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.

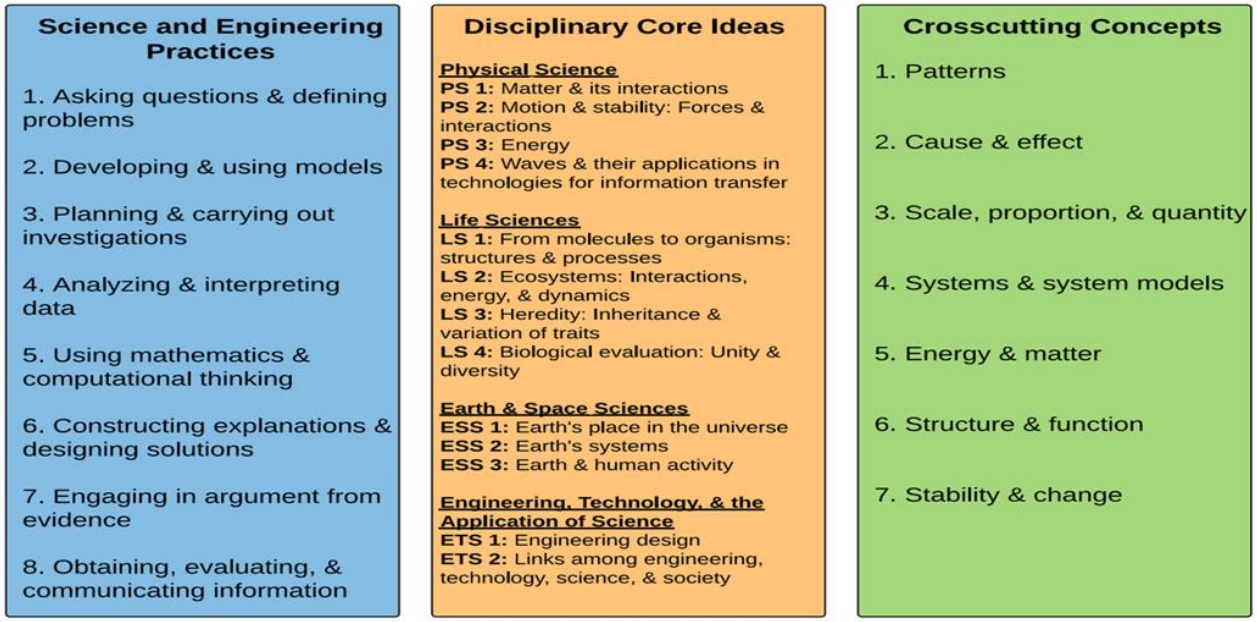
The Tennessee Academic Standards for Science were developed using the National Research Council's 2012 publication, A Framework for K-12 Science Education as their foundation. The framework presents a new model for science instruction that is a stark contrast to what has come to be the norm in science 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.



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.

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.

Quarter 1 Curriculum Map Survey

7th Grade Quarter 1 Curriculum Map					
Unit 1 **Interactions of Matter**	Unit 2 Cell Structure and Function	Unit 3 Human Body Systems	Unit 4 Reproduction, Survival, and Heredity	Unit 5 Cycling of Matter and Energy	Unit 6 Earth's Atmosphere
9 weeks	6 weeks	3 weeks	9 weeks	3 weeks	6 weeks
Quarter 1	Quarter 2		Quarter 3	Quarter 4	

UNIT 1: Interactions of Matter (9 weeks)

Overarching Question(s)

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

Unit 1, Lesson 1	Lesson Length	Essential Question	Vocabulary
Introduction to Matter	3 days	What properties define matter?	matter, mass, weight, volume, density

Standards and Related Background Information	Instructional Focus	Instructional Materials
DCI(s) **Standard(s)** **Explanation** **Misconceptions** **Suggested Science and Engineering Practice(s)** **Suggested Crosscutting Concept(s)** Lesson 1 is designed to provide background knowledge for students before learning standards within Disciplinary Core Idea, PS1: Matter and Its Interactions.	**Learning Outcomes** • Define matter, mass, and weight. • Distinguish between mas and weight. • Describe how to measure the mass and the weight of an object. • Define volume. • Determine the volume of a rectangular solid and of an irregular shaped object using displacement. • Define density. • Describe how mass, volume, and density are related.	**Curricular Materials** HMH Tennessee Science TE, pp. 14-29 Engage and Explore • Similar but Different Activity, TE p. 16 • Engage Your Brain, SE p. 5 Explain Matter • Active Reading #5, SE p. 6 • Visualize It! #6, SE p. 6 Mass and Weight • Active Reading #7, SE p. 7 • Visualize It! #8, SE p. 8

