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

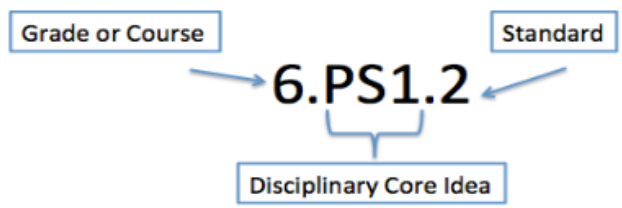
Learning Progression
At the end of the elementary science experience, students can observe and measure phenomena using appropriate tools. They are able to organize objects and ideas into broad concepts first by single properties and later by multiple properties. They can create and interpret graphs and 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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Physical Science Quarter 1 Curriculum Map Curriculum Map Feedback Survey								
Quarter 1			Quarter 2	Quarter 3			Quarter 4	
Structures and Routine	Unit 1 Matter	Unit 2 Chemical Reactions	Unit 3 Motions and Stability	Unit 4 Energy and Machines	Unit 5 Heat and Electricity	Unit 6 Nuclear Energy	Unit 7 Waves	Unit 8 Electromagnetic Radiation
Week 1	3 Weeks	5 Weeks	9 Weeks	3 Weeks	4 Weeks	2 Weeks	4 Weeks	5 Weeks

UNIT 1 WEEK 1 [5 days]: STRUCTURES AND ROUTINES

This week is for teachers to establish routines and procedures during the first week of school. No content is to be taught during this week.

(WEEKS 2-3) UNIT 1 Matter [3 weeks]

Overarching Question(s)

What causes matter to change states? How does gas behave under different conditions?

Unit	Lesson Length	Essential Question	Vocabulary
Unit 1 Matter Part 1	**Length** UNIT 1 WEEK 2 [7 days]	**Essential Questions** • How do particles move in the different states of matter? • How is a gas affected when pressure, temperature, or volume is change?	Boiling point, kinetic theory, heat of fusion, heat of vaporization, melting point, condensation, evaporation, phase change, sublimation, deposition, plasma, thermal expansion, pressure, buoyancy, Charles's Law, Boyle's Law

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI PSCI.PS1: Matter and Its Interactions **Standard** PSCI.PS1.1 Using the kinetic molecular theory and heat flow considerations, explain the changes of state for solids, liquids, gases, and plasma. PSCI.PS1.2 Graphically represent and discuss the results of an investigation involving pressure, volume, and temperature of a gas. **Explanation** In the K- 8 grades, students learn that matter exists as different substances that have different observable	**Learning Outcomes** • Distinguish among solids, liquids, gases, and plasmas. • Describe and illustrate the physical differences among solids, liquids, and gases in terms of their mass, volume, density, shape, and particle arrangement. • Explain the interrelationship between pressure, temperature, and volume of gases. • Solve Gas Laws problems. **Phenomenon** You may demo some of the dry ice experiments, let students explore, or use video to engage. Pose the following question: **Is it possible to have boiling ice water? If so, explain how. If not, why not?**	**Curricular Resources** Engage Phase Changes or use TE/SE pg. 440 Explore The Behavior of Gases Explain Cooking Under Pressure: Applying the Ideal Gas Law in the Kitchen or Observing Pressure – Mini-Lab pg. 450 Elaborate Extreme Robots or Soda Can Investigation Evaluate Chapter 14 Solids, Liquids, and Gases Chapter Test or Assessment Transparency **Glencoe Physical Science**

properties which serve different purposes. The fact that matter exists as atoms, particles that cannot be seen with our eyes and molecules explains its properties. At the 9 – 12 level, students are expected to further develop their understanding of atoms and explain matter in more physical terms. The state of matter of a substance is dependent on three factors: the intermolecular attractions between the atoms/molecules of the substance, the external pressure on the substance, and the temperature of the substance. Some substances such as hydrogen and helium atoms exist primarily as gasses due to very weak intermolecular attractions. This contrasts with substances such as ionic compounds which have extremely strong intermolecular attractions keeping atoms in a very organized crystal lattice pattern even at high temperatures. Pressure can be seen as an external force from surrounding matter pushing the particles closer together. Use phase change diagrams during discussions of this standard. (Students are not expected to differentiate between the types of intermolecular attractions, merely to recognize their role in substances moving between states of matter.) When exploring the behavior of gases, 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. Individual	Dry ice is usually a fascinating and fun material for your students. From making “fog” to “boiling in water,” it is well-known for creating special effects. Carbon dioxide, however, also has fascinating and very useful chemical properties. At room temperature and pressure, solid carbon dioxide will warm to –78 °C and then begin to sublime to carbon dioxide gas. The carbon dioxide gas is, initially, also at –78 °C, which causes moisture in the air to condense and form the characteristic fog that dry ice is famous for. One interesting feature of carbon dioxide is that at atmospheric pressure, it only exists as a solid or gas. In order to exist as a liquid, carbon dioxide must be subjected to a pressure of at least 5.11 atmospheres. Most chemicals will exist as a solid, liquid, or gas depending on temperature and pressure. This relationship between phase, pressure, and temperature can be presented graphically in the form of a phase diagram. https://www.flinnsci.com/api/library/Download/cc3f4560edb447c693d6ad631f971ff3 What is dry ice? Chief Scientist Carl Nelson teaches what dry ice is and what you can do with it. https://www.youtube.com/watch?v=oVmIAqwgIRo Safety Tip: Correct Way to Store Dry Ice https://www.youtube.com/watch?v=RK8u2c6FJbY 8 Cool Dry Ice Experiments https://www.youtube.com/watch?v=yrN05YdYigw Do not do the last experiment in the school setting!!! The Science Teacher’s Activity-A-Day Book 1.1 Boyle’s Gas Law Marshmallow Under Pressure p. 3 Materials Needed: Large Plastic Syringe (without a needle), Large Marshmallow, and a Black Sharpie or Felt-tip Pen You may also use a plastic syringe that will fit a mini marshmallow. If you don’t have this book, then use Flinn Scientific: The Expanding Marshmallow https://www.flinnsci.com/api/library/Download/eea8dce150cd46a88bbfcab58bb7572f or Experiments with a 140 mL Syringe	**Chapter 14 – Solids, Liquids, and Gases** **14.1 Matter and Thermal Energy** Phase Change Lab p. 440 Students will heat ice and graph the temperature changes over time. They will observe the thermal energy changes that occur as matter goes from the solid to the gas state. Vernier – Activity # 3 -Freezing and Melting of Water https://www.vernier.com/experiments/psv/3/freezing_and_melting_of_water/ http://www2.vernier.com/sample_labs/PSV-03-LABQ-freeze_melt.pdf Teacher’s Pet Phase Diagrams Video https://www.youtube.com/watch?v=zn8MzCiVCCc Liquids and Solids Video https://www.youtube.com/watch?v=YN3MVNXHbYg **14.2 Properties of Fluids** Mini-Lab Relate Density and Buoyancy p. 442 Students will investigate the properties of density and buoyancy. Related Article: Eureka! The Archimedes Principle By Rachel Ross, Live Science Contributor | April 25, 2017 08:57pm ET https://www.livescience.com/58839-archimedes-principle.html Activity: Cartesian Divers Flinn Scientific https://www.flinnsci.com/api/library/Download/e3467797ed574c1ea3aeb05ba06466a2 Cartesian divers are great toys that can be used to teach important science concepts. Several variations of Cartesian divers are on the market. Imagine that you and your classmates are members of a research and development team at a toy company and are challenged to design a new Cartesian diver toy. Can you design a toy that includes at least three divers that will descend and ascend in a particular order? **14.3 Behavior of Gases** Virtual Lab Boyle’s Law – What factors influence the pressure of a gas? http://www.glencoe.com/sites/common_assets/science/virtual_labs/PS08/PS08.html Solve Gas Law Problems Mini-Lab Observe Pressure p. 450 How Science Works – Detecting Dark Matter p.454 This is a good example of how scientific knowledge is a work in progress. Article: SCUBA Diving and Gas Laws by Polly Dornette https://www.carolina.com/teacher-resources/Interactive/scuba-diving-and-gas-laws/tr29802.tr Stop at the end of the Charles’s Law section Teacher’s Pet Gas Laws Video https://www.youtube.com/watch?v=Osq71Y82uac Gases and Gas Laws Video https://www.youtube.com/watch?v=0cnelAlE2vY

