Randolph Township Schools
Randolph Middle School

Grade Six Science Curriculum

"It is the tension between creativity and skepticism that has produced the stunning and unexpected findings of science."

-Carl Sagan

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Randolph Township Schools
Department of Science, Technology, Engineering, & Mathematics
Grade 6 Science

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Randolph Township Schools

Mission Statement

We commit to inspiring and empowering all students in Randolph schools to reach their full potential as unique, responsible and educated members of a global society.

Randolph Township Schools
Affirmative Action Statement

Equality and Equity in Curriculum

The Randolph Township School district ensures that the district's curriculum and instruction are aligned to the state's standards. The curriculum provides equity in instruction, educational programs and provides all students the opportunity to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socioeconomic status.

N.J.A.C. 6A:7-1.7(b): Section 504, Rehabilitation Act of 1973; N.J.S.A. 10:5; Title IX, Education Amendments of 1972

RANDOLPH TOWNSHIP BOARD OF EDUCATION
EDUCATIONAL GOALS
VALUES IN EDUCATION

The statements represent the beliefs and values regarding our educational system. Education is the key to self-actualization, which is realized through achievement and self-respect. We believe our entire system must not only represent these values, but also demonstrate them in all that we do as a school system.

We believe:

- The needs of the child come first
- Mutual respect and trust are the cornerstones of a learning community
- The learning community consists of students, educators, parents, administrators, educational support personnel, the community and Board of Education members
- A successful learning community communicates honestly and openly in a non-threatening environment
- Members of our learning community have different needs at different times. There is openness to the challenge of meeting those needs in professional and supportive ways
- Assessment of professionals (i.e., educators, administrators and educational support personnel) is a dynamic process that requires review and revision based on evolving research, practices and experiences
- Development of desired capabilities comes in stages and is achieved through hard work, reflection and ongoing growth

Randolph Township Schools
Department of Science, Technology, Engineering, & Mathematics
Introduction

Randolph Township Schools is committed to excellence. We believe that all children are entitled to an education that will equip them to become productive citizens of the 21st century. We believe that an education grounded in the fundamental principles of science, technology, engineering, and math (STEM) will provide students with the skills and content necessary to become future leaders and lifelong learners.

A sound STEM education is grounded in the principles of inquiry, rigor, and relevance. Students will be actively engaged in learning as they use real-world STEM skills to construct knowledge. They will have ample opportunities to manipulate materials and solve problems in ways that are developmentally appropriate to their age. They will work in an environment that encourages them to take risks, think critically, build models, observe patterns, and recognize anomalies in those patterns. Students will be encouraged to ask questions, not just the "how" and the "what" of observed phenomena, but also the "why". They will develop the ability, confidence, and motivation to succeed academically and personally.

STEM literacy requires understandings and habits of mind that enable students to make sense of how our world works. As described in Project 2061's *Benchmarks in Science Literacy*, *The Standards for Technological Literacy*, and *Professional Standards for Teaching Mathematics*, literacy in these subject areas enables people to think critically and independently. Scientifically and technologically literate citizens deal sensibly with problems that involve mathematics, evidence, patterns, logical arguments, uncertainty, and problem-solving.

Grade 6 Science
Introduction

The Grade 6 Science Course is the first of three middle school Science courses. We believe that all children are entitled to an education that will equip them to become productive citizens of the 21st century. We believe that an education grounded in the fundamental principles of science inquiry and rigor will provide students with the skills and content necessary to become future leaders. Students would be actively engaged in learning as they model real-world scientific behaviors to construct knowledge. This course introduces key concepts and skills that are essential for students as they prepare for the second course of Science. Students will gain an understanding of concepts pertaining to Earthy systems, reproductive success, ecosystems, forces and motion, interactions, astronomy, weather and climate, NJ ecosystems services and biodiversity, and minerals. They will have ample opportunities to manipulate materials in ways that are developmentally appropriate to their age. They will work in an environment that encourages them to take risks, think critically, build models, observe patterns, and recognize anomalies in those patterns. Students should be encouraged to ask questions, not just the "how" and the "what" of observed phenomena, but also the "why". Scientific literacy requires understandings and habits of mind that enables students to make sense of how the natural and physical worlds work. As described in Project 2061's *Benchmarks in Science Literacy*, scientific literacy enables people to think critically and independently. Scientifically literate citizens deal sensibly with problems that involve evidence, patterns, logical arguments, and uncertainty. The science curriculum has been developed with age appropriate activities and expectations to achieve these goals.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Curriculum Pacing Chart
Grade 6 Science