	• Calculate density, mass, or volume given two of the three variables. **Phenomenon**  A hot air balloon consists of a large bag, called an envelope, with a gondola or wicker basket suspended underneath. A burner (with power typically of several megawatts) sits in the basket and is used to heat the air inside the envelope through an opening. This heated air generates lift by way of a buoyant force. The figure below shows a typical burner. The hot air inside the envelope is less dense than the surrounding (cooler) air. This difference in density causes the hot air balloon to be lifted off the ground due to the buoyant force created by the surrounding air.	• Mass and Weight Quick Lab, TE p. 16 (SEP-Using mathematics and computational thinking) Volume • Active Reading #9, SE p. 9 • Think Outside the Book #10, SE p. 9 • Do the Math #11, SE p. 11 (SEP-Using Mathematics and Computational Thinking) • Do the Math #12, SE p. 12 (SEP-Using Mathematics and Computational Thinking) • Finding Volume by Displacement Quick Lab, TE p. 16 (SEP-Using Mathematics and Computational Thinking) Density • Active Reading #13, SE p. 13 • Predict #14, SE p. 13 • Density Dependent Daily Demo, TE p. 17 (SEP-Developing and Using Models) • Do the Math #15, SE p. 14 (SEP-Using Mathematics and Computational Thinking) • Do the Math #16, SE p. 15 (SEP-Using Mathematics and Computational Thinking) <u>Extend</u> Reinforce and Review • Visual Summary, SE p. 16 <u>Evaluate</u> Formative Assessment • Throughout TE

		• Lesson Review, SE p. 16 Summative Assessment • Mass, Volume, and Density Alternative Assessment, TE p. 21 • Lesson Quiz **Additional Resources** Properties of Matter STUDY JAMS! Video

UNIT 1: Interactions of Matter (9 weeks)			
Overarching Question(s)			
How can one explain the structure, properties, and interactions of matter?			
Unit 1, Lesson 2	**Lesson Length**	**Essential Question**	**Vocabulary**
Properties of Matter	2 days	What are physical and chemical properties of matter?	physical property chemical property
Standards and Related Background Information		**Instructional Focus**	**Instructional Materials**
DCI(s) **Standard(s)** **Explanation** **Misconceptions** **Suggested Science and Engineering Practice(s)** **Suggested Crosscutting Concept(s)** Lesson 2 is designed to provide background knowledge for students before learning standards within Disciplinary Core Idea, PS1: Matter and Its Interactions.		**Learning Outcomes** • Describe physical and chemical properties of matter. • Explain how to distinguish physical properties from chemical properties. • Describe characteristic properties of matter. • Explain how to use characteristic properties to identify substances. **Phenomenon**  The bog is flooded with up to 18 inches of water the night before the berries are to be harvested. The growers then use water reels, nicknamed “eggbeaters,” to churn the water and loosen the cranberries from the vine. Each berry has a tiny pocket of air that allows it to float to the surface of the water, because it is less dense than	**Curricular Materials** HMH Tennessee Science TE, pp. 32-47 <u>Engage and Explore</u> • Describe It Activity, TE p. 34 • Engage Your Brain #s 1 and 2, SE p. 21 <u>Explain</u> Physical Properties • Active Reading #5, SE p. 23 • Visualize It! #6, SE p. 23 • Think Outside the Book #7, SE p. 23 • Visualize It! #s 8-10, pp. SE 24-25 • Inquiry #11, p. SE 25 • Observe Physical Properties Quick Lab, TE p. 35 (SEP-Obtaining, Evaluating, and Communicating Information) Chemical Properties • Active Reading #12, SE p. 26 • Predict #13, SE p. 26 Comparing Physical and Chemical Properties

	water. Density is a property of matter (characteristic) that can be used to identify and /or describe a substance.	• Active Reading #14, SE p. 28 • Visualize It! #s15-16, SE p. 28 Using Properties to Identify Unknown Substances • A Rockin' Reaction Daily Demo, TE p. 35 • Infer #20, SE p. 30 • Do the Math #21, SE p. 31 • Identifying an Unknown Substance Exploration Lab, TE p. 34 (SEPs-Planning and Carrying out Controlled Investigations, Analyzing and Interpreting Data, Engaging in Argument from Evidence) • Determining Density Virtual Lab, TE p. 35 <u>Extend</u> • At the Scene #s17-19, SE p. 29 Reinforce and Review • Visual Summary, SE p. 32 <u>Evaluate</u> Formative Assessment • Throughout TE • Lesson Review, SE p. 33 Summative Assessment • Identifying Physical and Chemical Properties, TE p. 39 • Lesson Quiz