demonstrations can be performed to explore each of the different gas laws. **Misconceptions** Ask students to define matter. Answers will vary, but some students may indicate that matter is anything that has mass and takes up space. Ask students how the different states of matter compare. Answers will vary. Use student responses to identify misconceptions about the topic. For example, many students may think that gases of a particular substance are not composed of the same particles as the solid of that same substance. **Science and Engineering Practices** **1.Asking Questions** Questions originate based on experience as well as need to clarify and test other explanations or determine explicit relationships between variables. **2. Developing and Using Models** Students create models which are responsive and incorporate features that are not visible in the natural world but have implications on the behavior of the modeled systems and can identify limitations of their models. **Cross-Cutting Concepts** **1.Patterns** Students recognize, classify and record patterns in quantitative data from empirical research and mathematical representations. **5. Energy and Matter** Students demonstrate and explain conservation of mass and energy in systems including systems with inputs and outputs.	http://www.chymist.com/Exps%20with%20a%20140%20mL%20syringe.pdf Explanation: Gases expand to fill their containers. When you pull the plunger of the syringe this creates a low pressure inside the syringe (a vacuum). The marshmallow fills with air. Under reduced pressure, the air expands to fill the syringe and causes the marshmallow to increase in size. When the marshmallow is removed from the syringe, you may observe that the marshmallow is smaller in size than when you started. This is a result of air escaping from the marshmallow. The marshmallow is slightly deflated. Show picture of the railroad tank car. Scenario: The inside of this tank car was steam cleaned, and then all vents and hatches were closed. The employees went home for the night. Pose the question, "What do you think happened next?" or "What did the employees find when they returned to work the next morning?" Show a picture of the collapsed railroad tank car. Show the video clip. This happens when you don't properly vent a storage tank https://www.youtube.com/watch?v=2WJVHtF8GwI&feature=youtu.be Student journaling/ Individual brainstorm: What was happening inside of the tanker or outside of the tanker that made it crush? Why did the tanker crush? How did the tanker crush? If it helps, think about "before" and "after" and draw a diagram. Read the post "**Revisiting the Can Crush Lab: Using the Practices to Investigate a Phenomenon**" http://www.negaresa.org/science/?p=337 to understand how the three dimensions of science connect through this phenomenon. Lesson resources are also provided. The phenomenon of the collapsing tanker provides a real-world, anchor for the lesson and drives student learning toward a meaningful goal.	**Performance Task** Soda Can Investigation - After developing initial models, students collect and analyze key evidence during the Soda Can Investigation. In the Soda Can Investigation, students implode an empty aluminum can to determine the cause of the implosion by relating the macroscopic observations to microscopic gas behaviors. After a targeted reading and class discussion, students return to revise their models created when the Collapsed Railroad Tanker phenomenon was introduced to the class. The Soda Can Investigation can be found in the post "**Revisiting the Can Crush Lab: Using the Practices to Investigate a Phenomenon**" http://www.negaresa.org/science/?p=337. **Lessons** https://wolfriver.org/ecology **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

****Activities/Performance Tasks are located in the section with the curricular resources***		

Physical Science Quarter 1 Curriculum Map Quarter 1 Curriculum Map Feedback							
Quarter 1		**Quarter 2**	**Quarter 3**			**Quarter 4**	
Unit 1 Matter	Unit 2 Chemical Reactions	Unit 3 Motions and Stability	Unit 4 Energy and Machines	Unit 5 Heat and Electricity	Unit 6 Nuclear Energy	Unit 7 Waves	Unit 8 Electromagnetic Radiation
3 Weeks	6 Weeks	9 Weeks	3 Weeks	4 Weeks	2 Weeks	4 Weeks	5 Weeks

(WEEKS 2-3) UNIT 1 Matter [3 weeks]			
Overarching Question(s)			
What causes matter to change states? How does gas behave under different conditions?			
Unit	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 1 Matter Part 2	**Length** UNIT 1 WEEK 3 [3 days]	**<u>Essential Questions</u>** • What are the differences between substances and mixtures? • How does the law of conservation of mass apply to chemical changes?	Substance, element, compound, heterogeneous mixture, suspension, colloid, homogeneous mixture, solution, physical property, physical change, distillation, chemical property, chemical change, law of conservation of mass
Standards and Related Background Information		**Instructional Focus**	**Instructional Resources**

