ROBBINSVILLE PUBLIC SCHOOLS

OFFICE OF CURRICULUM AND INSTRUCTION

SCIENCE

8th Grade Integrated Science

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Course Philosophy

Science and science education are essential to the lives of everyone. By learning science, students become informed and involved citizens as well as innovative thinkers. This course is structured around The Next Generation Science Standards (NGSS), where students apply their knowledge and skills to master these new science standards. The NGSS embodies a new vision for how students learn science by combining core ideas with cross-cutting concepts, science, and engineering practices. They emphasize the practice of scientific inquiry and analysis, and provide students with a variety of interactions that shift the cognitive expectation from simple answers to higher-level, critical-thought responses. Explicit strategies guide the learner while hands-on investigations focus on open-ended inquiry. By introducing students to new concepts with phenomena, students actively discover the knowledge and skills required to solve real-world problems. This course strives to educate students in science and engineering in order to prepare them for today's technologically advanced world.

Course Description

The 8th grade integrated science program is structured and based on the Next Generation Science Standards. Integrated science is a revolutionary science program that provides students with science topics that span many scientific disciplines. This course integrates multiple disciplines to enable students to make relevant connections and generate meaningful associations with the real world. By integrating crucial critical thinking skills, students enhance content and skills in all disciplines. This course helps students think about, read about, write about, and talk about science. It elevates thinking and learning by engaging students with phenomena, and with problem-based activities to anchor each topic. Students will connect science, technology, engineering, and mathematics with STEM activities that fuel innovation, problem solving, collaboration, and reasoning—skills needed for future careers. This blended print and digital curriculum prepares students for the challenges of tomorrow.

Core and Supplemental Instructional Materials

Core Materials	Supplemental Materials
• Elevate Science Course 3 by Pearson Education	• Teacher created resources • Various internet activities • TedED • Brain POP • National Geographic • IXL • Newsela • EdPuzzle • Kesler Station labs • Khan Academy • Crash Course • PBS Digital Learning https://whyy.pbslearningmedia.org/ • https://www.ck12.org/teacher/ • https://sciencespot.net/

Social Emotional Learning Connections

Below are the five core SEL Competencies as outlined by CASEL, and examples of how each may be addressed within this curriculum

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.

Example 1: Students will incorporate a short mindfulness break in the beginning of each class to help reduce stress and anxiety so they feel more comfortable and safe in the classroom environment.
Example 2: Have students create a classroom contract. An effective classroom contract should contain the teacher's expectations as well as the students' hopes and needs for the school year.

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.

Example 1: Students will do a self-reflection sheet for each project to analyze their own effort and motivation on their work in order to be accountable.
Example 2: Students will use a planner and calendar to organize their work and time-management skills. The teacher will chunk big assignments to help with time-management skills.

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.

Example 1: Students learn that the use of science is affected by political, social and economic concerns. Students will discuss how different cultures and social standards affect science growth and innovation.
Example 2: Challenge students to do some research about controversial ethical issues assoc iated with human cloning, including the social and legal aspects of it.

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.

Example 1: Students will perform labs in small groups, where they will communicate clearly, listen well, and cooperate while engaging in the lab experiment.

Example 2: Students should seek and offer help from their peers when needed during group activities. When discussing ideas with group members, students will use positivity and open-mindedness during their communication.

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.

Example 1: During the first week of school, have students brainstorm "Science Expectations." They should think about what good teamwork involves and how it could work better, and they produce a Science Expectations poster to display in the classroom throughout the year.
Example 2: Students will brainstorm and discuss ways that they can decide to help reduce climate change to be responsible for their actions and how they affect the Earth and its climate.

Integration of 21st Century Themes and Skills

NJSLS-CLKS 9.4: Life Literacies and Key Skills	
Creativity and Innovation	*See specific standards and their connections/examples for this disciplinary concept listed within each individual unit* Can be found in unit: 2, 4, 7, 8, 9, 10
Critical Thinking and Problem Solving	*See specific standards and their connections/examples for this disciplinary concept listed within each individual unit* Can be found in unit: 1, 2, 6, 8, 10
Digital Citizenship	*See specific standards and their connections/examples for this disciplinary concept listed within each individual unit* Can be found in unit: 1, 4, 5, 8
Global and Cultural Awareness	*See specific standards and their connections/examples for this disciplinary concept listed within each individual unit* Can be found in unit: n/a
Information and Media Literacy	*See specific standards and their connections/examples for this disciplinary concept listed within each individual unit* Can be found in unit: 2, 5, 8
Technology Literacy	*See specific standards and their connections/examples for this disciplinary concept listed within each individual unit* Can be found in unit: 2, 3, 7, 8, 9

Robbinsville Ready 21st Century Skill Integration

The following skills will be embedded throughout the curriculum and instruction of this course.

Collaborative Team Member: Robbinsville students will learn more by working together than in isolation. As educational theorist Lev Vygotsky advocated, learning is a social process. Many workplaces today encourage employees to work in teams to solicit diverse perspectives, brainstorm new ideas and/or products, and solve problems. Further, collaboration fosters interpersonal relationships, self-management skills, cooperation, and a sense of collective responsibility. Collaborative team members are able to work with diverse groups of people who hold a variety of perspectives.

Effective Communicator: Robbinsville students must be able to clearly articulate their ideas orally, in writing, and across various media in order to successfully connect to the world around them. As the world becomes increasingly globalized, communication is more than just sharing one's ideas. Effective communicators are able to communicate their convictions, actively listen and analyze others' work to identify perspective and/or potential bias.

Emotionally Intelligent Learner: Robbinsville students who are emotionally intelligent learn to be empathetic, demonstrate integrity and ethical behavior, are kind, are self-aware, willing to change, and practice self-care. They are better able to cope with the demands of the 21st century digital society and workplace because they are reliable, responsible, form stable and healthy relationships, and seek to grow personally and professionally. Emotionally intelligent people are able to manage their emotions, work effectively on teams and are leaders who can grow and help to develop others.

Informed and Involved Citizen: Robbinsville students need to be digital citizens who are civically and globally aware. The concept of what it means to be "literate" has evolved along with 21st century technological and cultural shifts. Our progressive vision of literacy entails having our students explore real world problems in the classroom. Informed and involved citizens are able to safely and accurately communicate with people all around the world and are financially, environmentally and informationally literate.

Innovative Thinker: Robbinsville students must encompass innovative thinking skills in order to be successful lifelong learners in the 21st century world. As stated by Karl Fisch and Scott McLeod in the short film Shift Happens, "We are currently preparing students for jobs that don't yet exist . . . using technologies that haven't been invented . . . in order to solve problems we don't even know are problems yet." Innovative thinkers are able to think analytically, solve problems critically, creatively engage in curiosity and tinkering, and demonstrate originality.

Resilient and Self-Directed Learner: Robbinsville students need to take risks and ultimately make independent and informed decisions in an ever-changing world. Author of Life, the Truth, and Being Free, Steve Maraboli stated, "Life doesn't get easier or more forgiving, we get stronger and more resilient." Self-directed scholars of the 21st century are able to set goals, initiate resolutions by seeking creative approaches, and adjust their thinking in light of difficult situations. Resilient students are able to take risks without fear of failure and overcome setbacks by utilizing experiences to confront new challenges. Resilient and self directed scholars will consistently embrace opportunities to initiate solutions and overcome obstacles.

Career Awareness and Planning Standards 9.2	
9.2.8.CAP.2: Develop a plan that includes information about career areas of interest.	**Example:** Students learn about different STEM careers that incorporate science and technology skills that are learned in the curriculum. Have students research careers of interest and discuss with the class.
9.2.12.CAP.13: Analyze how the economic, social, and political conditions of a time period can affect the labor market.	**Example**: Students will research how STEM jobs can be affected by the economy, as well as social and political conflicts (ex: cloning, space travel,etc) about moral and ethical concerns that can affect their specific career path.
9.2.8.CAP.12: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.	**Example:** Incorporate reflection and exploration about student interests in science topics based on their own talents and strengths. Students journal about all the careers covered in the curriculum and then research one that interests them. They then share their findings with each other in small groups and post them on the wall or the class website.

Robbinsville Public Schools
Scope, Sequence, Pacing and Assessment

8th Grade Science

Unit Title	Unit Understandings and Goals	Recommended Duration/ Pacing	Assessments
Unit 1: Atoms and the Periodic Table	The structure of atoms and the periodic table are important concepts that will be used in future investigations to help understand the properties of elements. While investigating this topic, students will make important connections between chemistry and the real world.	6 Weeks (Approximately 30 days)	Formative · Interactivities · Hands-on investigative labs · Virtual labs · Enrichment activities · QUEST project check-ins · Teacher and peer feedback · Open-ended/ scaffolded questions
			Summative · Lesson checks · Lesson quiz · Unit assessment · QUEST project rubric · Teacher feedback and comments
			Common Benchmark Assessments (mid/end of course) · Content SGO · Skills SGO
			Alternative Assessments (projects, etc when appropriate) · QUEST project: Dessert Disaster · Performance- Based assessment: Shedding Light on Ions
Unit 2: Chemical Reactions	The significance of physical and chemical changes to matter is the context that frames this topic. students analyze evidence collected in changes of matter to determine if a physical change or chemical reaction has occurred.	3+ Weeks (Approximately 18 days)	Formative · Interactivities · Hands-on investigative labs · Virtual labs · Enrichment activities · QUEST project check-ins · Teacher and peer feedback · Open-ended/ scaffolded questions

			Summative · Lesson checks · Lesson quiz · Unit assessment · QUEST project rubric · Teacher feedback and comments
			Common Benchmark Assessments (mid/end of course) · Content SGO · Skills SGO
			Alternative Assessments (projects, etc when appropriate) · QUEST project:Hot and Cool Chemistry · Performance- Based assessment: Evidence of Chemical Change
Unit 3: Forces and Motion	Every experience in everyday life is a study in force and motion. Just sitting and reading this text provides a scene to develop concepts such as friction, gravity, and balanced forces. In this topic, students learn about motion; various forces that cause motion; related concepts such as speed, velocity, and acceleration; Newton's three laws of motion; and friction and gravitational forces all within the context of everyday (and not-so-everyday) experience.	3+ Weeks (Approximately 18 days)	Formative · Interactivities · Hands-on investigative labs · Virtual labs · Enrichment activities · QUEST project check-ins · Teacher and peer feedback · Open-ended/ scaffolded questions
			Summative · Lesson checks · Lesson quiz · Unit assessment · QUEST project rubric · Teacher feedback and comments
			Common Benchmark Assessments (mid/end of course) · Content SGO · Skills SGO
			Alternative Assessments (projects, etc when appropriate) · QUEST project: Build a Better Bumper Car · Performance- Based assessment: Stopping on a Dime
Unit 4: Genes and Heredity	This topic deals with patterns of reproduction and inheritance. Students will identify how offspring receive traits from their parents.	4+ Weeks (Approximately 22 days)	Formative · Interactivities · Hands-on investigative labs · Virtual labs · Enrichment activities · QUEST project check-ins · Teacher and peer feedback · Open-ended/ scaffolded questions

