Verona Public School District
Curriculum Overview

8th Grade Science

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Verona Public Schools Mission Statement:

The mission of the Verona Public Schools, the center of an engaged and supportive community, is to empower students to achieve their potential as active learners and productive citizens through rigorous curricula and meaningful, enriching experiences.

Course Description:

The 8th grade science curriculum provides “opportunities for students to engage directly with natural phenomena, tools of science, real-world problems and technical and design challenges. The course provides an instructional framework to help all students develop age-appropriate scientific habits of mind while building on students’ prior knowledge and experiences and allowing them to apply knowledge and problem solving strategies in new contexts,” (STC, 2012).

The 8th grade science program makes use of three Science and Technology Centers kits: **Electricity, Waves and Information Transfer; Genes & Molecular Machines; and Space Systems Exploration**. In the Electricity, Waves, and Information Transfer unit students will be applying what they learn as they explore the technology behind touch screen devices, students design a stylus. As part of the unit assessment, students demonstrate their content knowledge and science and engineering skills as they design a remote medical system for assessing and transporting patients from a natural disaster area. As a part of the Genes and Molecular Machines unit, students will investigate cells, asexual and sexual reproduction, mitosis and meiosis, DNA and its relationship to observable traits, genetic diversity, and genetic technologies. Assessment for the unit will have students creating a presentation on a technology that has changed the way humans influence the inheritance of desired traits in organisms. In the Space Systems Exploration unit students will use physical and mathematical models plus data analysis, to get a thorough understanding of the Earth-Sun-Moon system. They then apply what they’ve learned to investigate environmental conditions on Mars and engineer scientifically sound human habitations. As part of the unit assessment students develop a scale model of Uranus and its five largest moons and use it to make predictions about the moon's’ gravities, orbital speeds, and eclipses.

Prerequisite(s):

7th Grade Science

Standard 8: Technology Standards	
8.1: Educational Technology: *All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.*	**8.2: Technology Education, Engineering, Design, and Computational Thinking - Programming:** *All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.*
A. Technology Operations and Concepts B. Creativity and Innovation C. Communication and Collaboration D. Digital Citizenship **X** E. Research and Information Fluency **X** F. Critical thinking, problem solving, and decision making	A. The Nature of Technology: Creativity and Innovation B. Technology and Society C. Design **X** D. Abilities for a Technological World E. Computational Thinking: Programming

SEL Competencies and Career Ready Practices	
Social and Emotional Learning Core Competencies: *These competencies are identified as five interrelated sets of cognitive, affective, and behavioral capabilities*	**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.*
Self-awareness: The ability to accurately recognize one's emotions and thoughts and their influence on behavior. This includes accurately assessing one's strengths and limitations and possessing a well-grounded sense of confidence and optimism.	**X** CRP2. Apply appropriate academic and technical skills. CRP9. Model integrity, ethical leadership, and effective management. CRP10. Plan education and career paths aligned to personal goals.
Self-management: The ability to regulate one's emotions, thoughts, and behaviors effectively in different situations. This includes managing stress, controlling impulses, motivating oneself, and setting and working toward achieving personal and academic goals.	CRP3. Attend to personal health and financial well-being. **X** CRP6. Demonstrate creativity and innovation. **X** CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity.
Social awareness: The ability to take the perspective of and empathize with others from diverse backgrounds and cultures, to understand social and ethical norms for behavior, and to recognize family, school, and community resources and supports.	CRP1. Act as a responsible and contributing citizen and employee. CRP9. Model integrity, ethical leadership, and effective management.
Relationship skills: The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. This includes communicating clearly, listening actively, cooperating, resisting inappropriate social pressure, negotiating conflict constructively, and seeking and offering help when needed.	**X** CRP4. Communicate clearly and effectively and with reason. CRP9. Model integrity, ethical leadership, and effective management. CRP12. Work productively in teams while using cultural global competence.
Responsible decision making: The ability to make constructive and respectful choices about personal behavior and social interactions based on consideration of ethical standards, safety concerns, social norms, the realistic evaluation of consequences of various actions, and the well-being of self and others.	CRP5. Consider the environmental, social, and economic impact of decisions. **X** CRP7. Employ valid and reliable research strategies. **X** CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership, and effective management.