DCI	Learning Outcomes	Curricular Resources
PSCI.PS1: Matter and Its Interactions **Standard** PSCI.PS1.3 Construct a graphical organizer for the major classifications if natter using composition and separation techniques. PSCI.PS1.4 Apply scientific principles and evidence to provide explanations about physical and chemical changes. **Explanation** In the K- 8 grades, students learn that matter exists as different substances that have different observable properties which serve different purposes. The fact that matter exists as atoms, particles that cannot be seen with our eyes and molecules explains its properties. At the 9 – 12 level, students are expected to further develop their understanding of atoms and explain matter in more physical terms. Matter of any type can be subdivided into particles that are too small to see. But even then, the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon; the effects of air on larger particles or objects. **Misconceptions** Students may believe there is no space between the particles of solids. The size (dimension) of the particles of solids is bigger than the particles of liquids and the particles of liquids are bigger than the particles of gases. Students may also believe that particles of solids	• Explain the differences between mixtures and substances. • Distinguish between homogenous and heterogeneous mixtures. • Identify the differences between elements and compounds. • Distinguish the relationship between suspensions, solutions, and colloids. • Identify physical and chemical properties. • Compare and contrast physical and chemical changes. **Phenomenon** You may demo some of the dry ice experiments, let students explore, or use video to engage. Pose the following question: **Is it possible to have boiling ice water? If so, explain how. If not, why not?** Dry ice is usually a fascinating and fun material for your students. From making "fog" to "boiling in water," it is well-known for creating special effects. Carbon dioxide, however, also has fascinating and very useful chemical properties. At room temperature and pressure, solid carbon dioxide will warm to –78 °C and then begin to sublime to carbon dioxide gas. The carbon dioxide gas is, initially, also at –78 °C, which causes moisture in the air to condense and form the characteristic fog that dry ice is famous for. One interesting feature of carbon dioxide is that at atmospheric pressure, it only exists as a solid or gas. In order to exist as a liquid, carbon dioxide must be subjected to a pressure of at least 5.11 atmospheres. Most chemicals will exist as a solid, liquid, or gas depending on temperature and pressure. This relationship between phase, pressure, and temperature can be presented graphically in the form of a phase diagram. https://www.flinnsci.com/api/library/Download/cc3f4560edb447c693d6ad631f971ff3 What is dry ice? Chief Scientist Carl Nelson teaches what dry ice is and what you can do with it. https://www.youtube.com/watch?v=oVmIAqwgIRo	Engage How Do You Sort Matter Explore Chromatography TE/SE pg. 465 Pure Substances vs. Mixtures TE/SE pg. 447 Virtual Lab: Understanding Matter Physical/Chemical Investigation Stations Explain Argument Using Evidence: Physical Change vs. Chemical Change Elaborate Conservation of Mass TE/SE pg. 478-479 Evaluate Claim, Evidence, Reasoning (CER) Physical Change vs. Chemical Change **Glencoe Physical Science** **Chapter 15 – Classification of Matter** **15.1 Composition of Matter** Have students create a graphical organizer or foldable (p. 460) to assist with this lesson. Mini-Lab related to Separating Mixtures p. 465. Students will investigate how to separate different mixtures. This lab can be substituted for the Chromatography lab. Investigating Matter Through Inquiry – Inquiry in Action offers teachers numerous investigative activities and background information for teachers on matter to get students generating their own questions. CPALMS has a lesson plan on pure substances, mixtures, and solutions. http://www.cpalms.org/Public/PreviewResourceLesson/Preview/125968 Soft Schools provides information and examples of pure substances. http://www.softschools.com/examples/science/pure_substances_examples/476/ This YouTube video provides an explanation of how to evaluate pure substances and mixtures. https://www.youtube.com/watch?v=88MBCyiaPSM **15.2 Properties of Matter** Brain Pop Movie – Property Changes Animation – Law of Conservation of Mass Screaming Balloons Science Investigation In this video students can explore the effects of a gas on a balloon (filling it).

cannot move. Solids are made up of the particles completely, but liquids and gases are made up of the particles that are no completely those particles. All solids have a definite shape. The shape of solids do not change unless they go through a physical change. Gases do not have weight. Gases are light, liquids are heavier than gases and solids are the heaviest. Gases are not affected by gravity which means they do not fall down like solids and liquids. **Science and Engineering Practices** **1.Asking Questions** Questions originate based on experience as well as need to clarify and test other explanations or determine explicit relationships between variables. **2. Developing and Using Models** Students create models which are responsive and incorporate features that are not visible in the natural world but have implications on the behavior of the modeled systems and can identify limitations of their models. **Cross-Cutting Concepts** **1.Patterns** Students recognize, classify and record patterns in quantitative data from empirical research and mathematical representations. **2. Cause and effect:** Students identify cause and effect relationships that routinely identify and can be used to explain change such as mixing two or more materials together to create a new material with different properties. **3. Scale, Proportion, and Quantity:**	Safety Tip: Correct Way to Store Dry Ice https://www.youtube.com/watch?v=RK8u2c6FJbY 8 Cool Dry Ice Experiments https://www.youtube.com/watch?v=yrN05YdYigw Do not do the last experiment in the school setting!!! The Science Teacher's Activity-A-Day Book 1.1 Boyle's Gas Law Marshmallow Under Pressure p. 3 Materials Needed: Large Plastic Syringe (without a needle), Large Marshmallow, and a Black Sharpie or Felt-tip Pen You may also use a plastic syringe that will fit a mini marshmallow. If you don't have this book, then use Flinn Scientific: The Expanding Marshmallow https://www.flinnsci.com/api/library/Download/eea8dce150cd46a88bbfcab58bb7572f or Experiments with a 140 mL Syringe http://www.chymist.com/Exps%20with%20a%20140%20mL%20syringe.pdf Explanation: Gases expand to fill their containers. When you pull the plunger of the syringe this creates a low pressure inside the syringe (a vacuum). The marshmallow fills with air. Under reduced pressure, the air expands to fill the syringe and causes the marshmallow to increase in size. When the marshmallow is removed from the syringe, you may observe that the marshmallow is smaller in size than when you started. This is a result of air escaping from the marshmallow. The marshmallow is slightly deflated. Show picture of the railroad tank car. Scenario: The inside of this tank car was steam cleaned, and then all vents and hatches were closed. The employees went home for the night. Pose the question, "What do you think happened next?" or "What did the employees find when they returned to work the next morning?" Show a picture of the collapsed railroad tank car. Show the video clip. This happens when you don't properly vent a storage tank https://www.youtube.com/watch?v=2WJVHtF8GwI&feature=youtu.be	CK-12 provides a lesson plan on changes in matter and includes the law of conservation of mass. http://www.ck12.org/section/Changes-in-Matter-::of::-Introduction-to-Matter-::of::-CK-12-Physical- Science-For-Middle-School/ This site provides a video demonstrating the conservation of mass. https://www.youtube.com/watch?v=774TbEUUM-A This site provides an explanation of the law of conservation of mass. https://www.etutorworld.com/science/7th-grade-science-tutoring/law-of-conservation-of- mass.html This site has a lab exercise to demonstrate the law of conservation of mass. http://www.nclark.net/conservation_of_matter_lab.pdf **Performance Task** Soda Can Investigation - After developing initial models, students collect and analyze key evidence during the Soda Can Investigation. In the Soda Can Investigation, students implode an empty aluminum can to determine the cause of the implosion by relating the macroscopic observations to microscopic gas behaviors. After a targeted reading and class discussion, students return to revise their models created when the Collapsed Railroad Tanker phenomenon was introduced to the class. The Soda Can Investigation can be found in the post "**Revisiting the Can Crush Lab: Using the Practices to Investigate a Phenomenon**" http://www.negaresa.org/science/?p=337. **Lessons** https://wolfriver.org/ecology **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

