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.

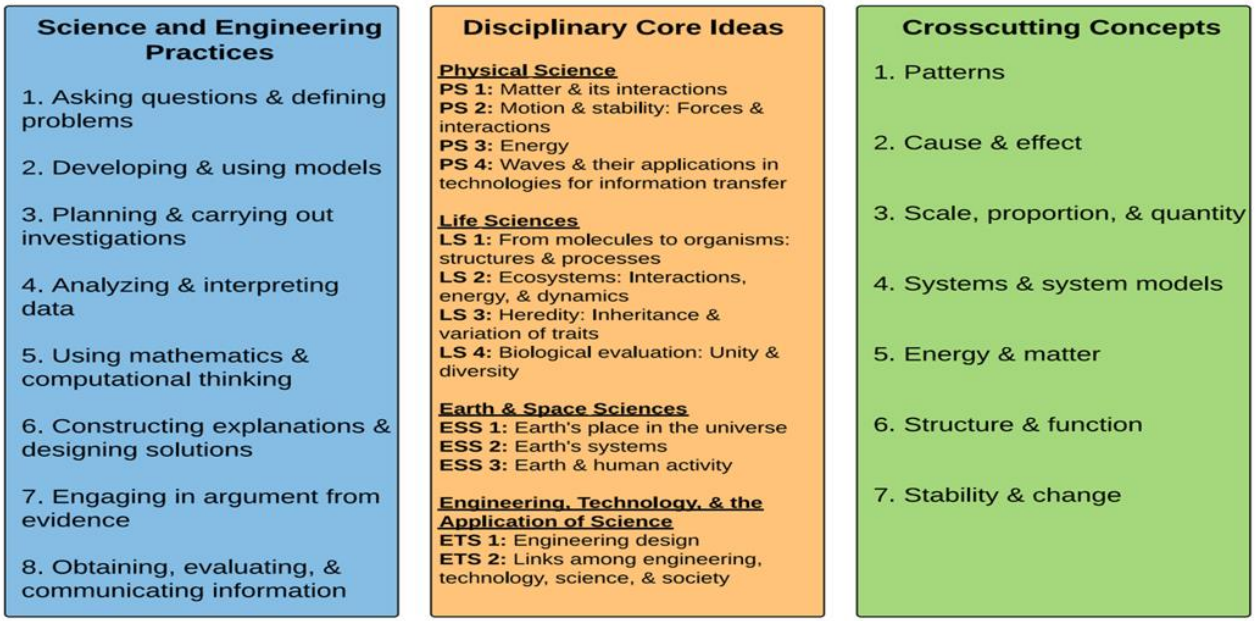
The Tennessee Academic Standards for Science were developed using the National Research Council's 2012 publication, A Framework for K-12 Science Education as their foundation. The framework presents a new model for science instruction that is a stark contrast to what has come to be the norm in science 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 3 Curriculum Map Quarter 3 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 4: Learn from the Past (4 weeks)

Overarching Question(s)

What evidence shows that different species are related?

Unit 4: Lesson 1	Lesson Length	Essential Question	Vocabulary
Things from Long Ago	2 weeks	What happened to organisms no longer living on Earth?	endangered, extinct

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) 5.LS4 Biological Change: Unity and Diversity **Standard(s)** 5.LS4.1: Analyze and interpret data from fossils to describe types of organisms and their environments that existed long ago. Compare similarities and differences of those to living organisms and their environments. Recognize that most kinds of animals (and plants) that once lived on Earth are now extinct.	**Learning Outcomes** Students will be able to explain why some animals are no longer found living on Earth. **Suggested Phenomenon** *Click on the phenomenon picture to view the video.*  **Mastodon**	**Curricular Resources** Engage Inspire Science TE, p. 77-78 Be a Scientist Notebook, p. 83: Phenomenon TE, Science in My World, p. 77: Phenomenon TE, Essential Question, p. 78 TE, Science and Engineering Practices, p. 78 Explore TE, pp. 78-79 *(LAB)* Be a Scientist Notebook, p. 85, Inquiry Activity: Model of Survival Explain

