FTS Middle School Science Overview

6th Grade
- Earth Systems
- Stability and Change on Earth
- Evidence of Common Ancestry
- Selection and Adaptation
- Weather and Climate
- Human Impacts
- Astronomy

7th Grade
- Structure and Function
- Inheritance and Variations of Traits
- Growth, Development, and Reproduction of Organisms
- Body Systems
- Interdependent Relationships in Ecosystems
- Organization for Matter and Energy Flow in Organisms
- Matter and Energy in Organisms and Ecosystems

8th Grade
- Forces and Motion
- Relationships among Forms of Energy
- The Electromagnetic Spectrum
- Types of Interactions
- Thermal Energy
- Structure and Properties of Matter
- Interactions of Matter
- Chemical Reactions

6th Grade: Earth Science Textbook

- Earth Systems
- Stability and Change on Earth
- Evidence of Common Ancestry
- Selection and Adaptation
- Weather and Climate
- Human Impacts
- Astronomy

Unit 1: Earth Systems

Students examine geoscience data in order to understand processes and events in Earth's history. Important crosscutting concepts in this unit are scale, proportion, and quantity, stability and change, and patterns in relation to the different ways geologic processes operate over geologic time. An important aspect of the history of Earth is that geologic events and conditions have affected the evolution of life, but different life forms have also played important roles in altering Earth's systems. Students understand how Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems. Students investigate the controlling properties of important materials and construct explanations based on the analysis of real geoscience data. Students are expected to demonstrate proficiency in analyzing and interpreting data and constructing explanations. They are also expected to use these practices to demonstrate understanding of the core ideas.

Instructional Days: 30
This unit is based on MS-ESS1- 4, MS-ESS2- 1, MS-ESS2- 2, and MS-ESS2- 3.
Textbook Chapters: 2, 3, 4, 7, 10, 11

Unit 2: Stability and Change on Earth

Students construct an understanding of the ways that human activities affect Earth's systems. Students use practices to understand the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts on the development of these resources. Students also understand that the distribution of these resources is uneven due to past and current geosciences processes or removal by humans. The crosscutting concepts of patterns, cause and effect, and stability and change are called out as organizing concepts for these disciplinary core ideas. In this unit of study students are expected to demonstrate proficiency in asking questions, analyzing and interpreting data, constructing explanations, and designing solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Instructional Days: 30
This unit is based on MS-ESS3-1, MS-ESS3-2, MS-ESS3-4, and MS-ESS3-5.
Textbook Chapters: 18

Unit 3: Evidence of a Common Ancestry *and Unit 4 combined*

Students understand how fossil records and anatomical similarities of the relationships among organisms and species describe biological evolution. Students examine evidence to support their understanding of patterns in the
fossil record and how those patterns show relationships between modern organisms and their common ancestors. Students use the practices of analyzing graphical displays and gathering, reading, and communicating information. The crosscutting concepts of cause and effect, patterns, and structure and function will support understanding across this unit of study.

Instructional Days: 15
This unit is based on MS-LS4-1, MS-LS4-2, and MS-LS4-3.

Unit 4: Selection and Adaptation

Students construct explanations based on evidence to support fundamental understandings of natural selection and evolution. They will use ideas of genetic variation in a population to make sense of how organisms survive and reproduce, thus passing on the traits of the species. Students use the practices of constructing explanations; obtaining, evaluating, and communicating information; and using mathematical and computational thinking. Crosscutting concepts of patterns and structure and function contribute to the evidence students can use to describe biological evolution will support understanding across this unit of study.

Instructional Days: 20
This unit is based on MS-LS4-4, MS-LS4-5, and MS-LS4-6.
Textbook Chapters: 11, Life Sci Ch. 6

Unit 5: Weather and Climate

This unit is broken down into three sub-ideas: Earth's large-scale systems interactions, the roles of water in Earth's surface processes, and weather and climate. Students make sense of how Earth's geo-systems operate by modeling the flow of energy and cycling of matter within and among different systems. A systems approach is also important here, examining the feedbacks between systems as energy from the sun is transferred between systems and circulates through the ocean and atmosphere. The crosscutting concepts of cause and effect, systems and system models, and energy and matter are called out as organizing concepts for these

disciplinary core ideas. In this unit, students are expected to demonstrate proficiency in developing and using models and planning and carrying out investigations as they make sense of the disciplinary core ideas.