			Summative · Lesson checks · Lesson quiz · Unit assessment · QUEST project rubric · Teacher feedback and comments
			Common Benchmark Assessments (mid/end of course) · Content SGO · Skills SGO
			Alternative Assessments (projects, etc when appropriate) · QUEST project: Funky Fruits · Performance- Based assessment: Make the Right Call
Unit 5: Natural Selection Over Time	In this topic, students will explore the processes that explain how organisms change over time. Students will investigate factors that drive natural selection and learn about evidence that supports the scientific theory of evolution.	4+ Weeks (Approximately 21 days)	Formative · Interactivities · Hands-on investigative labs · Virtual labs · Enrichment activities · QUEST project check-ins · Teacher and peer feedback · Open-ended/ scaffolded questions
			Summative · Lesson checks · Lesson quiz · Unit assessment · QUEST project rubric · Teacher feedback and comments
			Common Benchmark Assessments (mid/end of course) · Content SGO · Skills SGO
			Alternative Assessments (projects, etc when appropriate) · QUEST project: A Migration Puzzle · Performance- Based assessment: A Bony Puzzle
Unit 6: History of Earth	The long history of Earth, its geologic features and its living organisms frames this topic. By studying the ages of rocks and arranging living things and geological events into a timeline, students recognize just how deep time is and how geologic events have impacted the evolution o f living things.	2+ Weeks (Approximately 11 days)	Formative · Interactivities · Hands-on investigative labs · Virtual labs · Enrichment activities · QUEST project check-ins · Teacher and peer feedback · Open-ended/ scaffolded questions
			Summative · Lesson checks

			· Lesson quiz · Unit assessment · QUEST project rubric · Teacher feedback and comments Common Benchmark Assessments (mid/end of course) · Content SGO · Skills SGO Alternative Assessments (projects, etc when appropriate) · QUEST project: The Big Fossil Hunt · Performance- Based assessment: Core Sampling Through Time
Unit 7: Energy in the Atmosphere and Ocean	How energy flows throughout Earth's atmosphere and oceans is the context that frames this topic. By analyzing models of global patterns of winds and ocean currents, students recognize that energy in the form of heat flows from the equator toward the poles and that this energy distribution impacts weather and climate.	2+ Weeks (Approximately 14 days)	Formative · Interactivities · Hands-on investigative labs · Virtual labs · Enrichment activities · QUEST project check-ins · Teacher and peer feedback · Open-ended/ scaffolded questions Summative · Lesson checks · Lesson quiz · Unit assessment · QUEST project rubric · Teacher feedback and comments Common Benchmark Assessments (mid/end of course) · Content SGO · Skills SGO Alternative Assessments (projects, etc when appropriate) · QUEST project: Crossing the Atlantic · Performance- Based assessment: Not All Heating is Equal
Unit 8: Climate	The impact of both natural and human factors on Earth's climate is the context of this topic. While comparing evidence between historical and recent data, students recognize the impact of human activity that has caused the extreme rise in global temperatures over the past century.	3 Weeks (Approximately 15 days)	Formative · Interactivities · Hands-on investigative labs · Virtual labs · Enrichment activities · QUEST project check-ins · Teacher and peer feedback · Open-ended/ scaffolded questions Summative · Lesson checks

			· Lesson quiz · Unit assessment · QUEST project rubric · Teacher feedback and comments Common Benchmark Assessments (mid/end of course) · Content SGO · Skills SGO Alternative Assessments (projects, etc when appropriate) · QUEST project: Shrinking Your Carbon Footprint · Performance- Based assessment: An Ocean of a Problem
Unit 9: Earth-Sun-Moon System	In this topic, students explore how the sun and moon affect Earth. They will study how different objects, including the Earth, sun, and moon move through space. Students will also see how the motion and position of the Earth, the sun, and the moon affect each other.	3 Weeks (Approximately 15 days)	Formative · Interactivities · Hands-on investigative labs · Virtual labs · Enrichment activities · QUEST project check-ins · Teacher and peer feedback · Open-ended/ scaffolded questions Summative · Lesson checks · Lesson quiz · Unit assessment · QUEST project rubric · Teacher feedback and comments Common Benchmark Assessments (mid/end of course) · Content SGO · Skills SGO Alternative Assessments (projects, etc when appropriate) · QUEST project: It's as Sure as the Tides · Performance- Based assessment: Modeling Lunar Phases
Unit 10: Solar System and the Universe	Scientists use evidence to piece together how celestial bodies formed (and continue to form), better understand our own origins, and discover how other planetary systems might support or develop life. In this topic, students examine the evidence and models that support scientists' understanding of the universe.	3+ Weeks (Approximately 16 days)	Formative · Interactivities · Hands-on investigative labs · Virtual labs · Enrichment activities · QUEST project check-ins · Teacher and peer feedback · Open-ended/ scaffolded questions Summative · Lesson checks · Lesson quiz

			· Unit assessment · QUEST project rubric · Teacher feedback and comments
			Common Benchmark Assessments (mid/end of course) · Content SGO · Skills SGO
			Alternative Assessments (projects, etc when appropriate) · QUEST project: Searching for a Star · Performance- Based assessment: Scaling Down the Solar System

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Unit # 1: Atoms and the Periodic Table

Enduring Understandings:	**Essential Questions:**
● Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. ● Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals) ● Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.	● How do atoms combine to form extended structures? ● How do subatomic particles of an atom affect its characteristics? ● What properties can be used to compare subatomic particles? ● How are isotopes of the same element different? ● How do atoms become ions? ● How does knowing the trends of the periodic table help scientists predict properties of the representative elements?

Interdisciplinary Connections

NJSLS Mathematics MP.2 Reason abstractly and quantitatively.

- Example: Most elements have several different isotopes, and they usually differ in abundance. As students look at a diagram of an atom, have them think about the components of an atom and the similarities and differences between isotopes.

NJSLS Mathematics MP.4 Model with mathematics.

- Example: Students will create and interpret a graph showing the melting and boiling points of a few molecular compounds and ionic compounds.s.

NJSLS English Language Arts R.2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas

- Example: Encourage students to locate the main ideas of Dalton's atomic theory from the reading. Have them provide a description in their own words. Then have students use tier descriptions to answer the questions about the two atoms.

NJSLS English Language Arts W.8.1-b Support claims with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

- Example: Have students form small groups and discuss ways in which the periodic table might be helpful in the following professions: forensic scientists, firefighters, doctors. For each profession, have them list a few duties that would require using the periodic table. Have each group share their ideas with the class.

NJSLS English Language Arts RL.8.1. Cite the textual evidence and make relevant connections that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.

- Example: Students will form small groups and create a Venn Diagram that compares and contrasts the modern periodic table with Mendeleev's periodic table.

Career/Real World Connections

Careers

- Food Related Careers- Nearly all food-related careers require an understanding of food chemistry, which can be gained through formal instruction or on-the-job training and experience.
- Chemist- A Chemist conducts qualitative and quantitative experiments on chemical substances to ensure quality control or develop new products or knowledge. The Chemist will perform a variety of tests and use different techniques to conduct experiments on organic and inorganic compounds.

Real World Connections

- Unlocking the Power of the Atom- In the 2th Century, scientists finally succeeded in splitting the atom. Splitting atoms into smaller atoms releases powerful energy. This process is called nuclear fission.
- State Abbreviations- Ask students to identify the abbreviations for ten states. List them on the board and discuss why they are useful. Then ask: How are chemical symbols like these abbreviations? How are they different? (Both are also easily recognizable by people who use them often. They are different because chemical symbols can be one or two letters, while state abbreviations are always two letters.)
- Particle Collider- The Large Hadron Collider, or LHC, is the world's most powerful particle accelerator. It is named for the hadron, one of the subatomic particles that are the building blocks or atoms.
- Pickling- People use vinegar to preserve foods because it lowers the pH level of a solution. Lowering the pH can prevent foods from spoiling or rotting because many organisms cannot survive in acidic environments.
- Role of Acids- When chemists work with acids, they usually have to wear protective clothing such as safety goggles and gloves. Many acids are dangerously corrosive, but there are acids found in the human body that are essential for life.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-PS1-1 9.4.8. CT.3 9.4.8. DC.1	What are the parts that make up an atom? What is atomic theory? What evidence supports the modern model of the atom? Why do elements need to be organized? How was the periodic table developed?	Students develop models to describe the atomic composition of simple molecules and extended structures. Students will identify and describe the properties of electrons, protons and neutrons. Students will describe the development of atomic theory, including the historical atomic of Dalton, Thompson, Rutherford, and Bohr, as well as how data from experiments caused the theory to change, and the basis of the modern atomic theory. Students will cite evidence that supports the modern model of the atom, including	**Phenomena:** - Case study: Unlocking the Power of the Atom - Milk and Soap Experiment https://thewonderofscience.com/phenomenon/2018/7/11/milk-and-soap-experiment - Aerogels - World's Lightest Solids https://thewonderofscience.com/phenomenon/2018/7/9/aerogels-worlds-lightest-solids - Slime https://thewonderofscience.com/phenomenon/2018/5/13/slime - Supercooled water https://thewonderofscience.com/	Elevate Interactivities: - Build an Atom? - Models of Atoms - Interactive Periodic Table - Groups of Elements - Examining Physical Properties of Powders Hands-On Labs: - What's in the Box? - A Modern Model of the Atom - Which Is Easier?	Open-ended quiz Think Pair Share Four corners Science notebooks Discussions/socratic seminars Graphic Organizers Individual whiteboards Lab reports

	What information about elements is provided by the periodic table? What causes atoms to bond together? How do valence electrons and bonding affect the properties of elements? How are electrons involved in bond formation? What types of bonds form between atoms? How do bonds determine certain properties of compounds? What properties describe acids and bases? What happens when acids and bases interact?	Rutherford's gold-foil experiment and Chadwick's discovery of the neutron. Students will identify and describe the organization used to create the periodic table. Students will describe the development of the periodic table. Students will interpret and use the periodic table for locating important information pertaining to the elements and to describe the elements. Students will recognize that a finite number of elements exist. Students will identify basic examples of atoms. Students will compare and classify properties of various compounds, including acids, bases, and salts. **CCC.3 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. **<u>Key Terms</u>** atom electron nucleus proton neutron atomic number isotope mass number atomic mass periodic table chemical symbol period group compound valence electrons	phenomenon/2018/7/9/supercooled-water - Collapsing Train Car https://thewonderofscience.com/phenomenon/2018/6/10/the-collapsing-train-car **SEP.2 Developing and Using Models** Develop and/or use models to predict and/or describe phenomena. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	- Groups in the Periodic Table Case study: Unlocking the Power of the Atom Design Challenge: When Particles Collide Density Simulator- https://phet.colorado.edu/en/simulation/legacy/density Interactive Periodic Table- http://www.ptable.com/ Solid, liquid and gas overview- https://www.chem.purdue.edu/gchelp/liquids/character.html	open-ended questioning Self assessments Peer assessments Show of hands/3-2-1 Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks QUEST project: How can you use chemistry to solve a culinary mystery? Performance- Based assessment: Shedding Light on Ions

		reactivity malleable ductile luster semiconductor ion polyatomic ion ionic bond covalent bond molecule nonpolar bond polar bond acid corrosive indicator base neutralization salt			

Robbinsville Public Schools

Unit # 2: Chemical Reactions

Enduring Understandings:	**Essential Questions:**
● Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. ● Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. ● The total number of each type of atom is conserved,and thus the mass does not change.	● How can you determine when a chemical reaction has occurred? ● How do substances combine or change (react} to make new substances? ● How does one characterize and explain these reactions and make predictions about them?