UNIT 1: Interactions of Matter (9 weeks)			
Overarching Question(s)			
How can one explain the structure, properties, and interactions of matter?			
Unit 1, Lesson 3	**Lesson Length**	**Essential Question**	**Vocabulary**
Physical and Chemical Changes	2 days	What are physical and chemical changes of matter?	physical change chemical change law of conservation of mass
Standards and Related Background Information		**Instructional Focus**	**Instructional Materials**
DCI(s) **Standard(s)** **Explanation** **Misconceptions** **Suggested Science and Engineering Practice(s)** **Suggested Crosscutting Concept(s)** Lesson 3 is designed to provide background knowledge for students before learning standards within Disciplinary Core Idea, PS1: Matter and Its Interactions.		**Learning Outcomes** • Describe physical and chemical changes of matter. • Describe how temperature influences chemical changes. • Differentiate between physical changes and chemical changes. • Explain how to identify signs of chemical changes of matter. • Describe the Law of Conservation of Mass. **Phenomenon**  Rust is another name for iron oxide, a compound which occurs when iron or an alloy that contains iron, like steel, is exposed to oxygen and moisture for a long period of time. Over time, the oxygen combines with the metal	**Curricular Materials** HMH Tennessee Science, pp. 48-61 <u>Engage and Explore</u> • What's New? Discussion, TE p. 50 • Engage Your Brain, SE p. 35 <u>Explain</u> Physical Change • Active Reading #5, SE p. 36 • Identify #6, SE p. 37 • Visualize It! #7, SE p. 37 Chemical Change • Visualize It! #8, SE p. 38 • Active Reading #9, SE p. 39 • Think Outside the Book #10, SE p. 39 • Properties of Combined Substances, TE p. 50 Comparing Physical and Chemical Changes • Active Reading #11, SE p. 40 • Infer #12, SE p. 41

	at an atomic level, forming a new compound called an oxide and weakening the bonds of the metal itself.	• Physical or Chemical Change? Quick Lab, TE p. 51 (SEP-Analyzing and Interpreting Data) Law of Conservation of Mass • Mass Doesn't Change Daily Demo, TE p. 51 • Active Reading #13, SE p. 42 • Visualize It! #s 14 and 15, SE p. 43 <u>Extend</u> Reinforce and Review • Changes in Matter Activity, TE p. 54 • Visual Summary, SE p. 44 Going Further • Technology Connection, TE p. 54 <u>Evaluate</u> Formative Assessment • Throughout TE • Lesson Review, SE p. 45 Summative Assessment • What a Change! Alternative Assessment, TE p. 55 • Lesson Quiz **Additional Resources** Physical and Chemical Changes of Matter STUDY JAMS! Video

UNIT 1: Interactions of Matter (9 weeks)			
Overarching Question(s)			
How can one explain the structure, properties, and interactions of matter?			
Unit 1, Lesson 4	**Lesson Length**	**Essential Question**	**Vocabulary**
Pure Substances and Mixtures	2 weeks	How do pure substances and mixtures compare?	atom, element, compound, mixture, pure substance, heterogeneous, homogeneous
Standards and Related Background Information		**Instructional Focus**	**Instructional Materials**
DCI(s) PS1: Matter and Its Interactions **Standard(s)** 7.PS1.2 Compare and contrast elemental molecules and compound molecules. 7.PS1.3 Classify matter as pure substances or mixtures based on composition. *7.PS1.5 Use the periodic table as a model to analyze and interpret evidence relating to physical and chemical properties to identify a sample of matter.* **Explanation(s)** 7.PS1.2 may be the first instance where students begin to investigate chemical formulae and supports 7.PS1.3 and 7.PS1.4. Emphasis should		**Learning Outcomes** • Describe different ways in which the particles that make up matter can combine to form various substances. • Classify elements and compounds as two types of pure substances. • Describe and classify examples of common elements and compounds. • Compare homogeneous mixtures and heterogeneous mixtures. • Classify mixtures as solutions, colloids, and suspensions; and devise methods by which to separate the components of various mixtures.	**Curricular Materials** HMH Tennessee Science TE, pp. 66-81 Engage and Explore • Edible Mixtures Discussion, TE p. 68 • Engage Your Brain, SE p. 51 • Active Reading #3, SE p. 51 Explain How Particles Combine • Active Reading #5, SE p. 52 • Think Outside the Book #6, SE p. 52 • Visualize It! #7, SE p. 53 • Classifying Matter Activity, TE p. 68 Pure Substances: Elements and Compounds • Compare #8, SE p. 54 • Modeling Pure Substances Daily Demo, TE p. 69 • Active Reading #9, SE p. 55 • Visualize It! Identify #10, SE p. 55 • Visualize It! Explain #11, SE p. 55

