Great Meadows Regional School District
Science Curriculum
Grade 7

CURRICULUM GUIDE
Approved
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Mr. David C. Mango, Superintendent
Mrs. Debra Grigoletti, Director of Curriculum & Instruction

Developed by:
Eric Shuler

This curriculum may be modified through varying techniques, strategies and materials, as per an individual student's Individualized Education Plan (IEP).

Approved by the Great Meadows Board of Education
At the regular meeting held on August 22, 2017
And
Aligned with the New Jersey Student Learning Standards for Science

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Philosophy and Rationale

Science, engineering, and technology influence and permeate every aspect of modern life. Some knowledge of science and engineering is required to engage with the major public policy issues of today as well as to make informed everyday decisions, such as selecting among alternative medical treatments or determining how to invest public funds for water supply options. In addition, understanding science and the extraordinary insights it has produced can be meaningful and relevant on a personal level, opening new worlds to explore and offering lifelong opportunities for enriching people's lives. In these contexts, learning science is important for everyone, even those who eventually

choose careers in fields other than science or engineering.

Source: NJ Student Learning Standards for Science.

Scope and Sequence

Unit 1

Classification: Taxonomy and Student Created Dichotomous Key - 35 days

Content

- All living things are made up of cells, which is the smallest unit that can be said to be alive
- An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular)
- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell
- In multicellular organisms, the body is a system of multiple interacting subsystems
- Subsystems in organisms are groups of cells that work together to form tissues and organs that are specialized for particular body functions
- The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record, it documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth
- Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent
- Comparison of the embryological development of different species also reveal similarities that show relationships not evident in the fully-formed anatomy
- Interpret data for patterns.
- Explain the anatomical similarities and differences among items of a type.
- Identify similarities and differences between organisms in their developmental stages.

Practice

- Develop and use a model to describe phenomena
- Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation
- Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each

publication and methods used, and describe how they are supported or not supported by evidence
- Analyze displays of data to identify linear and nonlinear relationships
- Analyze and interpret data to determine similarities and differences in findings
- Use mathematical representations to support scientific conclusions and design solutions
- Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events
- Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena
- Analyze and interpret data to determine similarities and differences in findings.
- Apply scientific ideas to construct an explanation for real world phenomena, examples, or events.
- Analyze displays of data to identify linear and nonlinear relationships.
- Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena.
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.

Unit 2

Features and Characteristics of Life: Student Research and Investigation Via Microscopy - 30 days

Content

- All living things are made up of cells, which is the smallest unit that can be said to be alive
- An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular)
- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell
- In multicellular organisms, the body is a system of multiple interacting subsystems
- Subsystems in organisms are groups of cells that work together to form tissues and organs that are specialized for particular body functions
- Each sense receptor respond to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain
- Nerve signals are then processed in the brain, resulting in immediate behaviors or memories
- The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record, it documents the

existence, diversity, extinction, and change of many life forms throughout the history of life on Earth
- Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent
- Comparison of the embryological development of different species also reveal similarities that show relationships not evident in the fully-formed anatomy
- Natural selection leads to the predominance of certain traits in a population, and the suppression of others
- Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions
- Traits that support successful survival and reproduction in the environment become more common, those that do not become less common, thereupon the distribution of traits in a population changes
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Practice

- Develop and use a model to describe phenomena
- Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation
- Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence
- Analyze displays of data to identify linear and nonlinear relationships
- Analyze and interpret data to determine similarities and differences in findings
- Use mathematical representations to support scientific conclusions and design solutions
- Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events
- Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena

Unit 3

Heredity: Student Investigation and Problem Solving Utilizing Mendelian Genetics Theory -30 days

Content

- Interpret data for patterns.
- Explain the anatomical similarities and differences among items of a type.
- Identify similarities and differences between organisms in their

developmental stages.
- Describe how genetic variations of traits in a population increase the probability of survival and reproduction in that population.
- Describe technologies utilized by humans to influence the inheritance of desired traits.
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Practice
- Analyze and interpret data to determine similarities and differences in findings.
- Apply scientific ideas to construct an explanation for real world phenomena, examples, or events.
- Analyze displays of data to identify linear and nonlinear relationships.
- Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena.
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.