Instructional Days: 20
This unit is based on MS-ESS2-4, MS-ESS2-5, and MS-ESS2-6.
Textbook Chapters: 12, 13, 14

Unit 6: Human Impacts on Earth Systems and Global Climate Change

Students build on their understanding of the ways that human activities affect Earth's systems. Students use science and engineering practices to understand the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts of these uses. The crosscutting concepts of cause and effect and the influence of science, engineering, and technology on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In this unit of study, students are expected to demonstrate above grade level proficiency in analyzing and interpreting data and designing solutions. They will also define design problems and evaluate competing design solutions to demonstrate understanding of the core ideas. The goal for middle school students is to define problems more precisely, to conduct a more thorough process of choosing the best solution, and to optimize the final design. This includes defining a problem by precisely specifying criteria and constraints for solutions as well as potential impacts on society and the natural environment; systematically evaluating alternative solutions; analyzing data from tests of different solutions; combining the best ideas into an improved solution; and developing testing and improving a model to reach an optimal solution. In earth and space science, students apply their engineering design capabilities to problems related to the impacts of humans on Earth systems.

Instructional Days: 25
This unit is based on MS-ESS3-3, MS-ETS1-1, MS-ETS1-2, and MS-ETS1-3.

Unit 7: Astronomy

This unit is broken down into three sub-ideas: the universe and its stars, Earth and the solar system, and the history of planet Earth. Students examine the Earth's place in relation to the solar system, the Milky Way galaxy, and the universe. There is a strong emphasis on a systems approach and using models of the solar system to explain astronomical and other observations of the cyclical patterns of eclipses, tides, and seasons. There is also a strong connection to engineering through the instruments and technologies that have allowed us to explore the objects in our solar

system and obtain the data that support the theories explaining the formation and evolution of the universe. Students examine geosciences data in order to understand the processes and events in Earth's history. The crosscutting concepts of patterns, scale, proportion, and quantity and systems and systems modeling are called out as organizing concepts for these disciplinary core ideas.

Instructional Days: 20
This unit is based on MS-ESS1-1, MS-ESS1-2, and MS-ESS1-3.

7th Grade: Life Science Textbook

- Structure and Function
- Inheritance and Variations of Traits
- Growth, Development, and Reproduction of Organisms
- Body Systems
- Interdependent Relationships in Ecosystems
- Organization for Matter and Energy Flow in Organisms
- Matter and Energy in Organisms and Ecosystems

Unit 1: Structure and Function

Students plan and carry out investigations to develop evidence that living organisms are made of cells. Students gather information to support explanations of the relationship between structure and function in cells. They are able to communicate an understanding of cell theory and understand that all organisms are made of cells. Students understand that special structures are responsible for particular functions in organisms. They then are able to use their understanding of cell theory to develop and use physical and conceptual models of cells. The crosscutting concepts of scale, proportion, and quantity and structure and function are the organizing concepts for these core ideas about processes of living organisms.

Instructional Days: 15
This unit is based on MS-LS1-1 and MS-LS1-2.
Textbook Chapters: 1, 2

Unit 2: Inheritance and Variation of Traits

Students develop and use models to describe how gene mutations and sexual reproduction contribute to genetic variation. Students understand how genetic factors determine the growth of an individual organism. They also demonstrate understanding of the genetic implications of sexual and asexual reproduction. The crosscutting concepts of cause and effect and

structure and function provide a framework for understanding how gene structure determines differences in the functioning of organisms. Students are expected to demonstrate proficiency in developing and using models. Students use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

Instructional Days: 20
This unit is based on MS-LS3- 1 and MS-LS3- 2.
Textbook Chapters: 3, 5, 6

Unit 3: Growth, Development, and Reproduction of Organisms

Students use data and conceptual models to understand how the environment and genetic factors determine the growth of an individual organism. They connect this idea to the role of animal behaviors in animal reproduction and to the dependence of some plants on animal behaviors for their reproduction. Students provide evidence to support their understanding of the structures and behaviors that increase the likelihood of successful reproduction by organisms. Students practice analyzing and interpreting data, using models, conducting investigations, and communicating information. The crosscutting concepts of cause and effect and structure and function support understanding across this topic.
Instructional Days: 25
This unit is based on MS-LS1-4 and MS-LS1-5.
Textbook Chapters: 9, 10, 11, 13

Unit 4: Body Systems

Students develop a basic understanding of the role of cells in body systems and how those systems work to support the life functions of the organism. Students will construct explanations for the interactions of systems in cells and organisms. Students understand that special structures are responsible for particular functions in organisms, and that for many organisms, the body is a system of multiple-interaction subsystems that form a hierarchy, from cells to the body. Students construct explanations for the interactions of systems in cells and organisms and for how organisms gather and use information from the environment. The cross cutting concepts of systems and system models and cause and effect provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in engaging in argument from evidence and obtaining, evaluating, and communicating information. Students use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

Instructional Days: 15
This unit is based on MS-LS1- 3 and MS-LS1- 8.