SUGGESTED TIME ALLOTMENT (days)	UNIT NUMBER	CONTENT - UNIT OF STUDY
1 Week	**I**	Earth Systems Overview
3 Weeks	**II**	Reproductive Success within Ecosystems
4 Weeks	**III**	Ecosystems
4 Weeks	**IV**	Forces and Motion
3 Weeks	**V**	Interactions
8 Weeks	**VI**	Astronomy
9 Weeks	**VII**	Weather and Climate
3 Weeks	**VIII**	New Jersey Ecosystem Services and Biodiversity
1 Week	**IX**	Minerals

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science
Unit I: Earth Systems Overview

<table>
<tr><td rowspan="5">STANDARDS / GOALS:

<u>NGSS:</u>

MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales (ESS2.A: Earth’s Materials and Systems)</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Earth’s systems have parts that work together allowing matter and energy to move through them.</td><td>• How can matter and energy flow through systems?</td></tr>
<tr><td>Earth’s spheres are systems and these systems continually interact affecting biotic and abiotic factors in both positive and negative ways.</td><td>• How can interactions within Earth’s systems be positive or negative?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

The geosphere is Earth’s crust, mantle, and core; the hydrosphere is water in all forms; the atmosphere is composed of gasses; and the biosphere is all living organisms.

Biotic and abiotic components are evident in the geosphere, hydrosphere, atmosphere, and biosphere.

Interactions occur between the four spheres that make up the earth system.</td><td>Students will be able to:

Identify characteristics of each of Earth’s spheres.

Categorize biotic and abiotic factors in each of earth’s spheres.

Determine and illustrate how natural phenomena, such as a volcanic eruption, affect earth’s spheres.</td></tr>
</table>

	Matter flows through systems in cycles to sustain Earth's processes from energy produced from the sun and Earth's core. **VOCABULARY:** sphere, system, interaction, energy flow, solid, liquid, gas, local, global **KEY TERMS:** geosphere, hydrosphere, atmosphere, biosphere, biotic, abiotic, matter, crust, mantle, core	Follow the flow of energy within the earth's spheres. Describe how earth systems interact based on an event including matter and energy.

ASSESSMENT EVIDENCE: Students will show their learning by:

- Reflection including asking questions and
- Collaborative discussion
- Record observations
- Explanatory writing
- Analyzing and interpreting data
- Research of primary and secondary resources
- Engaging in argument from evidence

KEY LEARNING EVENTS AND INSTRUCTION:

- Sphere walk: Students will identify biotic and abiotic factors. Students will categorize these factors into the four spheres.
- Images: Students will view pictures of systems with or without disturbances. Students will then discuss the biotic and abiotic factors in the visible spheres, describe system interactions, and identify possible disturbances and repercussions.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science
Unit I: Earth Systems Overview

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
1 week	**Earth Systems Overview**	*NEWSELA* *Pearson Interactive Textbooks* *NJ Model Curriculum Resources* *https://www.classzone.com/books/earth_science/terc/content/investigations/es0103/es0103page01.cfm?chapter_no=investigation* *http://serc.carleton.edu/introgeo/earthsystem/nutshell/index.html*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science
Unit II: Reproductive Success within Ecosystems

<table>
<tr><td rowspan="6">STANDARDS / GOALS:

<u>NGSS:</u>

MS-LS1-4: Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

MS-LS1-5: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Growth of organisms depends on inherited characteristics and the quality of the environment.</td><td>• What conditions are essential for living things to have long term success in a system?</td></tr>
<tr><td>Animals and plants have specialized behaviors, reproductive parts, adaptations, and strategies that help them to successfully reproduce.</td><td>• What factors are essential in living things for long term success in a system?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Favorable conditions for plant growth are sunlight, water, nutrients, soil, and air.

Flowers have specialized parts for reproduction including pistil, stigma, style, ovary, petal, sepal, stamen filament and anther.

Some plants attract pollinators by making bright flowers, smells, and providing nectar.

Favorable conditions for animal’s reproduction include food, water, shelter, space, and mates.</td><td>Students will be able to:

Design an experiment to explore plant growth conditions.

Dissect a flower and identify specialized parts.

Discover methods plants use to attract pollinators.