Unit 4

Ecology and Ecosystems: Student Research and Use of Fundamental Ecological Field Biology Techniques - 30 days

Content
- All plants, algae (including phytoplankton) and many microorganisms use the energy from light to make sugars from carbon dioxide from the atmosphere and water via photosynthesis to release oxygen. These sugars can be used immediately or stored in their tissues for later use
- Within organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or release energy
- Organisms, and populations of organisms, are dependent on their environmental interaction both with other living things and with nonliving factors
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources, may compete with each other for limited resources, access to which consequently constrains their growth and reproduction
- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers and decomposers as these groups interact within an ecosystem
- Transfers of matter into and out of the physical environment occur at every level
- Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments
- The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem

- Ecosystems are dynamic in nature, their characteristics can vary over time
- Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations
- Photosynthesis, is a chemical reaction in which plant produce complex food molecules (sugars) and requires and energy input (i.e., sunlight) to occur
- Carbon dioxide and water combine to form a carbon-based organic molecule(s) and release oxygen in the process
- Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy
- During cellular respiration, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials
- Predatory interactions may reduce the number of organisms or eliminate whole populations of organisms
- Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other survival
- Although species involved in competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environment, both living and nonliving are shared
- Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems
- The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health
- Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as will as ecosystem services that humans rely on, for example, water purification and recycling
- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem
- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring
- Animals engage in characteristic behaviors that increase the odds of reproduction
- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction
- Genetic factors as well as local conditions affect the growth of the adult plant
- Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes
- Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual
- Changes (mutations) it genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited

- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring
- Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent, these versions may be identical or may differ from each other
- In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations
- Though rare, mutations may result in changes to the structure and function of proteins, some of which are beneficial, others harmful, and some neutral to the organism
- In *artificial* selection, humans have the capacity to influence certain characteristics of organisms by selective breeding
- Humans can choose desired parental traits determined by genes which are then passed onto offspring

Practice

- Develop a model to describe phenomena
- Develop a model to describe unobservable mechanisms
- Analyze and interpret data to provide evidence for phenomena
- construct a scientific explanation based upon valid and reliable evidence obtained from sources (including students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future
- Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem
- Science knowledge is based upon logical connections between evidence and explanations
- Science disciplines share common rules of obtaining and evaluating empirical evidence
- Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena
- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria
- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they din in the past and will continue to do so in the future
- Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation of a model for a phenomenon or a solution to a problem
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence

Unit 5

Plants and the Wildflower Project: Plant Research, Experimentation and Field Biology Collection, Identification and Specimen Preservation - 40-45 days

Content

- Interpret data for patterns.
- Explain the anatomical similarities and differences among items of a type.
- Identify similarities and differences between organisms in their developmental stages.
- Describe how genetic variations of traits in a population increase the probability of survival and reproduction in that population.
- Describe technologies utilized by humans to influence the inheritance of desired traits.
- All plants, algae (including phytoplankton) and many microorganisms use the energy from light to make sugars from carbon dioxide from the atmosphere and water via photosynthesis to release oxygen. These sugars can be used immediately or stored in their tissues for later use
- Within organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or release energy
- Organisms, and populations of organisms, are dependent on their environmental interaction both with other living things and with nonliving factors
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources, may compete with each other for limited resources, access to which consequently constrains their growth and reproduction
- Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments
- The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem
- Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations
- Photosynthesis, is a chemical reaction in which plant produce complex food molecules (sugars) and requires and energy input (i.e., sunlight) to occur
- Carbon dioxide and water combine to form a carbon-based organic molecule(s) and release oxygen in the process
- Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy
- During cellular respiration, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials
- Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems
- The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health
- Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as will as ecosystem services that humans rely

on, for example, water purification and recycling
- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem
- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring
- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction
- Genetic factors as well as local conditions affect the growth of the adult plant
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited
- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring
- In *artificial* selection, humans have the capacity to influence certain characteristics of organisms by selective breeding
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Practice

