# Paulsboro Schools

# Curriculum

**Physical Science**

**Grade 9**

**2011 - 2012**

*** For adoption by all regular education programs**
**Board Approved: June 2011**
**as specified and for adoption or adaptation by**
**all Special Education Programs in accordance**
**with Board of Education Policy.**

# PAULSBORO SCHOOL DISTRICT

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# Paulsboro Schools Mission Statement

The mission of the Paulsboro School District is to provide each student educational opportunities to assist in attaining their full potential in a democratic society.

Our instructional programs will take place in a responsive, community based school system that fosters respect among all people.

Our expectation is that all students will achieve the New Jersey Core Curriculum Content Standards (NJCCCS) at every grade level.

# INTRODUCTION, PHILOSOPHY OF EDUCATION, AND EDUCATIONAL GOALS

**Introduction/Philosophy: "Today more than ever before, science holds the key to our survival as a planet and our security and prosperity as a nation"(Obama, 2008)**
**Scientific literacy assumes an increasingly important role in the context of globalization. The rapid pace of technological advance, access to an unprecedented wealth of information, and the pervasive impact of science and technology on day-to-day living require a depth of understanding that can be enhanced through quality science education. In the 21st century, science education focuses on the practices of science that lead to a greater understand of the growing body of scientific knowledge that is required of citizens in an ever-changing world.**

## Educational Goals (taken from NJCCCS)

**The main goal of General Science is to help students gain an appreciation of science as a process. Due to the many advances in technology, General Science is an every changing subject matter. The primary emphasis in this course is to give students an overall understanding of larger Science concepts rather than a narrow view of terms and processes that need to be memorized. Essential to this conceptual understanding of General Science is a grasp of science as a process rather than as an accumulation of facts. This conceptual understanding can be achieved through scientific inquiry and critical thinking assessments rather than rote memory skills. The goal of this course is to provide students with knowledge of Chemistry, Biology and Earth Science by giving them the skills they need to conceptualize those sciences rather than memorize them.**

# New Jersey State Department of Education
# 21st Century College and Career Readiness Standards

## The 12 Career Ready Practices

These practices outline the skills that all individuals need to have to truly be adaptable, reflective, and proactive in life and careers. These are researched practices that are essential to career readiness.

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence

# LAL STANDARDS

LA.9-10.W.9-10.2.A-E
LA.9-10.W.9-10.7
LA.9-10.SL.9-10.1
LA.9-10.SL.9-10.2
LA.9-10.SL.9-10.4
LA.9-10.SL.9-10.5
LA.9-10.L.9-10.4
LA.11-12.W.11-12.2
LA.11-12.W.11-12.7
LA.11-12.SL.1.A
LA.11-12.SL.1.C
LA.11-12.SL.11-12.2
LA.11-12.SL.11-12.4
LA.11-12.SL.11-12.5
LA.11-12.L.11-12.4
LA.11-12.L.11-12.6

## MODIFICATIONS

### Special Education:
Students Hands on activity, cooperative learning, peer tutoring, extended time, reteach in utilizing various methods. Utilize remediation resources which include assessment and intervention, in planning and instruction.

### English Language Learners:
Provide hands-on activities and explanations. Use reduced text, so that print is not so dense. Assess comprehension through demonstration or other alternative means (gestures, drawings). Give instructions/directions in writing and orally. Use of translation dictionaries to locate words in the native language.
Use English Learners resources such as study guides, assessments and a visual glossary.

### At-Risk Students:
Hands on activities cooperative learning, reteach using various methods. Make use of remediation lessons and quizzes when appropriate.

### Gifted and Talented Students:
Utilize Pre-AP Resources such as the pacing, assignment and best practices guide.

# Science
# Scope and Sequence Map

| Quarter 1 – 40 days | |
|---|---|
| The student will plan and conduct investigations in which:<br><br>a. Data are organized into tables showing repeated trials and means<br>b. Variables are defined<br>c. Sources of experimental error are identified<br>d. Dependent variables, independent variables, and constants are identified<br>e. Variables are controlled to test hypotheses, and trials are repeated<br>f. Interpretations from a set of data are evaluated and defended<br>g. An understanding of the nature of science is developed and reinforced. | This unit will cover the metric system and methods of conversion<br><br>a. Metric units (SI — International System of Units) are used<br>b. Models are constructed to illustrate and explain phenomena<br>c. Continuous line graphs are constructed, interpreted, and used to make predictions |
| This unit introduces students to the atom and examines changing perspectives of the nature of the atom throughout history. In following a historical story, students learn about the parts of the atom and its properties such as atomic number, atomic mass, and electron arrangement. This unit prepares students for the periodic table.<br><br>a. Early Theories of the Atom<br>b. The Nuclear Atom<br>c. Atomic Number and Mass Number<br>d. Ions<br>e. Isotopes and Atomic Mass<br>f. The Bohr Atom | With a basis in matter and the structure of the atom, students now turn their attention to the organization of atoms and elements and their graphic representation as a periodic table. The properties of the periodic table are defined, and then students examine trends that are brought out by the arrangement of atoms according to atomic number. Students study elements by learning about metals and other classes of elements.<br><br>a. Atomic Number and the Periodic Law<br>b. The Periodic Table<br>c. Trends within the Periodic Table<br>d. Metals<br>e. Nonmetals<br>f. Metalloids<br>g. Inner Transition Metals |
| **Quarter 2 – 40 days** | |
| This unit will cover the concepts of the similarities, difference and evolutionary significance of prokaryotic and eukaryotic cells, sub-cellular organization, the cell cycle, its regulation and cell division (mitosis)<br><br>a. Cell Organelles<br>b. Cellular Energetics and Metabolism | This unit will cover the concepts of meiosis, gametogenesis, eukaryotic chromosomes, and inheritance patterns<br><br>a. Mitosis<br>b. Meiosis<br>c. Mendelian Genetics<br>d. Structure and Function of DNA/RNA<br>e. Transcription and Translation |
| | |

