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.

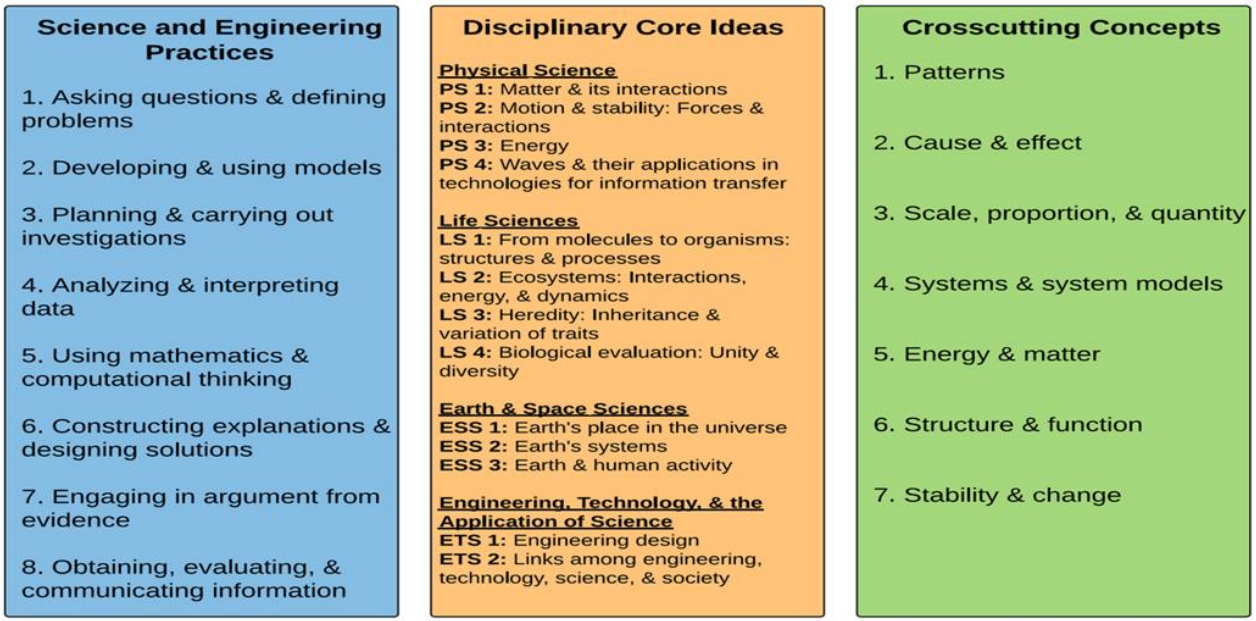
The Tennessee Academic Standards for Science were developed using the National Research Council's 2012 publication, A Framework for K-12 Science Education as their foundation. The framework presents a new model for science instruction that is a stark contrast to what has come to be the norm in science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

Kindergarten Quarter 4 Curriculum Map Quarter 4 Curriculum Map Feedback					
Quarter 1			Quarter 2	Quarter 3	**Quarter 4**
Structure and Routine	Unit 1 Matter	Unit 2 Classifying Information	Unit 3 Weather	Unit 4 Plants and Animals	**Unit 5 Protecting Our Earth**
1 week	5 weeks	3 weeks	9 weeks	9 weeks	**9 weeks**

UNIT 5: Protecting Our Earth (9 weeks)

Overarching Question(s)

How do Earth's surface processes and human activities affect each other?