- Analyze and interpret data to determine similarities and differences in findings.
- Apply scientific ideas to construct an explanation for real world phenomena, examples, or events.
- Analyze displays of data to identify linear and nonlinear relationships.
- Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena.
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.
- Develop a model to describe phenomena
- Develop a model to describe unobservable mechanisms
- Analyze and interpret data to provide evidence for phenomena
- construct a scientific explanation based upon valid and reliable evidence obtained from sources (including students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future
- Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem
- Science knowledge is based upon logical connections between evidence and explanations
- Science disciplines share common rules of obtaining and evaluating empirical evidence
- Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena
- Evaluate competing design solutions based on jointly developed and

agreed-upon design criteria
- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they din in the past and will continue to do so in the future
- Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation of a model for a phenomenon or a solution to a problem
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence

Mission Statement

The Great Meadows Regional School District will provide quality educational opportunities that ensure the individual success of all students within a safe and supportive environment. and to build lifelong learners who will meet society's challenges into and beyond the 21'st century. To that end, it is anticipated that all students will achieve The NJ Student Learning Standards at all grade levels.

Units

Unit 1 - Classification: Taxonomy and Student Created Dichotomous Key

Stage 1: Desired Results

Content Standards

- **MS-LS1-1** Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- **MS-LS1-2** Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. [
- **MS-LS1-4** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. [
- **MS-LS2-1** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- **MS-LS2-5** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- **MS-LS3-1** Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
- **MS-LS3-2** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- **MS-LS4-1** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.

- **MS-LS4-2** Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships
- **MS-LS4-3** Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.
- **MS-LS4-4** Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment
- **MS-LS4-6** Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

Essential Questions

- Why do we classify items in our daily lives?
- Why do scientists classify items?
- How do the characteristics of organisms help us to classify them?
- When classifying items, why is it important to make sure that your categories are not subjective?
- How is a Dichotomous Key not only a simplistic, but also a sophisticated tool in a biologist's "toolbox"?
- Why is it important to be specific in the description of observed items?

Enduring Understandings

- Items are classified for many reasons, including organization, saving time, maintaining order, for learning, aesthetics and primarily in biology to see similarities and differences.
- A Dichotomous Key is a vital tool in the identification of unknown organisms.
- When reporting observations of abiotic or biotic things we must be very specific in the descriptions of observed items.
- In scientific reporting of observed items we can not allow subjectivity to come into play.

Knowledge and Skills (SWBAT)

- Use previous life experience to classify items that may be similar or not.
- Observe the characteristics of an observed item and record those observations in a clear manner.
- Follow appropriate lab techniques and procedures in a variety of laboratory experimentations.
- Work within a small group format to create an understanding of the observations seen.
- Work within a large group format to communicate ideas concerning to that group in a comprehensive manner.
- Use oral arguments to back up a thought, or reasoning for an understood concept.
- Use discussion techniques to come to a consensus within a large group setting.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)
Assessment Methods (formative, summative, other evidence and/or student self-assessment)

Formative: informal observation, discussion (large group and partner share), lab reports, "Do Now"s, short constructed response,quizzes.

Summative: written lab summaries/explanations, practical based unit tests, mid-year and year-end grade level assessment, final project.

Stage 3: Learning Plan

In this unit, students will create an understanding and reasoning for the use of classification of organisms based upon shared characteristics.

The unit will be introduced through student identification of objects in their daily lives that are classified and the many reasons why this may be necessary. Later Lego blocks will be used to create a unique object of their own making. Characteristics of each object in the class will be compared and contrasted in order to see how each is very similar, yet very different from all others in the classroom. Along the way students will be identifying and creating a name for each grouping/characteristic that is observable. Students will be responsible to record the information that is created in the whole class setting to then create a set of questions or statements that would separate each object/classification. It will be important for each grouping name, statement or question is agreed upon by all in the class. This will eliminate any form of bias, or opinion.