Standard 9: 21st Century Life and Careers		
9.1: Personal Financial Literacy: *This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.*	**9.2: Career Awareness, Exploration & Preparation:** *This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.*	**9.3: Career and Technical Education:** *This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.*
A. Income and Careers B. Money Management C. Credit and Debt Management D. Planning, Saving, and Investing **X** E. Becoming a Critical Consumer F. Civic Financial Responsibility G. Insuring and Protecting	A. Career Awareness (K-4) **X** B. Career Exploration (5-8) C. Career Preparation (9-12)	A. Agriculture, Food & Natural Res. B. Architecture & Construction C. Arts, A/V Technology & Comm. D. Business Management & Admin. E. Education & Training F. Finance G. Government & Public Admin. H. Health Science I. Hospital & Tourism J. Human Services K. Information Technology L. Law, Public, Safety, Corrections & Security M. Manufacturing N. Marketing **X** O. Science, Technology, Engineering & Math P. Transportation, Distribution & Log.

Course Materials	
Core Instructional Materials: *These are the board adopted and approved materials to support the curriculum, instruction, and assessment of this course.*	**Differentiated Resources**: *These are teacher and department found materials, and also approved support materials that facilitate differentiation of curriculum, instruction, and assessment of this course.*
• STC Kits: o Electricity, Waves and Information Transfer o Genes & Molecular Machines o Space Systems Exploration • Chromebooks	• CK12.org TWIG Videos • Brain Pop Kahoot • YouTube Education Science Flix's- videos and nonfiction reading passages • NGSS Performance tasks • https://www.nextgenscience.org/classroom-sample-assessment-tasks • NGSS Assessment Portal • https://ngss-assessment.portal.concord.org/ • Interactives https://concord.org/stem-resources/grade-level/middle-school • NewsEla - nonfiction reading passages • PHet simulations • Gizmo simulations

Unit Title / Topic: Electricity, Waves and Information Transfer | **Unit Duration: 60 days**

Stage 1: Desired Results

Established Goals:

MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. [Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.]

MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] [Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.]

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

MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. [Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen.] [Assessment Boundary: Assessment does not include binary counting. Assessment does not include the specific mechanism of any given device.]

Science and Engineering Practices

Asking Questions and Defining Problems
- Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. (MS-PS2-3)

Developing and Using Models
- Develop and use a model to describe phenomena. (MS-PS4-2)

Using Mathematics and Computational Thinking
- Use mathematical representations to describe and/or support scientific conclusions and design solutions. (MS-PS4-1)

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

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence
- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS4-1)

Disciplinary Core Ideas

PS2.B: Types of Interactions
- Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)

PS4.A: Wave Properties
- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)
- A sound wave needs a medium through which it is transmitted. (MS-PS4-2)

PS4.B: Electromagnetic Radiation
- When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2)
- The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2)
- A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2)
- However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2)

PS4.C: Information Technologies and Instrumentation
- Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)

Crosscutting Concepts

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

Patterns
- Graphs and charts can be used to identify patterns in data. (MS-PS4-1)

Structure and Function
- Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2)
- Structures can be designed to serve particular functions. (MS-PS4-3)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World
- Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3)

Connections to Nature of Science

Science is a Human Endeavor
- Advances in technology influence the progress of science and science has influenced advances in technology. (MS-PS4-3)

Common Core State Standards Connections:

ELA/Literacy –

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. **(MS-PS4-3)**
RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. **(MS-PS4-3)**
RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. **(MS-PS4-3)**
WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. **(MS-PS4-3)**
SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. **(MS-PS4-1),(MS-PS4-2)**

Mathematics –

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

Transfer Goal:

Students will be able to independently use their learning to understand the role of energy and how it relates to technology and information transfer in our world.

Students will understand that:

- Electric current flows through a closed circuit that contains a source of electrical energy.
- Resistors and capacitors regulate current in an electric circuit.
- Many circuit components transform some electrical energy into thermal energy, and thermal energy transfers from circuit components to the surrounding environment.
- Some electric devices transform electrical energy into kinetic energy.
- Waves transfer energy through matter, and in some cases, through empty space.
- We can identify and describe waves by their properties.
- Waves interact with matter in predictable ways. Understanding those interactions helps us to use waves in engineering design.
- Various technologies use light and sound waves to encode, store and/or transmit information in digital or analog formats.
- Information technologies incorporate electricity and waves to transmit communications
- Global communications systems rely on information technology designs that use wave properties to encode and transmit information.
- Animal body systems use electrical impulses to send, respond to, and store information.
- Animals have evolved communications systems that use waves to detect the environment.
- Medical imaging technologies use electricity and waves to detect and image structures inside the body.
- Touch screen technologies use electrical properties to sense and respond to touch.