Discover cause and effect relationships that accumulate in reproductive success.</td></tr>
</table>

	Animals attract a mate by having colorful plumage, vocalizing, and making nests. Animals keep young alive by choosing a safe nesting site location, time to raise young, and number of young (R and K model). Animal survival instincts include herding, flocking, or schooling. Successful reproduction of animals and plants may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability. **VOCABULARY:** behavior, reproduction, specialized **KEY TERMS:** essential, biological success, seed dispersal, competition with species, pollination, vocalization, schooling, herding, flocking, fertilization, plumage, petal, sepal, female, pistil, stigma, style, ovary, ovules, male, stamens, anther, filament, pollen, dispersal	Collect data from video footage of animal behavior. Identify factors animals utilize to increase the success rate for the survival of their offspring. Examine the survival instincts of animals. Construct argument based on empirical evidence and scientific reasoning to support oral and written explanations for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

ASSESSMENT EVIDENCE: Students will show their learning by:

- Reflection including asking questions
- Collaborative discussion
- Planning and carrying out investigations
- Explanatory writing
- Developing and using models
- Analyzing and interpreting data
- Research of primary and secondary resources
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

KEY LEARNING EVENTS AND INSTRUCTION:

- Utilize science and engineering practices to design and preform an experiment on plant pollination.
- Research what plants need to grow and present findings
- Find seeds in nature and bring into school for seed dispersal activity
- Journal observations from plant experiment
- Observe Lily flower's specialized reproductive parts
- Read NEWSELA article with pollination (example: Chinese pear orchards that utilize human pollination)
- Observe and analyze animal behaviors for reproduction and survival via video clips

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science
Unit II: Reproductive Success within Ecosystems

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
3 weeks	**Reproductive Success within Ecosystems**	*NEWSELA* *Pearson Interactive Textbooks* *NJ Model Curriculum Resources* *Lab Aids Ecosystems*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science
Unit III: Ecosystems

<table>
<tr><td rowspan="6">STANDARDS / GOALS:

<u>NGSS:</u>

MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Changes in matter and energy (resources) affect populations in ecosystems.</td><td>• How do changes in the availability of resources affect populations?</td></tr>
<tr><td>Patterns of interactions among organisms across multiple ecosystems can be identified and predicted.</td><td>• How can patterns of interactions between organisms be used to make predictions among and within systems?</td></tr>
<tr><td>The stability of an ecosystem can be evaluated by tracing the flow of matter and energy within that ecosystem.</td><td>• What conditions determine the stability of a system?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with others for limited resources which may constrain organisms’ growth and reproduction.

Organisms and populations of organisms are dependent on their environmental interactions with other living and nonliving things.</td><td>Students will be able to:

Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

Use cause-and-effect relationships to predict the effect of resource availability on organisms and populations in natural systems.</td></tr>
</table>

	Science assumes that objects and events in ecosystems occur in consistent patterns that are understandable through measurement and observation. The patterns of interactions of organisms with their environment, both its living and nonliving components, are used to make predictions about relationships among and between organisms and abiotic components of ecosystems. Predatory interactions may reduce the number of organisms or eliminate whole populations of organisms while mutually beneficial interactions may become so interdependent that each organism requires the other for survival. Food webs are models that demonstrate how matter and energy are transferred among producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter and energy into and out of the physical environment occur at every level and are cycled repeatedly between the living and nonliving parts of the ecosystem. **VOCABULARY:** organism, stability, population, resource, energy, environment, recycle, nutrient **KEY TERMS:** matter, ecosystems, composition, adaptations, food webs, ecosystem collapse, biodiversity, invasive species, producers, consumers, decomposers,	Identify consistent patterns in ecosystems through measurement and observation. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems (Include qualitative or quantitative relationships between variables as part of explanations about interactions within ecosystems.) Make predictions about the impact within and across ecosystems of competitive, predatory, or mutually beneficial relationships as abiotic (e.g., floods, habitat loss) or biotic (e.g., predation) components change. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. Track the transfer of energy as energy flows through an ecosystem.

	mutually beneficial (symbiotic), predatory, competition, parasitic, commensalism, trophic levels	

ASSESSMENT EVIDENCE: Students will show their learning by:

- Reflection including asking questions and collaborative discussion
- Inquiry-based lab activities
- Planning and carrying out investigations
- Explanatory writing
- Developing and using models
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Research of primary and secondary resources
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

KEY LEARNING EVENTS AND INSTRUCTION:

- Population study that focuses on competition for resources
- Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem
- Adaptation activity (e.g., bird beaks)
- Construct an explanation about interactions within ecosystems
- Jigsaw biomes or ecosystems with the purpose of constructing an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- Make predictions about the impact within and across ecosystems of competitive, predatory, or mutually beneficial relationships as abiotic (e.g., floods, habitat loss) or biotic (e.g., predation) components change.

