and function to unfamiliar phenomena.	candy. Students can adjust the amount of sugar and the temperature to see how much rock candy they can make. This simulation is designed so that it can be paired.	mixture. http://www.harcourtschool.com/activity/mixture/mixture.html Main idea: Solutions are homogeneous mixtures. Separation of Pen Inks by Chromatography Athletic Rivals Lab Counterfeit Drug Quick Lab p. 391 Observing Solutions, Suspensions, and Colloids **Explain** **Elaborate** **Evaluate** **Textbook** Modern Chemistry Chap. 12.1 & 12.3 **Performance Task** • Students will perform lab activities involving the separation of mixtures. • Student will calculate the concentration of solutions using molarity. • Students will classify mixtures as homogeneous or heterogeneous. **Additional Resources**

Chemistry Quarter 3 Curriculum Map					
Quarter 1		Quarter 2	Quarter 3		Quarter 4
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5 weeks	4 weeks	9 weeks	3 weeks	**6 weeks**	9 weeks

Unit 3 Interactions of Matter Part II (9 Weeks)			
Overarching Question(s)			
How do particles combine to form the variety of matter one observes?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 4 Interactions of Matter Part III	3 Days	• How do solutes affect the freezing and boiling points of solvents?	Colligative properties, nonvolatile substance, molal freezing point depression, freezing point depression, molal boiling point constant, boiling point elevation

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI CHEM1.PS1: Matter and Its Interactions **Standard** **CHEM1.PS1.15** Investigate, describe, and mathematically determine the effect of solute concentration on vapor pressure using the solute's van't Hoff factor on freezing point depression and boiling point elevation **Explanation** Liquids undergo evaporation. The particles entering the air create vapor pressure above the liquid sample, which pushes "up" against the "downward" pressure of the atmosphere. If a liquid sample is heated, more particles leave the sample and enter the air space above the liquid, increasing the vapor pressure pushing out of the liquid against the atmospheric pressure pushing back into the liquid. At the point where the vapor pressure of the liquid is equal to the atmospheric pressure, molecules within the liquid experience less pressure from the surrounding liquid and can form bubbles that rise to the surface due to low density. This phenomenon is described as boiling. When solute is added to a solvent, the surface of the	**Learning Outcomes (*Possible Objectives*)** • Calculate the new freezing and boiling points of solutions. **Phenomenon** **Brinicles** https://sites.google.com/site/sciencephenomena/ As Ocean water freezes just water forms a solid and small brine pockets get caught between the water crystals, increasing the concentration of salt in the unfrozen water. These more concentrated pockets of salt water do not freeze and can eventually sink out of the ice and enter the ocean below the floating ice. Because they are colder than the surrounding ocean water, the below zero brine water causes the less salty ocean water to freeze around it is creating Brinicles, which are hollow ice tubes.	**Curricular Resources** **Textbook** Modern Chemistry Chap. 13.2 **Laboratory Activities/Investigations** • Boiling-Point Elevation and Freezing-Point Depression – interactive experiment; you pick the solvent and solute and control the temperature and observe the boiling point or freezing point of your solution. http://group.chem.iastate.edu/Greenbowe/sections/projectfolder/flashfiles/propOfSoln/colligative.html • Salt vs. Sugar Lab—students mix equal amounts of sugar and water into separate beakers of ice of the same size and measure the temperature of each and compare the results. Students then do the same and measure the boiling point of the solution. • Making Ice Cream in a Freezer Bag **Suggestions for Classroom Use:** This phenomenon is used to tie together freezing points of fresh and salt water to discuss phase changes and bulk properties of materials. Then you discuss why they salt roads and finally an investigation into why we add salt to ice to make the cream freeze. You can also do many phase change and specific heat labs.

liquid will contain fewer solvent particles, since solute particles now occupy some of the space. Therefore, less solvent particles will enter the air above the liquid, lowering the vapor pressure. Now a greater temperature will be needed to supply enough solvent particles to create a vapor pressure equal to atmospheric pressure. Since the change in required temperature is due to the presence of solute particles at the solution's surface, only the number of solute particles created during the dissolving/dissociating processes is a factor. The number of particles (either molecules or ions) resulting from the addition of a solute is called the van 't Hoff factor. A heating curve for a solution brought to boiling will not plateau when it begins to boil since the concentration of the solution will rise as solvent particles are driven off. **Misconceptions** Students may think that adding salt to a pot of cooking water raises the boiling point and causes food to cook faster. As a practical example, a cook might add about 30 g of NaCl to 5 L of water to cook pasta. This 5 L solution contains 1.0 mol of ions, so its ion concentration is 0.2 m. At best, such a solution would have a boiling point about 0.1◦C higher than that of pure water, hardly enough to make a difference in cooking time. Raising the boiling point from 100 ◦C to 102◦C would require almost 600 g (1.3 lbs.) of salt in 5 L of water **Science and Engineering Practices** **Planning and carrying out controlled investigations** *Students plan and perform investigations to aid in the development of a predictive model for interacting variables, considering the quantity of data with respect to experimental uncertainty, and select methods for collection and analysis of data.*		http://www.dailymotion.com/video/xmqezx_bbc-nature-brinicle-ice-finger-of-death-filmed-in-antarctic_shortfilms **Simulations** Modern Chemistry Teacher Resources Animation: Colligative Properties **Videos** Modern Chemistry Teacher Resources: Why It Matters: Ions & Colligative Properties **Performance Tasks** Analyze the effect of different compounds and concentrations on the melting and boiling point of solutions. Students analyze and explain the effect of putting salt on icy streets

