BARTLETT CITY SCHOOLS

Department of Teaching & Learning
Fourth Grade Science Curriculum Guide
2019-2020
Fourth Grade Pacing Guide

First Quarter (9 weeks) Aug. 12-Oct. 11	
Units	**Topics**
Engineering Technology & Applications of Sciences (ETS 1&2) **2 Weeks** **Aug. 12 – Aug. 23**	1. Engineering Process 2. Appropriate tools and measurements
Life Science (LS2) **2 weeks** **Aug. 26 – Sept. 6**	1. Plants and Photosynthesis
Life Science (LS2) **3 weeks** **Sept. 9 – Sept. 27**	1. Interactions in Ecosystems 2 .Balance in Ecosystems
Life Science (LS2) **2 weeks** **Sept. 30 – Oct. 11**	1. Living Things Respond to Change

Second Quarter (8 weeks) Oct. 21-Dec. 20	
Units	**Topics**
Earth & Space Science (ESS 1&2) **3 weeks** **Oct. 21 – Nov. 8**	1. Day and Night 2. Shadows 3. Earth and Its Layers
Earth & Space Science (ESS2) **3 weeks** **Nov. 12 – Dec. 6**	1. Earth's Landforms & Features 2. Erosion & Weathering
Earth & Space Science & Life Science (ESS3) (LS4) **2 weeks** **Dec. 9 – Dec. 20**	1. Resources from the Past 2. Natural Resources 3. Human Activity Affects Earth

Third Quarter (10 weeks) Jan. 6-Mar. 13	
Units	**Topics**
Energy (PS3) **3 weeks** **Jan. 6 – Jan. 24**	1. Speed and Energy 2. Energy Change in Collisions
Energy (PS3) **3 weeks** **Jan. 27 – Feb. 14**	1. Energy Transformations
Waves (PS4) **4 weeks** **Feb. 18 – Mar. 13**	1. How Waves Move 2. How Waves Affect How We See 3. How Waves Transmit Information

Fourth Quarter (10 weeks) Mar. 16-May22	
Units	**Topics**
Engineering Technology & Applications of Sciences (ETS 1&2) **Mar. 16 – May 1**	1. Tools for Technology 2. Inventions 3. Technology
May 4 – May 8	Family Life and Maker Faire
May 11 – May 22	Begin working in HMH 5th grade text

Updated 6/2019

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Guiding Question: What tools, skills, knowledge, and inquiry skills are needed to conduct engineering processes?

1st Nine Weeks- Engineering Technology & Applications of Sciences (2 weeks) Aug. 12 – Aug. 23

DCI: **4.ETS2 Links Among Engineering, Technology, Science and Society**

TN State Standards	Objectives/Learning Targets Explanations	Instructional Resources	Crosscutting Concepts and Science & Engineering Principles
ETS2.1 Use appropriate tools and measurements to build a model. **COMPONENT IDEA:** *A. Interdependence of Science, Technology, Engineering, and Math*	*****All ETS standards should be used connectively with all other standards throughout the year. They should be used to support in students' inquiry skills for lessons.***** **ETS2.1** **Explanation:** Progress in science and engineering are intertwined. As scientific understanding increases, it can provide information for the development of new processes and materials that will improve technology. These improvements permit the creation of better tools for scientific investigation. Through the use of tools, students can replicate the processes of engineers in design. As tools used in manufacturing and design progress, the production and design processes become more efficient. A recent example might include the ability to create prototypes utilizing 3D printing which produces scale models with tighter tolerances than traditional hand crafted models. ***To appreciate these developments, students should experience simple methods of constructing models to support their science content.*** **Examples of appropriate tools and measurements may include rulers, scissors, glass lenses or mirrors to develop a pin-hole camera, a periscope, or kaleidoscope to explain the phenomena of visible light must bounce off an object and enter the eye for an object to be seen.**	**HMH Tennessee Science** Unit 1 Lesson 2 and 5 Teacher's edition pgs: 17A-26, 45A-54, 55A-56 Digital lesson: Login to HMH, then click Lesson 2: https://tinyurl.com/y6lb893f Lesson 5: https://tinyurl.com/y45eo69b Unit 9 STEM: Teacher's edition pgs. 448A-448B Flipchart pages 3,4,6, & 7 **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y2lhr6fh **Brainpop video**: https://tinyurl.com/y5qhmkmp	**ETS2.1** **Crosscutting Concept:** **Scale, Proportion, and Quantity** *Students make measurements of physical properties of objects using base units.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Planning and carrying out controlled investigations** *Students can make measurements for the purpose of testing and comparing competing design solutions or understanding the effects of modifications to an existing device.*

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Guiding Question: What do plants need to survive?

1st Nine Weeks-Life Science: Plants & Photosynthesis (2 weeks) Aug. 26 – Sept. 6

DCI: **4.LS2: Ecosystems: Interactions, Energy, and Dynamics**

TN State Standards	Objectives/Learning Targets Explanations	Instructional Resources	Crosscutting Concepts and Science & Engineering Principles
4.LS2.1 Support an argument with evidence that plants get the materials they need for growth and reproduction chiefly through a process in which they use carbon dioxide from the air, water, and energy from the sun to produce sugars, plant materials, and waste (oxygen); and that this process is called **photosynthesis.** **COMPONENT IDEA:** *A. Interdependent Relationships in Ecosystems*	**4.LS2.1** **EXPLANATION:** ***In second grade, students were introduced to the idea that organisms depend on their environment to meet general survival needs.*** ***In third grade, students were introduced to gaseous matter in their physical sciences studies.*** Building on that information, students are now prepared to examine the invisible needs of plants for survival. Plants fulfill the role of "**producer**" which implies that nearly all types of food originated as a plant. **Activity** Students can examine elodea plants in water to observe their production of gas (**oxygen)** under varying conditions. Bromothymol blue can be used as an indicator to show the conversion of **carbon dioxide** (blow bubbles into water) into oxygen by the elodea. In preparation for later grades, it should be emphasized that plant matter comes from carbon dioxide, not the soil or water. **In addition to forms of matter involved with photosynthesis, discussions should include the role of plants in capturing energy from the sun and bringing this energy into the biosphere.** ***(Instruction should be limited to the requirements for photosynthesis/plant growth and not the processes.)***	**HMH Tennessee Science** Unit 6 Lesson 3 Teacher's edition pages: 300-301 For digital lesson, login to HMH, then click https://tinyurl.com/y25d2ebg **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y3vvvfxq **Brainpop video**: https://tinyurl.com/nonzdlf	**4.LS2.1** **Crosscutting Concept:** **Energy and Matter** *Students begin to recognize types of energy present in a system and the ability to transfer this energy between objects* **SCIENCE AND ENGINEERING PRINCIPLE:** **Engaging in argument from evidence** *Students create and identify evidence-based arguments and consider whether an argument is supported by evidence or relies on opinions or incomplete representations of relevant evidence*