RANDOLPH TOWNSHIP SCHOOL DISTRICT

Grade Six Science

Unit III: Ecosystems

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
4 weeks	**Ecosystems**	*NEWSELA* *Pearson Interactive Textbooks* *NJ Model Curriculum Resources* *Lab Aids Ecosystems*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science Curriculum
UNIT IV: Forces and Motion

<table>
<tr><td rowspan="5">STANDARDS / GOALS:

<u>NGSS:</u>

MS-PS2-1: Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects.

MS-PS2-2: Plan an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object.

MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Newton’s laws of motion dictate how objects react to changes in force and mass, and how objects react to collisions.</td><td>• What factors change an object’s motion? How do these factors alter motion?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Motion is defined as changing distance over time relative to a stationary reference point.

For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton’s third law).</td><td>Students will be able to:

Define relative motion and reference points.

Identify if something is in relative motion when given a particular reference point by investigation the location of the object in question over a given time period.

Hypothesize what will happen if two objects collide.

Define a design problem involving the motion of two colliding objects that can be solved through the development of an object, tool, process, or system and that includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.</td></tr>
</table>

combined into a new solution to better meet the criteria for success. **MS-ETS1-4:** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.		Apply Newton's third law to design a solution to a problem involving the motion of two colliding objects.
	Models can be used to represent the motion of objects in colliding systems and their interactions, such as inputs, processes, and outputs, as well as energy and matter flows within systems.	Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.
	The greater the mass of the object, the greater the force needed to achieve the same change in motion.	Identify what factors affect the motion of an object.
	The change in an object's motion depends on balanced (Newton's first law) and unbalanced forces in a system. Evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object includes qualitative comparisons of forces, mass, and changes in motion (Newton's second law).	Explain how object's motion depends on balanced, unbalanced forces, mass, and changes in motion in a system using Newton's first and second laws as evidence. Plan an investigation individually and collaboratively to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
	VOCABULARY: force, motion, mass, gravity, collide, interaction, balanced, unbalanced, direction, weight, friction, air resistance, problem, brainstorm, design, invention, iteration, modify, test, **KEY TERMS:** Newton's laws, force and motion, net forces, acceleration, engineering, design process, constraint, innovation, iteration, prototype, troubleshoot, optimize	

ASSESSMENT EVIDENCE: Students will show their learning by:

- Reflection including asking questions
- Collaborative discussion
- Inquiry-based lab activities or Planning and carrying out investigations
- Explanatory writing
- Developing and using models
- Analyzing and interpreting data
- Expressing concepts mathematically

KEY LEARNING EVENTS AND INSTRUCTION:

- Minute to win it activities
- Floating feather
- Force cars design experiment
- Pendulums lab design

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science
Unit IV: Forces and Motion

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
4 weeks	**Forces and Motion**	*NEWSELA* *Pearson Interactive Textbooks* *NJ Model Curriculum Resources* *Forces and Motion: Basic* https://phet.colorado.edu/en/simulation/forces-and-motion-basics Energy Skate Park https://phet.colorado.edu/en/simulation/legacy/energy-skate-park *Build the fastest sailboat (from NJDOE model curriculum)*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science
Unit V: Interactions

<table>
<tr><td rowspan="6">STANDARDS / GOALS:

<u>NGSS:</u>

MS-PS2-3: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

MS-PS2-4: Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

MS-PS2-5: Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Electrical, magnetic, and gravitational forces emit fields that can apply force on objects without contact.</td><td>• Can you apply a force on something without touching it?</td></tr>
<tr><td>Magnetic and electric forces can attract and/or repel each other due to the direction of the electron flow.</td><td>• How and why do magnetic and electric forces attract and/or repel each other?</td></tr>
<tr><td>The distance between objects and the mass of the objects are the factors that determine the strength of the gravitational pull between the objects.</td><td>• What affects the strength of gravitational forces?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Fields exist between objects that exert forces on each other even though the objects are not in contact.</td><td>Students will be able to:

Students will conduct an investigation and evaluate an experimental design to produce data that can serve as the basis for evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.</td></tr>
</table>

		Investigate interactions of magnets, electrically charged strips of tape, and electrically charged pith balls are examples of fields that exist between objects exerting forces on each other, even though the objects are not in contact. Map the field lines produced by an electric or magnetic source.
	Devices that use electric and magnetic forces could include electromagnets, electric motors, and generators. Electric and magnetic (electromagnetic) forces can be attractive or repulsive. The size of an electric or magnetic (electromagnetic) force depends on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.	Students will identify the cause-and-effect relationships between fields that exist between objects and the behavior of the objects. Observe and conclude the effects of magnetic object interactions to understand attractive or repulsive forces. Perform investigations using devices that use electromagnetic forces. Collect and analyze data that could include the effect of the number of turns of wire on the strength of an electromagnet or the effect of increasing the number or strength of magnets on the speed of an electric motor.
	Gravitational interactions are always attractive and depend on the masses of interacting objects, unless the mass are so small that gravity's effects are negligible when compared to larger massed objects. Evidence supporting the claim that gravitational interactions are attractive and depend on the masses of interacting objects could include data generated from simulations or digital tools and charts displaying mass, strength of interaction, distance from the sun, and orbital periods of objects within the solar system.	Conduct an experiment involving the Earth and objects falling towards earth in order to construct an explanation that mass and distance are the factors that affect gravitational force. Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

	VOCABULARY: electricity, magnetism, magnitude, mass, distance, gravity **KEY TERMS:** force, electromagnetic, interactions, electrons, magnetic field, attraction, repulsion, current	Develop and use models to represent the gravitational interactions between two masses.

ASSESSMENT EVIDENCE: Students will show their learning by:

- Reflection including asking questions
- Collaborative discussion
- Inquiry-based lab activities or Planning and carrying out investigations
- Explanatory writing
- Developing and using models
- Analyzing and interpreting data
- Research of primary and secondary resources
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

KEY LEARNING EVENTS AND INSTRUCTION:

- Observe magnetic fields using magnetic bars and iron filings
- Making an electromagnetic motor using Neodymium magnets
- Vandergraaf Generator
- pHet Simulations of orbiting planets around the sun

RANDOLPH TOWNSHIP SCHOOL DISTRICT

Grade Six Science
Unit V: Interactions

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
3 Weeks	**Interactions**	*NEWSELA* *Pearson Interactive Textbooks* *Phet Magnet and Compass* *https://phet.colorado.edu/en/simulation/legacy/magnet-and-compassv* *Phet* Gravity Force Lab https://phet.colorado.edu/en/simulation/gravity-force-lab *Phet Lunar Lander* *https://phet.colorado.edu/en/simulation/legacy/lunar-lander* *Phet Pendulum Lab* https://phet.colorado.edu/en/simulation/legacy/pendulum-lab *Static Electricity* *https://phet.colorado.edu/en/simulation/balloons-and-static-electricity* *Phet Fairday's Electromagnet Lab* *https://phet.colorado.edu/en/simulation/legacy/faraday* *Impact Crater Lab to study Gravity (F=ma)* *https://www.researchgate.net/publication/231073113* *_Impact_crater_experiments_for_introductory_physics_and_astronomy_laboratories*

Grade Six Science
Unit VI: Astronomy

<table>
<tr><td rowspan="8">STANDARDS / GOALS:

<u>NGSS:</u>

MS-ESS1-1: Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

MS-ESS1-2: Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

MS-ESS1-3: Analyze and interpret data to determine scale properties of objects in the solar system.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>The solar system consists of the sun and a collection of objects including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.</td><td>• What are the objects that are a part of our solar system and what forces act upon those objects?</td></tr>
<tr><td>Cyclic patterns such as the seasons, moon phases, and eclipses are observable, describable, and predictable.</td><td>• How are we able to observe that objects in space move?</td></tr>
<tr><td>Time, space, and energy phenomena in the solar system can be observed at various scales, using models to study systems that are too large.</td><td>• What are the scale properties of objects in the solar system?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids, that are held in orbit around the sun by its gravitational pull on them.</td><td>Students will be able to:

Order by size objects in the solar system

Order by size all part of the universe Milky Way galaxy, which is one of many galaxies in the universe.</td></tr>
</table>