Crosscutting Ideas **Cause and Effect** *Students use cause and effect models at one scale to make predictions about the behavior of systems at different scales.*		

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Quarter 1		Quarter 2	Quarter 3		Quarter 4
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5 weeks	4 weeks	9 weeks	3 weeks	**6 weeks**	9 weeks

Unit 3 Interactions of Matter Part II (9 Weeks)			
Overarching Question(s)			
How do particles combine to form the variety of matter one observes?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 4 Interactions of Matter Part III	2 Days	• What is solubility? • How is solubility represented on graphs?	Intermolecular forces, like dissolves like, solubility, solubility values, nonpolar solvents
Standards and Related Background Information		**Instructional Focus**	**Instructional Resources**
DCI CHEM1.PS2 Motion and Stability: Forces and Interactions **Standard** **CHEM1.PS2.3** Construct a model to explain the process by which solutes dissolve in solvents and develop an argument to describe how intermolecular forces affect the solubility of different chemical compounds **Explanation**		**Learning Outcomes (*Possible Objectives)*** Interpret a solubility graph. **Phenomenon** **Self-Siphoning Liquid** Polyethylene oxide, being a polyether, and containing oxygen as every third atom in the chain, readily forms hydrogen bonds with water. The large number of oxygen and their two pairs of nonbonded p electrons explains its high-water solubility for its molecular mass. The long strands of gel are formed when the large molecules intertwine much like spaghetti and are cross-linked by water molecules attached to the oxygen on adjacent molecule. The result is a viscoelastic gel. That is,	**Curricular Resources** **Engage** • Like Dissolve Like Simulation http://www.pdesas.org/module/content/resources/14992/view.ashx • Water Dissolves Salt https://www.simbucket.com/simulation/dissolving-a-salt-crystal/ https://learn.concord.org/resources/162/solubility **https://www.youtube.com/watch?v=7OuJ6ierB9s**

A similar task and standard exist in the fifth grade (5.PS1.3). At that time, students performed an investigation (which is again mentioned in CHEM1.PS2.4) into factors affecting solubility. However, student background knowledge was not sufficient to explore any explanation of their results. Explorations into intermolecular attractions in the previous standard (CHEM1.PS2.2) have introduced students to the existence of forces between molecules in a substance. Students can now apply these attractions to form explanations for how solute-solute, solute-solvent, and solvent-solvent attractions all interact as substances dissolve. *(Solubility constants and saturation of solutions are beyond the scope of this standard.)* **Misconceptions** Students often misunderstand the effect the polarity and intermolecular forces on whether a solute will dissolve in a solvent. Spot removers can be used as an example. All spot removers do not remove all stains. The fact that oil does not dissolve in water, but alcohol does dissolve in water can also be used help students understand intermolecular forces and dissolving. Students could draw the molecular structure and brainstorm why oil does not dissolve in water and why alcohol does dissolve in water. **Science and Engineering Practices** **Engaging in argument from evidence** Students critically evaluate evidence supporting an argument and create written or oral arguments that invoke empirical evidence, scientific reasoning and scientific explanations. **Crosscutting Ideas** **Cause and Effect** Students use cause and effect models at one scale to make predictions about the behavior of systems at different scales.	like molasses, the gel has a high viscosity due to the large number of hydrogen bonds between the polymer molecules and water and is elastic since these very long molecules can both straighten when stretched and slide past each other, forming fresh hydrogen bonds as they move. The resulting fluid will siphon itself. The hydrogen bonds link the fluid to itself like a length of chain as it siphons which pulls the fluid from the container towards the ground.	**Explore** Salts & Solubility –check out the solubility of table salt and other salts in water. Design and dissolve your own salt! http://phet.colorado.edu/en/simulation/soluble-salts **Explain** **Elaborate** Modern Chemistry p. 403 Artificial Blood **Evaluate** **Textbook** Modern Chemistry Chap. 12.1 **Performance Tasks** Students will classify solute and solvent pairings as soluble or insoluble based on intermolecular attractions.