This activity will be used to model the steps involved in the creation of a Dichotomous Key, a very sophisticated tool for the identification of living things.

Cross curricular connections:

Mathematics - Students will utilize mathematics to collect data related to Lego structure's length, height width, number of blocks used. They will understand the importance of accurately recording numerical values as well as proper units of measure. Students will display mathematical data in the form of a table, which will eventually become a Dichotomous Key.

English Language Arts/Literacy - Students will utilize ELA skills through online research and communication of grouping names, statement or question formation for their final project. Recording of data and observations in a lab journal, and through the writing of a formal science lab report, lab journal or note packet. Students will identify ways to elaborate and clarify their written expression through the use of sketches, pictures, and other visual presentations when called for or appropriate.

21st Century Skills -

- Critical thinking and Problem Solving
- Communication and Collaboration through lab reports and both small and large group activities
- Information and Media Literacy
- Classroom Computers and Laptops for research, data collection, and lab

reports, and final project

Modifications

- Structure lessons around questions that are authentic/phenomena based, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a phenomena-based, social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Time Allotment: 35 days

Resources:

Suggested resources will include but are not limited to the following:

- District approved science textbook
- Assessments
- Student Chromebooks
- Websites
- Google Classroom
- Videos
- Teacher/student made exemplars
- Laboratory investigations
- STEM/STEAM activities

Unit 2 - Features and Characteristics of Life: Student Research and Investigation via Microscopy

Stage 1: Desired Results

Content Standards

- **MS-LS1-1** Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- **MS-LS1-2** Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.
- **MS-LS1-3** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- **MS-LS1-4** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
- **MS-LS1-7** Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
- **MS-LS1-8** Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories
- **MS-LS3-2** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- **MS-LS4-4** Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment
- **MS-LS4-5** Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms

Essential Questions

- What are the characteristics and needs/necessities that all living things share?
- How does a compound light microscope work?
- Why is the documentation of observed items/experiences important?
- Can we see characteristics that are shared between organisms at the macroscopic and microscopic level?

Enduring Understandings

- All organisms share a set number of characterics that identify them as being living things, these include: Being made of cells, contain DNA, require energy, reproduce, sense and respond to their environment, growth and development.
- All organisms have similar needs and they can be stated as: water, air, food and a place to live.
- A compound light microscope is comprised of a set of multiple lenses that magnify objects that are difficult or unable to be seen with the naked eye.

- There are many types of microscopes and lenses that offer the user to gain a greater insight as to what their individual needs may be.

Knowledge and Skills (SWBAT)

- Identify the characteristics and necessities shared by all organisms.
- Explain how organisms are made of cells, that create tissues, that form organs, systems and work together in organisms.
- Explain how the cell membrane allows all materials that enter and exit the cell as a main boundary of the cell.
- Follow appropriate lab techniques and procedures in a variety of laboratory experimentations.
- Identify the functions and parts of a compound light microscope.
- Create a wet mount for use on compound light microscope.
- Use evidence to show that all living things are made of cells, either one or more than one.
- Produce a diagram of items viewed under the microscope that records what has been viewed for later, and identification of an unknown item.
- Calculate the total magnification that an item is being viewed under.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods (formative, summative, other evidence and/or student self-assessment)

Formative: informal observation, discussion (large group and partner share), lab reports, “Do Now”s, short constructed response,quizzes.

Summative: written lab summaries/explanations, practical based microscopy unit tests, mid-year and year-end grade level assessment.

Stage 3: Learning Plan

In this unit, students will research the characteristics and necessities of life that all organisms share. They will hopefully understand and be able to articulate that different sources will list these characteristics or necessities slightly differently.

Students will prepare a nutrient rich growth media for the collection, growth and study of bacteria in controlled laboratory setting. Through this task they will also create a graph that illustrates this dynamic population change when conditions are right.