Interdisciplinary Connections

NJSLS Mathematics 6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

- Example: Salinity, or concentration in seawater, varies in different parts of the ocean. Students will determine how many grams of dissolved salts they would expect to find in each seawater sample.

NJSLS English Language Arts W.6.9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

- Example: Students will observe what happens when salt mixes with water. Ask students to write down their explanation about why the salt seems to disappear. Then students will pair up and discuss and revise their explanations.

NJSLS English Language Arts W.6.2. Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content

- Example: Students will brainstorm the changes in matter that occur during the process of making a pizza. They will then categorize each change as physical or chemical, and give reasons for their conclusions.

NJSLS English Language Arts R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text**.**

- Example: Remind students that some metals react to acids. Then ask these questions: What are most food cans made of? What happens when these metals come into contact with acid?

NJSLS English Language Arts R2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

- Example: While reading about acids and bases, students will underline the ways in which acids affect bog bodies. They will then choose the effect of acid that they think is most important and justify their choice.

Career/Real World Connections

Careers

- Chemist- A chemist searches for new knowledge about chemicals and uses it to improve the way we live. He or she may develop products such as synthetic fibers, drugs, and cosmetics. Chemists create processes, including oil refining and petrochemical processing, that reduce energy use and pollution. They specialize in areas such as analytical, organic, inorganic, physical and theoretical, macromolecular, medical, and materials chemistry.
- Forensic Scientist- Forensic chemists analyze non-biological trace evidence found at crime scenes in order to identify unknown materials and match samples to known substances. They also analyze drugs/controlled substances taken from scenes and people in order to identify and sometimes quantify these materials
- Material Scientists and Technicians- Material Science focuses on making materials with specific properties that meet certain performance standards. New technologies that allow scientists to control atoms have resulted in new products, such as nano-sturctured materials that are often inspired by materials made by living organisms. The amount of college required varies from two years to a PhD, depending on the complexity of the different jobs in the industry.

Real World Connections

- Treating Injuries- If you hurt a muscle in your boy or get an injury, you may wonder when to use an ice pack and when to use a heat pack. Ice is beneficial for any superficial tissue injury, both to dull the pain and to reduce bleeding. Heat is typically applied to help with chronic pain and for muscle pain. Heat treatments can stimulate blood flow and loosen tissues. Have students research precautions to follow when using cold or heat packs.
- Food Preparation- Many foods, including ice cream, are colloids. Colloids have a creamy texture. When placed in the mouth, the heat causes the colloidal particles to break apart and release a burst of flavor. Some chebs use liquid nitrogen to create colloids from any kind of food.
- Photosynthesis- Physical and Chemical Changes occur everywhere on Earth. Water evaporates into the air and becomes water vapor (gas), an example of physical change. Plants use water vapor, carbon dioxide gas, and light to synthesize food, an example of chemical change.
- Cooking- Cooking usually involves chemical reaction and the food is transformed in the cooking process. Cooked food is easier to eat and digest than raw food.
- Artists- The chemical properties of some artists' materials make them hazardous to human health. Artists must take precautions to protect themselves and those nearby from both short and long term effects of these materials (ex: solvents, adhesives, solder, epoxy, etc).
- Plastic Pollution- Remind students of the guiding questions "How does the production and use of synthetic materials affect society?" Plastics are polymers, a type of synthetic material. One [property of plasticthat has made it so useful is how long it lasts. Unfortunately, this property has led to a major worldwide problem, plastic pollution.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-PS1-2 MS-PS1-3	How can the properties of mixtures and solutions be used to classify them? What do the visible properties of mixtures	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.	**Phenomena-** Students observe the phenomena of a firefly giving off light.	Elevate Interactivities: - Mixing Substances - Separating a Mixture - Inside a Water Treatment Plant	Open-ended quiz Think Pair Share Four corners

MS-PS1-5 MS-PS1-6 9.4.8.CI.2 9.4.8.CT.2 9.4.8.IML.3 9.4.8.TL.1	reveal about their molecular and atomic properties? How can the different parts of a mixture be identified and separated? How can data about the characteristic physical and chemical properties of substance be used to identify whether a physical or chemical change has occurred? What factors affect the rate at which a chemical change occurs? How can a model be used to identify the components of a chemical reaction? How can a chemical equation be used to model the conversation of mass? How are synthetic materials made from natural resources? How does the production and use of synthetic materials affect society?	Gather and snake sense of information to design that synthetic materials come from natural resources and impact society. Students develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. Students undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.. **CCC.1 Patterns:** Macroscopic patterns are related to the nature of the macroscopic and atomic-level structure. **CCC.5 Energy and Matter:** Matter is conserved because atoms are conserved in physical and chemical processes. **CCC.6 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. **Key terms:** mixture colloid suspension solution solvent solute solubility physical change chemical change reactant product exothermic reaction endothermic reaction law of conservation of mass	Reaction in a bag https://thewonderofscience.com/phenomenon/2018/7/8/reaction-in-a-bag Elephant Toothpaste https://thewonderofscience.com/phenomenon/2018/5/13/elephant-toothpaste Burning Steel Wool https://thewonderofscience.com/phenomenon/2018/7/8/burning-steel-wool **SEP.2 Developing and Using Models** Develop a model to describe unobservable mechanisms **SEP.4 Analyzing and Interpreting Data** Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships. Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships. Distinguish between causal and correlational relationships in data. Analyze and interpret data to provide evidence for phenomena. **SEP.8 Obtaining, Evaluating, and Communicating Information** Gather, read and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each	- Water Contamination and Removal Methods - Evidence of Chemical Reactions - Analyze Exothermic and Endothermic Graphs - Conservation of Matter - Model o a Chemical Reacikon - Reactants and Products - Model the Conservation of Mass - Describe the Impact of Synthesis - The Impact o Synthetics Hands-On Labs: - What Happens When Chemicals React? - Particles in Liquids - Energy Salts - Presto Change-O! - Changes in a Burning Candle - Is Matter Conserved? - Making Plastics from Starch Engineering design challenge: Making Water Safe to Drink	Science notebooks Discussions/socratic seminars Graphic Organizers Individual whiteboards Lab reports open-ended questioning Self assessments Peer assessments Show of hands/3-2-1 Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks QUEST project:Hot and Cool Chemistry Performance- Based assessment: Evidence of Chemical Change

		open system closed system synthetic natural resource polymer	publication and methods used, and describe how they are supported or not supported by evidence. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	Case study: Is Plastic Really so Fantastic? Lesson ideas- https://www.ck12.org/chemistry/recognizing-chemical-reactions/ Types of Chemical Reactions https://www.thoughtco.com/types-of-chemical-reactions-604038	

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Unit #3: Forces and Motion

Enduring Understandings:	**Essential Questions:**
● The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. ● All positions of objects and the directions of forcesand motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. ● Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have a large mass-e.g., Earth and the sun. ● A system of objects may also contain stored (potential) energy, depending on their relative positions. ● When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object.	● How is the motion of an object affected by forces that act on it? ● How can one predict an object's continued motion, change in motion, or stability? ● How do forces influence motion? ● How do we recognize different states of energy? ● How can we describe the position of an object? ● How does the mass of an object influence motion? ● How does friction affect a moving object?

Interdisciplinary Connections

NJSLS Mathematics 7.EE.B.3: Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies

- Example: Students will examine multiple diagrams of an object being pushed from opposite sides. Students will use a number line to help them visualize the addition of forces, recognize forces applied in the same direction as an addition problem, and relate the direction of force to positive and negative directions on a number line.

NJSLS Mathematics 7.EE.B.4: Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

- Example: Students will use the equations for Newton's second law to understand how mass and force affect the motion of a volleyball.

NJSLS Mathematics 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.

- Example: Guide students as they apply the linear equation to the data on a distance-versus-time graph. Students will mark two points on the line and calculate the slope.

NJSLS English Language Arts RI.8.1. Cite the textual evidence and make relevant connections that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.

- Example: Students will provide evidence from the reading to explain how instantaneous speed differs from average speed.

NJSLS English Language Arts RI.6.7. Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

- Example: Students will examine a figure of a dog in a moving car, and read the correlating text. Students will draw a scene to represent what is happening to the dog in the moving car scenario and label the different possible reference points.

Career/Real World Connections

Careers

- Mechanical Engineer- Mechanical engineering is the application of the principles and problem-solving techniques of engineering from design to manufacturing to the marketplace for any object. Mechanical engineers analyze their work using the principles of motion, energy, and force—ensuring that designs function safely, efficiently, and reliably, all at a competitive cost. Mechanical engineers make a difference. That's because mechanical engineering careers center on creating technologies to meet human needs. Virtually every product or service in modern life has probably been touched in some way by a mechanical engineer to help humankind.
- Amusement Park Ride Designers- People who have a hand in the design and construction of rides include mechanical engineers, electrical engineers, and structural engineers. They must take advanced physics and math courses to be able to calculate the forces at play, including the stresses in the rides' components. They must ensure safe speeds while maximizing the thrill for rides.