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5 weeks	4 weeks	9 weeks	3 weeks	**6 weeks**	9 weeks

Unit 3 Interactions of Matter Part II (9 Weeks)			
Overarching Question(s)			
How do particles combine to form the variety of matter one observes?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 4 Interactions of Matter Part III	4 Days	How can solutes dissolve faster?	Solution equilibrium, saturated solution, unsaturated solution, supersaturated solution, solubility, solvated

Standards and Related Background Information	**Instructional Focus**	**Instructional Resources**
DCI CHEM1PS2 Motion and Stability: Forces and Interactions **Standard** **CHEM1PS2.4**: Conduct an investigation to determine how temperature, surface area, and stirring affect the rate of solubility. Construct an argument to explain the relationship observed in experimental data using collision theory. **Explanation** This standard is nearly identical to a fifth-grade standard that explores factors affecting the solubility of a compound. Though collision theory is	**Learning Outcomes (*Possible Objectives)*** • Demonstrate/explain how to affect the rate of solubility. **Phenomenon** **Dissolving Process** Students can carry out an investigation using lifesavers. Teacher should provide hot water, mortar and pestle, test tubes with stoppers. Students could compete to see who can dissolve their lifesavers in the same amount of water the fastest. Students should try different factors they believe with increase dissolving rate and record time required to dissolve the life savers. Have students record their data in a data table. Next, students will discuss in groups what caused the lifesavers to dissolve the fastest and why they thought this factor caused the fastest dissolving. This investigation should lead to the factors that affect the rate of dissolving.	**Curricular Resources** **Textbook** Modern Chemistry Chap. 12.2 **Engage** How Water Dissolves Salt: https://www.youtube.com/watch?v=xdedxfhcpWo Factors That Affect the Rate of Solubility: https://www.ck12.org/chemistry/rate-of-dissolving/enrichment/Factors-that-affect-Rate-of-Solubility-Overview/?referrer=concept_details Sink Hole Solutions: https://www.ck12.org/chemistry/rate-of-dissolving/rwa/Sinkhole-Solutions/?referrer=concept_details

more closely related to rates of reaction, in this case the application of collision theory explores how the same factors underlying collision theory for how reactions also facilitate solvation processes. **Misconceptions** Students often believe that raising the temperature of any mixture will cause more solute to dissolve in the solvent. Modern Chemistry p. 400 Solubility vs. Temperature graph can be used to help students understand that this is not true for all substances. They will then understand that the solubility of some substances actually decreases as the temperature increase, for example gas solubility always goes down with an increase in temperature. **Science and Engineering Practice** **Planning and carrying out controlled investigations** Students plan and perform investigations to aid in the development of a predictive model for interacting variables, considering the quantity of data with respect to experimental uncertainty, and select methods for collection and analysis of data **Cross Cutting Concepts** **Energy and Matter** Students design or define systems in order to evaluate a specific phenomenon or problem.	**Tea and dissolving** Use the example of making sweet tea to show how temperature affects the dissolution process. Students can carry out an investigation where each student is given a sample of tea and ask to test the effect of temperature on how much sugar can be dissolved in the tea. Students will then discussion why more sugar can dissolve in the hot tea than the cold tea. Students should discuss what happens on a particle level within the tea when the tea is heated. Discussion should lead to particle motion and therefore kinetic energy increasing as the temperature goes up. Students should develop and understanding that temperature is a measure of the kinetic energy of the particles and that particle motion determines dissolving rat	**Explore** Virtual Lab Factors that Affect Dissolving rate: https://www.ck12.org/assessment/tools/geometry-tool/plix.html?eId=SCI.CHE.754&questionId=53d7e8538e0e087ba8b8e938&artifactID=1886265&backUrl=https%3A//www.ck12.org/chemistry/Rate-of-Dissolving/%23interactive&plix_redirect=1 Modern Chemistry Teacher Resources 12.2 The Effect of Temperature on The Solubility of Salts. **Explain** **Elaborate** Rate of Dissolving: https://www.ck12.org/chemistry/rate-of-dissolving/lesson/Rate-of-Dissolving-CHEM/?referrer=concept_details **Evaluate** **Performance Tasks** • Construct an argument to explain the relationship observed in experimental data using collision theory. • Carry out a lab investigation to determine how temperature, surface area, and stirring affect the rate of solubility.

Chemistry Quarter 3 Curriculum Map					
Quarter 1		Quarter 2	Quarter 3		Quarter 4
Unit 1 Atomic Structure	Unit 2 Interactions of Matter	Unit 3 Interactions of Matter Part II	Unit 4 Interactions of Matter	Unit 5 Matter and Energy	Unit 6 Acid & Bases and Nuclear Chemistry

	Part I		Part III		
5 weeks	4 weeks	9 weeks	3 weeks	**6 weeks**	9 weeks

Unit 3
Interactions of Matter Part II (9 Weeks)

Overarching Question(s)			
How is energy transferred and conserved?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit5 Matter and Energy	1 Day	• What is energy? • What is heat flow?	Thermochemistry, temperature, joule, heat