include definitions of both monoatomic elements existing as atoms as well as diatomic elements which form true molecules. Students should also be able to differentiate between molecules of a diatomic element and compound molecules. 7.PS1.3 Pure substances include both elements and compounds. Mixtures include both mixtures of elements and compounds. 7.PS1.3 indirectly builds on the idea that chemicals have specific properties. When elements/compounds exist in a mixture, each of the parts retains its unique physical properties. In the event of a reaction within this mixture, a pure substance can result (assuming perfect ratios of constituent parts). This new pure substance will have a new set of physical properties (e.g., boiling point, state of matter at room temperature, conductivity). *7.PS1.5 The properties of a pure substance under specific conditions can be used to identify that substance. Examples of such properties might include, melting point, boiling point, ability to conduct an electrical current, flammability, odor, pH, or interacting with magnets. This standard is intricately connected with 7.PS1.3 as changes from a mixture into a pure substance result in a change to these physical properties. For instance, the	**Phenomenon**  Seawater is a mixture of many different substances. Some of these substances can be observed when the water in seawater evaporates and leaves behind salt. Water, H_2O, is a pure substance, a compound made of hydrogen and oxygen. Calcium carbonate is also dissolved in seawater and is used by the corals to build their hard skeletons.	• Active Reading #12, SE p. 56 • Visualize It! #13, SE p. 57 • Identifying Elements and Compounds Quick Lab, TE p. 69 (SEP-Obtaining, evaluating, and communicating information) Mixtures • Visualize It! #14, SE p. 58 • Active Reading #15, SE p. 59 • Investigating Separating Mixtures Exploration Lab, TE p. 69 (SEP-Planning and carrying out controlled investigations, Analyzing and interpreting data) • Active Reading #16, SE p. 60 • Classify #17, SE p. 61 • Observing Mixtures Quick Lab, TE p. 69 (SEP-Engaging in argument from evidence) Extend Reinforce and Review • Thrown into the Mix Activity, TE p. 72 • Synthesizing Key Topics Graphic Organizer, TE p. 72 • Visual Summary, SE p. 62 Going Further • Earth Science Connection, TE p. 72 • Mathematics Connection, TE p. 72 Evaluate Formative Assessment • Throughout TE

mixture of two liquids with differing pHs can create a new substance with a unique pH. Discussions should include both pure elemental substances and pure compounds. Use of the periodic table should also include similarities in physical and chemical properties of compounds formed from a metal and a non-metal (ionic compounds), compared with compounds formed from a pair of non-metals (molecular compounds). **Misconception(s)** It is important that students understand that the same two substances can mix in different ways at different proportions, but still form the same kind of mixture. Changing the amount of one substance does not change the mixture's identity. Stress to students that the properties of a compound are sometimes different from those of the elements making up the compound. **Suggested Science and Engineering Practice(s)** Analyzing and interpreting data 7.PS1.2, 7.PS1.5 Students form explanations using sources (including student-developed investigations) which show comprehension of parsimony, utilize quantitative and qualitative models to		• Lesson Review, SE p. 73 • Reteach, TE p. 73 Summative Assessment • Matter Menu Alternative Assessment, TE p. 73 • Lesson Quiz **Additional Resources** • Mixtures STUDY JAMS! Video • Elements & Compounds STUDY JAMS! Video • Build a Molecule PhET Interactive Simulations • 7.PS1.3 Student Activity, Card Sort, Engagement, Reading Support, Testing Questions, and Teacher Guide

make predictions, and can support or cause revisions of a particular conclusion. Engaging in argument from evidence 7.PS1.3 Students present an argument based on empirical evidence, models, and invoke scientific reasoning. **Suggested Crosscutting Concept(s)** Scale, Proportion, and Quantity 7.PS1.2 Students develop models to investigate scales that are beyond normal experiences. Patterns 7.PS1.3, 7.PS1.5 Students recognize, classify, and record patterns for macroscopic phenomena based on microscopic structure.		

UNIT 1: Interactions of Matter (9 weeks)			
Overarching Question(s)			
How can one explain the structure, properties, and interactions of matter?			
Unit 1, Lesson 5	**Lesson Length**	**Essential Question**	**Vocabulary**
States of Matter	3 days	How do particles in solids, liquids, and gases move?	solid, liquid, gas
Standards and Related Background Information		**Instructional Focus**	**Instructional Materials**

DCI(s)
PS1: Matter and Its Interactions

Standard(s)
7.PS1.6 Create and interpret models of substances whose atoms represent the states of matter with respect to temperature and pressure.

Explanation(s)
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

Learning Outcomes
- Explain how the particles (atoms and molecules) that make up matter are constantly in motion.
- Describe the motion of particles in solids, liquids, and gases.
- Explain how movement of particles (atoms and molecules) in solids, liquids, and gases affect the properties of solids, liquids, and gases.

Phenomenon

This picture of Utah's Diamond Fork Hot Springs displays water in all three states of matter.

