Unit #2: Physical Science 7- Electromagnetic Force

Content Area: **Science**
Course(s): **Science 7**
Time Period: **Second Marking period**
Length: **Mid-December through March**
Status: **Published**

Unit Overview

Our science education program is intended to create a community of diverse learners who are engaged in active learning, collaborative problem-solving activities, and scientific inquiry. Our students will engage in the "Practices of Science." They will ask questions, develop and use models, plan and carry out investigations, analyze data, use mathematics and computational thinking, construct explanations, engage in argument from evidence, and obtain, evaluate, and communicate information. These will serve as a foundation for successful careers and informed, responsible citizens in an ever-changing world that is increasingly dependent on science, technology, and engineering.

In the Foss Electromagnetic Force Course, students manipulate equipment to collect data about magnetic fields and electricity. They construct explanations based on observable patterns and develop models that define the cause-and-effect relationships of the forces and interactions they are measuring.

STAGE 1- DESIRED RESULTS

2020 New Jersey Student Learning Standards- Science

Physical Science

SCI.MS-PS2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
SCI.MS-PS3-2	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.
SCI.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.
SCI.MS-PS3-1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
SCI.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.

SCI.MS-PS2-1	Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
SCI.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.
SCI.MS-PS3-5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Science and Engineering Practices

- Analyzing and Interpreting Data
- Asking Questions and Defining Problems
- Constructing Explanations and Designing Solutions
- Developing and Using Models
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information
- Planning and Carrying Out Information
- Using Mathematics and Computational Thinking

Cross Cutting Concepts

- Cause and Effect
- Energy and Matter
- Influence of Engineering, Technology, and Science on Society and the Natural World
- Interdependence of Science, Engineering, and Technology
- Patterns
- Scale, Proportion, and Quantity
- Stability and Change
- Structure and Functions
- Systems and System Models

Disciplinary Core Ideas

Physical Sciences

- PS1A: Structure and Properties of Matter
- PS1B: Chemical Reactions

- PS1C: Nuclear Processes
- PS2A: Forces and Motion
- PS2B: Types of Interaction
- PS3A: Definitions of Energy
- PS3B: Conservation of Energy and Energy Transfer
- PS3C: Relationship Between Energy and Forces
- PS3D: Energy in Chemical Processes and Everyday Life
- PS4A: Wave Properties
- PS4C: Information Technologies and Instrumentation

Life Sciences

- LS1D: Information Processing

Earth and Space Sciences

- ESS3A: Natural Resources
- ESS3C: Human Impacts on Earth Systems

Engineering. Technology. and Applications of Science

- ETS1A: Defining and Delimiting an Engineering Problem
- ETS1B: Developing Possible Solutioins
- ETS1C: Optimizing the Design Solution

Essential Questions

Investigation 1: What is Force?

- What makes things move?
- What is energy?
- What makes spring scales move?
- What do spring scales measure?
- How can you measure a push and pull?
- What is kinetic energy?
- How do objects interact?
- How is energy transformed when connected to different devices?
- How do multiple forces affect motion?
- How does friction affect the force needed to move an object?
- What are Newton's three laws of motion?

Investigation 2: Force of Magnetism

- What happens when magnets interact?
- How can we detect a magnetic field?
- What factors affect the force of attraction between magnets?
- Why do magnets repel and attract at times?
- What is a compass used for?
- What is potential energy?
- Is there something that is the same about all the objects that stick to magnets?
- What is a permanent magnet? What is a temporary magnet?
- How can magnetism be induced?

Investigation 3: Electromagnetism

- What is required to complete an electric circuit?
- How does an electromagnet work?
- What modifications to an electromagnet will affect the strength of its magnetic field?
- How is energy transferred from one source to another?
- In an electromagnet, is electricity flowing through the wire?
- Can magnetic fields pass through materials like the plastic insulation on the wire?

Investigation 4: Energy Transfer

- How does an electric motor work?
- How can we generate electrical energy?
- What are the big ideas about electromagnetic force?