Later through the use of a compound light microscope, students will be able to experience some of these characteristics via microscopy. During the microscopy aspect of the unit students will not only learn how to appropriately use a compound light microscope, but they will also research other types of microscopes and their uses.

It will be important for students to diagram all items viewed and record all observations at the time that the observations are made. Toward the end of the unit students will use the diagrams made to identify unknown objects under the microscope.

Cross curricular connections:

Mathematics - Students will utilize mathematics to collect data related to object mass, speed, and ramp distances. They will understand the importance of accurately recording numerical values as well as proper units of measure. Maintaining accurate data will be important in the graphing of exponential growth of bacteria over a time span. Students will display mathematical data in a variety of ways such as tables, graphs, and diagrams. In addition, students will calculate the total magnification of objects viewed using a compound light microscope.

English Language Arts/Literacy - Students will utilize ELA skills through online research of energy forms, the recording of data and observations in a lab journal, and through the writing of a formal science lab report, lab journal or note packet. Students will identify ways to elaborate and clarify their written expression through the use of sketches, pictures, and other visual presentations when called for or appropriate.

21st Century Skills -

- Critical thinking and Problem Solving
- Communication and Collaboration through lab reports and small group activities
- Information and Media Literacy
- Classroom Computers and Laptops for research, data collection, and lab reports

Modifications

- Structure lessons around questions that are authentic/phenomena based, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a phenomena-based, social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Time Allotment: 30 days

Resources:

Suggested resources will include but are not limited to the following:

- District approved science textbook

- Assessments
- Student Chromebooks
- Websites
- Google Classroom
- Videos
- Teacher/student made exemplars
- Laboratory investigations
- STEM/STEAM activities

Unit 3 - Heredity: Student Investigation and Problem Solving Utilizing Mendelian Genetics Theory

Stage 1: Desired Results

Content Standards

- **MS-LS1-1** Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- **MS-LS1-2** Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.
- **MS-LS1-3** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- **MS-LS1-4** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
- **MS-LS1-5** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms
- **MS-LS1-6** Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms
- **MS-LS1-7** Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
- **MS-LS1-8** Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories
- **MS-LS3-1** Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

- **MS-LS3-2** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- **MS-LS4-1** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
- **MS-LS4-2** Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships
- **MS-LS4-3** Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.
- **MS-LS4-4** Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment
- **MS-LS4-5** Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms
- **MS-LS4-6** Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

Essential Questions

- How can we predict the outcome of a cross between any given set of parent organisms (sexually or asexually)?
- How can we track a genetic mutation that takes place in a family or a population of organisms?
- How can you account for the large variety of individuals of the same species?
- How can tools such as a Punnett Square and mathematics assist in the prediction of crosses between a variety of parent organisms?

Enduring Understandings

- All organisms reproduce either sexually or asexually. The outcome of sexual reproduction is a blending of traits and the outcome of asexual reproduction is duplicate (barring mutation) of the parent organism.
- If we know in a characteristic, which is a dominant and which is a recessive trait we should be able to predict mathematically the number of offspring that would carry the dominant, the recessive or both traits.
- If we know in a characteristic, which is a dominant and which is a recessive trait we should be able to predict mathematically the number of offspring that would show the dominant or the recessive traits.
- Sexual reproduction in organisms provides for a variation in individuals within a population and is the driving force in evolution.
- Mathematics is useful in the prediction of offspring that reproduce sexually or asexually.

Knowledge and Skills (SWBAT)

- Identify a genetic trait.
- Describe that an allele is unit of genetic material that will carry a gene for a specific trait.
- Follow appropriate lab techniques and procedures in a variety of laboratory experimentations.
- Differentiate between a dominant and a recessive trait or characteristic.
- Differentiate between a genotype and a phenotype for a given trait.
- Accurately use a Punnett Square to predict the characteristics of offspring of two parent organisms, or vice versa.
- Make predictions or construct an explanation that reveals genetic characteristics between F1, F2 and F3 generations of an organism's family genetic line.
- Use mathematics to calculate the possible genetic characteristics of organisms using a Punnett Square, and express the calculations as a percentage.
- Problem solve a variety of genetics based problems.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods (formative, summative, other evidence and/or student self-assessment)

Formative: informal observation, discussion (large group and partner share), lab reports, "Do Now"s, short constructed response,quizzes.

