NEPTUNE CITY SCHOOL DISTRICT

Elementary Science
Curriculum
Grade 4

NEPTUNE CITY SCHOOL DISTRICT
Office of the Chief School Administrator, Principal
210 West Sylvania Avenue
Neptune City, NJ 07753

The Neptune City School District is appreciative and proud to accept and align the curriculum of the NEPTUNE CITY School District to properly prepare the Neptune City students for successful integration into the NEPTUNE CITY High School Educational Program.

April 1, 2025 Document C1#1

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SCHOOL DISTRICT MISSION STATEMENT

The Neptune City School District, in partnership with the parents and the community, will support and sustain an excellent system of learning, promote pride in diversity, and expect all students to achieve the New Jersey Student Learning Standards at all grade levels to become responsible and productive citizens.

NEPTUNE CITY SCHOOL DISTRICT

ELEMENTARY SCIENCE
GRADE 4
CURRICULUM

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NEPTUNE CITY SCHOOL DISTRICT

Elementary Science
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Acknowledgements

The Grade 4 Science Curriculum was developed for the NEPTUNE CITY Elementary Schools through the efforts of Cheryl Janulis, elementary teacher, in cooperation with Stacie Ferrara, Ed.D., Supervisor of STEM, and with guidance of Sally A. Millaway, Ed.D., Director for Curriculum, Instruction and Assessment.

Mrs. Janulis is to be commended for her dedication in creating learning plans that are aligned with the 2020 New Jersey Student Learning Standards in Science. These learning plans contain student-centered, inquiry-based activities that meet the requirements of the standards. It is our hope that this guide will serve as a valuable resource for the staff members who teach second grade and that they will feel free to make recommendations for its continued improvement.

NEPTUNE CITY SCHOOL DISTRICT

DISTRICT MISSION STATEMENT

The primary mission of the NEPTUNE CITY School District is to prepare all of our students for a life-long learning process and to become confident, competent, socially- and culturally-conscious citizens in a complex and diverse world. It is with high expectations that our schools foster:

- A strong foundation in academic and modern technologies
- A positive, equitable, and varied approach to teaching and learning
- An emphasis on critical thinking skills and problem-solving techniques
- A respect for and an appreciation for our world, its resources, and its diverse people
- A sense of responsibility, good citizenship, and accountability
- An involvement by the parents and the community in the learning process

NEPTUNE CITY School District

Educational Outcome Goals

The students in the NEPTUNE CITY schools will become life-long learners and will:

- Become fluent readers, writers, speakers, listeners, and viewers with comprehension and critical thinking skills.
- Acquire the mathematical skills, understandings, and attitudes that are needed to be successful in their careers and everyday life.
- Understand fundamental scientific principles, develop critical thinking skills, and demonstrate safe practices, skepticism, and open-mindedness when collecting, analyzing, and interpreting information.
- Become technologically literate.
- Demonstrate proficiency in all New Jersey Student Learning Standards (NJSLS).
- Develop the ability to understand their world and to have an appreciation for the heritage of America with a high degree of literacy in civics, history, economics and geography.
- Develop a respect for different cultures and demonstrate trustworthiness, responsibility, fairness, caring, and citizenship.
- Become culturally literate by being aware of the historical, societal, and multicultural aspects and implications of the arts.
- Demonstrate skills in decision-making, goal setting, and effective communication, with a focus on character development.
- Understand and practice the skills of family living, health, wellness and safety for their physical, mental, emotional, and social development.
- Develop consumer, family, and life skills necessary to be a functioning member of society.
- Develop the ability to be creative, inventive decision-makers with skills in communicating ideas, thoughts and feelings.
- Develop career awareness and essential technical and workplace readiness skills, which are significant to many aspects of life and work.

INTEGRATED SOCIAL AND EMOTIONAL LEARNING COMPETENCIES

The following social and emotional competencies are integrated in this curriculum document:

Self-Awareness	
x	Recognize one's own feelings and thoughts
x	Recognize the impact of one's feelings and thoughts on one's own behavior
x	Recognize one's personal traits, strengths and limitations
x	Recognize the importance of self-confidence in handling daily tasks and challenges
Self-Management	
x	Understand and practice strategies for managing one's own emotions, thoughts and behaviors
x	Recognize the skills needed to establish and achieve personal and educational goals
	Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals
Social Awareness	
x	Recognize and identify the thoughts, feelings, and perspectives of others
x	Demonstrate an awareness of the differences among individuals, groups, and others' cultural backgrounds
x	Demonstrate an understanding of the need for mutual respect when viewpoints differ
	Demonstrate an awareness of the expectations for social interactions in a variety of setting
Responsible Decision Making	
x	Develop, implement and model effective problem solving and critical thinking skill
x	Identify the consequences associated with one's action in order to make constructive choices
x	Evaluate personal, ethical, safety and civic impact of decisions.
Relationship Skills	
x	Establish and maintain healthy relationships
x	Utilize positive communication and social skills to interact effectively with others
x	Identify ways to resist inappropriate social pressure
	Demonstrate the ability to present and resolve interpersonal conflicts in constructive ways
x	Identify who, when, where, or how to seek help for oneself or others when needed

Unit Plan Title	Safety
Suggested Time Frame	Ongoing and Embedded in Units as Appropriate

Overview / Rationale
Safety in the classroom setting is important for students and teachers. Personal safety is reviewed at the beginning of each school year in science lessons and should be demonstrated and adhered to by teachers and students in all activities including class demonstrations, lab investigations, hands-on projects, gardening, outdoor classroom settings and any other school setting as well as SummerWood.

Stage 1 – Desired Results

Established Goals:
Although there are no specific New Jersey Student Learning Standards in Science describing safety procedures or rules, teachers should refer to the standards in each unit that requires and utilizes laboratory activities, demonstrations and investigations to support meeting the standard(s).

Essential Questions:	**Enduring Understandings:**
● How can accidents and injuries be avoided in the classroom and laboratory settings? ● What steps should be taken to respond to emergencies and accidents in the classroom, laboratory and workplace setting?	● Safety precautions are important for all areas of life and should be practiced by everyone on a daily basis. ● It is important that safety practices are understood and exercised in the classroom, laboratory, and on the job.
Knowledge: *Students will know…* ● Lab safety rules and expectations ● Names and uses of lab equipment ● Location and use of safety equipment	**Skills:** *Students will be able to…* ● Explain appropriate health and safety practices in the classroom and laboratory. ● Identify common hazards in the classroom and school setting.. ● Identify name and use of material and equipment ● Explain how to respond to various safety situations and accidents. ● Demonstrate how to use materials and equipment. .

Interdisciplinary Connections
New Jersey Student Learning Standards -English Language Arts (2016) NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed. **New Jersey Student Learning Standards-Comprehensive Health and Physical Education(2020)** 2.1.5.PGD.1: Identify effective personal health strategies and behaviors that reduce illness, prevent injuries, and maintain or enhance one's wellness (e.g., adequate sleep, balanced nutrition, ergonomics, regular physical activity). 2.1.5.CHSS.1: Identify health services and resources available and determine how each assists in addressing needs and emergencies in a school and in the community (e.g., counselors, medical professionals). 2.2.5.MSC.3: Demonstrate and perform movement skills with developmentally appropriate control in isolated settings (e.g., skill practice) and applied settings (e.g., games, sports, dance, recreational activities). 2.3.5.PS.1: Develop strategies to reduce the risk of injuries at home, school, and in the community.