Essential Questions:

- What is electricity and how is it measured?
- How can components in an electric circuit affect current and voltage?
- How is the transfer of thermal energy from electric devices regulated?
- How do components in an electrical system transform electrical energy into kinetic energy?
- How can we use models to understand wave properties?
- How do waves behave when they interact with matter?
- How do we use waves to encode and transmit information?
- How can electricity and waves be used to communicate information from one place to another?
- How are the properties of electromagnetic waves useful for human communication systems?
- How does your body use electrical signals to detect and respond to information in your environment?
- How do animals use waves to communicate and navigate their environments?
- How are electricity and waves used to diagnose and treat medical conditions?
- How are electrical components used to design touch screen devices?

Students will know:

- Action potential, active state, ammeter, ampere, amplitude, analog, auditory, axon, battery, capacitance, capacitive touch screen, capacitor, chemical energy, circuit, compound battery, compression, conductor, constraints, convex, crest, criteria, current, decibel, diagnostic protocol, digital, disperse, echolocation, electrical energy, electricity, electrode, electrolyte, electromagnet, electromagnetic radiation, electromagnetic spectrum, electromagnetic wave, electromagnetism, energy, energy transfer, energy transformation, frequency, gauge, generation, global positioning system, heat, hertz, hypothesis, incandescence, incident ray, intensity, kinetic energy, law of conservation of energy, lens, longitudinal wave, mechanical wave, medium, membrane potential, modification, nervous system, neuron, neutral, nonconductor, Ohm, Ohm's law, opaque, optical fiber, optimize, parallel, pitch, magnetic poles, power, prediction prototype, radiate, rarefaction, reflect, reflected ray, refract, resistance, resistive touch screen, resistor, resting potential, schematic diagrams, sensory receptors, series, static electricity, stimulus, stylus, temperature, terminal, thermal energy, threshold, translucent, transmit, transparent, transverse, wave, trough, volt, voltage, voltmeter, watt, wave, wave energy, wavelength

Students will be able to:

- Construct a wet cell battery
- Draw schematics
- Construct series and parallel circuits using compound batteries
- Measure current and voltage
- Measure resistance and capacitance using Ohm's Law
- Measure thermal energy transfer
- Construct an electromagnet and spinning coil motor
- Model and measure longitudinal and transverse waves
- Observe wave transmission through various media
- Observe and measure reflection and refraction
- Model analog and digital storing and recording of data
- Use optical fibers to transmit information with light waves
- Send a message along an optical fiber

	● Design an information communication system utilizing fiber optics ● Use a model to understand the global positioning system ● Model the body's response to external stimuli ● Research the formation of memories ● Model animal communication and navigation ● Model echolocation ● Prepare a diagnostic protocol ● Create a risk analysis using diagnostic protocol ● Explore and design touchscreen devices ● Examine human electrical conductivity

Stage 2: Acceptable Evidence

Transfer Task - Disaster Relief System

Students will apply what they know about electricity, waves and information transfer to design circuits, systems, and devices that regulate thermal energy transfer, transmit wave-based information, and assist those with special needs. They have learned how waves and electricity are used to see inside a person's body and to detect the location of a car on a highway or a finger on a screen. They have learned how analog information is converted to digital data and stored electronically. In this assessment, they will draw on their skills and knowledge to plan a disaster relief system for providing necessary medical care to patients after a natural disaster from afar. They will also answer written questions to further demonstrate what they have learned throughout the unit.

Students will use Student Sheet A.1a "Equipment Planning" and A.1b "Map of Disaster Area" to help inform their design decisions and disaster relief plan which they will present to the class. Student will also use Student Sheet A.2a "Written Assessment Questions" and A.2b "Written Assessment Answer Sheet" to identify the ways in which their disaster relief system successfully demonstrated their knowledge and skills and ways in which they could improve upon their original work.

Unit Title / Topic: Genes & Molecular Machines	Unit Duration: 75 days

Stage 1: Desired Results

Established Goals:

MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living cells, and understanding that living things may be made of one cell or many and varied 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. [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.]

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. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]

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. [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting 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. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]

MS-LS4-5. Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. [Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.]