Enduring Understanding

In our Electromagnetic Force unit, students will be expected to build on their understanding of Newton's Laws of Motion. They will build on concepts taught in elementary school through their motion unit. Students will develop, build, and test models. They will plan and conduct experiments, analyze and interpret data, using mathematical and computational thinking. Students will work to develop explanations, and use these practices to demonstrate understanding of the core ideas. Students will understand how interactions of motion work within systems. Students will apply ideas about gravitational, electrical, and magnetic forces to explain a variety of phenomena. They will focus on ideas about energy; transformation of energy, the relationship between energy and forces, and energy and chemical processes.

Students will know…

Investigation Guide Vocabulary

Investigation 1: What is Force?

Energy, force, friction, interaction, kinetic energy, net force, newton, spring scale

Investigation 2: Force of Magnetism

Attract, compass, gravitational force, induced magnetism, magnet, magnetic field, magnetism, permanent magnet, pull, potential energy, repel, temporary magnet

Investigation 3: Electromagnetism

Battery, circuit, component, constraint, contact point, core, criterion, electric current, electromagnet, electromagnetic force, electromagnetic radiation, electromagnetism, energy transfer, engineer, filament, insulation

Investigation 4: Energy Transfer

Brush, commutator, fossil fuel, generator, motor, nonrenewable, renewable, rotate, shaft, solar cell

Science Resource Vocabulary

Investigation 1: What is Force?

Acceleration, compress, force, friction gravity, interaction, magnet, net force, newton, shaft, spring scale, weight

Investigation 2: Force of Magnetism

Attract, compass, gravitational field, induced magnetism, magnetic field, magnetism, particle, permanent

magnet, pole, repel, temporary magnet

Investigation 3: Electromagnetism

Battery, circuit, climate change, closed circuit, complete circuit, component, conductor, contact point, core, drag, electric circuit, electric force, electromagnet, electromagnetic force, electromagnetism, electron, energy, engineer, filament, incandescent lightbulb, incomplete circuit, insulator, lamp, maglev, motor, open circuit, semiconductor, static

Investigation 4: Energy Transfer

Automobile, brush, commutator, constraint, criterion, fossil fuel, fuel, generator, greenhouse gas, nonrenewable, potential energy, power grid, renewable, solar cell, sustainable, turbine

Misconceptions:

- Mass and weight are the same.
- It requires more force to pull something than to push something.
- All metals are magnetic.
- A battery stores electricity, as opposed to energy.
- The bigger the battery, the more power it has.
- All batteries are rechargeable.
- Energy is the same as force.
- Energy is lost in many transformations.
- Things "use up" energy.

- Putting a battery in the freezer extends its life.
- Inanimate objects are not applying force.
- Work equates to labor.

Students will be able to...

Investigation 1: What is Force?

- Plan and carry out investigations to measure the force required to push and pull various objects on various surfaces.
- Analyze and interpret data from force experimentation to draw conclusions about force and friction.
- Use mathematics and computational thinking when analyzing data about friction and net force.
- Develop and use models to explain net force on an object.

Investigation 2: Force of Magnetism

- Analyze and interpret data about magnetic force in a series of experiments looking at force over distance and force when more magnets are introduced.
- Develop and use models to construct explanations about magnetic fields and explain their properties and interactions.

Investigation 3: Electromagnetism

- Develop and use a model to explain how a magnetic field results from an electric current through a wire.
- Design an electromagnet that will meet specific criteria and constraints.

Investigation 4: Energy Transfer

- Analyzing and interpreting data to compare the components and function of motors and generators.
- Developing and using models to explain energy transfers within a system.
- Obtaining, evaluating, and communicating information about energy sources for human use, including renewable and nonrenewable sources, and their environmental consequences.