Unit 5: Lesson 1	Lesson Length	Essential Question	Vocabulary
Land, Air, and Water Pollution	3 weeks	How do people's actions change land, air, and water?	pollution

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) K.ESS3 Earth and Human Activity K.ETS1 Engineering Design **Standard(s)** K.ESS3.3: Communicate solutions that will reduce the impact from humans on land, water, air, and other living things in the local environment. K.ETS1.1: Ask and answer questions about the scientific world and gather information using the senses. K.ETS1.2: Describe objects accurately by drawing and/or labeling pictures.	**Learning Outcomes** Students will understand that humans impact Earth's systems and communicate a solution that will help reduce that impact. **Suggested Phenomena** *Click on the phenomenon picture to view the video.* 	**Curricular Resources** Engage Inspire Science TE, p. 149-150 TE, p. 149, Phenomenon TE, p. 150, Essential Question TE, p. 150, Science and Engineering Practices Explore Inspire Science TE, pp. 151-153 *(LAB)* Be a Scientist Notebook, p. 66 Inquiry Activity: River Pollution Science Paired Read Aloud/Science File, p. 4-13: A Big Difference Explain

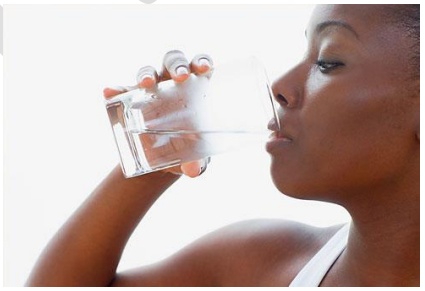
Explanation and Support of Standard K.ESS3.3 People make decisions in order to live more comfortably. Students should consider the choices that they make in order to live more comfortably, compared to those required for survival. Devices that students might use to be more comfortable or for pleasure/recreation have impacts on the world around them. Identifying impacts of these devices can help to minimize cumulative effects of their decisions. Choosing to re-use and recycle materials can decrease additions to landfills, which can contaminate ground-water resources, reduce wildlife habitat, or release dangerous/unpleasant gases (such as ammonia) into the air. K.ETS1.1 Engineering leads to improvements in our daily lives and must begin by understanding the problem to be improved by a solution. Students can be presented with a design task related to a different standard, such as a designing a device to reduce human impacts on the environment (K.ESS3.3). Entering a design process is important that students brainstorm questions that would have to be answered in order to develop the best possible solution. Students should begin to explore how the understandings gained by asking the right questions will impact design solutions for an engineering problem. K.ETS1.2	Phenomenon Explanation: People can reduce pollution. Human activity contributes to pollution of the environment. These effects can be very small or large.	TE, pp. 153-157 TE, Vocabulary, p. 153 Science Paired Read Aloud/Science File, Humans Affect Earth Science File: What Is Pollution? Digital Interactive: Pollution in the Park Video: Oil Spill <u>Elaborate</u> Inspire Science TE, p. 158-160 *(LAB)* TE, p.158, Inquiry Activity: Listen to the Story *(LAB)* TE, p.159, Inquiry Activity: Oil and Water <u>Evaluate</u> Inspire Science TE, pp. 160-161 *(LAB)* Be A Scientist Notebook, Performance Task, p. 69: Air Quality eAssessment **Additional Resources** Lesson: Pollution In Our Town Lesson: What Is Pollution Anyway Video: Learn About Pollution Video: Types of Pollution **ESL Supports and Scaffolds** <u>WIDA Standard 4</u>

In early stages, the design process involves actively developing solutions in brainstorming sessions. To participate in collaborative settings, students must be able to make a physical representation of their ideas early in the design process in order to receive feedback from others. In later grades, students will transition from such preliminary drawings to the creation of detailed models and prototypes. The process of labeling such images allows students to recognize that their device consists of a number of smaller parts whose interactions must be considered and planned. **Suggested Science and Engineering Practice(s)** Obtaining, Evaluating, and Communicating Information **Suggested Crosscutting Concept(s)** Cause and Effect **Teacher Overview** Pollution is a global problem. Things we use to make our lives more comfortable, such as cars and computers, can pollute our environment. Electronic devices, such as computers and smartphones, are replaced with newer versions. The outdated electronics often end up in landfills, contaminating the soil with metals. The exhaust from cars and factories produce chemicals that pollute the air. Some of these pollutants we can see, such as the smoke from a fire. Other pollutants, like carbon dioxide, are invisible. Homes and factories generate sewage and garbage that can pollute land and water. Chemicals used		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 Pre-teach Global, solutions, problem Visuals for pollution Provide sentence frames: We can solve pollution by_____ Pollution is_____ People cause pollution by_____

