PISCATAWAY
TOWNSHIP SCHOOLS

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Science 5

Content Area: Science
Grade Span: 5
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COURSE OVERVIEW

Description

The performance expectations in fifth grade help students formulate answers to questions such as: “When matter changes, does its weight change? How much water can be found in different places on Earth? Can new substances be created by combining other substances? How does matter cycle through ecosystems? Where does the energy in food come from and what is it used for? How do lengths and directions of shadows, and how does the appearance of some stars change in different seasons?” Students are able to describe that matter is made of particles too small to be seen through the development of models. Students develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students determine whether the mixing of two or more substances results in new substances. Through the development of models, students are able to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. They describe and graph data to provide evidence about the distribution of water on Earth. Students develop an understanding of the idea that plants get the materials they need for growth chiefly from air and water. Using models, students can describe the movement of matter among plants, animals, decomposers, and the environment and that energy in animals’ food was once energy from the sun. Students are expected to develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. Every instructional unit is anchored by a unique phenomenon that is drives student discovery.

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	Length
1: Space Systems	Interactions Within the Earth, Sun, and Moon System	18-20 days
2: Matter Interactions	Properties of Matter and Chemical Reactions	18-20 days
3: Earth’s Systems	Earth’s Water and Interactions of Earth’s Spheres	18-20 days
4: Ecosystem Interactions	Matter and Energy in Organisms and Ecosystems	18-20 days

Resources

- District-created learning materials
- Mystery Science supplemental materials

UNIT 1: SPACE SYSTEMS

Summary and Rationale

In this unit of study, students examine interactions within the Earth, Sun, and moon system to develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. The crosscutting concepts of patterns, cause and effect, and scale, proportion, and quantity are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in analyzing and interpreting data and engaging in argument from evidence. Students are also expected to use these practices to demonstrate an understanding of the core ideas.

Recommended Pacing

18-20 days

State Standards (Performance Expectations)

5-PS2-1: Support an argument that the gravitational force exerted by Earth on objects is directed down.	
Clarification Statement	"Down" is a local description of the direction that points toward the center of the spherical Earth.
Boundary Statement	Assessment does not include mathematical representation of gravitational force
5-ESS1-1: Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth.	
Boundary Statement	Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage)
5-ESS1-2: Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.	
Clarification Statement	Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.
Boundary Statement	Assessment does not include causes of seasons.

Instructional Focus

Unit Enduring Understandings (Crosscutting Concepts)

- **Patterns:** Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. (5-ESS1-2)
- **Cause and Effect:** Cause and effect relationships are routinely identified and used to explain change. (5-PS2-1)
- **Scale, Proportion, and Quantity:** Natural objects exist from the very small to the immensely large. (5-ESS1-1)

Unit Essential Questions

- What patterns do we notice when observing the sky?
- What effect does Earth's gravitational force have on objects?
- What effect does the relative distance from Earth have on the apparent brightness of the sun and other stars?

Objectives

Students will know (DCIs):

- **Types of Interactions**
  - The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.

- **The Universe and its Stars**
  - The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.
- **Earth and the Solar System**
  - The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.

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

- Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. (5-ESS1-2)
- Support an argument with evidence, data, or a model. (5-PS2-1), (5-ESS1-1)

Resources

See *Grade 5 NGSS Curriculum Resources* drive
Mystery Science program materials

Interdisciplinary Connections

Connections to NJSLS - English Language Arts

• RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-PS2-1); (5-ESS1-1)

• RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS1-1) • RI.5.8 Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s). (5-ESS1-1)

• RI.5.9 Integrate and reflect on (e.g. practical knowledge, historical/cultural context, and background knowledge) information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-PS2-1); (5-ESS1-1)

• W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-PS2-1); (5- ESS1-1)

• SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS1-2)

Connections to NJSLS – Mathematics

• MP.2 Reason abstractly and quantitatively. (5-ESS1-1), (5-ESS1-2)

• MP.4 Model with mathematics. (5-ESS1-1), (5-ESS1-2)

• 5.NBT.A.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. (5-ESS1-1)

• 5.G.A.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS1-2)

UNIT 2: MATTER INTERACTIONS

Summary and Rationale

In this unit of study, students investigate various properties of matter the nature of chemical reactions to describe that matter is made of particles too small to be seen and to develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students determine whether the mixing of two or more substances results in new substances. The crosscutting concept of scale, proportion, and quantity is called out as an organizing concept for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, and use these practices to demonstrate understanding of the core ideas. The crosscutting concepts of cause and effect and scale, proportion, and quantity are also called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in planning and carrying out investigations and using mathematics and computational thinking. Students are expected to use these practices to demonstrate understanding of the core ideas.

