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 a meaningful curriculum 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 curriculum provides instructional planning designed to help students reach these outcomes. The curriculum maps contain components to ensure that instruction focuses students toward college and career readiness. Educators will use this guide and the standards as a roadmap for curriculum and instruction. The sequence of learning is strategically positioned so that necessary foundational skills are spiraled in order to facilitate student mastery of the standards.

Our collective goal is to ensure our students graduate ready for college and career. Being College and Career Ready entails, many aspects of teaching and learning. We want our students to apply their scientific learning in the classroom and beyond. These valuable experiences include students being facilitators of their own learning through problem solving and thinking critically. The Science and Engineering Practices are valuable tools used by students to engage in understanding how scientific knowledge develops. These practices rest on important "processes and proficiencies" with longstanding importance in science education. The science maps contain components to ensure that instruction focuses students toward understanding how science and engineering can contribute to meeting many of the major challenges that confront society today. The maps are centered around five basic components: the Tennessee Academic Standards for Science, Science and Engineering Practices, Disciplinary Core Ideas, Crosscutting Concepts, and Phenomena.

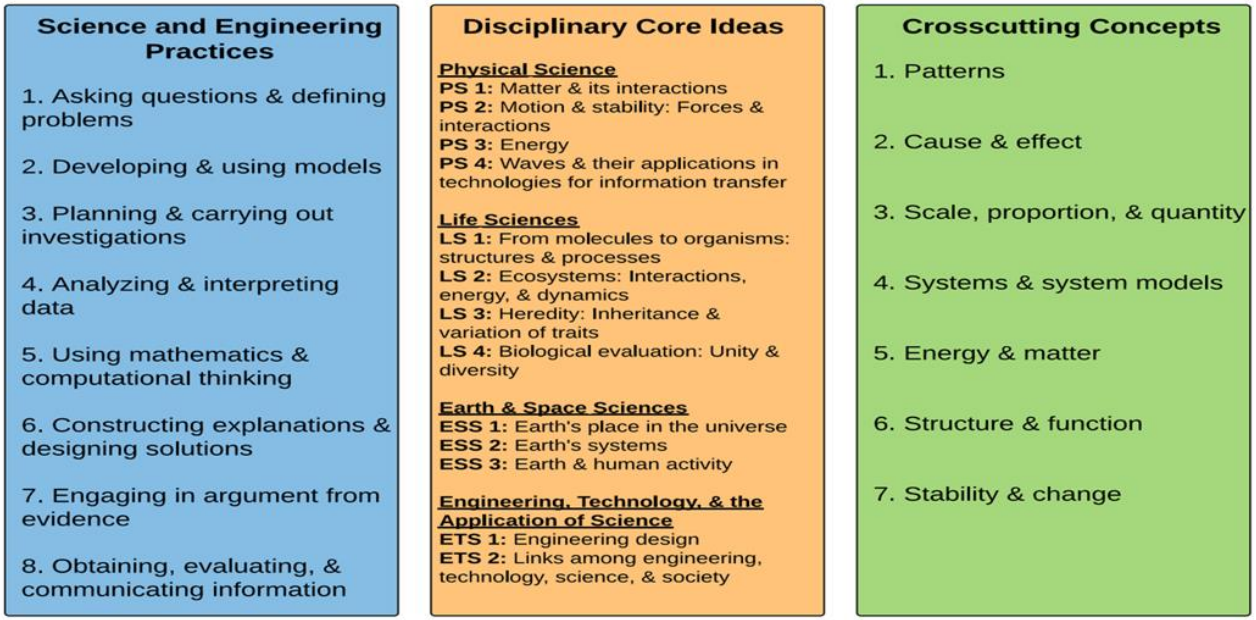
The Tennessee Academic Standards for Science were developed using the National Research Council's 2012 publication, A Framework for K-12 Science Education as their foundation. The framework presents a new model for science instruction that is a stark contrast to what has come to be the norm in science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

become memorizing concepts and solving mathematical formulae. Practicing science had become prescribed lab situations with predetermined outcomes. The framework proposes a three-dimensional approach to science education that capitalizes on a child's natural curiosity. The Science Framework for K-12 Science Education provides the blueprint for developing the effective science practices. The *Framework* expresses a vision in science education that requires students to operate at the nexus of three dimensions of learning: Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The *Framework* identified a small number of disciplinary core ideas that all students should learn with increasing depth and sophistication, from Kindergarten through grade twelve. Key to the vision expressed in the *Framework* is for students to learn these disciplinary core ideas in the context of science and engineering practices. The importance of combining Science and Engineering Practices, Crosscutting Concepts and Disciplinary Core Ideas is stated in the *Framework* as follows:

Standards and performance expectations that are aligned to the framework must take into account that students cannot fully understand scientific and engineering ideas without engaging in the practices of inquiry and the discourses by which such ideas are developed and refined. At the same time, they cannot learn or show competence in practices except in the context of specific content. (NRC Framework, 2012, p. 218)

To develop the skills and dispositions to use scientific and engineering practices needed to further their learning and to solve problems, students need to experience instruction in which they use multiple practices in developing a particular core idea and apply each practice in the context of multiple core ideas. We use the term "practices" instead of a term such as "skills" to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Students in grades K-12 should engage in all eight practices over each grade band**.** Crosscutting concepts have application across all domains of science. As such, they are a way of linking the different domains of science. Crosscutting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. There are seven crosscutting concepts that bridge disciplinary boundaries, uniting core ideas throughout the fields of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas and develop a coherent and scientifically based view of the world.

The map is meant to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional practice. In fact, our goal is not to merely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. Teachers who are knowledgeable about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-positioned to make decisions about how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, leaders, and other support providers--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related best practices. However, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning are non-negotiable. We must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful support of literacy and language learning across the content areas.



Learning Progression

At the end of the elementary science experience, students can observe and measure phenomena using appropriate tools. They are able to organize objects and ideas into broad concepts first by single properties and later by multiple properties. They can create and interpret graphs and models that explain phenomena. Students can keep notebooks to record sequential observations and identify simple patterns. They are able to design and conduct investigations, analyze results, and communicate the results to others. Students will carry their curiosity, interest and enjoyment of the scientific world view, scientific inquiry, and the scientific enterprise into middle school.

At the end of the middle school science experience, students can discover relationships by making observations and by the systematic gathering of data. They can identify relevant evidence and valid arguments. Their focus has shifted from the general to the specific and from the simple to the complex. They use scientific information to make wise decision related to conservation of the natural world. They recognize that there are both negative and positive implications to new technologies.

As an SCS graduate, former students should be literate in science, understand key science ideas, aware that science and technology are interdependent human enterprises with strengths and limitations, familiar with the natural world and recognizes both its diversity and unity, and able to apply scientific knowledge and ways of thinking for individual and social purposes.

Structure of the Standards

- Grade Level/Course Overview: An overview that describes that specific content and themes for each grade level or high school course.
- Disciplinary Core Idea: Scientific and foundational ideas that permeate all grades and connect common themes that bridge scientific disciplines.
- Standard: Statements of what students can do to demonstrate knowledge of the conceptual understanding. Each performance indicator includes a specific science and engineering practice paired with the content knowledge and skills that students should demonstrate to meet the grade level or high school course standards.

Purpose of Science Curriculum Maps

This map is a guide to help teachers and their support providers (e.g., coaches, leaders) on their path to effective, college and career ready (CCR) aligned instruction and our

pursuit of Destination 2025. It is a resource for organizing instruction around the Tennessee Academic Standards for Science, which defines 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

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Quarter 1		Quarter 2		Quarter 3	Quarter 4
Unit 1 Ecology	Unit 2 Biodiversity	Unit 3 Biodiversity	Unit 4 Earth's Systems	Unit 5 Earth and Human Activity I	Unit 6 Earth and Human Activity II
6 weeks	3 weeks	3 Weeks	6 weeks	9 weeks	9 weeks

UNIT 5: Earth and Human Activity I [9 weeks]

Overarching Question(s)

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

Unit	Lesson Length	Essential Question	Vocabulary
Unit 5 Earth and Human Activity I	**Length [8 days]**	**Essential Questions** • What is food security? • How is food produced? • How are environmental issues and food production connected? • How can society manage agricultural pests more sustainably? • What are sustainable solutions to food production?	Food security, food insecurity, chronic malnutrition, over-nutrition, subsidy, industrialized agriculture, monoculture, traditional agriculture, polyculture, organic agriculture, green revolution, aquaculture, topsoil, desertification, soil salinization, agrobiodiversity, pest, synthetic pesticide, integrated pest, management (IPM), soil conservation, organic fertilizer, synthetic inorganic fertilizer, aquaponics