Guiding Question: How does energy flow in an ecosystem?

1st Nine Weeks-Life Science: Interactions in Ecosystems AND Balance in Ecosystems (3 weeks) Sept. 9 – Sept. 27			
***DCI:* 4.LS2: Ecosystems: Interactions, Energy, and Dynamics**			
4.LS2.2 Develop models of terrestrial and aquatic	**4.LS2.2** **EXPLANATION:**	**HMH Tennessee Science** Unit 6, Lesson 4 Teacher's edition pages: 313A-324	**4.LS2.2** **Crosscutting Concept:** **Energy and Matter** *Students begin to recognize types of*

food chains to describe the movement of energy among producers, herbivores, carnivores, omnivores, and decomposers. **(Organisms)** **COMPONENT IDEA:** *A. Interdependent Relationships in Ecosystems*	***In fourth grade, students should become cognizant that living systems require energy (a term in limited use in earlier grades) in addition to matter*** All ecosystems require an organism that is able to convert energy from some form into chemical energy that can be passed along a food chain. For most ecosystems on Earth, the Sun's energy is captured by photosynthetic organisms (**producers**) creating the foundation for energy transfer up the food chain. **Consumers** are organisms that eat other organisms. Based on their specific diet, consumers can be classified as either **herbivores, carnivores, or omnivores.** **Decomposers** fulfill a unique role by returning certain nutrients to the soil so that they can be reincorporated into the food chain at the producer level. There are far less substantial means of energy production, such as sulfur-reducing bacteria, that allow certain producers to obtain energy from abiotic sources. Within the biosphere, organisms have certain dietary habits that allow them to organize in a manner that tracks the flow of energy in an ecosystem. ***(Instruction should focus on photosynthesis as the primary means of bringing energy into the biosphere.)***	For digital lesson, login to HMH, then click https://tinyurl.com/y5622pan **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y2o933fh **Brainpop video:** **https://tinyurl.com/kaeun8d**	*energy present in a system and the ability to transfer this energy between objects.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Developing and using models** *Student models begin to become abstract and metaphorical, incorporating relationships between events and predictive aspects for recurring events.*

Guiding Question: How do changes affect ecosystems?

1st Nine Weeks- Life Science: Balance in Ecosystems			
DCI: **4.LS2: Ecosystems: Interactions, Energy, and Dynamics**			
TN State Standards	**Objectives/Learning Targets Explanation**	**Instructional Resources**	**Crosscutting Concepts and Science & Engineering Principles**

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4.LS2.3 Using information about the roles of organisms (producers, consumers, decomposers), evaluate how those roles in food chains are interconnected in a food web, and communicate how the organisms are continuously able to meet their needs in a stable **food web**. **COMPONENT IDEA:** *A. Interdependent Relationships in Ecosystems* **4.LS2.4** Develop and use models to determine the effects of introducing a species to, or removing a species from, an ecosystem and how either one can damage the balance of an **ecosystem**.	**4.LS2.3** **EXPLANATION:** ***The focus of this standard is on the relationships in an ecosystem***. **Ecosystems** contain organisms that act in different ways to meet their needs. **Food chains** and **food webs** create feeding relationships. Food chains effectively organize a hierarchy or relationships based on patterns in consumption for organisms. By contrast, food webs present more realistic visualizations for the transfer of energy and matter within an ecosystem. An example of how roles of organisms are interconnected in a food web might include grass (producer) in a forest clearing, which produces its own food through photosynthesis. A rabbit (consumer-herbivore) eats the grass. A fox (consumer-carnivore) eats the rabbit. When the fox dies, decomposers such as worms and mushrooms break down its body, returning the matter and energy stored in the fox to the soil where it provides nutrients for plants like grass. ***(This standard does not include discussion of various forms of symbiosis.)*** **4.LS2.4** **EXPLANATION:** ***It is important that discussions of this standard extend beyond simply investigating invasive species.*** ***Instruction should have an equal focus on using the number of different species present in an ecosystem(population) as***	**HMH Tennessee Science** Unit 6, Lesson 4 Teacher's edition pages: 313A-324 For digital lesson, login to HMH, then click https://tinyurl.com/y5622pan **Discovery Education video:** Login to Clever, then click link **https://tinyurl.com/y6ld2u2v** **Brainpop video:** https://tinyurl.com/k8tvwak https://tinyurl.com/kc2vty7 **HMH Tennessee Science** Unit 6, Lesson 2, 3, & 5 Teacher's edition pages: 281A-296, 299A-312, 325A-326 Flipchart pg. 34	**4.LS2.3** **Crosscutting Concept:** **Structure and Function** *Students begin to recognize that objects have smaller substructures which determine the property of a material or system* **SCIENCE AND ENGINEERING PRINCIPLE:** **Developing and using models** *Student models begin to become abstract and metaphorical, incorporating relationships between events and predictive aspects for recurring events.* **4.LS2.4** **Crosscutting Concept:** **Stability and Change** *Students begin to describe changes in terms of time over which they occur; their rate*