Stage 2 – Assessment Evidence
Pre-Assessments: What do you know about safety? ***Formative Assessments:*** Equipment- names and uses Room layout and safety equipment location Use of Safety equipment- eye wash, hood, fire blanket, fire extinguisher Fire drill exit Call for help in school

Unit Plan Title	Unit 1: Plant and Animal Structures
Suggested Time Frame	5-6 weeks

Overview / Rationale

In this unit, students explore plant structures that are used for support and growth, protection, reproduction, and responding to the environment. Students examine animal structures that are used for digestion, circulation, support, movement, protection, reproduction, and sensing and responding to the environment. Can students use what they know about the structures of both plants and animals to give a comic book artist ideas for creating new creatures for his latest work?

Stage 1 – Desired Results

Established Goals:

New Jersey Student Learning Standards in Science (2020)

4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2 Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

4-PS4-2 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

Essential Questions:

- What plant structures are used for support and growth?
- What animal structures are used for digestion and circulation?
- What plant structures are used for protection?
- What animal structures are used for reproduction?
- What animal structures are used for sensing the environment?

Enduring Understandings:

Students will understand that…

- Plants have structures that they use for support and growth.
- Animals have structures that are used for digestion and circulation.
- Plants have structures that are used for protection.
- Animals have structures that are used for reproduction.
- Animals have structures that are used for sensing the environment.

Knowledge:

Students will know…

- Plants have roots, which anchor the plant into the ground and take in water and nutrients from the soil.
- Plants have a stem, which holds the plant upright and carries the water and nutrients to the other parts of the plant.
- Plants have leaves, and that is where food is made for the plant.
- Photosynthesis is the process by which plants make their own food.
- Animals have internal and external structures animals use for digestion.

- Animals have substructures of the circulatory system that work to serve a function.
- Plants have structures that protect them from drying.
- Plants have spines and thorns for protection.
- Plants have different kinds of bark, and each type protects the plant in a different way.
- Plants produce poison and bad-tasting substances for protection.
- Animals have structures that help them reproduce.
- Sense receptors are structures that can work together to detect information about the environment and help an animal find food, reproduce, detect danger, and so on. They can detect light (eyes), sound (ears), smells (noses), touch (skin), and taste (taste buds).

Skills:

Students will be able to…

- Observe shapes and structures of plant parts that serve functions
- Describe a plant system in terms of its components and structures.
- Investigate celery stalks demonstrating that water can be transported through the celery stems up to the leaves.
- Support an argument, supported by evidence that plants have structures for support and growth.
- Describe components of a system animals use to eat and digest food.
- Identify internal and external structures animals use for digestion.
- Obtain information from a video as a basis to write a narration to communicate scientific information about how animals survive.
- Explain how substructures of the circulatory system work to serve a function.
- Draw and label a model digestive and circulatory system to support an argument about how and why the structures work together.
- Conduct research on a problem before beginning to design a solution.
- Explore the various structures plants use for protection.
- Observe patterns to which kinds of protection a plant might need and answer questions based on evidence presented.
- Apply scientific ideas, using criteria and constraints, to generate a solution to protecting a hypothetical plant.
- Compare solutions and choose the best solution based on how well the criteria and constraints are met.
- Observe animals in different ecosystems to produce data to serve as the basis for evidence for animal reproduction.
- Use their observations as evidence to support a claim on whether the organisms being observed are attracting a mate, reproducing, or caring for an offspring.
- Construct an explanation, using evidence from observations to support that animals have internal and external structures that function to support reproduction.

Interdisciplinary Connections

New Jersey Student Learning Standards for English Language Arts (2016)

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

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

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

NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
NJSLSA.SL2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information
SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.

New Jersey Student Learning Standards for Mathematics (2016)
MP.1 Make sense of problems and persevere in solving them.
MP.3 Construct viable arguments and critique the reasoning of others.
5.MD.B. Represent and interpret data.
4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

New Jersey Student Learning Standards for Career Readiness,Life Literacies, and Key Skills (2020)
9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions.
9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process
9.4.5.CT.2: Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem

New Jersey Student Learning Standards for Computer Science and Design Thinking (2020)
8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.

Student Resources
● Interactive notebook (available in Spanish) ● Science Journal (available in Spanish)
Teacher Resources
● Teach TCI teacher subscription www.teachtci.com. Reach out to the STEM Supervisor for a login and password. ● Unit 1 Lesson guides (#s?) ● Science journal ● Interactive Student Notebook ● Teach TCI Handouts

Stage 2 – Assessment Evidence
Pre-Assessments: Observing Phenomena

Formative Assessments:
Vocabulary
Questions and Observations of Student Work Throughout the Lesson
Wrap Up: My Science Concepts
Make Sense of Phenomena

Summative Assessments:
Lesson/Unit Assessment (available in Spanish)
Lesson Game
Show What You Know

Performance Task(s):
Celery Stalk Investigation

Stage 3 – Learning Plan

Bold= Fast track (required activities)
Italic = Extended track (optional activities to support student learning)

Lesson 1 What Plant Structures are Used for Support and Growth?

Observing phenomena (5 min):Students observe a photo and ask questions.

Introducing Plant Structures (5 min): Students watch a video and answer questions.

Plant Structure Videos (25 min): Students watch 3 videos and answer questions.

Observing Photosynthesis (20 min) : Students watch videos, view a diagram, and answer questions.

Investigating a Celery Stalk (25 min): Students participate in an investigation using celery, water, and food coloring to observe the vascular system of a plant.

Reviewing the Vascular System (5 min): Students will watch a video to review the vascular system and then discuss questions.

Vocabulary (3 min): Students match vocabulary terms to definitions (chlorophyll, leaf, photosynthesis, root, stem, vascular system).

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)
1. Plants Need Sunlight, Air, Water, and Nutrients
2. Roots Take in Water and Provide Support
3. Stems Support Plants
4. Leaves Make Food
5. The Vascular System

Show What you Know (10min): Students write a claim with 2 pieces of evidence.

Make Sense of Phenomena (5 min) Use what you have learned to explain a phenomenon.

Lesson 2 What Plant Structures are Used for Protection?

Observing Phenomena (5 min): Students observe a photo, watch a video, and ask questions.

Introducing Plant Protection (2 min): Students are introduced to a plant that needs their help because t is in a hot and dry environment with many animals that eat plants.

Modeling the Process (5 min): Students will examine an image and answer questions.

Observing Plant Protection (20 min): Students visit stations around the room to learn about different plants.

Observing More Plant Protection (10 min): Students examine photographs and fill out a table.

Debriefing Protecting Plant Structures (10 min): Students will respond to questions about plant protection.

Generating Solutions (10 min): Students brainstorm solutions that meet criteria and constraints.

Comparing and Presenting Solutions (15 min): Students will join with another pair and look at all their solutions. They will compare how well each solution is likely to meet the criteria and constraints and choose their best solution.

Vocabulary (3 min): Students match vocabulary terms to definitions. (spine, bark, thorn)

Wrap-Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text with Notes (Reading):

1. Protection Against Drying
2. Spines and Thorns
3. Plant Coverings
4. Poisons and Bad-Tasting Substances

Show What You Know (10 min): Students create a Super Plant.

Making Sense of Phenomenon (5 min): Use what you have learned to explain a phenomenon.

Lesson 3 What Plant Structures are Used for Reproduction?

Observing Phenomena (5 min): Students observe a photo, watch a video, and ask questions.

Observing Flowers (5 min) Students compare and contrast different flowers.

Diagramming Your Flower (5 min) Students draw and label a diagram of plant structures.

Dissecting Your Flower (15 min): Students dissect a flower.

Analyzing a Video (5 min): Students describe how a bee is helping a plant reproduce.

Constructing an Argument (10 min): Students make an argument that answers this question: *Why do plants have flowers?*

Studying Symmetry and Revising a Claim (10 min): Students identify symmetry in flowers and support/revise a claim that all flowers have a line of symmetry.