Curricular Materials
HMH Tennessee Science TE, pp. 82-94
<u>Engage and Explore</u>
- Engage Your Brain, SE p. 65
- Active Reading #s 3 and 4, SE p. 65

<u>Explain</u>
Particles in Motion
- Describe #5, SE p. 66
- Describe #6, SE p. 67
- Describe #7, SE p. 67
- Modeling Particle Motion Activity, TE p. 84
- How Far Apart Are They? Activity, TE p. 84

Properties of Solids, Liquids, and Gases
- Properties of Matter Daily Demo, TE p. 85
- Active Reading #8, SE p. 68
- Think Outside the Book #9, SE p. 68
- Visualize It! #10, SE p. 69
- Apply #11, SE p. 70

organized crystal lattice pattern even at high temperatures. Pressure can be seen as an external force from surrounding matter pushing the particles closer together. It is logical to incorporate triple point diagrams into 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.)* **Suggested Science and Engineering Practice(s)** 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. **Suggested Crosscutting Concept(s)** Cause and Effect Students infer and identify cause and effect relationships from patterns.		• Can Crusher Quick Lab, TE p. 84 (SEP-Developing and using models, constructing explanations and designing solutions, engaging in argument from evidence) • Changing Volumes Quick Lab, TE p. 85 (SEP-Developing and using models, engaging in argument from evidence) Extend Making Glass #s 12-14, SE p. 71 (SEP-Obtaining, evaluating, and communicating information) Reinforce and Review • Name That Matter Activity, TE p. 88 • Visual Summary, SE p. 72 Going Further • Engineering Connection, TE p. 88 • Chemistry Connection, TE p. 88 Evaluate Formative Assessment • Throughout TE • Lesson Review, SE p. 73 • Reteach, TE p. 89 Summative Assessment • States of Matter Assessment, TE p. 89 • Lesson Quiz **Additional Resources** States of Matter: Basics PhET Interactive Simulations

UNIT 1: Interactions of Matter (9 weeks)			
Overarching Question(s)			
How can one explain the structure, properties, and interactions of matter?			
Unit 1, Lesson 6	**Lesson Length**	**Essential Question**	**Vocabulary**
Changes of State	2 days	What happens when matter changes state?	freezing, boiling, sublimation, melting, condensation, deposition, evaporation
Standards and Related Background Information		**Instructional Focus**	**Instructional Materials**
DCI(s) PS1: Matter and Its Interactions **Standard(s)** 7.PS1.6 Create and interpret models of substances whose atoms represent the states of matter with respect to temperature and pressure. **Explanation** 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		**Learning Outcomes** • Explain what happens when a substance gains or loses energy. • Explain that changes of state conserve energy. • Explain melting and freezing. • Explain why a substance has the same freezing and melting point. • Explain evaporation, boiling, condensation, sublimation, and deposition. • Use a model of particle motion to show that changes of state conserve mass.	**Curricular Materials** HMH Tennessee Science TE, pp. 96-115 <u>Engage and Explore</u> • Moving Particles Activity, TE p. 98 • Engage Your Brain #s 1 and 2, SE p. 75 • Active Reading #s 3 and 4, SE p. 75 <u>Explain</u> Changes in States of Matter • Identify #5, SE p. 76 • Visualize It! #6, SE p. 76 • Visualize It! #s 7 and 8, SE p. 77 • Modeling Particle Motion Quick Lab, TE p. 99 (SEP-Developing and using models) • Changes of State Exploration Lab, TE p. 99 • Change of Pace Virtual Lab, TE p. 99 Changes Between Solid, Liquid, and Gas States • Evaporation and Condensation Daily Demo, TE p. 98 • Predict #9, SE p. 78

organized crystal lattice pattern even at high temperatures. Pressure can be seen as an external force from surrounding matter pushing the particles closer together. It is logical to incorporate triple point diagrams into 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.)* **Suggested Science and Engineering Practice(s)** <u>Developing and using models</u> 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. **Suggested Crosscutting Concept(s)** <u>Cause and Effect</u> Students infer and identify cause and effect relationships from patterns.	**Phenomena**  Firefighters hose down a fire inside a three-story building, but because of below zero temperatures the building turns to ice.  "Ice Palace" Chicago 2013 As firefighters try to extinguish a fire, the building turns to ice due to the temperature.	• Visualize It! #10, SE p. 78 • Active Reading #11, SE p. 78 • Model #12, SE p. 79 • Infer #13, SE p. 79 • Predict #14, SE p. 80 • Identify #15, SE p. 80 • Apply #16, SE p. 81 • Visualize It! #17, SE p. 81 • Think Outside the Book #18, SE p. 82 • Active Reading #19, SE p. 83 • Relate #20, SE p. 83 • Boiling Water Without Heating It Quick Lab, TE p. 99 (SEP-Constructing explanations and designing solutions, engaging in arguments from evidence Conservation of Mass During Changes of State • Active Reading #21, SE p. 84 • Visualize It! #s 22-24, SE pp. 84-85 <u>Extend</u> Reinforce and Review • We Are Particles Activity, TE p. 102 • Concept Map Graphic Organizer, TE p. 102 • Visual Summary, SE p. 86 <u>Evaluate</u> Formative Assessment • Throughout TE • Lesson Review, SE p. 87