Standards and Related Background Information	**Instructional Focus**	**Instructional Resources**
DCI CHEM1.PS3: Energy **Standard** **CHEM1.PS3.1** Contrast the concepts of temperature and heat flow in macroscopic and microscopic terms. Understand that thermal energy is a form of energy and temperature is a measure of average kinetic energy. **Explanation** Students have been exposed to the types of energy (potential, kinetic, thermal, and chemical) and energy transfer (working, heating, and radiating) in the sixth grade. At that time, students classified energy types in systems and transformations. The focus in Chemistry 1 should be on understanding that measuring the temperature of a system is a way to quantify the thermal energy (average kinetic energy) of the particles in that system. Heating is a mechanism that transfers energy to or from a system. Students should also explore absolute vs. relative scales of temperature mechanisms. Students should recognize that energy will always flow from objects with greater thermal energy to areas with lesser thermal energy,	**Learning Outcomes (*Possible Objectives*)** • Calculate how energy leaves one substance and goes to another. **Phenomenon** Fill a 250 ml beaker and a 10 ml graduated cylinder with hot water. Ask a student to confirm that the water in both containers has the same temperature. Ask students which container they think can potentially release more energy as heat. Have them informally compare temperature and heat.	**Curricular Resources** **Textbook** Modern Chemistry Chap. 16.1 **Engage** Modern Chemistry Chap. 16 Teacher Resources Endothermic & Exothermic Reactions Endothermic and Exothermic Reactions – high-energy video describing the science behind these reactions. http://www.teachersdomain.org/asset/rr10_vid_endoexo/ **Explore** Forms of Energy Energy forms and changes – Build your own system, with energy sources, changers, and users. http://phet.colorado.edu/en/simulation/energy-forms-and-changes **Explain** **Elaborate** **Evaluate**

but rates of energy flow are a property of the materials being heated. The degree to which the temperature changes as an object is also a physical property of a material. Activities may include collecting or analyzing pressure vs. temperature data, then considering why a graph of collected data does not pass through the origin. (Heat capacity and conductivity will only be assessed qualitatively.) **Misconceptions** Students often misuse the terms temperature and heat. Students need to understand that temperature is a measure of average kinetic energy of particles in a sample of matter. In contrast, heat is the energy that is transferred between samples of matter because of a difference in their temperatures **Science and Engineering Practice** **Using mathematics and computational thinking** *Students can create computational or mathematical models for interactions in the natural world using unit equivalencies.* **Cross Cutting Concepts** **Patterns** *Students recognize, classify, and record patterns in quantitative data from empirical research and mathematical representations.*		**Performance Tasks** • Students will draw energy diagrams of both on a molecular level and a macroscopic level to show the effect of energy on a system and show the transfer of energy within a system. • Students should indicate temperature change using the term kinetic energy and heat as a movement of energy from one system to another.

5 weeks	4 weeks	9 weeks	3 weeks	**6 weeks**	9 weeks
Unit 3 Interactions of Matter Part II (9 Weeks)					
Overarching Question(s)					
How is energy transferred between objects or systems?					

Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 5 Matter and Energy	7 Days	• What are the differences in a heating curve and a phase diagram? • What do they show? • How are heat and temperature similar and different?	Heat, specific heat,

Standards and Related Background Information	**Instructional Focus**	**Instructional Resources**
DCI CHEM1.PS3: Energy **Standard** **CHEM1.PS3.2** Draw and interpret heating and cooling curves and phase diagrams and analyze the energy changes involved in calorimetry by using the law of conservation of energy quantitatively (use of $q=mC\Delta T$) and qualitatively. **Explanations** This is one of two standards where students are to investigate changes in specific types of energy: In this case, thermal energy and phase energy. Starting as early as kindergarten, students are introduced to solid and liquid phases of matter. By third grade, students are considering the particulate nature of matter to discuss physical properties of the different phases. In fifth grade, students discuss phase changes from the perspective of the arrangement of particles. Chemistry 1 is the first time that students make a connection between phase changes and energy changes. Students commonly struggle with the idea that substances can be heated, but that heating does not always result in a change in temperature. Models of	**Learning Outcomes (Possible Objectives)** • Identify the state of matter at any point in a heating curve and a phase diagram. • Explain the differences between heat and temperature. **Phenomenon** Students can begin with a sample of ice. Students should measure the temperature of the ice and record the data in a data table. Students should then heat the ice and measure the temperature of the water several times as they heat the water and record the data in the data table. Students should continue to heat the sample until it boils and measure the temperature of the sample at the boiling point and record this data. Students should continue to measure the temperature for 2 minutes after boiling and record the temperature. Students can then use the data collected to plot and label a graph. Students should use the graph to show the phase changes of water thereby developing a phase diagram for water. Students should discuss why the temperature does not change while there is still ice, again when there is no ice left, and again once the water boils. This should lead to a discussion of the energy added being used to overcome intermolecular forces not increase the kinetic energy of the particles. **Water and Phase Changes** Water is a great substance for students to learn about phase change in terms of temperature and heat energy.	**Curricular Resources** **Textbook** Modern Chemistry Chap. 16.1 • Calorimetry • Counting Calories • Temperature of a Bunsen Burner Flame • Energy Content of Foods **Engage** Calorimetry and the Law of Conservation of Energy: https://chemdemos.uoregon.edu/demos/Calorimetry-Computer-Simulation-NEW-html5-version **Suggestions for Classroom Use:** Does the temperature of water rise while it is boiling? Students explore how heat and temperature relate to phase changes. This simulation is very versatile and works great for all age levels. Students pick a starting state and end state for the water and then observe how the motion of the H_2O molecules changes from start to end. The animation is synchronized with a phase change diagram comparing heat and temperature. **Resources** **Phase Change SIM** **https://www.ck12.org/c/chemistry/physical-change/**