# Science

# Scope and Sequence Map Page 2

| Quarter 3 – 40 days | |
|---|---|
| This unit will cover the concepts of population dynamics, communities and ecosystems, and global issues. Also included in this unit will be discussions on environmental concerns and possible solutions to these problems<br><br>a. Interactions in the biosphere<br>b. Community Ecology<br>c. Population Ecology<br>d. Ecosystems | |
| | |
| **Quarter 4 – 40 days** | |
| The student will investigate and understand the characteristics of the Earth and the solar system. Key concepts include:<br><br>a. Position of the Earth in the solar system<br>b. Sun-Earth-moon relationships (seasons, tides, and eclipses)<br>c. Characteristics of the sun, planets and their moons, comets, meteors, and asteroids | The structure of our atmosphere has a profound effect on Earth and its living things. In this unit, students first develop a firm basis for understanding how the sun's energy is the basis for many of the characteristics of our atmosphere.<br><br>a. Layers in the Atmosphere<br>b. Composition of the Atmosphere |
| Plate Tectonics and its effect on the Earth's surface will be examined. The effects, causes and relations with Plate Tectonics and earthquakes and volcanoes are also studied.<br><br>a. Plate tectonics<br>b. Earthquakes and Volcanoes | Study of the minerals and rocks that comprise Earth is students' most tangible way to engage in the nature of the Earth's structure. In this unit, students tackle the nature of rocks, their origin, distribution, and transformation.<br><br>a. Minerals on Earth<br>b. General Properties<br>c. Rocks and Their Mineral Composition<br>d. Three Kinds of Rocks<br>e. Rock cycle |

**5.2 Physical Science** All students will understand that physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.

**A. Properties of Matter:** All objects and substances in the natural world are composed of matter. Matter has two fundamental properties: matter takes up space, and matter has inertia.

| Essential Questions | Enduring Understandings |
|---|---|
| How do the particles of an atom influence that atoms behavior? | Use atomic models to predict the behavior of atoms interaction |
| **Content Statements** | **Cumulative Progress Indicators** |
| Electrons, protons, and neutrons are parts of the atom and have measurable properties, including mass and, in the case of protons and electrons, charge. The nuclei of atoms are composed of protons and neutrons. A kind of force that is only evident at nuclear distances holds the particles of the nucleus together against the electrical repulsion between the protons | All objects and substances in the natural world are composed of matter. Matter has two fundamental properties: matter takes up space, and matter has inertia. **(5.2.12.A1)** |

**Instructional Focus:**

- Modeling (using physical or digital tools)the three major particles of atoms
- Determine how each particle is essential to the function of an atom
- Determine how protons and neutrons determine the characteristics of individual elements

| Desired Results | Investigations, Labs, and Sense Making Experiences |
|---|---|
| Define the atom as the basic building block of matter<br><br>Explain Dalton's theory and describe why it was more successful than Democritus's theory<br><br>Compare and contrast Bohr's model with the modern model of the atom<br><br>Describe the subatomic particles and their charges<br><br>Calculate the charge of an atom and find the oxidative charge<br><br>Explain the relationship between matter, atoms and elements<br><br>Distinguish between elements, compounds and mixtures | - Detailed chapter notes<br>- Corresponding worksheets<br>- Discussion and discussion analysis<br>- Answer essential questions |

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**A. Properties of Matter:** All objects and substances in the natural world are composed of matter. Matter has two fundamental properties: matter takes up space, and matter has inertia.

| Essential Questions | Enduring Understandings |
|---|---|
| How does molecular structure of a molecule determine the characteristics of a molecule? How is matter structured? | Solid, liquid and gas structures and characteristics are determined by how atoms are arranged in a molecule |
| **Content Statements** | **Cumulative Progress Indicators** |
| Differences in the physical properties of solids, liquids, and gases are explained by the ways in which the atoms, ions, or molecules of the substances are arranged, and by the strength of the forces of attraction between the atoms, ions, or molecules. | Account for the differences in the physical properties of solids, liquids, and gases. **(5.2.12.A2)** |

**Instructional Focus:**

- Explain how molecules are arranged in a specific order
- Identify the major components of the nuclear atom and explain how they interact
- Interpret Dalton's theory in terms of Laws of Conservation of Mass and Matter

| Desired Results | Investigations, Labs, and Sense Making Experiences |
|---|---|
| Distinguish between the four classes of matter<br><br>Use the Kinetic theory to decide the properties and structure of the different states of matter<br><br>Describe the energy transfers involved in the changes of state<br><br>Describe the Laws of Conservation of mass, energy and matter and explain how they apply to the changes of state<br><br>Distinguish between chemical and physical changes in matter<br><br>Distinguish between chemical and physical properties in matter<br><br>Calculate the density, mass, or volume depending on the variables given | - Lab: Properties of matter: physical versus chemical<br>- Detailed chapter notes<br>- Corresponding worksheets<br>- Discussion and discussion analysis<br>- Answer essential questions |
| | |

**5.2 Physical Science** All students will understand that physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.

**A. Properties of Matter:** All objects and substances in the natural world are composed of matter. Matter has two fundamental properties: matter takes up space, and matter has inertia.

| Essential Questions | Enduring Understandings |
|---|---|
| How does the understanding of the periodic table and its trends enable us to predict the reactions and formation of new substances | The periodic table is arranged by atomic number and has specific trends which allow chemists to predict outcomes to various reactions |
| **Content Statements** | **Cumulative Progress Indicators** |
| In the Periodic Table, elements are arranged according to the number of protons (the atomic number). This organization illustrates commonality and patterns of physical and chemical properties among the elements | Predict the placement of unknown elements on the Periodic Table based on their physical and chemical properties. **(5.2.12.A3**) |

