

Subject: Science

Unit 1:

Grade Level: 8

Designed by: Tunkhannock Area Middle School

School District: Tunkhannock Area

School: Middle School

Brief Summary of Unit:

Units of Studies include:	<p>The Nature of Science – topics include reasoning and analysis</p> <ul style="list-style-type: none">processes, procedures and tools of scientific investigationssystems, models and patterns <p>Biological Sciences – topics include structures and functions of organisms</p> <ul style="list-style-type: none">continuity of lifeecological behavior and systems <p>Physical Sciences – topics include structure, properties and interaction of matter and energy</p> <ul style="list-style-type: none">forms, sources, conversion and transfer of energyprinciples of motion and force <p>Earth and Space Sciences – topics include earth features and processes that change earth and its resources</p> <ul style="list-style-type: none">weather, climate and atmospheric processescomposition and structure of the Universe
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Unit The Nature of Science

S8.A.1 Reasoning and Analysis

S8.A.1.1 Explain, interpret, and apply scientific, environmental, or technological knowledge presented in a variety of formats (e.g., visuals, scenarios, graphs).

S8.A.1.1.1 Distinguish between a scientific theory and an opinion, explaining how a theory is supported with evidence, or how new data/information may change existing theories and practices.

S8.A.1.1.2 Explain how certain questions can be answered through scientific inquiry and/or technological design.

S8.A.1.1.3 Use evidence, such as observations or experimental results, to support inferences about a relationship.

S8.A.1.1.4 Develop descriptions, explanations, predictions, and models using evidence.

Overarching Understandings

- Scientists approach problems methodically, and their ideas are tested by themselves and by their peers

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Scientists may come from varied content backgrounds but their work contains similar techniques, habits of mind and tools• Scientists utilize the Scientific Method• Investigation is a complex process that includes asking questions, seeking evidence, forming hypotheses, testing hypotheses, being skeptical and working cooperatively• Technology plays an important role in applying scientific discovery to everyday life	<ul style="list-style-type: none">• Where do scientists come from and how do they think?• How do scientists approach problems?• What tools do scientists use?
Knowledge	Skills
<ul style="list-style-type: none">• Key vocabulary: evidence, hypothesis, scientific inquiry, technology, theory, law• The role of scientific inquiry and peer review• How computers and satellites changing the nature of science	<ul style="list-style-type: none">• Students will explain why it is important for scientists to be skeptical• Students will compare and contrast the characteristics of scientific thinking that all scientists share• Students will be able to explain the value of testing and retesting ideas scientifically• Students will describe how tools help scientists in their work

Assessment

Evaluation Criteria	Evidence of Understanding
<ul style="list-style-type: none">• Formative assessments: (observations, questioning, response logs, graphic organizers, visual representations, think-pair-share, peer and self assessments)• Summative assessments:• Teacher-generated quizzes and tests	<ul style="list-style-type: none">• Higher level skills: analyze for comprehension, make conclusions, construct models, predict patterns, determine outcomes

Materials and Resources

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Unit The Nature of Science

<p>S8.A.1 Reasoning and Analysis</p> <p>S8.A.1.2 Identify and explain the impacts of applying scientific, environmental, or technological knowledge to address solutions to practical problems.</p> <p>S8.A.1.2.1 Describe the positive and negative, intended and unintended, effects of specific scientific results or technological developments (e.g., air/space travel, genetic engineering, nuclear fission/fusion, artificial intelligence, lasers, organ transplants).</p> <p>S8.A.1.2.2 Identify environmental issues and explain their potential long-term health effects (e.g., pollution, pest controls, vaccinations).</p> <p>S8.A.1.2.3 Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton’s laws of motion, Mendelian genetics).</p> <p>S8.A.1.2.4 Explain society’s standard of living in terms of technological advancements and how these advancements impact on agriculture (e.g. transportation)</p>

<p>Overarching Understandings</p> <ul style="list-style-type: none"> • Unintended impacts of scientific discoveries and development

