PISCATAWAY
TOWNSHIP SCHOOLS

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Science 7

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Grade Span: 7
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COURSE OVERVIEW

Description

Through engagement in the performance expectations arranged into the bundles that compose the seventh-grade science curriculum, students will continue to establish a conceptual understanding of science content and ideas from multiple disciplines of science. Student learning establishes an understanding of how forces create a change of motion when acting both at a distance and when in contact. Student investigations will focus on how forces can be described and measured by observing the motion of objects and movement of energy. Additionally, 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 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, expanding their understanding of waves from 6th grade as a means of sending digital information. Students also begin to develop an understanding of how the structures of organisms enable life's functions. Students investigate the body as a system of interacting subsystems, with their primary focus of discovery on groups of cells that together form tissues and organs. This understanding is expanded through exploration of the specialized cells in the nervous system and digestive system functioning.

Goals

This course aims to: ● develop student use of models as scientific explanation ● enable students to plan and conduct investigations ● develop student ability to analyze and interpret data, as well as utilize mathematical and computational thinking ● advance student ability to construct explanations clearly and effectively based on arguments from evidence ● allow students to obtain, evaluate, and communicate information ● allow students opportunities to model understanding of the core ideas within this course

Scope and Sequence

Unit	Topic (Bundle)	Length
Forces and Motion	How can we describe the motion of objects?	~7 weeks
	Can you apply a force on an object without touching it?	~3 weeks
Earth in Space	How can we explain observable patterns in the Earth-Sun-Moon system?	~7 weeks
	How do we send information through space and on Earth?	~4 weeks
Structure and Function in Organisms	How do cells contribute to the functioning of an organism?	~4 weeks
	How can systems be used to describe the human body?	~8 weeks

Resources

Suggested Resources:

- District-created learning materials
- Mosa Mack Science
- Gizmos (ExploreLearning)
- Kesler Science supplemental materials
- Albert.iO materials

UNIT 1: FORCES AND MOTION

Summary and Rationale

Students will be able to describe the motion of objects in terms of the size and direction of forces. Additionally, students will be able to expand on previous learning related to properties (specifically mass) to discuss the link between kinetic energy and speed of an object. Newton's Laws are used as a means to facilitate discussion and investigation into motion of objects to predict outcomes in collisions. Using Newton's Laws, students are able to apply an understanding of force size and direction to describe and predict the overall motion of a single object. Students discover a relationship between forces and mass when regarding a change in an object's motion. Investigations reveal relationships between kinetic energy and speed. This is an expansion on previous learning about the relationship between kinetic energy and mass. Students will not only be able to describe the fundamental interactions of forces during a collision, but also design a potential solution to an identified problem relative to those understandings. Students will investigate certain forces that act at a distance and draw conclusions relative to the factors that impact their strength. Specifically, students will focus on electric and magnetic forces to provide evidence of the fields that exist allowing forces to be exerted on objects that are not in contact.

Recommended Pacing

~ 9 weeks total

State Standards (Performance Expectations)

Bundle 1: How can we describe the motion of objects?	~6 weeks total
Thread 1a: How can we predict the motion of an object?	~3 weeks

MS-PS2-2: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Clarification Statement	Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.
Assessment Boundary	Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.

Thread 1b: What happens when objects collide?	~3 weeks

MS-PS3-1: Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to **the speed of an object.**

Clarification Statement	Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a whiffle ball versus a tennis ball.

MS-PS2-1: Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

Clarification Statement	Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.
Assessment Boundary	Assessment is limited to vertical or horizontal interactions in one dimension.

MS-PS3-5: Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.	
Clarification Statement	Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.
Assessment Boundary	Assessment does not include calculations of energy.

Bundle 2: Can you apply a force on an object without touching it?	~3 weeks

MS-PS2-3: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.	
Clarification Statement	Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.
Assessment Boundary	Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.
MS-PS2-5: Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.	
Clarification Statement	Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.
Assessment Boundary	Assessment is limited to electric and magnetic fields and limited to qualitative evidence for the existence of fields.