Vocabulary (3 min): Students match vocabulary terms to definitions. (cone, fertilization, ovary, pistil, pollen)

Wrap-Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text with Notes (Reading):

1. Plants Make More Plants
2. Some Plants Produce Flowers
3. Some Plants Produce Cones
4. Seeds Must Be Scattered
5. Plants That Reproduce with Spores

Show What You Know (10 min): Students write a story about a piece of pollen, which begins on a stamen, or a male cone, and ends by growing into a new plant.

Making Sense of Phenomenon (5 min): Use what you have learned to explain a phenomenon.

Lesson 4 How Do Plants Respond to their Environment?

Observing Phenomena (5 min): Students observe photo, watch a video, and ask questions.

Setting Up and Reviewing Plant Responses (15 min) Students create a simple model plant using their bodies.

Playing Plant Says (15 min): Students play a game similar to Simon Says.

Debriefing the Plant Says game (10 min): Students choose a stimulus and explain how a plant would respond to that stimulus. They complete a T-chart.

Describing How Plants Respond (5 min): Students draw and label a diagram describing how plants respond to their environment.

Vocabulary (3 min): Students match vocabulary terms to definitions. (response, stimulus, gravity)

Wrap-Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text with Notes (Reading):

1. Stems and Leaves Respond to Light
2. Roots Respond to Gravity and Water
3. Leaves and Stems Respond to Touch
4. Plants Respond to Seasons

Show What You Know (10 min): Students write a claim that answers the lesson question: *How do plants respond to their environment?* Then, they explain using at least two pieces of evidence that support their claim.

Making Sense of Phenomenon (5 min): Use what you have learned to explain a phenomenon.

Lesson 5 What Animal Structures are Used for Digestion and Circulation?

Observing Phenomena (5 min): Students observe a photo, watch a video, and ask questions.

Observing Snow Monkeys (10 min): Students create a narration for a video.

Observing Bovine: (10 min): Students create a narration for a video.

Observing Structures for Digestion (10 min): Students create a narration for a video.

Observing Structures for Circulation (10 min): Students create a narration for a video.

Vocabulary (3 min): Students match vocabulary terms to definitions.

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text with Notes (Reading):

1. Animals Need Food, Water, and Air to Survive
2. Structures for Getting Food and Water
3. Structures for Digesting Food
4. Blood Transports Materials
5. The Heart is a Pump

Show What you Know (10min): Students observe a photo and answer a series of questions.

Make Sense of Phenomena (5 min) Use what you have learned to explain a phenomenon.

Lesson 6 What Animal Structures are Used for Support, Movement, and Protection?

Observing Phenomena (5 min): Students observe a photo, watch a video, and ask questions.

Asking Questions (5 min): Students watch the video and answer questions.

Observing Pill Bugs (20 min): Students observe pill bugs and answer the Investigation Question: *What structures do pill bugs have for movement and protection?*

Identifying Structures on Other Animals (5 min): Students observe two more animals and answer questions about structures for protection.

Acting Out Animal Structures (25 min): Students act out structures an animal uses for support, movement, and protection.

Observing Symmetry in Animals (5 min): Students explore symmetry in animals.

Vocabulary (3 min): Students match vocabulary terms to definitions. (joint, skeleton, muscle, exoskeleton)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text with Notes (Reading):

1. Bones Make up the Skeleton
2. Muscles Move Bones
3. Bird and Fish Structures for Movement
4. Animals Without Backbones Need Support
5. Other Structures Allow Movement
6. Animal Structures for Protection

Show What you Know (10min): Students observe a photo and answer a series of questions.

Make Sense of Phenomena (5 min) Use what you have learned to explain a phenomenon.

Lesson 7 What Animal Structures are Used for Reproduction?

Observing Phenomena (5 min): Students begin by analyzing a photograph. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Exploring a Hot Air Balloon (30 min): Students will "fly" around the world to different ecosystems in a hot air balloon. Then you will descend to the ground and observe the reproductive structures of various animals.

Sharing Your Findings (15 min): Students will share their findings.

Vocabulary (3 min): Students match vocabulary terms to definitions. (sperm, egg)

Wrap-Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text with Notes (Reading):

1. Structures for Finding and Choosing a Mate
2. Structures for Reproduction
3. Structures for Taking Care of Offspring

Show What You Know (10 min): Students write a claim that answers the lesson question: *How do animals' structures help them reproduce?* They provide at least two pieces of evidence that support their claim.

Making Sense of Phenomenon (5 min): Students will write and support a claim about the animal structures used for reproduction.

Lesson 8 What Animal Structures are Used for Sensing the Environment?

Observing Phenomena (5 min): Students begin by analyzing a photograph. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Reviewing Models (10 min). Students learn why it's important to know what is alike and different between the model and the thing it represents.

Introducing Pinhole Cameras (5 min): Students discuss how pinhole cameras work.

Building a Pinhole Camera (20 min): Students will build a pinhole camera. They will use this camera as a model for understanding how an eye sees images.

Making Observations (15 min): Students will go outdoors to explore with their pinhole cameras.

Developing a Model for Light (15 min): Students will analyze a diagram and use their observations to build a model about how light works in their notebook.

Vocabulary (3 min): Students match vocabulary terms to definitions. (sense receptor, eardrum, eye, antenna, ear, taste bud)

Wrap-Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text with Notes (Reading):

1. Sense Organs Detect Stimuli
2. Structures for Detecting Sound
3. Structures that are Sensitive to Touch
4. Structures for Detecting Substances
5. Structures for Detecting Light
6. Scientists Studying Light
7. Engineering Sense Organs

Show What you Know (10min): Students will summarize what they've learned about sense receptors in a table.

Making Sense of Phenomenon (5 min): Students will write and support a claim about what would happen if owls didn't have large eyes.

Lesson 9 How Do Animals Respond to Their Environment?

Observing Phenomena (5 min): Students begin by analyzing a photograph. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Developing a Model for the Senses (15 min) Students click buttons on an image to learn how animals use their senses to respond to the world around them, and then they draw a model.

Setting the Stage (10 min): Groups will learn how to work as sense detectives to find a missing rabbit.

Gathering Evidence (30 min): Groups will work as sense detectives and visit different stations to find Snowball the Rabbit. They will fill out tables as they work.

Examining the Evidence (15 min): Students will examine the evidence they gathered during the investigation and determine where Snowball is hiding.

Vocabulary (3 min): Students match vocabulary terms to definitions. (brain, memory, spinal cord, behavior)

Wrap-Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text with Notes (Reading):

1. The Brain Controls the Body's Activities
2. Nerves and the Spinal Cord
3. Instincts
4. Reflexes
5. Learned Behavior
6. Memory

Show What you Know (10min): Students will complete a diagram and draw a diagram to show how animals respond to their environment.

Making Sense of Phenomenon (5 min): Students will write and support a claim about how sandhill cranes respond to their environment.

Unit Plan Title	Unit 2: Energy
Suggested Time Frame	6-7 weeks

Overview / Rationale

In this unit, students explore how energy and motion are related, how energy is transferred between colliding objects, and how energy is transferred by sound, light, heat, and electric currents. Students examine the ways energy is stored and used, and how people choose energy resources. Students design a safety device for bike riding that uses energy. How can students use what they know to help teach others about how energy transfers from one place to another by creating a safety pamphlet about bike helmets?

Stage 1 – Desired Results

Established Goals:

New Jersey Student Learning Standards in Science (2020)

4-PS3-1 Use evidence to construct an explanation relating the speed of an object to the energy of that object.

4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide.

4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Essential Questions:

- How are energy and motion related?
- How is energy transferred by colliding objects?
- How is energy transferred by sound, light, and heat?
- How is energy transferred by electric currents?
- How is energy stored and used?
- How do people choose energy resources?