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI EVSC.ESS3: Earth and Human Activity **Standard** **EVSC.ESS3.6** Use a model to make predictions regarding the impact of topsoil loss due to erosion resulting from human activity. Design, evaluate, and revise a solution to preserve topsoil. **EVSC.ESS3.7** Construct an argument including claim, evidence, and scientific reasoning regarding the impact of the Green Revolution on	**Learning Outcomes** • Explain the concepts of food security and insecurity. • Identify the main causes of food insecurity. • Discuss the consequences of food insecurity on human health. • Explore ways to improve food security. • Identify three major systems used to produce food. • Describe the types of agriculture that use croplands. • Understand the pros and cons of crossbreeding and genetic engineering in food production. • Describe how food production contributes to environmental issues. • Understand how environmental issues impact food production and, therefore, food security. • Understand why pests need to be managed to ensure food security. • Discuss the trade-offs of synthetic pesticides.	**Curricular Resources** **Engage** **Soil Conservation** https://www.youtube.com/watch?v=_UeVvUzgJAY **Soil Conservation – Building a Culture of Conservation** https://www.iowalearningfarms.org/page/soil-conservation **The Green Revolution** https://www.youtube.com/watch?v=Giqt0Ldswg4 **Norman Borlaug & The Green Revolution** https://www.youtube.com/watch?v=Lg9-HTtgFOk **Are GMOs Good or Bad? Genetic Engineering & Our Food** https://www.youtube.com/watch?v=7TmcXYp8xu4 **What are GMOs? - Purdue Agriculture** https://ag.purdue.edu/GMOs/Pages/WhatareGMOs.aspx

agricultural practices, food availability, and the environment. **EVSC.ESS3.8** Research information on the environmental impacts of genetically modified organisms and engages in debate regarding pros and cons of this agricultural technology. **Explanation** Human activities in agriculture, industry, and everyday life have had major impacts on the land, rivers, ocean, and air. Humans affect the quality, availability, and distribution of Earth's water through the modification of streams, lakes, and groundwater. Large areas of land, including such delicate ecosystems as wetlands, forests, and grasslands, are being transformed by human agriculture, mining, and the expansion of settlements and roads. Human activities now cause land erosion and soil movement annually that exceed all-natural processes. **Misconceptions** ***Food Insecurity in the United States*** Some students may think that because the United States is a more-developed nation, very few people in this country experience food insecurity. Inform	• Explore alternative, more sustainable ways to manage agricultural pests. • Recognize that sustainable solutions to agriculture must conserve soil, water, and energy. • Identify a variety of solutions to produce crops and animal products sustainably. **Phenomenon** ***Heirloom Crops and Heritage Seeds*** https://www.nationalgeographic.com/magazine/2011/07/food-ark/ Writer Charles Siebert notes in "Food Ark," National Geographic magazine, July 2011, that "it took more than 10,000 years of domestication and selective breeding techniques for humans to create the vast biodiversity in our food supply that we're now watching ebb away." In 1903, commercial seed houses offered hundreds of varieties of cabbage, lettuce, peas, radishes, and corn. In 1983, there were fewer than 30 of each. Which means genetic diversity is ebbing away as well. The lack of genetic diversity in our food crops opens them up to potential devastation by disease-causing viruses and other organisms on a scale that would make the Irish potato famine of the mid-1800s seem like small potatoes. Efforts are now underway to restore some of that lost diversity through reliance on heirloom crops and heritage breeds. "Heirloom" refers to certain varieties of fruits, flowers, and vegetables, and "heritage" refers to certain animal breeds. Both terms describe plants and animals not used in large-scale agriculture. See "Food Ark" for examples of the great variety of chickens, cattle, and potatoes that fall into these categories.	**GMOs: Facts About Genetically Modified Food** https://www.livescience.com/40895-gmo-facts.html **Explore** **Explain** **Elaborate** **Evaluate** **Textbook Resources** **Environmental Science: Sustaining Your World – Chapter 9** **Page 281** – Section 9.1 Assessment, Question 5 **Page 293** – Section 9.2 Assessment, Questions 3 & 4 **Page 303** – Section 9.3 Assessment, Questions 2 & 4 **Page 306** – Section 9.4 Assessment, Questions 1 & 3 **Page 313** – Section 9.5 Assessment, Questions 1, 4, & 5 **Performance Tasks** ***Farmlands (Page 272)*** Display a map showing land used for farming in the United States. Discuss the role of your area in food production for the country or the world. Prompts: • Reasons our area is/is not good for farming include . . . • Although we are located in a prime farmland area, I see no evidence of it because . . . • The kinds of crops grown in our part of the country include . . . • I think agriculture is/is not important because . . . ***Get to Know GMOs*** http://www.discoveringfarmland.com/sites/discoveringfarmland.com/files/pdf/Exploration%20Activity_%20Get%20to%20Know%20GMOs.pdf