	Stars have scale properties	Analyze and interpret data to determine similarities and differences among objects in the solar system. Construct, justify, and utilize a classification system for stars based on multiple criteria.
	The solar system appears to have formed from a disk of dust and gas, held in orbit by the balanced forces of gravity and inertia (Newton's first law of motion).	Apply the concepts of gravity and Newton's First Law of inertia to the formation of the solar system
	Gravity is the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them.	Model the role of gravity in the motions and interactions within galaxies and the solar system.
	Patterns in the apparent motion of the sun, moon, and stars in the sky can be observed, described, predicted, and explained with models.	Develop and use a physical, graphical, or conceptual models to describe patterns in the apparent motion of the sun, moon, and stars in the sky.
	The seasons are a result of the tilt of the Earth on its axis and are caused by the differential intensity of sunlight on different areas of Earth across the year.	Investigate the angle of light and the area of surface illuminated on a flat and then sphered surface. Develop and use models to explain the relationship between the tilt of Earth's axis and seasons.
	Patterns can be used to identify cause-and-effect relationships that exist in the apparent motion of the sun, moon, and stars in the sky.	Utilize physical and virtual models to investigate relative position of the moon orbiting the Earth causes moon phases and eclipses.

	Science assumes that objects and events in the solar system occur in consistent patterns that are understandable through measurement and observation.	Identify daily, monthly, and yearly patterns in the motion of the sun, moon, and stars.
	Objects in the solar system have scale properties.	Create a scale model to express distances between objects within the solar system Observe virtual models (zoom in and out) to compare size of objects within the solar system. Construct, justify, and utilize a classification system for solar system objects based on multiple criteria.
	Time, space, and energy phenomena in the solar system can be observed at various scales, using models to study systems that are too large.	Determine the best measurement of distance within the solar system Define astronomical unit (AU)
	Data from Earth-based instruments, space-based telescopes, and spacecraft can be used to determine similarities and differences among solar system objects.	Define light year, light minute Create a time line of discovery for a planet based on the types of Earth-based instruments, space-based telescopes, and spacecraft that were used to make discoveries.
	Engineering advances have led to important discoveries in space science, and scientific discoveries have led to the development of entire industries and engineered systems.	Gather, read, and synthesize on the important discoveries and innovations in space science that are now commonly used in everyday life.

	VOCABULARY: solar system, moon, planet, star, sun **KEY TERMS:** astronomy, position, motion, orbit, gravity, gibbous, crescent, waning, waxing, solar eclipse, lunar eclipse, rotation, revolution, orbit, tilt, gravity, scale, phases, spring tide, neap tide, comet, asteroid, meteor, satellite, telescope, galaxy, light year, astronomical unit	

ASSESSMENT EVIDENCE: Students will show their learning by:

- Reflection including asking questions and
- Collaborative discussion
- Inquiry-based lab activities or Planning and carrying out investigations
- Explanatory writing
- Developing and using models
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Research of primary and secondary resources
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

KEY LEARNING EVENTS AND INSTRUCTION:

- Light on a globe
- Moon phase DI activity with bulb
- Solar System object sorting activity
- Solar System distance activity
- Star information sorting activity
- Phet simulations
- Planet project
- Ablative Shielding (Heat shield)

RANDOLPH TOWNSHIP SCHOOL DISTRICT

Grade Six Science

Unit VI: Astronomy

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
8 Weeks	**Astronomy**	*NEWSELA* *Pearson Interactive Textbooks* *NJ Model Curriculum Resources* *Phet Gravity and Orbits* *https://phet.colorado.edu/en/simulation/legacy/gravity-and-orbits* *Phet My Solar System* *https://phet.colorado.edu/en/simulation/legacy/my-solar-system* *Online Resources* https://docs.google.com/document/d/1vREJegrIcAYuxNWme--yCJa1QyLMuP_N5EVo5jAn7ro/edit?usp=sharing

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science
Unit VII: Weather and Climate

<table>
<tr><td rowspan="8">STANDARDS / GOALS:

<u>NGSS:</u>

MS-ESS2-4: Develop a model to describe the cycling of water through Earth’s systems driven by energy from the sun and the force of gravity.

MS-ESS2-5: Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

MS-ESS2-6: Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>There are various processes involved in the cycling of water through Earth’s systems.</td><td>• How does water cycle through the earth’s spheres?</td></tr>
<tr><td>Data of the complex interactions from air masses is used to predict weather patterns.</td><td>• What data is necessary to make short-term and long-term weather predictions?</td></tr>
<tr><td>Models are used to display patterns that can determine regional climates.</td><td>• How can dynamic models of weather maps be used to predict regional climates?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.