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COMPONENT IDEA: *A. Interdependent Relationships in Ecosystems*	***an indication of the overall health of that ecosystem.*** Ecosystems can be threatened by invasive species which can outcompete native species for shared energy and resources. As a result of the inability to compete, the variety of native species decreases, reducing biodiversity. The reduced biodiversity presents the opportunity for more significant consequences from external factors, which are no longer damped by the ecosystem. When an ecosystem changes, some organisms survive while others do not, with less diversity, threats to single species prove more substantial. **Models such as food webs, food chains, and the energy pyramid can serve *predictive functions*.** An example of introducing a species may include the introduction of tilapia and snakehead fish to countless streams, lakes, and rivers throughout the Indonesian Islands and other locations around the world, where these predatory fish almost always eat any native fish species to extinction. An example of removing a species might include prairie dogs, which are beneficial and contribute to the existence of the ecosystem in which they live. Without their existence, their ecosystem would be dramatically different or cease to exist altogether.	For digital lesson, login to HMH, then click Lesson 2: https://tinyurl.com/yxkbf8or Lesson 3: https://tinyurl.com/y25d2ebq Lesson 5: https://tinyurl.com/y6fllg3 **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y4ktowcg **Brainpop video:** https://tinyurl.com/kdo45yb	**SCIENCE AND ENGINEERING PRINCIPLE:** **Engaging in argument from evidence** *Students create and identify evidence-based arguments and consider whether an argument is supported by evidence or relies on opinions or incomplete representations of relevant evidence*

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Guiding Question: How do organisms survive changes in their ecosystem?

1st Nine Weeks- Life Science: Living Things Respond to Change (2 weeks) Sept. 30 – Oct. 11			
DCI: **4.LS2: Ecosystems: Interactions, Energy, and Dynamics**			
4.LS2.5 Analyze and interpret data about changes (land characteristics, water distribution, temperature, food, and other organisms) in the **environment** and describe what mechanisms organisms can use to affect their ability to survive and **reproduce**. **COMPONENT IDEA:** *C. Ecosystem Dynamics, Functioning, and Resilience*	**4.LS2.5** **EXPLANATION:** The foundation for this standard began in **first grade** when students first examined the reliance of organisms on their surroundings to meet needs. Before reaching this standard, students have also examined the consequences of changes in the environment on the organisms. This standard begins to unify the core ecology ideas with those of natural selection. **Environmental changes** can threaten some species, while proving advantageous to others. When the ecosystem changes, some organisms will survive and reproduce while others will not. Those organisms who struggle in an environment after a change has occurred will either die off or may move to a new location. Changes to the environment may also provide opportunities for new organisms to establish themselves. The organisms that are most likely to survive may have lifestyles and structures that provide them advantages. ***In the instruction of this standard, it is important to introduce students to a variety of changes in the environment and make connections between these changes and the ability of the ecosystems to meet the needs of organisms.*** ***Examples of specific adaptations should be secondary discussions as those discussions appear***	**HMH Tennessee Science** Unit 5, Lessons 5 and 6 Unit 6, lesson 2 Teacher's edition pages: 247A-260, 261A-262, 281 a-296. Flipchart pt. 29 For digital lesson, login to HMH, then click Lesson 5: https://tinyurl.com/y4ckzrl3 Lesson 6: https://tinyurl.com/y3xyf3tm **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y5gvxobz **Brainpop video:** https://tinyurl.com/oht7pmd	**4.LS2.5** **Crosscutting Concept:** **Cause and Effect** *Students routinely search for cause and effect relationships in systems they study.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Analyzing and interpreting data.** *Students should be able to organize experimental data to reveal patterns and utilize data using simple graph to form explanations.*

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	as part of standards under life sciences disciplinary core idea 4.		
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First Nine Weeks Vocabulary

Vocabulary:

1. Plants and Photosynthesis
energy (sun), xylem, phloem, transpiration, photosynthesis, chlorophyll, chloroplast, oxygen, carbon dioxide, sugar

2. Interactions in Ecosystems
environment, ecosystem, biosphere, organism, biotic factor, abiotic factor, terrestrial, aquatic, producer, consumer, decomposer, herbivore, carnivore, omnivore, invasive species, food chain, food web

3. Balance in Ecosystems
environmental changes, limiting factor, habitat, niche, competition, population, community, reproduction, adaptation, extinction, symbiosis, mutualism, commensalism, parasitism,

4. Living Things Respond to Change
camouflage, mimicry, structural adaption, behavioral adaption, instinct

Other Vocabulary
cell, cell wall, membrane, cytoplasm, nucleus, mitochondria

Resources:
HMH Tennessee Science: https://www-k6.thinkcentral.com
Science Launch Packs: https://packs.eb.com Password: Bartlett Username: gopanther1 (available until Oct. 2019 only)
Interactive Videos: http://www.turtlediary.com/
Britannica: https://www.britannica.com
Tennessee Electronic Library
Discovery Streaming
Brain Pop Jr.

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Guiding Questions: 1. What is the relationship between the Earth Moon and Sun? 2. What causes the day and night cycle on Earth? 3. Why does the Sun cause different shadows during the day? 4. What are the characteristics of Earth's different layers?