**Instructional Focus:**

- Explaining early atomic theory and compare and contrast to the modern day periodic table
- Model how the periodic table is arranged by common physical and chemical properties
- Demonstrate the ability to determine outcomes of various reactions based on an elements placement on the periodic table

| Desired Results | Investigations, Labs, and Sense Making Experiences |
|---|---|
| Use the periodic table to determine the number of protons, electrons and neutrons in an atom<br><br>Describe how an abundance of isotopes affect an atom's atomic mass<br><br>Locate alkali metals, Earth alkaline metals and transition metals in the periodic table<br><br>Locate semiconductors, halogens and noble gases in the periodic table<br><br>Identify the symbol, atomic number and atomic mass of common elements<br><br>Relate an element's chemical properties to the electron arrangement of its atom | - Adopt-An-Element project<br>- Detailed chapter notes<br>- Corresponding worksheets<br>- Discussion and discussion analysis<br>- Answer essential questions |

**5.3 Life Science:** Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

**A. Organization and Development:** Living organisms are composed of cellular units (structures) that carry out functions required for life. Cellular units are composed of molecules, which also carry out biological functions.

| Essential Questions | Enduring Understandings |
|---|---|
| How does structure relate to function in living systems from the organismal to the cellular level? | Living systems, from the organismal to the cellular level, demonstrate the complementary nature of structure and function. |
| **Content Statements** | **Cumulative Progress Indicators** |
| Cellular function is maintained through the regulation of cellular processes in response to internal and external environmental conditions. | Predict a cell's response in a given set of environmental conditions. **(5.3.12.A.3)** |

**Instructional Focus:**

- Modeling how processes are regulated both internally and externally by environments in which cells exist
- Explaining how the fundamental life processes of organisms depend on a variety of chemical reactions that occur in specialized areas of the organism's cells
    - *Assessments will not include the identification of cellular organelles*
- Modeling how cells are enclosed within semi-permeable membranes that regulate their interaction with their surroundings, including the transport of materials into and out of the cell
    - *Assessments will not include the molecular basis of membrane transport*

| Desired Results | |
|---|---|
| Describe how cells function in a narrow range of physical conditions, such as temperature and pH, to perform life functions<br><br>Formulate a scientific question about the movement of molecules across a membrane under differing conditions of temperature, starting concentration, pH, etc.<br><br>Explain why cells of organisms swell when placed in water and why they shrink when placed in a solution of salt water. Evaluate other student explanations of the same phenomenon. Construct a representation that generalizes the phenomenon to all organisms.<br><br>Describe the composition, structure, and function of the cell membrane and how it allows for cellular transport mechanisms to work<br><br>Describe the structure and function of cells and their organelles<br><br>Understands the three main tenets of the Cell Theory<br><br>Differentiate between passive and active transport<br><br>Construct a representation of a cell membrane undergoing passive and active transport, in terms of difference in concentration required energy and direction of molecule movement. Explain how the movement of molecules impacts the cell, and, as a result, impacts the organism as well.<br><br>Relate the structure of cellular organelles to their function | - Detailed chapter outlines for each unit<br>- Literature review research papers based on current scientific articles<br>- Discussion and discussion analysis<br>- Osmosis (dialysis tubing) lab<br>- 3 D cell project<br>- Webquest: Cells<br>- Cell diagram<br>- Corresponding worksheets |

**A. Organization and Development:** Living organisms are composed of cellular units (structures) that carry out functions required for life. Cellular units are composed of molecules, which also carry out biological functions.

| Essential Questions | Enduring Understandings |
|---|---|
| How does structure relate to function in living systems from the organismal to the cellular level? | Living systems, from the organismal to the cellular level, demonstrate the complementary nature of structure and function. |

| Content Statements | Cumulative Progress Indicators |
|---|---|
| Cell differentiation is regulated through the expression of different genes during the development of complex multicellular organisms. | Describe modern applications of the regulation of cell differentiation and analyze the benefits and risks (e.g. stem cells, sex determination). **(5.3.12.A.5)** |

**Instructional Focus:**

- Identifying genes as a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism
  - *Assessments will not include the names and structures of nucleotides or the individual detailed steps of the processes of transcription and translation*
- Relating the specialization of cells in multicellular organisms to the different patterns of gene expression rather than to differences of the genes themselves
- Applying these understandings to analyze, support and/or critique current and emerging biotechnologies
  - *Assessments will not include the mechanisms of biotechnologies such as PCR, electrophoresis*

| Desired Results | Investigations, Labs, and Sense Making Experiences |
|---|---|
| Describe modern applications of the regulation of cell differentiation and analyze the benefits and risks<br><br>Give examples, using information gathered from print and electronic resources, of situations in which errors that occur during gene activation or gene inactivation lead to errors in cell differentiation.<br><br>Compare between embryonic stem cells and adult or body stem cells, and among different types of adult stem cells.<br><br>Give examples, using information gathered from print and electronic resources, of traits that depend on the quantity of protein produced, which, in turn, is dependent on the number of copies of a particular version of a gene. Predict and justify how zero, one or two copies of a particular version of a gene might affect the expression of a particular trait.<br><br>Describe how genes are segments of DNA molecules located in the chromosome of a cell. DNA molecules contain information that determines a sequence of amino acids, which results in a specific protein<br><br>Describe the structure of nucleic acids and how DNA doubles itself before mitosis<br><br>Differentiate between transcription and translation<br><br>Identify functions performed by DNA segments that do not code for proteins. | - DNA webquest<br>- Biotechnology Ethical Discussion (science, technology, and society)<br>- Detailed chapter outlines for each unit<br>- Literature review research papers based on current scientific articles<br>- Discussions and discussion analyses<br>- DNA structure and replication model<br>- Protein synthesis model<br>- Corresponding worksheets |

**5.3 Life Science**: Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

**C.Interdependence:** All animals and most plants depend on both other organisms and their environment to meet their basic needs.

| Essential Questions | Enduring Understandings |
|---|---|
| How are organisms dependant on each other? | The survival of organisms is affected by interactions with each other and their environment, and can be altered by human manipulation. |
| **Content Statements** | **Cumulative Progress Indicators** |
| Biological communities in ecosystems are based on stable interrelationships and interdependence of organisms. | Analyze the interrelationships and interdependencies among different organisms, and explain how these relationships contribute to the stability of the ecosystem. **(5.3.12.C.1)** |