Water can be stored as surface water, underground, or snowpack and cycle through Earth’s systems driven by energy from the sun and the force of gravity.</td><td>Students will be able to:

Model the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle.

Identify where water can be stored and the energy source for the water cycle.</td></tr>
</table>

	The motions and complex interactions of air masses result in changes in weather conditions.	Collect data for evidence to show how motions and complex interactions of air masses result in changes in weather conditions.
	Examples of data that can be used to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions include weather maps, diagrams, and visualizations; other examples can be obtained through laboratory experiments.	Analyze and interpret weather map data and diagrams to predict weather conditions.
	Air masses flow from regions of high pressure to regions of low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time.	Examine how air masses move from high pressure to low pressure and affect the temperature, pressure, humidity, precipitation, and wind of a location over time.
	The complex patterns of the changes in and movement of water in the atmosphere, determined by winds, landforms, latitude, altitude, ocean temperatures, and currents, are major determinants of local weather patterns.	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with information that is gained from reading text about how the complex patterns of the changes and movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents are major determinants of local weather patterns.
	Unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates that vary by latitude, altitude, and land distribution.	Distinguish factors that determine regional climate such as rotation of the earth, and how they are affected by latitude, altitude, and land distribution.
	Ocean circulation that, in part, determines regional climates is the result of the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents.	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

	VOCABULARY: climate, weather, solid, liquid, gas, gravity **KEY TERMS:** water cycle, water vapor, condensation, precipitation, evaporation, transpiration, infiltration, runoff, air pressure, air masses, maritime, continental, polar, temperate, tropical, isobar, fronts, global wind, local wind, latitude, altitude, ocean current, atmosphere, hydrosphere, meteorology, albedo, prediction, symbols	

ASSESSMENT EVIDENCE: Students will show their learning by:

- Reflection including asking questions and collaborative discussion
- Inquiry-based lab activities or Planning and carrying out investigations
- Explanatory writing
- Developing and using models
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Research of primary and secondary resources
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

KEY LEARNING EVENTS AND INSTRUCTION:

- Observe evaporation and condensation in a soda bottle to prove the evaporating water didn't just disappear. Draw a diagram.
- Observe cloud formation by making a cloud in a bottle.
- Include readings on surface water and the water cycle
- Observe air pressure using smoke to "see" air. Then make high and low pressure and watch convection phenomena.
- Draw a diagram of convection.
- Define air pressure and convection.
- Perform the soil and water lab to observe soil heating and cooling quickly, while water cools slowly but holds onto the heat longer.
- Make predictions based on ocean and land scenario about wind during day and night.
- Introduce weather maps and look at fronts. Observe weather data over a period of 1 or 2 weeks to observe patterns.
- Supplement weather unit with current events on weather events. Examples: Hurricanes, El Nino, Tornadoes, Thunderstorms, Fog, Frost, Freezing Rain, Snow Storms.
- Read about air masses and fronts.
- Students observe convection in water to model ocean currents.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science
Unit VII: Weather and Climate

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
9 Weeks	**Weather and Climate**	*NEWSELA* *Pearson Interactive Textbooks* *NJ Model Curriculum Resources*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science
Unit VIII: New Jersey Ecosystem Services and Biodiversity

<table>
<tr><td rowspan="6">STANDARDS / GOALS:

<u>NGSS:</u>

MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Changes to physical or biological components of an ecosystem affect populations in positive and negative ways.</td><td>• How do changes in the environment effect populations?</td></tr>
<tr><td>In order to make sustainable decision regarding ecosystems we evaluate tradeoffs.

Ecosystem services provide humanity and biodiversity with life support like clean air and water.</td><td>• How do we manage resources of an ecosystem in order to maintain optimal biodiversity and ecosystem services?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Ecosystems are dynamic in nature therefore changes in the physical or biological components of the system are complex.</td><td>Students will be able to:

Recall wetlands store and filter water runoff.

Recall predator prey relationships.