Real World Connections

- Wingsuits- Skydivers have the benefit of a full parachute to slow them down as they approach the ground. Some skydivers use a wingsuit to help provide forces of lift, drag and thrust, similar to airplanes.
- Simple Machines- Force such as gravity and fraction can make heavy objects difficult to move. Thousands of years ago, people invented devices such as simple machines that made moving heavy objects easier. In a simple machine, a person applies an input force to the machine, and the machine then applies an output force on the object being moved.
- Curling- Curling is a sport in which players slide a large stone from one end of a sheet of ice to atarget at the other end. The closer the stone is to the center of the target, the more points the team earns. During play, one teammate pushes the stone toward the target, and other teammates use rubber brooms to "sweep," or slightly smooth, the ice in front of the moving stone.
- Artificial Satellites- Many artificial satellites orbit Earth. These satellites send communication signals, monitor weather, and gather data from space. Each satellite is launched from Earth and then orbits Earth at a certain height, similar to the way that the moon orbits Earth. Engineers use Newton's Laws when they launch satellites.

Guiding / Topical Questions with Specific Standards	Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies

MS-PS2-1 MS-PS2-2 MS-PS2-4 MS-PS3-2 9.4.8.TL.1	When is an object in motion? How do you determine speed from calculation and distance-versus-time graphs? How is velocity related to speed and acceleration? How can you interpret a graph to determine acceleration? How do Newton's laws of motion describe when and how objects move? How do an object's mass and the forces acting upon an object affect its motion? What are action and reaction forces, and how do they impact an object's motion?	Students plan an investigation to provide evidence of the change in an object and the mass of the object. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. **CCC.4 Systems and System Models** Models can be used to represent systems and their interactions- such as inputs, processes and output- and energy and matter flows within systems. **CCC.7 Stability and Change** Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. **Key terms:** motion reference point force newton friction gravity net force speed slope velocity acceleration inertia weight	**Phenomena:** Rube goldberg machines https://thewonderofscience.com/phenomenon/2018/7/8/amazing-rube-goldberg-machines A bed of nails https://thewonderofscience.com/phenomenon/2018/7/9/a-bed-of-nails Raw or Boiled Egg Experiment https://thewonderofscience.com/phenomenon/2018/7/11/raw-or-boiled-egg-experimentdex Slow Motion Golf Ball Collision https://thewonderofscience.com/phenomenon/2018/7/8/slow-motion-golf-ball-collision **SEP.2 Developing and Using Models** Develop a model to describe unobservable mechanisms. **SEP.3 Planning and Carrying Out investigations** Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how much data is needed to support a claim. **SEP.7 Engaging in Argument from Evidence** Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a	Elevate Interactivities: - Relative Motion - Balanced and Unbalanced forces - Explore Forces - Falling for Velocity - Motion Graphs - How Forces Affect Motion - How are Mass, Motion and Force Related? - Going, Going, Gone - Fuel Efficient Vehicles - Exploring Gravity - The Pull of the Tides Hands-On Labs: - Motion Commotion - Walking the Walk - Newton Scooters - Observing Friction - Sticky Sneakers Design Challenge: Generating Energy from Potholes Case Study: Finding your way with GPS Coaster Creator: https://www.fossweb.com/delegate/ssi-wdf-ucm-webContent/Contribution%20Folders/FOSS/multimedia_2E/BalMotion_MM_2E/activities/rollercoaster_html.html Lesson Ideas- http://www.ck12.org/ng	Open-ended quiz Think Pair Share Four corners Science notebooks Discussions/socratic seminars Graphic Organizers Individual whiteboards Lab reports open-ended questioning Self assessments Peer assessments Show of hands/3-2-1 Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks QUEST project: Build a Better Bumper Car

			model for a phenomenon or a solution to a problem. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	ss/middle-school-physical-sciences/matter-and-its-interactions Videos- https://www.thehappyscientist.com/physical-science-content Concept Help- http://www.bozemanscience.com Energy Lab- http://www.pbs.org/wgbh/nova/labs/about-energy-lab/educator-guide/ R.E.A.C.T- http://www.nrel.gov/docs/gen/fy01/30927.pdf Office of Energy Efficiency and Renewable Energy https://www.energy.gov/eere/education/careers-and-education	Performance- Based assessment: Stopping on a Dime

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Unit # 4: Genes and Heredity

Enduring Understandings:	**Essential Questions:**
● Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. ● 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 gene two alleles of each gene, one acquired from each parent. Thes versions may be identical or may be different from each other. ● Genes are located in the chromosomes of cells, 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. ● In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes that are beneficial, others harmful, and some neutral to the organism.	● How do offspring receive traits from their parents? ● How are characteristics of one generation passed to the next? ● How can individuals of the same species and even siblings have different characteristics? ● Why (How) do individuals of the same species vary in how they look, function and behave?

Interdisciplinary Connections

NJSLS Mathematics 7.SP.C.8: Find probabilities of compound events using organized lists, tables, tree diagrams and simulation.

- Example: Have students predict the probability of a specific allele from one parent being passed on to an offspring.

NJSLS Mathematics 7.RP.A.2c 2. Recognize and represent proportional relationships between quantities.

- Example: Students will complete the data table provided in reading and then create a graph to compare the total number of sea turtle nests at the beach to the number of nests that hatched sea turtles.

NJSLS English Language Arts RI.6.2. Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.

- Example: Students will explain how Mendel came to the conclusion that an organism's traits were carried on different alleles.

NJSLS Social Studies 6.1.12.CivicsPR.16.a: Analyze government efforts to address intellectual property rights, personal privacy, and other ethical issues in science, medicine, and business that arise from the global use of new technologies.

- Example: Students will research different country's laws about the advancement of genetic research and debate the ethical and societal concerns with new technology and innovations.

NJSLS Comprehensive Health and Physical Education: A variety of factors can contribute to alcohol, tobacco, and drug disorders (e.g., mental health, genetics, environment) and a wide variety of treatment options are available depending on the needs of the individual.

- Example: Students will research certain diseases. They will research the genetic links of each disease and realize that many diseases, both mental and physical, have a genetic component.

Career/Real World Connections

Careers

- A geneticist is a scientist who studies all aspects of genes, including how they are inherited and how they behave. Many geneticists are involved in research or teaching at universities. Others work for government agencies or hospitals. Students take classes in genetics, biology, chemistry, ath and statistics.
- Genetic counselors help people who are at risk for a disease or a genetic disorder. They are experts in genetics, so they know better than anyone how genes work. They give emotional support and help families make health decisions.
- A genetic engineer is a type of scientific professional who specializes in working with genetics in animals, plants and humans. Genetic engineers might work in a research lab creating new genetic variants of plants that produce food or they might work as a genetic counselor for humans with rare genetic diseases.

Real World Connections

- Genetic Technologies: Genetic technologies can be used to decrease the likelihood of problems appearing in future generations of animals, humans and even plant life. For example, humans can use a process called artificial selection to selectively breed only those organisms with desired traits to produce the next generation. These are not necessarily the best traits, but rather they are traits that humans desire. Scientists can also use genetic technologies in an attempt to manipulate the DNA in organisms to achieve desired traits in a process called genetic engineering.
- Cloning: Cloning is the use of specific processes to produce a genetically identical copy of a cell, a gene, a tissue or even an entire plant or animal. the three main types of artificial cloning and gene cloning., which replicates genes or segments of DNA; reproductive cloning, which produces copies of plants or animals; and therapeutic cloning; which produces embryonic stem cells that can help repair or replace injured or diseased tissue. While these types of cloning happen in laboratories, cloning occurs in nature too.
- DNA testing: In 1990, the National Institutes of Health (NIH), the Department of Energy, and other partners joined together to determine the sequence of the 3 billion base pairs found in human DNA. This project was called the Human Genome Project. Since 1992, hundreds of innocent people have been freed from prison - some from death row - thanks to DNA testing. The Innocence Project an organization that uses DNA testing to free prisoners who were wrongfully convicted. First, a sample is taken from the prisoner. Laboratory procedures allow a scientist to compare two samples. If the prisoner's DNA is different from the DNA at the crime scene, that evidence may help free the prisoner.
- Artificial Selection: Eating dinner is an opportunity to consider how people have selected certain desirable traits in the plants and animals we use for food. As a result of artificial selection over many generations, domesticated plants and animals are quite different from their ancestors. In order for artificial selection to work, populations must have variations in their traits.

- Genetic Diseases: Diseases that result from a change in a single gene are called monogenic. In these diseases, the protein made by the mutated gene is altered and does not function as intended. While each type of monogenic disease is relatively rare, there are at least 10,000 monogenic diseases, and collectively they affect millions of people and cause significant loss of life.
- Preparing Karyotypes: Each chromosome pair viewed in a karyotype appears to have its own distinct "bar code" of bands. This banding is due to staining done during the karyotyping process. Staining reveals characteristic structural features for each chromosome.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-LS3-1 MS-LS3-2 MS-LS4-4 MS-LS4-5 9.4.8. CI.4 9.4.8. DC.2	How did Gregor Mendel advance the fields of genetics and inheritance? How are inherited alleles related to an organism's traits? How is probability related to inheritance? What is the relationship among genes, chromosomes, and inheritance? How is a pedigree used to track inheritance? How does the formation of sex cells during meiosis differ from the process of cell division? How do humans use artificial selection to produce organisms with desired traits? How do scientists engineer new genes?	Students investigate Gregor Mendel's advances in the field of genetics and inheritance. Through Gregor Mendel's experiments, students discover how inherited alleles are related to an organism's traits and how probability is related to inheritance. Students explore the relationship between genes, chromosomes and inheritance. Students utilize models, such as a pedigree, to track inheritance. Students delve into DNA replication to explore how cells make proteins and the process of protein synthesis. Students learn how changes in DNA and RNA lead to trait variations in individuals and species. Students investigate how humans use genetic information for the benefits of society. Students examine the use of artificial selection, how mutations create different traits, and how scientists engineer new genes. **CCC.2 Cause and Effect: Mechanism and Prediction** Cause and effect relationships may be used to predict phenomena in natural or designed systems.	**Phenomena:** Two horses produce a foal of a different color to explore inheritance of traits. They will also consider their own observations of resemblance within biological families. Malaria and Sickle Cell anemia https://thewonderofscience.com/phenomenon/2018/7/5/malaria-and-sickle-cell-anemia The Potential And Ethics Of CRISPR https://thewonderofscience.com/phenomenon/2018/7/8/the-potential-and-ethics-of-crispr **SEP.2 Developing and Using Models** Develop and/or use models to predict and/or describe phenomena. **SEP.5 Using Mathematics and Computational Thinking** Use mathematical representations to support scientific conclusions and design solutions. **SEP.8 Obtaining, Evaluating and Communicating Information**	Elevate Interactivities: - Making Copies - Offspring Season - Look Inside - Colorful Chromosomes - The Role of DNA - Making Proteins - Sex-Linked Traits and Disorders - Track your Traits - DNA FIngerprinting - Solving Problems with Genetics Hands-On Labs: - Observing Pistils and Stamens - chromosomes and Inheritance - Modeling Protein Synthesis - Extraction in Action Case Study: Cephalopods	Open-ended quiz Think Pair Share Four corners Science notebooks Discussions/socratic seminars Graphic Organizers Individual whiteboards Lab reports open-ended questioning Self assessments Peer assessments Show of hands/3-2-1 Exit slips Project rubrics