Students use standard units to measure and describe physical quantities such as weight, time, temperature, and volume that can be used as evidence as conservation of mass. **Activities/Performance Tasks** **Activities/Performance Tasks are located in the section with the curricular resources**	Student journaling/ Individual brainstorm: What was happening inside of the tanker or outside of the tanker that made it crush? Why did the tanker crush? How did the tanker crush? If it helps, think about "before" and "after" and draw a diagram. Read the post "**Revisiting the Can Crush Lab: Using the Practices to Investigate a Phenomenon"** http://www.negaresa.org/science/?p=337 to understand how the three dimensions of science connect through this phenomenon. Lesson resources are also provided. The phenomenon of the collapsing tanker provides a real-world, anchor for the lesson and drives student learning toward a meaningful goal.	

Start of Unit 2 part 1 - 7 Days

Physical Science Quarter 1 Curriculum Map Quarter 1 Curriculum Map Feedback							
Quarter 1		**Quarter 2**	**Quarter 3**			**Quarter 4**	
Unit 1 Matter	Unit 2 Chemical Reactions	Unit 3 Motions and Stability	Unit 4 Energy and Machines	Unit 5 Heat and Electricity	Unit 6 Nuclear Energy	Unit 7 Waves	Electromagn etic Radiation
3 Weeks	6 Weeks	9 Weeks	3 Weeks	4 Weeks	2 Weeks	4 Weeks	5 Weeks

UNIT 2 Chemical Reactions [6 weeks]			
Overarching Question(s)			
How are atoms and elements differentiated? How is the periodic table used? What are the different types of chemical reactions?			
Unit	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 2 Chemical Reactions Part 1	**Length** [10 DAYS]	**<u>Essential Questions</u>** • How does a compound differ from its component elements? • What does a chemical formula represent? • How do electron dot diagrams help predict chemical bonding? • Why does chemical bonding occur? • What are ionic bonds and covalent bonds? • Which particles are produced by different types of bonding? • How do nonpolar and polar covalent bonds compare? • How do you balance a chemical equation? • How do electron dot diagrams help predict chemical bonding? • Why does chemical bonding occur? • How are oxidation numbers determined? • How are formulas written for ionic and covalent compounds? • How are ionic and covalent compounds named?	chemical bond, chemical formula, covalent bond, ion, ionic bond, molecule, anion, cation, nonpolar bond, nonpolar molecule, polar bond, polar molecule, binary compound, hydrate, oxidation number, polyatomic ion
Standards and Related Background Information		**Instructional Focus**	**Instructional Resources**

DCI	Learning Outcomes	Curricular Resources
DCI PSCI.PS1: Matter and Its Interactions **Standard** PSCI.PS1.8 Using the patterns of electrons in the outermost energy level, predict how elements may combine. PSCI.PS1.9 Use the periodic table as a model to predict the formulas of binary ionic compounds. Explain and use the naming conventions for binary ionic and molecular compounds. **Explanation** The concepts addressed in the above standards appear as patterns leading to the arrangement of the periodic table or are patterns in the behavior of atom which can be explained by patterns within the periodic table. Students should engage in activities that provide opportunities to uncover these patterns. All bonds in compounds represent some form of electromagnetic (electrostatic attraction). The difference between bond types is related to the cause for the electrostatic attraction, whether or not atoms are ionized when they interact. Students use the periodic table to predict how elements may combine due to their positions. Also, students learn to name ionic and covalent compounds and how to write chemical formulas. The concepts above are important because it prepares students for understanding concepts in chemistry. Students will discuss orbital notations in chemistry and the discussion relates back to the organization of the periodic table and	**Learning Outcomes** • Use information about an element's position in the periodic table to determine the charge of its ions. • List the three major subatomic particles and distinguish among their location, charges, and relative masses. • Know the chemical symbols for the common elements. • Use the periodic table to identify the characteristics and properties of metals, non-metals, and metalloids • Label a periodic table with oxidation numbers of main group elements, identify elements likely to form ions and use information to construct formulas for compounds • Explain ionic and covalent bonding based on the oxidation numbers of the elements in a compound. **Phenomenon** **Why did the Statue of Liberty turn green?** It's green because the copper has corroded, and the simple salts of copper that have formed are blue-green. The copper reacted with the air and produced copper salts, which some people called corrosion products or tarnish. When copper is exposed to the air for long periods of time and without anyone handling it like this, that's what happens. And the color of the salts or corrosion products is green. **See Figure 1** on page 552 in **Glencoe Physical Science Teacher Edition.** **How does potassium iodide look and what can it be used for?** Potassium iodide is a stable, white solid that looks like table salt. Potassium is very reactive with water, silver in color, soft, and a metal. Iodine is a dark gray solid that sublimates into a purple gas. **See Figure 2** on page 553 in **Glencoe Physical Science Teacher Edition.** Potassium iodide (KI) is a chemical	**Curricular Resources** Engage Virtual Lab: Atomic Structure and Chemical Bonds Explore Atomic Trading Cards Explain Paper Chromatography Elaborate Nonstick Surfaces-Are They Worth the Risks? Evaluate Strength of Attraction: Ions vs. Molecules Lab A or Lab B, TE/SE pg. 572-573 **Physical Science Teacher Edition** **Chapter 18 – Chemical Bonds** **18.1 Stability in Bonding** Review Main Idea – Elements and Compounds p. 552. Chemical Bonds Discussion (Similar Formulas), p. 553. Caption Question p. 553. In-Text Question, p. 553. Khan Academy Video on Bonding https://www.khanacademy.org/science/biology/chemistry--of-life/chemical-bonds-and-reactions/v/ionic-covalent-and-metallic-bonds **18.2 Types of Bonds** Visual Learning (Figure 8) p. 559. Activity- has students find potassium and iodine on the periodic table. How many electrons does potassium have? How many electrons does iodine have? Have students count the number of electrons in figure 8. Explain how the electrons allowed on each energy level. Challenge- Caption Question Figure 8 p. 559. Discussion (Atom Identity & Electron Moves), p. 559. Complete the Activity on Ionic Bonds p. 560 Activity – Ionic Bonds Review This is a review activity for ionic bonding. PowerPoint to be used as hand outs. Students are given a "dating card" each which gives an element and some information about them. Students need to "speed date" with each other to find another element (or elements) to form a bond with in order to make a compound. Wrap up- certificate sheet. Students given a certificate of bonding sheet; they must draw a dot and cross diagram for the compound they made as well as explain in terms of electrons/oxidation states why they decided to make this compound. http://www.sharemylesson.com/teaching-resource/Ionic-bond-speed-dating-6087374/