them that about 46 million people in the United States suffer from food insecurity, with one-third of them being children. Hold a class discussion about why people may face food insecurity in this country. Because this is a sensitive topic, do not force participation, and remind all students to be respectful of others' thoughts and opinions. **Science and Engineering Practices** • Developing and Using Models • Using Mathematics and Computational Thinking • Engaging in Argument from Evidence **Cross-Cutting Concepts** • Cause and Effect • Systems and System Models • Energy and Matter • Stability and Change		***Soil Conservation (Page 309)*** Have students make one or more drawings to illustrate each method of soil conservation described in the text. Provide students with colored pencils and/or markers, paper, or a computer graphics program to complete their illustrations. Have students include a caption as part of their drawings. Display students' work around the classroom. ***STEM ACTIVITY – Fish Consumption (Page 317)*** **Additional Resources:**

Quarter 1		Quarter 2		Quarter 3	Quarter 3
Unit 1 Ecology	Unit 2 Biodiversity	Unit 3 Biodiversity	Unit 4 Earth's Systems	Unit 5 Earth and Human Activity I	Unit 6 Earth and Human Activity II
6 weeks	3 weeks	3 Weeks	6 weeks	9 weeks	9 weeks

UNIT 5: Earth and Human Activity [9 weeks]

Overarching Question(s)

How do humans change the planet?

Unit	Lesson Length	Essential Question	Vocabulary
Unit 5 Earth and Human Activity I	[8 days]	**Essential Questions** • Why is fresh water in short supply? • How can people increase freshwater supplies? • How can people use fresh water more sustainably? • How can people reduce air, land, and water pollution?	zone of saturation, water table, reliable surface runoff, virtual water, water footprint, subsidence, reservoir, aqueduct, snowpack, desalination, flood irrigation, drip irrigation, gray water, water pollution, wastewater, cultural eutrophication

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI EVSC.ESS3: Earth and Human Activity **Standard** EVSC.ESS3.5 Plan and carry out an investigation examining best management practices in water usage, agriculture, forestry, urban/suburban development, mining, or fishing and communicate findings. EVSC.ESS3.13 Analyze and interpret data on the effects of land, water, and air pollution on the environment and on human health. Propose solutions for minimizing pollution from specific sources. **Explanation**	**Learning Outcomes** • Describe the concept of sustainability and its significance to environmental science. • Understand the link between ecosystem services and natural resources. • Recognize some major environmental problems that lead to natural capital degradation. • Describe the purpose of the ecological footprint. • Assess how ecosystems can be affected by the human population. **Phenomenon** ***Drought occurs worldwide.*** http://www.watereducation.org/sites/main/files/imagecache/carousel/main-images/drought_tips_2.jpg Drought impacts regions worldwide. Scarcity of water in an area can result from a variety of factors, including lack of precipitation, climate change, and human water usage	Curricular Resources Engage **This is Farming -- Sustainability Practices: Water Management** https://www.youtube.com/watch?v=JU6KXify7Qg **Agricultural Water Management 101** https://www.youtube.com/watch?v=V5WiD8ZPSNk **Soil Water Management** https://www.youtube.com/watch?v=YULwrICaB1Y **Soil Management – A Foundational Strategy for Conservation** https://www.nature.org/en-us/what-we-do/our-insights/perspectives/soil-management-a-foundational-strategy-for-conservation/ **Soil management and health** https://extension.umn.edu/soil-and-water/soil-management-and-health **What is Integrated Pest Management? IPM Techniques** https://www.pestworld.org/pest-control-help/integrated-pest-management/

