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 provide 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.

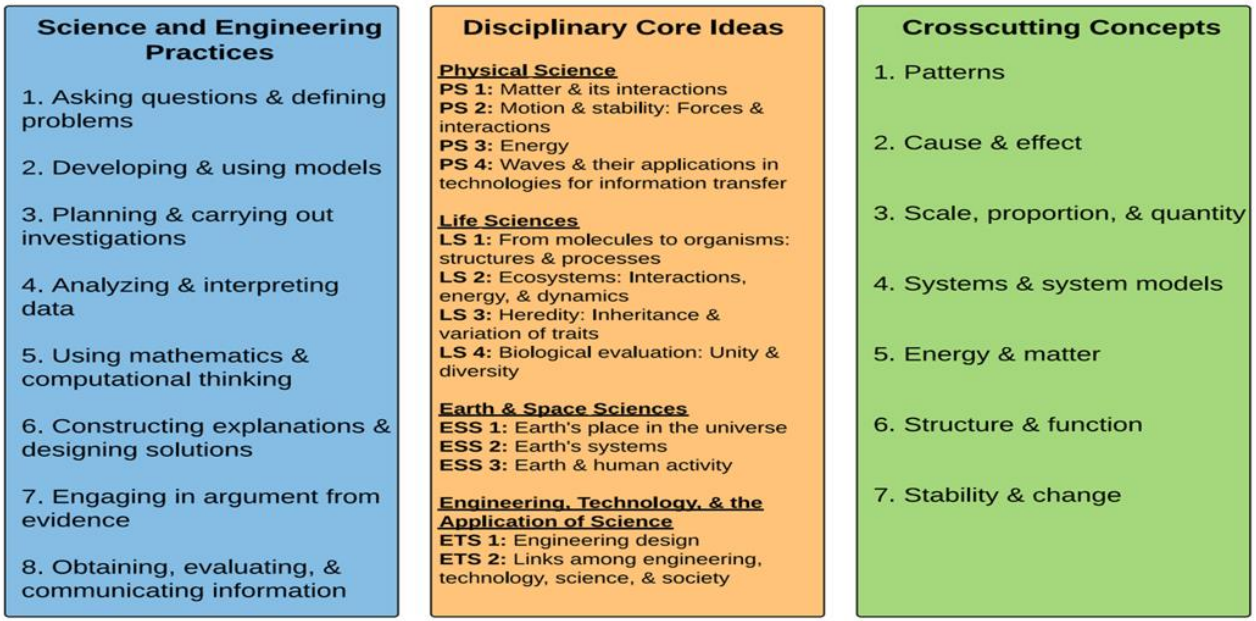
The Tennessee Academic Standards for Science were developed using the National Research Council's 2012 publication, A Framework for K-12 Science Education as their foundation. The framework presents a new model for science instruction that is a stark contrast to what has come to be the norm in science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

5th Grade Quarter 4 Curriculum Map Quarter 4 Curriculum Map Feedback							
Quarter 1		Quarter 2		Quarter 3		**Quarter 4**	
Structure and Routine	Unit 1 The Solar System and Beyond	Unit 2 Structure and Functions of Living Things	Unit 3 Traits and Heredity	Unit 4 Learn from the Past	Unit 5 Matter	**Unit 6 Physical and Chemical Changes**	Unit 7 Forces and Motion
1 week	8 weeks	3 weeks	6 weeks	4 weeks	5 weeks	**5 weeks**	4 weeks

UNIT 6: Physical and Chemical Changes (4 weeks)

Overarching Question(s)

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

Unit 6: Lesson 1	Lesson Length	Essential Question	Vocabulary
Physical Changes	1 week	What happens to the amount of matter when it changes state?	boiling point, freezing point, physical change, conservation of mass, melting point

Standards and Related Background Information

DCI(s)

5.PS1 Matter and Its Interactions

Standard(s)

5.PS1.1: Analyze and interpret data from observations and measurements of the physical properties of matter to explain phase changes between a solid, liquid, or gas.

5.PS1.2: Analyze and interpret data to show that the amount of matter is conserved even when it changes form, including transitions where matter seems to vanish.

Instructional Focus

Learning Outcomes

Students will be able to show conservation of matter during a change in state.

Suggested Phenomenon

Click on the phenomenon picture to view the video.