Instructional Focus

Unit Enduring Understandings (Crosscutting Concepts)

- **Bundle 1:**

Thread 1a:

- **Stability and Change:** Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. (MS-PS2-2)
- **The Nature of Science:** Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS3-5)

Thread 1b:

- **Scale, Proportion, and Quantity:** Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. (MS-PS3-1)
- **Systems and System Models:** Models can be used to represent systems and their interactions— such as inputs, processes and outputs—and energy and matter flows within systems. (MS-PS2-1)
- **Energy and Matter:** Energy may take different forms (e.g. energy in fields, thermal energy, and energy of motion). (MS-PS3- 5)
- **The Nature of Science:** Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS3-5)

- **Bundle 2**

- **Cause and Effect:** Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS2-3), (MS-PS2-5)

Unit Essential Questions

- How can we describe the motion of objects?
- How can we predict the motion of objects?
- What happens when objects collide?
- Can you apply a force on an object without touching it?

Objectives

Students will know (DCIs):

➢ **Bundle 1:**

Thread 1a:

- **Forces and Motion**
  - The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.
  - All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.

Thread 1b:

- **Definitions of Energy**
  - Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed.
- **Forces and Motion**
  - For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law).
- **Conservation of Energy and Energy Transfer**
  - When the motion energy of an object changes, there is inevitably some other change in energy at the same time.

➢ **Bundle 2:**

- **Types of Interactions**
  - Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.
  - Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively).

Students will be able to (Science and Engineering Practices):

➢ **Bundle 1:**

Thread 1a:

- Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS2-2)

Thread 1b:

- Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1)
- Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1)
- Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. (MS-PS3-5)

➢ **Bundle 2:**

- Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. (MS-PS2-3)
- Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-PS2-5)

Resources

See *Grade 7 Curriculum Resources* drive

Interdisciplinary Connections

Connections to NJSLS – English Language Arts

➢ **Bundle 1:**

Thread 1a:

- RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-2)
- WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS2-2)

Thread 1b:

- RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (MS-PS3-1), (MS-PS2-1), (MS-PS3-5)
- RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-1)
- RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS3-1)
- WHST.6-8.1Write arguments focused on discipline content. (MS-PS3-5)
- WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS2-1)

➢ **Bundle 2:**

- RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (MS-PS2-3)
- RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-5)
- WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS2-5)

Connections to NJSLS – Mathematics

➢ **Bundle 1:**

Thread 1a:

- MP.2 Reason abstractly and quantitatively. (MS-PS2-2)
- 6.SP.B.5 Summarize numerical data sets in relation to their context. (MS-LS2-2)

- 6.EE.A.2 Write, read, and evaluate expressions in which letters stand for numbers. (MS-PS2-2)
- 7.EE.B.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-PS2-2)
- 7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-PS2-2)

Thread 1b:

- MP.2 Reason abstractly and quantitatively. (MS-PS3-1), (MS-PS2-1), (MS-PS3-5)
- 6.RP.A.1 Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS3-1), (MS-PS3-5)
- 6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship. (MS-PS3-1)
- 6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative numbers to represent quantities in realworld contexts, explaining the meaning of 0 in each situation. (MS-PS2-1)
- 6.EE.A.2 Write, read, and evaluate expressions in which letters stand for numbers. (MS-PS2-1)
- 7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-PS3-1), (MS-PS3-5)
- 7.EE.B.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-PS2-1)
- 7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-PS2-1)
- 8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. (MS-PS3-1)
- 8.EE.A.2 Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and$x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational. (MS-PS3-1)
- 8.F.A.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS3-1), (MS-PS3-5)