phase energies associated with the arrangement of particles aid in dispelling these misconceptions. Comparisons should identify similarities in energies in solids and liquids as compared to vastly different energy in gases. Discussions of heat of fusion/vaporization and calculations to enrich these discussions are appropriate. Finally, students should be able to quantify relationships in which heating creates a change in the thermal energy of a sample. Activities may include determining energy released when an object is burned to change the temperature of a substance in a closed system. (Note that this standard is limited to calculations of energy associated with changes in thermal energy, and not energies associated with phase transformations.) **Misconceptions** Students often think that a temperature change, expressed in kelvins is 273 units larger than the same change expressed in degrees Celsius. Remind them that the temperature increment of one kelvin is the same size change as a temperature increment of one C, so change is the same number whether expressed in C or K. Example: The change from 20°C to 60°C = 40°C this is equivalent to a change from 293 K to 333 K, which is a change of 40 K. Specific heat is recorded in J/g·C but the values are the same as those in J/g·K. **Science and Engineering Practice** **Planning and carrying out controlled investigations** *Students plan and perform investigations to aid in the development of a predictive model for interacting variables, considering the quantity of data with respect to experimental uncertainty, and select methods for collection and analysis of data.*		**https://www.ck12.org/c/chemistry/changes-of-state/** **Specific Heat** Place a small paper cup on wire gauze above a lit Bunsen burner, and watch the cup burn. Fill a second a paper cup about half full of water and place it on the wire gauze above the Bunsen burner. The water will begin to boil in the cup, keeping the temperature of the cup below the combustion temperature of paper. Have students make observations about the differences in the two demonstrations. Have students discuss their observations. Students should work with their group or table partner to develop a valid explanation for the cup containing the water not burning. Use this to lead into the specific heat of water and how this leads to the cup not burning when filled with water. **Explore** Interactive Activity Involving Specific Heat: http://www.chm.davidson.edu/vce/calorimetry/SpecificHeatCapacityOfCopper.html **Explain** **Elaborate** **Evaluate** **Performance Tasks** • Students will calculate specific heat, mass, change in temperature, or heat when given three of the 4 four values by using the specific heat formula. • Students will carry out a lab activity involving measuring the temperature change of a metal sample and calculating the heat released or the specific heat. • Make a heating and cooling curve for water and use the data to create a phase diagram for water. • Students will interpret phase diagrams and heating and cooling curves to answer questions involving changes in phase as indicated by the heating and cooling curve.

Cross Cutting Concepts **Cause and Effect** *Students use cause and effect models at one scale to make predictions about the behavior of systems at different scales.*		

Chemistry Quarter 3 Curriculum Map					
Quarter 1		Quarter 2	Quarter 3		Quarter 4
Unit 1 Atomic Structure	Unit 2 Interactions of Matter Part I	Unit 3 Interactions of Matter Part II	Unit 4 Interactions of Matter Part III	Unit 5 Matter and Energy	Unit 6 Acid & Bases and Nuclear Chemistry
5 weeks	4 weeks	9 weeks	3 weeks	**6 weeks**	9 weeks

Unit 3 Interactions of Matter Part II (9 Weeks)			
Overarching Question(s)			
What is meant by conservation of energy?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 5 Matter and Energy	2 Days	• How does the energy for reactants equal the energy for product?	law of conservation of energy, enthalpy change, exothermic, endothermic, enthalpy change
Standards and Related Background Information		**Instructional Focus**	**Instructional Resources**
DCI CHEM1.PS3: Energy **Standard** **CHEM1.PS3.4** Analyze energy changes to explain and defend the law of conservation of energy **Explanations** Standards PS3.2 and PS3.3 identify the energy types most commonly associated with chemical reactions and build on sixth grade discussions of energy storage and transfer types. In Chemistry 1, students		**Learning Outcomes (Possible Objectives)** • Identify from a graph endothermic and exothermic reactions. **Phenomenon** **Explosions** This phenomenon introduces a discussion of how explosions contain and transform energy, what happens to the energy, and where that energy goes. This phenomenon also introduces the idea of energy transformations and conservation and how those transformations impact our lives on a day-to-day basis. Further connections can be made to supernova explosions and energy transformation from stars to the Earth,	**Curricular Resources** **Textbook** Chap. 16.1 **Explore** Modern Chemistry Teacher Resources: • Calorimetry Lab • A Burning Interest **Suggestions for Classroom Use:**