Frozen Waterfall

Instructional Resources

Curricular Resources

Engage

Inspire Science TE, p. 205-207

Be a Scientist Notebook, p. 207: Phenomenon

TE, p. 205: Phenomenon

TE, Essential Question, p. 206

TE, Science and Engineering Practices, p. 207

Explore

TE, pp. 207-209

(LAB) Be a Scientist Notebook, p. 209, Inquiry Activity: Frozen or Unfrozen

Explain

5.PS1.3: Design a process to measure how different variables (temperature, particle size, stirring) affect the rate of dissolving solids into liquids. 5.PS1.4: Evaluate the results of an experiment to determine whether the mixing of two or more substances result in a change of properties. **Explanation(s)** 5.PS1.1 Bulk properties of matter are physical properties that are observable when there is more than one particle of that substance in a pure form. For example, water will change from a liquid to a solid at 100oC when a sample of water is pure. Bulk properties can be used to identify a sample of matter. Students have been exposed to some physical properties such as hardness or reflectivity in 3.PS1.1. Third grade students do not have the background in math necessary to make measurements during phase changes, so physical properties such as boiling point and melting point are introduced in fifth grade. A sample of paraffin wax (e.g. manicurist wax), melted in a water bath will refreeze at room temperature and permit freezing point data collection. (Students should observe data gathered during a phase change, but students are not expected to explain a particle level cause for phase changes.)	Phenomenon Explanation: Cooling the substance reverses the state change. A change of state is a physical change because the substance does not change into a different substance, even though it may look, act, or feel different. The molecules have not changed.	TE, pp. 209-214 Be a Scientist Notebook, p. 212, Vocabulary Science Handbook/eBook: Physical Properties Science Handbook/eBook: Changes in Matter Science Handbook/eBook: Mass and Volume Simulation: Particles in Matter Elaborate TE, p. 215 *(LAB)* Be A Scientist Notebook, p. 215, Inquiry Activity/Simulation: Temperature Points Evaluate TE, pp. 215-217 *(LAB)* Be A Scientist Notebook, p. 215, Performance Task: Build a Dam eAssessment Additional Resources Lesson: Day 1 Physical Versus Chemical Changes Lesson: Day 2 Physical Verses Chemical Changes Video: Particle Model of Matter Video: Matter Compilation: Crash Course Kids **ESL Supports and Scaffolds** **WIDA Standard 4** To support students in speaking refer to this resource: WIDA Doing and Talking Science

5.PS1.2 This standard can be used to gather evidence for the idea that matter does not cease to exist simply because we can no longer see it. This idea is introduced in third grade, and reinforced again. "Transitions where matter seems to vanish" can include both evaporation of a pure substance, dissolving a solid into a liquid, or combining of two substances to form a gas. Demonstration might include: evaporation of a liquid, melting a solid, dissolving salt or sugar into water or dropping antacid tablets into a glass of water, producing gas. Students can make measure the masses of these systems before and after combining to provide evidence for the law of conservation of mass even when particles seem to vanish. 5.PS1.3 Students can create experiments to investigate the relationships between these variables. Care should be taken to ensure that subsequent trails are comparable by using controls. For example, if studying the effect of varying temperature on dissolving a solid, equal amounts of solid should be utilized. This standard can be connected to 5.PS1.2 since the process of dissolving the solids might appear to cause matter to vanish. 5.PS1.4		When applicable- use Home Language do build vocabulary in concepts. Spanish Cognates Pre-teach: **(consider teaching additional vocabulary to support Entering Level ELs)** State, change States of matter video States of matter visuals Create a word wall with visuals and vocabulary that you would like students to use in speaking and writing. Sentence stems for observations: I observed -----. When I touch the ------, I feel . The has---------- . I noticed ---------. Explain sentence stems: An important reason for why (how) this happens is that . Another reason is that . I know this because . To support students with the scientific explanation: Question starters What's the connection between….?