		• Reteach, TE p. 103 Summative Assessment • States of Mind Alternative Assessment, TE p. 103 • Lesson Quiz • Unit 1 Connect Essential Questions, SE p. 88 • Unit 1 Think Outside the Book, SE p. 88 • Unit 1 Review, SE p. 89-94 **Additional Resources** • States of Matter phET Interactive Simulations • Solids, Liquids, Gases STUDY JAMS! Video

UNIT 1: Interactions of Matter (9 weeks)			
Overarching Question(s)			
How can one explain the structure, properties, and interactions of matter?			
Unit 1, Lesson 7	**Lesson Length**	**Essential Question**	**Vocabulary**
The Atom	3 days	How do we know what parts make up an atom?	matter, atom, electron, neutron, proton, nucleus, electron cloud, atomic number, mass number
Standards and Related Background Information		**Instructional Focus**	**Instructional Materials**

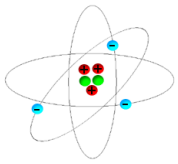
DCI(s)
PS1: Matter and Its Interactions

Standard(s)
7.PS1.1 Develop and use models to illustrate the structure of atoms, including the subatomic particles with their relative positions and charge.

Explanation
Ultimately, understanding of the sub-structure of atoms will allow Chemistry I students to understand causes for intermolecular attractions as well as bonding and the implications of these phenomena. In fifth grade, students observed some of these phenomena including dissolving solids and phase changes. This seventh grade standard acts as the intermediate point between what students have already seen, and the

Learning Outcomes
- Describe the way in which atoms make up matter.
- Describe scientific contributions to the atomic theory.
- Describe the current model of the atom.
- State the location, charge, and relative mass of protons, neutrons, and electrons in an atom.
- Identify the nucleus and electron cloud in a model of an atom.
- Determine the atomic number and mass of an atom.

Phenomena



Click on the picture to display the animation. All matter is formed from basic building blocks called *atoms*. Atoms are made of even smaller particles

Curricular Materials
HMH Tennessee Science, TE pp. 126-139
<u>Engage and Explore</u>
- Photographic Dots Activity, TE p. 128
- Engage Your Brain #s 1-2, SE p. 99
- Active Reading #s 3-4, SE p. 99

<u>Explain</u>
The Atom
- Active Reading #5, SE p. 100
- Visualize It! #6, SE p. 100

Development of the Atomic Theory
- Active Reading #7, SE p. 102
- Model #8, SE p. 102
- Analyze #9, SE p. 103

Parts of the Atom
- Active Reading #10, SE p. 104
- Summarize #11, SE p. 105
- Modeling Atomic Nucleus Daily Demo, TE p. 128

explanations that can occur when this foundation is set in place. Relevant historical models include Thomson's plum pudding model to explain the behavior of electrons and ion formation and the work of Rutherford and Bohr to explain nuclear developments and structures descriptions of isotopes. Observations of static charge attractions between invisible tape, paper, and foil present an opportunity for students to employ Thomson's model. (Electron configurations are beyond the scope of this standard and grade level.) **Misconception(s)** Help students develop an understanding of how small an atom is. Point out that even something as small as a particle of dust is made of millions of atoms! Stress to students that although atoms are tiny, they do contain empty space and are not static. However, atoms do not possess Students may confuse the charges of subatomic particles with the overall charge of an atom. Emphasize that an atom is neutral, it has no overall charge. The atomic number is the number of protons in the nucleus of an atom. Although the number of electrons and the number of neutrons may change	called *protons*, *electrons*, and *neutrons*. Protons and neutrons live in the nucleus of an atom and are almost identical in mass. However, protons have positive charges whereas neutrons have no charge. Electrons have a negative charge and orbit the nucleus in *shells* or *electron orbitals* and are much less massive than the other particles.	• Active Reading #12, SE p. 106 • Think Outside the Book #s 13 and 14, SE p. 106 • Calculate #15, SE p. 107 • How Are Atoms Structured? Virtual Lab, TE p. 129 Extend Reinforce and Review • Atomic Role-Playing, TE p. 132 • Visual Summary, SE p. 108 Going Further • Technology Connection, TE p. 132 Evaluate Formative Assessment • Throughout TE • Lesson Review, SE p. 109 • Reteach, TE p. 133 Summative Assessment • Atomic Activities Alternative Assessment, TE p. 133 • Lesson Quiz **Additional Resources** • Atomic Structure Simulation • PhET Build an Atom Interactive Simulations • Atoms: Protons, Neutrons, Electrons STUDY JAMS! Video • 7.PS1.1 Student Activity and Teacher Guide

(in ions and isotopes), the number of protons remains constant. **Suggested Science and Engineering Practice(s)** 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. **Suggested Crosscutting Concept(s)** Structure and Function Students begin to attribute atomic structure and interactions between particles to the properties of a material.		

