Science G5

EWING PUBLIC SCHOOLS
2099 Pennington Road
Ewing, NJ 08618

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Superintendent

In accordance with The Ewing Public Schools' Policy 2230, Course Guides, this curriculum has been reviewed and found to be in compliance with all policies and all affirmative action criteria.

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Course Description and Rationale

Students in this course will learn to explain scientific phenomena. The Next Generation Science Standards (NGSS) performance expectations rely on three dimensions of learning to develop student understanding of scientific concepts. Core conceptual ideas are learned by engaging in scientific and engineering practices and considering crosscutting concepts. These three dimensions support students in developing useable knowledge to explain real world phenomena in the sciences.

In science, performance expectations at the elementary school level use three dimensional learning to foster student understanding of science concepts.

Students will use the following eight NGSS Science and Engineering Practices to demonstrate understanding of the disciplinary core ideas and develop critical thinking skills:

- Asking questions (science) and defining problems (engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using math and computational thinking
- Constructing explanations (science) and designing solutions (engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

The following seven crosscutting concepts support the development of a deeper understanding of the disciplinary core ideas:

- Patterns
- Cause and effect: mechanism and explanation
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter: flows, cycles and conservation
- Structure and function

The course is a year-long course that meets for 45 minutes per day, on average for half the days of each marking period. The course uses a project-based approach to exploring many concepts. Many of the core ideas will be applied to engineering problems, allowing students to also develop an understanding of the engineering design process. This will further develop problem-solving and critical thinking skills as students work to design, test, solve, and revise solutions to problems. The crosscutting concepts of patterns through structure and function are used as organizing concepts for these disciplinary core ideas. These performance expectations focus on students demonstrating proficiency in developing and using models, using mathematical thinking, and obtaining, evaluating and communicating information; and to use these practices to demonstrate understanding of the core ideas.

The course content is arranged into four units of study:

- Earth’s Systems
- Space Systems: Stars and the Solar System
- Structure and Properties of Matter
- Matter and Energy in Organisms and Ecosystems

Career Readiness, Life Literacies, and Key Skills

During this course, students will work on developing, to an age appropriate level, the following Career Readiness, Life Literacies, and Key Skills:

Disciplinary Concepts:

- Career Awareness and Planning
    1. Different types of jobs require different knowledge and skills
- Creativity and Innovation
    1. Brainstorming can create new, innovative ideas.
- Critical Thinking and Problem-solving
    1. Critical thinkers must first identify a problem then develop a plan to address it in order to effectively solve a problem.
- Digital Citizenship
    1. Young people can have a positive impact on the natural world in the fight against climate change.
- Information and Media Literacy
    - Digital tools and media resources provide access to vast stores of information that can be searched.
    - Digital tools can be used to display data in various ways.
    - A variety of diverse sources, contexts, disciplines and cultures provide valuable and necessary information that can be used for different purposes.
    - Information is shared or conveyed in a variety of formats and sources.
- Technology Literacy
    - Digital tools have a purpose.
    - Collaboration can simplify the work an individual has to do and sometimes produce a better product.

Technology Integration

Computer Science and Design Thinking

During this course, students will work on developing, to an age appropriate level, the following Computer Science and Design Thinking Skills:

Disciplinary Concepts and Core Ideas:

- Data & Analysis
    - Individuals collect, use, and display data about individuals and the world around them.
    - Data can be used to make predictions about the world.
- Engineering Design
    - Engineering design is a creative process for meeting human needs or wants that can result in multiple solutions.
    - Limitations (constraints) must be considered when engineering designs.

- Interaction of Technology and Humans
    - Human needs and desires determine which new tools are developed.
    - Technology has changed the way people live and work.
    - Various tools can improve daily tasks and quality of life.
- Effects of Technology on the Natural World
    - The use of technology developed for the human designed world can affect the environment, including land, water, air, plants, and animals.
    - Technologies that use natural sources can have negative effects on the environment, its quality, and inhabitants.
    - Reusing and recycling materials can save money while preserving natural resources and avoiding damage to the environment.