will synthesize an understanding of law of conservation of energy by being able to distinguish system from surroundings and recognizing that tracking energy requires both the system and surrounding energies to be considered. Students can consider interactions such as a beverage warming/cooling, a refrigerator cooling food, the function of Freon in cooling systems, or a car's cooling system as examples where multiple systems interact. **<u>Misconceptions</u>** Phrases such as "at constant temperature" and at "constant pressure" are often misunderstood. Processes described using these phrases can involve changes in temperature or pressure. When such a process is complete, the products are brought back to the initial temperature and pressure and pressure. The change in enthalpy is the same as if the temperature and pressure had not changed during the process. So the phrase "at constant temperature and pressure" means only that the initial and final conditions are the same. **<u>Science and Engineering Practices</u>** **Developing and using models** *Students can create models for interactions of two separate systems.* **<u>Crosscutting Ideas</u>** **Energy and Matter** *Students explain the conservation of energy by discussing the transfer mechanisms between objects or fields as well as into or out of a system.*	followed by a discussion of renewable energy sources and electricity production.	• This phenomenon can be used in the classroom as an introductory portion of Segment 3 in the course "Physics in the Universe." Segment 3 pertains to energy conversion and renewable energy, so explosions are a great introduction to the idea of energy conversion. Follow-up activities include a demonstration of an explosion using baking soda and vinegar, then a lab activity with explosions in film canisters using Alka-Seltzer. The first resource is a link to a video from "The Slow-Mo Guys" where explosions of increasing size are shown in ultra-slow motion to spectacular results. The video can be used to introduce students to explosions and create interest in the upcoming study of energy transformations. The video can be watched in its entirety, or in pieces along with guiding questions that drive student discussion toward thinking about the concept of change. • The second resource, the demonstration of an explosion, walks teachers through the construction of a model rocket that uses baking soda and vinegar to create an explosion that lifts the rocket off the table top. Students can see that the baking soda and vinegar act as the "fuel" that drives the explosion of the rocket. Students will be guided through questioning to the conclusion that the fuel added to the rocket is the cause of the explosion, and that there is internal energy within the fuel that is being transformed into mechanical energy of the rocket components. • The third resource is the hands-on activity that allows students to actively investigate and create a model that will explode. This activity can be facilitated after the second resource once students have observed the teacher's larger model of the explosion. In contrast, the teacher could present this activity after the engaging video, challenging the students to use the materials provided in order to solve a problem (i.e. rocket that launches to the greatest height, etc.). This can be followed by the teacher demonstrating the actual steps to creating the biggest explosion using either the same student materials or a larger model (i.e. 10 oz. bottle,

		Pringles container, etc.). A transition can be made to the rest of the unit by looking at the phenomenon of supernova, an explosion of a star. Supernovae can be the bridging phenomenon that leads to the idea of most of Earth's energy coming from our sun. Renewable energy becomes a natural topic of conversation, and the flow of a unit will feel very organic. **Engage** **Slow-Mo Explosions video** **Baking Soda/Vinegar Rocket demo** **Film Canister Rocket/Explosion - Student Activity** Law of conservation of energy simulation: **https://www.compadre.org/precollege/items/detail.cfm?ID=12729** Calorimetry and the Law of Conservation of Energy: https://chemdemos.uoregon.edu/demos/Calorimetry-Computer-Simulation-NEW-html5-version **Explore** **Explain** **Elaborate** **Evaluate** **Performance Task** • Students will calculate the loss of heat by a metal and relate it to the heat gained by the water in a calorimetry lab. • Student will develop a description of how energy changes form in a chemical reaction. Use the breaking of chemical bonds and the release of energy.

Atomic Structure	Interactions of Matter Part I	Interactions of Matter Part II	Interactions of Matter Part III	Matter and Energy	Acid & Bases and Nuclear Chemistry
5 weeks	4 weeks	9 weeks	3 weeks	**6 weeks**	9 weeks

Unit 3
Interactions of Matter Part II (9 Weeks)

Overarching Question(s)

How do particles combine to form the variety of matter one observes?