Enduring Understandings:

Students will understand that…

- All objects have energy.
- Energy is defined as the ability of an object to move another object or cause some other kind of change.
- Objects moving faster have more energy, and objects moving slower have less energy.
- All the energy that an object has was transferred to it by another object at some point.
- All energy is conserved.
- Energy cannot be created or destroyed.

Knowledge:

Students will know…

- Kinetic energy, or what we call "energy of motion," is dependent on the weight of the object.
- Heavier objects have more kinetic energy, and lighter objects have less kinetic energy.
- The kinetic energy of an object is dependent on the speed of the object.
- When an object transfers energy to another object, it "loses" the energy that is transferred away.
- Objects only get energy from other objects, and they only lose energy by transferring it to other objects.
- The energy of an object can be "stored up" based on its position.

Skills:

Students will be able to…

- Discuss that energy can be transferred in various ways and between objects.
- Plan and conduct an investigation to find out how high on a ramp a ball needs to be placed for it to roll a certain distance.
- Use measurements, observations, and patterns as evidence to construct an explanation that explains how energy and motion are related.
- Discover that the faster a given object is moving, the more energy it possesses
- Identify scientific (testable) and non-scientific (non-testable) questions.
- Plan and conduct a fair-test investigation and work collaboratively to produce data to serve as the basis for evidence.
- Predict reasonable outcomes based on patterns such as cause and effect relationships.
- Construct and/or support an argument with evidence, data, and/or a model.
- Discover that when objects collide, energy is transferred from one object to another, thereby changing their motion.
- Review that energy can be transferred in various ways and between objects.
- Use observations of images showing different kinds of energy transfers as evidence to support solutions to problem scenarios.
- Conclude that energy is present whenever there are moving objects, sound, light, or heat.
- Understand that energy can be moved from place to place by moving objects or through sound or light.
- Discuss ways energy can be transferred by electric currents.
- Describe part by part, how electric current flows in a system.
- Build circuits and make observations to produce data to serve as the basis for evidence to test a design solution.
- Apply scientific ideas to solve design problems and discover multiple ways to build a circuit that gives the same result.
- Define a simple design problem and engineer a solution by designing a tool that uses stored energy by electric currents to produce sound, light or motion.
- Apply the concept that energy can be transferred in various ways and between objects to engineer a device.
- Build a lunchbox alarm that uses energy stored in a battery to power a device that will produce sound, light, or motion.
- Define criteria and constraints and propose and compare different solutions based on how well they meet those criteria and constraints.
- Research energy sources to obtain information and describe that energy fuels are derived from natural resources and their uses affect the environment.

- Compare information from reliable sources to come up and report possible solutions about energy resources in a town.
- Create a poster listing pros and cons of an energy choice, using relevant evidence about how it can solve a problem.
- Identify cause and effect relationships to illustrate the advantages and drawbacks of using a kind of energy resource.
- Conclude that energy and fuels that humans use are from natural sources and their uses affect the environment in many ways and that some resources are renewable and others are not.

Interdisciplinary Connections

New Jersey Student Learning Standards for English Language Arts (2016)
NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.R2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.

New Jersey Student Learning Standards for Mathematics (2016)
MP.1 Make sense of problems and persevere in solving them.
MP.3 Construct viable arguments and critique the reasoning of others.
5.MD.B. Represent and interpret data.
4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

New Jersey Student Learning Standards for Career Readiness,Life Literacies, and Key Skills (2020)
9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions.
9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process

New Jersey Student Learning Standards for Computer Science and Design Thinking (2020)
8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.

Student Resources
● Interactive notebook (available in Spanish) ● Science Journal (available in Spanish)
Teacher Resources
● Teach TCI teacher subscription www.teachtci.com. Reach out to the STEM Supervisor for a login and password. ● Unit 1 Lesson guides (#s?) ● Science journal ● Interactive Student Notebook ● Teach TCI Handouts

Stage 2 – Assessment Evidence
Pre-Assessments: Observing Phenomena ***Formative Assessments:*** Vocabulary Questions and Observations of Student Work Throughout the Lesson Wrap Up: My Science Concepts Make Sense of Phenomena ***Summative Assessments:*** Lesson/Unit Assessment (available in Spanish) Lesson Game Show What You Know ***Performance Task(s):*** Creating a Safety Pamphlet Designing a Safety Device

Stage 3 – Learning Plan
Bold= Fast track (required activities) *Italic = Extended track (optional activities to support student learning)* **Lesson 1 How are Energy and Motion Related?** **Observing phenomena (5 min): Students view a photo, watch a video, and write questions about how energy and motion are related.** *Reviewing Energy Concepts (5 min): Students participate in a science talk.* **Setting Up the Investigation (10 min): Students will set up the investigation area to explore how energy and speed are related to make a ball roll a certain distance.**

The 1 Meter Challenge (15 min): Students participate in an investigation and record the angle of their ramp, the distance up the ramp, and whether their ball needed more energy, less energy, or had the right amount of energy to roll 1 meter.

The 1 Meter Challenge: Discussion (15 min): Class comes together to discuss results of investigation.

Improving the Investigation (5 min): Students think of a way to change variables to make their investigation more efficient.

The 2 Meter Challenge (15 min): Students participate in an investigation to make a ball roll only 2 meters. They record findings in a table.

The 2 Meter Challenge: Discussion (15 min): Class discusses variables.

Reflection (5 min): Class discusses how groups went about the two challenges.

Vocabulary (3 min): Students match vocabulary terms to definitions. (transfer, energy, conserved)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)
1. Moving Objects Have Energy
2. Heavier Objects Have More Energy
3. Objects Moving Faster Have More Energy
4. Energy Can Be Gained and Lost
5. Energy Can Be Stored
6. Energy is Conserved

Show What you Know (10min): Students come up with a claim on how energy and motion are related. Then, they explain how they would investigate this claim.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 2 How is Energy Transferred by Colliding Objects?

Observing phenomena (5 min): Students view a photo, watch a video, and write questions about how energy and motion are related.

Reviewing Energy Concepts (5 min): Students participate in a science talk.

Setting Up Your Zipline (5 min): To prepare to use what they know about the energy of motion to develop and test several investigations using ziplines, students will build a zipline.

Planning An Investigation (15 min): Students will think of some ways that they might make their investigation a fair test and enter them in a table. Then they will use this information to predict the results of their investigation.

Conducting an Investigation (15 min): Students will conduct the investigation, record observations, and write a conclusion.

Sharing Results (5 min): Students will share and discuss results.

Designing Your Own Investigations (40 min): Students will come up with two more questions and design investigations to test them.

Vocabulary (3 min): Students match vocabulary terms to definitions. (collision, touch, energy, conserves, transfers, motion)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)
1. Energy is Transferred and Conserved
2. Collisions and Motion
3. Collisions and Sound, Light, and Heat
4. Imagining Collisions Without Conserved Energy

Show What you Know (10min): Students identify testable questions and choose one to investigate.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 3 How is Energy Transferred by Sound, Light, and Heat?

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Reviewing and Observing Energy Transfers in Class (15 min): Students will observe and discuss energy transfers.

Energy Transfer by Heat (10 min): Students observe several images and discuss some ways energy is being transferred in the image. Then, they will read each problem solving scenario and come up with solutions.

Energy Transfer by Sound (10 min): Students observe several images and discuss some ways energy is being transferred in the image. Then, they will read each problem solving scenario and come up with solutions.

Energy Transfer by Light (10 min): Students observe several images and discuss some ways energy is being transferred in the image. Then, they will read each problem solving scenario and come up with solutions.

Energy Transfer by Heat, Sound, and Light (10 min): Students observe several images and discuss some ways energy is being transferred in the image. Then, they will read each problem solving scenario and come up with solutions.