Textbook Chapters: 14, 15, 16

Unit 5: Interdependent Relationships in Ecosystems

Students build on their understandings of the transfer of matter and energy as they study patterns of interactions among organisms within an ecosystem. They consider biotic and abiotic factors in an ecosystem and the effects these factors have on a population. They construct explanations for the interactions in ecosystems and the scientific, economic, political, and social justifications used in making decisions about maintaining biodiversity in ecosystems. The crosscutting concept of stability and change supports understanding across this topic. This unit includes a two-stage engineering design process. Students first evaluate different engineering ideas that have been proposed using a systematic method to determine which solutions are most promising. They then test different solutions, and combine the best ideas into a new solution that may be better than any of the preliminary ideas.

Instructional Days: 25
This unit is based on MS-LS2-4, MS-LS2-5, MS-ETS1-1, and MS-ETS1-3.

Unit 6: Organization for Matter and Energy Flow in Organisms

Students provide a mechanistic account for how cells provide a structure for the plant process of photosynthesis in the movement of matter and energy needed for the cell. Students use conceptual and physical models to explain the transfer of energy and cycling of matter as they construct explanations for the role of photosynthesis in cycling matter in ecosystems. They construct scientific explanations for the cycling of matter in organisms and the interactions of organisms to obtain matter and energy from an ecosystem to survive and grow. They understand that sustaining life requires substantial energy and matter inputs, and that the structure and functions of organisms contribute to the capture, transformation, transport, release, and elimination of matter and energy. The crosscutting concepts of matter and energy and structure and function provide a framework for understanding of the cycling of matter and energy flow into and out of organisms. Students are also expected to demonstrate proficiency in developing and using models. Students use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

Instructional Days: 15
This unit is based on MS-LS1- 6 and MS-LS1- 7.

Unit 7: Matter and Energy in Organisms and Ecosystems

Students analyze and interpret data, develop models, construct arguments, and demonstrate a deeper understanding of the cycling of matter, the flow of energy, and resources in ecosystems. They are able to study patterns of interactions among organisms within an ecosystem. They consider biotic and abiotic factors in an ecosystem and the effects these factors have on populations. They also understand that the limits of resources influence the growth of organisms and populations, which may result in competition for those limited resources. The crosscutting concepts of matter and energy, systems and system models, patterns, and cause and effect are used to develop understandings.

Instructional Days: 25
This unit is based on MS-LS2-1, MS-LS2-2, and MS-LS2-3.

8th Grade: Physical Science Textbook

- Forces and Motion
- Relationships among Forms of Energy
- The Electromagnetic Spectrum
- Types of Interactions
- Thermal Energy
- Structure and Properties of Matter
- Interactions of Matter
- Chemical Reactions

Unit 1: Forces and Motion

Students use system and system models and stability and change to understanding ideas related to why some objects will keep moving and why objects fall to the ground. Students apply Newton's third law of motion to related forces to explain the motion of objects. Students also apply an engineering practice and concept to solve a problem caused when objects collide. The crosscutting concepts of system and system models and stability and change serve as organizing concepts for these disciplinary core ideas. Students demonstrate proficiency in asking questions; planning and carrying out investigations; designing solutions; engaging in argument from evidence; developing and using models; and constructing explanations and designing solutions.

Instructional Days: 25
This unit is based on MS-PS2-1, MS-PS2-2, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, and MS-ETS1-4.

Textbook Chapters: 1, 2

Unit 2: Relationships among Forms of Energy

Students mathematically, graphically, and in paragraph form, explain the relationship between energy and forces. Students develop their understanding of important qualitative ideas about energy, including that the interactions of objects can be explained and predicted using the concept of transfer of energy from one object or system of objects to another, and the total change of energy in any system is always equal to the total energy transferred into or out of the system. Students understand that objects that are moving have kinetic energy and that objects may also contain stored (potential) energy, depending on their relative positions. Students begin to know the difference between energy and temperature, and the relationship between forces and energy. Students use the practices of analyzing and interpreting data, developing and using models, and engaging in argument from evidence. The crosscutting concepts of scale, proportion, and quantity; systems and system models; and energy and matter will support understanding across this unit of study.

Instructional Days: 20
This unit is based on MS-PS3-1, MS-PS3-2, and MS-PS3-5.
Textbook Chapters: 5

Unit 3: Thermal Energy

Students come to know the difference between energy and temperature. They understand that the total change of energy in any system is always equal to the total energy transferred into or out of the system. The crosscutting concepts of energy and matter; scale, proportion, and quantity; and influence of science, engineering, and technology on society and the natural world are the organizing concepts for these disciplinary core ideas. Science and engineering practices include constructing explanations and designing solutions, asking questions and
defining problems, engaging in argument from evidence, planning and carrying out investigations, and analyzing and interpreting data. Students will be able to apply an understanding of design to the process of energy transfer. They define design problems, develop models, and evaluate competing design solutions to demonstrate understanding of the core ideas.