Unit, Lesson	Lesson Length	Essential Question	Vocabulary
Unit 4 Interactions of Matter Part III	12 Days	• How are Pressure, Volume and Temperature related: individually and all together? • What units are used for each aspect of a gas law • How are units converted? • What happens to the other measurements when any of the variables are changed? • How can these changes be shown mathematically?	Pressure, newton, barometer, millimeters of mercury, atmosphere of pressure, Pascal, partial pressure, Dalton's law of partial pressure, Boyles' Law, Charles Law, Gay Lusaac's Law, combined gas law, absolute zero

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI CHEM1.PS1: Matter and Its Interactions **Standard** **CHEM1.PS1.5** Conduct investigation to explore and characterize the behavior of gases (pressure, volume, temperature), develop models to represent this behavior and construct arguments to explain this behavior. Evaluate the relationship (qualitatively and quantitatively) at STP between pressure and volume (Boyle's Law), temperature and volume (Charles' Law), temperature and pressure (Gay Lusaac's Law), and moles and volume (Avogadro's Law) and evaluate and explain these relationships with respect to kinetic -molecular theory. Be able to understand, establish and predict the relationships between volume, temperature, and pressure using the combined gas law both qualitatively	**Learning Outcomes (Possible Objectives)** • Identify the Gas Law according to the measurement (pressure, temperature, volume) affected. • Predict and explain the behavior of other measurements when the first is changed. • Convert to Kelvin and back to Celsius. • Convert to Liters and back to milliliters. • Convert between all different pressure units. • Mathematically substitute into the gas laws and solve for changes. **Phenomenon** **Marshmallows in a Syringe** https://www.youtube.com/watch?v=GNbxpRpF5z8&feature=youtu.be Students can carry out this experiment using a large syringe and a mini marshmallow. Students take the end cap off of the syringe and remove the plunger. Students then place the marshmallow in the syringe and replace the plunger. Next, replace the end cap. Students will then pull	**Curricular Resources** **Textbook** Modern Chemistry Chap. 11.1 & 11.3 **Engage** Modern Chemistry Teacher Resources: • Why It Matters: Gases **Explore** Properties of Gases: http://phet.colorado.edu/en/simulation/gas-properties Modern Chemistry Teacher Resources Chap. 11 • Air Pressure in a Piston Lab • Mass and Density of Air at Different Temperatures • Sec 11.2 Boyle's Law Lab **Explain**

Explanation When exploring the behavior of gasses, it is important to consider experimental design. Experiments used to show the relationships between these sets of variables should include one independent and one dependent variable. Other variables should be held constant. Pressure should serve as the dependent variable because it cannot be manipulated directly. Avogadro's Law can be used to relate the amount of gas in two different containers in lieu of knowing actual number of gas particles in an individual container. Individual demonstrations can be performed to explore each of the different gas laws. **Misconceptions** • Students frequently think that the gas laws apply to real gases. Remind students that the gas laws are abstractions that apply to ideal gases and that they apply to real gases only as an approximation. But, close to atmospheric pressure and room temperature, the approximations generally yield results that are close to those expected from an ideal gas. Discuss the properties that prevent real gases from acting like ideal gases. Remind students of the ways in which real gases deviate from ideal behavior • Students often are unclear about whether gas law references to pressure refer to pressure exerted by the gas or pressure exerted on the gas. Point out that in most cases the two quantities are the same. • Students may wonder about the fact that temperature measurement has a lowest possible value (0 K), but no maximum	back on the syringe plunger. Students should see the marshmallow expand. Students should then release the plunger and they should see the marshmallow shrink. Have students discuss with their partners what is causing this affect relating their observations to changes in pressure and volume. **Balloon in a Flask** https://www.youtube.com/watch?v=FWxZ86TnCLg&feature=youtu.be Put between 10-20 ml of water in a flask and heat it to a boil. Let the water boil vigorously for one full minute. Remove the flask from the heat and put a balloon on the flask. Let the flask cool slowly. **Guiding Question(s)** Predictions: Explain the procedure and ask students to make predictions. What do you think will happen? Why do you think this? After the demonstration: 1) What is in the flask besides the water? 2) What is the water doing when we boil it? 3) What is the steam doing to the air in the flask? 4) Why did the balloon go inside the flask (explain in terms of molecular motion)? Why did the balloon continue to expand inside the flask? **Can Crushing** Have students carry out the following simulation https://phet.colorado.edu/en/simulation/legacy/gas-properties Obtain an empty aluminum can. Transfer about 10 ml of tap water into the can. Place the can on a hot plate on high. Fill a large beaker or tub with cold water. Heat the can until you see a steady stream of steam leaving the opening. Carefully pick up the can with tongs or hot gloves. Quickly flip the can over and dunk the top of the can into the cold water. Leave it for a few seconds and observe the change that takes place. Have students draw a storyboard of what was happening in the can 1) When the can was hot on the hot plate. 2) The instant that the can was placed in the ice bath. 3) After the can was crushed (What force actually crushed the can). As you illustrate the gas particles' behavior, compare the events that took place with the aluminum can to the PhET simulation of gas properties. How does the PhET simulation support the changes that took place with the aluminum can?	**Elaborate** Modern Chemistry Textbook • p. 356: The Gas Laws and Scuba Diving • p. 364 Chemistry's First Law **Evaluate** **Performance Tasks** • Students will perform labs involving the gas laws and use diagrams and the gas laws to describe the processes concerning volume, temperature, and pressure. • Students will perform calculations with Boyles' Law, Charles Law, Gay Lusaac's Law and the combined gas law

value. Discuss with them the relationship between temperature and particle motion. **Science and Engineering Practices** **Planning and carrying out controlled investigations** *Students should derive proportionalities and equalities for dependent variables that include multiple independent variables, considering uncertainty, and limitations of collected data.* **Crosscutting Ideas** **Scale, Proportion, and Quantity** *Students use proportional relationships to predict how changing one property will affect another in a system.*	**Why are the Fish Dying?** Ask students to think about the following question: "Why do fish in shallow ponds sometimes asphyxiate during summer heat waves?" Students should pick a partner and share their ideas. Each pair of partners should answer the following questions: 1) What did the two of you decide was the reason the fish died? 2) Show the relationship between the cause of the death of the fish and the kinetic molecular theory and intermolecular forces.	