Vocabulary (3 min): Students match vocabulary terms to definitions. (reflect, absorb, vibrate)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)
1. Sound, Light, and Heat Transfer Energy
2. Sound Carries Energy
3. Light Carries Energy
4. Heat Carries Energy
5. Imagining Sound, Light, and Heat without Conserved Energy

Show What you Know (10min): Students write a caption for an image describing how energy is transferred.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 4 How is Energy Transferred by Electric Currents?

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Discussing Electric Currents (10 min): Students will describe how electric current is flowing step-by-step.

Deciding Circuit Notation (5 min): Students will record circuit notations they decided on as a class.

Building Circuits (35 min): Students will build and draw circuits using a variety of materials.

Making and Solving a Puzzle (25 min): Students will design their own puzzle.

Vocabulary (3 min): Students match vocabulary terms to definitions. (motor, electricity, electric current, solar cell)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)
1. Electric Currents Transfer Energy
2. Light and Heat Can Make Electric Currents
3. Electric Currents and Motion

4. Electric Currents and Sound
5. Electric Currents and Light
6. Electric Currents and Heat
7. Imagining Electric Currents without Conserved Energy

Show What you Know (10min): Students describe how energy is being transferred by an electric current in a picture.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 5 How is Energy Stored and Used?

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Reviewing Circuits (5 min): Students will review how circuits work.

Defining the Problem (10 min): Students will identify the criteria for a lunchbox alarm and list possible constraints.

Planning a Design (10 min): Students will draw and label their design for an alarm.

Building the Design (20 min): Students will build their alarm.

Testing the Design (10 min): Groups test each others' alarms.

Improving the Design (10 min): Students will improve the design of their lunchbox alarm based on the test.

Presenting Your Design (20 min): Students will share their design with the class, describing each step they took in the engineering process.

Vocabulary (3 min): Students match vocabulary terms to definitions. (efficient)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)
1. Energy is Stored
2. Stored Energy is Useful
3. Engineers Use Energy to Solve Problems
4. Energy Can Solve Everyday Problems

Show What you Know (10min): Students write captions for different images that explain how the stored energy is converted to another form.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 6 How Do People Choose Energy Resources?

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Energy Resources (5 min): Students will briefly review the types of energy resources.

Understanding Your Role (5 min): Students will learn about the investigation. They will act as science and engineering advisors to the mayor of Townville. They will research a certain energy resource and then report back to the mayor of Townville.

Researching Your Resource (10 min): Students will conduct research on the energy resource. They will take notes using questions like: How is the resource obtained? How does it affect the environment? Is it renewable?

Calculating Costs (15 min): Students will calculate costs of using the energy resource.

Creating a Poster (15 min): Students will create a poster illustrating the pros and cons of their energy resource.

Presenting Your Poster (15 min): Students will present their posters to the class.

Voting (10 min): Students (the citizens of Townville) will vote for which energy resource they want.

Vocabulary (3 min): Students match vocabulary terms to definitions. (renewable resource, natural resource, nonrenewable resource)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)

1. Everything Uses Energy
2. Energy Comes from Natural Resources
3. Energy Resources Have Advantages and Disadvantages
4. Energy Use in the Past and Present

Show What you Know (10min): Students pick an energy resource, research questions, and write a letter to their mayor explaining why they think this energy resource should be used in their town.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Unit Plan Title	Unit 3: Earth's Changing Surface
Suggested Time Frame	6-7 weeks

Overview / Rationale

Students are introduced to the anchoring phenomenon of how the once tall and pointy Appalachian Mountains have become low and rounded over time. In this unit, students investigate Earth's changing surface as they explore clues that show Earth's surface changes. Students examine how water, wind, and living things also make changes to Earth's surface. Students find out about fossils and how the location of fossils can indicate past changes to Earth's surface. Students locate where earthquakes, volcanoes, and mountains are found, and discover what people can do about natural hazards. Using what they know about how Earth's surface changes and the resulting natural hazards, can students develop a hazard plan for their community?

Stage 1 – Desired Results

Established Goals:
New Jersey Student Learning Standards-Science (2020)

4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features.

4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes and climate change have on humans.

Essential Questions:

- What are some clues that Earth's surface changes?
- How does water change Earth's surface?
- How does wind change Earth's surface?
- How do living things change Earth's surface?
- How do fossils form and what do they show?
- Where on Earth are earthquakes, volcanoes, and mountains found?
- What can people do about natural hazards?

Enduring Understandings:
Students will understand that…

- Water flow changes Earth's surface.
- Water breaks rocks, soils, and sediment into smaller particles and moves them around.
- Wind changes the surface through weathering, erosion, and deposition.
- Wind can move smaller particles of rock, soils, and sediments around.
- Living things affect the physical characteristics of their regions.
- Most fossils form when plants and animals get buried under the surface of the Earth.

- The presence and location of certain fossil types indicate the order in which rock layers were formed.
- Some mountains are volcanoes or old volcanoes that do not erupt anymore.
- In some places, the solid rocks at Earth's surface are pushing up against each other. Very, very slowly, the rocks fold and pile up into mountains
- Earthquakes and volcanoes both occur at places where there are cracks in the Earth's crust.
- Humans cannot eliminate hazards, but they can take steps to reduce their impact

Knowledge:
Students will know…

- Weathering, erosion, and deposition are three processes that can change Earth's surface.
- Earth's surface can be broken down (weathering), parts of it can be carried away (erosion), and part of it can settle down in new places (deposition).
- People can prevent damage to erosion by building windbreaks, planting crops in ways that hold topsoil, and keeping or planting native plants in areas that have droughts.
- Plants can cause weathering when they grow into rocks.
- Tree roots can cause erosion by loosening soil so that wind or water can carry it away.
- Animals that burrow into the ground can erode soil.
- Tree roots can prevent erosion by holding soil in place.
- Fossils are evidence of an organism that lived a long time ago.
- Fossils form when a material covers the remains of a plant or animal and preserves them.
- Looking for patterns of fossils in each rock layer, and comparing fossils in different rock layers, can tell you how Earth's surface changed over time.
- Earthquakes occur in patterns. They tend to occur around the Pacific Ocean or between Asia and the Mediterranean. They also occur nearby volcanoes and mountains.
- Mountains form when rock pushes against other rock, which also causes earthquakes.
- Maps help you visualize the locations of earthquakes, volcanoes, and mountains on Earth.
- Earthquakes, volcanoes, and mountains tend to be found in the same locations. Many of them are found around the Pacific Ocean. These features also outline Earth's tectonic plates.
-

Skills:
Students will be able to…

- Make observations to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- Understand that rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, and living organisms affect the physical characteristics of their regions.
- Use cause and effect relationships to explain change to physical characteristics of land.
- Understand the process of erosion by seeing how a stream table works to simulate water flow and erosion. Then, they will use this as the basis for evidence in their future tests.
- Gather data by testing different variables on their own stream tables such as material, amount of water, time poured, and the slope of the table.
- Make simple cause and effect claims after discussing their data as a class.
- Create a model to simulate wind caused erosion, deposition and weathering.
- Make observations to find evidence that wind causes erosion, deposition and weathering.
- Gather enough information to be sure of a pattern and discuss what makes good evidence.
- Examine examples of how living things change and prevent change to Earth's surface.