Summative: written lab summaries/explanations, practical based unit tests, mid-year and year-end grade level assessment.

Stage 3: Learning Plan

In unit 3, students will gain an in depth experience of solving Mendelian Genetics problems. Specific terminology will be used and students will be required to practice using the terms as well as solving genetics problems. Problems will range from general and basic to complex.

Through experimentation and their work on the problems mathematics will be used to calculate the probability of certain outcomes based upon the parent or offspring information given. Throughout the unit mathematics will be a major tool for their problem solving.

Cross curricular connections:

Mathematics - Students will utilize mathematics to collect and communicate data related to genotypes and phenotypes of parents and offspring. They will understand the importance of accurately recording numerical values as well as proper units. Students will display mathematical data in a variety of ways such as tables, graphs, and diagrams. In addition, students will calculate averages of small and large group data.

English Language Arts/Literacy - Students will utilize ELA skills through online problem solving and communicating final results to the class and within small group settings. The recording of data and observations in a lab journal, and through the

writing of a formal science lab report, lab journal or note packet. Students will identify ways to elaborate and clarify their written expression through the use of Punnett Squares, sketches, pictures, and other visual presentations when called for or appropriate.

21st Century Skills -

- Critical thinking and Problem Solving
- Communication and Collaboration through lab reports and small group activities
- Information and Media Literacy
- Classroom Computers and Laptops for research, data collection, and lab reports

Modifications

- Structure lessons around questions that are authentic/phenomena based, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a phenomena-based, social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Time Allotment: 30 days

Resources:

Suggested resources will include but are not limited to the following:

- District approved science textbook
- Assessments
- Student Chromebooks
- Websites
- Google Classroom
- Videos
- Teacher/student made exemplars
- Laboratory investigations

- STEM/STEAM activities

Unit 4 - Ecology and Ecosystems: Student Research and Use of Fundamental Ecological Field Biology Techniques

Stage 1: Desired Results

Content Standards

- **MS-LS1-5** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms
- **MS-LS1-6** Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms
- **MS-LS1-7** Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
- **MS-LS2-1** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- **MS-LS2-2** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems
- **MS-LS2-3** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem
- **MS-LS2-4** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations
- **MS-LS2-5** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- **MS-LS3-2** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- **MS-LS4-1** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
- **MS-LS4-4** Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment
- **MS-LS4-5** Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms
- **MS-LS4-6** Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

Essential Questions

- What is an interaction?
- Where does the energy come from that powers the cells in living things?
- How does energy flow in an ecosystem?
- If energy is always moving through an ecosystem, how can some actually be lost?
- Why do we classify organisms within an ecosystem or the ecosystem at all?
- Why are some organisms more or less likely to survive in the environment in which they live? What factors could influence this survival?
- Is it ethical for humans to knowingly interfere with the biotic and/or abiotic factors in an ecosystem?
- What do ecologists need to know in order to assess the health of a given ecosystem.
- How can we estimate the size of a particular population of organisms?
- Which method of assessing an ecosystem is most useful and why?
- What types of models can accurately communicate information about a specific ecosystem or population?

Enduring Understandings

- In any ecosystems there are many interactions both biotic and abiotic.
- All energy on the planet originates from the Sun, cycles through it and is recycled through both the biotic and abiotic factors.
- A food web is a much more realistic representation of energy flow in an ecosystem than an food chain.
- All the energy that an organism takes in is not passed on. It can be lost or used by the organism for life processes.
- Many methods may be employed to assess the size of a population and the health of an ecosystem. Methods may be specific to the organisms or ecosystem being studied.
- Ecosystems are not easy to model in the laboratory setting.