to manufacture products, clean our homes, kill insects, or grow better lawns can seep into water and harm humans, plants, and other animals. Plastic does not go away. It litters roadsides, lakes, and oceans. Around the world, people and governments are working together to solve the problem of pollution and protect Earth. **Misconceptions** Students may believe that polluted air is always smoky and brownish in color. They may have a difficult time understanding that dangerous pollutants may be invisible to the naked eye. Help them understand by equating the situation to putting sugar in lemonade: you may not see the grains of sugar anymore, but you know that the sugar is in the lemonade. Also, help students understand that a loss of air quality is not always caused by human activity—a natural disaster such as a forest fire or a volcanic eruption can affect the air, too.		

Kindergarten Quarter 4 Curriculum Map Quarter 4 Curriculum Map Feedback					
Quarter 1			Quarter 2	Quarter 3	**Quarter 4**
Structure and Routine	Unit 1 Matter	Unit 2 Classifying Information	Unit 3 Weather	Unit 4 Plants and Animals	**Unit 5** **Protecting Our Earth**
1 week	5 weeks	3 weeks	9 weeks	9 weeks	**9 weeks**

UNIT 5: Protecting Our Earth (9 weeks)			
Overarching Question(s)			
How do Earth's surface processes and human activities affect each other?			
Unit 5: Lesson 2	**Lesson Length**	**Essential Question**	**Vocabulary**
Help Save Natural Resources	3 weeks	How can we save natural resources?	conserve, natural resource

Standards and Related Background Information	**Instructional Focus**	**Instructional Resources**
DCI(s) K.ESS3 Earth and Human Activity K.ETS1 Engineering Design **Standard(s)** K.ESS3.3: Communicate solutions that will reduce the impact from humans on land, water, air, and other living things in the local environment. K.ETS1.1: Ask and answer questions about the scientific world and gather information using the senses. **Explanation and Support of Standard** K.ESS3.3 People make decisions in order to live more comfortably. Students should consider the choices that they make in	**Learning Outcomes** Students will understand that humans use Earth's natural resources and communicate a solution that will help conserve resources. **Suggested Phenomena** *Click on the phenomenon picture to view the video.* 	**Curricular Resources** Engage Inspire Science TE, p. 163-164 TE, p. 163, Phenomenon TE, p. 164, Essential Question TE, p. 164, Science and Engineering Practices Explore Inspire Science TE, pp. 164-166 *(LAB)* Be a Scientist Notebook, p. 72, Inquiry Activity: Use Less Water Science Paired Read Aloud/Science File, pp. 4-13: Farm to Table Explain

order to live more comfortably, compared to those required for survival. Devices that students might use to be more comfortable or for pleasure/recreation have impacts on the world around them. Identifying impacts of these devices can help to minimize cumulative effects of their decisions. Choosing to re-use and recycle materials can decrease additions to landfills, which can contaminate ground-water resources, reduce wildlife habitat, or release dangerous/unpleasant gases (such as ammonia) into the air. K.ETS1.1 Engineering leads to improvements in our daily lives and must begin by understanding the problem to be improved by a solution. Students can be presented with a design task related to a different standard, such as a designing a device to reduce human impacts on the environment (K.ESS3.3). Entering a design process is important that students brainstorm questions that would have to be answered in order to develop the best possible solution. Students should begin to explore how the understandings gained by asking the right questions will impact design solutions for an engineering problem. **Suggested Science and Engineering Practice(s)** Obtaining, Evaluating, and Communicating Information **Suggested Crosscutting Concept(s)** Cause and Effect	Phenomenon Explanation: Natural resources are not made by humans. They exist naturally in the environment and are used by humans. Examples of natural resources are soil, water, trees, rocks, oil, and coal.	TE, pp. 167-172 TE, Vocabulary, p. 167 Science Paired Read Aloud/Science File: Natural Resources Digital Interactive: Items Made from Plants Simulation: Firewood from the Forest *(LAB)* TE, p.169, Inquiry Activity: Natural Resources in the Classroom Elaborate Inspire Science TE, p. 172-173 *(LAB)* TE, p.172, Inquiry Activity: Food Sources Evaluate Inspire Science TE, pp. 174-175 *(LAB)* Be A Scientist Notebook, Performance Task, p. 77: Help the Environment eAssessment **Additional Resources** Lesson: Natural Resources and Products Lesson: Exploring Natural Resources and Products Video: Natural Resources of The Earth **ESL Supports and Scaffolds** WIDA Standard 4