Science and Engineering Practices

Planning and Carrying Out Investigations
- Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1)

Engaging in Argument from Evidence
- Use 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. (MS-LS1-4)

Developing and Using Models
- Develop and use a model to describe phenomena. (MS-LS3-1),(MS-LS3-2)

Constructing Explanations and Designing Solutions
- Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4-2)
- Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS-LS4-4)

Obtaining, Evaluating, and Communicating Information
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5)

Disciplinary Core Ideas

LS1.A: Structure and Function
- All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1)

LS1.B: Growth and Development of Organisms
- Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)
- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)
- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MS-LS3-2)

LS3.A: Inheritance of Traits
- 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) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1)
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)

LS3.B: Variation of Traits
- 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. (MS-LS3-2)
- 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 changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1)

LS4.B: Natural Selection
- Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)
- In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. (MS-LS4-5)

Crosscutting Concepts

Cause and Effect
- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4)
- Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2)
- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-4)

Scale, Proportion, and Quantity
- Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1)

Structure and Function
- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS3-1)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology
- Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS1-1), (MS-LS4-5)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems
- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS4-1),(MS-LS4-2)

Science Addresses Questions About the Natural and Material World
- Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS4-5)

Transfer Goal:

Students will be able to independently use their learning to understand how traits are inherited and how humans have influenced traits and biodiversity in various organisms.

Students will understand that:

- Offspring inherit traits from their parents in predictable ways.
- Selection results in change in populations over time.
- Organisms within a species show a variety of traits.
- Cells are the basic component of life.
- Organisms are made up of cells, tissues, organs and systems.
- Cells differ in shape and function.
- Living organisms must reproduce sexually or asexually to survive.
- Genetic information is passed to offspring.
- All cells reproduce by dividing through mitosis and meiosis.
- Living things have different phenotypes, which are determined by their genotype and the environment.
- Variation is present in organisms of the same species. It is present among sexually reproducing organisms, even when they have the same parents, because the combination of inherited alleles is random.
- The probability of passing on inherited alleles can be predicted.
- Each parent contributes half the alleles; the alleles that are received are random.
- DNA is found in cells and is the design code for all living organisms.
- Mutations cause variation in individuals of a species, which leads to genetic diversity in the process of evolution.
- Sexual reproduction in plants requires pollination. Many flowering plants use pollinators to reproduce.
- Genetic diversity increases a population's ability to survive.
- Natural selection is the driving force in evolution of species. Humans have also influence evolution via artificial selection of traits.
- There are many unique adaptations that animals have that allow them to survive and thrive in their environments.
- Both genetic engineering and artificial selection can produce variants from the natural, or wild type, set of traits for a population.

Essential Questions:

- What do you already know about cells, reproduction and genetics?
- What are the building blocks of life?
- What can cells tell us about how organisms reproduce?
- Where do cells come from?
- Why do family members look similar but not identical to one another?
- How does DNA determine the traits that organisms have?
- How do behaviors and structures allow plants and animals to reproduce more successfully and better survive?
- How do differences within a population help a species survive?
- How do natural and artificial selection change a population over time?
- What are some ways humans have influenced the inheritance of desired traits in organisms?

Students will know:

- Adaptation, alleles, anther, apoptosis, artificial selection, asexual reproduction, binary fission, blended inheritance, budding, cancer, cell, cell division, cell membrane, cell wall, central vacuole, chloroplast, chromosome, clone, codominance, common ancestry, courtship, cross-pollination, daughter cells, deletion, differentiation, divergence, DNA, domestication,

Students will be able to:

- Observe variations in zebrafish, examine cells and look for similarities between parents and offspring.
- Create and analyze wet-mount slides of various organisms that allow them to distinguish between unicellular and multicellular organisms.
- Design a cell whose structure would adequately meet the function of an animal bone.