- Draw inferences from the text to create a visual aid to help explain their assigned text.
- Build knowledge through investigation, note taking and categorizing information to create an act-it-out to explain how living things change Earth's surface.
- Look for evidence from patterns in rock formations and fossils in rock layers by conducting their own fossil dig.
- Identify the evidence that supports why similar organism fossils are found in the same rock layer.
- Find evidence to support the explanation that even though some systems appear stable, they will eventually change over long periods of time.
- Understand that the presence and location of certain fossil types indicate the order in which rock layers were formed.
- Create a map of Earth's features and use it to analyze and interpret patterns of where earthquakes, mountain ranges, and volcanoes are located.
- Use patterns as evidence to make sense of phenomena with logical reasoning.
- Understand that the locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Maps can help locate the different land and water features areas of Earth.
- Act like engineers to design earthquake resistant-buildings and test their designs by making and using a quake table that simulates earthquakes.
- Define a simple design problem reflecting a need or a want that includes specific criteria and constraints on materials, building height, and number of earthquakes.
- Test their initial designs and then improve them to better address scientific and engineering questions and problems.
- Compare all the design solutions from the class and choose the one that best met the criteria and constraints of the problem.

Interdisciplinary Connections

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9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions.
9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process
9.4.5.CT.2: Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem

New Jersey Student Learning Standards for Computer Science and Design Thinking (2020)
8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.

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Stage 2 – Assessment Evidence

Pre-Assessments:
Observing Phenomena

Formative Assessments:
Vocabulary
Questions and Observations of Student Work Throughout the Lesson
Wrap Up: My Science Concepts
Make Sense of Phenomena

Summative Assessments:
Lesson/Unit Assessment (available in Spanish)
Lesson Game
Show What You Know

Performance Task(s):
Investigating Changes to the Appalachian Mountains
Developing Hazard Plans

Stage 3 – Learning Plan
Bold= Fast track (required activities) *Italic = Extended track (optional activities to support student learning)* **Lesson 1 What are Some Clues that Earth's Surface Changes?** **Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.** **Solving Earth's Mysteries (20 min): Students will solve mysteries of different areas where the land has changed. They will examine three clues in each area to determine what is changing the land: water, wind, or living things.** **Earth's Mysteries Revealed (5 min): Students will tell if they solved the mystery, share which clue helped them solve it, and tell how they reached their conclusion.** *Solving More Earth Mysteries (15 min): Students will solve this mystery: Something is carrying away sand in Area D! Is it water, wind, or living things?* *More Earth Mysteries Revealed (5 min): Students will share how they solved the mystery,* **Vocabulary (3 min): Students will drag and drop vocabulary terms into a paragraph. (deposition, weathering, eroding)** **Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.** Text With Notes (Reading) 1. Earth's Changing Surface 2. Water Leaves Evidence of How it Changes Earth's Surface 3. Wind Leaves Evidence of How it Changes Earth's Surface 4. Living Things Leave Evidence of How they Change Earth's Surface **Show What you Know (10min): Students find a place where the land has changed in the area around them. They draw a picture of the place where land has changed and find at least two pieces of evidence of what changed the land: water, wind, or living things.** **Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.** ******** **Lesson 2 How Does Water Change Earth's Surface?** ***[SUMMERWOOD LESSON: This lesson is covered during the Grade 4 Summerwood Winter class lesson and will be taught by the elementary Environmental Science teacher. The classroom teacher does not have to teach lesson 2 if the Winter lesson is scheduled. The lesson is listed below in case the Winter lesson can not be scheduled.]***

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Reviewing the Main Ideas (5 min): Students will review erosion.

Modeling the Stream Tables (5 min): Students will observe how a stream table works and discuss findings.

Planning the Investigation (25 min): Students will plan their investigation of erosion using a stream table.

Carrying Out the Investigation (20 min): Students will carry out their investigation and record results.

Sharing Your Results (15 min): Students will share their results as a class.

Vocabulary (3 min): Students will match vocabulary terms to their definitions (glacier, mineral, sediment, sedimentary rock)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)

1. Rainwater Causes Weathering and Erosion
2. Rainwater Causes Deposition
3. Deposition Helps Form New Rocks
4. River Water Weathers and Erodes
5. Ice Causes Weathering and Erosion
6. Glaciers Cause Weathering, Erosion, and Deposition

Show What you Know (10min): Students will design a stream table investigation to answer a question.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

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Lesson 3 How Does Wind Change Earth's Surface?

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Reviewing the Main Ideas (5 min): Students will discuss the various ways wind can affect land.

Modeling Wind in a Box (10 min): Students will set up a wind box and simulate the effects of wind on sand.

Observing Wind Changes (10 min): Students will carry out an investigation that simulates wind and make observations to find evidence that wind causes weathering, erosion, and deposition.

Observing Wind Changes with Obstacles (10 min): Students will add objects to their wind bins.

Reflecting (10 min): Students will discuss observations as a class.

Vocabulary (3 min): Students will match vocabulary terms to their definitions (dust storm, windbreak)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)

1. Wind Causes Weathering and Erosion
2. Wind Weathers Rock into Natural Substances
3. Wind Deposits Material in New Places
4. Wind Can Transport Material Long Distances
5. Wind Erosion Can Cause Damage
6. Controlling Damage from Wind Erosion

Show What you Know (10min): Students will write a story about a day in the life of a piece of sand or soil.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 4 How Do Living Things Change Earth's Surface?

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Identifying Examples (10 min): Students will identify some examples of living things affecting Earth's surface.

Preparing for Your Act-it-Out (15 min): Students will examine examples of how living things change and prevent change to Earth's surface. They will create an act-it-out based on their assigned example to explain how living things change Earth's surface.

Writing a Script for Your Act-it-Out (10 min): Students will write a script for their act-it-out that meets specific criteria.

Performing Your Act-it-Out (15 min): Students will follow a set of procedures to perform their Act-it-Out. Non-performing students will fill out a chart to record if the living thing affects weathering, erosion, or deposition.

Examining the Examples (15 min): Students will look at images and answer these questions: What living thing is affecting Earth's surface in this image? Is the living thing affecting weathering, erosion, or deposition? How?

Vocabulary (3 min): Students will match vocabulary terms to their definitions (dam, till)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)

1. Plants Cause Erosion and Weathering
2. Plants Prevent Erosion and Weathering
3. Animals Cause Erosion and Weathering
4. Animals Cause Deposition
5. Humans Cause Erosion
6. Humans Can Reduce Erosion

Show What you Know (10min): Students complete the caption for each image to explain how living things affect Earth's surface.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 5 How Do Fossils Form and What Do They Show?

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Reviewing the Fossil Record (5 min): Students will review a fossil record and answer questions.

Digging for Fossils (20 min): Students will work with a partner to act like paleontologists to participate in a fossil dig.

Finding Patterns (10 min): Students will click on each layer's name to reveal the fossils in it. They will answer the questions: Which layer of fossils is oldest? Which is the youngest? Describe the characteristics of each fossil.What type of organism do you think created each fossil?

Constructing Explanations (15 min): Students will support scientists' claims about fossils with evidence.

Vocabulary (3 min): Students will match vocabulary terms to their definitions (fossil, fossil record)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)

1. Fossils are the Remains of Ancient Life

2. How Fossils are Made
3. Fossils are Revealed and Studied
4. Fossils Give us Clues about Ancient Environments

Show What you Know (10min): Students examine two rock layers with fossils and use evidence from the fossils to explain how the land in the fossil site changed over time.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 6 Where on Earth are Earthquakes, Volcanoes, and Mountains Found?

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Identifying Mountains, Volcanoes, and Earthquakes (5 min): Students will watch videos and identify which videos show mountains, volcanoes, and earthquakes.

Making a Map (20 min): Students will make a map of mountains, volcanoes, and earthquakes to find out more about these natural phenomena.

Finding Patterns (15 min): Students will use the maps they have made to find patterns in mountains, volcanoes, and earthquakes.

Vocabulary (3 min): Students will match vocabulary terms to their definitions (magma, elevation, lava, volcano, earthquake, physical map)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)
1. Maps Show Patterns on Earth's Surface
2. Earthquakes Occur in Patterns
3. Volcanoes Occur in Patterns
4. Mountain Ranges Occur in Patterns

Show What you Know (10min): Students examine a map of Earth's volcanoes and earthquakes and look for similarities and differences in their patterns to complete a Venn diagram.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 7 What Can People Do About Natural Hazards?