Air and water pollution caused by human activities affect the condition of the atmosphere and of rivers and lakes, with damaging effects on other species and on human health. The activities of humans have significantly altered the biosphere, changing or destroying natural habitats and causing the extinction of many living species. These changes also affect the viability of agriculture or fisheries to support human populations. Land use patterns for agriculture and ocean use patterns for fishing are affected not only by changes in population and needs but also by changes in climate or local conditions (such as desertification due to overuse or depletion of fish populations by overextraction). **Misconceptions** ***Surface Water and Groundwater*** Some students may be confused by these two terms because "groundwater" sounds like water that is on the ground or in a cavern beneath the surface. Emphasize that most groundwater is located within the soil and rock layers above bedrock, whereas surface water is located on top of the ground. **Science and Engineering Practices** • Asking Questions and Defining Problems • Analyzing and Interpreting Data • Using Mathematics and Computational Thinking • Constructing Explanations and Designing Solutions	patterns negatively impacting the areas vegetation, animal populations and, ultimately, the human population. 97% of Earth's water is unavailable or inaccessible to humans. Drought can be used as an investigation of the hydrologic cycle. In the resources below are links to data evidence of drought, classroom activities, and global satellite imaging. Classroom activities will support students in their investigation of the distribution, frequency, severity and causes of drought. Resource 1 allows students to visualize and examine drought data and ask questions that can be answered with the data. Resource 2 introduces the importance of our changing fresh water supply and human dependence on freshwater availability. Resource 3, the satellite imaging, provides students an opportunity to visually inspect the effect of drought in an area.	**Structural Pest Management - UGA Extension - University of Georgia** http://extension.uga.edu/programs-services/structural-pest-management.html **Various Causes and Effects of Land Pollution That Need Your Attention** https://www.youtube.com/watch?v=uTJExjbsEuc **Water and Water Pollution** https://www.toppr.com/guides/biology/natural-resources/water-and-water-pollution/ **Pollution Facts & Types of Pollution** https://www.livescience.com/22728-pollution-facts.html Explore Explain Elaborate Evaluate **Textbook Resources** **Environmental Science: Sustaining Your World – Chapter 10** **Page 325 –** Section 10.1 Assessment, Questions 4-5 **Page 330 –** Section 10.2 Assessment, Questions 1 – 5 **Page 334 –** Section 10.3 Assessment, Questions 1 – 5 **Page 347 –** Questions 1, 3, 6, & 7 **Performance Tasks** ***Stem Activity – Oil Spill Cleanup*** ***(Page 351)*** ***Hoover Dam*** Have students locate Hoover dam on a physical map of the United States, and then make comparisons with historical photos and maps of the area before the dam was completed.

• Engaging in Argument from Evidence **<u>Cross-Cutting Concepts</u>** • Stability and Change		Prompts: • If the dam did not exist, the surrounding area would look like . . . • The original Colorado riverbed would be located . . . • Geographically, this was a good place to locate the dam because . . Students might search http://news.nationalgeographic.com/ (keyword search: Hoover Dam) to see more pictures of the dam or to find out how drought is changing the Colorado River. ***Who Did It? (Soil Investigation)*** https://www.teachersfirst.com/lessons/forensics/soil-lesn.cfm ***All About Water*** https://www.teachengineering.org/lessons/view/cub_drink_lesson01 ***How Clean is that Water?*** https://www.teachengineering.org/lessons/view/cub_enveng_lesson02 ***Pollution Solutions*** http://www.discoveryeducation.com/teachers/free-lesson-plans/pollution-solutions.cfm **Additional Resources:** **US Drought Portal** **Will the World Ever Run Out of Water?** **Planet.com Sign up for a free account and use "Planet Explorer."** **US Drought Portal** **Will the World Ever Run Out of Water?** **Planet.com Sign up for a free account and use "Planet Explorer."**

Environmental Science Quarter 3 Curriculum Map Quarter 3 Curriculum Map Feedback			
Quarter 1	**Quarter 2**	**Quarter 3**	**Quarter 4**

Unit 1 Ecology	Unit 2 Biodiversity	Unit 3 Biodiversity	Unit 4 Earth's Systems	Unit 5 Earth and Human Activity I	Unit 6 Earth and Human Activity II
6 weeks	3 weeks	3 weeks	6 weeks	9 weeks	9 weeks

UNIT 5: Earth and Human Activity I [9 weeks]

Overarching Question(s)

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

Unit, Lesson	Lesson Length	Essential Question	Vocabulary
Unit 5 Earth and Human Activity I	9 days	**Essential Questions** • How do geological processes relate to society and the environment? • What are Earth's mineral resources, and how long might reserves last? • What are the effects of using mineral resources? • How can society use mineral resources more sustainably?	Mineral, mineral resource, rare earth metal, ore, reserve, depletion time, surface mining, overburden, spoils, open-pit mining, strip mining, mountaintop removal, subsurface mining, tailings, smelting, materials revolution, nanotechnology,