ELA Integration:

- **NJSLS.RI.5.1** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-ESS1-1) (5-ESS3-1) (5-LS1-1) (5-PS2-1)
- **NJSLS.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) (5-ESS2-1) (5-ESS2-2) (5-ESS3-1) (5-LS2-1) (5-PS1-1) (5-PS3-1)
- **NJSLS.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)
- **NJSLS.RI.5.9** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ESS1-1) (5-ESS3-1) (5-LS1-1) (5-PS2-1)
- **NJSLS.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) (5-ESS2-1) (5-ESS2-2) (5-LS2-1) (5-PS3-1)
- **NJSLS.W.5.1** Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-ESS1-1) (5-LS1-1) (5-PS2-1)
- **NJSLS.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)
- **NJSLS.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) (5-PS1-2) (5-PS1-3) (5-PS1-4)
- **NJSLS.W.5.9** Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-ESS3-1) (5-PS1-2) (5-PS1-3) (5-PS1-4)

Mathematics Integration:

- **NJSLS.MP.2** Reason abstractly and quantitatively. (5-ESS1-1),(5-ESS1-2) (5-ESS2-1),(5-ESS2-2),(5-ESS3-1) (5-LS1-1),(5-LS2-1) (5-PS1-1),(5-PS1-2),(5-PS1-3)

- **NJSLS.MP.4** Model with mathematics. (5-ESS1-1),(5-ESS1-2) (5-ESS2-1),(5-ESS2-2),(5-ESS3-1) (5-LS1-1),(5-LS2-1) (5-PS1-1),(5-PS1-2),(5-PS1-3)
- **NJSLS.MP.5** Use appropriate tools strategically. (5-LS1-1) (5-PS1-2),(5-PS1-3)
- **NJSLS.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) (5-ESS2-1)
- **NJSLS.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) (5-PS1-2)
- **NJSLS.5.MD.C.3** Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (5-PS1-1)
- **NJSLS.5.MD.C.4** Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. (5-PS1-1)
- **NJSLS.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)
- **NJSLS.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)
  NJSLS.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)

Unit 1: Earth's Systems

Recommended Pacing - 22 days

Why Is This Unit Important?

This unit targets two major areas of Earth's Systems:

- Through the development of a model, using an example, students are able to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
- Students describe and graph data to provide evidence about the distribution of water on Earth.

Disciplinary Core Ideas:

- 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. (5-ESS2-1)
- 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. (5-ESS2-2)
- 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. (5-ESS3-1)

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)

Cross Cutting Concepts:

- Standard units are used to measure and describe physical quantities such as weight and volume. (5-ESS2-2)
- A system can be described in terms of its components and their interactions. (5-ESS2-1),(5-ESS3-1)

Enduring Understandings:

- 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.
- 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.
- 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.
- Standard units are used to measure and describe physical quantities such as weight, and volume.
- A system can be described in terms of its components and their interactions.
- Science findings are limited to questions that can be answered with empirical evidence.

Essential Questions:

- How do the geosphere, hydrosphere, atmosphere, and biosphere differ?
- How are the geosphere, hydrosphere, atmosphere, and biosphere similar? What do they have in common?
- How does the ocean affect the geosphere, hydrosphere, atmosphere, and biosphere?
- How does the ocean affect weather?
- How does the ocean effect climate?
- How much water can be found in different places on Earth?

Acquired Knowledge:

- Understand the structure and interaction of the following major systems of the Earth
- Geosphere
- Hydrosphere
- Atmosphere
- Biosphere
- Ocean ecosystems
- The impact of the ocean on the geosphere, hydrosphere, atmosphere, and biosphere
- Weather versus climate
- The impact of the ocean on weather and climate
- The role of water on the biosphere
- Human impact on the geosphere, hydrosphere, atmosphere, and biosphere.

Acquired Skills:

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

Assessments:

Formative Assessment:

- Group discussions/presentations:
  - Propose higher order questions
  - Present information to students and ask a question
  - Have students discuss their answers with their peers at their table and discuss together as a group

Summative Assessment:

- Sustainability Project:
  - Human Impacts

Benchmark Assessment:

- Students will be assessed on their ability to 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.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]
- Students will be assessed on their ability to 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. [Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.]
- Students will be assessed on their ability to obtain and combine information about ways individual communities use science ideas to protect the Earth's resources, environment, and address climate change issues.

