ROBBINSVILLE PUBLIC SCHOOLS

OFFICE OF CURRICULUM AND INSTRUCTION

SCIENCE

7th 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 7th 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 2 by Pearson Education	● Teacher created resources ● Various internet activities ● TedED ● Brain POP ● National Geographic ● IXL ● Newsela ● EdPuzzle ● Kesler Station labs ● Khan Aadam ● Crash Course ● PBS Digital Learning

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 learn about the body systems and how they interact. They will gain self-awareness of being healthy due to proper diet and exercise, and the importance of making healthy choices in life.

Example 2: Establish clear norms and consequences in the beginning of the year so that students can see the impact of their own actions and behaviors on outcomes. Students will develop appropriate strategies for providing feedback to each other if someone is not pulling their weight in their group.

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 learn how stress affects the body and can lead to depression, anxiety, headaches, digestive issues, and cardiovascular disease. In class, students discuss ways of reducing stress naturally, including exercise, meditation and positive mindset.

Example 2: Students will participate in a lesson in which they will discuss how to use certain equipment, such as computers and microscopes, as well as other resources appropriately.

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 will learn about some of the important impacts of women and minorities in science, in order to help them identify with different cultural communities - including both well-known stories like that of Henrietta Lacks and her connection to cell biology and smaller stories like that of Cynthia Lucero and her connection to osmosis.

Example 2: Cultivate students' empathy by encouraging them to "put themselves in the shoes" of people living in different parts of the world with limited resources. This will help them view other perspectives of peoples' cultures and the issues they face.

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 build diverse work groups through the use of cooperative learning and project-based learning activities. The engineering design process is a perfect opportunity to encourage students to team up, develop and test ideas, appreciate each other's creativity, and talk about their successes and failures.

Example 2: Students will create their own ideas for how investigations should be carried out in an environment that encourages collaboration and respect. They will discuss ways to demonstrate respect for others during group activities.

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: Students describe how they can help the environment by stopping pollution and stop wasting water to help with the World Water Crisis. They will discuss ways that we can reverse human impacts on the environment, and describe things they can do to better the planet.

Example 2: Teaching students to accurately recognize when they have encountered a problem and learn to analyze the situation from a variety of angles, which includes identifying how and why the problem arose. After students have sufficiently identified, analyzed, and considered the problem, they then need to develop and practice methods for solving problems.

Integration of 21st Century Themes and Skills

Educational Technology

Standards: 8.1.8.A.1, 8.1.P.C.1, 8.1.8.D.2, 8.1.8.F.1

- **Technology Operations and Concepts: 8.1.8.A.1** Students can demonstrate knowledge of a real world problem using digital tools.
  - Example: Students can research a human impact topic of their choice as part of the Human Impacts on the Environment unit. They will learn to use reliable internet sources and articles as part of their research, and then create a public service announcement about their topic by making and submitting a digital poster or video.

- **Communication and Collaboration: 8.1.P.C.1** Collaborate with peers by participating in interactive digital games or activities.
  - Example: Students can work in small groups to complete a QUEST for the Human Body System unit. In their small groups they will collaborate to develop a training plan for an athlete. Students will work together to complete digital activities and labs to investigate how body systems interact to function properly and at their maximum potential, and present their findings to the class.

- **Digital Citizenship: 8.1.8.D.2** Demonstrate the application of appropriate citations to digital content.
  - Example: Students will learn how to choose reliable websites from educational websites, government websites and organizations. They will research information for multiple assignments (projects, labs, and CER's) and cite their information in proper MLA format.

- **Critical thinking, problem solving, and decision making: 8.1.8.F.1** Explore a local issue, by using digital tools to collect and analyze data to identify a solution and make an informed decision.
  - Example: Students can do research and make observations about the ecosystem they live in. They will describe how the ecosystem would be affected by building a highway nearby, and develop solutions to decrease the impact on the ecosystem.

● Career Ready Practices

● Standards: CRP3, CRP5, CRP7, CRP8

CRP3. Attend to personal health and financial well-being: Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial wellbeing, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

- Example: Students will demonstrate their understanding of personal health by creating a personal training program to determine how athletes train for maximum fitness. Students will discuss how body systems interact to help athletes maintain peak performance. Their plan will include a diet for nutritional/digestive needs, workout plan for peak respiratory, circulatory and muscular fitness.

CRP5. Consider the environmental, social, and economic impacts of decisions: Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment, and the profitability of the organization.

- Example: Students will discuss and explore the environmental, social and economic impacts of human activities and overpopulation. They will identify the effects of human impacts on ecosystems, land, water and air. Students will describe ways that these impacts can be helped with private organizations and government interventions, and demonstrate their understanding of human impacts on the environment and economy by creating a public service announcement to raise awareness in society.

CRP7. Employ valid and reliable research strategies. Career-ready individuals are discerning in accepting and using new information to make decisions, change practices, or inform strategies. They use a reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

- Example: Students will cite all sources they use for research for their QUEST projects and CER's with a bibliography, and learn to use MLA and/or APA formatting to cite reliable sources such as those from government, education, and organization websites.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

- Example: Students will research and analyze data to understand scientific problems, and develop solutions to fix problems. For example, in the Populations and Communities unit, students will develop a way to create an animal crossing across a highway in order to reduce impacts on animal populations.

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, can 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.

Scope, Sequence, Pacing and Assessment

7th Grade Science

Unit Title	Unit Understandings and Goals	Recommended Duration/ Pacing	Assessments			
			Formative	**Summative**	**Common Benchmark Assessments** (mid-course and end of course **only**)	**Alternative Assessments** (projects, etc. **when appropriate**)
Unit 1: The Cell System	The organization and development of living things, in particular their cells, are the main ideas that frame this topic. While studying cells, students use models to recognize cell structures and conduct an investigation to understand cell structures and functions. Using models, students will describe the function of a cell as a whole, and ways that parts of the cell contribute to the function.	4+ Weeks (Approximately 23 days)	Interactivities Hands-on investigative labs Virtual labs Enrichment activities QUEST project check-ins Teacher and peer feedback Open-ended/ scaffolded questions	Lesson checks Lesson quiz Unit assessment QUEST project rubric Teacher feedback and comments	Content SGO Skills SGO	QUEST project "How can you design a model exhibit for a science museum?" Performance-Based assessment: "Design and Build a Microscope"
Unit 2: Human Body Systems	How human body organs and their systems interact is the main idea that frames this topic. Students will demonstrate the interactions among several systems and learn how the nervous system sends and receives messages throughout the body. This topic supports student understanding of the importance of making healthy lifestyle decisions in regard to their physical and nutritional health.	4 Weeks (Approximately 20 days)	Interactivities Hands-on investigative labs Virtual labs	Lesson checks Lesson quiz Unit assessment QUEST project rubric	Content SGO Skills SGO	QUEST project "How do your body systems interact when you train for your favorite sport?" Performance-Based Assessment:

			Enrichment activities QUEST project check-ins Teacher and peer feedback Open-ended/ scaffolded questions	Teacher feedback and comments		"Reaction Research"
Unit 3: Reproduction and Growth	The diversity of ways in which living things reproduce and grow is the context that frames this topic. While learning how plants and animals reproduce and grow, students will come to recognize the importance of the environmental factors in the growth of all living things, including themselves.	3-4 Weeks (Approximately 17 days)	Interactivities Hands-on investigative labs Virtual labs Enrichment activities QUEST project check-ins Teacher and peer feedback Open-ended/ scaffolded questions	Lesson checks Lesson quiz Unit assessment QUEST project rubric Teacher feedback and comments	Content SGO Skills SGO	QUEST project "How can we reduce the impact of construction on plants and animals?" Performance-Based Assessment: "Clean and Green"
Unit 4: Ecosystems	Patterns of inheritance between living and nonliving things in an ecosystem, and how these interactions affect resource availability are the main ideas that frame this topic. While studying organisms' interactions in ecosystems and limiting factors that affect their populations, students begin to recognize the connections among features of an ecosystem, human and natural events, and overall health of an ecosystem, including the availability of resources.	3 Weeks (Approximately 15 days)	Interactivities Hands-on investigative labs Virtual labs Enrichment activities	Lesson checks Lesson quiz Unit assessment QUEST project rubric	Content SGO Skills SGO	QUEST project "What do you think is causing Pleasant Pond to turn green?" Performance-Based Assessment: "Last Remains"