Teacher Overview A natural resource is something from Earth that people use. Plants, soil, rocks, water, sunlight, and air are natural resources. Oil and coal are also natural resources. We use many natural resources to make things. Some clothing is made of cotton, which comes from a plant. Furniture may be made of wood from a tree, which is a plant. Plants provide us with food. Air, sunlight, and water are essential to help plants grow. Conservation is one way everyone can help save our natural resources. For example, to conserve water, people might try to use less water when washing dishes or brushing their teeth. To conserve electricity, people can turn off lights and unplug devices that use electricity when they are not being used. Cars burn a lot of energy. To conserve energy, people might consider walking or using a bicycle for short trips. **Misconceptions** Students may think Earth has always been the way it is now. Students may think that Earth could never run out of water, trees, or other natural resources. Some resources, such as trees, are renewable. New tree seeds or saplings can be planted and protected until they grow into mature trees. Other resources, such as oil, are nonrenewable. Once all of the oil has been removed from Earth, there will be no more left. Help students understand that protecting Earth's natural resources is important because when nonrenewable resources are gone, we can't get them back. Even renewable resources		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 Pre-teach Save; conserve Natural Resource Image Provide sentence stems: We can save the earth by_____ Examples of natural resources are_____. Water is important because_____.

must be cared for. Resources, such as water, can be damaged by human actions. The damaged resources may no longer be useful—or even harmful. Earth's natural resources, such as air, water, and land, help keep us alive, so it is up to us to protect them.		

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Structure and Routine	Unit 1 Matter	Unit 2 Classifying Information	Unit 3 Weather	Unit 4 Plants and Animals	**Unit 5 Protecting Our Earth**
1 week	5 weeks	3 weeks	9 weeks	9 weeks	**9 weeks**

UNIT 5: Protecting Our Earth (9 weeks)

Overarching Question(s)

How do Earth's surface processes and human activities affect each other?

Unit 5: Lesson 3	Lesson Length	Essential Question	Vocabulary
Reduce, Reuse, Recycle	3 weeks	How can we take care of Earth?	Compost, reduce, reuse, recycle

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) K.ESS3 Earth and Human Activity K.ETS1 Engineering Design **Standard(s)** K.ESS3.3: Communicate solutions that will reduce the impact from humans on land, water, air, and other living things in the local environment. K.ETS1.1: Ask and answer questions about the scientific world and gather information using the senses. K.ETS1.2: Describe objects accurately by drawing and/or labeling pictures.	**Learning Outcomes** Students will be able to communicate solutions to the problem of excess waste that include reducing, reusing, and recycling. **Suggested Phenomena** *Click on the phenomenon picture to view the video.* 	**Curricular Resources** Engage Inspire Science TE, p. 177-178 TE, p. 177, Phenomenon TE, p. 178, Essential Question TE, p. 178, Science and Engineering Practices Explore Inspire Science TE, pp. 179-181 *(LAB)* Be a Scientist Notebook, p. 79, Inquiry Activity: Sort Recyclables Science Paired Read Aloud/Science File, pp. 4-13: Finley Fish Finds a New Stream Explain