STAGE 2- EVIDENCE OF LEARNING

Formative Assessment

- 3- Minute Pause
- A-B-C Summaries
- Analogy Prompt
- Choral Response
- Debriefing
- Exit Card / Ticket
- Hand Signals
- Idea Spinner
- Index Card Summaries
- Inside-Outside Circle Discussion (Fishbowl)
- Journal Entry
- Misconception Check
- Observation

- One Minute Essay
- One Word Summary
- Portfolio Check
- Questions & Answers
- Quiz
- Self-Assessment
- Student Conference
- Think-Pair-Share
- Web or Concept Map

Authentic Assessments

- Follow lab safety procedures throughout the unit.
- Determine the relationship between applied force and work output.
- Use data tables and graphs to interpret data.
- Build and test a series and a parallel circuit.
- Measure, collect data, and apply formulas to calculate work, speed, and power.
- Work in cooperative groups to complete assignments.
- Build, modify, and troubleshoot designs.
- Complete Focus Questions.
- Improve a Design Challenge for electromagnets.

Benchmark Assessments

- End-of-investigation assessments.
- I-Checks.
- Focus questions.
- End-of-unit district exam.
- complete a research project.

STAGE 3- LEARNING PLAN

Instructional Map

Investigation 1 – What is Force? (9 Sessions)

Part 1: (4 Sessions) Push and Pull

Students start their inquiry of force using spring scales to push and pull objects, noting that some objects require more push or pull to put them into motion. They complete a series of push and pull experiments, and quantify force in terms of the amount of stretch of a steel spring. Students are introduced to the idea that forces add, producing more force or canceling one another.

Part 2: (1 Session) Friction

Students use spring scales to measure the force needed to move loads on different surfaces. They review class results to consider patterns. Friction is developed as a force opposing motion, a force that changes depending on the two surfaces that are touching.

Part 3: (4 sessions) Forces in Action

Students observe force exerted on one side of a rolling cart and on both sides of the cart. The idea of net force is developed to explain how force can cause motion in some instances but not in others. Students observed force being exerted on the cart that is positioned against the wall and try to explain as to why it is not moving. The idea that inanimate objects, like walls, can push is considered. Students use the idea of net force to analyze a number of force problems.

Investigation 2: Force of Magnetism (9 Sessions)

Part 1: (1 Session) Properties of Magnets

Students observe that the two sides (pulls) of magnets are different, attracting or repelling one another, depending on orientation. While they conduct an investigation to determine if like or opposite pulls attract, students learn the north/south convention for naming poles.

Part 2: (3 Sessions) Magnetic Fields

Students work with magnets and other objects to discover that magnetism acts through certain materials including air, nonmagnetic metals and nonmetals. They also discover that bringing a magnet close to a piece of iron induces magnetism in the iron. Students learn that these effects are manifestations of the invisible magnetic fields that surrounds every magnet.

Part 3: (5 Sessions) Force over Distance

Students use a spring scale to measure the force of attraction between magnets. They increase the distance between the magnets and remeasure the force. Students learn that the force of attraction between magnets decreases as the distance between them increases. Next, they add additional magnets to a system to learn how magnetic fields overlap. Students then use an online activity to help visualize magnetic fields and to test further predictions.

Investigation 3: Electromagnetism (10 Sessions)

Part 1: (3 Sessions) Building a Circuit

Students are introduced to electricity and energy. They discover how to make a complete circuit using D-cell, wires, and a lightbulb. Students discuss the electricity's pathway in the circuit and the function in each of the systems components. They also take a close look at the anatomy of a lightbulb.

Part 2: (2 Sessions) Building an Electromagnet

Students discover that a steel core becomes a magnet when current flows through an insulated wire wound around the steel core.

Part 3: (5 Sessions) Improving the Design

Students brainstorm different variables that might affect the strength of their electromagnet, and then test those variables. Working as a class, they combine their results to determine the best design for an electromagnet.

Investigation 4: Energy Transfer (9 Sessions)

Part 1: (2 Sessions) Electric Motors

Students operate an electric motor in a circuit, dissect a motor, and explain how it works after analyzing its components. They describe its design and function in terms of its components and energy transfer.

Part 2: (5 Sessions) Electric Generators

Students observe a generator and compare its components and function to a motor. They explain the interactions in terms of energy transfer. They consider energy sources for human electricity use and use solar cells to power an electric motor. Students read about human energy sources, including resource limitations and consequences.