			QUEST project check-ins Teacher and peer feedback Open-ended/ scaffolded questions	Teacher feedback and comments		
Unit 5: Populations, Communities and Ecosystems	The impact of ecosystem changes on a region's biodiversity is the context that frames this topic. While studying organisms' interaction in ecosystems and factors that affect their populations, students recognize the importance of biodiversity for sustaining life on Earth.	3-4 Weeks (Approximately 18 days)	Interactivities Hands-on investigative labs Virtual labs Enrichment activities QUEST project check-ins Teacher and peer feedback Open-ended/ scaffolded questions	Lesson checks Lesson quiz Unit assessment QUEST project rubric Teacher feedback and comments	Content SGO Skills SGO	QUEST project "Should an animal crossing be constructed in my community?" Performance-Based Assessment: "Changes in an Ecosystem"
Unit 6: Distribution of Natural Resources	The distribution of natural resources and the ways humans use the resource are explored in this topic. While studying nonrenewable and renewable resources, students also explore the use of minerals and water resources.	3-4 Weeks (Approximately 18 days)	Interactivities Hands-on investigative labs Virtual labs Enrichment activities QUEST project check-ins	Lesson checks Lesson quiz Unit assessment QUEST project rubric Teacher feedback and comments	Content SGO Skills SGO	QUEST project "How could natural resources have saved a ghost town?" Performance-Based Assessment: "To Drill or Not to Drill"

			Teacher and peer feedback Open-ended/ scaffolded questions			
Unit 7: Human Impacts on the Environment	The various ways that humans impact Earth's systems form the context for this topic. Students will identify the ways that a growing human population uses and effects Earth's air, land , and water. Students will also identify ways to mitigate the impact of humans, using technology or sustainable-use policies.	3-4 Weeks (Approximately 17 days)	Interactivities Hands-on investigative labs Virtual labs Enrichment activities QUEST project check-ins Teacher and peer feedback Open-ended/ scaffolded questions	Lesson checks Lesson quiz Unit assessment QUEST project rubric Teacher feedback and comments	Content SGO Skill s SGO	QUEST project "How can you help your school reduce its impact on Earth's systems?" Performance-Based Assessment: "Washing Away"
Unit 8: Waves and Electro-magnetic Radiation	Each day, students encounter many forms of energy transmission through waves. Students explore and examine the different properties of these waves and the way that the waves interact with matter and with each other. Through this study, they also learn the ways in which electromagnetic waves are particularly relevant to our lives and to the use of technologies that we use every day.	4 Weeks (Approximately 20 days)	Interactivities Hands-on investigative labs Virtual labs Enrichment activities QUEST project check-ins Teacher and peer feedback	Lesson checks Lesson quiz Unit assessment QUEST project rubric Teacher feedback and comments	Content SGO Skills SGO	QUEST project "How can you design a system to stop a thief?" Performance-Based Assessment "Making Waves"

			Open-ended/ scaffolded questions			
Unit 9: Electricity and Magnetism	This topic introduces students to electric forces, magnetic forces, and the interaction between them. Students investigate these forces and interactions and learn about the design and operation of electromagnets, motors, and generators.	3-4 Weeks (Approximately 18 days)	Interactivities Hands-on investigative labs Virtual labs Enrichment activities QUEST project check-ins Teacher and peer feedback Open-ended/ scaffolded questions	Lesson checks Lesson quiz Unit assessment QUEST project rubric Teacher feedback and comments	Content SGO Skills SGO	QUEST project "How can you lift an object without making contact?" Performance-Based Assessment "Planetary Detective"
Unit 10: Information Technologies	This topic introduces students to information signals and the technologies that encode and transmit that information. Students study digital and analog signals in order to compare their advantages and disadvantages.	3 Weeks (Approximately 14 days)	Interactivities Hands-on investigative labs Virtual labs Enrichment activities QUEST project check-ins Teacher and peer feedback Open-ended/ scaffolded questions	Lesson checks Lesson quiz Unit assessment QUEST project rubric Teacher feedback and comments	Content SGO Skills SGO	QUEST project "What is the best way to record sound for my scenario?" Project-Based Assessment "Over and Out"

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Unit # 1: The Cell System

Enduring Understandings:	**Essential Questions:**
● All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multi-cellular). ● Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. ● Plants and many other microorganisms use the energy from the light to make sugars (food) from carbon dioxide which comes from the atmosphere, and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. ● Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.	● How does the structure of cells determine their function? ● How do the structures of organisms enable life's functions? ● How do organisms detect, process, and use information about the environment?

Interdisciplinary Connections

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.

- Examples: Students will write a mathematical expression to calculate the total magnification of a microscope, and represent quantitative relationships by drawing a human hair at actual size and at the size it appears under a microscope. Students can also analyze proportional relationships by determining the difference between the giant dragonfly and the modern dragonfly, and infer the relationship between dragonfly size and air oxygen levels.

NJSLS Mathematics 8.F.B.5: Describe qualitatively the functional relationship between two quantities by analyzing a graph. Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

- Example: Students will draw a picture to show the relationship between carbon dioxide molecules and glucose molecules from photosynthesis. They will work with a partner to develop an equation to model this relationship.

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 analyze quantitative relationships by proving the equations for photosynthesis and cellular respiration are balanced.

Career/Real World Connections

Careers

- Museum Curator- Responsible for managing and overseeing artifacts, models, and exhibits for the museum.
- Biologist- Some biologists such as microbiologists and cytologists, focus on studying different types or aspects of cells. They may also study how infections and diseases affect cells.

Real World Connections

- Public Health- some bacteria can cause diseases and illnesses and can be presented by practicing good hygiene.
- Stem Cell Research- Stem cells are cells that have not yet differentiated into specialized cells. Research suggests that these cells may one day be used to repair or replace damaged or destroyed cells in the human body. This can help to treat or even cure diseases such as Alzheimer's and Parkinson's. There is a controversy over the use of embryonic stem cells in the lab and whether or not they should be studied or destroyed for their stem cells.
- Drinking Salt Water- People stranded in the ocean should never drink salty ocean water due to osmosis, and water would leave the cells causing dehydration and possibly death.
- Environment- Kelp forests (giant algae) provide food and shelter to many animals in the ocean. Pollution of the ocean can threaten the kelp forests by slowing their growth, which would result in many consequences to the ecosystem and environment.
- Sports Medicine- Muscle soreness is caused by lactic acid buildup in the muscles from the process of fermentation. Sports medicine specialists help design workouts to help athletes perform in the aerobic and anaerobic zones to enhance performance and endurance.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-LS1-1 MS-LS1-2 MS-LS1-3 MS-LS1-6 MS-LS1-7 MS-LS2-3	What evidence is there that cells make up living things? How do cells determine the structure of living things? What are some special structures within a cell? How do the different parts of a cell help it to function? How are animal cells different from plant cells? What is the primary role of the cell membrane in cell function?	Students investigate and explain how cells determine the structure of living things Using models, students compare and contrast cell structures and their functions. They also compare and contrast plant and animal cells. Students explore the primary role of the cell membrane and how it helps the cell to maintain homeostasis. Students explore how cells undergo reproduction. Using models, they recognize how structures in the cell support this process. Students investigate how plants and other organisms use photosynthesis to make food.	Phenomena: - Observe different types of cells - The Mighty Mole Rat - Tumor/cancer formation - Water Intoxication https://www.youtube.com/watch?v=jeiHmGTn_X8 - The immortal cells of Henrietta Lacks https://thewonderofscience.com/phenomenon/2018/7/8/the-immortal-cells-of-henrietta-lacks - Killer T Cell https://thewonderofscience.com/phenomenon/2018/7/9/killer-t-cell-the-cancer-assassin	Elevate Interactivities: - In Common - Functions of All Cells - Through A Microscope - A Strance Specimen - Build a Cell - Structure Function Junction - Specialized Cells - -Cell Transport - Entering and Leaving a Cell - Active Cell Division - A Cell Divides	Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks QUEST project "Design a Model Exhibit for a Science Museum" Performance-based assessment: "Design

	What are the functions of cell division? Which structures in a cell help it to reproduce? How do plants and other organisms use photosynthesis to make food? What role does photosynthesis play in cycling materials and energy through ecosystems? How can cells release energy without oxygen? How are matter and energy conserved during cellular respiration?	Students explore how organisms use cellular respiration to break down food and produce energy and carbon dioxide. **CCC.3 Scale, Proportion and Quantity** Students will understand that changes in a small-scale system, such as a cell, are viewed over much shorter times. It is important to recognize that processes that occur locally and on short time scales can have long-term and large-scale impacts as well. **CCC.5 Energy and Matter** Students will learn that matter is conserved because atoms are conserved in physical and chemical processes. Within a natural system, the transfer of energy drives the motion and/or cycling of matter. **CCC.6 Structure and Function** Students will understand that complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. <u>Key terms</u>: -cell -microscope -cell theory -organelle -cell wall - cell membrane -cytoplasm -nucleus -mitochondria -chloroplast -vacuole -selectively permeable -diffusion	**SEP.3 Planning and Carrying Out Investigations** Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. **SEP.2 Develop and Use Models** Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. Develop and use a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. **SEP.7 Engaging in Argument from Evidence** Use arguments supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER)	- How Does a Broken Bone heal? - The Cell Cycle - Food or Fiction? - Making Food for Cells - Flower Food - Making Energy for Cells <u>Hands-On Labs:</u> - Observing Cells - How Large Are Cells? - Comparing Cells - Make a Cell Model - Eggsperiment With a Cell (egg osmosis) - Modeling Mitosis - Energy from the Sun - Cellular Respiration - Exhaling Carbon Dioxide Living vs. Nonliving: https://www.exploratorium.edu/imaging_station/activities/classroom/characteristics/ca_characteristics.php Cell City Analogy: https://www.biologycorner.com/worksheets/cell-analogy.html Cell Structure Video: https://www.youtube.com/watch?v=URUJD5NEXC8	and build a Microscope" - Students will design and build their own microscopes to observe small objects.