2nd Nine Weeks-Earth Science- Earth and Its Layers (3 weeks) Oct. 21 – Nov. 8			
DCI: ESS1: Earth's Place in the Universe AND ESS2: Earth's Systems			
TN State Standards	**Objectives/Learning Targets Explanation**	**Instructional Resources**	**Crosscutting Concepts and Science & Engineering Principles**
4.ESS1.2 Use a model to explain how the **orbit** of the Earth and sun cause observable patterns: **A.** day and night; **B.** changes in length and direction of shadows over a day. **COMPONENT IDEA:** *B. Earth and the Solar System*	**4.ESS1.2** **EXPLANATION:** **In fifth grade 5.PS2.3**, students begin to explore gravity and at that point can develop an understanding of the role of gravity and inertia in maintaining Earth's orbit. **This standard sets a foundation for those discussions by leading students to make connections between the shadows that they see changing over a day AND the events occurring at a planetary scale underlying those changes.** These changes in the length and direction of shadows become key evidence in connecting the tilt of the Earth's axis to the formation of seasons **in fifth grade.** **Activity:** Opportunities to explore this standard might include recording the length of their shadows at preset times during the day over an extended period of time, using a spotlight/floodlight/flashlight to model this process within a classroom, and/or creating a scale model using spheres and a flashlight.	**HMH Tennessee Science** Unit 7, lessons 1 and 2 Teacher's Edition pages 335A-348, 349A-350, Flipchart pg. 37 For digital lesson, login to HMH, then click lesson 1: https://tinyurl.com/yy7dqq6q Lesson 2: https://tinyurl.com/yxnscmz2 **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/yy4vjykt **Brainpop video:** **https://tinyurl.com/zldbn9k**	**4.ESS1.2** **Crosscutting Concept:** **Scale, Proportion, and Quantity** *Students become familiar with sizes immensely large or small or durations extremely short or long.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Analyzing and interpreting data** *Students should be able to organize experimental data to reveal patterns and utilize data using simple graph-to- form explanations.*

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4.ESS2.4 Analyze and interpret data on the four layers of the Earth, including thickness, composition, and physical states of these layers. **COMPONENT IDEA:** *A. Earth Materials and Systems*	**4.ESS2.4** **EXPLANATION:** Earth's systems include the **atmosphere**, **hydrosphere, biosphere**, and **geosphere**. ***This standard elaborates on the internal structure of the geosphere to include: the crust, mantle, outer core, and inner core***. ***Students should develop an understanding of the relative positions, thicknesses, and compositions of these layers.*** ***Knowing the characteristics of each layer prepares students to understand processes such as convection within the mantle or radioactive decay within Earth's core.***	**HMH Tennessee Science** Unit 8, Lesson 3, Teacher's edition pages 381A-396 For digital lesson, login to HMH, then click https://tinyurl.com/yxk6vjxd **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y43lc2sj **Brainpop video:** https://tinyurl.com/o48xne5	**4.ESS2.4** **Crosscutting Concept:** **Systems and System Models** *Students group and describe interactions of the components that define a larger system.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Analyzing and interpreting data.** *Students organize data (observations and measurements) in a manner which facilitates further analysis and comparisons.*

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Guiding Questions: 1. What are Earth's features? 2. How do living and nonliving things change Earth's surface?

2nd Nine Weeks- Earth Science: Earth's Landforms & Features (3 weeks) Nov. 12 – Dec. 6			
DCI: ESS2 Earth's Systems & Earth's Place in the Universe			
TN State Standards	**Objective/Learning Targets Explanation**	**Instructional Resources**	**Crosscutting Concepts and Science & Engineering Principles**
4.ESS2.1 1) Collect and analyze data from observations to provide evidence that rocks, soils, and **sediments** are broken into smaller pieces through **mechanical weathering** (frost wedging, abrasion, tree root wedging) and are transported by water, ice, wind, gravity, and **vegetation**. **COMPONENT IDEA:** *A. Earth Materials and Systems* **4.ESS1.1** Generate and support a claim with evidence that over long periods of time, erosion (**weathering and transportation-erosion) and deposition** have changed landscapes and created new landforms. **COMPONENT IDEA:** *C. The History of Planet Earth*	**4.ESS2.1** **EXPLANATION:** ***This standard focuses on the actual processes and mechanisms that break down rocks to form soils and sediments and transport these sediments***. **Mechanical weathering** includes wearing of rock by water, ice, wind, living organisms, and gravity. Once broken down, the materials can be moved by a number of different mechanisms. **Activities** Students can recreate the process of frost wedging by freezing a sealed water bottle and observing the effects. Early introductions to the idea of experimental design can be achieved by freezing an empty water bottle at the same time. ***(4.ESS2.1 focuses on processes whereas 4.ESS1.1 focuses on the landforms affected/created by these processes.)*** **4.ESS1.1** **EXPLANATION:** ***Students should separate the processes of weathering and erosion and their roles in changing the surface of Earth.*** ***Weathering processes are more explicitly addressed in 4.ESS2.1 and pertain to the breaking down of materials. Erosive processes transport these broken down materials. The focus of this standard is on the idea that these processes occur over very long periods of time.*** Throughout history, there have been events such as earthquakes and volcanoes that create sudden dramatic changes to the landscape. However, gradual processes occurring continuously have also played a significant role in creating Earth's current landscape. **Landforms which should be explored include local, regional, and global.** **Activity**: Students can model the effects of weathering and erosion to create small scale landforms to understand how particular structures and formations may arise from weathering and erosion processes.	**HMH Tennessee Science** Unit 8, Lesson 1 Teacher's edition pages 361A-376 For digital lesson, login to HMH, then click https://tinyurl.com/y6ryznc2 **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y6me8pb3 **Brainpop video:** https://tinyurl.com/okbwane **HMH Tennessee Science** Unit 8, Lesson 1 and 2 Teacher's edition pages 361A-376, 379A-380, Flipchart pages 39 and 41 For digital lesson, login to HMH, then click Lesson 1: https://tinyurl.com/y6ryznc2 Lesson 2: https://tinyurl.com/yxvd59fq **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/yydpf8n4 **Brainpop video: (on landforms only)**	**4.ESS2.1** **Crosscutting Concept:** **Cause and Effect** *Students identify conditions required for specific cause and effect interactions to occur through investigation.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Constructing explanations and designing solutions** *Students can create evidence based explanations for relationships seen in the natural world as well as identify evidence that supports other explanations.* **4.ESS1.1** **Crosscutting Concept:** **Stability and Change** *Students recognize that even apparently stable systems may be undergoing imperceptible changes.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Developing and using models** *Student models begin to become abstract and metaphorical, incorporating relationships between events and predictive aspects for recurring events.*