Knowledge and Skills (SWBAT)

- Describe how energy flows through an ecosystem or habitat.
- Construct an explanation that describes the flow of energy through an ecosystem.
- Follow appropriate lab techniques and procedures in a variety of laboratory experimentations.
- Evaluate whether a given scenario illustrates an interaction of an organism within an ecosystem.
- Use a model to create an illustration with mathematical evidence that explains how organisms within a population may have an increased probability of survival based upon a genetic variation.
- Chose a method for the estimation of a model populations size and calculate the estimated population(s) size.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods (formative, summative, other evidence and/or student self-assessment)

Formative: informal observation, discussion (large group and partner share), lab reports, "Do Now"s, short constructed response,quizzes.

Summative: written lab summaries/explanations, practical based unit tests, mid-year and year-end grade level assessment.

Stage 3: Learning Plan

In this unit, students will explore and research through laboratory investigations the basics of ecology. Topics will include; levels of classification in the biosphere, biotic and abiotic factors, population estimation techniques, food chains and webs, the energy pyramid, the origin and flow of energy in an ecosystem, the loss of energy in an ecosystem, interactions and interdependence in an ecosystem, biodiversity, population density, carrying capacity, humans and their impact (both good and bad) on ecosystems. Students will create a double line graph that illustrates the interaction and impact on two populations in a predator prey relationship.

Cross curricular connections:

Mathematics - Students will utilize mathematics to collect data related to the estimation of a population's size and that population's density. They will understand the importance of accurately recording numerical values as well as proper units of measure. Maintaining accurate data will be important in the graphing of the predator prey relationship over a given time span. Students will also demonstrate the understanding that a population estimation is just an estimation as it is constantly changing. Students will display mathematical data in a variety of ways such as tables, graphs, and diagrams. In addition, students will calculate averages and net forces.

English Language Arts/Literacy - Students will utilize ELA skills through online research of energy forms, the recording of data and observations in a lab journal, and through the writing of a formal science lab report, lab journal or note packet. Students will identify ways to elaborate and clarify their written expression through the use of sketches, pictures, and other visual presentations when called for or appropriate.

21st Century Skills -

- Critical thinking and Problem Solving
- Communication and Collaboration through lab reports and small group activities
- Information and Media Literacy
- Classroom Computers and Laptops for research, data collection, and lab reports

Modifications

- Structure lessons around questions that are authentic/phenomena based, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).

- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a phenomena-based, social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Time Allotment: 30 days

Resources:
Suggested resources will include but are not limited to the following:

- District approved science textbook
- Assessments
- Student Chromebooks
- Websites
- Google Classroom
- Videos
- Teacher/student made exemplars
- Laboratory investigations
- STEM/STEAM activities

Unit 5 - Plants and the Wildflower Project: Plant Research, Experimentation, and Field Biology Collection, Identification and Specimen Preservation

Stage 1: Desired Results

Content Standards

- **MS-LS1-3** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- **MS-LS1-4** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
- **MS-LS1-5** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms
- **MS-LS1-6** Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms

- **MS-LS1-7** Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
- **MS-LS2-1** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- **MS-LS2-2** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystem
- **MS-LS2-3** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem
- **MS-LS2-4** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations
- **MS-LS2-5** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- **MS-LS3-1** Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
- **MS-LS3-2** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- **MS-LS4-1** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
- **MS-LS4-2** Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships
- **MS-LS4-3** Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.
- **MS-LS4-4** Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment
- **MS-LS4-5** Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms
- **MS-LS4-6** Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

<u>Essential Questions</u>

- As a group, why are plants successful?
- Plants can reproduce either asexually or sexually, which manner is better for the

plant or for humans?
- Why makes plants very good learning tools?
- Genetic engineering in plants is relatively easy. Should we do it and how? Who gets to chose?
- What protections have plants incorporated into their survival strategy and are they similar to other species (non-plants)?
- What can a biological study of an ecosystem tell us about a group of organisms?