		-osmosis -endocytosis -exocytosis -cell cycle -interphase -replication -mitosis -cytokinesis -photosynthesis -autotroph -heterotroph -chlorophyll -cellular respiration -fermentation	Science Videos Science Stations Interactive Science Journals Digital Learning	Cell Interactives: http://learn.genetics.utah.edu/content/cells/ Microscope Mania: http://sciencespot.net/Pages/classbio.html#micro Microscope Simulation: http://www1.udel.edu/biology/ketcham/microscope/_Interactive Interactive Online cells: http://www.cellsalive.com/cells/cell_model.htm	

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Unit #2: Human Body Systems

Enduring Understandings:	**Essential Questions:**
• In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. • Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behavior or memories. • Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function.	• How do systems interact in the human body? • How do the structures of the body allow them to function properly? • How do the decisions that we make each day influence how efficiently our body's operate? • In order to prevent disease and infection how might one create proactive strategies?

Interdisciplinary Connections

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 convert a large number (number of body cells) into an exponent using scientific notation.

NJSLS Mathematics 7.RP.A.3: Use proportional relationships to solve multistep ratio and percent problems.

- Example: Students will calculate the amount of sodium they consume daily by changing percentages to fractions, analyzing and proportional relationships, performing calculations, and applying mathematical concepts.

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 convert the data in a table into a double bar graph that shows the difference between the blood flow rate while the body is resting and exercising intensely.

NJSLS Comprehensive Health and Physical Education 2.1.8.PGD.4: Analyze the relationship between healthy behaviors and personal health.

- Example: Students create a menu and exercise program for an athlete to determine how a healthy behavior affects a person's overall health and to help prevent diseases such as heart disease and Type 2 diabetes.

Career/Real World Connections

Careers

- Some doctors specialize in different parts of the body. For example, gastroenterologists specialize in digestive disorders, including those that affect specific organs and digestive processes.
- Nutritionists and dieticians promote healthy eating habits and develop nutrition plans tailored to an individual's dietary or medical needs.
- A medical illustrator is a professional artist with advanced education in both the life sciences and visual communication. Collaborating with scientists, physicians, and other specialists, medical illustrators transform complex information into visual images that have the potential to communicate to broad audiences.
- A physical therapist helps injured or ill people improve movement and manage pain. They are often an important part of preventive care, rehabilitation, and treatment for patients with chronic conditions, illnesses, or injuries.

Real World Connections

- Olympic athletes are able to complete tremendous feats through extensive physical training and striving to meet their nutritional needs to improve their overall health.
- There are some common idioms linked to the nervous system. Students can work together to explain the figurative meanings of these idioms (*Examples: fly by the seat of your pants, knee-jerk reaction, sweating bullets, in the blink of an eye, firing on all cylinders*).

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-LS1-3 MS-LS1-8	How do groups of cells form interacting subsystems in the body? How do the structures of specialized organs relate to their functions in the body? How do organ systems interact to carry out all the necessary functions for an organism's growth and survival? How do organ systems interact to maintain homeostasis?	Students identify patterns when observing how cells form interacting subsystems of the body. Through models, students identify and investigate the organs that are specialized for particular body functions. Students identify and investigate how organ systems interact with each other to carry out all necessary functions for an organism's growth and survival. Through this investigation, students relate how the organ systems interact and maintain homeostasis. Students investigate and explain how the digestive system provides necessary energy to the body's cells in the form of nutrients. Students use this information to analyze the nutritional value of foods and develop healthy meals.	Phenomena: - Athlete in training - Case studies of illness/diseases - Lab grown organs - Runner's High https://thewonderofscience.com/phenomenon/2018/7/9/runners-high **SEP.7 Engaging in Argument from Evidence** Use arguments supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. **SEP.8 Obtaining, Evaluating, and Communicating Information**	Elevate Interactivities: - Human Body Sytems - Advances in Medical Technology (artificial skin) - He's a Growing Boy - Balancing Act - Communication and Homeostasis - A Variety of Symptoms - Training Symptoms - Investigating Cells and Homeostasis - Body Highways and Byways	Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks Journal writings: trace journey of oxygen molecule through the body) QUEST project "How do your body systems interact when you train

	What are the important nutrients your body needs to carry out its processes? How does food become materials your body can use? How do your body's systems process the food you eat? How are materials transported on the body? How does the respiratory system interact with other systems to exchange gases? How does the excretory system interact with other systems to remove wastes from the body? Which systems control processes in the human body? How does the body sense and respond to stimuli in the environment? How do the cells that make up the nervous system respond to stimuli?	Students investigate and determine the relationship between the circulatory and respiratory systems, which provide the body with oxygen and remove carbon dioxide. Students identify the nervous system as the central system that controls all other systems and bodily functions. Students use models to determine how the endocrine system works with the nervous system to regulate growth and development and maintain homeostasis. **CCC.4 Systems and System Models** Students will understand how the systems in the body interact with other systems; they may have subsystems and be a part of larger complex systems. <u>Key terms:</u> -tissue -organ -organ system -stimulus -response -gland -hormone -stress -digestion -nutrients -carbohydrates -peristalsis -saliva -enzyme -circulatory system -artery -capillary -vein -lymph -bronchi -alveoli -excretion -nephron	Gather and Synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	- Circulatory System - Humans vs. Computers - Flex Your Rflexes - Why Practice Makes Perfect <u>Hands-On Labs</u> - How Is Your Body Organized? - Observing Cells and Tissues - Parts Working Together - Your Heart, Your Breathing - Body Systems Working Together - Testing a Training Plan - How Does Your Knee React? - What Are the Parts of the Nervous System? Body Systems- heart function: https://www.smm.org/heart/heart/top.html Body Systems- lung function: https://www.smm.org/heart/lungs/top.html Innerbody system research: https://www.innerbody.com/htm/body.html Human Body Systems interactive website by	for your favorite sport?" Performance- Based Assessment: "Reaction Research" - Students design and conduct an investigation to explore how different factors affect reaction times, then share the results with game developers.

		-neuron -synapse -brain -spinal cord -gland -negative feedback -reflex		University of Utah http://www.uen.org/themepark/systems/human.shtml How the Body Works: KidsHealth; http://kidshealth.org National Geographic : Human Body http://science.nationalgeographic.com/science/healthand-human-body/human-body/	

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Unit #3: Reproduction and Growth

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 hence two alleles of each gene, one acquired from each parent. These versions may be identical or may be different from each other. ● Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. ● Animals engage in characteristic behaviors that increase the odds of reproduction. ● Genetic factors as well as local conditions affect the growth of the adult plant.	● What factors influence the growth of organisms and their ability to reproduce? ● How do organisms reproduce and transfer genes to their offspring? ● How do organisms grow and develop? ● How does genetic variation among organisms affect survival and reproduction? ● How do environmental and genetic factors influence an organism's growth?

Interdisciplinary Connections

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

- Example: Have students use data from a table to distinguish the relationship between animal size and gestation period, then construct a boxplot for each animal.

NJSLS Mathematics 7.SP.B.4: Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations:

- Example: Students will interpret information in a graph (showing number of survivors of species vs. age) to make an inference about the role of parental care for three separate animal species.

NJSLS Mathematics 8.EE.B.5: Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

- Example: Students will interpret data in a graph (human malnutrition and height) by calculating the differences between two populations over time.

NJSLS Comprehensive Health and Physical Education 2.1.8.PGD.2: Analyze how genetics and family history can impact personal health.

- Example: As part of the "Reproduction and Growth Unit," students will learn about the different types of diabetes, and compare how the different types have a genetic or environmental influence.

NJSLS Health and Physical Education 2.1.8.PGD.2: Analyze how genetics and family history can impact personal health.

- Example: Students will learn about different genetic diseases and how they can affect human health.