the arrangement of elements in the periodic table. **Misconceptions** **Roman Numerals** The use of Roman numerals can be confusing. Copper (II) oxide is CuO, with one copper atom for each oxygen atom. The compound copper (I) oxide is written as Cu_2O, with two copper atoms for each oxygen atom. Remind students that the Roman numeral represents the charge on an atom, and the Arabic subscript numbers, such as 2 and 3, show the number of atoms of each element. **Science and Engineering Practices** **1.Asking Questions** Questions originate based on experience as well as need to clarify and test other explanations or determine explicit relationships between variables. **2. Developing and Using Models** Students create models which are responsive and incorporate features that are not visible in the natural world but have implications on the behavior of the modeled systems and can identify limitations of their models. **Cross-Cutting Concepts** **1.Patterns** Students recognize, classify and record patterns in quantitative data from empirical research and mathematical representations. ****Activities/Performance Tasks Activities/Performance Tasks are located in the section with the curricular resources***	compound that can be used to protect the thyroid gland from possible radiation injury caused by radioactive iodine (radioiodine). **Visual Learning – Energy Levels (McGraw Hill Connect ED)** **https://connected.mcgraw-hill.com/c2j/resourceLibrary.do?bookId=MPF89YHKZK8ZBF6PR4OTWJKCE1&mode=SEARCH&searchTerm=visual+learning+electron+energy+levels** **Why is Iodized salt an important nutrient?** It provides iodine in the diet. Iodine is necessary for making thyroid hormone and is often lacking in the diets of people who live inland and don't get much seafood (the ocean contains iodine, in the form of iodide compounds, and so seafood does to). Some areas of the world have soil that is very low in iodine, and people living in those areas used to suffer from goiters (enlargements of the thyroid gland) and cretinism (retardation of growth and mental development due to thyroid hormone deficiency). Iodized salt prevents this. **See Figure 7** on page 558 in **Glencoe Physical Science Teacher Edition.**	PHet simulation- building an atom: https://phet.colorado.edu/en/simulation/build-an-atom **18.3 Writing Formulas and Naming Compounds** Practice Problems 14-16; p. 567. Caption Question p. 571. Section Review p. 571. Khan Academy Video on Writing Formulas and Naming Compounds https://www.khanacademy.org/science/chemistry/atomic-structure-and-properties/introduction-to-compounds/v/naming-ions-and-ionic-compounds Photographic Periodic Table: A great visual of what the elements actually look like in real life: http://www.periodictable.com/ Powerpoint on the four types of chemical bonds Videos and Scientific American articles on chemical bonding: https://www.nbclearn.com/portal/site/learn/chemistry-now/how-atoms-bond Students will write a paragraph about Mendeleev's periodic table. Students will use their paragraph to convince a reader that the periodic table is extremely useful to scientists. *(Hint: Use specific facts to support your argument.)* **Concepts in Action – Elemental Friends and Foes – Prentice Hall** The following website describes molecules and compounds, provides examples, and has links to other interesting pages, such as 3-D models of molecules:http://www.edinformatics.com/math_science/compounds_molecules.htm Atoms, Elements, Compounds and Mixtures Video https://www.khanacademy.org/science/chemistry/atomic-structure-and-properties/modal/v/elements-and-atoms Try this javascript test to assess your knowledge -- physical change or chemical change? http://www.edinformatics.com/math_science/a_p_chem.htm Teacher Resources Site **http://education.jlab.org/indexpages/teachers.html** Chemical nomenclature – Khan Academy https://www.khanacademy.org/science/chemistry/atomic-structure-and-properties/introduction-to-compounds/v/naming-ions-and-ionic-compounds Students work in small groups to learn about the chemical composition of common substances using the American Chemical Society website. http://www.discoveryeducation.com/teachers/free-lesson-plans/elements-of-chemistry-compounds-and-reactions.cfm **Performance Task** Checking for understanding. Logical-Mathematical. Have students read labels of various products and find five compounds that have names with numeric prefixes. Have them write out the formulas for each of these compounds. Reteach – Prefix. Ask students why calcium chloride ($CaCl_2$) is named without using the prefix system shown in Table 6 (p.570) While carbon tetrachloride (CCl_4) does use a prefix to designate the number of chlorine atoms. Answer – the prefix system is used for covalent compounds. $CaClO_2$ is ionic.