Observing Phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Examining Earthquake Damage (5 min): Students will examine images and tell how an earthquake affected each structure.

Building and Testing Your Quake Table and Design (55 min): Students will work in groups to act like engineers and design buildings for Townsville. They will test their design by making and using a quake table that simulates earthquakes.

Improving the Design (15 min): Students will use the results of the test to make changes to their design.

Sharing Your Results (15 min): Students will present their designs.

Reflecting on the Investigation (5 min): Students will choose the design that they think Townsville will build and use evidence to explain their answer.

Vocabulary (3 min): Students will match vocabulary terms to their definitions (natural hazard, seismic hazard map, tsunami)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)
1. Most Natural Hazards Cannot Be Prevented
2. Hazards from Earthquakes Can Be Reduced
3. Hazards from Volcanoes Can Be Reduced
4. Hazards from Tsunamis Can Be Reduced
5. People Should Prepare For Emergencies

Show What you Know (10min): Students will read information about a problem and three possible solutions and compare and research these different solutions people have come up with to reduce hazards from tsunamis.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Unit Plan Title	Unit 4: Waves and Information
Suggested Time Frame	6-7 weeks

Overview / Rationale

Students are introduced to the anchoring phenomenon of how, by using sound waves, people can communicate. In this unit, students explore waves and their properties, how waves affect objects, and which waves travel through Earth causing seismic activity. Students understand how sound waves and patterns are used to send messages. Using their knowledge, can students demonstrate different ways information can be transferred by creating a new communication method?

Stage 1 – Desired Results

Established Goals:

New Jersey Student Learning Standards-Science (2020)

4-PS4-1 Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

4-PS4-2 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

4-PS4-3 Generate and compare multiple solutions that use patterns to transfer information.

Essential Questions:

- What are some examples of waves?
- What are some properties of waves?
- How do waves affect objects?
- Which wave travels through Earth?
- How can sound waves be used to send messages?
- How can patterns be used to send messages?

Enduring Understandings:

Students will understand that…

- Examples of waves are water waves, waves on a string, and sound waves.
- Water waves, waves on a string, and sound waves can be described by amplitude, wavelength, and frequency.
- Water waves, waves on a string, and sound waves affect objects' shape and position.
- Seismic Waves Move the Earth.
- Earthquakes, which are caused by a sudden shifting of Earth's crust, create waves that move through Earth's crust.
- Sound waves are used in a variety of different ways to communicate information from place to place.
- Modern devices work by using digitized patterns of 1s and 0s. Examples are telegraphs, cell phones, radios, and computers.

Knowledge:

Students will know…

- All waves are a repeating pattern of moving matter.
- Waves go through crests (highest points) and troughs (lowest points).
- Water waves, waves on a string, and sound waves move through matter and spread out in every direction they can.
- In water waves, matter moves in circles.
- In waves on a string, matter moves side to side.
- In sound waves, matter moves forward and backward.
- The amplitude of a wave tells how large it is.
- The wavelength of a wave tells how long it is.
- The frequency of a wave tells how often a wave passes a certain point.
- Moving matter creates waves by causing a pattern of crests and troughs.
- There are three kinds of seismic waves: P-waves, S-waves, and surface waves.
- Digitizing is breaking sounds into sections that can be represented by letters or numbers.
- Morse code is one method for representing letters in a way that can be easily sent over a long distance, such as by using a telegraph.

Skills:

Students will be able to…

- Observe models of three types of waves and learn that waves are regular patterns of motion.
- Understand that waves can be made in water by disturbing the surface.
- Compare waves and classify waves by their similarities and differences in patterns.
- Develop a model by using an analogy describing how the matter moves in waves.
- Develop models of waves using string, springs, and containers of water.
- Describe how waves of the same type can differ in amplitude and wavelength.
- Model the different properties of waves with objects and with their bodies.
- Recognize and describe patterns within waves.
- Observe that water waves, which are regular patterns of motion, move across the surface of deep water, and the water goes up and down in place; it does not move in the direction of the wave.
- Discuss waves and make a presentation that explains how moving matter can create a water wave, string wave, and sound wave.
- Compare and contrast data about waves to discuss similarities and differences in wave patterns.
- Model waves (P-waves, S-waves, and surface waves) using their bodies.
- Demonstrate that waves in deep water go up and down in place and not in the direction of the wave.
- Discuss similarities and differences in patterns to classify waves.
- Understand that science findings are based on recognizing patterns.
- Make a drum that can make multiple sounds.
- Devise drum patterns to represent different geometry terms and create a key so others can interpret the terms.
- Generate and compare sound patterns used to transfer information.
- Create scales and digitize measurements
- Understand that digitized information can be transmitted over long distances.

- Apply knowledge that digitized information can be transmitted over long distances without significant degradation by designing and testing a device to send digital messages using Morse code.
- Plan and carry out an investigation of their designed devices and use fair tests to produce data as a basis for evidence to determine if the devices worked properly.
- Draw diagrams of different solutions that use patterns to send messages and then compare the design solutions.
- Demonstrate how the designed device uses patterns to send words and pictures.

Interdisciplinary Connections

New Jersey Student Learning Standards for English Language Arts (2016)
NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

New Jersey Student Learning Standards for Mathematics (2016)
MP.1 Make sense of problems and persevere in solving them.
MP.3 Construct viable arguments and critique the reasoning of others.
5.MD.B. Represent and interpret data.
4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

New Jersey Student Learning Standards for Career Readiness,Life Literacies, and Key Skills (2020)
9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions.
9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process
9.4.5.CT.2: Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem

New Jersey Student Learning Standards for Computer Science and Design Thinking (2020)
8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.

Student Resources
● Interactive notebook (available in Spanish) ● Science Journal (available in Spanish)
Teacher Resources
● Teach TCI teacher subscription www.teachtci.com. Reach out to the STEM Supervisor for a login and password. ● Unit 1 Lesson guides (#s?) ● Science journal ● Interactive Student Notebook ● Teach TCI Handouts

Stage 2 – Assessment Evidence
Pre-Assessments: Observing Phenomena ***Formative Assessments:*** Vocabulary Questions and Observations of Student Work Throughout the Lesson Wrap Up: My Science Concepts Make Sense of Phenomena ***Summative Assessments:*** Lesson/Unit Assessment (available in Spanish) Lesson Game Show What You Know ***Performance Task(s):*** Developing a Communication Method Using Waves

Stage 3 – Learning Plan
Bold= Fast track (required activities) *Italic = Extended track (optional activities to support student learning)* **Lesson 1 What are Some Examples of Waves?** **Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.** *Introducing Waves (5 min): Students will be introduced to the three types of waves.* **Annotating and Comparing Models of Waves (35 min): Students will examine models of waves, read text, and annotate images.** *Comparing Waves (5 min): Students will discuss what all waves have in common.*

Comparing How Matter Moves in Waves (10 min): Students will examine wave simulations, read text, and annotate the model.

Vocabulary (3 min): Students will drag and drop vocabulary terms into a paragraph (trough, classify, matter, pattern, wave, rest position, crest)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)

1. Water Waves
2. Waves on a String
3. Sound Waves
4. How Waves are Similar and Different

Show What you Know (10min): Students will write analogies to help them remember how matter moves in each type of wave.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 2 What are Some Properties of Waves?

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Creating and Describing Waves (15 min): Students will follow steps to make waves on a string.

Categorizing Waves (15 min): Students will group the words they came up with to describe changes in waves.

Modeling Waves (30 min): Students will create/model water and sound waves that have small amplitude, large amplitude, short wavelength, and long wavelength.