UNIT 2: EARTH IN SPACE

Summary and Rationale

Students make discoveries related to the various patterns observable in the Earth-Sun-Moon system and their resulting effects. This includes lunar phases, eclipses, and seasons. The primary focus in explanation of these phenomena is on the role gravitational forces play on planetary orbit. Students will further their understanding of gravitational forces (started in the Physical Sciences unit) to develop ideas related to orbits in the Solar System. Students will be able to apply the concept of gravitational force to explain why objects move the way they do in space. Students apply their learning about orbits to examine the observable phenomena within the Earth-Sun-Moon system. Based on an understanding of this system, students will make claims related to the predictable nature of certain events, including solar eclipses, lunar cycles, and seasons. Tides (from the previous thread) can serve as another example of a similar predictable pattern. Students make discoveries related to the scale of the Solar System. Focus is on analysis of data to make claims about different solar system objects. Emphasis is on the analytical and interpretive process, rather than memorization of characteristics of planets. Students build upon previous learning about wave properties (from grade 6 Physical Science) to make discoveries about electromagnetic radiation waves. Previous learning focused on wave properties, sound waves, and the need for a medium to travel through. This bundle expands on this by presenting students with the vacuum of space as not having a medium for mechanical (sound) waves to travel through and the presence of electromagnetic waves (for example light waves). Students also apply their understanding of electromagnetic waves as a means of sending analog and digital information. Students explore electromagnetic radiation waves as a type of wave that can travel through space without a medium. Student investigations can focus on light waves and the reflection of light to create color within the electromagnetic spectrum. Students should also be able to apply their previous learning of wave properties (frequency, wavelength, amplitude) to light waves. Students investigate electromagnetic waves other than light waves that can be used to send information - for example radio waves used to communicate in space. Emphasis is on the difference between analog and digital signals and their reliability to send signals.

Recommended Pacing

~ 12 weeks

State Standards (Performance Expectations)

Bundle 1: How can we explain observable patterns in the Earth-Sun-Moon system?	~8 weeks total
Thread 1a: What is the role of gravity in the motions of objects in our Solar System?	~3 weeks

MS-PS4-2: Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.	
Clarification Statement	Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.
Assessment Boundary	Assessment is limited to qualitative applications pertaining to light and mechanical waves.

MS-ESS1-2: Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.	
Clarification Statement	Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).

Assessment Boundary	Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.
Thread 1b: Why can we predict solar eclipses and other astronomical events?	~3 weeks
MS-ESS1-1: Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.	
Clarification Statement	Examples of models can be physical, graphical, or conceptual.
Thread 1c: What exists in the Solar System besides Earth, the Sun, and the Moon?	~2 weeks
MS-ESS1-3: Analyze and interpret data to determine scale properties of objects in the solar system.	
Clarification Statement	Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.
Assessment Boundary	Assessment does not include recalling facts about properties of the planets and other solar system bodies.
Bundle 2: How do we send information through space and on Earth?	~5 weeks
Thread 2a: Can waves travel in space?	~3 weeks
MS-PS4-2: Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.	
Clarification Statement	Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.
Assessment Boundary	Assessment is limited to qualitative applications pertaining to light and mechanical waves.
MS-PS4-1: Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.	
Clarification Statement	Emphasis is on describing waves with both qualitative and quantitative thinking.
Assessment Boundary	Assessment does not include electromagnetic waves and is limited to standard repeating waves.
Thread 2b: How do we use electromagnetic radiation to send information?	~2 weeks
MS-PS4-3: Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.	
Clarification Statement	Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in Wi-Fi devices, and conversion of stored binary patterns to make sound or text on a computer screen.
Assessment Boundary	Assessment does not include binary counting. Assessment does not include the specific mechanism of any given device.
Instructional Focus	
Unit Enduring Understandings (Crosscutting Concepts)	

➢ **Bundle 1:**

Thread 1a:

- **Systems and System Models:** Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. (MS-PS2-4), (MS-ESS1-2)
- **The Nature of Science:**
  - Science knowledge is based upon logical and conceptual connections between evidence and explanations (MS-PS2-4)
  - Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation (MS-ESS1-2)

Thread 1b:

- **The Nature of Science:** Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation (MS-ESS1-2)

Thread 1c:

- **Engineering, Technology, and Applications of Science:** Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (MS-ESS1-3)

➢ **Bundle 2:**

Thread 2a:

- **Patterns:** Graphs and charts can be used to identify patterns in data. (MS-PS4-1)
- **Structure and Function:** Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2)

Thread 2b:

- **Structure and Function:** Structures can be designed to serve particular functions (MS-PS4-3)
- **Engineering, Technology, and Applications of Science:** Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3)

Unit Essential Questions

- How can we explain observable patterns in the Earth-Sun-Moon system?
- What is the role of gravity in the motions of objects in our Solar System?
- Why can we predict solar eclipses and other astronomical events?
- What exists in the Solar System besides Earth, the Sun, and the Moon?
- How do we send information through space and on Earth?
- Can waves travel in space?
- How do we use electromagnetic radiation to send information?