Define biodiversity as the variety of species found in Earth’s terrestrial and oceanic ecosystems.</td></tr>
</table>

		Define ecosystem services (clean water, clean air, water storage, and flood reduction).
	Evaluating empirical evidence can be used to support arguments about changes to ecosystems.	Describe changes in one part of a system might cause large changes in another part. Gather, read, and analyze examples of population dynamics due to manmade or natural stressors. Recognize patterns in data and make warranted inferences about changes in populations. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. Utilize population data to make warranted inferences about changes in populations (invasive species, loss of keystone species, loss of predator).
	Sustainable decisions compare the factors of ecosystem health, economic impact, and social justice.	Evaluate the completeness, or integrity, of an ecosystem's biodiversity in order to measure its health.
	Engineering solutions are costly replacements for natural ecosystem services. The engineering and design process is a systematic method for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	Perform a benefits analysis of the ecosystem with regards to human resources such as food, energy, medicines, and services (water purification, nutrient recycling, water storage, flood reduction, and/or prevention of soil erosion). Design a solution using the engineering design process for a local environmental concern.

	The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. **VOCABULARY:** ecosystem, problem, brainstorm, design, invention, iteration, modify, test, **KEY TERMS:** sustainability, biodiversity, engineering, design process, constraint, innovation, iteration, prototype, troubleshoot, optimize	Utilize a tradeoff matrix to make decisions while designing solutions for maintaining biodiversity and ecosystem services. Optimize the design through collaborative discussion and further data collection to gain information for the redesign process. Create a scale model of a design solution for a specific problem for maintaining biodiversity and ecosystem services. Share and evaluate the design with others in order to determine similarities and differences among several design solutions. Identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

ASSESSMENT EVIDENCE: Students will show their learning by:

- Reflection including asking questions and
- Collaborative discussion
- Inquiry-based lab activities or Planning and carrying out investigations
- Explanatory writing
- Developing and using models
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Research of primary and secondary resources
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

KEY LEARNING EVENTS AND INSTRUCTION:

- Collect data on ecosystem
- Design and develop a solution to scenario regarding water conservation

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science Curriculum
Unit VIII: New Jersey Ecosystem Services and Biodiversity

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
3 Weeks	**New Jersey Ecosystem Services and Biodiversity**	*NEWSELA* *Pearson Interactive Textbooks* *NJ Model Curriculum Resources* *Visualizing Sustainability* *https://computingforsustainability.com/2009/03/15/visualising-sustainability/* *Great Swamp* *Passaic Water Shed*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science
Unit IX: Minerals

<table>
<tr><td rowspan="6">STANDARDS / GOALS:

<u>NGSS:</u>

MS- PS1-3: Gather and make sense of information to describe that synthetic materials come from natural resources and impact society

5-PS1-3: Make observations and measurements to identify materials based on their properties

MS-ESS2-1: Develop a model to describe the cycling of Earth’s materials and the flow of energy that drives this process.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Minerals are identified based on hardness, breakage, streak, density, luster, color, and crystal structure.</td><td>• How can we use characteristics to identify materials?</td></tr>
<tr><td>Managing resources using the sustainability model compares three factors, social equity, environmental stewardship, and economic growth.</td><td>• How do we manage resources available in our region?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Minerals can be identified by testing hardness, chemical reaction, breakage, streak, luster, color, crystal structure, and density.

Minerals can be identified as natural resources</td><td>Students will be able to:

Identify Students will use a dichotomous key to identify minerals.

Gather, read, and synthesize about local historical mining (zinc and iron.)

Students will design a method of mineral extraction from ore.</td></tr>
</table>

	VOCABULARY: Mohs hardness scale, cleavage, fracture, streak, density, luster, glassy, metallic, dull, color, crystal structure **KEY TERMS:** Dichotomous Key	

ASSESSMENT EVIDENCE: Students will show their learning by:

- Reflection including asking questions and
- Collaborative discussion
- Inquiry-based lab activities or Planning and carrying out investigations
- Obtaining, evaluating, and communicating information

KEY LEARNING EVENTS AND INSTRUCTION:

- Mineral identification lab
- Ore to Store: Designing a way to collect valuable minerals from ore

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade Six Science
Unit IX: Minerals

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
1 week	**Minerals**	*Dichotomous Key for mineral identification* *Background information on Zinc mining in New Jersey* *NEWSELA* *Pearson Interactive Textbooks*

APPENDIX A

NGSS http://www.nextgenscience.org/next-generation-science-standards
NJ State Model Curriculum http://www.nj.gov/education/modelcurriculum/sci/ms.shtml