Part 3: (2 Sessions) Force and Energy

Students consider key points from the entire course to prepare for the final benchmark assessment. They revisit the entry level survey and improve their responses.

Modification/Differentiation of Instruction

Differentiation Strategies for Special Education Students

- Remove unnecessary material, words, etc., that can distract from the content
- Use of off-grade level materials
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Time allowed
- Level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in "chunks"

- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Varied homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Ability to work at their own pace
- Present ideas using auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials
- Strategy and flexible groups based on formative assessment
- Differentiated checklists and rubrics, if available and appropriate

Differentiation Strategies for Gifted and Talented Students

- Increase the level of complexity
- Decrease scaffolding
- Variety of finished products
- Allow for greater independence
- Learning stations, interest groups
- Varied texts and supplementary materials
- Use of technology
- Flexibility in assignments
- Varied questioning strategies
- Encourage research
- Strategy and flexible groups based on formative assessment or student choice
- Acceleration within a unit of study
- Exposure to more advanced or complex concepts, abstractions, and materials
- Encourage students to move through content areas at their own pace
- After mastery of a unit, provide students with more advanced learning activities, not more of the same activity
- Present information using a thematic, broad-based, and integrative content, rather than just single-subject areas

Differentiated Strategies for ELL Students

- Remove unnecessary materials, words, etc., that can distract from the content
- Provide appropriate scaffolding

- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in “chunks”
- Varied texts and supplementary materials, including visuals
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Allow students to work at their own pace
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Role play
- Provide graphic organizers, highlighted materials
- Strategy and flexible groups based on formative assessment

<u>Differentiation Strategies for At Risk Students</u>

- Remove unnecessary materials, words, etc., that can distract from the content
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in “chunks”
- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials
- Strategy and flexible groups based on formative assessment

504 Plans

Students can qualify for 504 plans if they have physical or mental impairments that affect or limit any of their abilities to:

- walk, breathe, eat, or sleep
- communicate, see, hear, or speak
- read, concentrate, think, or learn
- stand, bend, lift, or work

Examples of accommodations in 504 plans include:

- preferential seating
- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- adjusted class schedules or grading
- verbal testing
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits
- occupational or physical therapy

Modification Strategies

- Cooperative Grouping
- Extended Time
- Frequent Breaks
- Highlighted Text
- Interactive Notebook
- Modified Test
- Oral Directions
- Peer Tutoring
- Preferential Seating

- Re-direct
- Repeated Drill and Practice
- Shortened Assisgnment
- Teacher Notes
- Tutorials
- Use of Additional Reference Materials
- Use of Audio Resources

Differentiation Strategies

High Preparation

- Alternative Assessments
- Choice Boards
- Games and Tournaments
- Group Investigations
- Guided Reading
- Independent Research / Project
- Interest Groups
- Learning Contracts
- Leveled Rubrics
- Literature Circles
- Multiple Intelligence Options
- Multiple Texts
- Personal Agendas
- Project Based Learning (PBL)
- Stations / Centers
- Think-Tac-Toe
- Tiered Activities / Assignments
- Varying Graphic Organizers

Low Preparation

- Choice of Book / Activity
- Cubing Activities
- Exploration by Interest (using interest inventories)

- Flexible Grouping
- Goal Setting With Student
- Homework Options
- Jigsaw
- Mini Workshops to Re-teach or Extend Skills
- Open-ended Activities
- Think-Pair-Share by Readiness, Interest, or Learning Style
- Use of Collaboration
- Use of Reading Buddies
- Varied Journal Prompts
- Varied Product Choice
- Varied Supplemental Materials
- Work Alone / Together

Horizontal Intergration- Interdisciplinary Connections

New Jersey Student Learning Standards for Mathematics

Grade 7

7.RP.A. Analyze proportional relationships and use them to solve real worls mathematical problems.

7.NS.A. Apply and extend previous understandings of operations.

7.EE.B. Solve real life and mathematical problems using numerical and algebraic expressions and equations.

Reading in Science

RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.

RST.6-8.2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.