Chemistry Quarter 3 Curriculum Map					
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Unit 3 Interactions of Matter Part II (9 Weeks)					
Overarching Question(s)					
How do particles combine to form the variety of matter one observes?					

Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 5 Matter and Energy	8 Days	• How do you calculate information about a gas if there are no changes? • How do units play a part in gas calculations? • How is the Ideal Gas Law used to solve quantitative gas problems?	Gay-Lusaac's law of combining volumes, Avogadro's law, standard molar volume of a gas, ideal gas law, ideal gas constant

		• What relationship do moles play in the pressure and volume of a gas?	

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI CHEM1.PS1: Matter and Its Interactions **Standard** **CHEM 1.PS1.6** Use the ideal gas law PV=nRT, to algebraically evaluate the relationship among the number of moles, volume, pressure, and temperature for ideal gases. **Explanations** If students have collected data during investigations for CHEM1.PS1.5, these data can then be used to linearize. With pressure assigned as the dependent variable and plotted against (moles)(temperature)/volume, the slope of the graph will be the gas constant, yielding the ideal gas law. After developing the mathematical model, this model can be used to make predictions for other systems. **Misconceptions** Students may think that because the molecules shown in the figures are drawn large, the volume of gas depends on the volume of the molecules. Remind students that in reality, gas molecules are very far apart at ordinary temperatures and pressures and that the sizes of the molecules themselves are inconsequential when compared to the total volume of the gas. **Science and Engineering Practices** **Developing and using models**	**Learning Outcomes (Possible Objectives)** • Identify the correct variable used for a given measurement. • Rearrange ideal gas law to solve for any variable. • Use the ideal gas constant to cancel out units and solve for a single unit. • Use gas stoichiometry to solve reaction calculations using gasses. **Phenomenon** **Airbags** Airbags use chemistry to help protect people in a car crash. In this simulation students explore how decomposition reactions, stoichiometry, and properties of gas are used to inflate an airbag in a car crash.	**Textbook** Modern Chemistry Chap. 11.3 **Engage** Modern Chemistry Chap. 11.3 Teacher Resources: Gas Stoichiometry **Explore** Modern Chemistry Teacher Resources: Using the Ideal Gas Law-virtual lab Molar Volume of a Gas Generating and Collecting O_2 Generating and Collecting H_2 **Suggestions for Classroom Use:** How does a chemical reaction inflate an airbag? Students adjust the amount and type of chemical to protect their crash test dummy. The airbag phenomena is often used in chemistry class as a way for students to apply Avogadro's law and stoichiometry to calculate the volume of gas produced. It can easily be paired with an in-class lab where students make Ziploc airbags using baking soda and vinegar. Additionally, this topic can be linked to physics topics such as Newton's 1st Law, force, and momentum, which are involved in car crashes. The CK-12 Chemistry Simulations immerse students in a real-world situation at the atomic level, connecting their own experiences to chemistry concepts, visual models, and mathematical models. All simulations are HTML5 compatible, so they are accessible using tablets, Chromebooks, laptops and desktops. All of the simulations are free. Each simulation includes resources to help differentiate learning: challenge questions, practice questions, and connections to other real-world scenarios. **Explain**

Students can test the predictive abilities of their models in a real-world setting and make comparisons of two models of the same process or system. **Crosscutting Ideas** **Cause and Effect** *Students use cause and effect models at one scale to make predictions about the behavior of systems at different scales.*		**Elaborate** **Evaluate** **Performance Tasks** • Students will perform calculations using the ideal gas law. • Students will perform stoichiometric calculations for gases. **Additional Resources** **Airbag SIM** **Decomposition Reactions** **Avogadro's Law**

Curriculum and Instruction- Science			
RESOURCE TOOLKIT			
Quarter 2		Chemistry	
Textbook Resources **Textbook** 5E Lesson Resource Link	**DCIs and Standards** **DCI** **CHEM1.PS1:** Matter and Its Interactions **Standard**	**Videos** Khan Academy Illuminations (NCTM) Discovery Education The Futures Channel The TeachingChannel Teachertube.com **Simulations**	**Additional Resources:** **ACT & SAT** TN ACT Information & Resources ACT College & Career Readiness Mathematics Standards SAT Connections SAT Practice from Khan Academy