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI EVSC.ESS3: Earth and Human Activity **Standard** EVSC.ESS3.4 Gather, organize, analyze, and present data on current land use trends by humans. Based on analysis, predict future trends. EVSC.ESS3.11 Define problems and suggest solutions associated with using, conserving, and recycling energy and mineral resources taking into account economic, social, and environmental costs and benefits. **Explanation** Humans depend on Earth's land, ocean, atmosphere, and biosphere for many	**Learning Outcomes** • Identify the three major parts of Earth's geosphere. • Explain the interaction between geologic events, human populations, and the environment. • Understand that Earth's dynamic processes produce important benefits as well as potential threats. • Discuss the variety of mineral resources and some of their uses. • Describe how mineral resources can become economically depleted. • Explain how market prices affect mineral supplies. • Describe the major types of mining. • Discuss the harmful environmental effects of mining. • Identify new materials that are replacing some metals for common uses. • Explain how mineral resources can be used more sustainably. **Phenomenon**	Curricular Resources Engage **Types of Land Uses: Recreational, Transport, Agricultural, Residential & Commercial** https://study.com/academy/lesson/types-of-land-uses-recreational-transport-agricultural-residential-commercial.html **Long-term study shows impact of humans on land** https://asunow.asu.edu/20160128-discoveries-long-term-study-shows-impact-humans-land **Recycling and Energy Conservation** https://www.youtube.com/watch?v=3IatBYd6Rqc **Is It More Important to You to Reduce, Reuse or Recycle?** https://ww2.kqed.org/education/2016/10/28/is-it-more-important-to-you-to-reduce-reuse-or-recycle/ **Seeking and Conserving Mineral Resources** https://www.youtube.com/watch?v=zmKo85NofLc **How Can We Conserve Minerals?** https://www.youtube.com/watch?v=NyzRSPH_yA0

different resources, including air, water, soil, minerals, metals, energy, plants, and animals. Some of these resources are renewable over human lifetimes, and some are nonrenewable or irreplaceable if lost. Resource availability has guided the development of human society. All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks, as well as benefits. New technologies and regulations can change the balance of these factors. **Misconceptions** ***Pressure Changes*** Many of your students, as the result of modeling volcanic eruptions with vinegar and baking soda, might hold the misconception that eruptions are the result of chemical reactions within the volcano. Read aloud the caption for Figure 11-5 to explain that pressure differences within the volcano cause it to erupt. **Science and Engineering Practices** • Developing and Using Models • Constructing Explanations and Designing Solutions • Engaging in Argument from Evidence • Obtaining, Evaluating, and Communicating Information **Cross-Cutting Concepts** • Patterns • Stability and Change	***Canada's Oil Sands*** https://www.nationalgeographic.com/content/dam/magazine/rights-exempt/2009/03/alberta-oil/1-millennium-mine.adapt.590.1.jpg The oil sand fields of Canada are yet another example of surface mining. There, as much as 4 tons of soil are moved to reap a single barrel of oil. It is this oil that was intended to flow from Alberta, Canada, to Texas through the proposed Keystone XL pipeline (which was denied in late 2015). The oil itself, however, has a consistency of peanut butter and must be mixed with additional chemicals to make it fluid enough to flow. Students can find out more about the sustainability of mining oil sands by reading "The Canadian Oil Boom: Scraping Bottom," National Geographic magazine, March 2009. https://www.nationalgeographic.com/magazine/2009/03/canadian-oil-sands/	Explore Explain Elaborate ***Land Use and Planning in Tennessee*** https://www.tn.gov/content/dam/tn/tacir/documents/LandUseAndPlanning.pdf Evaluate **Textbook Resources** **Environmental Science: Sustaining Your World – Chapter 11** **Page 362 –** Section 11.1 Assessment, Questions 1 & 4 **Page 368 –** Section 11.2 Assessment, Questions 1 – 6 **Page 374 –** Section 11.3 Assessment, Questions 1 – 4 **Page 377 –** Section 11.4 Assessment, Questions 1 – 4 **Performance Tasks** ***Stem Activities – Product Life Cycles (Page 381)*** ***West Virginia*** Find and display a map that shows coal reserves in the United States. Have a volunteer locate West Virginia and discuss student's thoughts regarding the impact of mining in the region. Point out that underground mines might yield as little as 40% of their coal as opposed to surface mines, which yield as much as 90%. Prompts: • One reason why the West Virginia economy is so coal-dependent might be. . . • West Virginia might be turning more to surface mines because . . . • The impact of surface mines might be greater/less than underground mines because . . .