dominant, dormant, egg, embryo, endoplasmic reticulum, eukaryotic, evolution, fertilization, fitness, gametes, gene, gene fixation, gene flow, gene pool, gene therapy, genetic cross, genetic diversity, genetic drift, genetic engineering, genetic manipulation, genetic recombination, genetic variation, genetics, genome, genotype, germinate, Golgi body, heterozygous, homozygous, Human Genome Project, incomplete dominance, induced pluripotent stem cells, inheritance, innate behavior, larvae, lysosome, meiosis, mitochondrion, mitosis, model organism, mRNA, multiple alleles, multicellular, mutation, natural selection, nitrogenous base, nucleotide, nucleus, offspring, organism, ovum, phenotype, pheromones, pistil, pleiotropy, pluripotent, pollen, polygenic trait, population, population genetics, probability, prokaryotic cell, protein, Punnett square, recessive, reproduction, ribosome, self-pollination, sexual reproduction, species, seed dispersal, sperm, stamen, stem cell, stigma, trait, transcribe, translate, unicellular, vacuole, variation, vegetative propagation, asexual reproduction (fission, budding, regeneration, vegetative propagation),	● Cross-pollinate flowers, simulation an example of sexual reproduction. ● Investigate various asexual methods of reproduction under a microscope. Analyze observations to consider the advantages and disadvantages of both asexual and sexual reproduction. ● Prepare and stain a wet-mount slide of onion root cells undergoing mitosis. Students then design and construct a model of a cell and predict the behaviors of the cell during mitosis. ● Explore plant reproductive cells undergoing meiosis. Students will then use their observations to design and construct a model of a cell and predict the cell behaviors that occur during meiosis. ● Compare and contrast mitosis and meiosis and how they both relate to reproduction. ● Explore complete dominance by using probability to determine genotypes and phenotypes in a newly created creature. Students will then use these creatures to demonstrate heredity and how genes are randomly passed to an offspring. ● Students will create Punnett square models that allow them to analyze and interpret the passing of traits from parents to offspring. ● Analyze the structure of DNA and determine the patterns that exist in the structure. ● Extract DNA from strawberries and use pop beads to model DNA transcription into RNA. Students will then translate the RNA into amino acids, forming proteins. ● Plan and carry out an investigation to determine how various seeds are dispersed and the conditions needed for a seed to germinate. ● Develop a model of a new species of flower, its pollinator, seed structure and method of dispersal. ● Harvest and germinate seeds from their previously grown plants. Students will then observe the variations that exist between the newly germinated plants. ● Use observed phenotypes to predict parental genotypes using Punnett Square models. ● Create a simulation to investigate genetic diversity within asexual and sexually reproducing organisms. ● Simulate natural selection by using different colored beads and different types of habitats. ● Model the process of artificial selection and consider the selection pressures of both natural and artificial selection and how they lead to evolution. ● Observe the different variants of zebrafish in their classroom to construct an explanation as to how the different kinds of zebrafish were created. ● Research and compile a list of different types of technologies related to genetic manipulation.

Stage 2: Acceptable Evidence

Transfer Task: Genes and Molecular Machines

Students will demonstrate their content knowledge and science and engineering skills to research a specific technology that humans have used to influence or change a desired trait in an organism. Students will utilize proper research techniques to answer a plethora of questions concerning their chosen technology and its effect on the genetics of the organisms it's used on.

Students will use Student Sheet 10.2 "Genetic Manipulation Research" to determine which technology their group will investigate. We are not sure if there are any other Blackline Masters that they will need to use because it appears that some are missing from the pdf document we were given from STC.

Unit Title / Topic: Space Systems Exploration	Unit Duration: 60 Days

Stage 1: Desired Results

Established Goals:

MS-ESS1-1. Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]

MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. [Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).] [Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.]

MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system. [Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]

MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]

Science and Engineering Practices

Developing and Using Models
- Develop and use a model to describe phenomena. (MS-ESS1-1),(MS-ESS1-2)

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

Constructing Explanations and Designing Solutions
- 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 did in the past and will continue to do so in the future. (MS-ESS1-4)

Disciplinary Core Ideas

ESS1.A: The Universe and Its Stars
- Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1)
- Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2)

ESS1.B: Earth and the Solar System
- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3)
- This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1)
- The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)

ESS1.C: The History of Planet Earth
- The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1-4)

Crosscutting Concepts

Patterns
- Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1)

Scale, Proportion, and Quantity
- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1-3),(MS-ESS1-4)

Systems and System Models
- Models can be used to represent systems and their interactions. (MS-ESS1-2)

Connections to Engineering, Technology, and Applications of Science

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

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems
- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1),(MS-ESS1-2)

Common Core State Standards Connections:

ELA/Literacy –

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3),(MS-ESS1-4)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS1-3)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS1-4)

SL.8.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points. (MS-ESS1-1),(MS-ESS1-2)

Mathematics –

MP.2 Reason abstractly and quantitatively. (MS-ESS1-3)

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

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3)

Transfer Goal:

Students will be able to independently use their learning to understand the interactions of bodies within our solar system and how technology is used to inform our understanding of of our solar system and the universe.