Career/Real World Connections

Careers

- Environmental biologists look at the environmental conditions of the habitats in which organisms live, sometimes designing landscapes to highlight specific organisms. Students can think like an environmental biologist and design a flower garden where each flower displays at least three tropisms, and lists the environmental conditions each flower would need for proper growth.
- Wildlife biologists study the behaviors of animals and the impact of the environment on animals' ability to survive and reproduce.
- A geneticist is a scientist who studies genes, including how they are inherited, mutated, activated, or inactivated. They often study the role that genes play in disease and health.

Real World Connections

- Genetically Modified Organisms (GMOs) are a current issue in the world of agriculture. GMOs are plants, animals, viruses ,and bacteria whose genetic makeup has been changed in a way that would not occur naturally through sexual or asexual reproduciton. Scientists are producing GMOs by selecting desirable traits from one organism and transferring them to another.
- Ants have a very structured set of behaviors that protect the colony and better ensure successful reproduction. The colony contains hundreds of thousands of ants with varying sizes and roles. They communicate through touching antennae, and exchanging pheromones that convey danger, food, caste, and reproductive status.
- Local parks take measures that promote the growth and development of the plant life found in that park or preserve.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-LS1-4 MS-LS1-5 MS-LS3-2	How do offspring produced by asexual reproduction and sexual reproduction compare? Why do different offspring of the same parent usually look different?	Students learn how organisms reproduce and transfer genes to their offspring. Students apply the process of asexual and sexual reporduction to explain the appearance of offspring. Students learn about the plant structures and processes related to plant reproduction, as well as the role other organisms play in the reproduction and growth of plants.	Phenomena: - Mouthbrooding fish https://thewonderofscience.com/phenomenon/2018/7/11/mouthbrooding-fish - Shrew caravan https://thewonderofscience.com/phenomenon/2018/7/5/shrew-caravan	Elevate Interactivities: - Your Physical Traits - Inheritance of Traits - Animal Reproduction - Plants and Pollinators	Exit slips Project rubrics Lesson quizzes and unit test Lesson checks

	Why do individuals of the same species vary in how they look, function, and behave? How do plants reproduce? How do seeds become new plants? Which specialized plant structures affect the probability of successful reproduction? What causes animals to behave in certain ways? What are some different ways in which animals reproduce? How can the behavior of animals increase their chances of reproducing? What stimulates plant growth? Which factors control plant and animal growth?	Students learn about animal behaviors related to reproduction, and how those behaviors affect the survival and growth of their offspring. Students examine the environmental factors that influence the growth and reproduction of organisms. **CCC.2 Cause and Effect** Students will explain how changes in genes can cause varying traits in offspring. <u>Key terms:</u> -asexual reproduction -sexual reproduction -fertilization -trait -gene -inheritence -allele -zygote -pollination -cones -ovule -fruit -germination -behavior -instinct -pheremone -mating system -migration -hormone -auxin -tropism -photoperiodtropism -dormancy -metamorphosis	- Movement of sunflowers with the sun - Wildlife returns from surrounding areas to areas humans have populated - Effects of ocean temperatures on the development and size of Atlantic cod. **SEP.7 Engaging in Argument from Evidence** Use arguments based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. **SEP.2 Developing and Using Models** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. **SEP.6 Constructing Explanations and Designing Solutions** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.	- Designer Flowers - Twin Studies - They're acting Like Animals! - Fireflies - The Mating Game - Growing and Thriving - Breeding Bigger Bovines - See How They Grow - Modeling Flowers - Growing Crops - Make Your Construction Case <u>Hands-On Labs:</u> - To Care or Not To Care - Is It All In the Genes? - Behavior Cycles - Watching Roots Grow Flower Dissection Lab https://www.nps.gov/common/uploads/teachers/lessonplans/Day2BeeWeek.pdf Challenges of Life https://www.bbc.co.uk/programmes/b00ncr13 Why Animals Migrate https://www.nationalgeographic.org/activity/why-animals-migrate/#:~:text=Animal%20Migration,-32&text=So	Reading checks QUEST project "How can we reduce the impact of construction on plants and animals?" Performance- Based Assessment: "Clean and Green" - Students will design and conduct an experiment to determine the effects on "eco-friendly" laundry detergents on plant growth.

			Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	me%20animals%2C%20such%20as%20the,on%20seasonal%20or%20geographic%20variations.	

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Unit #4: Ecosystems

Enduring Understandings:	**Essential Questions:**
● Organisms, and populations of organisms, are dependent on their environmental interactions, both with other living things and with nonliving factors. ● In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. ● Growth of organisms and population increases are limited by access to resources. ● Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. ● Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. ● The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.	● How do organisms interact with the living and nonliving environments to obtain matter and energy? ● How do matter and energy move through an ecosystem? ● What happens to ecosystems when the environment changes? ● Why is it important to preserve all components of an ecosystem?

Interdisciplinary Connections

NJSLS Mathematics 7.SP.A.1: Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

- Example: Students will graph numbers from a data table showing deer population over time and describe the trend they see in the graph. They will then determine possible factors that may have caused the trend they observe.

NJSLS Mathematics 7.RP.A.2b: Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

- Example: Calculate energy available at each level of a food pyramid and determine how this amount would change if the food web changes.

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 determine the dependent and independent variables in a graph showing the effects of nitrogen-fixing bacteria on soybean crops. They will use evidence from the graph to interpret the results of the bacteria treatment on soybean seed yield.

Career/Real World Connections

Careers

- Environmental scientists study the health of ecosystems by looking at the problems in the environment and investigate solutions. They follow the transfer of energy from one organism to another to understand what happens when this flow of energy is interrupted.
- Forest rangers help protect wildlife and educate communities about protecting natural resources. They monitor forest growth, set guidelines for use of the forests, monitor forest fires, and conduct research into the health of the ecosystem. Forest rangers have a strong background in biology and ecology.

Real World Connections

- Florida agriculture- producers are a vital part of the ecosystem because they are a food source for many other organisms. In 2014, 60 percent of all oranges grown in the US were from Florida's orange trees because of the climate.
- The National Oceanic and Atmospheric Administration (NOAA) studies algal blooms by the use of field observation, and collecting and testing water samples. They also use different technologies to collect data when studying algal blooms, such as satellite images, buoy data, and remote sensing technologies.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-LS2-1 MS-LS2-3	How are populations affected by changes to the amount and availability of resources? How are population size and resource availability related? What are the energy roles in an ecosystem? How is energy transferred between living and nonliving parts of an ecosystem?	Students investigate the organization of ecosystems and analyze evidence of the effects of limiting factors on resource availability, organisms, and populations of organisms within an ecosystem. Students model food and food webs to learn how energy flows between the living and nonliving things within ecosystems. Students model how organisms and their environments participate in the cycling of carbon, oxygen, nitrogen and water. **CCC.2 Cause and Effect**	Phenomena: - Rapid population decline of the migratory cerulean warbler population - Composting - Expedition to different Biomes - Management of forest and fisheries - Attack of the Killer Fungi https://thewonderofscience.com/phenomenon/2018/5/14/attack-of-the-killer-fungo - The Great Oxidation Event https://thewonderofscience.com/phenomenon/2018/6/15/the-great-oxygenation-event	Elevate Interactivities: - There's No Place Like Home - Factors Affecting Growth - An Ecological Mystery - Suspicious Activities - Food Sources - Living Things in Ecosystems - Energy Roles and Flows - A Changing Ecosystem - Nutrients and Aquatic Organisms	Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks Evidence-based assessment: Create a food web and describe the role of each organism in the web.

	How is energy conserved in an ecosystem? How is matter transferred between the living and nonliving parts of an ecosystem? How is matter conserved in an ecosystem?	Students will observe how changes in the food chain can affect entire ecosystems. **CCC.5 Energy and Matter** Students will show how the transfer of energy can be tracked as energy flows through a designed or natural ecosystem. <u>Key terms:</u> - organism - habitat - biotic factor - abiotic factor - population - community - ecosystem - limiting factor - producer - consumer - decomposer - food chain - food web - energy pyramid - Law of Conservation of Mass - Law of Conservation of Energy - evaporation - condenstaion - precipitation	- 50 Year old Ecosystem https://thewonderofscience.com/phenomenon/2017/10/8/ls2-ecosystems **SEP.4 Analyzing and Interpreting Data** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (MS-LS2-1) **SEP.2 Developing and Using Models** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (MS-LS2-3) Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	- Cleaning an Oil Spill - Recycling Your Energy - Earth's Recyclables - Matter and Energy in a Pond <u>Hands-On Labs:</u> - Elbow Room-explore effects of space as a limited resource - Modeling a dam - Observing Decomposers - Following Water PBS- Exploring Ecosystems https://nj.pbslearningmedia.org/resource/lsps07.sci.life.eco.lpexpecosystems/exploring-the-systems-in-ecosystems/ Scholastic Ecosystems https://www.scholastic.com/teachers/activities/teaching-content/ecosystems-11-studyjams-interactive-science-activities/ Ecosystems: Interactions, Energy and Dynamics https://www.ck12.org/ngss/middle-school-life-sciences/ecosystems:-interactions,-energy,-and-dynamics	QUEST project "What Do you Think is Causing Pleasant Pond to Turn Green?" Performance- Based Assessment: "Last Remains" - Students will design and carry out an investigation by observing remains found in an owl pellet. Based on their findings, students will make a claim based on their evidence stating whether or not the idea to introduce barn owl in the community will help bring the rodent population under control.