		• I would/would not advocate for mining to continue in West Virginia because . . . ***Seminole Land Use*** http://www.seminole.wateratlas.usf.edu/education/curriculum/Seminole/lessons/WA23_Land_Use_Activity-T.pdf ***Recycling Lessons and Activities*** https://www.monroecounty.gov/p/des-AmericaRecycleTeacherBook.pdf **Additional Resources:**

Environmental Science Quarter 3 Curriculum Map					
Quarter 1		**Quarter 2**		**Quarter 3**	**Quarter 4**
Unit 1 Ecology	Unit 2 Biodiversity	Unit 3 Biodiversity	Unit 4 Earth's Systems	Unit 5 Earth and Human Activity I	Unit 6 Earth and Human Activity II
6 weeks	3 weeks	3 weeks	6 weeks	9 weeks	9 weeks

Unit 5: Earth and Human Activity I **[3 weeks]**			
Overarching Question(s)			
How do humans depend on Earth's resources?			
Unit, Lesson	Lesson Length	Essential Question	Vocabulary
Unit 5 Earth and Human Activity I	18 Days	**Essential Questions** • What is net energy, and why is it important? • What are the advantages and disadvantages of using fossil fuels? • What are the advantages and disadvantages of using nuclear power? • Why is energy efficiency an important energy resource? • What are sources of renewable energy? • How can society transition to a more sustainable energy future?	Commercial energy, net energy, crude oil, refining, petrochemical, peak production, proven oil reserve, horizontal drilling, hydraulic fracturing, natural gas, coal, nuclear fission, nuclear fusion, energy efficiency, cogeneration, hydrogen fuel cell, passive solar heating system, active solar heating system, solar thermal system, photovoltaic cell, hydropower, biomass, biofuel, geothermal energy, decarbonization, district heating
Standards and Related Background Information		Instructional Focus	Instructional Resources

DCI EVSC.ESS3: Earth and Human Activity **Standard** **EVSC.ESS3.1** Research Earth's natural resources (renewable and nonrenewable resources). Construct an argument from evidence supporting the claim that a particular type of resource is important for humans. **EVSC.ESS3.12** Ask questions about technology needed to develop alternative energy sources and obtain information from various sources to answer those questions. **Explanation** All forms of resource extraction and land use have associated economic, social, environmental, and geopolitical costs and risks, as well as benefits. New technologies and regulations can change the balance of these factors—for example, scientific modeling of the long-term environmental impacts of resource use can help identify potential problems and suggest desirable changes in the patterns of use. Much energy production today comes from nonrenewable sources, such as coal and oil. However, advances in related science and technology are reducing the cost of energy from renewable resources, such as sunlight, and some regulations are favoring their use. As a result, future energy supplies are likely to come from a much wider range of sources.	**Learning Outcomes** • Define commercial energy and identify the types of nonrenewable energy resources. • Understand that it takes energy to produce energy and explain the significance of net energy. • Explain why energy resources with a low net energy need government subsidies. • Discuss oil, natural gas, and coal as commercial energy sources. • Understand the advantages and disadvantages of using fossil fuels for energy. • Understand how a nuclear fission reaction works and describe the nuclear fuel cycle. • Explain the advantages and disadvantages of using nuclear power. • Discuss the future of nuclear power. • Define energy efficiency and explain what makes a device energy efficient. • Identify ways in which energy is used inefficiently. • Describe ways to improve energy efficiency with regard to industry, transportation, and home building. • Explain why renewable energy resources have not been more widely adopted. • Identify sources of renewable energy and their applications. • Understand the advantages and disadvantages of each source of renewable energy. • Identify the challenges associated with transitioning to a more sustainable energy future. • Describe paths society can take to transition to more sustainable energy use. **Phenomenon** ***Hand crank device charges cell phone*** http://s.hswstatic.com/gif/wind-up-cell-phone-charger-2.jpg A handheld device with a crank handle is used to charge a cell phone. Multiple energy transfer/transformations are involved as well as the	Curricular Resources Engage **Nonrenewable and Renewable Energy Resources** https://ww2.kqed.org/quest/2014/02/13/nonrenewable-and-renewable-energy-resources-2/ **Classification of Resources: Renewable & Non-Renewable** https://www.toppr.com/guides/evs/what-if-it-finishes/materials-resources-and-its-classification/ **What Are the Alternative Energy Sources ? – SRE** https://www.survivalrenewableenergy.com/alternative-energy-sources/ **Top 10 Energy Sources of the Future** https://www.youtube.com/watch?v=uStFvcz9Or4 Explore Explain Elaborate Evaluate **Textbook Resources** **Environmental Science: Sustaining Your World – Chapters 12 & 13** **Page 388 –** Section 12.1 Assessment, Questions 2 – 5 **Page 399 –** Section 12.2 Assessment, Questions 2, 4, & 5 **Page 407 –** Section 12.3 Assessment, Questions 1 – 5 **Page 425 –** Section 13.1 Assessment, Questions 1 – 4 **Page 441 –** Section 13.2 Assessment, Questions 1 – 5 **Page 443 –** Section 13.3 Assessment, Questions 1 – 3 **Performance Tasks** ***Stem Activity – Fracking (Page 411)*** ***Stem Activity – Wind Turbines (Page 447)***