	How can genetic information be used?	**CCC.3 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 **CCC.6 Structure and Function** Complex and Microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on natural structures/ systems can be analyzed to determine how they function. **<u>Key terms:</u>** heredity dominant allele recessive allele probability genotype phenotype chromosome cell cycle pedigree meiosis chromatids mitosis DNA protein synthesis messenger RNA transfer RNA variation sex chromosomes autosomal chromosomes mutation sex-linked genes artificil selection genetic engineering gene therapy clone genome	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. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	Engineer design challenge: Reinventing DNA as data storage Nation Human Genome Research Institute https://www.genome.gov/about-genomics/teaching-tools/Genomics-Education-Websites Teach Genetics https://www.genome.gov/about-genomics/teaching-tools/Genomics-Education-Websites Genes in Life http://genesinlife.org/teachingtools BioEd Online https://www.bioedonline.org/lessons-and-more/resource-collections/gene-u-genetics-and-inheritance/	Lesson quizzes and unit test Lesson checks Reading checks QUEST project: Funky Fruits Performance- Based assessment: Make the Right Call

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Unit # 5: Natural Selection and Change Over Time

Enduring Understandings:	**Essential Questions:**
• 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 differentspecies also reveals 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 new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. • 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 onto offspring.	• How do characteristics change over time? • What evidence shows that different species are related? • How does genetic variation among organisms affect survival and reproduction? • How does the environment influence populations of organisms over multiple generations? • What is biodiversity, how do humans affect it, and how does it affect humans?

Interdisciplinary Connections

NJSLS Mathematics 7.RP.A.1 Compute unit rates associated with ratios of fractions, including ratios of lengths,areas and other quantities measured in like or different units.

- Example: Students will compare the similar anatomical body structures of different species. They will use a metric ruler to measure the upper arm bones, lower arm bones and the fingers, looking for equivalent ratios within their data sets.

NJSLS English Language Arts R2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

- Example: Students will summarize from the text how scientists show that organisms and Earth changed over time.

NJSLS English Language Arts W9. Draw evidence from literary or informational texts to support analysis, reflection, and research

- Example: Students will use their science notebooks to describe different methods of gathering evidence, and then they will evaluate what might prevent that goal from being met.

NJSLS Social Studies 6.2.8.GeoPP.1.b: Use maps to examine the impact of the various migratory patterns of hunters/gatherers that moved from Africa to Eurasia, Australia, and the Americas

- Examples: Students will research how humans have evolved based on changing environments and evolution based on scientific discoveries and data.

Career/Real World Connections

Careers

- Paleontologist: Students who are interested in studying fossils may consider a career in paleontology. The scope of a paleontologist's job goes well beyond collecting fossils, however. While some paleontologists work on dig sites, others work for museums, colleges and universities, or laboratories. They analyze specimens and use special techniques to clean and preserve them. Paleontologists also spend time doing research and writing papers.
- Evolutionary Biologist: An evolutionary biologist researches theories of evolution, studies living organisms in their natural habitats, runs tests on animals and microscopic organisms, and publishes findings on biodiversity and animal or plant behavior.

Real World Connections

- Human Teeth and Mouth: Wisdom teeth are typically removed because the human mouth does not have room for them. It is hypothesized that at one time humans had bigger mouths and a need for more molars to chew food. However, it is believed that changes to our diet and lifestyle have led to a decrease in human jaw size over time.
- Whale Watching: Some migrating animals, like the North Atlantic right whale, are one of Florida's tourist attractions. Right whales spend the summer in New England and Nova Scotia and the winters off the northern coast of Florida. These whales almost went extinct from unsustainable whaling practices.
- Designer Dog Breeds: One way humans can help control traits is to breed two different dogs to produce offspring with desired traits. These designer dogs are a cross between two purebred dogs. One example is the labradoodle. The first labradoodle dog was bred in 1989. A labradoodle is a cross between a standard poodle and a labrador retriever. The poodle is very smart and has fur that sheds very little. The poodle may be less irritating for people allergic to dogs. Labradors are gentle, easily trained, and shed seasonally.
- Fossil Technology: Did you know that a scientist can study a fossil without even taking it out of the ground? Thanks to 3D printing technology, advanced X-ray imaging, and electron microscopy, this is now a possibility. With 3D technology, scientists can reconstruct missing parts of fossils and can even replicate fossils images of a fossilized animal's soft tissue and organs. Electron microscopy can help scientists look inside the bodies of fossilized organisms.
- Evolutionary Technology: When discussing fossils, as students did in the last lesson, it is easy to become focused on how evolution occurred in the past and forget that it continues to happen today. Using sophisticated computer technology, scientists can now digitally simulate and observe the evolution of various organisms, from viruses and bacteria to more complex organisms like vertebrates.

Guiding / Topical Questions with Specific Standards	Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies

MS-LS4-1 MS-LS4-2 MS-LS4-3 MS-LS4-4 MS-LS4-5 MS-LS4-6 9.4.8. DC.1 9.4.8. IML.5 9.4.8. IML.12	What processes explain how organisms can change over time? What observations and evidence support the theory of evolution? How does natural selection lead to change over time in organisms? What are the roles of genes, mutations, and the environment in natural selection? How do natural selection and inherited variations influence a population? How does sexual selection influence a population's genetic variation? How is species interaction a factor in evolution? What supports evidence for the scientific theory of evolution? How do fossils show change over time? What does the early development of different organisms tell us about evolution? How does failure to adapt to a changing environment	Students will explore the evidence that leads to the development of the scientific theory of evolution and investigate how species change over time Students will investigate how natural selection leads to the development of the scientific theory of evolution and investigate how species change over time. Students will investigate how genetics and variation in traits influence a population. Students will also examine how species interactions affect evolution. Students will examine evidence that supports scientific theory for evolution, including fossils and similarities in structures among different organisms. Students will also explore factors that lead to extension. Students will investigate how modern technology and DNA provide new evidence about evolution. **CCC.1 Patterns** Patterns can be used to identify cause and effect relationships. Graphs, charts, and images can be used to identify patterns in data. **CCC.2 Cause and Effect: Mechanism and Prediction** Phenomena may have more than one cause, and some cause and effect relationship in systems can only be described using probability **Key terms:** species evolution fossil adaptation	**Phenomena:** A Tale of Two Birds https://www.calacademy.org/educators/a-tale-of-two-birds Evolution of the eye https://www.youtube.com/watch?v=qrKZBh8BL_U Comparitive embryology http://www.pbs.org/wgbh/evolution/library/04/2/l_042_03.html When Whales had legs https://www.youtube.com/watch?v=-OCMx2VuP1U **SEP.4 Analyzing and Interpreting Data** Analyze displays of data to identify linear and nonlinear relationships Analyze and interpret data to determine similarities and differences in findings **SEP.5 Using Mathematics and Computational Thinking** Use mathematical representations to support scientific conclusions and design solutions. **SEP.6 Constructing Explanations** Construct an Explanation that includes qualitative or quantitative relationships between variables that describe phenomena. **SEP.8 Obtaining, Evaluating, and Communicating Information** Gather, read, and synthesize information from multiple appropriate sources and assess the credibility,	Elevate Interactivities: - Mystery on the Galapagos Islands - Animal Feeding adaptations - Adaptations and Variations - Mice Selection on the Prairie - Species Adaptations - Lessons from the Potato Famine - Mutations Aren't All that bad - Separated species - Along the Canyon Wall - Legs, Arms, Wings and Flippers - Tiny Clues - Fossils Around the World - Tree of Life - Long Necks and Hoofed Feet Hands-On Labs: - Nature At Work - Variation in a Population - Adaptations of Birds - Finding Proof - DNA Evidence Case study: Could Dinosaurs Roar? Design Challenge: Fossils from Bedrock National Geographic https://www.nationalg	Open-ended quiz Think Pair Share Four corners Science notebooks Discussions/socratic seminars Graphic Organizers Individual whiteboards Lab reports open-ended questioning Self assessments Peer assessments Show of hands/3-2-1 Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks QUEST project: A Migration Puzzle Performance- Based assessment: A Bony Puzzle

	lead to a species' extinction? How does modern technology provide evidence that all organisms have a common ancestor? What new discoveries about evolution has modern technology made possible?	scientific theory mechanism natural selection competition fossil record embryo homologous structures extinct protein endosymbiosis	accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	eographic.org/topics/resource-library-natural-selection/?q=&page=1&per_page=25 National History Museum https://www.nhm.ac.uk/discover/what-is-natural-selection.html Natural Selection Science Games https://www.legendsoflearning.com/learning-objectives/natural-selection/ NSTA Natural Selection and Adaptations https://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=33	

Robbinsville Public Schools

Unit # 6: History of Earth

Enduring Understandings:	**Essential Questions:**
● 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.	● How can events in Earth's past be organized? ● How do people reconstruct and date events in Earth's planetary history?

Interdisciplinary Connections

NJSLS English Language Arts W2: Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

- Example: Students will read the text and explain (in their own words) one of the methods that geologists use to find the relative ages of rocks.

NJSLS English Language Arts R1: cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

- Example: Students will use the text to cite evidence to explain what impact the amniotic egg had on lifeforms on Earth.

NJSLS Mathematics 7.EE.A.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

- Example: Students will write an expression representing the percentage of DNA that gorillas share with humans and infer their evolutionary relationship based on their answers.

Career/Real World Connections

Careers

- Paleontologist- A paleontologist is a scientist who studies the history of life on Earth through the fossil record. Fossils are the evidence of past life on the planet and can include those formed from animal bodies or their imprints (body fossils).
- Geologists study earth processes such as earthquakes, landslides, floods, and volcanic eruptions to survey land and draw up safe building plans. When geologists investigate earth materials, they not only investigate metals and minerals, but also look for oil, natural gas, water and methods to extract these.