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Unit #5: Populations, Communities and Ecosystems

Enduring Understandings:	**Essential Questions:**
● Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. ● Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. ● Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. ● Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. ● Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. ● There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	● How do living and nonliving things affect one another? ● How can resource availability affect interactions between organisms? ● How can changes to physical or biological components of an ecosystem affect organisms and populations? ● What is the value of biodiversity?

Interdisciplinary Connections

NJSLS Mathematics 7.RP.A.2d: Explain what a point (x,y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0,1) and (1,*r*) where *r* is the unit rate.

- Example: Students will write a formula to show the amount of water filtered by 7 oysters in one day and use the formula to calculate the amount of water 5, 10, 15 and 20 oysters and filer. They will do the same with mussels, then graph the two sets of data to compare the results.

NJSLS Mathematics 7.RP.A.2d: Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

- Example: Students will use ratio reasoning when comparing the African lion population from 1950 to that of 2000, and use the ratio to determine the relationship between human population density and the lion population.

NJSLS Social Studies 6.1.5.GeoGI.4: Explain how cultural and environmental characteristics affect the distribution and movement of people, goods, and ideas.

- Students will describe how human populations and technology have impacted ecosystems and environments around the globe.

Career/Real World Connections

Careers

- An epidemiologist is a scientist who studies outbreaks of disease in human populations (such as the coronavirus which causes COVID-19). Their job is to determine how the outbreak started, how it was transmitted from person to person, and the most effective treatment. They investigate how populations are affected and the results of their investigations help other doctors and scientists figure out how to prevent future outbreaks.
- Field Biologists study living things and how they interact with the other living and nonliving things in their environment. They research the way all living things interact in an environment. They may monitor any disruptions within parts of an ecosystem and determine how populations of organisms might be impacted.
- Population ecologists study patterns to determine relationships between a specific population and the individuals and communities where they live. Community ecologists study patterns to determine the relationships among different populations within a geographic area

Real World Connections

- Urban development- highways are built to accommodate large companies, and create evacuation and supply roots for natural disasters. These highways impact the animal populations in these areas.
- One important reason that biodiversity is important to humans is its role in developing medicines (pharmaceutical). Examples of plants and animals that help create medications include the Pacific yew tree used to fight cancer cells, microbes used as a source of penicillin, and cone snails to help with neurological disorders.
- The National Wildlife Federation is an organization committed to observation. It strives to protect wildlife, help habitats, confront climate change, and advocate for conservation by supporting laws and policies.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-LS2-1 MS-LS2-2 MS-LS2-3	How is population size affected by predation and symbiotic relationships? How are patterns of interactions between organisms similar in different ecosystems?	Students model different types of relationships between organisms and how changes to one population may impact another. Students investigate how changes to abiotic factors in ecosystems impact populations.	Phenomena: - Florida's red tide https://www.youtube.com/watch?v=-WJ0hi_Pi44 - Invasive species: Hemlock Woolly Adelgid https://www.fs.usda.gov/naspf/	Elevate Interactivities: - Competition in Daily Life - Life on the Reef - Symbiotic Relationships - Shared Interactions	Exit slips Project rubrics Lesson quizzes and unit test Lesson checks

MS-LS2-4 MS-LS2-5 MS-LS4-1	How do natural events impact the environment? How do human activities impact ecosystems? What affects biodiversity? What factors affect biodiversity? How do human activities impact biodiversity? Why is it important to maintain healthy ecosystems? Which supporting services are necessary to all other ecosystem services? How does biodiversity impact ecosystem services?	Students investigate the importance of biodiversity; consider the scientific, economic, and social implications of human intervention in ecosystems and design solutions for maintaining biodiversity. Students learn how ecosystems are important to humans and consider design solutions for maintaining ecosystem service. **CCC.1 Patterns** Students will construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. **CCC.7 Stability and Change** Students will understand that small changes in one part of an ecosystem might cause large changes in another part. **CCC.2 Cause and Effect** Students will understand that there are relationships between resources and growth of individual organisms that affects the numbers of organisms in ecosystems during periods of abundant and scarce resources. <u>Key terms:</u> - niche - competition - predation - symbiosis - commensalism - mutualism - parasitism - succession - pioneer species - biodiversity - keystone species - extinction - invasive species	- Southern Pine Beetle Outbreak https://www.fs.fed.us/foresthealth/applied-sciences/mapping-reporting/spb-hazard-rating-maps.shtml - The role of the African elephant as a keystone species - The Wolves of Yellowstone https://www.nationalgeographic.org/media/wolves-yellowstone/ **SEP.4 Analyzing and Interpreting Data** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. **SEP.7 Engaging in Argument from Evidence** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. **SEP.2 Developing and Using Models** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	- Research Animal Crossings - Succession in an Ecosystem - A Butterfly Mystery - Community Options - Biodiversity in the Amazon - Preventing Soil Erosion - Maintaining Healthy Ecosystems - Human Impacts on Biodiversity - Diverse Systems - Walk This Way <u>Hands-On Labs:</u> - How Communities Change - Competition and Predation - Primary or Secondary - Modeling Keystone Species - Ecosystem Impacts Engineering Design Challenge: Students design and build a model of a geometric dome that could be filled with plants to showcase the biodiversity of a particular biome. PBS Population Dynamics https://nj.pbslearning	Reading checks QUEST project "Should an animal crossing be constructed in my community?" Performance-Based Assessment: "Changes in an Ecosystem" - Students will work with a model of a forests ecosystem to demonstrate how a forest fire changes the population sizes of longleaf pine trees and oaks. They will then construct an argument about the necessity of intentional forest fires to help preserve an endangered tree species.

			Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	media.org/subjects/science/life-science/ecology/population-dynamics/ Biology Corner-Ecology https://www.biologycorner.com/category/worksheets/ecology/	

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Unit #6: Distribution of Natural Resources

Enduring Understandings:	**Essential Questions:**
● Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. ● Conservation of non-renewable resources is vital to the world' health.	● How is the distribution of natural resources the result of geological processes? ● How can we use our resources in a more responsible way?

Interdisciplinary Connections

NJSLS Mathematics 7.EE.B.4a: Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently.

- Example: Students interpret information in a chart showing US Annual Natural Gas Consumption over time. They will determine the trend in the data and describe factors that may have contributed to this trend.

NJSLS Mathematics MP.2: Reason abstractly and quantitatively.

- Example: Students will represent quantitative relationships by creating a graph showing the production of industrial wind farms in the U.S. over the coming decades. Once they create this graph, they will analyze the data to make predictions.

NJSLS Social Studies 6.1.5.GeoPP.3: Use geographic models to describe how human movement relates to the location of natural resources and sometimes results in conflict.

- Example: Students will explain how many wars were fought over land and other natural resources in order to acquire economic value for their nations.

Career/Real World Connections

Careers

- Nuclear scientists who work with the International Energy Agency (IAEA) monitor the development of peaceful projects as well as the whereabouts of nuclear material such as uranium.
- A land use planner organizes and designs plans for land use. They evaluate population number and the environmental and economic factors that will be affected, normally working with land developers and public officials to establish a cost-effective, salubrious, and ethical habitat.
- An environmental planner largely deals with making sure that development projects comply with environmental laws and regulations. They help reduce impacts, facilitate environmental permitting, and write environmental reports and documents.