When two different substances are combined, there are essentially two things that might happen: The two substances might become a new substance(s), or the two substances might simply become mixed together without changing. A change in properties is evidence that the substances have formed a new substance. If no change any properties have occurred, it is likely that the substances have merely mixed. Students should use the knowledge of physical properties of matter from 3.PS1.1 and 5.PS1.1 to evaluate two substances that have been mixed. **Suggested Science and Engineering Practice(s)** Analyzing and Interpreting Data Constructing Explanations and Designing Solutions **Suggested Crosscutting Concept(s)** Cause and Effect **Teacher Overview** Three states of matter are most familiar—solid, liquid, and gas. The state of matter depends on the thermal energy of its particles and the attractive forces between the particles. In a solid, the attractive forces are strong enough to hold particles of matter rigidly in position. When a solid substance is heated, its particles gain thermal energy and begin to move relative to one another, but they remain close together. Further heating		What link do you see between… Why do you think…? What is our evidence that…. Do we have enough evidence to make that claim? But what about this other evidence that shows…? <u>Response Starters</u> I agree with you because of (evidence or reasoning) I don't agree with your claim because of (evidence or reasoning) This evidence shows that…

adds more energy to the particles. Eventually, the particles gain enough energy that they break away from one another and move independently. This is the gas state. Cooling the substance reverses the state change. A change of state is a physical change because the substance does not change into a different substance, even though it may look, act, or feel different. The molecules have not changed. During any change of state, the amount of matter does not change. **Misconception** Students may think that a substance becomes a different substance during a change of state. Have students rip a piece of paper or smash a cracker to demonstrate physical changes. A common misconception about conservation of mass is that the total mass increases in a precipitation reaction because the precipitate produced is solid and heavier than a liquid.		

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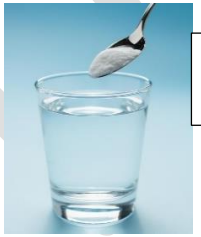
1 week	8 weeks	3 weeks	6 weeks	4 weeks	5 weeks	**5 weeks**	4 weeks

UNIT 6: Physical and Chemical Changes (4 weeks)

Overarching Question(s)

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

Unit 6: Lesson 2	Lesson Length	Essential Question	Vocabulary
Mixtures and Solutions	2 weeks	What happens when different types of matter are mixed?	mixture, solution, solubility, colloid, distillation

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) 5.PS1 Matter and Its Interactions **Standard(s)** 5.PS1.3: Design a process to measure how different variables (temperature, particle size, stirring) affect the rate of dissolving solids into liquids. 5.PS1.4: Evaluate the results of an experiment to determine whether the mixing of two or more substances result in a change of properties.	**Learning Outcomes** Students will be able to show that mass is conserved when different substances are mixed together. **Suggested Phenomenon** *Click on the phenomenon picture to view the video.*  Creating a solution of saltwater mixture.	**Curricular Resources** Engage Inspire Science TE, p. 219-220 Be a Scientist Notebook, p. 221: Phenomenon TE, p. 219: Phenomenon TE, Essential Question, p. 220 TE, Science and Engineering Practices, p. 220 Explore TE, pp. 221-222 *(LAB)* Be a Scientist Notebook, p. 223, Inquiry Activity: Solubility Solutions Explain

Explanation(s) 5.PS1.3 Students can create experiments to investigate the relationships between these variables. Care should be taken to ensure that subsequent trails are comparable by using controls. For example, if studying the effect of varying temperature on dissolving a solid, equal amounts of solid should be utilized. This standard can be connected to 5.PS1.2 since the process of dissolving the solids might appear to cause matter to vanish. 5.PS1.4 When two different substances are combined, there are essentially two things that might happen: The two substances might become a new substance(s), or the two substances might simply become mixed together without changing. A change in properties is evidence that the substances have formed a new substance. If no change any properties have occurred, it is likely that the substances have merely mixed. Students should use the knowledge of physical properties of matter from 3.PS1.1 and 5.PS1.1 to evaluate two substances that have been mixed. **Suggested Science and Engineering Practice(s)** Constructing Explanations and Designing Solutions	Phenomenon Explanation: A mixture represents a type of physical change in which the components do not chemically bind to each other. Therefore, the components usually retain their individual properties. Solutions are mixtures that blend completely and cannot be quickly or easily separated back into their original parts.	TE, pp. 222-226 Be a Scientist Notebook, p. 225, Vocabulary Simulation: Mixtures in Action Elaborate TE, pp. 226-227 *(LAB)* Be A Scientist Notebook, p. 228, Inquiry Activity: Separating Mixtures Evaluate TE, pp. 228-229 *(LAB)* Be A Scientist Notebook, p. 230, Performance Task: Making Mixtures eAssessment Additional Resources Lesson: Separating Mixtures Pre-Requisite Lesson: Separating Mixtures Discovery Video: Solution, Solvent, Solute **ESL Supports and Scaffolds** **WIDA Standard 4** To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable- use Home Language do build vocabulary in concepts. Spanish Cognates Pre-teach: **(consider teaching additional vocabulary to support Entering Level ELs)** State, change, conserved, mixture