Real World Connections

- Natural History Museums: Natural history museums are places where people can learn about the past history of life on Earth, as well as the changes Earth's surface has gone through. Most states have at least one natural history museum or a museum that has departments dealing with the subject. Have students work in pairs to find locations for the following museums.
- Road cuts: Often, rather than run roads or highways over hills, the people constituting roads cut through hills. When they do this, they expose the layers of rock on each side of the road.

- Dinosaurs as Index fossils: Oil companies often deploy scientists to help them find oil, including oil beneath the ocean or other large bodies of water. In the late 1990's a company drilling in Norway's North Sea found something they believed was plant matter. In 2003, another scientist examined the find-and discovered that it was a dinosaur bone. The specimen was found 2.3 km below the seafloor. Because the fossil belonged to a dinosaur that lived during a relatively brief period in time, it can be used as an index fossil to determine the geologic age of the rocks in which it was found. That dinosaur, a *Plateosaurus*, lived in the late Triassic period, the first period of the Mesozoic era.
- Our Current Geologic Time: While eras are divided into periods are divided into epochs. Only recently, scientists have begun to believe that we may be entering a new epoch in Earth's history. The epoch begins with humankind's use of technology changing the planet in ways that cannot easily be undone, including altering global weather patterns and causing a possible sixth mass extinction.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-ESS1-4 9.4.8. CT.3 9.4.8. DC.7	How do geologists describe the ages of rocks? How do geologists determine the relative ages of rocks? How do geologists determine the absolute age of rocks? What is the purpose of the geologic time scale? How do events help geologists define and divide geologic time?	Students investigate the different ways to determine the relative and absolute ages of rock layers, as well as events that can affect those layers. Students model the long history of Earth, first into eras, then into periods, each marked by its own unique organisms and geologic features. Students investigate how major events in Earth's history have shaped evolution as well as geologic features and provided the beginning and ending points of eras and periods. As students learn about the ages of rocks, how the geologic time scale is divided, and how major events have impacted evolution, they apply their new knowledge and improved practices to propose solutions to real-world problems. **CCC.3 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 **Key terms:** relative age absolute age	**Phenomena:** How Was The Grand Canyon Formed? https://thewonderofscience.com/phenomenon/2018/5/13/how-was-the-grand-canyon-formed Tropical Fossils in Wyoming https://www.georgiascienceteacher.org/phenomena?filterT=134 New Island Formation https://www.youtube.com/watch?v=S0_ANqwuCzA **SEP.6 Constructing Explanations and Designing Solutions** Construct a scientific explanation based on valid and reliable evidence obtained from sources 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. Hands-On Labs Virtual Labs	Elevate Interactivities: - Oldest to Youngest - Radiometric Dating - Know Your Index Fossils - On the Clock - A Very Grand Canyon - Going Away - How Old Are These Rocks? - Observation and Deduction - Big Changes Hands-On Labs: - The Story in Rocks - Going Back in Time - Changes in the Water Case study: Rewriting the history of your food Design Challenge: Tiny Fossil, Big Accuracy	Open-ended quiz Think Pair Share Four corners Science notebooks Discussions/socratic seminars Graphic Organizers Individual whiteboards Lab reports open-ended questioning Self assessments Peer assessments Show of hands/3-2-1 Exit slips Project rubrics

		law of superposition fossil unconformity radioactive decay radioactive dating geologic time scale era period invertebrate vertebrate amphibian reptile mass extinction mammal	Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	Global to Local: A New Mass Extinction Museum of Natural History https://www.colorado.edu/cumuseum/programs/schools-and-groups/fossils-classroom/materials-and-resources/geologic-time-scale National Park Service https://www.nps.gov/subjects/geology/time-scale.htm Smithsonian https://naturalhistory.si.edu/education/teaching-resources/earth-science The National Acadamies https://www.nap.edu/resource/12161/origin_and_evolution_of_earth_final.pdf	Lesson quizzes and unit test Lesson checks Reading checks QUEST project QUEST project: The Big Fossil Hunt Performance- Based assessment: Core Sampling Through Time

Robbinsville Public Schools

Unit # 7: Energy in the Atmosphere and Ocean

Enduring Understandings:	**Essential Questions:**
● Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. ● Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. ● The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally re-distributing it through ocean currents.	● How does energy move throughout Earth's atmosphere and ocean? ● What regulates weather and climate? ● How do the properties and movements of water shape Earth's surface and affect its systems?

Interdisciplinary Connections

NJSLS Mathematics 6.EE.A.2.C: Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those New Jersey Student Learning Standards for Mathematics 7 involving whole number exponents, in the conventional order when there are no parentheses to specify a particular order.

- Example: Students will convert measurements from degrees Fahrenheit to degrees Celsius to determine air temperature in units of the metric system.

NJSLS Mathematics 6.RP.A.3: Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

- Example: Students will use a table to determine how cold the air will feel with the windchill factor accounted for.

NJSLS English Language Arts W.6.1.B: Support claim(s) with clear reasons and relevant evidence, using credible sources and demonstrating an understanding of the topic or text.

- Example: Students will explain how the Earth's atmosphere acts similarly to a greenhouse, and use a visual image to synthesize information from the text to address ow gases in the atmosphere absorb and contain heat.

Career/Real World Connections

Careers

- Meteorologists analyze how global patterns affect local weather. In college, students who want to pursue a career in weather forecasting study physics, chemistry, biology, calculus, and computer science.
- Oceanographers are researching how the ocean affects climate and how climate change is affecting the ocean. An oceanographer's role is to understand and predict how the world's oceans and seas work, as well as to work out how to make the most efficient and sustainable use of their resources.

- Hydrologists study how water moves across and through the Earth's crust. They study how rain, snow, and other forms of precipitation impact river flows or groundwater levels, and how surface water and groundwater evaporate back into the atmosphere or eventually reach the oceans.

Real World Connections

- Ocean hazards: weather hazards include large storms and hurricanes. In 2015 the container ship *El Faro* sank when it was caught in a hurricane. In most cases weather detection technology can help a captain avoid hurricanes or Scott. Geographic hazards include anything on the seascape that can harm vessels such as quarries, icebergs, and sandbars. In 2011 the containership MSC Luciana ran aground on a sandbar and had to be pulled free by tugboats.
- Global warming: The global climate is warming at a quickening case. This phenomenon is referred to as global warming and is believed to be the result of increased levels of carbon dioxide, chlorofluorocarbons or CFCs, and other pollutants in the atmosphere. Although overwhelming evidence supporting the existence of global warming has been collected by the scientific community, some people do not believe that it is happening.
- Weather forecasting: The first official weather forecast was made in 1870. The early forecasts were highly inaccurate because they use information gained from Earth's surface rather than Earth's atmosphere. Meteorologists only had part of the information necessary for accurate weather predictions. Today forecasters rely on essential information from the atmosphere, such as air masses, fronts, and developing low pressure centers, to more accurately predict weather.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS--ESS2-6 9.4.8. CI.1 9.4.8. TL.1	How does the Sun's energy reach and move through Earth's atmosphere? How is heat transferred in Earth's atmosphere? What role does the atmosphere play in allowing life to thrive on Earth? What causes winds? How does the Sun's energy affect the wind characteristics? How do wind redistribute energy around earth?	Students model how energy is transferred from the sun to earth surface and air by radiation, conduction, and convection. Students investigate how differences in air pressure caused by the unequal heating of the atmosphere create global and local winds and how the rotation of earth produces patterns of calm areas and global wind belts. Students investigate how unequal heating and earths rotation produce patterns of ocean circulation that distribute energy. **CCC.4 Systems and System Models** Models can be used to represent systems and their interactions- such as inputs, processes and outputs- and energy, matter, and information flows within systems. **Key terms:** electromagnetic wave	**Phenomena:** UAE Building a Mountain to Increase Rainfall https://thewonderofscience.com/phenomenon/2018/6/10/uae-building-a-mountain-to-increase-rainfall Why Does the Wind Blow? https://thewonderofscience.com/phenomenon/2018/6/15/why-does-the-wind-blow The Driest Place on Earth https://thewonderofscience.com/phenomenon/2018/6/15/the-driest-place-on-earth How to Make a Cloud in Your Mouth https://thewonderofscience.com/phenomenon/2018/7/12/how-to-make-a-cloud-in-your-mouth	Elevate Interactivities: - Fluid on the Move - Patterns in the Wind - Where th Wind Blows - Winds Across the Globe - Currents and Climate - Ocean Habitats - Keeping Current on Currents Hands-On Labs: - Heating Earthś Surface United States Precipitation - Modeling Ocean Current Formation	Open-ended quiz Think Pair Share Four corners Science notebooks Discussions/socratic seminars Graphic Organizers Individual whiteboards Lab reports open-ended questioning Self assessments

	What causes ocean currents? How do ocean currents redistribute Earth's energy?	greenhouse effect thermal energy convection conduction radiation wind sea breeze land breeze Coriolis Effect Jet stream Current El Nino La Nina	Hair Frizz https://www.georgiascienceteacher.org/phenomena?filterT=138 Hurricanes https://nwacceastlab.maps.arcgis.com/apps/MapJournal/index.html?appid=ec07b440f80f413cae487365b7cf33e2 **SEP.2 Developing and Using Models** Develop and or use a model to predict and or describe phenomena. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	Design Challenge: Windmills of the future Case Study: Hurricanes in the Making CLEAN https://cleanet.org/clean/educational_resources/index.html NOAA Climate https://www.climate.gov/teaching/toolbox-teaching-climate-energy NASA Climate https://climate.nasa.gov/resources/education/	Peer assessments Show of hands/3-2-1 Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks QUEST project: Crossing the Atlantic Performance- Based assessment: Not All Heating is Equal

Enduring Understandings:	**Essential Questions:**
● Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. ● Human activities such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise of Earth's mean temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depends on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely to visions and activities.	● How have natural processes and human activities changed Earth's climate? ● How do people model and predict the effects of human activities on Earth's climate?

Interdisciplinary Connections

NJSLS Mathematics 6.RP.A.1: Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

- Example: Students will determine the altitude of a weather balloon by analyzing the proportional relationship between temperature and altitude.

NJSLS English Language Arts R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

- Example: Students search the text for information related to the figure Major Ocean Currents by using text clues.

NJSLS Computer Science and Design Thinking 8.1.8.DA.6: Analyze climate change computational models and propose refinements.

- Example: Students will observe CO_2 and methane graphs from the past few decades, and analyze different influences on atmospheric conditions.