Explanation and Support of Standard K.ESS3.3 People make decisions in order to live more comfortably. Students should consider the choices that they make in order to live more comfortably, compared to those required for survival. Devices that students might use to be more comfortable or for pleasure/recreation have impacts on the world around them. Identifying impacts of these devices can help to minimize cumulative effects of their decisions. Choosing to re-use and recycle materials can decrease additions to landfills, which can contaminate ground-water resources, reduce wildlife habitat, or release dangerous/unpleasant gases (such as ammonia) into the air. K.ETS1.1 Engineering leads to improvements in our daily lives and must begin by understanding the problem to be improved by a solution. Students can be presented with a design task related to a different standard, such as a designing a device to reduce human impacts on the environment (K.ESS3.3). Entering a design process is important that students brainstorm questions that would have to be answered in order to develop the best possible solution. Students should begin to explore how the understandings gained by asking the right questions will impact design solutions for an engineering problem. K.ETS1.2	Phenomenon Explanation: Reduce, reuse, and recycle is about having less trash. The three R's describe solutions that help us control the amount of trash we generate.	TE, pp. 182-186 TE, Vocabulary, p. 182 Science Paired Read Aloud, pp. 14-23: Taking Care of Our Earth Video: Recycling Plant Digital Interactive: Recycled Objects Simulation: Firewood from the Forest <u>Elaborate</u> Inspire Science TE, p. 186-187 Digital Interactive: Composting <u>Evaluate</u> Inspire Science TE, pp. 187-189 Be A Scientist Notebook, Performance Task, p. 81: Reduce Trash Poster eAssessment **Additional Resources** Lesson: Give and Get-Reduce, Reuse, Recycle & Remind! Lesson: Environmental Engineers Video: Take a Field Trip to a Recycling Center **ESL Supports and Scaffolds** <u>WIDA Standard 4</u> To support students in speaking refer to this resource: <u>WIDA Doing and Talking Science</u>

In early stages, the design process involves actively developing solutions in brainstorming sessions. To participate in collaborative settings, students must be able to make a physical representation of their ideas early in the design process in order to receive feedback from others. In later grades, students will transition from such preliminary drawings to the creation of detailed models and prototypes. The process of labeling such images allows students to recognize that their device consists of a number of smaller parts whose interactions must be considered and planned. **Suggested Science and Engineering Practice(s)** Obtaining, Evaluating, and Communicating Information **Suggested Crosscutting Concept(s)** Cause and Effect **Teacher Overview** In 2012 alone, Americans generated about 250 million tons of trash. Materials in trash come from natural resources. We can create less trash if we recycle materials into new objects, reuse items, and reduce the amount of things we use. We can also use fewer materials that cannot be recycled, buy things made with recycled materials, and avoid over-packaged items. Before beginning this lesson, identify recycling centers in your community and the materials they accept. Composting is a process that breaks down plants so the nutrients can be reused to support new plant growth.		When applicable- use Home Language do build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Pre-teach: Compost, recycle, reuse Provide sentence stems: We can help by_____ Some things I can recycle are_____ Recycling is important because_____

Compost needs four things: air; water; dried or dead plant parts like leaves and pine needles; and fresh, living parts such as grass clippings, kitchen vegetable scraps, weeds, and other plants. Compost materials need to be added in layers, alternating between wet and dry. **Misconceptions** Students may think that once something is produced, it lasts forever. Some students may know that things decompose, but may think it takes millions of years. Help students understand that some things, such as furniture, silverware, books, and dishes, can be reused just as they are. Other things, such as glass containers, can be recycled to make new glass containers or kitchen counter tops. Some students may think that anything can be recycled. Explain that even some things made of glass cannot be recycled: some light bulbs cannot be recycled because of metal parts and a special coating. Tell students the best way to find out whether a product can be recycled is to read the label on the product package. Explain that trash does not disappear. It is taken to a landfill where it might sit for years. Show pictures of a landfill, if possible, to help students understand the amount of trash generated by people.		