Real World Connections

- The use of solar power for generating electricity has been available for decades, but the demand for solar energy has risen in recent years. They are used in individual homes or solar power plants, and can be used to provide energy to people in countries without stable energy infrastructure.
- Silicon is a resource extracted from silica sand or quartz and is the main "ingredient" in the construction of computers. When the Technology Age was in its infancy, a large number of startups set up shop on a stretch of land near San Francisco. This area became known as "Silicon Valley."
- Fracking is the process of injecting liquid at high pressure into subterranean rocks, so as to force open existing fissures and extract oil or gas. Air pollution and water contamination due to the toxic chemicals used in hydraulic fracturing are the greatest concerns within fracking sites, while the need for wastewater disposal and shrinking water supplies are also pressing issues directly related to the procedure.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-ESS3-1 MS-ESS3-3 MS-ESS3-4	What are nonrenewable resources? What factors affect the distribution of nonrenewable energy resources? How has human activity impacted the distribution of fossil fuels? What are renewable energy resources? How do renewable energy resources reduce human reliance on other natural resources? What are mineral resources? What factors affect the distribution of minerals on Earth?	Students explore the diversity of nonrenewable energy sources and the impact of their scarcity on human energy use. Students investigate the difference between renewable and nonrenewable resources, the benefits of alternative energy sources, and methods to reduce fossil fuel use. Students learn about the diversity of minerals in the world and how humans use them. Students investigate the distribution and characteristics of water resources on Earth and learn about the human impacts of their use. **CCC.2 Cause and Effect** Students will understand that human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy) can cause changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. Key terms: - natural resource	Phenomena: - Phosphorus mining and the disruption of the phosphorus cycle - Urban Farming - Mineral formation - UAE Building a Mountain to Increase Rainfall https://thewonderofscience.com/phenomenon/2018/6/10/uae-building-a-mountain-to-increase-rainfall **SEP.6 Constructing Explanations and Designing Solutions** Construct a scientific explanation based on evidence for how the uneven distribution of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. Apply scientific principles to design a method for monitoring and minimizing	Elevate Interactivities: - Renewable Resources in Your Community - Using Renewable Resources - Biogas Farming - Distribution of Minerals - Surviving on Minerals - Drinkable Water - Wetland Restoration - Water Worth Hands-On Labs: - What's in a Piece of Coal? - Fossil Fuels - Distribution of Fossil Fuels - Using Resources - The Power of Wind - An Artesian Well Design Challenge- students will design a method to use hydro power on a small scale to generate power. PBS Natural Resources Videos	Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks QUEST project "How could natural resources have saved a ghost town?" Performance- Based Assessment: "To Drill or Not to Drill" - Students will develop a model that they can use to predict whether or not an oil company will locate oil below their town.

	How do geological processes affect the distribution of groundwater on Earth? How is water used as a resource?	- nonrenewable resource - fossil fuels - nuclear fission - renewable resource - ore - crystallize - desalination	the human impact on the environment. **SEP.7 Engaging in Argument from Evidence** Construct an argument supported by evidence for how increases in human population per-capita consumption of natural resources impact Earth's systems. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	https://nj.pbslearningmedia.org/subjects/science/earth-and-space-science/natural-resources/ Interpreting Resource Maps https://www.whiteplainspublicschools.org/cms/lib/NY01000029/Centricity/Domain/353/Resource%20Maps%20Geography.pdf PBS Future Fuels https://www.pbslearningmedia.org/resource/deb0cbd6-4a49-4e08-9dfb-14dd4c46bc2c/future-fuelsnc-science-now/support-materials/ Explained: The World's Water Crisis video https://www.youtube.com/watch?v=C65iqOSCZOY National Geographic Distribution of Resources https://www.nationalgeographic.org/idea/distribution-resources/ Earth's Water- A Drop in Your Cup https://www.calacademy.org/educators/lesson-plans/earths-water-a-drop-in-your-cup Nine Wars Caused by Commodoties https://www.businessinsider.com/nine-wars-that-were-fought-over-commodities-2012-8	

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Unit #7: Human Impacts on the Environment

Enduring Understandings:	**Essential Questions:**
● Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	● How does human activity impact Earth's systems? ● How has the rapid increase in human population impacted the planet? ● How do human impacts affect the environment? ● What are some solutions to fix or reduce the negative human impacts on the planet?

Interdisciplinary Connections

NJSLS Mathematics 7.RP.A: Analyze proportional relationships and use them to solve real-world and mathematical problems.

- Example: Students will analyze proportional relationships of how energy consumption has changed over time in the U.S. over the past century.

NJSLS Visual and Performing Arts 1.2.8.Cr1b: Organize and design artistic ideas for media arts productions.

- Example: Students create a public service announcement for a human impact of their choice. Their public service announcement will be designed as a digital poster or video.

NJSLS Computer Science and Design Thinking 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

- Example: Students will research innovative solutions for human impacts such as pollution and deforestation, and propose a way to use this technology or design a new technology which will help the environment.

NJSLS Social Studies 6.2.8.HistoryCC.1.a: Describe the influence of the agricultural revolution on population growth and the subsequent development of civilizations (e.g., the impact of food surplus from farming).

- Example: Students will explain how the Industrial Revolution led to human population growth by increasing the use of natural resource consumption over time.

Career/Real World Connections

Careers

- Environmental engineering is a fast-growing field in which engineers address environmental hazards that arise from human use of resources. They may specialize in sustainable land use, protecting water sources, managing waste, or even helping to design laws that protect the environment while allowing smart resource use.
- A career in environmental protection provides many avenues for someone with a passion for the environment. For example, they could focus on reducing the negative environmental impacts from human activity, helping restore damage ecosystems, or even developing sustainable ways of life that have yet to be created.

Real World Connections

- Some respiratory problems, such as asthma, bronchitis, and emphysema, are caused or worsened by breathing polluted air. Knowing the air quality in the area is important to know if a person has one of these respiratory concerns.
- People usually know how to reduce pollution or incorporate "green" routines in their lives, but often this doesn't happen. Reasons for lack of action could include convenience, cost, or even awareness.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-ESS3-4	How has the human population changed over time? How is the consumption of natural resources by humans affected by changes in population size? What are the causes of air pollution? What are the long-term negative impacts of air pollution? What efforts are being made to decrease the levels of air pollution around the world? What natural resources are obtained from Earth's geosphere? Why are natural resources on land so important to Earth's systems?	The various ways that humans impact Earth's systems form the context for this topic. Students will identify the ways that a growing human population uses and affects Earth's air, land , and water. Students will also identify ways to mitigate the impact of humans, using technology or sustainable-use policies. Students learn that as the human population increases, human need for natural resources also increases and that resource use has impacts on Earth's systems. Students learn about the causes of air pollution, the long-term impact it has on Earth's systems, and efforts to decrease the levels of air pollution around the world. Students investigate natural resources obtained from Earth's geosphere, the importance of these resources, and how human activities impact the availability of resources. Students learn why freshwater is a limited resource within Earth's systems, how human activities cause freshwater and ocean pollution, and how humans utilize technology and other methods to help limit freshwater and ocean pollution.	Phenomena: - Water treatment plant recycles sewage and yard waste into nutrient-rich soil and fertilizer - Mystery of the Missing Bees https://thewonderofscience.com/phenomenon/2018/5/13/the-mystery-of-the-missing-bees - Google maps timelapse https://thewonderofscience.com/phenomenon/2018/4/29/google-maps-timelapse - Easter Island Deforestation https://thewonderofscience.com/phenomenon/2017/10/8/ess3-earth-and-human-activity **SEP.7 Engaging in Argument from Evidence** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. Hands-On Labs Virtual Labs Online webquests	Elevate Interactivities: - Modern Life - Sources of Resources - More Trash, Less Space - Air Pollution Sources and Solutions - Trash vs. Water - Using Land - Farming Lessons - How You Use Water - Water Cycle Interrupted - Mutation Mystery - Wetland Restoration - Damage from the Skies - Ride the Light Rail Hands-On Labs: - Finding a Solution to Your Pollution - Growth Spurt - Doubling Time - How Does the Scent Spread?	Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks Scientific arguments (CER) QUEST project "How can you help your school reduce its impact on Earth's systems" Performance- Based Assessment: "Washing Away" - Students will design and conduct an investigation into the impact of vegetation and ground cover on soil erosion.

	How do human activities positively and negatively affect land resources? Why is freshwater such a limited resource within Earth's systems? How do certain human activities cause freshwater and ocean pollution? What methods have humans developed to reduce freshwater and ocean pollution?	**CCC.2 Cause and effect** Students will understand how human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. <u>Key terms:</u> - birth rate - death rate - exponential growth - pollution - overpopulation - conservation - sustainable use - point source - nonpoint source - emissions - ozone - acid rain - natural resource - renewable resource - nonrenewable resource - deforesatiaon - erosion - desertification - sustainable - sewage - sediment - thermal pollution	Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	- It's All in the Air - Mining Matters - Ride the Light Rail - Getting Clean - Reducing Waste - Trash vs. Water - Using Land Banning Plastic Water Bottles CER httpsnj.pbslearningmedia.org/resource/banning-plastic-bottles-video/above-the-noise/ Population Connection https://www.populationconnection.org/	

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Unit #8: Waves and Electromagnetic Radiation

Enduring Understandings:	**Essential Questions:**
● A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. ● When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. ● The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. ● A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. ● However, because light can travel through space, it cannot be a matter wave, like sound or water waves. ● A sound wave needs a medium through which it is transmitted.	● What are the properties of mechanical and electromagnetic waves? ● How does the structure of a wave impact it's behavior and characteristics? ● How do changes in one part of a wave affect other parts of a wave? ● How do waves interact with each other?