Objectives

Students will know (DCIs):

➢ **Bundle 1:**

Thread 1a:

- **Types of Interactions**
  - Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun.
- **The Universe and Its Stars**
  - Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.
- **The Earth and the Solar System**
  - The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.

Thread 1b:

- **The Universe and Its Stars**
  - Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.
- **Earth and the Solar System**
  - This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that silt and are caused by the differential intensity of sunlight on different areas of Earth across the year.

Thread 1c:

- **The Earth and the Solar System**
  - The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.

➢ **Bundle 2:**

Thread 2a:

- **Electromagnetic Radiation**
  - When light shines on an object, itis reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light.
  - The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.
  - A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media.
  - However, because light can travel through space, it cannot be a matter wave, like sound or water waves.

Thread 2b:

- **Information Technologies and Instrumentation**
  - Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.

Students will be able to (Science and Engineering Practices):

➢ **Bundle 1:**

Thread 1a:

- Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-PS2-4)
- Develop and use a model to describe phenomena (MS-ESS1-2)

Thread 1b:

- Develop and use a model to describe phenomena (MS-ESS1-1)

Thread 1c:

- Analyze and interpret data to determine similarities and differences in findings. (MS-ESS1-3)

➢ **Bundle 2:**

Thread 2a:

- Develop and use a model to describe phenomena. (MS-PS4-2)
- Use mathematical representations to describe and/or support scientific conclusions and design solutions. (MS-PS4-1)

Thread 2b:

- Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. (MS-PS4-3)

Resources

See *Grade 7 Curriculum Resources* drive

Interdisciplinary Connections

Connections to NJSLS – English Language Arts

- **Bundle 1:**

Thread 1a:

- WHST.6-8.1 Write arguments focused on discipline-specific content. (MS-PS2-4)
- SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS1-2)

Thread 1b:

- SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS1-1)

Thread 1c:

- RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3)
- RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS1-3)

- **Bundle 2:**

Thread 2a:

- SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS4-1), (MS-PS4-2)

Thread 2b:

- RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-PS4-3)
- RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-PS4-3)
- RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-PS4-3)
- WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-PS4-3)

Connections to NJSLS – Mathematics

- **Bundle 1:**

Thread 1a:

- MP.4 Model with mathematics. (MS-ESS1-2)
- 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-2)
- 6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-2)
- 7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-ESS1-2)
- 7.EE.B.6 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS1-2)

Thread 1b:

- MP.4 Model with mathematics. (MS-ESS1-1)
- 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1)

- 7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-ESS1-1)

Thread 1c:

- MP.2 Reason abstractly and quantitatively. (MS-ESS1-3)
- 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-3)
- 7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-ESS1-3)

➢ **Bundle 2:**

Thread 2a:

- MP.2 Reason abstractly and quantitatively. (MS-PS4-1)
- MP.4 Model with mathematics. (MS-PS4-1)
- 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS4-1)
- 6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS4-1)
- 7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-PS4-1)
- 8.F.A.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS4-1)

Thread 2b:

- N/A

UNIT 3: STRUCTURE AND FUNCTION IN ORGANISMS

Summary and Rationale

Students' investigations produce data that provides evidence distinguishing between living and nonliving things. Discoveries also support the concept that living things may be made of one cell or many and varied cells. Students investigate cells as the smallest unit of life. Instruction leads to student discoveries related to the functioning of cells as individual systems. Focus of cell structures is on their relationship to the function of the cell as a whole. Students develop a conceptual understanding of the role of groups of cells in body systems and how those systems work to support the life functions of the organism. Primarily, student discovery centers around different types of, or specialized, cells that are responsible for making tissues/organs with particular functions in organisms. Students develop evidence to explain that the body is a system of multiple-interaction subsystems. Specifically, explanations for the interactions of systems in cells and organisms focus on how organisms gather and use information from the environment with specialized nerve cells and the functioning of the digestive system. Students develop a conceptual understanding focused on identifying evidence that certain types of cells group together to form specific tissues and organs. Specifically, focus in this thread is on the interactions of the circulatory, respiratory, and muscular systems. Student discovery is based on the interactions of these systems, rather than the mechanisms of one body system independent of others. Students develop an understanding of how food is broken down within the digestive system to support the growth and basic functioning of an organism. This thread builds upon the previous thread to identify more evidence of interactions between systems by investigating the digestive and excretory system. Specifically, focus is on how the digestive system functions to move energy and matter through an organism by interacting with other systems. Student focus is on the nervous system and its function to gather and respond to stimuli within the organism's environment. Focus is on the observation and process of response to stimuli, rather than the mechanisms of transferring information.