**Instructional Focus:**

- Analyzing the interactions between organisms that result from the ability to produce populations of infinite size in an environment where resources are finite
- Providing evidence of how organisms both cooperate and compete in ecosystems
- Using evidence to explain why interrelationships and interdependencies of organisms may generate stable ecosystems

| Desired Results | Investigations, Labs, and Sense Making Experiences |
|---|---|
| Distinguish between biotic and abiotic components of an ecosystem and explain how they cycle<br><br>Describe the abiotic characteristics of an ecosystem: its boundaries, its components, its inputs and outputs, and its interactions, as well as the boundaries and other characteristics of overlapping ecosystems.<br><br>Evaluate claims of possible relationships between the changes in the abiotic components and the biotic components of the environment.<br><br>Provide examples of a population, community and ecosystem<br><br>Predict how changes in one population might affect other populations based upon their relationships in the food web<br><br>Graph changes in population growth, given a table<br><br>Describe common relationships among organisms and provide examples of producer/consumer, predator/prey or parasite/host relationship<br><br>Describe common ecological relationships between and among species and their environments<br><br>Describe the role of decomposers in the transfer of energy in an ecosystem<br><br>Explain how two organisms can be mutually beneficial and how that can lead to interdependency<br><br>Identify the factors in an ecosystem that influences fluctuations in population size<br><br>Predict the consequences of an invasive organism on the survival of native species | - Detailed chapter outlines for each unit<br>- Literature review research papers based on current scientific articles<br>- Discussions and discussion analyses<br>- Corresponding worksheets<br>- Biome project<br>- Prey/predator lab<br>- Food chain project<br>- Webquest: Ecosystem |

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**C. Interdependence:** All animals and most plants depend on both other organisms and their environment to meet their basic needs.

| Essential Questions | Enduring Understandings |
|---|---|
| How are organisms dependant on each other? | The survival of organisms is affected by interactions with each other and their environment, and can be altered by human manipulation. |
| **Content Statements** | **Cumulative Progress Indicators** |
| Stability in an ecosystem can be disrupted by natural or human interactions. | Model how natural and human-made changes in the environment will affect individual organisms and the dynamics of populations. **(5.3.12.C.2)** |

**Instructional Focus:**

- Identifying situations where humans intentionally and unintentionally modify ecosystems as a result of population growth, technology, and consumption
- Providing evidence of how human destruction of habitats threatens current local and global ecosystem stability
- Predicting how direct harvesting, pollution, atmospheric changes, and other factors will affect population dynamics in a given ecosystem based on data and accepted mathematical models
- Predicting how natural disasters such as hurricanes, floods, volcanoes will affect population dynamics in a given ecosystem based on data and accepted mathematical models

| Desired Results | Investigations, Labs, and Sense Making Experiences |
|---|---|
| Predict what will happen to the number of organisms of a given species in an ecosystem following a temporary biotic or abiotic change in that ecosystem (e.g., a very cold winter or a disease that kills large numbers of one of the species in the ecosystem) and what will happen after conditions return to what they were before the disruption. Justification for the prediction is based on knowledge of how ecosystems typically respond to temporary changes in environmental conditions, how this particular ecosystem has responded to such changes in the past, and the scale of these particular changes.<br><br>Recognize that, and describe how, human beings are part of the Earth's ecosystems. Note that human activities can deliberately or inadvertently alter the equilibrium in ecosystems<br><br>Examine the negative impact of human activities<br><br>Describe the greenhouse effect and list some possible causes<br><br>List the possible causes and consequences of global warming<br><br>Describe ecosystem stability. Understand that if a disaster such as a flood or fire occurs, the damaged ecosystem is likely to recover in stages of succession that eventually result in a system similar to the original one<br><br>Recognize and describe that a great diversity of species increases the chance that at least some living organisms will survive in the face of cataclysmic changes in the environment | - Detailed chapter outlines for each unit<br>- Corresponding worksheets<br>- Literature review research papers based on current scientific articles<br>- Lab: Exponential population growth<br>- Discussions and discussion analyses<br>1. Discussion: Human Impact on Ecosystem |

**5.3 Life Science**: Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

**D.** Heredity and Reproduction: Organisms reproduce, develop, and have predictable life cycles. Organisms contain genetic information that influences their traits, and they pass this on to their offspring during reproduction.

| Essential Questions | Enduring Understandings |
|---|---|
| How is genetic information passed through generations? | There are predictable patterns of inheritance, and the variation that exists within a species is related to its mode of reproduction (sexual or asexual). |
| **Content Statements** | **Cumulative Progress Indicators** |
| Genes are segments of DNA molecules located in the chromosome of each cell. DNA molecules contain information that determines a sequence of amino acids, which result in specific proteins. | Explain the value and potential applications of genome projects. **(5.3.12.D.1)** |

**Instructional Focus:**

- Recognizing that the instructions for specifying the characteristics of the organism are carried in DNA, a large polymer formed from subunits of four kinds (adenine, thymine, guanine, and cytosine)
    - *Assessments will not include the identification of the structure of specific nucleotides or the nature of bonding between DNA strands*
- Explaining how the chemical and structural properties of DNA allow for genetic information to be both encoded in genes and replicated
    - *Assessments will not include the individual detailed steps of the processes of transcription and translation*
- Identifying that hereditary information is contained in genes, located in the chromosomes of each cell, and each gene carries a single unit of information
- Providing specific examples of how an inherited trait of an individual can be determined by one or many genes and a single gene can influence more than one trait
- Analyzing the current and potential impact of genome projects on human health (e.g. pathogenic bacteria or disease vectors) or species with commercial importance (e.g. livestock and crop plants)

| Desired Results | Investigations, Labs, and Sense Making Experiences |
|---|---|
| Recognize that every species has its own characteristic DNA sequence<br><br>Describe the structure and function of DNA<br><br>Describe how traits in organisms are the result of DNA structure..<br><br>Analyze the primary structure (amino acid sequence) of specific proteins (e.g., insulin and hemoglobin). Create a table showing which amino acids make up each protein molecule, and the numbers of each amino acid that make up these proteins.<br><br>Evaluate and, if necessary, revise representations that illustrate the processes of transcription and translation to show how the sequence of nucleotide bases produces a complementary strand of bases in RNA (ribonucleic acid), and how each sequence of three bases in RNA codes for specific amino acids that are linked together to make proteins.<br><br>Give examples, using information gathered from print and electronic resources, of traits that result from specific proteins.<br><br>Identify functions performed by DNA segments that do not code for proteins.<br><br>Explain the value and potential application of genome projects | - Detailed chapter outlines for each unit<br>- Corresponding worksheets<br>- Literature review research papers based on current scientific articles<br>- Discussions and discussion analyses<br>- DNA candy replication model<br>- Protein synthesis model |