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4.ESS2.2 Interpret maps to determine that the location of **mountain ranges, deep ocean trenches, volcanoes, and earthquakes** occur in patterns. **COMPONENT IDEA:** *B. Plate Tectonics and Large-Scale Systems Interactions*	**4.ESS2.2** **EXPLANATION:** **2.ESS2.3 introduced students to reading maps and identifying features on very simple maps.** **There are two developments to this standard.** 1. The first added complexity is that students must now be able to read more complicated maps. The maps that are examined should include the ***location and distribution of features*** that students may not have experienced firsthand, whereas *second grade map features were familiar, natural resources*. 2. In addition, students are ***now examining the maps with the goal of observing patterns in the locations of features.*** As cartographers produced increasingly more detailed maps, including sonar-generated maps of the ocean floor, patterns which appeared became incorporated into the origin of tectonic theory. ***Major trends include that mountain chains form at the inside or edge of continents, and the presence of major bands of earthquakes and volcanoes occur where mountains meet oceans. Evidence for previous volcanic activity can include the presence of igneous rocks.***	https://tinyurl.com/haukkas **HMH Tennessee Science** Unit 8, Lesson 3, Teacher's edition pages 381A-396 (Please note these are the same resources in HMH text as used in 4.ESS2.4) The videos below are more specified to 4.ESS2.2) For digital lesson, login to HMH, then click https://tinyurl.com/yxk6vjxd **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/yydpf8n4 **Brainpop video:** https://tinyurl.com/mva6lhr https://tinyurl.com/o48xne5	**4.ESS2.2** **Crosscutting Concept:** **Pattern** *Students use patterns as evidence in an argument or to make predictions, construct explanations, and engage in arguments.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Analyzing and interpreting data.** *Students should organize data (observations and measurements) in a manner which facilitates further analysis and comparisons.*

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Guiding Questions: 1. What are fossils and what can we learn from them? 2. What are natural resources?

2nd Nine Weeks- Earth Science : Earth and Its Resources (2 weeks) Dec. 9 - Dec. 20			
DCI: LS4: Biological Change: Unity and Diversity, ESS3: Earth and Human Activity, ESS2: Earth's Systems			
TN State Standards	**Objectives/Learning Targets Explanation**	**Instructional Resources**	**Crosscutting Concepts and Science & Engineering Principles**
4.LS4.1 **Obtain information** about what a **fossil** is and ways a fossil can provide information about the past. **COMPONENT IDEA:** *A. Evidence of Common Ancestry*	**4.LS4.1** **EXPLANATION:** **In 3.LS4.1, students were introduced to the idea that variations within a species may favor the survival of some organisms over.** By extension, it is likely that this discussion also included the idea that some types of organisms that were once found on Earth have become extinct. Through the use of fossil timelines we can observe changes in organisms over long periods of time. For example: We see fish without jawbones 500 million years ago, yet fossils from 400 million years ago show the emergence of jawbones. The appearance of new animal types can also be observed (amphibians 350mya, reptiles 300mya, mammals 230mya, and birds 120mya). Younger rocks contain embedded fossils that are younger and look more like the animals we see today. Examples of information could include type, size, and distribution of fossil organisms. Fossils used for examination can include both visible and microscopic.	**HMH Tennessee Science** Unit 8, Lesson 5 Teacher's edition pages 401A-410 There is no digital lesson for Unit 8, Lesson 5 **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/yyvwvyts **Brainpop video:** https://tinyurl.com/p58frwp	**4.LS4.1** **Crosscutting Concept:** **Scale, Proportion, and Quantity** *Students become familiar with sizes immensely large or small or durations extremely short or long.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Constructing explanations and designing solutions** *Students can create evidence based explanations for relationships seen in the natural world as well as identify evidence that supports other explanations.*
4.ESS3.1 **Obtain and combine information** to describe that energy and fuels are derived from **natural resources** and that some energy and fuel sources are **renewable** (sunlight, wind, water)	**4.ESS3.1** **EXPLANATION:** All material resources and energy used by humans are taken from the environment. **This idea is originally presented in kindergarten when students begin to consider the ways that humans utilize the land (e.g. wood can be burnt for heating). In kindergarten, the examples given did not involve processing of the materials.** **Discussions of 4.ESS3.1 should also include basic discussions of how the materials are extracted or obtained to support**	**HMH Tennessee Science** Unit 9, Lesson 1 Teacher's edition pages 417A-430 For digital lesson, login to HMH, then click https://tinyurl.com/y69nzjlp	**4.ESS3.1** **Crosscutting Concept:** **Energy and Matter** *Students begin to recognize types of energy present in a system and the ability to transfer this energy between objects* **SCIENCE AND ENGINEERING PRINCIPLE:** **Constructing**

and some are **non-renewable** (fossil fuels, minerals). **COMPONENT IDEA:** *A. Natural Resources*	**4.ESS3.2. These discussions do not need to involve detailed descriptions of the processes, but should focus on the general consequences of obtaining the different types of energy. (e.g., fossil fuels are extracted from deposits below Earth's surface.)** The extraction processes used to obtain resources from the earth have effects on the earth. **Students should develop an understanding of what differentiates the listed renewable and non- renewable resources.** **A full discussion relating the time to renew resources to human lifetimes will occur in 6.ESS3.1.**	**Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y3oxlctw **Brainpop video:** https://tinyurl.com/gqngh9q	**explanations and designing solutions** *Students can create evidence based explanations for relationships seen in the natural world as well as identify evidence that supports other explanations.*
4.ESS3.2 **Create an argument, using evidence** from research, that human activity (farming, mining, building) can affect the land and ocean in positive and/or negative ways. **COMPONENT IDEA:** *C. Human Impacts on Earth Systems*	**4.ESS3.2** **EXPLANATION:** **As addressed in 4.ESS3.2 the processes used to obtain materials from the environment have consequences.** **Students should examine the activities that humans undertake and their effects. Discussions can include, but are not limited to farming, mining, and building.** For example, human development frequently involves paving of roads affecting runoff in areas. Development can be carried out to include measures which deliberately minimize its effects. Examples include treatment of sewage, recycling of resources, and monitoring the byproducts of agricultural activities.	**HMH Tennessee Science** Unit 9, Lesson 2 Teacher's edition pgs. 433A-444 For digital lesson, login to HMH, then click https://tinyurl.com/y5w5s973 **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y65tmblr **Brainpop video:** https://tinyurl.com/lzdxa8p https://tinyurl.com/mef3xjm	**4.ESS3.2** **Crosscutting Concept:** **Cause and Effect** *Students routinely search for cause and effect relationships in systems they study.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Engaging in argument from evidence** *Students create and identify evidence- based arguments and consider whether an argument is supported by evidence or relies on opinions or incomplete representations of relevant evidence.*
4.ESS2.3 **Provide examples to support the claim**	**4.ESS2.3** **EXPLANATION:**	**HMH Tennessee Science** Unit 6, Lesson 2 Teacher's edition pgs. 281A-296	**4.ESS2.3** **Crosscutting Concept:** **Systems and System Models** *Students group and describe*