Recommended Pacing

~ 12 weeks

State Standards (Performance Expectations)

Bundle 1: How do cells contribute to the functioning of an organism?	~4 weeks
MS-LS1-1: Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.	
Clarification Statement	Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.
MS-LS1-2: Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.	
Clarification Statement	Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.
Assessment Boundary	Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.
Bundle 2: How can systems be used to describe the human body?	~8 weeks total

Thread 2a: Are all cells in the human body the same?	~4 weeks
MS-LS1-3: Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.	
Clarification Statement	Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.
Assessment Boundary	Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.
Thread 2b: How do our bodies get energy to function?	~2 weeks
MS-LS1-7: Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.	
Clarification Statement	Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.
Assessment Boundary	Assessment does not include details of the chemical reactions for photosynthesis or respiration.
Thread 2c: How do interacting body systems help organisms receive and respond to information from their environments?	~2 weeks
MS-LS1-8: Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.	
Assessment Boundary	Assessment does not include mechanisms for the transmission of this information.

Instructional Focus

Unit Enduring Understandings (Crosscutting Concepts)

- **Bundle 1:**
  - **Scale, Proportion, and Quantity:** Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1)
  - **Structure and Function:** Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-2)
  - **Engineering, Technology, and Applications of Science:** Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS1-1)
- **Bundle 2:**

Thread 2a:

- **Systems and System Models:** Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS-LS1-3)
- **The Nature of Science:** Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS-LS1-3)

Thread 2b:

- **Energy and Matter:** Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)

Thread 2c:

- **Cause and Effect:** Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8)

Unit Essential Questions

- How do cells contribute to the functioning of an organism?
- How can systems be used to describe the human body?
- Are all cells in the human body the same?
- How do our bodies get energy to function?
- How do interacting body systems help organisms receive and respond to information from their environments?

Objectives

Students will know (DCIs):

- **Bundle 1:**
  - **Structure and Function**
    - All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).
    - Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.
- **Bundle 2:**

Thread 2a:

- **Structure and Function**
  - In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.

Thread 2b:

- **Organization for Matter and Energy Flow in Organisms**
  - Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.

Thread 2c:

- **Information Processing**
  - Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.

Students will be able to (Science and Engineering Practices):

- **Bundle 1:**
  - Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1)
  - Develop and use a model to describe phenomena. (MS-LS1-2)
- **Bundle 2:**

Thread 2a:

- Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS-LS1-3)

Thread 2b:

- Develop a model to describe unobservable mechanisms. (MS-LS1-7)

Thread 2c:

- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS1-8)

Resources

See *Grade 7 Curriculum Resources* drive

Interdisciplinary Connections

Connections to NJSLS – English Language Arts

- **Bundle 1:**
  - **WHST.6-8.7** Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-LS1-1)
  - **SL.8.5** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-2)
- **Bundle 2:**

Thread 2a:

- **RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-3)
- **RI.6.8** Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (MS-LS1-3)
- **WHST.6-8.1** Write arguments focused on discipline content. (MS-LS1-3)

Thread 2b:

- **SL.8.5** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-7)

Thread 2c:

- **WHST.6-8.8** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-LS1-8)

Connections to NJSLS – Mathematics

- **Bundle 1:**
  - **6.EE.C.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (MS-LS1-1), (MS-LS1-2)
- **Bundle 2:**

Thread 2a:

- **6.EE.C.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (MS-LS1-3)

Thread 2b/2c:

- N/A