**5.3 Life Science:** Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

D. **Heredity and Reproduction**: Organisms reproduce, develop, and have predictable life cycles. Organisms contain genetic information that influences their traits, and they pass this on to their offspring during reproduction.

| Essential Questions | Enduring Understandings |
|---|---|
| How is genetic information passed through generations? | There are predictable patterns of inheritance, and the variation that exists within a species is related to its mode of reproduction (sexual or asexual). |
| **Content Statements** | **Cumulative Progress Indicators** |
| Inserting, deleting, or substituting DNA segments can alter the genetic code. An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment. | Predict the potential impact on an organism (no impact, significant impact) given a change in a specific DNA code, and provide specific real world examples of conditions caused by mutations. **(5.3.12.D.2)** |

**Instructional Focus:**

- Recognizing that changes in DNA (mutations) occur spontaneously at low rates, and some of these changes make no difference to the organism, whereas others can change cells and organisms

**E.** Explaining that only mutations in germ cells can create the variation that changes an organism's offspring
  - *Assessments will not include the specific detailed steps of meiosis*

**F.** Tracing the progression of conditions that result from genetic mutation in a variety of different organisms

| Desired Results | Investigations, Labs, and Sense Making Experiences |
|---|---|
| Explain why an insertion, deletion or substitution of an individual nucleotide base affects not only the amino acid sequence of the proteins that are produced but also the protein structure that result from the altered amino acid sequence.<br><br>Give examples, using evidence gathered from print and electronic resources, of genetic diseases (e.g., cystic fibrosis, sickle cell anemia, Tay-Sachs disease or phenylketonuria) that result from mutations to a single gene. Identify, for each example, the specific type of mutation that causes the change in amino acid sequence and ultimately the change in the protein that is produced.<br><br>Propose possible effects (on the gene) of exposing an organism to radiation and toxic chemicals<br><br>Explain that the traits of an individual are influenced by both the environment and the genetics of the individual<br><br>Explain why only mutations occurring in gametes can be passed on to offspring and predict how mutations may be transferred to progeny<br><br>Explain how it may be possible to identify genetic defects from just a karyotype of a few cells<br><br>Explain that the sorting and recombination of genes in sexual reproduction result in a great variety of possible gene combinations from the offspring of two parents<br><br>Recognize that genetic variation can occur from such processes as crossing over, jumping genes, and deletion and duplication of genes | - Detailed chapter outlines for each unit<br>- Corresponding worksheets<br>- Literature review research papers based on current scientific articles<br>- Discussions and discussion analyses<br>- Disease pamphlet<br>- Meiosis clay model |

**D. Heredity and Reproduction:** Organisms reproduce, develop, and have predictable life cycles. Organisms contain genetic information that influences their traits, and they pass this on to their offspring during reproduction.

| Essential Questions | Enduring Understandings |
|---|---|
| How is genetic information passed through generations? | There are predictable patterns of inheritance, and the variation that exists within a species is related to its mode of reproduction (sexual or asexual). |
| **Content Statements** | **Cumulative Progress Indicators** |
| Sorting and recombination of genes in sexual reproduction result in a great variety of possible gene combinations in the offspring of any two parents. | Demonstrate through modeling how the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring (meiosis, fertilization). **(5.3.12.D.3)** |

**Instructional Focus:**

**G.** Explaining the process where an egg and sperm unite to begin the development of a new individual, and how that new individual receives genetic information from its parents

*a. Assessments will not include the specific detailed steps of meiosis, fertilization and early embryological development*

**H.** Explaining how sexually produced offspring are never identical to either of their parents

**I.** Understanding how new heritable characteristics can result from new combinations of existing genes in reproductive cells

**J.** Recognizing how heritable characteristics can strongly influence what capabilities an organism will have, therefore influencing how likely it is to survive and reproduce

| Desired Results | Investigations, Labs, and Sense Making Experiences |
|---|---|
| Explain, based on knowledge of how sex cells form in sexually reproducing organisms, why there is variation among offspring, even within the same family.<br><br>Construct a representation — or several representations — of sex cell formation, demonstrating that the DNA of the daughter cells is different from the DNA of the parent cell<br><br>Observe the variation of traits among the individual organisms within a population. Explain, based on the transmission of genetic information, why there is so much variation within the population.<br><br>Demonstrate through modeling how the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring<br><br>Draw and label a homologous chromosome pair with heterozygous alleles highlighting a particular gene locus<br><br>Differentiate between dominant, recessive, co-dominant, polygenic and sex-linked traits<br><br>Explain the genetic basis for Mendel's laws of segregation and independent assortment<br><br>Determine the genotype and phenotype of monohybrid crosses using the Punnett Square | - Detailed chapter outlines for each unit<br>- Corresponding worksheets<br>- Literature review research papers based on current scientific articles<br>- Discussions and discussion analyses<br>- Diagram gamete fertilization and genetic recombination via Punnett Squares |

**5.4 Earth Systems Science** All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

**A. Objects in the Universe:** Our universe has been expanding and evolving for 13.7 billion years under the influence of gravitational and nuclear forces. As gravity governs its expansion, organizational patterns, and the movement of celestial bodies, nuclear forces within stars govern its evolution through the processes of stellar birth and death. These same processes governed the formation of our solar system 4.6 billion years ago

| Essential Questions | Enduring Understandings |
|---|---|
| What is the basic structure of the Universe? | Evidence collected through the use of various forms of technology in combination with mathematical modeling shows that the universe has a well defined structure all the way out to the farthest observable distances |
| **Content Statements** | **Cumulative Progress Indicators** |
| The Sun is one of an estimated two hundred billion stars in our Milky Way galaxy, which together with over one hundred billion other galaxies make up the universe. | Analyze simulated and/or real data to estimate the number of stars in our galaxy and the number of galaxies in our universe. **(5.4.12.A.4)** |