that organisms affect the physical characteristics of their regions. **COMPONENT IDEA:** *E. Biogeology*	These effects that organisms have on their regions can include both short-and-long term effects. Living organisms depend on the Earth to meet basic needs. Long-term effects include restructuring the surface of the land to suit human needs (e.g. building of roads, dams, fuels, agriculture) or other organisms creating habitats and shelters. Much earlier in Earth's history, it was the dramatic increases of living organisms in certain areas and that created deposits of fossil fuels for the remains of these organisms.	For digital lesson, login to HMH, then click https://tinyurl.com/yxkbf8or **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y6dgzlpm https://tinyurl.com/y4ktowcg **Brainpop game:** https://tinyurl.com/h3zcr5b	*interactions of the components that define a larger system.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Obtaining, evaluating, and communicating information** *(Observe/Evaluate) Students can read and summarize text and embedded, non-text elements from multiple sources synthesizing an understanding on a scientific idea. Students can communicate scientific information in writing utilizing embedded elements.*

Second Nine Weeks Resources

Vocabulary:

1. Day and Night, Axis, revolution, rotation, orbit
2. Shadows
   Apparent motion, shadow, eclipse(solar and lunar),
3. Earth and Its Layers-
   Crust, Mantle Outer Core, Inner Core ,magma, atmosphere, hydrosphere, biosphere, and geosphere
4. Earth's Landforms & Features
   landform, continent, tectonic plate, volcano, earthquake, fault, topographical map, mountain ranges, ocean trenches,
5. Erosion & Weathering
   weathering, vegetation, erosion, deposition, sediment, mechanical weathering (physical), chemical weathering
6. Resources from the Past
   fossil, amber, imprint, mold, cast,
7. Natural Resources
   natural resource, nonrenewable resource, fossil fuel, pollution, mineral resource, conservation, renewable resource, alternative energy source
8. Human Activity Affects Earth.
9. Chemical weathering, acid rain, sinkhole, fertilizer,
   Other Vocabulary- moon phases

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Guiding Questions: 1. How are speed and energy related? 2. What happens when objects collide?

3rd Nine Weeks- Physical Science : Speed and Energy (3 weeks) Jan. 6 – Jan. 24			
DCI: 4PS3: Energy 4.ETS1: Engineering Design			
TN State Standards	**Objectives/Learning Targets Explanation**	**Instructional Resources**	**Crosscutting Concepts and Science & Engineering Principles**
4PS3.1 **Use evidence to explain the cause and effect** relationship between the speed of an object and the energy of an object. **COMPONENT IDEA:** *A. Definitions of Energy*	**4PS3.1** **EXPLANATION:** ***The energy of a moving object is properly referred to as kinetic energy. This knowledge is imperative to teaching 4.PS3.2.*** As an object's speed increases, so too does its kinetic energy. To illustrate this concept, consider dropping balls of play dough from different heights. Slow motion videos can confirm the increase in speeds when dropped from varying heights. ***Relating back to 2.PS3.1, students can recognize that larger changes in shape are associated with greater amounts of energy.***	**HMH Tennessee Science** Unit 3, Lessons 3 and 4 Teacher's edition pgs. 121A-138, 139A-140 Flipchart page 15 For digital lesson, login to HMH, then click Lesson 3: https://tinyurl.com/y6ayyo3c Lesson 4: there is no digital lesson **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y6qjue6k **Brainpop video:** https://tinyurl.com/n8chzau	**4PS3.1** **Crosscutting Concept:** **Cause and Effect** *Students routinely search for cause and effect relationships in systems they study.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Constructing explanations and designing solutions** *Students can create evidence-based explanations for relationships seen in the natural world as well as identify evidence that supports other explanations.*

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4PS3.2 **Observe and explain** the relationship between potential energy and kinetic energy. **COMPONENT IDEA:** *D. Energy in Chemical Processes and Everyday Life*	**4PS3.2** **EXPLANATION:** The idea that humans produce energy from nothingness is a misconception that students might possess. Energy exists in various stored forms know as potential energies. This potential energy can then be converted or released. For instance, water at high at elevation contains (gravitational) potential energy that can be harnessed by hydroelectric dams to produce electricity by spinning turbines. Food is a stored energy form that is released during digestion. Examples which build on these ideas might include using a hoop spring or elastic band to propel a toy car forward (elastic potential energy). Recognizing that deforming the spring to greater amounts increases the potential energy of the spring. **Activity:** Additionally, students can use electric toy cars with different numbers of batteries and observe the speeds of these cars. (electric potential energy) To "remove" batteries, but allow the car to function, the ends of the batteries can first be taped over with masking tape to prevent them from releasing energy into the circuit. The battery can then be wrapped neatly in aluminum foil and inserted into the toy as normal. The foil allows electricity to flow through the circuit.	**HMH Tennessee Science** Unit 3, Lesson 1 Teacher's edition pgs. 103A-118 For digital lesson, login to HMH, then click https://tinyurl.com/y6rruzol **Discovery Education video:** Login to Clever, then click link. https://tinyurl.com/y4vzktsn **Brainpop video:** https://tinyurl.com/qyqac56	**4PS3.2** **Crosscutting Concept:** **Energy and Matter** *Students begin to recognize types of energy present in a system and the ability to transfer this energy between objects.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Planning and carrying out controlled investigations** *Students carry out investigations in groups, where conditions and variables are controlled, utilize appropriate instruments, and deliberately plan multiple trials.*

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Guiding Question: How can stored energy be used?