Interdisciplinary Connections

NJSLS Mathematics 6.RP.A.2: Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a reaction relationship.

- Example: Students will use the data from a table to examine relationships between wavelength and frequency, and between wavelength and speed. They will infer what the missing numbers are based on the data provided.

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

- Example: Students will identify the proportional relationship between voltage and current by using the equation *Voltage = current x resistance*

Career/Real World Connections

Careers

- X-ray technicians are crucial members of many medical science teams. Their ability to help safety and accurately image parts of bodies can help doctors diagnose and treat many different conditions. Most work side-by-side with doctors to treat patients.
- A lighting designer plans how to light a stage or performance space. The designer uses three factors- color, intensity, and motion- to light a show in the most striking and effective way possible.

Real World Connections

- Lasers are key components of many of the products that we use every day. Consumer products like Blu-Ray and DVD players rely on laser technology to read information from the disks. Barcode scanners rely on lasers for information processing. Lasers are also used in many surgical procedures such as LASIK eye surgery.
- Sound and light pollution - Excessive sound waves, or sound pollution, can have a detrimental effect on quality of life by causing stress, while sound waves of excessive volume (i.e., amplitude) can damage hearing. Nighttime illumination can interfere with animal behavior and disrupt human sleep. Some cities have ordinances to control the levels of sound and light waves to reduce sound and light pollution.
- During a tsunami (tidal wave), waves in the deep ocean can interact via constructive interference, becoming massively powerful and causing a great deal of destruction. Tsunamis can damage roads and other means of transport, or block them with debris making reconstruction even more difficult. A warning system enables residents to seek shelter and safety early and reinforce their homes and businesses, reducing the damage of the wave and making it easier to resume their regular lives.
- The human ability to hear high frequencies generally degrades over time. A person's hearing range can also be impacted by hearing damage related to exposure to loud sounds. Listening to loud music or being near very loud sounds such as jet engines, can increase the rate of hearing loss.
- Music therapy- sound in the form of music has a strong connection with the brain. Scientists studying the brain found that when people hear music, the parts of their brain responsible for control of movement, emotions, and creativity become activated. Brain scientists have also found that the brain is more plastic (able to change) than once thought.
- The human eye focuses light in a number of steps to produce sharp images. Light enters the eye through the cornea, which refracts light due to its shape - convex - and to the differences in refraction indices between it and air. Light then moves through the pupil (controlled by muscles in the iris) and into the lens. Light then travels into the vitreous humor and the image is projected on the retina. Nerve impulse travel from the retina to the brain where a visual image is formed.

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
MS-PS4-1 MS-PS4-2 MS-PS4-3	How can you use a simple model to describe a wave and its features? How can you observe the properties of waves? What kinds of patterns can you predict based on wave properties? How are sound waves reflected?	Students examine and model different properties of waves. They compare the properties of different types of waves and compare how they transfer energy. Students investigate the ways that waves can react when they strike materials and the effects of interactions between waves. Students investigate how sound waves interact with matter through reflection, absorption, transmittal, and diffraction and how properties of materials affect the speed of sound.	Phenomena: - Role of waves in a baseball game - Jets breaking the sound barrier (sonic boom) https://www.youtube.com/watch?v=6B4IVcCuIZE - Rainbows and moonbows - Cell phones networks (4G & 5G) - Helium changing your voice - Shark tracking https://www2.whoi.edu/site/osl/vehicles/remus-sharkcam/ **SEP.2 Developing and Using Models**	Elevate Interactivities: - Describe the Properties of Waves - Modeling Waves - Making Waves - Light behavior - Model Wave Interactions - Use Models to Describe Wave Behavior - Virtual Optics - Reflection, Transmission, and	Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks Design Challenge "Say 'Cheese'"

	How are sound waves affected by medium? What factors affect the speed of sound waves? What makes up an electromagnetic wave? How can you model electromagnetic wave behavior? What kinds of waves make up the electromagnetic spectrum?	Students learn about the different types of electromagnetic waves, how they compare, and how they are used. Students model light-matter interactions to determine how transparent, translucent, opaque, and colored materials reflect and absorb light. Students also model how light interacts with concave and convex lenses. **CCC.1 Patterns** Students will identify patterns based on wave properties such as how amplitude of a wave is related to the energy in a wave. **CCC.6 Structure and Function** Students will develop and use a model to describe that a structure of a wave can be modified to serve particular functions by taking into account properties of different materials and how materials can be shaped and used. <u>Key terms:</u> - wave - mecahnical wave - medium - electromagnetic radiation - transverse wave - amplitude - longitudinal wave - wavelength - frequency - reflection - refraction - diffraction - absorption - interference - standing wave - resonance - loudness - intensity - decibel - pitch	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. **SEP.5 Using Mathematics and Computational Thinking** Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	Absorption of Sound Waves - Sound - Doppler Effect - Build an Electromagnetic Wave - Models of Light - Describe Electromagnetic Waves - Reflecting on Reflections - Describe the Behavior of Light - Predicting the Behavior of Light Rays <u>Hands-On Labs:</u> - Waves and Their Characteristics - Follow the Bouncing Ball - Standing Waves and Wave Interference - Understanding Sound - Build a Wave - Light Interacting With Matter - An Optimal Optical Solution PBS- Making Waves with the Electromagnetic Spectrum https://nj.pbslearningmedia.org/resource/phy03.sci.phys.energy.lp_emspect/making-wave	QUEST project - "How Can you Design a System to Stop a Thief?" Performance-Based Assessment "Making Waves" - Students will model the behavior of water waves and explain how the waves interact with each other and with objects in their paths.

		- Doppler effect - electromagnetic wave - electromagnetic spectrum - radio waves - microwaves - visible light - ultraviolet rays - infrared rays - X-rays - gamma rays		s-with-the-electromagnetic-spectrum/ CPalms- The Electromagnetic Spectrum https://www.cpalms.org/Public/PreviewResourceLesson/Preview/18939 NASA- The Electromagnetic Spectrum Video Series & Companion Book https://science.nasa.gov/ems	

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Unit #9: Electricity and Magnetism

Enduring Understandings:	**Essential Questions:**
● Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). ● 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. ● Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.	● What factors affect the strength of electric and magnetic forces? ● How does electricity relate to magnetism? ● How do magnetic poles interact? ● How do the properties of magnets allow them to be useful to society?

Interdisciplinary Connections

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

- Example**:** Students will draw comparative inferences by using a data table to determine how current affects the strength of the magnetic field.

NJSLS Mathematics 7.RP.A.2a Decide whether two quantities are in a proportional relationship.

- Example**:** Students will use an equation that shows the ratio of voltage in two coils is equal to the ratio of loops. They will show each proportional relationship as a fraction.

NJSLS Computer Science and Design Thinking 8.2.8.ED.4: Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team.

- Example: Students will use an online virtual lab to hypothesize and troubleshoot the reason for a lightbulb not working properly.

Career/Real World Connections

Careers

- Electrical engineers design and develop a wide variety of electric systems. Transportation, communication, power transmission, and motor controls are some of the many types of systems an electrical engineer might work on.
- Robotic Engineers - Electromagnets are commonly used in all kinds of robotic devices. The electromagnets create an electric current to power the robotics to make the motor spin and cause the robot to move. Robotics engineers design, test and build the robotic parts, which are able to operate on their own or are controlled by an individual. Robots are used in the aerospace, entertainment, automotive, computer, and nuclear industries.
- MRI Technicians - Electromagnets are used in magnetic resonance imaging (MRI) machines to create a magnetic field around a patient and look inside a patient's body. The magnetic forces send radio waves throughout a patient's body and create pictures of the tissues. MRI technicians are responsible for

preparing and executing an MRI procedure. Not only do they explain the procedure to the patient, but they also help move the patient onto the MRI platform. Once the MRI procedure is complete, technicians develop the images and pass them on to physicians.