**Instructional Focus:**

- Mathematical models and computer simulations are used in studying evidence from many sources in order to form a scientific account of the universe.
- Our solar system formed about five billion years ago from a giant cloud of gas and debris. Gravity caused Earth and the other planets to become layered according to density differences in their materials.
- The characteristics of the planets of the solar system are affected by each planet's location in relationship to the Sun.
- Asteroids, comets, and meteors are components of our solar system.
- As the Earth and other planets formed, the heavier elements fell into their centers. On planets close to the sun the lightest elements were mostly blown or boiled away by radiation from the newly formed sun; on the outer planets the lighter elements still surround them as deep atmospheres of gas or as frozen solid layers.
- Our solar system coalesced out of a giant cloud of gas and debris left in the wake of exploding stars about five billion years ago. Everything in and on the earth, including living organisms, is made of this material.
- Most objects in the solar system are in regular and predictable motion
- Gravity influences the motions of celestial objects. The force of gravity between two objects in the universe depends on their masses and the distance between them.
- The orbit of each planet is an ellipse with the Sun located at one of the foci.

| Desired Results | Investigations, Labs, and Sense Making Experiences |
|---|---|
| Describe the structure and gravitational interaction of our planetary system<br><br>List and define the components of our solar system<br><br>Compare and contrast inner versus outer planets<br><br>Analyze the interrelationship between gravity and inertia and its effects on the orbit of planets or satellites<br><br>Describe the position and motion of our solar system in our galaxy and the overall scale, structure and age of the universe<br><br>Explain the effects of rotation and revolution<br><br>Describe the relationship between of the Earth, Moon and Sun systems<br><br>Describe the makeup of the planets, stars comets, meteors and asteroids<br><br>Explain the orderly, predictable motion of celestial bodies | - Construct a chart comparing various features of the planets<br>- Research (and predict) what will happen to the speed of the Earth's rotation due to the moons gravity and the tides<br>- Draw explanatory diagrams to represent the two daily high tides on Earth and the celestial position of the moon during these two occurrences<br>- Using Kepler's Second law of Planetary Motion, describe or diagram the paths of objects in the solar system<br>- Detailed chapter notes<br>- Corresponding worksheets<br>- Literature review research papers based on current scientific articles<br>- Discussions and discussion analyses<br>- Discovery – 'The Universe' |

**5.4 Earth Systems Science ;** All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

C. **Properties of Earth Materials**: Earth's composition is unique, is related to the origin of our solar system, and provides us with the raw resources needed to sustain life.

| Essential Questions | Enduring Understandings |
|---|---|
| How do changes in one part of an Earth system affect other parts of the system? | Composition of the soils and the atmosphere provide the interfaces for changes in the composition of the Earth's systems. |
| **Content Statements** | **Cumulative Progress Indicators** |
| The chemical and physical properties of the vertical structure of the atmosphere support life on Earth. | Analyze the vertical structure of Earth's atmosphere, and account for the global, regional, and local variations of these characteristics and their impact on life. **(5.4.12.C.2)** |

**Instructional Focus**:

- Life is adapted to conditions on the earth, including the force of gravity that enables the planet to retain an adequate atmosphere, and an intensity of electromagnetic waves from the sun that allows water to be present in the liquid state.
- Greenhouse gases in the atmosphere, such as carbon dioxide and water vapor, are transparent to much of the incoming sunlight but not to the infrared light from the warmed surface of the earth. When greenhouse gases increase, more thermal energy is trapped in the atmosphere, and the temperature of the earth increases the light energy radiated into space until it again equals the light energy absorbed from the sun.
- The atmosphere has mass, is bound to Earth by gravity, and exerts pressure which is greater near Earth's surface and decreases with altitude.
- The atmosphere, which is very thin relative to Earth's radius, varies vertically in layers which differ in composition, density, and temperature. The lowest 8-16 km of the atmosphere - the troposphere - contains most of Earth's weather systems.

| Desired Results | Investigations, Labs, and Sense Making Experiences |
|---|---|
| Describe the composition and layers of the atmosphere<br><br>Describe the difference between weather and climate and how the atmosphere dictates both<br><br>Research the greenhouse effect as it relates to the atmosphere | - Construct a concept map or diagram explain the proposed causes of the Greenhouse Effect<br>- Diagram the atmospheric layers<br>- Detailed chapter notes<br>- Corresponding worksheets<br>- Discussion and discussion analysis<br>- Answer essential questions |
| | |

**5.4 Earth Systems Science:** All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

**D. Tectonics**: The theory of plate tectonics provides a framework for understanding the dynamic processes within and on Earth.

| Essential Questions | Enduring Understandings |
|---|---|
| How and why have the Earth's tectonic plates changed over time? How do we know? | Theories governing the movement of lithospheric plates were developed over time through the analysis of Earth materials. |
| **Content Statements** | **Cumulative Progress Indicators** |
| Convection currents in the upper mantle drive plate motion. Plates are pushed apart at spreading zones and pulled down into the crust at subduction zones. | Explain the mechanisms for plate motions using earthquake data, mathematics, and conceptual models. **(5.4.12.D.1)** |

**Instructional Focus:**

- The outward transfer of Earth's internal heat drives convective circulation in the mantle that moves the lithospheric plates comprising Earth's surface
- The lithosphere consists of separate plates that ride on the more fluid asthenosphere and move slowly in relationship to one another, creating convergent, divergent, and transform plate boundaries. These motions indicate Earth is a dynamic geologic system.
- These plate boundaries are the sites of most earthquakes, volcanoes, and young mountain ranges.
- Compared to continental crust, ocean crust is thinner and denser. New ocean crust continues to form at mid-ocean ridges.
- Many processes of the rock cycle are consequences of plate dynamics. These include the production of magma (and subsequent igneous rock formation and contact metamorphism) at both subduction and rifting regions, regional metamorphism within subduction zones, and the creation of major depositional basins through down-warping of the crust.
- Plate motions have resulted in global changes in geography, climate, and the patterns of organic evolution.