Acting it Out (15 min): Students will watch a video of water waves and describe the using the terms crest, trough, amplitude, and wavelength. Then, they will use their bodies to act out these terms.

Vocabulary (3 min): Students will match vocabulary terms to their definitions (dependent, independent, wavelength, amplitude, frequency)

Wrap Up: My Science Concepts (4 min): Students look at an image and answer questions. They drag a dot on a scale to show their level of understanding of concepts.

Text With Notes (Reading)

1. The Properties of Water Waves

2. The Properties of Waves on a String
3. The Properties of Sound Waves

Show What you Know (10min): Students will look at diagrams and answer questions about the wavelength of all the waves in the diagrams.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 3 How Do Waves Affect Objects?

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Observing How Waves Form (20 min): Students will observe videos and plan a presentation in which they give an explanation of the videos.

Observing How Waves Affect Objects (20 min): Students will observe videos and plan a presentation in which they give an explanation of the videos.

Researching and Presenting Waves (40 min): Students will work in groups to choose one of the examples of waves they've studied: water waves, waves on a string, or sound waves. Then, they will research and create a presentation about their wave.

Vocabulary (3 min): Students will drag and drop vocabulary terms to fit into a paragraph (object, repeatedly, move, position, wave)

Wrap Up: My Science Concepts (4 min): Students will drag a dot to the place that best shows their understanding of each concept.

Text With Notes (Reading)
1. Water Waves Affect Objects' Shape and Position
2. Waves on a String Affect Objects' Shape and Position
3. Sound Waves Affect Objects' Shape and Position
4. You Use All Three Types of Waves to Hear a Guitar

Show What you Know (10min): Students will use pictures and words to tell a story about how a wave is formed, how it moves, and how it affects an object.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 4 Which Waves Travel Through Earth?

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Modeling Seismic Waves (15 min): Students will experience the different types of seismic waves the earthquake would cause.

Learning and Connecting Types of Seismic Waves (10 min): Students will compare each seismic wave (shown in diagrams) to the other examples of waves they've learned about. They'll tell how matter moves in each type of wave and drag and drop each wave type to the seismic wave it best matches.

Comparing Seismic Waves (15 min): Students will compare the patterns of the different seismic waves.

Playing "Which Wave Am I?" (10 min): Students will guess which type of seismic wave is being described based on a set of rules.

Vocabulary (3 min): Students will match vocabulary terms to their definitions (earthquake, seismic wave)

Wrap Up: My Science Concepts (4 min): Students will drag a dot to the place that best shows their understanding of each concept.

Text With Notes (Reading)
1. Seismic Waves Move the Earth
2. P-waves Are Similar to Sound Waves
3. S-waves Are Similar to Waves on a String
4. Surface Waves Are Similar to Water Waves
5. Scientists and Engineers Study Earthquakes

Show What you Know (10min): Students will use the model of seismic waves they have worked with to add at least one item to each space in a triple Venn diagram.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 5 How Can Sound Waves Be Used to Send Messages?

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Reviewing Geometry (15 min): Students will review the terms point, line segment, and line.

Making Drums (5 min): Students will make drums using a plastic jar, plastic wrap, a rubber band, and a pencil.

Making Patterns (10 min): Students will create drum patterns for a list of geometry terms.

Communicating in Patterns (20 min): Students will use their drums to communicate the geometry terms.

Making Bingo Cards (10 min): Students will fill in bingo cards with the different geometry terms and symbols and cut out bingo circles from a handout.

Practicing and Playing Bingo (20 min): Students will learn how to play Bingo and then practice.

Discussing the Investigation (5 min): Students will answer questions with a partner, then as a class: What was digitized? What information was communicated? How was it communicated? What information did you need to know to understand and translate the drum communication?

Vocabulary (3 min): Students will drag and drop vocabulary terms into a paragraph (communicate, parts, similar, music)

Wrap Up: My Science Concepts (4 min): Students will drag a dot to the place that best shows their understanding of each concept.

Text With Notes (Reading)
1. Using Sound Waves to Send Information
2. Digitizing Sound Waves
3. Digitizing Waves and Measurements

Show What you Know (10min): Students will create scales, and then digitize each measurement.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Lesson 6 How Can Patterns Be Used to Send Messages?

Observing phenomena (5 min): Students will start by analyzing a photo. Then they'll be introduced to the lesson phenomenon, which they will be able to explain by the end of the lesson.

Reviewing Morse Code (10 min): Students will review Morse Code and learn that they are going to act like engineers who will design and test a digital device that can send signals in Morse code.

Defining the Problem (15 min): Students will learn that they will design and test a digital device to send two types of messages: Words in Morse code and a black and white picture using a grid of 1s and 0s. They will define the problem and respond to the questions: What are the criteria for a successful digital device? What are the constraints?

Defining the Test (15 min): Students will test their solutions to determine which of them best solves the problems.

Updating the Problem (10 min): Students will update their criteria and constraints.

Planning and Building a Solution (25 min): Students will brainstorm at least three different design solutions that use patterns to send messages, and they will choose one design to build.

Testing the Solution (15 min): Students will test out their solutions and reflect on the testing process.

Sharing Your Solution (15 min): Students will share their device with the class.

Vocabulary (3 min): Students will match vocabulary terms to their definitions (digital device, telegraph)

Wrap Up: My Science Concepts (4 min): Students will drag a dot to the place that best shows their understanding of each concept.

Text With Notes (Reading)
1. Sending Words with Morse Code
2. Sending Pictures with a Telegraph
3. Sending Messages as 1s and 0s
4. Digital Devices Use Digitized Messages

Show What you Know (10min): Students will use a code to reveal an image and write a caption that describes the image. Then, they will turn a picture into code.

Make Sense of Phenomena (5 min) Students use what they have learned to explain a phenomenon.

Accommodations and Modifications:

Below please find a list of suggestions for accommodations and modifications to meet the diverse needs of our students. Teachers should consider this a resource and understand that they are not limited to the recommendations included below.
An accommodation changes HOW a student learns; the change needed does not alter the grade-level standard. A modification changes WHAT a student learns; the change alters the grade-level expectation.

Special Education and 504 Plans All modifications and accommodations must be specific to each individual child's IEP (Individualized Educational Plan) or 504 Plan.

- Provide redirection
- Provide notes and copies of handouts with
- Pre-teach or preview vocabulary
- Have students repeat directions
- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments
- Model skills/techniques to be mastered
- Emphasize key words or critical information by highlighting
- Use of graphic organizers
- Teachers should note any issue that may impact safety- ex. contact lenses, allergies.

English Language Learners:
All modifications and accommodations should be specific to each individual child's LEP level as determined by the WIDA screening or ACCESS, utilizing the WIDA Can Do Descriptors.
● Pre-teach or preview vocabulary
● Repeat or reword directions
● Have students repeat directions
● Use of small group instruction
● Scaffold language based on their Can Do Descriptors
● Alter materials and requirements according to Can Do Descriptors

Students at Risk of Failure:
● Use of self-assessment rubrics for check-in
● Pair visual prompts with verbal presentations
● Ask students to restate information and/or directions
● Opportunity for repetition and additional practice
● Model skills/techniques to be mastered
● Extended time
● Provide copy of class notes
● Strategic seating with a purpose
● Provide students opportunity to make corrections and/or explain their answers

● Support organizational skills

High Achieving:
Extension Activities
● Allow for student choice from a menu of differentiated outcomes; choices grouped by complexity of thinking skills; variety of options enable students to work in the mode that most interests them
● Allow students to pursue independent projects based on their individual interests
● Provide enrichment activities that include more complex material
● Allow opportunities for peer collaboration and team-teaching
● Set individual goals

NEPTUNE CITY SCHOOL DISTRICT
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