Career/Real World Connections

Careers

- The National Oceanic and Atmospheric Administration (NOAA) is a government organization that supports the health of our planet. Scientists who work for this organization studied the skies and the oceans.
- Environmental science is the study of the environment and solutions to environmental problems. Students interested in protecting ecosystems, monitoring pollution, and studying wildlife might find their niche within the environmental sciences. These green jobs are plentiful in state and local governments, as well as the private sector.
- Alternative Energy Jobs- Also known as renewable or green energy, alternative energy is essential to eliminating the world's dependence on fossil fuels and is one of the central pillars of a green economy.Hydroelectric, solar, and wind energy are rapidly expanding, and green jobs in this field are growing four times faster than the average job in the United States.

- Careers in Atmospheric and Earth Sciences- Earth science is a broad field that includes hydrology, geology, and ecology. Atmospheric science focuses on the study of the Earth's atmosphere and includes meteorology, which involves weather forecasting. If you're interested in studying climate change, testing water quality, or creating geological maps that pinpoint mineral resources, some of the green jobs below might interest you.

Real World Connections

- Seasons: have students identify the different types of weather associated with each season in their area. Organize student comments into each season on the board. Have students summarize the typical weather experience for each season. Explain to students that climate summarizes the weather for the entire year or over many years in a specific area.
- Electric cars: The purchase and use of electric cars has increased over the past few years. Why? People want to do their part to improve air quality. Not only is this good for the environment, it is also good for our health. Explain that transportation accounts for 1/3 to 1/2 of greenhouse gas emissions. Start students thinking about how electric cars benefit the climate.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-ESS2-6 MS-ESS3-5 9.4.8. CI.1 9.4.8. CT.1 9.4.8. CT.2 9.4.8. DC.8 9.4.8. IML.8 9.4.8. TL.4	How does climate differ from weather? How do latitude, altitude, and land distribution affect patterns of circulation in the atmosphere and ocean? How do patterns of circulation in the atmosphere and ocean determine regional climate? What affects the greenhouse gases in the atmosphere have on global temperatures? How do natural processes and human activities affect patterns of change in global temperatures?	Students investigate how factors such as latitude, altitude, land distribution, and ocean current influence climate patterns. Students learn about the greenhouse effect and use the historical and recent data to identify trends in Earth's warming and cooling patterns. Students model how increased temperatures affect water levels, identify the effects of warmer temperatures on living organisms, and design solutions to lessen the effects of climate change. **CCC.2 Stability and Change** Stability might be disturbed either by sudden events or gradual changes over time. **CCC.4 Systems and system models** Models can be used to represent systems and their interactions- such as inputs, processes and outputs- and energy, matter, and information flows within systems. **CCC.7 Stability and change**	**Phenomena:** World Climographs https://thewonderofscience.com/phenomenon/2018/6/15/world-climographs Glacier National Park Is Melting Away https://thewonderofscience.com/phenomenon/2018/5/13/glacier-national-park-is-melting-away The Dark Snow Project https://thewonderofscience.com/phenomenon/2018/6/15/the-dark-snow-project Boiled water freezes instantly https://www.youtube.com/watch?v=ZGjwe-BCfms **SEP.1 Asking questions and Defining problems** Ask questions to identify and clarify evidence of an argument.	Elevate Interactivities: - Two Sides of a Mountain - Olympic Choices - In the Greenhouse - Human Impact on Climate Change - Climate Change Q&A - Methane Management - Emission Reduction Hands-On Labs: - Classifying Climates - What is the Greenhouse Effect? - Thermal Expansion of Water Design Challenge: Changing Climate Change Case Study: The Carbon Cycle	Open-ended quiz Think Pair Share Four corners Science notebooks Discussions/socratic seminars Graphic Organizers Individual whiteboards Lab reports open-ended questioning Self assessments Peer assessments Show of hands/3-2-1

	How do changes in global temperatures impact natural systems on earth? What can be done to mitigate climate change and its effects?	Stability might be distributed either by an event or gradual changes that accumulate over time. **<u>Key terms:</u>** climate greenhouse gas greenhouse effect climate change global warming fossil fuel cascade effect alterative energy	**SEP.2 Developing and Using Models** Development and/or use of models to predict and/or describe phenomena. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	Climate map http://www.climatehotmap.org/index.html Climate and Global Change https://www.windows2universe.org/?page=/earth/climate/climate.html NASA Climate https://climate.nasa.gov/resources/education/ NOAA Climate https://www.climate.gov/teaching Climate Change Connection http://climatechangeconnection.org/resources/climate-friendly-schools/resources-for-schools/ Global Change https://www.globalchange.gov/browse/educators	Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks QUEST project: Shrinking Your Carbon Footprint Performance- Based assessment: An Ocean of a Problem

Unit # 9: Earth-Sun-Moon System

Enduring Understandings:	**Essential Questions:**
• Patterns of the apparent motion of the sun, the moon,and stars in the sky can be observed, described, predicted, and explained with models. • This model of the solar system can explain eclipses of the sun and the moon. Earth's spin access 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.	• How do the sun and the moon affect Earth? • What are the predictable patterns caused by Earth's movement in the solar system? • How do the earth, moon, and sun operate as a system? • How does the position, motion and tilt of the Earth, relative to the Sun, produce seasons and night/day?

Interdisciplinary Connections

NJSLS Mathematics 7.RP.A.2c Represent proportional relationships by equations.

- Example: Students will create an equation to determine the distance of Halley's Comet to the Earth in the year 1910.

NJSLS English Language Arts R.1: Cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

- Example: Students will read and review paragraphs under each section heading to locate the evidence that supports the statement that seasons are caused by the tilt of Earth's axis.

Career/Real World Connections

Careers

- Fishermen: Commercial and recreational saltwater fishing depend on knowing the movement of tides to help them catch fish. People in the fishing industry can use that knowledge to improve their catches. Certain species of fish will concentrate in particular areas depending on the conditions of the tide. This is especially true for surf anglers who fish from the beach.

Real World Connections

- Renewable energy: most people are familiar with many types of renewable energy such as solar and wind energy, but many students may not know that the ocean can be a source of renewable energy as well. Florida is home to the south east national Marine renewable energy center, which focuses on research and building technologies that harness energy from the ocean.
- Moon: The moon has a huge impact on life on earth. For starters, it influences ocean tide. The rising and falling, creating changing conditions along the ocean sure, I thought to help contribute to the diversity we see in life today. For humans, a direct impact of the moon has been the presence of moonlight. The changes people thought about the moon also made people wonder about what they were observing and why it was happening. The changing appearance of the moon played a role in early belief systems. Much of our early art, literature, and mythology are a result of human curiosity about the moon. Early astronomers used predictable patterns of the moon to develop calendars and plans for agriculture.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-ESS1-1 9.4.8. CI.4 9.4.8. TL.3	• What objects can you see in the night sky? • Wide and stars in the night sky seem to move? • How do objects in the solar system move? • How does Earth's motion affect the amount of daylight and the seasons? • Why do ours and the moon remain in orbit? • Why does the moon appear to change shape? • What causes solar and lunar eclipses? • How does the sun and moon affect the tides?	• Students investigate different objects seen in the night sky and how earth, the sun, and other planets move through space. • Students investigate how earth and the moon remain in orbit and how earth's motion affects the amount of daylight and the seasons. • Students investigate how the sun and moon affect tides, the causes of different types of eclipses, and the phases of the moon. **CCC.1 Patterns** Patterns can be used to identify cause and effect relationships. **Key terms:** satellite star planet meteor comet constellation geocentric heliocentric ellipse axis rotation revolution orbit solstice equinox gravity law of universal gravitation interia phase eclipse umbra penumbra	**Phenomena:** Seeing the Moon During the Day https://thewonderofscience.com/phenomenon/2018/7/11/seeing-the-moon-during-the-dayd Star Trails https://thewonderofscience.com/phenomenon/2018/7/11/star-trails Total Solar Eclipse https://thewonderofscience.com/phenomenon/2018/5/3/total-solar-eclipse **SEP.2 Developing and Using Models** Develop and/or use models to predict and/or describe phenomena. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	Elevate Interactivities: - Discovery of the Solar System - Interpreting the Night Sk - Patterns in Earth's Rotation and Revolution - What Keeps Objects in Motion? - Seasons of Earth - Our View of the Moon - Eclipses - Moon Phases and Eclipses Hands-On Labs: - Watching the Skies - Lighten Up! - How Does the Moon Move? Case Study: The Ptolemaic Model: Explaining the Unexplained Design Challenge: Power from the tides Moon Connection: http://www.mooncon nection.com/ NASA Education: http://www.nasa.gov/offices/education/about/index.html	Open-ended quiz Think Pair Share Four corners Science notebooks Discussions/socratic seminars Graphic Organizers Individual whiteboards Lab reports open-ended questioning Self assessments Peer assessments Show of hands/3-2-1 Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks QUEST project: It's as Sure as the Tides

		tide spring tide neap tide		Teach Earth Science https://teachearthscience.org/earthmoonsun.html FOSS https://www.fossweb.com/moduledetail?dDocName=G3906488	Performance- Based assessment: Modeling Lunar Phases

Unit # 10: Solar System and the Universe

Enduring Understandings:	**Essential Questions:**
• Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. • 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. • Solar system appears to have formed from a disc of dust and gas, drawn together by gravity.	• What kind of data and evidence help us to understand the universe? • What celestial bodies are present in the Universe and what are their scale relationships? • How do stars, such as our Sun, produce energy? • How can technology help us understand the history of the universe and what is yet to be discovered?

Interdisciplinary Connections

NJSLS English Language Arts RL.6.2. Determine a theme or central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.

- Example: Students will summarize the text about how stars, star systems and galaxies are related, then restate the main points of the passage and eliminate details and examples.

NJSLS English Language Arts W.6.2.-8 Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples.

- Example: Students will create a T-chart showing the steps of the evolution of a neutron star on the leftand supporting detail on the right.

NJSLS Mathematics 6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

- Example: Students will use the H-R diagram to review the properties along the x and y axes, interpret the graph to determine the relationship between surface temperature and absolute brightness of stars.

NJSLS Mathematics MP.4: Model with mathematics.

- Example: As a class, students will convert the distance represented in one light-year to scientific notation.

Career/Real World Connections

Careers

- Astronomer: An astronomer is a scientist in the field of astronomy who focuses their studies on a specific question or field outside the scope of Earth. They observe astronomical objects such as stars, planets, moons, comets and galaxies – in either observational or theoretical astronomy.
- Physicist: A physicist is a scientist who specializes in the field of physics, which encompasses the interactions of matter and energy at all length and time scales in the physical universe
- Astronaut: An astronaut is a person trained, equipped, and deployed by a human spaceflight program to serve as a commander or crew member aboard a spacecraft.