Obtaining, Evaluating, and Communicating Information **Suggested Crosscutting Concept(s)** Cause and Effect **Teacher Overview** A mixture represents a type of physical change in which the components do not chemically bind to each other. Therefore, the components usually retain their individual properties. Solutions are mixtures that blend completely and cannot be quickly or easily separated back into their original parts. Most of the mixtures and solutions we use in our everyday lives are combined chemically, resulting in new materials such as foams, chemical products, or even metal mixtures called alloys. Colloids are important in both the natural environment and for manufactured products. A colloid is a mixture of at least two types of substances. The substances do not change; each retains its own properties. The particles do not settle out of the mixture and cannot be seen. **Misconceptions** Students may be under the impression that mixtures and solutions can be made only by combining a solid and a liquid, such as sugar and water. Explain that mixtures can be made by		Create a word wall with visuals and vocabulary that you would like students to use in speaking and writing. Sentence stems for observations: I observed -----. The has---------- . I noticed ---------. Cause and effect vocabulary: highlight these signal words to support students in speaking and writing about the topic. • So • Because • Since • If ... Then ... • Therefore • This led to • Reason why • As a result • May be due to • Effect of • Consequently • For this reason Explain sentence stems: An important reason for why (how) this happens is that . Another reason is that . I know this because . To support students with the scientific explanation: <u>Question starters</u> What's the connection between….? What link do you see between… Why do you think…? What is our evidence that…. Do we have enough evidence to make that claim?

combining substances in any state of matter—solid, liquid, or gas. The two substances may be of the same state, such as two solids, or two different states, such as a liquid and a gas. The air we breathe is a mixture of several gases. Students should be aware that the number of possible mixtures and solutions is limitless. A colloid mixture has particles that are not as small as a solution and not as large as a suspension. The particles are intermediate in size. What makes the colloid mixture unique is that the particles, though larger than those in a solution, are still evenly distributed and remain that way. Examples of colloid mixtures are shampoo, hair conditioner, and bath gel.		But what about this other evidence that shows…? <u>Response Starters</u> I agree with you because of (evidence or reasoning) I don't agree with your claim because of (evidence or reasoning) This evidence shows that…

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Structure and Routine	Unit 1 The Solar System and Beyond	Unit 2 Structure and Functions of Living Things	Unit 3 Traits and Heredity	Unit 4 Learn from the Past	Unit 5 Matter	**Unit 6 Physical and Chemical Changes**	Unit 7 Forces and Motion
1 week	8 weeks	3 weeks	6 weeks	4 weeks	5 weeks	**5 weeks**	4 weeks

UNIT 6: Physical and Chemical Changes (4 weeks)

Overarching Question(s)

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

Unit 6: Lesson 3	Lesson Length	Essential Question	Vocabulary
Chemical Changes	2 weeks	How does matter change when it interacts with other matter?	chemical properties, chemical change, chemical reaction, precipitate

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) 5.PS1 Matter and Its Interactions **Standard(s)** 5.PS1.2: Analyze and interpret data to show that the amount of matter is conserved even when it changes form, including transitions where matter seems to vanish. 5.PS1.4: Evaluate the results of an experiment to determine whether the mixing of two or more substances result in a change of properties.	**Learning Outcomes** Students will be able to determine if mixing certain substances results in a chemical reaction. **Suggested Phenomenon** *Click on the phenomenon picture to view the video.* 	**Curricular Resources** Engage Inspire Science TE, p. 231-233 Be a Scientist Notebook, p. 235: Phenomenon TE, p. 231: Phenomenon TE, Essential Question, p. 232 TE, Science and Engineering Practices, p. 233 Explore TE, pp. 233-235 *(LAB)* Be a Scientist Notebook, p. 237, Inquiry Activity: Conservation of Mass