Recommended Pacing

18-20 days

State Standards (Performance Expectations)

5-PS1-1: Develop a model to describe that matter is made of particles too small to be seen.	
Clarification Statement	Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.
Boundary Statement	Assessment does not include the atomic scale mechanism of evaporation and condensation or defining the unseen particles.
5-PS1-2: Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.	
Clarification Statement	Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.
Boundary Statement	Assessment does not include distinguishing mass and weight.
5-PS1-3: Make observations and measurements to identify materials based on their properties.	
Clarification Statement	Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.
Boundary Statement	Assessment does not include density or distinguishing mass and weight.
5-PS1-4: Conduct an investigation to determine whether the mixing of two or more substances results in new substances.	

Instructional Focus

Unit Enduring Understandings (Crosscutting Concepts)

- **Cause and Effect:** Cause and effect relationships are routinely identified, tested, and used to explain change. (5-PS1-4)
- **Scale, Proportion, and Quantity:**
  - Natural objects exist from the very small to the immensely large. (5-PS1-1)

- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-2), (5-PS1-3)
- **The Nature of Science:** Science assumes consistent patterns in natural systems. (5-PS1-2)

Unit Essential Questions

- When matter changes, does its weight change?
- How can properties be used to identify materials?
- What kind of model would best represent/describe matter as made of particles that are too small to be seen?
- What happens when two or more substances are mixed together?

Objectives

Students will know (DCIs):

- **Structure and Properties of Matter**
  - Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.
  - Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.)
  - The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.
- **Chemical Reactions**
  - When two or more different substances are mixed, a new substance with different properties may be formed.
  - No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.)

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

- Develop a model to describe phenomena. (5-PS1-1)
- Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5-PS1-2)
- Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5-PS1-3)
- Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (5-PS1-4)

Resources

See *Grade 5 NGSS Curriculum Resources* drive
Mystery Science program materials

Interdisciplinary Connections

Connections to NJSLS – English Language Arts

• RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS1-1)

• RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS1-1)

• W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (5-PS1-2), (5-PS1-3), (5-PS1-4)
• W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-PS1-2), (5- PS1-3), (5-PS1-4)
• W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-PS1-2), (5- PS1-3), (5-PS1-4)

Connections to NJSLS – Mathematics
• MP.2 Reason abstractly and quantitatively. (5-PS1-1)
• MP.4 Model with mathematics. (5-PS1-1)
• 5.NBT.A.1 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. (5-PS1-1)
• 5.NF.B.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (5-PS1-1)
• 5.MD.C.3 Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (5-PS1- 1)
• 5.MD.C.4 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. (5-PS1- 1)

UNIT 3: EARTH'S SYSTEMS

Summary and Rationale

In this unit of study, students describe and graph data to provide evidence about the distribution of water on Earth. Additionally, they describe ways in which the geosphere, biosphere, hydrosphere, and atmosphere interact. The crosscutting concepts of scale, proportion, quantity and systems, and systems models are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade appropriate proficiency in using mathematics and computational thinking and in obtaining, evaluating, and communicating information, developing and using models, obtaining, evaluating, and communicating information. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Recommended Pacing

18-20 days

State Standards (Performance Expectations)

5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Clarification Statement	Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system
Boundary Statement	Assessment is limited to the interactions of two systems at a time.

5-ESS2-2: Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

Boundary Statement	Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere

5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources, environment, and address climate change issues.

Instructional Focus

Unit Enduring Understandings (Crosscutting Concepts)

- **Scale, Proportion, and Quantity:** Standard units are used to measure and describe physical quantities such as weight, and volume. (5-ESS2-2)
- **Systems and System Models:** A system can be described in terms of its components and their interactions. (5-ESS2-1), (5-ESS3-1)
- **The Nature of Science:** Science findings are limited to questions that can be answered with empirical evidence. (5-ESS3-1)

Unit Essential Questions

- How do individual communities use science ideas to protect Earth's resources and environment?
- Where is water found on the Earth? What percentage of the Earth's water is freshwater?
- How do individual communities use science ideas to protect Earth's resources and environment?
- In what ways do the geosphere, biosphere, hydrosphere, and/or atmosphere interact?