Students will understand that:

- Cyclical changes in the relative positions of the Sun-Earth-Moon create observable and regular day/night, lunar and annual cycles.
- Cyclical changes in the relative positions of the Sun-Earth-Moon create a predictable lunar cycle with distinct phases of the moon.
- Cyclical changes in the relative positions of the Sun-Earth-Moon create tidal cycles of predictable duration and amplitude.
- Cyclical changes in the relative positions of the Sun-Earth-Moon create solar and lunar eclipses of predictable timing and location.
- Seasons on Earth are a result of the tilt of Earth's axis and the motion of Earth around the Sun.
- Scale models help scientists visualize and study systems that involve large distances and sizes.
- Scientists develop and use models designed to help answer specific research questions.
- Gravity is an attractive force exerted by objects with large mass, such as planets, and is positively correlated to the planet's mass.
- Gravity is the force that shapes the universe and controls the structure of solar systems and various bodies within them.
- Surface features on other planets and moons reveal how geologic processes on Earth also occur on other planets.
- Effective engineering design is critical for successful space exploration.

Essential Questions:

- What do you know about how planets and moons move in our solar system?
- How can a model help you understand how the interactions of the Sun-Earth-Moon explain cycles experienced on Earth?
- Why do the patterns you can see in the Moon's appearance occur?
- What causes tides?
- What causes solar and lunar eclipses?
- Why does Earth have seasons?
- How can we use models to understand the relative sizes of bodies in the solar system and the distances between them?
- How can we find and evaluate data to explore questions about Jupiter and its moons?
- How does gravity influence our solar system?
- How do planets and moons stay in their specific orbits to maintain the structure of our solar system?
- How can you use satellite images to look for evidence of geologic features similar to those on Earth on other planets?
- What are the criteria and constraints for humans to explore and live in space?

Students will know:	Students will be able to:
• Albedo, alcove, annular eclipse, antumbra, aphelion, apron, archaeoastronomy, astronaut, astronomy, axis (axes), Big Bang Theory, causation, constraint, correlation, cosmonaut, criteria, datum (data), diameter, electromagnetic spectrum, erosion, galaxy, geocentric, gravitational instability, gravity, Gregorian calendar, gully, habitation, heliocentric, heliocentric orbit, illuminate, infrared, light-year, long-duration habitation, lunar, lunar eclipse, lunar phase, mass, neap tide, orbit, orbital inclination, orbital plane, partial lunar eclipse partial solar eclipse, penumbra, perihelion, radio telescope, relativity, revolution, rotation, rover, satellite, scale factor, season, sediment, semi-major axis, semi-minor axis, solar eclipse, solar radiation, space-time continuum, spectrometer, spring tide, surface gravity, tide, telescope, total lunar eclipse, total solar eclipse, umbra, waning gibbous, waxing gibbous, weight	• Construct a model to represent what they know about the Sun-Earth-Moon system. • Examine the relative sizes and distance between the Sun-Earth-Moon system. • Use a model to show how the Sun illuminates the Moon through its orbit and how the spatial relationship between the Sun-Earth-Moon system result in a distinct and predictable pattern of lunar phases. • Examine tidal data to identify patterns in the timing and amplitude of high and low tides and explore how they may relate to the lunar cycle. • Create a model of the Sun-Earth-Moon system to demonstrate the effects of the Sun and Moon on tides. • Create a model of the Sun-Earth-Moon system to extend their understanding of the geometry of the Sun-Earth-Moon system to explain solar and lunar eclipses. • Model summer and winter shadows and explore how the geometry of the Sun-Earth-Moon system changes throughout the year in different hemispheres. • Utilize observable planetary data to decide on scale factors, then utilize these factors to draw and graph scale models of the solar system. • Examine data and create graphs to understand how gravity, mass and weight are related. • Build a simple physical model to portray the space/time continuum. • Examine the relationships between relative body mass, distance and orbital period using a simple model. • Apply their understanding of scale ratios to determine the scale properties of geologic surface features on Mars. • Utilize data to identify similarities and differences in the geology of Earth and Mars. • Explore how scientists and engineers identify design problems and evaluate design solutions to help humans prepare for a mission to Mars. • Work in groups to develop a scientifically sound design for a human habitation on Mars.

Stage 2: Acceptable Evidence

Transfer Task - How does the Universe Work?

Students will apply what they know about the interactions between and subsequent effects of the bodies in the Sun-Earth-Moon system to develop a scale model of Uranus and its five largest moons. They will use it to make predictions about the moons' gravities, orbital speeds and eclipses. Students will also analyze the model's ability to demonstrate other aspects of the Uranus moons' system. These include scale properties, axial tilts, orbital properties, lunar phases and seasons on the moons.

Students will use Student Sheet A.1 "Modeling the Uranus Moons System" to assist in the creation of their model and allow them to make evidence based predictions utilizing the data.