Explanation and Suggestion of Standard 5.PS1.2 This standard can be used to gather evidence for the idea that matter does not cease to exist simply because we can no longer see it. This idea is introduced in third grade, and reinforced again. "Transitions where matter seems to vanish" can include both evaporation of a pure substance, dissolving a solid into a liquid, or combining of two substances to form a gas. Demonstration might include: evaporation of a liquid, melting a solid, dissolving salt or sugar into water or dropping antacid tablets into a glass of water, producing gas. Students can make measure the masses of these systems before and after combining to provide evidence for the law of conservation of mass even when particles seem to vanish. 5.PS1.4 When two different substances are combined, there are essentially two things that might happen: The two substances might become a new substance(s), or the two substances might simply become mixed together without changing. A change in properties is evidence that the substances have formed a new substance. If no change any properties have occurred, it is likely that the substances have merely mixed. Students should use the knowledge of physical properties of	Phenomenon Explanation: Burning is a chemical change. The matter undergoes a transformation to produce a new type of matter with a different chemical composition.	Explain TE, pp. 235-239 Be a Scientist Notebook, p. 239, Vocabulary Science Handbook/eBook: Chemical Changes Digital Interaction: Types of Chemical Change Elaborate TE, pp. 239-241 Be A Scientist Notebook, p. 242, Inquiry Activity: Rate of Reaction Evaluate TE, pp. 241-243 *(LAB)* Be A Scientist Notebook, p. 245, Performance Task: Changes in Matter eAssessment Additional Resources Lesson: Physical Changes Versus Chemical Changes Video: Physical and Chemical Changes Video: The Physical and Chemical Properties of Matter **ESL Supports and Scaffolds** **WIDA Standard 4** To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable- use Home Language do build vocabulary in concepts. Spanish Cognates

matter from 3.PS1.1 and 5.PS1.1 to evaluate two substances that have been mixed. **Suggested Science and Engineering Practice(s)** Analyzing and Interpreting Data Obtaining, Evaluating, and Communicating Information **Suggested Crosscutting Concept(s)** Cause and Effect Energy and Matter **Teacher Overview** A chemical reaction occurs when two or more molecules interact. The bonds between the atoms are broken, and a new substance is formed. A reaction may include atoms, ions, compounds, or molecules of a single element. Physical changes accompany many chemical reactions, such as the emission of heat or light, the formation of a precipitate, the evolution of a gas, or a change in color. There is a difference between a chemical change and a chemical reaction. In a chemical reaction, different substances combine and produce a new substance with new and different physical and chemical properties. A chemical change is any change that results in the formation of new chemical substances. At the molecular level, chemical change involves making or breaking bonds between atoms.		Pre-teach: **(consider teaching additional vocabulary to support Entering Level ELs)** State, change Visual supports for knowing if a chemical reaction has occurred. Create a word wall with visuals and vocabulary that you would like students to use in speaking and writing. Sentence stems for observations: I observed -----. The has---------- . I noticed ---------. Cause and effect vocabulary: highlight these signal words to support students in speaking and writing about the topic. • So • Because • Since • If ... Then ... • Therefore • This led to • Reason why • As a result • May be due to • Effect of • Consequently • For this reason Explain sentence stems: An important reason for why (how) this happens is that . Another reason is that . I know this because .

Misconceptions Some students may think that matter is used up during a chemical reaction or that atoms are fundamentally changed. During a chemical reaction, atoms link together in new ways to create new substances that are different from the original substances. The amount of matter does not change, simply takes on a different form. Students may have difficulty distinguishing between a chemical change and a change of state, which is a physical change. Help students overcome this misconception by explaining that with a chemical change a new substance is formed, and the process is difficult to reverse. The original chemicals change into an entirely different substance that has a different chemical composition.		To support students with the scientific explanation: <u>Question starters</u> What's the connection between….? What link do you see between… Why do you think…? What is our evidence that…. Do we have enough evidence to make that claim? But what about this other evidence that shows…? <u>Response Starters</u> I agree with you because of (evidence or reasoning) I don't agree with your claim because of (evidence or reasoning) This evidence shows that…

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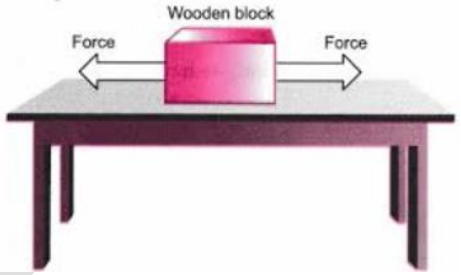
1 week	8 weeks	3 weeks	6 weeks	4 weeks	5 weeks	5 weeks	**4 weeks**

UNIT 6: Forces and Motion (4 weeks)

Overarching Question(s)

How can one explain and predict interactions between objects and within systems of objects?