Alternative Assessment:

- Modified project requirements and rubrics

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- Earth's Systems

In-Class Activities and Laboratory Experiences:

- Interactions of earth's Systems
- Develop a Model
- Graphing Water Data
- Plants and Pollution
- Protecting Land, Air, and Water
- Using Solar Energy

Closure and Reflection Activities:

- Tower of Trees

Instructional Materials:

- Exploring Science Cengage & National Geographic Learning; 2016

Technology Connections:

- http://ngss-k-5-ausd.weebly.com/5-earth-systems.html
- http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=21
- https://whyy.pbslearningmedia.org/subjects/science/earth-and-space-science/earths-systems/earths-systems-continually-interact/

Unit 2: Space Systems: Stars and the Solar System

Recommended Pacing - 22 days

Why Is This Unit Important?

This unit targets a major area of Space Systems: Stars and the Solar System:

- 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.

Disciplinary Core Ideas:

- The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (5- PS2-1)
- 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. (5-ESS1-1)
- 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. (5-ESS1-2)

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)

Cross Cutting Concepts:

- 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 relationships are routinely identified and used to explain change. (5-PS2-1)
- Natural objects exist from the very small to the immensely large. (5-ESS1-1)

Enduring Understandings:

- The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.
- 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.
- 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.
- Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.
- Cause and effect relationships are routinely identified and used to explain change.
- Natural objects exist from the very small to the immensely large.

Essential Questions:

- What is gravity?
- What affects gravity?
- What is the sun?
- What do you know about the sun, Earth, and moon system?
- How do lengths and directions of shadows or relative lengths of day and night change from day to day, and how does the appearance of some stars change in different seasons?
- What causes the phases of the moon?

Acquired Knowledge:

- Gravity
- Factors that affect gravity
- The sun
- The interactions of the sun, Earth, and moon system
- Apparent brightness
- Day versus night – the causes
- Apparent motion
- Shadows
- Moon Phases

Acquired Skills:

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

Assessments:

Formative Assessment:

- Group discussions/presentations:
  - Propose higher order questions
  - Present information to students and ask a question
  - Have students discuss their answers with their peers at their table and discuss together as a group

Summative Assessment:

- Project:
  - Represent Data

Benchmark Assessment:

- Students will be assessed on their ability to 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.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]
- Students will be assessed on their ability to support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth. [Assessment Boundary: 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).]
- Students will be assessed on their ability to 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.] [Assessment Boundary: Assessment does not include causes of seasons.]

Alternative Assessment:

- Modified project requirements and rubrics

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- What is Gravity?

In-Class Activities and Laboratory Experiences:

- Gravity
- Our Star – the Sun
- Apparent Brightness
- Day and Night
- Apparent Motion
- Sunlight and Shadows
- Graph Hours of Daylight
- Moon Phases

Closure and Reflection Activities:

- Career Exploration: Astrobiologist

Instructional Materials:

- Exploring Science Cengage & National Geographic Learning; 2016

Technology Connections:

- https://whyy.pbslearningmedia.org/subjects/science/earth-and-space-science/earths-systems/earths-systems-continually-interact/
- http://ngss-k-5-ausd.weebly.com/5space-systems-stars-and-solar-system.html
- http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=22

Unit 3: Structure and Properties of Matter

Recommended Pacing - 22 days

Why Is This Unit Important?

This unit targets three major areas of Structure and Properties of Matter:

- Students are able to describe that matter is made of particles too small to be seen through the development of a model.
- 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.