Explanation and Support of Standard 5.LS4.1 Plant and animal fossils can help scientists describe the past environment at a given location. For example, coal deposits are indicative of areas that were once swamps and marine fossils allow us to see that areas of land were once underwater. This standard asks students to make claims about the environment where the fossils lived. Since both plant and animal materials can become fossilized, information found in fossils can provide evidence about the environment at the time that organism lived. Evidence can be drawn from sets of fossils found geographically and chronologically near to each other, or by comparing the structure of fossils from extinct organisms to similar organisms still living. Claims can include descriptions of both habits and habitats of now extinct organisms. An example could include the bottom dwelling trilobite living mostly in water that was able to curl up much like today's pill bugs. Examples of fossils and their environments could include marine fossils that are now found on land, tropical plant fossils found	Phenomenon Explanation: There is no one definite cause of mass extinctions. Some causes are specific to certain groups of organisms. In general, mass extinctions are caused by gradual or catastrophic changes in the environment.	TE, pp. 80-85 Be a Scientist Notebook, p. 80, Vocabulary Science Handbook/eBook: Endangered or Extinct Digital Interaction: Extinct Animals Digital Interaction: Extinct and Protected Animals <u>Elaborate</u> TE, pp. 85-86 *(LAB)* Be A Scientist Notebook, p. 91, Inquiry Activity: Horseshoe Crab Research <u>Evaluate</u> TE, pp. 87-89 *(LAB)* Be A Scientist Notebook, p. 92, Performance Task: Research an Extinct Animal eAssessment Additional Resources Lesson: Researching the Endangered Pacific Northwest Tree Octopus Lesson: Endangered Species and Animal Classification Video: 10 Most Beautiful Endangered Animals on Planet Earth Video: Endangered Animals! Video: Endangered and Extinct Animals Video: 10 Extinct Animals Scientist Are Ready to Bring Back **ESL Supports and Scaffolds** WIDA Standard 4:

in the Arctic, and fossils of extinct organisms. **Suggested Science and Engineering Practice(s)** Analyzing and Interpreting Data **Suggested Crosscutting Concept(s)** Scale, Proportion, and Quantity **Teacher Overview** A plant or animal is extinct when the last member of the species dies. As long as plant and animal species have existed on Earth, species have been going extinct. Mass extinctions occur when many species have disappeared in a short time frame. The dinosaurs were wiped out at the end of the Cretaceous Period about 65 million years ago in a mass extinction. There are several explanations for mass extinctions including volcanic eruptions producing toxic gasses and particulates, falling sea levels, asteroid or comet impacts, global cooling, and global warming. Extinctions of individual species have occurred due to over-hunting, over-fishing, and habitat loss. Endangered species are those whose numbers are so low that they are in danger of becoming extinct.		The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Provide concept maps and graphic organizers to support students in explain how weathering and erosion change the earth's surface. Provide a word wall with vocabulary you would like students to use in speaking and writing. Provide sentence stems to support students in explaining: Weathering effects the surface of the earth by…. Erosion changes the earth by….. To support students with the scientific explanation: Question starters What's the connection between….? What link do you see between… Why do you think…?

Misconceptions Students might think that dinosaurs and humans existed on Earth at the same time. Dinosaurs disappeared from Earth about 65 million years ago, and humans appeared on Earth only 200 thousand years ago. Students might not realize that 90% of organisms that once lived on Earth have become extinct. There are many causes both natural and human-made. Some of these include over-hunting and habitat loss, as well as due to large-scale events such as volcanic eruptions and the ice age.		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…

5th Grade Quarter 3 Curriculum Map Quarter 3 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 4: Learn from the Past (3 weeks)

Overarching Question(s)

What evidence shows that different species are related?

Unit 4: Lesson 2	Lesson Length	Essential Question	Vocabulary
Fossils	2 weeks	What can we learn from fossils?	fossil, paleontologist, skeleton

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) 5.ESS1 Earth's Place in the Universe **Standard(s)** 5.ESS1.7: Use evidence from the presence and location of fossils to determine the order in which rock strata were formed. **Explanation and Support of Standard** 5.ESS1.7 Generally, the process of depositing sediment (4.ESS1.1) occurs extremely slowly when measured compared to a human lifetime. Our understanding of how	**Learning Outcomes** Students will explain what fossils are and how they were formed. **Suggested Phenomenon** *Click on the phenomenon picture to view the video.* 	**Curricular Resources** Engage Inspire Science TE, p. 91-92 Be a Scientist Notebook, p. 95: Phenomenon TE, Science in My World, p. 91: Phenomenon: TE, Essential Question, p. 92 TE, Science and Engineering Practices, p. 92 Explore TE, pp. 92-93 *(LAB)* Be a Scientist Notebook, p. 97, Inquiry Activity: Layers and Fossils Explain