Real World Connections

- "Maglev" trains - In Japan, South Korea, and China, you can hop on a train that uses electromagnets to levitate above a rail above a rail and travel at incredibly high speeds. Magnetism is used to elevate this "maglev" train several centimeters above the tracks and also to propel it forward. The absence of friction between the train and the track allows the mangle train to achieve speeds up to 600 kilometers per hour.
- Animal Magnetism - Scientists have discovered that some are able to use the magnetic field around Earth to navigate. Loggerhead turtle hatchlings, for example, use magnetism to travel thousands of miles through the ocean back to their birthplace. Homing pigeons use magnetism to find their way back home. Scientists hypothesize that art of this ability is due to small amounts of an iron-containing compound in the animals' brains that can sense and respond to Earth's magnetic field.
- Cosmic Rays - Cosmic rays are high-energy protons and atomic nuclei which move through space at nearly the speed of light. They originate from the sun, from outside of the solar system, and from distant galaxies. The charged particles in cosmic rays are deflected by the magnetic field and many are prevented from hitting the atmosphere directly. Some particles in the Belts, the solar wind and cosmic rays, are deflected by the magnetic field to the North and South Poles, creating the auroras.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-PS2-3 MS-PS2-5 MS-PS3-2	What causes electric fields and electric forces? How is potential energy affected by positions of changes? How is static electricity different from current? How can you change the magnetic force and potential energy between objects? How can you detect and describe a magnetic field? How can you describe the magnetic field produced by a current?	Students identify evidence that electric force is exerted by invisible fields that extend through space and model how the potential energy of two interacting electric charges changes when their position changes. Students differentiate between static electricity and current. Students identify evidence that magnetic force is exerted by invisible fields that extend through space and model how the potential energy of two interacting magnets changes when their position changes. Students identify evidence of a planetary magnetic field around Earth. Students learn that a magnetic field is created by current, and they investigate this phenomenon by building and determining how to control solenoids and electromagnets. Students analyze diagrams of motors and generators that show that an electromagnet	Phenomena: - Bumblebees respond to flowers' electrical fields - Wind turbines https://interactives.ck12.org/simulations/physics/wind-turbine/app/index.html?utm_source=projectphenomena&utm_medium=website&utm_campaign=ngss - Auroras - Magnetic slime - Programmable magnets https://www.youtube.com/watch?v=drD416THU7Y&feature=youtu.be **SEP.1 Asking Questions and Defining Problems** Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.	Elevate Interactivities: - Electric Currents - Theremin - Charged Interactions - Apply Electrical Forces - Interactions of Magnetic Fields - Modeling Magnetic Fields - Electricity and Magnetism - Electromagnetic Evidence - Electric motors - Generators Hands-On Labs: - Magnetic Poles	Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks Scientific arguments (CER) QUEST Project "How can you lift an object without making contact?" Performance-Based Assessment " Planetary

	What are the properties of solenoids and electromagnets? How do magnetic fields affect moving charges? How do generators and transformers work?	moves when it is placed in a magnetic field and current flows through a conductor when there is a relative motion between it and a magnetic field. Students identify the energy transformation that occurs in each device. **CCC.2 Cause and Effect** Students will describe what changes and what occur in the magnetic field when a current flows in the opposite direction. **CCC.4 Systems and System Models** Students will draw the magnetic field lines around a nail which has its head as its north pole and its point as its south pole to model the electromagnetic field. <u>Key Terms:</u> - electron - electric force - electric field - electric current - conductor - static electricity - magnet - magnetism - magnetic force - magnetic pole - magnetic field - electromagnetism - solenoid - electromagnet	**SEP.2 Developing and Using Models** 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. **SEP.3 Planning and Carrying Out Investigations** Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces to each other even though the objects are not in contact. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos Science Stations Interactive Science Journals Digital Learning	- Uncanny Attractions - Detecting Charges - Charged Interactions - Detecting Fake Coins - Tracking Levitation - Electric Current and Magnetism - Build an electromagnet - Electric, Magnetic Motion Exploratorium https://www.exploratorium.edu/snacks/subject/electricity-and-magnetism STEM Learning-Electricity and Magnetism https://www.stem.org.uk/best/physics/big-idea-electricity-and-magnetism Science Buddies - Electricity, Magnetism, & Electromagnetism Tutorial https://www.sciencebuddies.org/science-fair-projects/references/electricity-magnetism-electromagnetism-tutorial#introduction	Detective" - Students will build a simple magnetometer to detect magnetic fields to test models of three planets. They will use evidence from their investigation to decide which planets have magnetic fields and which one most likely could support life.

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Unit #10: Information Technologies

Enduring Understandings:	**Essential Questions:**
● Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.	● Why are digital signals a reliable way to produce, store, and transmit information? ● How are instruments that transmit and detect waves used to expand human senses?

Interdisciplinary Connections

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

- Example: Using Ohm's law, students will demonstrate simple calculations that show patterns between changes in resistance and current and between changes in voltage and current.

NJSLS Computer Science and Design Thinking 8.1.8.CS.1: Recommend improvements to computing devices in order to improve the ways users interact with the devices.

- Example: Students will compare bandwidth sizes and how an increase in bandwidth (Ex: 5 GB) improves speed of transmission signal.

Career/Real World Connections

Careers

- Software developers affect virtually every part of our lives – and definitely our virtual lives. Software developers invent the technologies we sometimes take for granted such as apps, social media, personal calendars, etc.
- Hardware engineers draw on computer engineering to develop hardware, either for use within an organization, or as a product to be sold commercially. Hardware engineers work in teams with other technology professionals and scientists to design, build, and troubleshoot existing computer hardware or entirely new hardware. Hardware engineers work with the goals of maximizing technological efficiency, minimizing issues and errors, and meeting current technological needs.
- Data scientists direct the gathering and application of data for a variety of organizations, including corporations and government agencies. Data scientists approach the retrieval, storage, and implementation of data and data systems from a broad view. They work to develop large-scale models of how an organization relates to its data. Individuals in this field consider methods of data mining, methods of storage and conveyance, hardware and software, trends in data, and niche applications of data.

Real World Connections

- Inventors - Making electricity work requires both scientists and inventors. Thomas Edison and Nikola Tesla are two well-known inventors who worked on electricity generation.
- GPS - People use the global positioning system, or GPS, to determine their location. GPS has 24 satellites orbiting the Earth. Each satellite constantly sends out radio signals with information about current time and the signals with information about current time and the satellite's position. A GPS receiver

receives these signals from the satellites that are closest to it. The receiver can determine its distance from those satellites by using the time of travel of the signal.

- Cell Phones - The number of cell phones used worldwide is almost 5 billion. It's the cell in cell phones that makes these devices work. Cells are small hexagona areas of land, each equipped with its own cell tower. Every cell phone caller must use a frequency different from other nearby callers; within each cell all frequencies can be used. When a person makes a call, the cell tower near them receives their signal and relays it to the cell tower that is near the person they are calling.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
MS-PS4-3	What are the components of a circuit? How does Ohm's law apply to circuits? What is the difference between a series circuit and a parallel circuit? How is information sent as signals? What are digital and analog signals? How are signals transmitted?	Students identify the three components of electric circuits and describe relationships among voltage, current, and resistance. Students model series and parallel circuits. Students describe the possible ways that information signals can be sent and model the encoding of information into analog and digital signals. Students describe different kinds of communication technologies and mode the transmission of analog and digital signals in order to compare their reliability and security. **CCC.6 Structure and Function** Students will be able to explain the cause of a malfunctioning light bulb in their construction of a parallel circuit. <u>Key terms:</u> - electrical circuit - voltage - resistance - Ohm's law - series circuit - parallel circuit - wave pulse - electronic signal - electromagnetic signal	<u>Phenomena:</u> - Pacemakers - High-Definition TV's - Analog vs. Digital Televisions https://thewonderofscience.com/phenomenon/2018/7/7/analog-vs-digital-television **SEP.8 Obtaining, Evaluating and Communicating Information** Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. Hands-On Labs Virtual Labs Online webquests Topic Enrichments Graphic Organizers Scientific arguments (CER) Science Videos	<u>Elevate Interactivities:</u> - Electric Circuits - Light the Lights - Electricity Your Heartbeat - Analog and Digital Signals - I've Got to Take This Call - Digitized Images - Analog and Digital Recordings - Technology and Communication - Film Cameras and Digital Cameras - Signal Reliability <u>Hands-On Labs:</u> - Continuous or Discrete? - Do the Lights Keep Shining? - Electric Current and Voltage - Constructing a Microphone - Constructing a Simple Computer Circuit	Exit slips Project rubrics Lesson quizzes and unit test Lesson checks Reading checks QUEST project "What is the best way to record sound for my scenario?" Performance-Based Assessment "Over and Out" - Students will design models that help visitors recognize that digital signals are a more valuable way than analog signals to transmit data and information.

		- digital signal - analaog signal - pixel	Science Stations Interactive Science Journals Digital Learning	- Let the Music Play PBS Electric Circuits https://nj.pbslearningmedia.org/resource/phy03.sci.phys.mfe.lp_electric/electric-circuits/ How is Electricity Generated? https://www.earthecho.org/educator-resources/how-is-electricity-generated-middle-school-lesson-plan Teach Engineering - What is Electricity? https://www.teachengineering.org/lessons/view/ucd_electricity_lesson01 Get Connected With Ohm's Law https://tryengineering.org/teacher/get-connected-ohms-law/	

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 • Spell-checker • Audio-taped books	• Extended time • Study guides • Shortened tests • Read directions aloud	• Consistent daily structured routine • Simple and clear classroom rules • Frequent feedback	• Individual daily planner • Display a written agenda • 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 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, 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/