Disciplinary Core Ideas:

- 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. (5-PS1-1)
- The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2)
- 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.) (5-PS1-3)
- When two or more different substances are mixed, a new substance with different properties may be formed. (5-PS1-4)

- 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.) (5-PS1-2)

Science and Engineering Practices:

- Use models to describe phenomena. (5-PS1-1)
- 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)
- Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5-PS1-3)
- Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5-PS1-2)

Cross Cutting Concepts:

- Cause and effect relationships are routinely identified and used to explain change. (5-PS1-4)
- 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)

Enduring Understandings:

- 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.
- The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.
- 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.)
- 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.)
- Cause and effect relationships are routinely identified, tested, and used to explain change.
- Natural objects exist from the very small to the immensely large.
- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.
- Science assumes consistent patterns in natural systems.

Essential Questions:

- How can you compare the amount of mass, or 'stuff', in two objects?
- What are properties of matter?
- Can new substances be created by combining other substances?
- When matter changes, does its weight change?
- How can we tell when a chemical reaction occurs?

Acquired Knowledge:

- Definition of matter
- States of matter
- Properties of matter
- The following physical properties of matter:
  - Hardness
  - Magnetism
  - Electrical conductivity
  - Thermal conductivity
  - Solubility
- Changing states of matter via heating and cooling
- Mixtures
- Physical versus chemical properties
- Chemical changes
- Signs of a chemical change
- Chemical reactions

Acquired Skills:

- Develop a model to describe phenomena.
- 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.
- Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.
- Measure and graph quantities such as weight to address scientific and engineering questions and problems.

Assessments:

Formative Assessment:

- Group discussions/presentations:
  - Propose higher order questions
  - Present information to students and ask a question
  - Have students discuss their answers with their peers at their table and discuss together as a group

Summative Assessment:

- Project:
  - Identify Materials

Benchmark Assessment:

- Students will be assessed on their ability to 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.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.]
- Students will be assessed on their ability to 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.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.]
- Students will be assessed on their ability to 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.] [Assessment Boundary: Assessment does not include density or distinguishing mass and weight.]
- Students will be assessed on their ability to conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Alternative Assessment:

- Modified project requirements and rubrics

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- Matter

In-Class Activities and Laboratory Experiences:

- States of Matter
- Matter
- Develop a Model
- Hardness
- Magnetism
- Electrical Conductivity
- Thermal Conductivity
- Solubility
- Changing States of Matter
- Mixtures
- Provide Evidence
- Chemical Reactions

Closure and Reflection Activities:

- Career Exploration: Research Scientist

Instructional Materials:

- Exploring Science Cengage & National Geographic Learning; 2016

Technology Connections:

- http://ngss-k-5-ausd.weebly.com/5-structures-and-properties-of-matter-part-1.html
- http://ngss-k-5-ausd.weebly.com/5-structures-and-properties-of-matter-part-2.html
- http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=19

Unit 4: Matter and Energy in Organisms and Ecosystems

Recommended Pacing - 22 days

Why Is This Unit Important?

This unit targets two major areas of Matter and Energy in Organisms and Ecosystems:

- 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.

Disciplinary Core Ideas:

- 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). (5-PS3-1)
- 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. *(secondary to 5-PS3-1)*
- Plants acquire their material for growth chiefly from air and water. (5-LS1-1)
- 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. (5-LS2-1)
- 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. (5-LS2-1)

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)

Cross Cutting Concepts:

- A system can be described in terms of its components and their interactions. (5-LS2-1)
- 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)

Enduring Understandings:

- 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).
- 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.
- 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.
- 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.
- A system can be described in terms of its components and their interactions.
- Matter is transported into, out of, and within systems.
- Energy can be transferred in various ways and between objects.
- Science explanations describe the mechanisms for natural events.

Essential Questions:

- How do plants get their energy?
- Where does the energy in food come from and what is it used for?
- How does matter cycle through ecosystems?
- How does a food chain differ from a food web? Which is more accurate in real life?
- What are invasive species?

Acquired Knowledge:

- Sun is the ultimate source of energy for all life on Earth
- Cycle of energy through living things
- Cycle of matter through living things
- Ecosystems
- Populations
- Communities
- Invasive plants
- Invasive animals

Acquired Skills:

- Use models to describe phenomena.
- Develop a model to describe phenomena.
- Support an argument with evidence, data, or a model.