Objectives

Students will know (DCIs):

- **The Roles of Water in Earth's Surface Processes**
  - Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.
- **Earth Materials and Systems**
  - Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.
- **Human Impacts on Earth Systems**
  - Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

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

- Develop a model using an example to describe a scientific principle. (5-ESS2-1)
- Describe and graph quantities such as area and volume to address scientific questions. (5-ESS2-2)
- Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. (5-ESS3-1)

Resources

See *Grade 5 NGSS Curriculum Resources* drive
Mystery Science program materials

Interdisciplinary Connections

Connections to NJSLS - English Language Arts

• RI.5.1 Quote accurately from a text and make relevant connections when explaining what the text says explicitly and when drawing inferences from the text. (5-ESS3-1)
• RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS2-1), (5-ESS2-2), (5-ESS3-1)
• RI.5.9 Integrate and reflect on (e.g. practical knowledge, historical/cultural context, and background knowledge) information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ESS3-1)
• W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-ESS2-2), (5-ESS3-1)
W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (5- ESS3-1)
• SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS2-1), (5-ESS2-2)

Connections to NJSLS - Mathematics

• MP.2 Reason abstractly and quantitatively. (5-ESS2-1), (5-ESS2-2), (5-ESS3-1)
• MP.4 Model with mathematics. (5-ESS2-1), (5-ESS2-2), (5-ESS3-1)
• 5.G.A.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS2-1)

UNIT 4: ECOSYSTEM INTERACTIONS

Summary and Rationale

In this unit of study, students develop an understanding of the movement of matter and energy through organisms and ecosystems. They conduct investigations to discover the idea that plants get the materials they need for growth chiefly from air and water. Using models, students can describe the movement of matter among plants, animals, decomposers, and the environment, and they can explain that energy in animals' food was once energy from the sun. The crosscutting concepts of energy and matter and systems and system models are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in developing and using models and engaging in argument from evidence. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Recommended Pacing

18-20 days

State Standards (Performance Expectations)

5-LS1-1: Support an argument that plants get the materials they need for growth chiefly from air and water.	
Clarification Statement	Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil
5-LS2-1: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.	
Clarification Statement	Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.
Boundary Statement	Assessment does not include molecular explanations
5-PS3-1: Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.	
Clarification Statement	Examples of models could include diagrams, and flowcharts.

Instructional Focus

Unit Enduring Understandings (Crosscutting Concepts)

- **Systems and System Models:** A system can be described in terms of its components and their interactions. (5-LS2-1)
- **Energy and Matter:**
  - Matter is transported into, out of, and within systems. (5-LS1-1)
  - Energy can be transferred in various ways and between objects. (5-PS3-1)
- **The Nature of Science:** Science explanations describe the mechanisms for natural events. (5-LS2-1)

Unit Essential Questions

- Where do plants get the materials they need for growth?
- How does matter move among plants, animals, decomposers, and the environment?
- How can energy in animals' food be traced to the sun?

Objectives

Students will know (DCIs):

- **Energy in Chemical Processes and Everyday Life**

- The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).

- **Organization for Matter and Energy Flow in Organisms**
  - Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion.
  - Plants acquire their material for growth chiefly from air and water.
- **Interdependent Relationships in Ecosystems**
  - The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.
- **Cycles of Matter and Energy Transfer in Ecosystems**
  - Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.

Students will be able to (Science and Engineering Practices):
- Use models to describe phenomena. (5-PS3-1)
- Develop a model to describe phenomena. (5-LS2-1)
- Support an argument with evidence, data, or a model. (5-LS1-1)

Resources

See *Grade 5 NGSS Curriculum Resources* drive
Mystery Science program materials

Interdisciplinary Connections

Connections to NJSLS – English Language Arts
• RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1)
• RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-LS2-1), (5-PS3-1)
• RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1)
• W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5- LS1-1)
• SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-LS2-1), (5-PS3-1)

Connections to NJSLS – Mathematics
• MP.2 Reason abstractly and quantitatively. (5-LS1-1), (5-LS2-1)
• MP.4 Model with mathematics. (5-LS1-1), (5-LS2-1)
• MP.5 Use appropriate tools strategically. (5-LS1-1)

• 5.MD.A.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems. (5-LS1- 1)