| Desired Results | Investigations, Labs, and Sense Making Experiences |
|---|---|
| Describe geologic, paleontologic, and paleoclimatologic evidence that indicates Africa and South America were once part of a single continent.<br><br>Describe the three types of plate boundaries (divergent, convergent, and transform) and geographic features associated with them (e.g., continental rifts and mid-ocean ridges, volcanic and island arcs, deep-sea trenches, transform faults).<br><br>Describe the three major types of volcanoes (shield volcano, stratovolcano, and cinder cones) and their relationship to the Ring of Fire.<br><br>Describe the interior of the Earth (in terms of crust, mantle, and inner and outer cores) and where the magnetic field of the Earth is generated.<br><br>Describe the differences between oceanic and continental crust (including density, age, composition)<br><br>Explain how plate tectonics accounts for the features and processes (sea floor spreading, mid-ocean ridges, subduction zones, earthquakes and volcanoes, mountain ranges) that occur on or near the Earth's surface.<br><br>Explain why tectonic plates move using the concept of heat flowing through mantle convection, coupled with the cooling and sinking of aging ocean plates that result from their increased density.<br><br>Use the distribution of earthquakes and volcanoes to locate and determine the types of plate boundaries. | - Detailed chapter notes<br>- Corresponding worksheets<br>- Discussion and discussion analysis<br>- Answer essential questions<br>- Research project on the different types of plates and their boundries<br>- Diagram the differences between the three types of volcanoes |

**5.4 Earth Systems Science** All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

**G. Biogeochemical Cycles**: The biogeochemical cycles in the Earth systems include the flow of microscopic and macroscopic resources from one reservoir in the hydrosphere, geosphere, atmosphere, or biosphere to another, are driven by Earth's internal and external sources of energy, and are impacted by human activity.

| Essential Questions | Enduring Understandings |
|---|---|
| How do natural and human-made changes in one part of the Earth system affect other parts of the system and in what ways can Earth processes be explained as interactions among spheres? | Earth's components form systems that have cycles and patterns that allow us to make predictions and informed decisions. |
| **Content Statements** | **Cumulative Progress Indicators** |
| Movement of matter through Earth's system is driven by Earth's internal and external sources of energy and results in changes in the physical and chemical properties of the matter. | Demonstrate, using models, how internal and external sources of energy drive the hydrologic, carbon, nitrogen, phosphorus, sulfur, and oxygen cycles. **(5.4.12.G.3)** |

**Instructional Focus:**

- All Earth processes are the result of energy flowing and mass cycling within and between Earth's systems. This energy is derived from the sun and Earth's interior. The flowing energy and cycling matter cause chemical and physical changes in Earth's materials and living organisms.
- Minerals are formed inorganically by the process of crystallization as a result of specific environmental conditions.
- Rocks are usually composed of one or more minerals.
- Rocks are classified by their origin, mineral content, and texture.
- Conditions that existed when a rock formed can be inferred from the rock's mineral content and texture.
- Igneous, metamorphic, and sedimentary rocks are indicators of geologic and environmental conditions and processes that existed in the past. These include cooling and crystallization, weathering and erosion, sedimentation and lithification, and metamorphism.

| Desired Results | Investigations, Labs, and Sense Making Experiences |
|---|---|
| Discriminate between igneous, metamorphic, and sedimentary rocks and describe the processes that change one kind of rock into another.<br><br>Explain the relationship between the rock cycle and plate tectonics theory in regard to the origins of igneous, sedimentary, and metamorphic rocks.<br><br>Explain how the size and shape of grains in a sedimentary rock indicate the environment of formation (including climate) and deposition.<br><br>Explain how the crystal sizes of igneous rocks indicate the rate of cooling and whether the rock is extrusive or intrusive.<br><br>Explain how the texture (foliated, nonfoliated) of metamorphic rock can indicate whether it has experienced regional or contact metamorphism.<br><br>Identify common rock-forming minerals | - Flow chart: Rock cycle<br>- PowerPoint: Rock cycle story<br>- Create a mineral collection: the collection should contain actual samples or pictures of the mineral or both<br>- Table: Three basic types of rocks<br>- Detailed chapter notes<br>- Corresponding worksheets<br>- Discussion and discussion analysis<br>- Answer essential questions |

**5.1 Science Practices:** Science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

**A. Understand Scientific Explanations**: Students understand core concepts and principles of science and use measurement and observation tools to assist in categorizing, representing, and interpreting the natural and designed world.

| Essential Question | Enduring Understanding |
|---|---|
| How do we build and refine models that describe and explain the natural and designed world? | Measurement and observation tools are used to categorize, represent and interpret the natural world. |
| **Content Statement** | **Cumulative Progress Indicator** |
| Mathematical, physical, and computational tools are used to search for and explain core scientific concepts and principles. | Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. **(5.1.12.A.1)** |

**Instructional Focus:**

**K.** Learning facts, concepts, principles, theories and models; then
**L.** Developing an understanding of the relationships among facts, concepts, principles, theories and models; then
**M.** Using these relationships to understand and interpret phenomena in the natural world

| Content Statement | Cumulative Progress Indicator |
|---|---|
| Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations. | Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories. **(5.1.12.A.2)** |

**Instructional Focus:**

**N.** Using tools, evidence and data to observe, measure, and explain phenomena in the natural world
**O.** Developing evidence-based models based on the relationships among fundamental concepts and principals
**P.** Constructing and refining explanations, arguments or models of the natural world through the use of quantitative and qualitative evidence and data

| Content Statement | Cumulative Progress Indicator |
|---|---|
| Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/evidence. | Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence. **(5.1.12.A.3)** |