Assessments:

Formative Assessment:

- Group discussions/presentations:
  - Propose higher order questions
  - Present information to students and ask a question
  - Have students discuss their answers with their peers at their table and discuss together as a group

Summative Assessment:

- Project:
  - Invasive Species

Benchmark Assessment:

- Students will be assessed on their ability to 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 flow charts.]
- Students will be assessed on their ability to 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.]
- Students will be assessed on their ability to 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.] [Assessment Boundary: Assessment does not include molecular explanations.]

Alternative Assessment:

- Modified project requirements and rubrics

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- What Life Needs

In-Class Activities and Laboratory Experiences:

- Growing Crops
- Hydroponics
- Support an Argument
- Compare and contrast
- Use Models
- Interactions in a Model Pond
- Develop a Model

Closure and Reflection Activities:

- Career Exploration: Conservationist

Instructional Materials:

- Exploring Science Cengage & National Geographic Learning; 2016

Technology Connections:

- http://ngss-k-5-ausd.weebly.com/5-matter-and-energy-in-organisms-and-ecosystems.html
- http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=20
- https://whyy.pbslearningmedia.org/subjects/science/life-science/

Sample Standards Integration

21st Century Skills & Career Readiness Practices

9.4.5.CI.1:

For example, in Unit 1, students need to obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

9.4.5.CI.3

For example, in Unit 3, students conduct an investigation to determine whether the mixing of two or more substances results in new substances.

9.4.5.CT.1

For example, in Unit 3, students make observations and measurements to identify materials based on their properties.

9.4.CT.4:

For example, in Unit 4, students will have to support an argument that plants get the materials they need for growth chiefly from air and water.

9.4.5.IML.2

For example, in Unit 3, students develop a model to describe that matter is made of particles too small to be seen.

8.1 Computer Science and Design Thinking

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.

For example in Unit 4, students will access, manage, evaluate, and synthesize information to develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Interdisciplinary Connections

NJSLS.RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-ESS1-1) (5-ESS3-1) (5-LS1-1) (5-PS2-1)

NJSLS.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) (5-ESS2-1) (5-ESS2-2) (5-ESS3-1) (5-LS2-1) (5-PS1-1) (5-PS3-1)

NJSLS.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)

NJSLS.RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ESS1-1) (5-ESS3-1) (5-LS1-1) (5-PS2-1)

NJSLS.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) (5-ESS2-1) (5-ESS2-2) (5-LS2-1) (5-PS3-1)

NJSLS.W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-ESS1-1) (5-LS1-1) (5-PS2-1)

NJSLS.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)

NJSLS.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) (5-PS1-2) (5-PS1-3) (5-PS1-4)

NJSLS.W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-ESS3-1) (5-PS1-2) (5-PS1-3) (5-PS1-4)

These standards are met through the completion of the benchmark performances in all four units. For example, in Unit 4, students will read texts and use media to obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

NJSLS.MP.2 Reason abstractly and quantitatively. (5-ESS1-1),(5-ESS1-2) (5-ESS2-1),(5-ESS2-2),(5-ESS3-1) (5-LS1-1),(5-LS2-1) (5-PS1-1),(5-PS1-2),(5-PS1-3)

NJSLS.MP.4 Model with mathematics. (5-ESS1-1),(5-ESS1-2) (5-ESS2-1),(5-ESS2-2),(5-ESS3-1) (5-LS1-1),(5-LS2-1) (5-PS1-1),(5-PS1-2),(5-PS1-3)

NJSLS.MP.5 Use appropriate tools strategically. (5-LS1-1) (5-PS1-2),(5-PS1-3)

These standards are met through the completion of the benchmark performances in all four units. For example, in Unit 2 students will have to reason both abstractly and quantitatively to support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.

NJSLS.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) (5-ESS2-1)

These standards are met through the completion of the benchmark performances in all three units. For example, in Unit 2, students 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.

NJSLS.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) (5-PS1-2)

NJSLS.5.MD.C.3 Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (5-PS1-1)

NJSLS.5.MD.C.4 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. (5-PS1-1)

NJSLS.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)

NJSLS.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)

NJSLS.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)

These standards are met through the completion of the benchmark performance in Unit 3, students 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.