UNIT 1: Interactions of Matter (9 weeks)			
Overarching Question(s)			
How can one explain the structure, properties, and interactions of matter?			
Unit 1, Lesson 8	**Lesson Length**	**Essential Question**	**Vocabulary**
The Periodic Table	2 weeks	How are elements arranged on the periodic table?	periodic table, chemical symbol, average atomic mass, metalloid, metal, group, nonmetal, period
Standards and Related Background Information		**Instructional Focus**	**Instructional Materials**

DCI(s)
PS1: Matter and Its Interactions

Standard(s)
7.PS1.5 Use the periodic table as a model to analyze and interpret evidence relating to physical and chemical properties to identify a sample of matter.

Explanation(s)
The properties of a pure substance under specific conditions can be used to identify that substance. Examples of such properties might include, melting point, boiling point, ability to conduct an electrical current, flammability, odor, pH, or interacting with magnets. This standard is intricately connected with 7.PS1.3 as changes from a mixture into a pure substance result in a change to these physical properties. For instance, the mixture of two liquids

Learning Outcomes
- Identify the atomic number, chemical symbol, name, and average atomic mass of an element on the periodic table.
- Compare and contrast the properties of metals, nonmetals, and metalloids
- Describe the arrangement of elements in groups and periods on the periodic table.

Phenomena

Lithium, sodium, and potassium (alkali metals) are placed in different beakers of water to show how the chemical reactions tend to get more violent as we move down the first column of the periodic table. A trend is noticed as we move in a certain direction on the periodic table,

Curricular Materials
HMH Tennessee Science, TE pp. 140-153
Engage and Explore
- Elementary Learning Activity, TE p. 142
- Engage Your Brain #s 1-2, SE p. 111
- Active Reading #s 3-4, SE p. 111

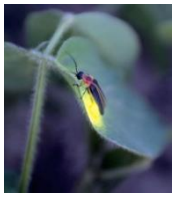
Explain
Information on the Periodic Table
- Visualize It! #5, SE p. 112
- Active Reading #6, SE p. 113
- Apply #7, SE p. 113
- Visualize It! #s 8-9, SE p. 115
- Analyze #10, SE p. 116
- Apply #11, SE p. 116
- Recognizing Patterns Quick Lab, TE p. 143 (SEP-Analyzing and interpreting data, obtaining, evaluating, and communicating information)

The Arrangement of Elements in the Periodic Table
- Identify #12, SE p. 117

with differing pHs can create a new substance with a unique pH. Discussions should include both pure elemental substances and pure compounds. Use of the periodic table should also include similarities in physical and chemical properties of compounds formed from a metal and a non-metal (ionic compounds), compared with compounds formed from a pair of non-metals (molecular compounds). **Misconception(s)** Students may have the misconception that the periodic table is organized according to only one characteristic such as size or chemical activity. Actually, there are several characteristics of elements form the basis of the periodic table. Students may also think that all atoms of a given element are identical and that they all have one unique mass. In fact, not all atoms of an atom are identical, and an element's atomic mass listed on the periodic table is a weighted average of the various isotopes of that element. **Suggested Science and Engineering Practice(s)** <u>Analyzing and interpreting data</u> Students should create and analyze graphical presentations of data to identify linear and non-linear relationships, and consider statistical	properties tend to increase or decrease. Click on the picture to play the video.  Fireworks rely on the chemical characteristics of the elements that are used to make them. The properties of elements react with others to display the beautiful colors that we see. Click on the picture to play the video.	• Active Reading #13, SE p. 118 • Think Outside the Book #14, SE p. 119 • Analyze #15, SE p. 119 • Analyze #16, SE p. 119 • What Trends Can You See in the Periodic Table Virtual Lab, TE p. 143 <u>Extend</u> Reinforce and Review • Concept Map Graphic Organizer, TE p. 46 • Visual Summary, SE p. 120 Going Further • Biology Connection, TE p. 146 <u>Evaluate</u> Formative Assessment • Throughout TE • Lesson Review, SE p. 121 • Reteach, TE p. 147 Summative Assessment • The Periodic Table Alternative Assessment, TE p. 147 • Lesson Quiz **Additional Resources** Periodic Table STUDY JAMS! Video

features within data and evaluate multiple data sets for a single phenomenon. **Suggested Crosscutting Concept(s)** Patterns Students recognize, classify, and record patterns for macroscopic phenomena based on microscopic structure.		