RST.6-8.5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.

RST.6-8.6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

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

RST.6-8.8.Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

RST.6-8.9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

RST.6-8.10. By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.

Writing in Science

LA.WHST.6-8.1 Write arguments focused on discipline-specific content.

LA.WHST.6-8.1.A Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.

LA.WHST.6-8.1.B Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

LA.WHST.6-8.1.C Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.

LA.WHST.6-8.1.D Establish and maintain a formal/academic style, approach, and form.

LA.WHST.6-8.1.E Provide a concluding statement or section that follows from and supports the argument presented.

LA.WHST.6-8.10 Write routinely over extended time frames (time for research, reflection, metacognition/self correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

LA.WHST.6-8.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

LA.WHST.6-8.2.A Introduce a topic and organize ideas, concepts, and information using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia) when useful to aiding comprehension.

LA.WHST.6-8.2.B Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.

LA.WHST.6-8.2.C Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.

LA.WHST.6-8.2.D Use precise language and domain-specific vocabulary to inform about or explain the topic.

LA.WHST.6-8.2.E Establish and maintain a formal/academic style, approach, and form.

LA.WHST.6-8.2.F Provide a concluding statement or section that follows from and supports the information

or explanation presented.

LA.WHST.6-8.3 (See note; not applicable as a separate requirement)

LA.WHST.6-8.4 Produce clear and coherent writing in which the development, organization, voice, and style are appropriate to task, purpose, and audience.

LA.WHST.6-8.5 With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.

LA.WHST.6-8.6 Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

LA.WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

LA.WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

LA.WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research.

2020 New Jersey Student Learning Standards- Computer Science and Design Thinking

Computer Science and Design Thinking Practices

CSDT.K-12.CSDTP1	Fostering an Inclusive Computing and Design Culture
CSDT.K-12.CSDTP2	Collaborating Around Computing and Design
CSDT.K-12.CSDTP3	Recognizing and Defining Computational Problems
CSDT.K-12.CSDTP4	Developing and Using Abstractions
CSDT.K-12.CSDTP5	Creating Computational Artifacts
CSDT.K-12.CSDTP6	Testing and Refining Computational Artifacts
CSDT.K-12.CSDTP7	Communicating About Computing and Design

8.2 Design Thinking

8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer. 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem. 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). 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. 8.2.8.ED.5: Explain the need for optimization in a design process. 8.2.8.ED.6: Analyze how trade-offs can impact the design of a product. 8.2.8.ED.7: Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).
8.2.8.ITH.1: Explain how the development and use of technology influences economic, political, social, and cultural issues. 8.2.8.ITH.2: Compare how technologies have influenced society over time. 8.2.8.ITH.3: Evaluate the impact of sustainability on the development of a designed product or system. 8.2.8.ITH.4: Identify technologies that have been designed to reduce the negative consequences of other technologies and explain the change in impact. 8.2.8.ITH.5: Compare the impacts of a given technology on different societies, noting factors that may make a technology appropriate and sustainable in one society but not in another.
8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem. 8.2.8.NT.2: Analyze an existing technological product that has been repurposed for a different function. 8.2.8.NT.3: Examine a system, consider how each part relates to other parts, and redesign

it for another purpose. 8.2.8.NT.4: Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product.
8.2.8.ETW.1: Illustrate how a product is upcycled into a new product and analyze the short- and long-term benefits and costs. 8.2.8.ETW.2: Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital). 8.2.8.ETW.3: Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact. 8.2.8.ETW.4: Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best.
8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies. 8.2.8.EC.2: Examine the effects of ethical and unethical practices in product design and development.

2020 New Jersey Student Learning Standards- Career Readiness, Life Literacies, and Key Skills

Career Readiness, Life Literacies, and Key Skills Practices

CRP.K-12.CRP1	Act as responsible and contributing community members and employee.
CRP.K-12.CRP2	Attend to financial well-being.
CRP.K-12.CRP3	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP4	Demonstrate creativity and innovation.
CRP.K-12.CRP5	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP6	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP7	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP8	Use technology to enhance productivity, increase collaboration and communicate effectively.
CRP.K-12.CRP9	Work productively in teams while using cultural/global competence.