Unit 7: Lesson 1	Lesson Length	Essential Question	Vocabulary
Motion	2 weeks	How can you tell whether something is moving?	Position, distance, direction, motion, speed

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) 5.PS2: Motion and Stability: Forces and Interactions 5.ETS1: Engineering Design **Standard(s)** 5.PS2.1: Test the effects of balanced and unbalanced forces on the speed and direction of motion of objects. 5.PS2.2: Make observations and measurements of an object's motion to provide evidence that pattern can be used to predict future motion.	**Learning Outcomes** Students will be able to create a model to show knowledge of patterns of motion. **Suggested Phenomenon** *Click on the phenomenon picture to view the video.*  	**Curricular Resources** Engage Inspire Science TE, p. 249-250 Be a Scientist Notebook, p. 253: Phenomenon TE, p. 249: Phenomenon TE, Essential Question, p. 250 TE, Science and Engineering Practices, p. 250 Explore TE, pp. 250-251 *(LAB)* Be a Scientist Notebook, p. 255, Inquiry Activity: An Object's Position Explain TE, pp. 252-258

5.ETS1.1: Research, test, re-test, and communicate a design to solve a problem. 5.ETS1.2: Plan and carry out tests on one or more elements of a prototype in which variables are controlled and failure points are considered to identify which elements need to be improved. Apply the results of tests to redesign the prototype. 5.ETS1.3: Describe how failure provides valuable information toward finding a solution **Explanation and Suggestion of Standard** 5.PS2.1 Students discuss "pushes" and "pulls" in second grade, and learn to use the proper term "forces" in third grade. Descriptions of forces should include both the strength of the force and the direction that it pushes/pulls. Objects at rest usually have multiple pushes or pulls acting on them, but the forces work against each other. They add up to a net force of zero. When sum of the pushes and pulls is not zero, the motion of the object will change: speed up, slow down, or change direction. Students should use conditions of constant motion— including rest—to infer a system of forces acting on an object. For example, if a person is standing and a student recognizes that gravity holds the person on Earth,	Phenomenon Explanation: The presence of an opposite force causes objects to stop moving. The wooden block is at rest (not moving) because the table stops it from moving downward toward the pull of gravity. No force is pushing or pulling the block across the table.	Be a Scientist Notebook, p. 257, Vocabulary Science Handbook/eBook: Position and Motion Video: Things Move Science Handbook/eBook: Distance and Direction *(LAB)* Be A Scientist Notebook, p. 259, Inquiry Activity: Measure an Object's Speed Elaborate TE, p. 259 *(LAB)* Be A Scientist Notebook, p. 263, Inquiry Activity: Moving Through Time Evaluate TE, pp. 260 *(LAB)* Be A Scientist Notebook, p. 264, Performance Task: Motion Models eAssessment Additional Resources Lesson: Newton's Laws of Motion Simulation Lesson: Turning Motion Video: Bill Nye: Motion Video: Motion and Types Video: What is Inertia? **ESL Supports and Scaffolds** **WIDA Standard 4** To support students in speaking refer to this resource: WIDA Doing and Talking Science

the student should be able to infer that there must be a second force acting on the person that opposes gravity, otherwise the person would be sinking into the Earth. Students can solve problems conceptually, but arriving at quantitative solutions is beyond the scope of the standard. For example, students can evaluate that a 3N force acting to the right and a 2N force acting to the left is unbalanced (a net force exists) and will therefore change the motion of the object. However, students are not expected to compute that the net force has a strength of 1N. (Tennessee math standards do not introduce positive and negative values as representations for opposite directions until sixth grade (6.NS.C.5).) 5.PS2.2 In 8.PS2, students will examine systems where objects move at a constant speed. With constant speed, the pattern in an objects motion involves moving the same distance with each equal interval of time. Standard 5.PS2.2 introduces the idea that there can be patterns in motion by looking at types of motion where the pattern is more obvious, cyclic motion. Examples could include, a pendulum swinging back and forth, a heavy object bobbing up and down at the end of a spring, or a carousel traveling repeatedly around the same circular track, etc. It is possible		When applicable- use Home Language do build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Force and motion video Force and motion visuals Sentence stems: I notice….. I observed that…. My evidence is…. I learned/discovered/heard that Create a word wall with visuals and vocabulary that you would like students to use in speaking and writing. Sentence stems for observations: I observed -----. The has---------- . I noticed ---------. Cause and effect vocabulary: highlight these signal words to support students in speaking and writing about the topic. • So • Because • Since • If ... Then ... • Therefore • This led to • Reason why • As a result • May be due to • Effect of • Consequently • For this reason