3rd Nine Weeks- Physical Science: Energy Transformations (3 weeks) Jan. 27 – Feb. 14

DCI: 4PS3: Energy

TN State Standards	Objectives/Learning Targets Explanation	Instructional Resources	Crosscutting Concepts and Science & Engineering Principles
4.PS3.3 **Describe** how stored energy can be converted into another form for practical use. **COMPONENT IDEA:** *D. Energy in Chemical Processes and Everyday Life*	**4.PS3.3** **EXPLANATION:** There are various mechanisms to store or concentrate energy to be used at a later time. Plants store up the suns energy and store this energy. When the plants are consumed, the energy can be unleased. For processes such as these to work, energy must be stored so that it can be released. A dam stores water on its uphill side, plants store energy from sunlight as they produce food, and batteries store electricity.	**HMH Tennessee Science** Unit 3, Lesson 1 Teacher's edition pgs. 103A-118 (Please note that the same HMH resources are used for 4.PS.3.2 as 4.PS.3.3) DE and Brainpop videos are different. For digital lesson, login to HMH, then click https://tinyurl.com/y6rruzol **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y6ljudyv **Brainpop video:** https://tinyurl.com/jx8b2yk	**4.PS3.3** **Crosscutting Concept:** **Energy and Matter** *Students begin to recognize types of energy present in a system and the ability to transfer this energy between objects.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Constructing explanations and designing solutions** *Students can create evidence based explanations for relationships seen in the natural world as well as identify evidence that supports other explanations.*

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Guiding Question: How do waves travel? What makes sound?

3rd Nine Weeks- Physical Science: How Waves Move (2 weeks) Feb. 18 – Feb. 28			
DCI: 4PS4: Waves and their Application in Technological Transfer			
TN State Standards	**Objectives/Learning Targets Explanation**	**Instructional Resources**	**Crosscutting Concepts and Science & Engineering Principles**
4.PS4.1 **Use a model** of a simple **wave** to explain regular patterns of **amplitude, wavelength, and direction**. **COMPONENT IDEA:** *A. Wave Properties: Mechanical and Electromagnetic*	**4.PS4.1** **EXPLANATION:** Student models should explore the patterns in the shapes of both **longitudinal and transverse waves** as well as patterns occurring when two waves interact. Students should be able to both identify **amplitude** within a model for a wave, as well as identify patterns for how amplitude changes when waves interact. Students should note the effects on the direction a wave travels when it intersects another wave while traveling through a **medium**. Waves can be observed traveling through an elongated spring that is quickly jerked sideways and returned to center on a tile floor. Floor tiles can be used as reference points where a wave might have an amplitude of one floor tile. ***(Students are not responsible for boundary behaviors of waves such as reflection at a fixed end.)***	**HMH Tennessee Science** Unit 4, Lesson 1 Teacher's edition pgs. 149A-164 For digital lesson, login to HMH, then click https://tinyurl.com/yyo92ebs **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y3noflzh **Brainpop video:** https://tinyurl.com/oy9w5qt	**4.PS4.1** **Crosscutting Concept:** **Pattern** *Students recognize, classify, and record patterns involving rates of change.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Developing and using models** *Student models begin to become abstract and metaphorical, incorporating relationships between events and predictive aspects for recurring events.*

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Guiding question: 1. How do animal eyes work? 2. Why do some people need glasses? 3. How do we use patterns and waves to transmit information? 4. What can light pass through?

3rd Nine Weeks- Physical Science: How Waves Affect How We See and Transmit Information (2 weeks) March 2 – March 13			
DCI: 4PS4: Waves and their Application in Technological Transfer			
TN State Standards	**Objectives/Learning Targets Explanation**	**Instructional Resources**	**Crosscutting Concepts and Science & Engineering Principles**
4.PS4.2 **Describe** how the colors of available light sources and the bending of light **waves** determine what we see. **COMPONENT IDEA:** *B. Electromagnetic Radiation*	**4.PS4.2** **EXPLANATION:** ***In first grade, students discussed the idea that objects are visible because they either reflect or emit their own light. Light was treated as a beam of light and color was not addressed in first grade.*** ***This standard provides students the opportunity to see that white light is composed of a combination of red, green, and blue light.*** Students can examine and record how the appearances of objects (solid-color and multi-color) change depending on the light source. **Prisms** can be used to bend light so that it is separated into component colors. **Lenses** and combinations of lenses can bend light to magnify or focus light for objects that cannot be seen with the naked eye. ***(Students are not responsible for explaining the properties of materials that cause them***	**HMH Tennessee Science** Unit 4, Lessons 3 and 4 Teacher's edition pgs. 169A-178, 179-190 For digital lesson, login to HMH, then click Lesson 3: https://tinyurl.com/y6ayv88p Lesson 4: https://tinyurl.com/yytmbfwb **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/yy8rkb3j **Brainpop video:** https://tinyurl.com/lxw68oj	**4.PS4.2** **Crosscutting Concept:** **Cause and Effect** *Students routinely search for cause and effect relationships in systems they study.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Analyzing and interpreting data.** *Students should be able to organize experimental data to reveal patterns and utilize data using simple graph-to-form explanations.*