- Aerospace Engineers: Aerospace engineers design aircraft, spacecraft, and space stations for human occupation. These professionals combine a love of math and science, especially physics, to conduct research and to design and develop vehicles and systems for a specific air and space environment. A student pursuing a career in aerospace engineering needs a minimum of four year college degree usually in physics, and often additional graduate coursework. Many aerospace engineers have advanced degrees in aeronautical engineering.

Real World Connections

- Medicine: The technology that allows the Hubble telescope to transmit so much information about outer space has also benefited the medical field. One of these important technological breakthroughs involves space telescope imaging spectrograph. This instrument was used to search for "supermassive black holes". NASA scientists introduced changes that improve the spectrograph detection ability. Medical researchers use the same silicon chips to improve imaging results within breast tissue. This led to more effective distinction between benign and cancerous tumors.
- Planet classification: Pluto was declassified as a planet in 2001. Have students discuss how planets and dwarf planets are classified? Other changes to the solar system might occur as scientists continue to study it?

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-ESS1-2 MS-ESS1-3 9.4.8. CI.3 9.4.8. CT.1	• How do the characteristics of the planets, moons, and smaller objects in the solar system compare? • What is the role of gravity in the moon motions of planets, moons, and smaller objects in the solar system? • What are the relationships between the sun and the planets in the solar system? • How does the electromagnetic spectrum help scientists learn about the universe? • How do scientists use technology to learn about the universe? • What are the properties of the star?	• Students analyze data to compare and contrast the planets and other objects in the solar system. • Students describe how technology is used to detect electromagnetic radiation and produce images in order to provide information about the universe. • Students classify stars based on their physical characteristics of absolute brightness, color, and temperature. They also learn the role gravity plays in the formation of a star. • Students learn the theory behind the formation of the universe and apply the concept of scientific notation as a means for scientists to measure the vastness of the universe. **CCC.3 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. **CCC.4 Systems and System Models**	**Phenomena:** Gravitational waves and LIGO https://thewonderofscience.com/phenomenon/2018/7/9/gravitational-waves-and-ligo Protecting the Earth from Killer Asteroids https://thewonderofscience.com/phenomenon/2018/7/9/protecting-the-earth-from-killer-asteroids 3D Tour of Constellations https://thewonderofscience.com/phenomenon/2018/7/8/3d-tour-of-constellations Total Solar Eclipse https://thewonderofscience.com/phenomenon/2018/5/3/total-solar-eclipse Forced Perspective https://thewonderofscience.com/phe	Elevate Interactivities: - Distance Learning - Anatomy of the Sky - Solar SYstem - How to Make a Solar System - Space Exploration - Telescopes - Launch a Space Probe - Eyes in Sky - Star Systems - Lives of the Stars - Types of Galaxies - Model a Galaxy Hands-On Labs: - Pulling Planets - Layers of the Sun - Space Exploration Vehicle - How Far is that Star - Model of the Milky Way	Open-ended quiz Think Pair Share Four corners Science notebooks Discussions/socratic seminars Graphic Organizers Individual whiteboards Lab reports open-ended questioning Self assessments Peer assessments

	• How do scientists classify stars? • What is the role of gravity in the formation of a star? • How can we determine the sizes of and distances between stars and galaxies? • What makes up galaxies of different sizes and shapes?	Models can be used to represent systems in their interactions - such as inputs, processes and outputs- and energy, matter, and information flows within systems. **Key terms:** solar system astronomical unit sun planet moon asteroid meteroids comets electromagnetic radiation visible light spectrum wavelength telescope nebula protostar white dwarf supernova apparent brightness absolute brightness galaxy universe light year big bang	nomenon/2018/7/5/forced-perspective **SEP.2 Developing and Using Models** Develop and/or use models to predict and/or describe phenomena. **SEP.4 Analyzing and Interpreting Data** Analyze and interpret data to determine similarities and differences in findings. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	Design Challenge: Blast Off! Extraordinary Science: Traveling Through the Milky Way Brief History of Rockets: https://www.grc.nasa.gov/www/k-12/TRC/Rockets/history_of_rockets.html Websites for Lesson Planning: NASA for Educators: https://www.nasa.gov/stem/foreducators/k-12/index.html Space xploration http://science-class.net/archive/science-class/Astronomy/Space_Exploration.htm Solar Dynamics Observatory https://sdo.gsfc.nasa.gov/ Amazing Space https://hubblesite.org/resource-gallery/learning-resources/amazing-space.html	Show of hands/3-2-1 Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks QUEST project: Searching for a Star Performance- Based assessment: Scaling Down the Solar System

General Differentiated Instruction Strategies

• Leveled texts • Chunking texts • Choice board • Socratic Seminar • Tiered Instruction • Small group instruction • Guided Reading • Sentence starters/frames • Writing scaffolds • Tangible items/pictures • Adjust length of assignment	• Repeat, reword directions • Brain breaks and movement breaks • Brief and concrete directions • Checklists for tasks • Graphic organizers • Assistive technology (spell check, voice to type) • Study guides • Tiered learning stations • Tiered questioning • Data-driven student partnerships • Extra time

Possible Additional Strategies for Special Education Students, 504 Students, At-Risk Students, and English Language Learners (ELLs)			
Time/General	**Processing**	**Comprehension**	**Recall**
• Extra time for assigned tasks • Adjust length of assignment • Timeline with due dates for reports and projects • Communication system between home and school • Provide lecture notes/outline	• Extra Response time • Have students verbalize steps • Repeat, clarify or reword directions • Mini-breaks between tasks • Provide a warning for transitions • Reading partners	• Precise step-by-step directions • Short manageable tasks • Brief and concrete directions • Provide immediate feedback • Small group instruction • Emphasize multi-sensory learning	• Teacher-made checklist • Use visual graphic organizers • Reference resources to promote independence • Visual and verbal reminders • Graphic organizers
Assistive Technology	**Assessments and Grading**	**Behavior/Attention**	**Organization**
• Computer/whiteboard • Tape recorder	• Extended time • Study guides	• Consistent daily structured routine	• Individual daily planner • Display a written agenda

• Spell-checker • Audio-taped books	• Shortened tests • Read directions aloud	• Simple and clear classroom rules • Frequent feedback	• Note-taking assistance • Color code materials

Enrichment

The goal of Enrichment is to provide learners with the opportunity to participate in extension activities that are differentiated and enhance the curriculum. All enrichment decisions will be based upon individual student needs.

- Show a high degree of intellectual, creative and/or artistic ability and demonstrate this ability in multiple ways.
- Pose questions and exhibit sincere curiosity about principles and how things work.
- The ability to grasp concepts and make real world and cross-curricular connections.
- Generate theories and hypotheses and pursue methods of inquiry.
- Produce products that express insight, creativity, and excellence.
- Possess exceptional leadership skills.
- Evaluate vocabulary
- Elevate Text Complexity
- Inquiry based assignments and projects
- Independent student options
- Tiered/Multi-level activities
- Purposeful Learning Center
- Open-ended activities and projects
- Form and build on learning communities
- Providing pupils with experiences outside the 'regular' curriculum
- Altering the pace the student uses to cover regular curriculum in order to explore topics of interest in greater depth/breadth within their own grade level
- A higher quality of work than the norm for the given age group.
- The promotion of a higher level of thinking and making connections.
- The inclusion of additional subject areas and/or activities (cross-curricular).
- Using supplementary materials in addition to the normal range of resources.

English Language Learner (ELL) Resources

- Learning style quiz for students- http://www.educationplanner.org/students/self-assessments/learning-styles-quiz.shtml
- "Word clouds" from text that you provide-http://www.wordle.net/
- Bilingual website for students, parents and educators: http://www.colorincolorado.org/
- Learn a language for FREE-www.Duolingo.com
- Time on task for students-http://www.online-stopwatch.com/
- Differentiation activities for students based on their Lexile-www.Mobymax.com
- WIDA-http://www.wida.us/
- Everything ESL - http://www.everythingESL.net
- ELL Tool Box Suggestion Site http://www.wallwisher.com/wall/elltoolbox
- Hope4Education - http://www.hope4education.com
- Learning the Language http://blogs.edweek.org/edweek/learning-the-language/
- FLENJ (Foreign Language Educators of NJ) 'E-Verse' wiki: http://www.flenj.org/Publications/?page=135
- OELA - http://www.ed.gov/offices/OBEMLA
- New Jersey Department of Education- Bilingual Education information http://www.state.nj.us/education/bilingual/

Special Education Resources

- Animoto -Animoto provides tools for making videos by using animation to pull together a series of images and combining them with audio. Animoto videos or presentations are easy to publish and share. https://animoto.com
- Bookbuilder -Use this site to create, share, publish, and read digital books that engage and support diverse learners according to their individual needs, interests, and skills. http://bookbuilder.cast.org/
- CAST -CAST is a non-profit research and development organization dedicated to Universal Design for Learning (UDL). UDL research demonstrates that the challenge of diversity can and must be met by making curriculum flexible and responsive to learner differences. http://www.cast.org
- CoSketch -CoSketch is a multi-user online whiteboard designed to give you the ability to quickly visualize and share your ideas as images. http://www.cosketch.com/
- Crayon -The Crayon.net site offers an electronic template for students to create their own newspapers. The site allows you to bring multiple sources together, thus creating an individualized and customized newspaper. http://crayon.net/ Education Oasis -Education Oasis offers a collection of graphic organizers to help students organize and retain knowledge – cause and effect, character and story, compare and contrast, and more! http://www.educationoasis.com/printables/graphic-organizers/
- Edutopia -A comprehensive website and online community that increases knowledge, sharing, and adoption of what works in K-12 education. We emphasize core strategies: project-based learning, comprehensive assessment, integrated studies, social and emotional learning, educational leadership and teacher development, and technology integration. http://www.edutopia.org/

- Glogster -Glogster allows you to create "interactive posters" to communicate ideas. Students can embed media links, sound, and video, and then share their posters with friends. http://edu.glogster.com/?ref=personal
- Interactives – Elements of a Story -This interactive breaks down the important elements of a story. Students go through the series of steps for constructing a story including: Setting, Characters, Sequence, Exposition, Conflict, Climax, and Resolution. http://www.learner.org/interactives/story/index.html
- National Writing Project (NWP) -Unique in breadth and scale, the NWP is a network of sites anchored at colleges and universities and serving teachers across disciplines and at all levels, from early childhood through university. We provide professional development, develop resources, generate research, and act on knowledge to improve the teaching of writing and learning in schools and communities. http://www.nwp.org
- Pacecar -Vocab Ahead offers videos that give an active demonstration of vocabulary with audio repeating the pronunciation, definition, various uses, and synonyms. Students can also go through flash cards which give a written definition and visual representation of the word. http://pacecar.missingmethod.com/