sediment is deposited leads us to the Law of Super-position, that the lowest layers of sediment were deposited first. This intent of this standard is to explain the history of a particular locations on Earth, not a broad history of major events across the entire planet. However, some events are observed widely in strata. Once deposited, natural processes can impact the otherwise pristine bands of sediment that we might see. For example, the shifting of sedimentary bands due to earthquakes, or deep cuts through earth due to flowing water. It is possible to recreate a history of Earth by using fossil patterns. For example, we might find marine fossils in an area far away from the ocean. This same layer may contain fossils of land animals in strata that formed later. From such evidence we are able to recreate the history of a location. **Suggested Science and Engineering Practice(s)** Arguing from Evidence **Suggested Crosscutting Concept(s)** Scale, Proportion, and Quantity	Phenomenon Explanation: Fossils contain evidence of the types of organisms that lived in the past.	TE, pp. 94-98 Be a Scientist Notebook, p. 99, Vocabulary Science Handbook/eBook: Fossils Science Handbook/eBook: What Fossils Tell Us Science Handbook/eBook: Fossil Fuels Digital Interactive: Types of Fossils <u>Elaborate</u> TE, pp. 99 *(LAB)* Be a Scientist Notebook, p. 104, Close Read: Layers of Past Life <u>Evaluate</u> TE, pp. 100-101 *(LAB)* Be A Scientist Notebook, p. 105, Performance Task: Rock Strata Models eAssessment Additional Resources Lesson: Discovering Fossils; A Classroom Dig Lesson: Starting a Mind Map of Fossils Video: Rock Layers and Fossils for Kids Video: Bill Nye - Fossils Video: What Is A Fossil? **ESL Supports and Scaffolds** WIDA Standard 4: The Language of Science To support students in speaking refer to this resource:

Teacher Overview Fossils are the remains or impressions of a prehistoric organism preserved in petrified form, as a mold, or as a cast in rock. Scientists use fossils to learn about how Earth formed, about past environmental conditions such as temperature and humidity, and about how that organism might have lived and died. Fossils can help scientists learn more about the structure of those organisms, as well as how the organisms evolved over time. **Misconceptions** Students might have misconceptions that fossils can only be pieces of dead animals and plants. They might think that fossils only represent bones and shells of extinct animals. In fact, fossils can be footprints and other kinds of imprints. Students also might think that fossils of tropical plants cannot be found in cold or dry areas. They do not realize that the conditions on the planet today are not the same as in the past. They might also think that all plants and animals become fossils. Students need to understand that fossils do not form easily and are very rare to find.		WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Pre-teach vocabulary (consider teaching additional vocabulary to Entering Level ELs): Deposit; leads us Provide concept maps and graphic organizers to support students in explain how fossils are formed. Provide a word wall with vocabulary you would like students to use in speaking and writing. **Youtube:** How fossils are formed Getepic Fossils series Provide sentence stems to support students in explaining: Fossils are formed by… When….occurs a fossil will form…. A fossil is….

		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**	4 weeks	5 weeks

UNIT 5: Matter (5 weeks)

Overarching Question(s)

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

Unit 5: Lesson 1	Lesson Length	Essential Question	Vocabulary
Matter's Structure	2 weeks	How are the particles in matter organized?	matter, mass, volume, weight, density, buoyancy

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) 5.PS1 Matter and Its Interactions 5.ETS2 Links Among Engineering, Technology, Science and Society **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.	**Learning Outcomes** Students will design a model to show their understanding of the structure of the three states of matter. **Suggested Phenomenon** *Click on the phenomenon picture to view the video.* 	**Curricular Resources** Engage Inspire Science TE, p. 171-172 Be a Scientist Notebook, p. 173: Phenomenon TE, Science in My World, p. 171: Phenomenon: TE, Essential Question, p. 172 TE, Science and Engineering Practices, p. 172 Explore TE, pp. 172-174 *(LAB)* Be a Scientist Notebook, p. 175, Inquiry Activity: Compare Objects Explain

