Unit #2: Physical Science 6- Waves

Content Area: **Science**
Course(s): **Science 6**
Time Period: **Second Marking period**
Length: **January through mid-March**
Status: **Published**

Unit Overview

The Foss Waves module is developmentally appropriate, because the fundamental characteristics that describe wave behavior and properties are described in terms of mathematical relationships and graphical models that are best suited for students in middle school.

The Foss Waves module uses concrete observations, those of physical properties of mechanical waves, to the most abstract concepts, by which students develop a model of electromagnetic waves. Students will also delve into engineering applications and real-life connections along the way.

Students leave this course with a greater appreciation and understanding of modern communications technology and a solid foundation for high school and college physics.

STAGE 1- DESIRED RESULTS

2020 New Jersey Student Learning Standards- Science

Physical Science

SCI.MS-PS4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
SCI.MS-PS4-3	Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.
SCI.MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

Engineering, Technology, and Applications of Science

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

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

- PS4A: Wave Properties
- PS4B: Electromagnetic Radiation
- PS4C: Information Technologies and Instrumentation

Engineering, Technology, and Applications of Science

- ETS1A: Defining and Delimiting an Engineering Problem
- ETS1B: Developing Possible Solutioins

Essential Questions

Investigation 1: Make Waves

- What is frequency?
- What defines a wave?

Investigation 2: Wave Energy

- What is the relationship between wave properties and wave energy?
- How are engineering challenges solved?
- What is the best way to insulate a recording studio from outside sounds?

Investigation 3: Light Waves

- What happens when light waves interact with matter?
- What do spectra reveal about light?
- What happens to light waves at the interface between different media?

Investigation 4: Communication Waves

- What are some design constraints in fiber- optic communications?
- How is sound sent through radio waves?
- How are images sent through radio waves?

Enduring Understanding

The Waves course challenges students to think about concepts they have never considered before. The course proceeds from the most concrete observations, those of physical properties of mechanical waves, to the most abstract concepts, by which students develop a model of electromagnetic waves. Students will delve into engineering applications and real-life connections along the way.

Investigation 1: Make Waves

- Collect frequency data from multiple sources
- Create and describe longitudinal and transverse waves.
- Apply computational thinking when diagramming a wave, measuring its properties, and calculating velocity.

Investigation 2: Wave Energy

- Modify a model to see what happens when a property of a wave is changed.
- Evaluate information about a historical engineering failure.
- Design a sound studio that meets specified criteria and constraints.

Investigation 3: Light Waves

- Use lasers to carry out investigations of optical properties of different media.
- Use light spectra to identify light sources, and collect evidence to support light-wave explanations about color.

Investigation 4: Communication Waves

- Transmit data through optical fibers to test time constraints.
- Analyze graphical displays of carrier waves, sound waves, and modulated waves to understand their relationships and describe their properties.

Students will know…

VOCABULARY

Investigation 1: Make Waves

Amplitude, compression wave, crest, frequency, kinetic energy, longitudinal wave, node, pulse, reflection, transverse wave, trough, velocity, wave, wavelength

Investigation 2: Wave Energy

Absorb, acoustic engineer, acoustics, amplitude, brainstorm, compression wave, constraint, crest, criterion, decibel (dB), echo, energy, frequency, kinetic energy, longitudinal wave, mechanical wave, medium, model

Node, oscillation, pattern, pitch, property, prototype, pulse, reflect, reflection, reverberation, trough, tsunami, variable, velocity, vibration, volume, wave, wavelength

Investigation 3: Light Waves

angle of incidence, angle of reflection, electromagnetic spectrum, electromagnetic wave, emit. Filter, gamma ray, incident beam, infer, infrared (IR) wave, interface, inverse relationship, laser, light, microwave, normal, line, photon, primary wave (p-wave), prism, radiation, radio wave, ray, reflected beam, refract, refraction, secondary wave (s-wave), seismic wave, seismograph, seismologist, spectroscope, spectroscopy, transparent, transverse wave, ultraviolet (UV) light, visible light, white light, X-ray