to study cyclic motion in order to make predictions about the behavior of the object in the future. For example, by studying the time it takes a pendulum to swing back and forth, it becomes possible to predict the moments in time the pendulum will return to its starting position. In their experimental designs, students should be responsible for selecting and measuring properties of the system that show a repeated pattern in the object's motion. This will generally include a measurement of the time needed to complete a cycle of motion. 5.ETS1.1 In order to effectively design a solution for a given problem, it is imperative that engineers become experts in the relevant fields. Students can use a deliberately crafted problem as a focal point for the design of a solution to the problem. Research driven by the need to solve a problem may provide a way for students to explore new concepts/phenomena. Communication may involve brainstorming possible solutions as well as presenting the results of the designed tests. Students might undertake design tasks which investigate how forces interact during a collision. In support of 5.LS1.1, students model pathways where an electronic device detects information from its surroundings and responds accordingly,		Explain sentence stems: An important reason for why (how) this happens is that . Another reason is that . I know this because . To support students with the scientific explanation: <u>Question starters</u> What's the connection between….? What link do you see between…

such as nightlights that turn on automatically, or garage door sensors for safety. 5.ETS1.2 Engineered objects are methodically tested before production. Tests are designed to stress certain components to determine the extremes to which a given component will remain functional. Student-developed tests should move beyond simply making a device and "trying it out" and should have tests designed to cause failure into a specified component. 5.ETS1.3 Failure is essential to both science and engineering. Without failure it is not possible to understand the limitations or shortcomings of a device or explanation. Students should be encouraged to embrace productive failure as part of the design process to encourage persistent exploration. Discussions can include failure in the context of a specific design for a device which fails to pass stress tests, as well as the notion that an idea might be considered "failing" when it does not provide sufficient explanation for some observation.		

Suggested Science and Engineering Practice(s) Planning and Carrying Out Investigations Obtaining, Evaluating, and Communicating Information **Suggested Crosscutting Concept(s)** Patterns **Teacher Overview** The universe is moving, so everything in it moves. Some movement is so slow, or so slight, that it is hard to observe. You can tell if something is moving by observing its position relative to other objects. Movement occurs in a direction, and that direction can change. In this lesson, students will learn how to determine if something is moving and will make a model to demonstrate motion. **Misconceptions** Students may have the misconception that a change in position fully explains motion, but motion also involves distance and time. Students may also think that speed and velocity are the same; however, velocity incorporates both speed and the direction of the moving object.		

5th Grade Quarter 4 Curriculum Map Quarter 4 Curriculum Map Feedback							
Quarter 1		Quarter 2		Quarter 3		**Quarter 4**	
Structure and Routine	Unit 1 The Solar System and Beyond	Unit 2 Structure and Functions of Living Things	Unit 3 Traits and Heredity	Unit 4 Learn from the Past	Unit 5 Matter	Unit 6 Physical and Chemical Changes	**Unit 7 Forces and Motion**
1 week	8 weeks	3 weeks	6 weeks	4 weeks	5 weeks	5 weeks	**4 weeks**

UNIT 6: Forces and Motion (4 weeks)

Overarching Question(s)

How can one explain and predict interactions between objects and within systems of objects?

Unit 7: Lesson 2	Lesson Length	Essential Question	Vocabulary
Forces Can Change Motion	2 weeks	How do forces change motion?	force, friction, balanced forces, unbalanced forces, acceleration

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) 5.PS2: Motion and Stability: Forces and Interactions **Standard(s)** 5.PS2.3: Use evidence to support that the gravitational force exerted by Earth on objects is directed toward the Earth's center. 5.PS2.4: Explain the cause and effect relationship between two factors (mass and distance) that affect gravity. 5.PS2.5: Explain how forces can create patterns within a system (moving in one direction, shifting back and	**Learning Outcomes** Students will be able to explain how forces can push and pull objects. **Suggested Phenomenon** *Click on the phenomenon picture to view the video.* 	**Curricular Resources** Engage Inspire Science TE, p. 263-264 Be a Scientist Notebook, p. 269: Phenomenon TE, p. 263: Phenomenon TE, Essential Question, p. 264 TE, Science and Engineering Practices, p. 264 Explore TE, pp. 264-265 *(LAB)* Be a Scientist Notebook, p. 271, Inquiry Activity: Force Affects the Way Objects Move