UNIT 1: Interactions of Matter (9 weeks)			
Overarching Question(s)			
How can one explain the structure, properties, and interactions of matter?			
Unit 1, Lesson 9	**Lesson Length**	**Essential Question**	**Vocabulary**
Chemical Reactions	2 weeks	How are chemical reactions modeled?	chemical reaction, exothermic reaction, endothermic reaction, law of conservation of energy, law of conservation of mass, chemical formula, chemical equation, reactant, product
Standards and Related Background Information		**Instructional Focus**	**Instructional Materials**
DCI(s) PS1: Matter and Its Interactions **Standard(s)** 7.PS1.4 Analyze and interpret chemical reactions to determine if the total number of atoms in the reactants and products support the Law of Conservation of Mass. **Explanation(s)** Students are expected to be able to interpret chemical formulae to determine the number and identity of different atoms taking part in a chemical reaction. Treatment of reactions should include the handling of polyatomic ions when these ions are present in both the reactants and products. A grade level definition of polyatomic		**Learning Outcomes** • Describe what happens to the atoms of a substance during a chemical reaction. • Identify signs that a chemical reaction take place. • Identify and describe the parts of a chemical formula. • Identify the reactants and products in a chemical reaction. • Balance a chemical equation to demonstrate that chemical reactions observe the law of conservation of mass. • Compare exothermic and endothermic reactions. • Describe how chemical reactions observe the law of conservation of energy.	**Curricular Materials** HMH Tennessee Science, TE pp. 154-167 <u>Engage and Explore</u> • Engage Your Brain #1 and 2, SE p. 123 • Active Reading #3, SE p. 123 <u>Explain</u> Chemical Reactions • Chemical Changes in Apples Daily Demo, TE p. 156 • Visualize It! #5, SE p. 124 • Breaking Bonds in a Chemical Reaction Quick Lab, TE p. 157 (SEP: Analyzing and Interpreting Data, Constructing Explanations and Designing Solutions, Engaging in Arguments from Evidence) Chemical Equations • Identify It! #6, SE p. 125

ions is a literal interpretation of the name that these are a set of atoms that function as a single atom. It is important to note that the coefficients proceeding a substance in a reaction represent the number of atoms/molecules/formula units or moles in a balanced reaction. In high school, these coefficients will be used to determine mole ratios, so beginning to use the term mole is helpful. Since the word mole literally translates, to "lump" there is no need to define an actual amount in a mole. *(Discussion of molar mass and Avogadro's Number are beyond the scope of this standard. Quantitative evaluation is limited to determining the number of each type of element or polyatomic ions in a reaction.)* **Misconception(s)** Explain that new elements cannot appear in the product of a chemical reaction. The only elements that are present are the ones in the substances of the reactants. The substances have broken apart and the elements are bonded differently and form new substances. **Suggested Science and Engineering Practice(s)** <u>Analyzing and interpreting data</u> Students should create and analyze graphical presentations of data to identify linear and non-	• Describe factors that affect the rate of a chemical reaction. **Phenomena**  Fireflies produce a chemical reaction inside their bodies that allows them to light up. This type of light production is called bioluminescence. The method by which fireflies produce light is perhaps the best known example of bioluminescence. When oxygen combines with calcium, adenosine triphosphate (ATP) and the chemical luciferin in the presence of luciferase, a bioluminescent enzyme, light is produced. Unlike a light bulb, which produces a lot of heat in addition to light, a firefly's light is cold light, without a lot of energy being lost as heat. This is necessary because if a firefly's light-producing organ got as hot as a light bulb, the firefly would not survive the experience.	• Visualize It! #s 7-8, SE p. 125 • Active Reading #9, SE p. 126 • Do the Math #10, p. 127 • Think Outside the Book #11, SE p. 127 Energy • List #12, SE p. 128 • Active Reading #13, SE p. 129 • Compare #14, SE p. 129 Reaction Rates • Active Reading #15, SE p. 130 • Catalysts and Chemical Reactions Quick Lab, TE p. 157 (SEP: Analyzing and Interpreting Data, Planning and Carrying Out Controlled Investigations) • What Factors Affect the Rate of a Chemical Reaction? Virtual Lab, TE p. 157 <u>Extend</u> Reinforce and Review • Visual Summary, SE p. 132 Going Further • Art Connection, TE p. 160 • Why It Matters: Enzymes, SE p. 131 <u>Evaluate</u> Formative Assessment • Throughout TE • Lesson Review, SE p. 133 • Reteach, TE p. 1617 Summative Assessment

linear relationships, consider statistical features within data and evaluate multiple data sets for a single phenomenon. **Suggested Crosscutting Concept(s)** Energy and Matter Students demonstrate conservation of mass in physical and chemical changes.	 The phenomena of a burning candle is used to introduce the idea of reactants and products. Click on the picture to view the teacher notes and lesson related to the phenomena.	• Modeling Chemical Equations Activity, TE p. 168 • Balancing Chemical Equations Think Science, SE p. 134-135 • Looking at Chemical Reactions Alternative Assessment, TE p. 161 • Lesson Quiz • Unit 2 Connect Essential Questions, SE p. 136 • Unit 2 Think Outside the Book, SE p. 136 • Unit 2 Review, SE p. 137-140 **Additional Resources** • What is a Chemical Reaction? • Balancing Chemical Equations PhET Interactive Simulations • Baggie Chemistry • Maintaining Mass • 7.PS1.4 Student Activity, Balancing Equations Mat, and Teacher Guide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