		<u>Performance Task</u> The common name for $Na_2B_4O_5(OH)_4 – 8H_2O$ is borax. It is used as a washing powder. Ask students to determine the number of oxygen atoms in the molecule. **<u>Performance Task</u>** Active Reading/Reflection – Have students identify what they learned from activities. Then divide sheets of paper into several columns and record their thoughts under headings such as *"What I Did," What I Learned," "Questions I Have," "Surprises I Experienced, and "Overall Response."* Have students write a Reflective Journal for writing formulas. **<u>Lessons</u>** https://wolfriver.org/ecology **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

Start of Unit 2 part 2 - 8 Days

Physical Science Quarter 1 Curriculum Map Quarter 1 Curriculum Map Feedback							
Quarter 1		**Quarter 2**	**Quarter 3**			**Quarter 4**	
Unit 1 Matter	Unit 2 Chemical Reactions	Unit 3 Motions and Stability	Unit 4 Energy and Machines	Unit 5 Heat and Electricity	Unit 6 Nuclear Energy	Unit 7 Waves	Electromagnetic Radiation
3 Weeks	6 Weeks	9 Weeks	3 Weeks	4 Weeks	2 Weeks	4 Weeks	5 Weeks

UNIT 2 Chemical Reactions [6 weeks]			
Overarching Question(s)			
How are atoms and elements differentiated? How is the periodic table used? What are the different types of chemical reactions?			
Unit	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 2 Chemical Reactions	**Length** [10 DAYS]	**<u>Essential Questions</u>** • What are the reactants and products in a chemical reaction? • Is mass conserved in a chemical reaction?	exothermic reaction, endothermic reaction, equilibrium, reactants, products, chemical equation, coefficient, mole, molar mass, synthesis reaction,

Part 2		• Why are chemical equations important? • How do you balance a chemical equation? • What are the five general types of equations? • How can you predict if a metal will replace another in a compound? • What do the terms oxidation and reduction mean? • How are redox reactions identified? • How can the source of energy changes in a chemical reaction be identified? • How do exergonic and endergonic reactions compare? • How do exothermic and endothermic reactions compare? • Is energy conserved during a chemical reaction? • What is the Law of Conservation of Mass? • What is a chemical reaction? • How is an element's identity determined? • How does an atom's electron configuration affect its chemical properties**?** • How are atoms of one element different from atoms of another element?	decomposition reaction, single replacement reaction, double replacement reaction, combustion reaction, oxidation-reduction

Standards and Related Background Information	**Instructional Focus**	**Instructional Resources**
DCI PSCI.PS1: Matter and Its Interactions **Standard** PSCI.PS1.10 Develop a model to illustrate the claim that atoms and mass are conserved during a chemical reaction (i.e., balancing chemical equations). PSCI.PS1.11 Use models to identify chemical reactions as synthesis, decomposition, single-replacement, and double-replacement. Given the reactants, use these models to predict the products of those chemical reactions. **Explanation** Chemical reactions are rearrangements of atoms that follow	**Learning Outcomes** • Construct the chemical formula of a compound using the periodic table. • Balance simple chemical equations, identifying the reactants, products, and proper coefficients. • Predict the products of common chemical reactions. • Describe synthesis, decomposition, single-replacement, and double replacement reactions using equations. • Use information about an element's position in the periodic table to determine the charge of its ions. • List the three major subatomic particles and distinguish among their location, charges, and relative masses. • Know the chemical symbols for the common elements.	**Curricular Resources** Engage Rusting-A Chemical Reaction Why Do Things Explode Explore Electron States and Simple Chemical Reactions To Glow or Now to Glow TE/SE pg. 605 Chemical Reactions Explain Conservation of Mass Lab and Extension Elaborate Food for Thought: Industrial use of Ammonia Concentration and Reaction Rates Evaluate Modeling Energy in Chemical Reactions Reaction Rates Lab A or Lab B, TE/SE pgs. 606-607

predicable patterns. There are patterns both at the macroscopic level in the behavior of some of the reaction classes, as well as patterns in the rearrangements of the atoms underlying the reaction. Students should be able to predict the products of the reactions, which also require the ability to recognize the general patterns for each type of reaction. These standards build on the idea that balancing chemical reactions provide evidence for conservation of mass and that the behavior of atoms follows predictable patterns. Students now have the opportunity to utilize this understanding as they perform and evaluate chemical reactions. Students who demonstrate understanding can use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques. **<u>Misconceptions</u>** Law of Conservation of Mass does not apply to atoms." Students may be able to repeat the Law of Conservation of Mass, but see no problem with atoms disappearing or appearing to balance equations. "Elements can form other elements." Several students when questioned about the appearance of copper on magnesium ribbon in copper sulfate remarked that the brown solid came	• Use the periodic table to identify the characteristics and properties of metals, non-metals, and metalloid. • Label a periodic table with oxidation numbers of main group elements. • Identify elements likely to form ions and use information to construct formulas for compounds. • Explain ionic and covalent bonding based on the oxidation numbers of the elements in a compound. **<u>Phenomenon</u>** When I squeeze the outside rind of an orange over a balloon - the balloon pops! What is going on?!? Then I find out this same stuff that comes out of the rind is flammable!?!? Are oranges flammable? What is this stuff and how does it pop balloons? **Several questions you may ask about this phenomenon:** 1. Does this count as a chemical reaction? 2. How do we know? 3. What are the chemicals? 4. Why are they reacting? 5. Where is the energy coming from? **Caption Question** (Figure 14 p.595) The chemical reactions happening inside the abdomen of a firefly produce light. *Infer.. How do you know these are exergonic reaction?* **Launch Lab on Rusting** https://catalog.mcgraw-hill.com/repository/private_data/DOC/50000027/50/87.pdf **Conservation of mass Lab (lab materials needed)** https://catalog.mcgraw-hill.com/repository/private_data/DOC/50000571/85/21.pdf	**Glencoe Physical Science Teacher Edition** **Chapter 19 Chemical Reactions** **<u>19.1 Chemical Changes</u>** Practice Problems 1- 4-16; p. 587. Section Review p. 589. **<u>19.2 Classifying Chemical Reactions</u>** Caption Question pp. 591,593. Types of chemical reactions video https://www.youtube.com/watch?v=M96tUDiZ5DQ **<u>19.3 Chemical Reactions and Energy</u>** Section Review p. 597. Visual Learning p. 596. Caption Question pp. 595 & 596. Khan Academy Video on Chemical Reactions https://www.khanacademy.org/science/biology/chemistry--of-life/chemical-bonds-and-reactions/v/chemical-reactions-introduction **<u>19.4 Reaction Rates and Equilibrium</u>** Practice Problems 14-16; p. 567. Caption Question p. 602. Section Review p. 604 Find out about convection, conduction, and radiation. Click on the "Heat Review Game" link for a fun online quiz. http://www.mansfieldct.org/schools/mms/staff/hand/convcondrad.htm Great inexpensive experiments and student activities: http://coolcosmos.ipac.caltech.edu/cosmic_classroom/light_lessons/thermal/detect.html Learn about heat transfer by advancing from page to page using the "Next" button. View illustrations with a boiling ball and discuss three types of heat transfer involved. Includes questions with answers. http://apollo.lsc.vsc.edu/classes/met130/notes/chapter2/htrans_intro.html "Adjusting your Water Heater to conserve Energy". Students are introduced to the Law of Conservation of Energy, specific heat, thermal energy and heat capacity as they discover ways to conserve energy. http://serc.carleton.edu/sp/mnstep/activities/27295.html Video on how heat and energy move through your home: https://www.teachingchannel.org/videos/stem-lesson-ideas-heat-loss-project **<u>Types of chemical reactions Web resources</u>** https://www.thoughtco.com/types-of-chemical-reactions-604038 http://www.dummies.com/education/science/chemistry/the-common-types-of-chemical-reactions/