forth, or moving in cycles), and describe conditions that affect how fast or slowly these patterns occur. **Explanation and Suggestion of Standard** 5.PS2.3 The goal of this standard within the component idea is for students to begin to understand the force of gravity. Students should understand that gravity is a force, not just a vague thing that makes things fall down. This conceptual understanding of gravity should be explored very early in 5.PS2.1. People generally describe the location of Earth's center as "down" or "underneath us," regardless of our position. For example, "down" points in opposite directions to observers located on opposite sides of the world. We observe that all falling objects are pulled towards the center of the Earth, and will fall that direction ("down") if the force of gravity is the only force pulling on them. This pattern can only occur on a spherical planet. Thus, to accept the claim that objects fall "down" we must also argue that Earth is spherical. Evidence for Earth's spherical shape can be seen in: a ship sailing beyond the horizon, Earth's circular shadow on the moon, or the increasing altitude of the position of the North Star in the night sky as we travel from the equator towards the North Pole. Students should be clear that "down" may not be the same direction for two people.	Phenomenon Explanation: Newton's First Law of Motion says that an object in motion will remain in motion, or an object at rest will remain at rest, unless an outside force acts upon it. Forces can change the direction of an object. An object that is not moving is acted upon by balanced forces that keep it at rest. The ball is at rest while it sits on the ground. Kicking the ball (outside force) puts it into motion. The ball will travel in the direction that it is kicked.	<u>Explain</u> TE, pp. 266-274 Be a Scientist Notebook, p. 273, Vocabulary Science Handbook/eBook: Force Simulation: Balancing Forces Science Handbook/eBook: Force—Balanced and Unbalanced Forces *(LAB)* Be A Scientist Notebook, p. 275, Inquiry Activity: Balanced Forces Science Handbook/eBook: Force—Gravity Science Handbook/eBook: Friction <u>Elaborate</u> TE, pp. *(LAB)* Be A Scientist Notebook, p. 280, Inquiry Activity: Friction Affects Force <u>Evaluate</u> TE, pp. 276-277 *(LAB)* Be A Scientist Notebook, p. 282, Performance Task: Building Demolition eAssessment Additional Resources Lesson: Newton's Laws of Motion Simulation Lesson: Turning Motion Video: Bill Nye: Motion Video: Motion and Types Video: What is Inertia?

5.PS2.4 The force of gravity is only an attractive force. This different from the forces exerted by magnets that can be either attractive or repulsive. Students should know that all objects exert a force on each other, however this force is EXTREMELY small, unless the objects are very large. Examples of the effect of distance on gravity might include that astronauts eventually experience weightlessness as they get further from the surface of the earth. (Care should be taken when addressing gravity on the moon vs Earth as an example, because there are differences in both mass and distance (radius), so identifying a single cause for the changes to gravity cannot be attributed exclusively to mass or distance.) 5.PS2.5 This standard uncovers the forces that create the regular patterns of motion observed in 5.PS2.2. Objects moving back and forth could include a mass bobbing up and down at the end of a stretched spring, or a pendulum. In either case, student can observe that the motion of the object changes in repeated patters — every time the mass on a spring moves upwards, the spring's force causes it to speed up, until that force is decreased to the point where the force of gravity (unchanging during the cycle) becomes the dominant force. Objects moving in cycles could include a yo-yo while performing the "around the world" trick. Planets orbiting the sun are also examples of moving		**ESL Supports and Scaffolds** **WIDA Standard 4** To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable- use Home Language do build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Force and motion video Force and motion visuals Sentence stems: I notice….. I observed that…. My evidence is…. I learned/discovered/heard that

in cycles, but students understanding the invisible force of gravity may not be possible. The tension force exerted by a yo-yo string is more tangible than gravity. In circular motion, a single centrally-directed force is required. In other words, the strength (magnitude) of the forces does not change, but the direction that is pushes is constantly changing. With a yo-yo we observe that the string is always pulling the yo-yo towards the center of its circular path. If this force, disappears, the circular pattern of motion changes. **Suggested Science and Engineering Practice(s)** Planning and Carrying Out Investigations Obtaining, Evaluating, and Communicating Information **Suggested Crosscutting Concept(s)** Patterns **Teacher Overview** The universe is moving, so everything in it moves. Some movement is so slow, or so slight, that it is hard to observe. You can tell if something is moving by observing its position relative to other objects. Movement occurs in a direction, and that direction can change. In this lesson, students will learn how to determine if something is moving and will make a model to demonstrate motion.		

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