Misconceptions ***Energy of the Future?*** Students may be under the impression that clean energy is still something to be discovered or developed. Discuss with them that the technology to greatly reduce our dependence on fossil fuels is present today and have them look for evidence of that as they explore the lesson. **Science and Engineering Practices** • Asking Questions and Defining Problems • Developing and Using Models • Analyzing and Interpreting Data • Using Mathematics and Computational Thinking • Constructing Explanations and Designing Solutions • Engaging in Argument from Evidence • Obtaining, Evaluating, and Communicating Information **Cross-Cutting Concepts** • Energy and Matter • Stability and Change • Patterns	conservation of energy. Students investigate types of energy, the transfer of energy, and energy conservation through simulations, hands-on activities, videos, and reading. The phenomena will generate questions and discussion about "How a hand crank generates energy to charge a cell phone". This involves concepts about energy source, energy generation, energy flow and energy conservation. This will address DCIs on energy within physical science, earth and engineering. Depending on the course (physics, chemistry, or earth science), this phenomenon can be adapted to address multiple disciplines. Resources include: (1) Article and Video discussing energy transfer and Activity where students create generator, (2)Online inquiry-based energy transfer simulation, (3) Article describing Energy Transfer, Energy Conservation, Energy types.	***Energy Consumption (Page 387)*** Have students go to http://eia.gov/state/ and click on your state to find the "Energy Consumption Estimates" compiled by the U.S. Energy Information Administration. Have students analyze the data and compare it with the energy resource data for the United States in Figure 12-2. While students can't do a direct numerical comparison, they can do a general comparison of the main energy sources in your state compared with those of the United States. Help focus students' analyses with the following prompts: • One comparison I can make between energy use in the country and that in my state is . . . • Hydropower is the largest renewable energy resource used in the country. In our state, the largest renewable energy resource is . . . ***Green Building Model*** Provide students with poster board, scissors, rulers, glue sticks, tape, plastic wrap, aluminum foil, and colored markers or pencils. Challenge small groups of students to construct a house or building that includes at least three energy efficiency features. Remind students to consider sunlight when placing windows in the structure and the structure's position on its "lot." Upon completion of the structures, have groups share and discuss their results. • **Struggling Students**: Work with these students to build one larger building that has the features mentioned in the text. Be sure each student understands how each feature functions to conserve energy. • **Advanced Learners**: Encourage these students to include six energy-efficient components into their designs and possibly come up with one or more of their own. **Additional Resources:** **How do we convert Mechanical Energy to Electrical Energy** **Phet Energy Transfer Simulation**

		Energy and how it becomes Electrical Power ***R.E.A.C.T.: Renewable Energy Activities Choices for Tomorrow*** https://www.nrel.gov/docs/gen/fy01/30927.pdf ***Is It Renewable Or Non-renewable Energy – EcoKids*** https://www.ecokids.ca/teachers/wp-content/uploads/sites/2/2015/09/LP_EN-Is-it-Renewable-or-Non-renewable-Energy-FLAT.pdf ***Alternative Energy Sources*** https://www.energy.gov/sites/prod/files/2014/06/f16/lesson297.pdf ***Activities for Engaging High School Students in Energy Studies*** https://parc.wustl.edu/files/parc/imce/student_engagement_in_energy.pdf

Curriculum and Instruction- Science			
RESOURCE TOOLKIT			
Quarter 2		**Environmental Science**	
Textbook Resources	**DCIs and Standards** **DCI** **Standard**	**Websites/Videos**	**Additional Resources** **ACT & SAT** TN ACT Information & Resources ACT College & Career Readiness Mathematics Standards SAT Connections SAT Practice from Khan Academy Khan Academy Illuminations (NCTM) Discovery Education The Futures Channel The TeachingChannel Teachertube.com