from the magnesium. They thought it was somehow present in the magnesium even though they agreed that magnesium was an element. **Science and Engineering Practices** **1.Asking Questions** Questions originate based on experience as well as need to clarify and test other explanations or determine explicit relationships between variables. **2. Developing and Using Models** Students create models which are responsive and incorporate features that are not visible in the natural world but have implications on the behavior of the modeled systems and can identify limitations of their models. **Cross-Cutting Concepts** **1.Patterns** Students recognize, classify and record patterns in quantitative data from empirical research and mathematical representations. ****Activities/Performance Tasks Activities/Performance Tasks are located in the section with the curricular resources***		https://chemfiesta.org/2015/09/08/the-six-types-of-reaction/ https://www.asd5.org/cms/lib4/WA01001311/Centricity/Domain/638/Five%20Types%20of%20Chemica%20Reactions.pdf **Exothermic and Endothermic reactions** Students will watch the video (Khan Academy) on exothermic and endothermic reactions https://www.khanacademy.org/science/biology/energy-and-enzymes/free-energy-tutorial/v/endergonic-exergonic-exothermic-and-endothermic-reactions **Performance Task** Ions Names- Give students a list of compound names that consist of the various ions presented in this chapter. Have them write the correct formulas for these compounds (p.567). **Performance Task** Have students inspect the ingredients list on the sides of various containers and find five chemical formulas. Have them determine the oxidation numbers of the various elements in each of the five compounds and make a table to exhibit their findings (p.567). **Lessons** https://wolfriver.org/ecology **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

Start of Unit 2 part 3 - 5 Days

Physical Science Quarter 1 Curriculum Map Quarter 1 Curriculum Map Feedback							
Quarter 1		**Quarter 2**	**Quarter 3**			**Quarter 4**	
Unit 1 Matter	Unit 2 Chemical Reactions	Unit 3 Motions and Stability	Unit 4 Energy and Machines	Unit 5 Heat and Electricity	Unit 6 Nuclear Energy	Unit 7 Waves	Electrom agnetic Radiatio n
3 Weeks	6 Weeks	9 Weeks	3 Weeks	4 Weeks	2 Weeks	4 Weeks	5 Weeks

UNIT 2 Chemical Reactions [6 weeks]			
Overarching Question(s)			
What are acids and bases? What is pH and how does it measure the concentration of acids and bases? How do acids and bases react with each other?			
Unit	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 2 Chemical Reactions Part 3	**Length** [10 DAYS]	**Essential Questions** • What are acids and bases? • What is pH and how does it measure the concentration of acids and bases? • How do acids and bases react with each other? • What defines an acid or a base? • How are common acids and bases used? • How do acids and bases form ions in solutions? • What determines the strength of an acid or a base? • How effectively do different acids and bases conduct electricity? • What is the difference between strength and concentration? • What is a neutralization reaction? • What is a salt, and how does it form? • What is the purpose of the indicator in a titration? • How do soaps and detergents doffer? • What is acid rain? • How is acid rain produced? • What causes acid rain?	Acids, hydronium ions, indicator, hydroxide ion, base, strong acid, weak acid, strong base, weak base, solute, solvent, polar dissociation, dispersion, ionization, solubility, saturated solution, unsaturated solution, supersaturated solution, concentration molarity, acid, indicator, base, neutralization, salt, pH, buffer, electrolyte, nonelectrolyte, nonpolar, acid rain, fossil fuels, fog, sulfuric acid
Standards and Related Background Information		**Instructional Focus**	**Instructional Resources**
DCI PSCI.PS1: Matter and Its Interactions **Standard** PSCI.PS1.12 Classify a substance as acidic, basic, or neutral by using pH tools and appropriate indicators. PSCI.PS1.13 Research and communicate explanations on how acid rain is created and its impact on the ecosystem. **Explanation**		**Learning Outcomes** • Apply indicators and instruments to classify a material as acidic, basic, or neutral. • Identify a substance as acidic, basic, or neutral based on its pH or response to an indicator or instrument. • Measure and compare the acid neutralizing strengths of antacids. • Recognize the effect of acid rain on the environment. • Conduct research on issues associated with acid rain.	**Curricular Resources** Engage Launch Lab: The Effects of Acid Rain TE/SE pg. 677 Why Is Chemistry Important in Nature Brain Pop: Acids and Bases Video Explore Acids, Bases, and Indicators Acid Rain Virtual Lab: Titrations Explain What is Acid Rain