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4.PS4.3 **Investigate** how lenses and digital devices like computers or cell phones use waves to enhance human senses. **COMPONENT IDEA:** *C. Information Technologies and Instrumentation*	***to absorb/reflect certain colors.)*** **4.PS4.3** **EXPLANATION:** **In 4.PS4.2, students are exposed to the bending of light as it crosses over the boundary between two materials.** Students could investigate or construct varying arrangements of lenses to determine how they are utilized in devices such as eyeglasses, microscopes, or telescopes. Digital devices are devices/components of devices that are either on or off. An LCD (computer/smartphone) screen is a series of tiny lightbulbs (pixels) that can be turned on or off individually to create a picture. A model of this process might be crowds at a stadium holding pieces of colored paper above their heads to create a mosaic when viewed from above. Computers store information about which pixels are turned on an off to display an image. This stored digital information can be transmitted using waves to share pictures remotely.	**HMH Tennessee Science** Unit 4, Lessons 1, 4, 5 Teacher's edition pgs. 149A-164, 179-190, 193A-194, Flipchart pgs. 20 and 22 For digital lesson, login to HMH, then click Lesson 1: https://tinyurl.com/yyo92ebs Lesson 4: https://tinyurl.com/yytmbfwb Lesson 5: https://tinyurl.com/yx9hrmwe	**4.PS4.3** **Crosscutting Concept:** **Structure and Function** *Students begin to attribute the shapes of sub-components to the function of the part.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Obtaining, evaluating, and communicating information** *(O/E) Students can read and summarize text and embedded, non-text elements from multiple sources synthesizing an understanding on a scientific idea. (C) Students can communicate scientific information in writing utilizing embedded elements.*

Third Nine Weeks Resources
Vocabulary: 1. Speed and Energy Speed, velocity, acceleration, force, energy, contact force, noncontact force, gravity, friction 2. Energy change in collisions Work, potential energy, kinetic energy, mechanical energy, energy transfer, conservation of energy 3. Energy Transformations Battery, electric current, circuit, switch, resistor, electromagnet, generator, magnetic field 4. How Waves Move Vibration, soundwave, medium, wavelength, frequency, pitch, amplitude, volume 5. How Waves Affect How We See Absorption, reflection, refraction, concave lens, convex lens, transparent, translucent, opaque, prism 6. How Waves Transmit Information Echo, echolocation, Coding, binary code

Other vocabulary: weight, mass, length, volume, physical properties

Guiding Questions 1. What tools, skills, knowledge, and inquiry skills are needed to conduct engineering processes? 2. How do science concepts, engineering skills, and applications of technology improve the quality of life?

4th Nine Weeks- Engineering Technology & Applications of Sciences (9 weeks)			
DCI: 4.ETS1: Engineering Design			
TN State Standards	**Objectives/Learning Targets Explanation**	**Instructional Resources**	**Crosscutting Concepts and Science & Engineering Principles**

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ETS1.1 **Categorize** the effectiveness of design solutions by comparing them to specified criteria for constraints **COMPONENT IDEA**: *C. Optimizing the Solution Design* **ETS2.2** **Determine** the effectiveness of multiple solutions to a design problem given the criteria and the constraints. **COMPONENT IDEA:** *C. Optimizing the Solution Design*	*****All ETS standards should be used connectively with all other standards throughout the year. They should be used to support in students' inquiry skills for lessons.***** **ETS1.1& ETS2.2** **EXPLANATION:** While the human imagination is boundless, the success of engineering solutions is dictated by real-world constraints. ***In grades K-2 student involvement in designing engineering problems focused on identifying opportunities for technology and engineering to fulfill a need or desire and recognizing the importance of a full understanding of the potential problem.*** ***In 3.ETS1, students were introduced to the principle of constraints.*** **With this standard, students are asked to evaluate the effectiveness of various solutions, placing emphasis on incorporating the constraints into the critique of solutions that meet the proposed criteria for success**. **Students might examine proposed design solutions meant to minimize the human impact on the land and ocean, or means of obtaining natural resources.**	**HMH Tennessee Science** Unit 2, lessons 1,2 Unit 3, Lessons 3,5,6,7 Teacher's edition pgs. 70-71, 77A-78, 142A-142B, 212A-212B, 328A-328B, 354 **Discovery Education video:** Login to Clever, then click link https://tinyurl.com/y6dmzgrj **Brainpop video:** https://tinyurl.com/y37fbr7j **HMH Tennessee Science** Unit 2, lessons 2 Unit 6, STEM Engineering and Technology Teacher's edition pgs. 70-71, 77A-78, 328A-328B, Flipchart pgs. 9 **Discovery Education video:** Login to Clever, then click link (many engineering videos incorporating constraints to choose from) https://tinyurl.com/y53lv49g	**ETS1.1 and ETS2.2** **Crosscutting Concept:** **Systems and System Models** *Students group and describe interactions of the components that define a larger system* **SCIENCE AND ENGINEERING PRINCIPLE:** **Analyzing and interpreting data.** *Students should interpret simple graphs to compare a set of solutions to a problem*

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ETS2.3 **Explain** how engineers have improved existing technologies to increase their benefits, to decrease known risks, and to meet societal demands. (artificial limbs, seatbelts, cell phones). **COMPONENT IDEA:** *B. Influence of Engineering, Technology, and Science on Society and the Natural World*	**ETS2.3** **EXPLANATION:** Examples can extend beyond those suggested, in the standard. **The rationale behind these three was to address the three facets of the standard:** 1)Improvements in artificial limbs improve the benefits of an already extant technology, 2) Seatbelts decrease the risks of injuries in car accidents, and 3) Cell phones meet the societal demand for greater connectedness and convenience. **As technology changes, it creates new demands from society as previously inconceivable technologies are realized.**	**HMH Tennessee Science** Unit 2, Lessons 3,4 Teacher's edition pgs. 79A-91, 93A-94, Flipchart pg. 11 For digital lesson, login to HMH, then click Lesson 3: https://tinyurl.com/y43epg5m Lesson 4: https://tinyurl.com/y3alogfx	**ETS2.3** **Crosscutting Concept:** **Cause and Effect** *Students routinely search for cause and effect relationships in systems they study.* **SCIENCE AND ENGINEERING PRINCIPLE:** **Engaging in argument from evidence** *Students create and identify evidence- based arguments and consider whether an argument is supported by evidence or relies on opinions or incomplete representations of relevant evidence.*