Instructional Days: 30
This unit is based on MS-PS3-3, MS-PS3-4, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, and MS-ETS1-4.
Textbook Chapters: 6

Unit 4: The Electromagnetic Spectrum

Students describe and predict characteristic properties and behaviors of waves when the waves interact with matter. Students can apply an understanding of waves as a means of sending digital information. The crosscutting concepts of patterns and structure and function are used as organizing concepts for these
disciplinary core ideas. The performance expectations require students to demonstrate above grade level proficiency in developing and using models; using mathematical thinking; and obtaining, evaluating, and communicating information and
using these practices to demonstrate understanding of the core ideas.

Instructional Days: 20
This unit is based on MS-PS4-1, MS-PS4-2, and MS-PS4-3.
Textbook Chapters: 15, 16, 17

Unit 5: Types of Interactions

Students use cause and effect; system and system models; and stability and change to understand ideas that explain why some materials are attracted to each other while others are not. Students apply ideas about gravitational, electrical, and magnetic forces to explain a variety of phenomena including beginning ideas about why some materials attract each other while others repel. In particular, students develop understandings that gravitational interactions are always attractive but that electrical and magnetic forces can be both attractive and negative. Students also develop ideas that objects can exert forces on each other even though the objects are not in contact, through fields. Students are expected to consider the influence of science, engineering, and technology on society and the natural world. They are expected to demonstrate proficiency in asking questions, planning and carrying out investigations, designing solutions, and engaging in argument.

Instructional Days: 25
This unit is based on MS-PS2-3, MS-PS2-4, and MS-PS2-5.
Textbook Chapters: 19, 20

Unit 6: Structure and Properties of Matter

Students build understandings of what occurs at the atomic and molecular scale. Students apply their understanding that pure substances have characteristic properties and are made from a single type of atom or molecule. They also provide a molecular level accounts to explain states of matter and changes between states. The crosscutting concepts of cause and effect; scale, proportion and quantity; structure and function;

interdependence of science, engineering, and technology; and influence of science, engineering and technology on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students demonstrate above grade level proficiency in developing and using models, and obtaining, evaluating, and communicating information. Students use these scientific and engineering practices to demonstrate understanding of the core ideas.
Instructional Days: 20
This unit is based on MS-PS1-1 and MS-PS1-2.
Textbook Chapters: 7, 8, 9

Unit 7: Interactions of Matter

Students provide molecular-level accounts of states of matter and changes between states, of how chemical reactions involve regrouping of atoms to form new substances, and of how atoms rearrange during chemical reactions. Students are also able to apply an understanding of optimization design and process in engineering to chemical reaction systems. Students are expected to demonstrate above grade level proficiency in obtaining, evaluating, and communicating information and developing and using models. The crosscutting concepts of structure and function; cause and effect; interdependence of science, engineering, and technology; and influence of science, engineering, and technology on society and on the natural world are organizing concepts for these disciplinary core ideas.

Instructional Days: 20
This unit is based on MS-PS1-3 and MS-PS1-4.
Textbook Chapters: 10, 11

Unit 8: Chemical Reactions

Students provide molecular-level accounts of states of matters and changes between states, of how chemical reactions involve regrouping of atoms to form new substances, and of how atoms rearrange during chemical reactions. Students also apply their understanding of optimization design and process in engineering to chemical reaction systems. The crosscutting concept of energy and matter is the organizing concept for these disciplinary core ideas. Students are expected to demonstrate above grade level proficiency in developing and using models; analyzing and interpreting data; designing solutions; and obtaining, evaluating, and communicating information. Students use these science and engineering practices to demonstrate understanding of the disciplinary core ideas. Students define problems more precisely in order to conduct a more thorough process of choosing the best solution and to optimize the final design. The focus is on a two-stage process of evaluating proposed ideas, using a systematic method to determine which proposed solutions are most promising, testing different solutions, and then combining the best ideas

into a new solution that may be better than any of the preliminary ideas. Improving designs involves an iterative process in which students test the best design, analyze the results, modify the design accordingly, and then retest and modify the design again. Students may go through this cycle two, three, or more times in order to reach the optimal (best possible) result.

Instructional Days: 25
This unit is based on MS-PS1-5, MS-PS1-6
Textbook Chapters: 12, 13