The concept of pH is first introduced in seventh grade as a chemical property of matter. Students in high school should be introduced to multiple explanations of acid and base behavior to permit classification of common substances (e.g. baking soda, ammonia, carbon dioxide) as acids or bases. Since first grade, discussions about ecosystem have involved relatively stable ecosystems, limiting disturbances to the impact of introduced species on these stable ecosystems. Under stable conditions, ecosystems remain in a condition of dynamic equilibrium. Catastrophic events can destroy entire ecosystems. Acid rain is one event that can destroy ecosystems. Acid rain describes any form of precipitation with high levels of nitric and sulfuric acids. It can also occur in the form of snow, fog, and tiny bits of dry material that settle to Earth. Students can research factors that contribute to acid rain. Including the biggest culprit is the burning of fossil fuels by coal-burning power plants, factories, and automobiles. **Misconceptions** **OH- Bases** Most of the bases examined in this section have OH- bonded to a metal. Students might have seen the OH symbols connected to other compounds called alcohols. This does not mean that alcohols fit the definition of a base. The -OH in an alcohol is called a hydroxyl group and is not the same thing as the hydroxide ion, OH-. Acids can burn and eat material away: Students think of acids as active agents that damage skin and other materials. The idea develops in young	• Explain how acid rain is produced. **Phenomenon** The formula for caffeine, the stimulant found in coffee, tea, and many soft drinks, is C8H10N4O2. Caffeine is a weak acid. Caffeinated beverages might stimulate the secretion of stomach acid, which might worsen ulcer symptoms. Acid and bases https://www.khanacademy.org/science/chemistry/acids-and-bases-topic Strengths of acids and bases https://www.youtube.com/watch?v=DupXDD87oHc Glencoe acid and bases http://glencoe.mheducation.com/sites/0078802482/student_view0/unit6/chapter24/ Acid rain is a phenomenon which can adversely affect aquatic life in high mountain lakes that lack buffering from dissolved salts. Acid Rain Videos https://www.youtube.com/watch?v=rqvGeLu8WF8 http://www.aptv.org/IQLEARNING/khan/video.php?readableid=chem31-buffers https://www.youtube.com/watch?v=VILCk2CpUCw	Elaborate Acid and Base Calculations Evaluate Acid Precipitation and Your Community **Glencoe Physical Science Teacher Edition** **Chapter 22 - Acids, Bases and Salts** **22.1 Acids and Bases** Caption Question p. 680. Review Problems 1- 5; p. 683. Section Summary p. 683. Acids and Bases Brain Pop https://www.brainpop.com/science/matterandchemistry/acidsandbases/ https://educators.brainpop.com/video/33282/ **22.2 Strengths of Acids and Bases** Caption Question p. 686. Section Review p. 687. pH scale Brain Pop https://www.brainpop.com/science/matterandchemistry/phscale/ Khan Academy Video on pH https://www.khanacademy.org/science/high-school-biology/hs-biology-foundations/hs-ph-acids-and-bases/v/introduction-to-ph **22.3 Salts** Caption Question pp. 689, 692,694. Khan Academy Video on Salts https://www.khanacademy.org/science/chemistry/acids-and-bases-topic/copy-of-acid-base-equilibria/v/acid-base-properties-of-salts **Acid Rain – In the Field p.698 TE** **Performance Task** Students will complete a WebQuest (p.698) and investigate "How is acid precipitation affecting your community?" students will work with a partner to locate information and evidence of the effects of acid precipitation. Explain how scientific knowledge informed decisions made by your local government. What actions resulted from this knowledge, such as legislation, studies, or activities? **Performance Task** Students will research the effects of acid precipitation on the health of humans. Have them present their findings to the class. If available, have students use presentation software to create a presentation for the class. Where in the U.S is acid rain most severe Virtual Lab Test http://www.glencoe.com/sites/common_assets/science/virtual_labs/CT11/CT11.html Acid Rain Web Resources http://www.scienceclarified.com/A-Al/Acid-Rain.html

children, who learn to think of acids as "dangerous". Acids are not perceived as being particulate, but rather continuous matter with special properties. Neutralization means an acid breaking down Rather than considering neutralization as a reaction between an acid and an alkali, students perceive this as removing acid properties. The alkali may stop the action of an acid, or alternatively the acid may break down. A base/alkali inhibits the burning properties of an acid. Students tend to meet acids in formal education well before alkalis, so ideas about these chemicals are relatively under-developed. Although dilute alkalis are in fact more corrosive than dilute acids, students' perceptions are that they have no corrosive properties, instead acting to or inhibit acids "eating away" other material. **Science and Engineering Practices** **1.Asking Questions** Questions originate based on experience as well as need to clarify and test other explanations or determine explicit relationships between variables. **2. Developing and Using Models** Students create models which are responsive and incorporate features that are not visible in the natural world but have implications on the behavior of the modeled systems and can identify limitations of their models. **Cross-Cutting Concepts**		http://www.weatherforkids.org/volcanoes.html https://www.britannica.com/science/acid-rain To distinguish and describe the three types of matter: elements, compounds, mixtures, students engage in two activities described on this website: http://mypages.iit.edu/~smile/ch9021.html Create PREZI on Classification on Elements Compounds and Mixtures **https://prezi.com/jafqrbq8ayqj/elements-compounds-and-mixtures/** Instructions for a lab activity in which students determine whether certain changes in matter are chemical or physical, and to describe the changes in detail using observational skills in the form of a printable handout: http://www.highschool247.com/sc8/secure/chemistry/chemphyslab.html **Lessons** https://wolfriver.org/ecology **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

1.Patterns Students recognize, classify and record patterns in quantitative data from empirical research and mathematical representations. ***<u>*Activities/Performance Tasks are located in the section with the curricular resources</u>***		

Curriculum and Instruction- Science			
RESOURCE TOOLKIT **Quarter 1** **Physical Science**			
Textbook	**DCIs and Standards**	**Videos**	**Additional Resources**
Textbook **Glencoe Physical Science Teacher Edition**	**DCI** PSCI.PS1: Matter and Its Interactions **Standard** PSCI.PS1.1 PSCI.PS1.2 PSCI.PS1.3 PSCI.PS1.4 PSCI.PS1.5 PSCI.PS1.6 PSCI.PS1.7 PSCI.PS1.8 PSCI.PS1.9 PSCI.PS1.10 PSCI.PS1.11 PSCI.PS1.12 PSCI.PS1.13	**Videos** Khan Academy Illuminations (NCTM) Discovery Education The Futures Channel The Teaching Channel Teachertube.com	**ACT & SAT** TN ACT Information & Resources ACT College & Career Readiness Mathematics Standards SAT Connections SAT Practice from Khan Academy