**Instructional Focus:**

- Understanding that data differs in quality and strength of explanatory power based on experimental design
- Evaluating strength of scientific arguments based on the quality of the data and evidence presented
- Critiquing scientific arguments by considering the selected experimental design and method of data analysis

**5.1 Science Practices:** Science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

**B. Generate Scientific Evidence Through Active Investigations:** Students master the conceptual, mathematical, physical, and computational tools that need to be applied when constructing and evaluating claims.

| Essential Question | Enduring Understanding |
|---|---|
| What constitutes useful scientific evidence? | Evidence is used for building, refining, and/or critiquing scientific explanations. |

| Content Statement | Cumulative Progress Indicator |
|---|---|
| Logically designed investigations are needed in order to generate the evidence required to build and refine models and explanations. | Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. **(5.1.12.B.1)** |

**Instructional Focus:**

- **Q.** Asking a question and deciding what to measure in order to answer the question
- **R.** Developing strategies for obtaining measurements, then systematically collecting data
- **S.** Structuring the gathered data, then interpreting and evaluating the data
- **T.** Using the empirical results to determine causal/correlational relationships

| Content Statement | Cumulative Progress Indicator |
|---|---|
| Mathematical tools and technology are used to gather, analyze, and communicate results. | Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. **(5.1.12.B.2)** |

**Instructional Focus:**

- **U.** Using mathematics in the collection and treatment of data and in the reasoning used to develop concepts, laws and theories
- **V.** Using tools of data analysis to organize data and formulate hypotheses for further testing
- **W.** Using existing mathematical, physical, and computational models to analyze and communicate findings

| Content Statement | Cumulative Progress Indicator |
|---|---|
| Empirical evidence is used to construct and defend arguments. | Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories. **(5.1.12.B.3)** |

**Instructional Focus:**

- **X.** Making claims based on the available evidence
- **Y.** Explaining the reasoning, citing evidence, behind a proposed claim
- **Z.** Connecting the claim to established concepts and principles

| Content Statement | Cumulative Progress Indicator |
|---|---|
| Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions. | Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations. **(5.1.12.B.4)** |

**Instructional Focus:**

**AA.** Analyzing experimental data sets using measures of central tendency
**BB.** Representing and describing mathematical relationships among variables using graphs and tables
**CC.** Using mathematical tools to construct and evaluate claims

**5.1 Science Practices:** Science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

**C. Reflect on Scientific Knowledge:** Scientific knowledge builds on itself over time.

| Essential Question | Enduring Understanding |
|---|---|
| How is scientific knowledge constructed? | Scientific knowledge builds upon itself over time. |
| **Content Statement** | **Cumulative Progress Indicator** |
| Refinement of understandings, explanations, and models occurs as new evidence is incorporated. | Reflect on and revise understandings as new evidence emerges. **(5.1.12.C.1)** |

**Instructional Focus:**

**DD.** Reflecting on the status of one's own thinking and learning (i.e. uncovering how a student knows what they know and why)
**EE.** Understanding that scientific knowledge can be revised as new evidence emerges

| Content Statement | Cumulative Progress Indicator |
|---|---|
| Data and refined models are used to revise predictions and explanations. | Use data representations and new models to revise predictions and explanations. **(5.1.12.C.2)** |

**Instructional Focus:**

**FF.** Recognizing that predictions or explanations can be revised on the basis of seeing new data and evidence
**GG.** Using data and evidence to modify and extend investigations
**HH.** Understanding that explanations are increasingly valuable as they account for the available evidence more completely

| Content Statement | Cumulative Progress Indicator |
|---|---|
| Science is a practice in which an established body of knowledge is continually revised, refined, and extended as new evidence emerges. | Consider alternative theories to interpret and evaluate evidence-based arguments. **(5.1.12.C.3)** |

**Instructional Focus:**

**II.** Understanding that there might be multiple interpretations of the same phenomena
**JJ.** Stepping back from evidence and explanations to consider whether another interpretation of a particular finding is plausible with respect to existing scientific evidence
**KK.** Considering alternative perspectives worthy of further investigations

**5.1 Science Practices:** Science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

**D. Participate Productively in Science:** The growth of scientific knowledge involves critique and communication, which aresocial practices that are governed by a core set of values and norms.

| Essential Question | Enduring Understanding |
|---|---|
| How does scientific knowledge benefit – deepen and broaden - from scientists sharing and debating ideas and information with peers? | The growth of scientific knowledge involves critique and communication - social practices that are governed by a core set of values and norms. |

| Content Statement | Cumulative Progress Indicator |
|---|---|
| Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. | Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. **(5.1.12.D.1)** |

**Instructional Focus:**

**LL.** Seeing oneself as an effective participant and contributor in science

**MM.** Interacting with others to test new ideas, soliciting and providing feedback, articulating and evaluating emerging explanations, developing shared representations and models, and reaching consensus

**NN.** Developing a sense of appropriate trust and skepticism when evaluating others' claims, evidence and reasoning

| Content Statement | Cumulative Progress Indicator |
|---|---|
| Science involves using language, both oral and written, as a tool for making thinking public. | Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. **(5.1.12.D.2)** |

**Instructional Focus:**

**OO.** Constructing literal representations from empirical evidence and observations

**PP.** Presenting and defending a scientific argument using literal representations

**QQ.** Evaluating others' literal representations for consistency with their claims, evidence and reasoning

**RR.** Moving fluently between representations such as graphs, data, equations, diagrams and verbal explanations

| Content Statement | Cumulative Progress Indicator |
|---|---|
| Ensure that instruments and specimens are properly cared for and that animals, when used, are treated humanely, responsibly, and ethically. | Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare. **(5.1.12.D.3)** |

**Instructional Focus:**

**SS.** Selecting and using appropriate instrumentation to design and conduct investigations

**TT.** Understanding, evaluating and practicing safe procedures for conducting science investigations

**UU.** Demonstrating appropriate digital citizenship (i.e., cyber-safety and cyber-ethics) when accessing scientific data from collaborative spaces. (See NJCCCS 8.1 and 9.1)

**VV.** Ensuring that living organisms are properly cared for and treated humanely, responsibly, and ethically