9.2 Career Awareness and Planning

9.2.8.CAP.1: Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest. 9.2.8.CAP.2: Develop a plan that includes information about career areas of interest. 9.2.8.CAP.3: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income. 9.2.8.CAP.4: Explain how an individual's online behavior (e.g., social networking, photo exchanges, video postings) may impact opportunities for employment or advancement.
9.2.8.CAP.11: Analyze potential career opportunities by considering different types of resources, including occupation databases, and state and national labor market statistics. 9.2.8.CAP.12: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.

9.4 Life Literacies and Key Skills

9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., cross-cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4). 9.4.8.CI.2: Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3). 9.4.8.CI.3: Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2). 9.4.8.CI.4: Explore the role of creativity and innovation in career pathways and industries.
9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (MS-ETS1-2). 9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1). 9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
9.4.8.DC.1: Analyze the resource citations in online materials for proper use. 9.4.8.DC.2: Provide appropriate citation and attribution elements when creating media products (e.g., W.6.8). 9.4.8.DC.3: Describe tradeoffs between allowing information to be public (e.g., within online games) versus keeping information private and secure. 9.4.8.DC.4: Explain how information shared digitally is public and can be searched, copied, and potentially seen by public audiences. 9.4.8.DC.5: Manage digital identity and practice positive online behavior to avoid inappropriate forms of self-disclosure. 9.4.8.DC.6: Analyze online information to distinguish whether it is helpful or harmful to reputation. 9.4.8.DC.7: Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys. 9.4.8.DC.8: Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).
9.4.8.GCA.1: Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a). 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.

9.4.8.IML.2: Identify specific examples of distortion, exaggeration, or misrepresentation of information. 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b). 9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations. 9.4.8.IML.5: Analyze and interpret local or public data sets to summarize and effectively communicate the data. 9.4.8.IML.6: Identify subtle and overt messages based on the method of communication. 9.4.8.IML.7: Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose (e.g., 1.2.8.C2a, 1.4.8.CR2a, 2.1.8.CHSS/IV.8.AI.1, W.5.8, 6.1.8.GeoSV.3.a, 6.1.8.CivicsDP.4.b, 7.1.NH. IPRET.8). 9.4.8.IML.8: Apply deliberate and thoughtful search strategies to access high-quality information on climate change (e.g., 1.1.8.C1b). 9.4.8.IML.9: Distinguish between ethical and unethical uses of information and media (e.g., 1.5.8.CR3b, 8.2.8.EC.2). 9.4.8.IML.10: Examine the consequences of the uses of media (e.g., RI.8.7). 9.4.8.IML.11: Predict the personal and community impact of online and social media activities. 9.4.8.IML.12: Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience. 9.4.8.IML.13: Identify the impact of the creator on the content, production, and delivery of information (e.g., 8.2.8.ED.1). 9.4.8.IML.14: Analyze the role of media in delivering cultural, political, and other societal messages. 9.4.8.IML.15: Explain ways that individuals may experience the same media message differently.
9.4.8.TL.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making. 9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4). 9.4.8.TL.3: Select appropriate tools to organize and present information digitally. 9.4.8.TL.4: Synthesize and publish information about a local or global issue or event (e.g., MS-LS4-5, 6.1.8.CivicsPI.3). 9.4.8.TL.5: Compare the process and effectiveness of synchronous collaboration and asynchronous collaboration. 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Vertical Integration- Discipline Mapping

Grade 4: Energy

Grade 6: Waves

Preparation for high school science courses.

Additional Materials

- Classroom posters display on laws of motion
- Word Wall
- YouTube Videos: motion, design, simple machines
- Bill Nye short videos: Motion, Simple Machines, Energy
- Additional supplies for building a battery: lemon, soda, Gatorade, juice, potato, etc.
- Additional metal strips for building a battery
- Additional metal objects for predicting magnetic interactions
- Foss website
- Quizlet
- Kahoot

- PowerPoint Design