5.ETS2.1: Use appropriate measuring tools, simple hand tools, and fasteners to construct a prototype of a new or improved technology 5.ETS2.2: Describe how human beings have made tools and machines (X-ray cameras, microscopes, satellites, computers) to observe and do things that they could not otherwise sense or do at all, or as quickly or efficiently. 5.ETS2.3: Identify how scientific discoveries lead to new and improved technologies. **Explanation and Support of Standard** 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	Phenomenon Explanation: Matter is anything that has mass and takes up space. Matter is measured and described by its mass, weight, volume, density, and buoyancy. Matter is made of particles and can be in the general form of a solid, liquid, or gas. Matter is what makes up all the objects, materials, and substances in our natural world and throughout the universe.	TE, pp. 174-180 Be a Scientist Notebook, p. 177, Vocabulary Science Handbook/eBook: Mass and Weight Science Handbook/eBook: Physical Properties Video: Measuring Matter Science Handbook/eBook: Measuring Matter Digital Interaction: Particles in Matter <u>Elaborate</u> TE, pp. 180-182 Science Handbook/eBook: Volume, Density, and Buoyancy Be a Scientist Notebook, p. 181: Volume, Density, and Buoyancy *(LAB)* Be a Scientist Notebook, p. 182, Inquiry Activity: Density and Buoyancy <u>Evaluate</u> TE, pp. 182-185 *(LAB)* Be A Scientist Notebook, p. 184, Performance Task: Modeling Matter eAssessment Additional Resources Video: What is Matter? Lesson: States of Matter Part 1 Lesson: States of Matters Part 2 Video: Three States of Matter for Kids Video: States of Matter: Solid, Liquid, Gas **ESL Supports and Scaffolds**

do not have the background in math necessary to make measurements during phase changes, so physical properties such as boiling point and melting point have been 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.) 5.ETS2.1 In accordance with 5.NBT math standards, it is now reasonable for students to perform appropriately precise metric measurements. With any measuring device, a student should include one estimated place value. For example, measurements made with a typical centimeter ruler, which includes millimeter increments, should also contain an estimated value for the tenths of a millimeter. Using tools allows students to acquire two important engineering skills. Students can		WIDA Standard 4: The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals **Pre-teach vocabulary: (consider teaching additional vocabulary to Entering Level ELs)** **States of** **Model** **Demonstration** **explain** **Youtube:** states of matter Get Epic states of matter series Sentence stems: My model shows the states of matter by----- I have demonstrated the three states of matter by---- The three states of matter are-----

gain an understanding of how tools have enabled humans to build. Students acquire the ability to produce actual prototypes as part of the engineering process. This skill allows for development of more involved tests of components of a design. (It is beyond the intent of the standard for students to arrive independently at the level of uncertainty for the device they are using to measure. This information should be provided. For example, students should be told that the ruler described above has an uncertainty of +/-0.05cm.) 5.ETS2.2 Scientific understanding develops as scientists are able to observe and explain things in the natural world. Technology has enabled scientists to extend their senses through the use of tools. These tools allow data storage, complex mathematical models, and increased capacity to see smaller and smaller details. For example, remote telescopes can be sent into space to observe stars and galaxies too distant to be observed from Earth's surface.		Provide concept maps and graphic organizers to support students in explain the different states of matter. Provide a word wall with vocabulary you would like students to use in speaking and writing. 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…

5.ETS2.3 The processes of scientific discovery and technological evolution are symbiotic. Scientific understanding allows engineers to design systems differently and utilize materials to their fullest extent. This perpetuates the creation of new devices that are more efficient or powerful than previous versions. The new devices open new research opportunities and permit further scientific understanding. This cycle is perpetual. Examples may include taking a current piece of technology, viewing how the invention has developed through the years, and making predictions on how that technology might improve: (e.g., telegraph, telephone, and cell phone). **Suggested Science and Engineering Practice(s)** Analyzing and Interpreting Data **Suggested Crosscutting Concept(s)** Scale, Proportion, and Quantity **Teacher Overview** Matter is anything that has mass and takes up space. Matter can be measured and described by its mass, weight, volume,		

density, and buoyancy. The three states of matter—solid, liquid, and gas—are electrically neutral. Plasma is a fourth form of matter that consists of ions and freely moving electrons. Ions are atoms that have acquired an electrical charge by gaining or losing one or more electrons (subatomic particles that have a negative charge). Although plasma is like a very hot gas, it has properties that are distinct from those of solids, liquids, and gases. For this reason, scientists consider plasma to be a fourth state of matter. The matter inside stars and some of the gases between stars, which make up more than 99 percent of the known universe, are plasma. Plasmas are structurally more complex than solids, liquids, and gases. Plasma physics is a field of active research. **Misconceptions** Students may think that mass and weight are the same thing. The mass of an object remains constant, because it is the measure of the amount of matter in an object. The weight of an object is relative to the gravitational pull on the object. Whereas an object will have the same mass no matter where it is located, the weight of an object will be different on Earth than it		

would be on the Moon because of the difference in gravitational pull. Students may also think that there are only three states of matter: solid, liquid, and gas. Guide them in understanding that plasma is a fourth state of matter that is present throughout the universe and on Earth. Provide the example of lightning, which does not meet the definition of a solid, liquid, or gas.		