Enduring Understandings
- Organisms survive because of evolutionary variations that makes some better suited to their environment and more likely to pass on their genetic traits to their offspring.
- Organisms that can reproduce in more than one way have a better chance for survival.
- Accuracy in the description of an organism or scientific observation, can not be retrieved if not recorded accurately from the start of the observation.

Knowledge and Skills (SWBAT)
- Describe the various methods of reproduction in the variety of classified plant groups.
- Describe the characteristics that set apart monocots and dicots.
- Follow appropriate lab techniques and procedures in a variety of laboratory experimentations.
- Use appropriate lab techniques in the collection, identification, data collection and preservation of collected wild specimens.
- Describe/explain the parts and functions of the reproductive organs of a flowering plant.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods (formative, summative, other evidence and/or student self-assessment)

Formative: informal observation, discussion (large group and partner share), lab reports, “Do Now”s, short constructed response,quizzes.

Summative: written lab summaries/explanations, practical based unit tests, mid-year and year-end grade level assessment, final project.

Stage 3: Learning Plan

In this unit, students will have a chance to not only research and experiment with plants, and their structures but also experience the work of a field biologist. Information learned in previous units will be compiled to assist in this unit. Through research and experimentation they will gain the basics of the various groups in the plant kingdom. Plant characteristics, structures, functions, growth and reproduction, tissues, photosynthesis, seed production and distribution will also be discussed and experienced. Students will also gain experience in the collection of, identification and specimen preservation of wildflower specimens.

Cross curricular connections:

Mathematics - Students will utilize mathematics to collect data related to water absorption rate, effects of pH and living space on a population size. They will understand the importance of accurately recording numerical values as well as proper units of measure. Students will display mathematical data in a variety of ways such as tables, graphs, and diagrams. In addition, students will calculate averages and net forces.

English Language Arts/Literacy - Students will utilize ELA skills through online research of energy forms, the recording of data and observations in a lab journal, and through the writing of a formal science lab report, lab journal or note packet. Students will identify ways to elaborate and clarify their written expression through the use of sketches, pictures, and other visual presentations when called for or appropriate.

21st Century Skills -

- Critical thinking and Problem Solving
- Communication and Collaboration through lab reports and small group activities
- Information and Media Literacy
- Classroom Computers and Laptops for research, data collection, and lab reports

Modifications

- Structure lessons around questions that are authentic/phenomena based, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a phenomena-based, social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Time Allotment: 40-45 days

Resources:

Suggested resources will include but are not limited to the following:

- District approved science textbook

- Classroom sets of identification field guides
- Assessments
- Student Chromebooks
- Websites
- Google Classroom
- Videos
- Teacher/student made exemplars
- Laboratory investigations
- STEM/STEAM activities

New Jersey Student Learning Standards

http://www.state.nj.us/education/cccs/

Integration of 21st Century Theme(s)

The following websites are sources for the following 21st Century Themes and Skills:
http://www.nj.gov/education/code/current/title6a/chap8.pdf
http://www.p21.org/about-us/p21-framework .
http://www.state.nj.us/education/cccs/standards/9/index.html

21st Century Interdisciplinary Themes (into core subjects)
- **Global Awareness**
- **Financial, Economic, Business and Entrepreneurial Literacy**
- **Civic Literacy**
- **Health Literacy**
- **Environmental Literacy**

Learning and Innovation Skills
- **Creativity and Innovation**
- **Critical Thinking and Problem Solving**
- **Communication and Collaboration**

Information, Media and Technology Skills
- **Information Literacy**
- **Media Literacy**
- **ICT (Information, Communications and Technology) Literacy**

Life and Career Skills
- **Flexibility and Adaptability**
- **Initiative and Self-Direction**
- **Social and Cross-Cultural Skills**
- **Productivity and Accountability**
- **Leadership and Responsibility**

Integration of Digital Tools
- **Classroom computers/laptops**
- **Technology Lab**
- **FM system**
- **Other software programs**