Investigation 4: Communication Waves

amplitude modulation (AM), analog, binary, carrier wave, coherent light, demodulate, digital, fiber optics, frequency modulation (FM), modulation, optical fiber, pixel, resolution, sampling rate, telecommunication, telegraph, total internal reflection, transducer

Waves:

Misconceptions:

1. Students think of light is something that comes from a source such a light bulb or sun.
2. Students do not believe that light is a wave or travels as a wave.
3. Students believes the see more of themselves by moving further back from the mirror.
4. Students think light goes through an an object or reflects off an object but does not refraction (change direction).
5. Students do not believe light reflects off all objects, and the reason why the object is seen.
6. Students do not think of sound as a wave.
7. Students think that sound can travel through liquids and solids.
8. Students do not make a connection between the science of sound and music.

9. Students think sound are only made with certain materials and object
10. Students think loudness and pitch are the same thing

Students will be able to...

Investigation 1: Make Waves

- Collect frequency data from multiple sources
- Create and describe longitudinal and transverse waves.
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Investigation 2: Wave Energy

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Investigation 3: Light Waves

- Use lasers to carry out investigations of optical properties of different media.
- Use light spectra to identify light sources, and collect evidence to support light-wave explanations about color.

Investigation 4: Communication Waves

- Transmit data through optical fibers to test time constraints.
- Analyze graphical displays of carrier waves, sound waves, and modulated waves to understand their relationships and describe their properties.

Investigation 1: Make Waves

Part 1: Pulse Rate

Students measure their pulse under different circumstances. They use the pulse rate to calculate frequency and consider repeating patterns.

Students will:

- A wave is a back-and-forth pattern of motion that transfers energy.

Part 2: Spring Waves

Students make two types of spring waves: longitudinal and transverse. They observe wave reflection and make waves with different wavelengths, frequencies, and amplitudes. They learn the key parts of a wave and measure and diagram a wave.

Students will:

- A wave is a back-and-forth pattern of motion that transfers energy.
- Key features of waves are crests, troughs, and nodes.
- Waves can be described in terms of wavelength, frequency, and amplitude.
- If you know the frequency and wavelength, you can calculate the velocity of a wave.

Investigation 2: Wave Energy

Part 1: Energy in Waves

Students learn about mechanical waves, which travel through a medium. They watch a video about ocean waves as an introduction to wave energy. After defining energy, they conduct several mini experiments with springs to determine the relationships between wave length, frequency, and amplitude.

Students will:

- A mechanical wave travels through a medium. The amplitude, frequency, and wavelength of a wave are related to the energy transferred by the wave.The frequency and wavelength of a wave are related.

Part 2: Bridge Collapse

Students consider the Tacoma Narrows Bridge case study. After learning about the bridge failure, they consider the steps required to solve an engineering problem. They learn more about the decisions made in the Tacoma Narrows design.

Students will:

- Planning, researching, modeling, and testing can help engineers develop successful designs.

Part 3: Energy in Sound Waves

Students engage in a soundproofing engineering challenge. They test absorption of sound by different materials in different configurations and make measurements with a decibel meter.

- Planning, researching, modeling, and testing can help engineers develop successful designs.
- A sound wave is a mechanical wave, so it requires a medium to travel.
- Waves interacting with media can be absorbed or reflected.
- The amplitude, frequency, and wavelength of a wave are related to the energy transferred by the

wave.

Investigation 3: Light Waves

Part 1: Mirrors

Students develop a model of waves to explain properties of electromagnetic radiation. They use lasers and mirrors to explore properties of light-wave reflection.

Students will:

- A wave model can be used to explain the properties of light.
- Light travels in straight lines, except at the interface between transparent media where refraction occurs.
- The angle of incidence equals the angle of reflection.

Part 2: Spectra

Students use spectroscopes to analyze spectra from various light sources and to observe that filters absorb light of specific wavelengths. They learn about the electromagnetic spectrum beyond the visible range.

Students will:

- The electromagnetic spectrum extends beyond visible light.
- Different wavelengths of visible light are perceived as different colors.
- When light shines on an object, the light is reflected, absorbed, or transmitted through the object.