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

UNIT 5: Matter (5 weeks)

Overarching Question(s)

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

Unit 5: Matter, **Lesson 2**	**Lesson Length**	**Essential Question**	**Vocabulary**
Matter's Properties	3 weeks	How can one explain the structure, properties, and interactions of matter?	element, compound, atom, molecule

Standards and Related Background Information	**Instructional Focus**	**Instructional Resources**
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.	**Learning Outcomes** How do the particles in matter affect its properties? **Suggested Phenomenon** *Click on the phenomenon picture to view the video.*  **Glassblowing**	**Curricular Resources** Engage Inspire Science TE, p. 187-188 Be a Scientist Notebook, p. 189: Phenomenon TE, Science in My World, p. 187: Phenomenon: TE, Essential Question, p. 188 TE, Science and Engineering Practices, p. 188 Explore TE, pp. 188-189 *(LAB)* Be a Scientist Notebook, p. 191, Inquiry Activity: What Is Inside Matter?

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 and Support of Standard** 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 have been 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.	Phenomenon Explanation: Matter is made of particles, atoms, and molecules that are far too small to see with ordinary magnification tools. These particles determine the arrangement and movement, which determines the property of matter.	Explain TE, pp. 190-195 Be a Scientist Notebook, p. 190, Vocabulary Science Handbook/eBook: Elements, Atoms, Molecules, and Compounds Science Handbook/eBook: Elements, Atoms, and Molecules Science Handbook/eBook: Chemical Properties Digital Interactive: Properties of Elements Elaborate TE, p. 196 Digital Interactive: Using Elements Be a Scientist Notebook, p. 197, Digital Interactive: Using Elements Evaluate TE, pp. 196-199 *(LAB)* Be A Scientist Notebook, p. 198, Performance Task: Testing Matter's Properties eAssessment Additional Resources Lesson: Introduction to The Periodic Table Lesson: Physical Changes vs Chemical Changes Video: What's My Property? Video: The Physical Properties and Chemical Properties of Matter **ESL Supports and Scaffolds**

(Students should observe data gathered during a phase change, but students are not expected to explain a particle level cause for phase changes.) 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.		WIDA Standard 4: The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals **Pre-teach vocabulary: (consider teaching additional vocabulary to Entering Level ELs)** **States of** **Model** **Demonstration** **explain** **Youtube:** states of matter Get Epic states of matter series **Sentence stems:** Due to the fact that _____, I think _____ is _____ because. I like _____ because _____.

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 **Suggested Crosscutting Concept(s)** Scale, Proportion, and Quantity **Teacher Overview** Matter is anything that occupies space and has mass. It can exist in four observable states: solid, liquid, gas, or plasma. Atoms are the smallest building blocks of matter. Molecules can also form from atoms of different elements. For example, one oxygen atom and two hydrogen atoms combine to form a water molecule. A molecule is the smallest unit of a substance that retains all the properties of the original substance. All matter in the world is made up of either a pure element or a combination of two or more elements, which is called a compound. Elements, atoms, and molecules build the materials found in everyday life.		**Signal words for explain:** Since, Caused by, In effect, Because of, This results in, Brought about, Due to, Consequently, Made possible, For this reason, Accordingly, As might be expected, Therefore, As a result of, Give rise to, If…then, Leads to, Was responsible for Provide concept maps and graphic organizers to support students in explain the different states of matter. Provide a word wall with vocabulary you would like students to use in speaking and writing. 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)

Misconceptions Students may expect solids to be hard and rigid, like wood. These students would not classify dough or sponges as solids. Students also may have read books that mention only three states of matter and therefore assume there are no others. In addition to the three common states of matter on Earth—solid, liquid, and gas—there is a fourth state of matter called plasma, which is more common in space. Since particles cannot be seen, students may have difficulty understanding particle theory in particular. This theory holds that particles are in constant motion, and empty space exists between the particles. Students may believe that the particles are fixed in place. Remind students that particles have energy no matter what state they are in.		This evidence shows that…