Part 3: Color

Students use color filters to make inferences about the relationship between wavelengths of light and the color of objects. They use this understanding to create a color camouflage drawing.

Students will:

- Different wavelengths of visible light are perceived as different colors.
- When light shines on an object, the light is reflected, absorbed, or transmitted through the object.

Part 4: Refraction

Students use lasers to determine that light can bend at the interface between two different media. They learn that when light bends so much that there is no refracted beam, there is total internal reflection.

Students will:

- Light travels in straight lines, except at the interface between transparent media where refraction

occurs.

Investigation 4: Communication Waves

Part 1: Optical Fibers

Students determine how far an optical fiber can be curved before it loses its ability to maintain total internal reflection.

Students will:

- Light can be transmitted long distances through optical fibers.
- Complex information like words, sounds, and images must be encoded to be sent as light.

Part 2: Sending Sound

Students learn about amplitude and frequency modulation, then consider the difference between analog and digital waves and create their own digitized waves.

Students will:

- Digital waves can have the same information as analog waves; digital waves can be improved by using smaller increments.
- Many modern communication devices use digitized signals (sent as waves) as a reliable way to encode and transmit information.
- Modern technology encodes information to improve transmission quality, reliability, and speed.

Part 3: Sending Images

Students analyze images at various resolutions to consider how to improve digital data. They learn more about the binary system and digitizing of data, then consider the benefits of digital waves.

Students will:

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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 procedures
- complete assignments
- develop and utilize models
- cooperate in groups and with partners
- complete a written science journal
- maintain class notes and vocabulary in MacBook Airs
- complete data tables
- complete and interpret graphs

Benchmark Assessments

- Final module exam.
- End of investigation assessments.

STAGE 3- LEARNING PLAN

Instructional Map

Sessions (60 Minutes Each)

Investigation 1: Make Waves

- Part 1- Pulse Rate (1 session)
- Part 2- Spring Waves (4 sessions)
- Assessment- (1 session)

Investigation 2: Wave Energy

- Part 1- Energy in Waves (2 sessions)
- Part 2- Bridge Collapse (2 sessions)
- Part 3- Energy in Sound Waves (4 sessions)
- Assessment- (1-2 sessions)

Investigation 3: Light Waves

- Part 1- Mirrors (2 sessions)
- Part 2- Spectra (2 sessions)
- Part 3- Color (2 sessions)
- Part 4- Refraction (2 sessions)
- Assessment- (1-2 sessions)

Investigation 4: Communication Waves

- Part 1- Optical Fibers (2 sessions)

Part 2- Sending Sounds (2 sessions)

Part 3- Sending Images (2 sessions)

Assessment- (2 sessions)

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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

Differentiation Strategies for At Risk 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
- 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

Grades 6

6.RP.A. Understand ratio concepts and use ratio reasoning to solve problems.

6.NS.B. Compute fluently with mulit-digit numbers and find common factors and multiples.

6.NS.C. Represent and analyze quantitative relationships between dependent and independent variables.

6.G. A. Solve real world and mathematical problems.

6.EE.A. Apply and extend previous understanding of arithmetic to algebraic expressions.

6.SP.B. Summarize and describe distributions.

Reading Science and Technical Subjects

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 History, Science and Technical Subjects

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

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.

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.

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

D. Establish and maintain a formal/academic style, approach, and form.

E. Provide a concluding statement or section that follows from and supports the argument presented.

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

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.

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

C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.

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

E. Establish and maintain a formal/academic style, approach, and form.

F. Provide a concluding statement or section that follows from and supports the information or explanation presented

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

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

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.

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.

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.

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.

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

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

Kindergarten: Materials and Motion

Grade 1: Sound and Light

Grade 2: Solids and Liquids

Grade 3: Motion and Matter

Grade 4: Energy

Grade 5: Mixtures and Solutions

Preparation for high school science courses

Additional Materials

Discovery Education with username and password

Visit FOSSWEB.com for list of websites, and additional readings

Search YouTube for related videos.