Topical Understandings	Essential Questions
<ul style="list-style-type: none"> • Scientific discovery can affect multiple levels of society • Side effects of advancing technology can have negative environmental impact • Standards of living are continuously affected by technological advancements 	<ul style="list-style-type: none"> • How is genetic engineering viewed by the scientific world versus the general public? • What are the pros and cons of certain agricultural advancements? • What are the short term and long term effects of environmental developments? • How have technological advancements altered our standards of living?
Knowledge	Skills
<ul style="list-style-type: none"> • Air and space travel has pushed new boundaries • Lasers are used for military, governmental, experimental and household purposes • Genetic engineering is now available for common practice • Application of long time, scientific laws can create solutions to new societal issues 	<ul style="list-style-type: none"> • Students will be able to discuss the intended versus the unintended effects of several scientific developments • Students will be able to describe the advancements made in air and space travel based on technological advancements • Students will be able to apply concepts such as Newton’s Laws of Motion and Mendelian Genetics to solve practical problems • Students will be able to hypothesize long term effects that may be generated from current environmental issues

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Unit The Nature of Science

S8.A.1 Reasoning and Analysis

S8.A.1.3 Identify and analyze evidence that certain variables may have caused measurable changes in natural or human-made systems.

S8.A.1.3.1 Use ratio to describe change (e.g., percents, parts per million, grams per cubic centimeter, mechanical advantage).

S8.A.1.3.2 Use evidence, observations, or explanations to make inferences about change in systems over time (e.g., carrying capacity, succession, population dynamics, loss of mass in chemical reactions, indicator fossils in geologic time scale) and the variables affecting these changes.

S8.A.1.3.3 Examine systems changing over time, identifying the possible variables causing this change, and drawing inferences about how these variables affect this change.

S8.A.1.3.4 Given a scenario, explain how a dynamically changing environment provides for the sustainability of living systems.

Overarching Understandings

- The ability to interpret change in scientific scenarios can lead to the sustainability of a system

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• The earth and its systems are dynamic• Observable patterns can lead to identifying variables• Ratios are a measureable tool to describe change	<ul style="list-style-type: none">• What does a dynamically changing environment mean?• What is sustainability?• How do ratios describe change in a system?• How long can a system be affected by variables before change occurs?
Knowledge	Skills
<ul style="list-style-type: none">• Key vocabulary: variables, sustainability, ratio carrying capacity, succession, dynamics, mechanical advantage• Change is constant• Sustainability can be managed in certain scenarios	<ul style="list-style-type: none">• Students will be able to make inferences to describe how the environment changes to provide for the sustainability of living systems• Students will identify variable that lead to system changes• Students will be able to compare variables using ratios• Students will be able to analyze evidence to explain change in systems

Assessment

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Unit The Nature of Science

S8.A.2 Processes, Procedures, and Tools of Scientific Investigations

S8.A.2.1 Apply knowledge of scientific investigation or technological design in different contexts to make inferences to solve problems.

S8.A.2.1.1 Use evidence, observations, or a variety of scales (e.g., mass, distance, volume, temperature) to describe relationships.

S8.A.2.1.2 Use space/time relationships, define concepts operationally, raise testable questions, or formulate hypotheses.

S8.A.2.1.3 Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.

S8.A.2.1.4 Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions.

S8.A.2.1.5 Use evidence from investigations to clearly communicate and support conclusions.

S8.A.2.1.6 Identify a design flaw in a simple technological system and devise possible working solutions.

Overarching Understandings

- Design and conduct an experiment using the Scientific Method

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Dependent variables must be measured and certain variables should be constant	<ul style="list-style-type: none">• What are the steps of the Scientific Method?• What is a constant?• What is a variable?• How is a control used in an experiment?
Knowledge	Skills
<ul style="list-style-type: none">• A dependent variable is one whose value depends upon another• A variable whose value does not depend upon another	<ul style="list-style-type: none">• Design an experiment to answer a question: (example) Which brand of paper towel is more absorbent?• Conduct the experiment to answer the question• Record and analyze data• Identify the constants, dependent and independent variables in the experiment• Construct a summary of the found data• Use design flaws to pose a new testable scenario

Assessment

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Unit The Nature of Science

S8.A.2 Processes, Procedures, and Tools of Scientific Investigations

S8.A.2.2 Apply appropriate instruments for a specific purpose and describe the information the instrument can provide.

S8.A.2.2.1 Describe the appropriate use of instruments and scales to accurately and safely measure time, mass, distance, volume, or temperature under a variety of conditions.

S8.A.2.2.2 Apply appropriate measurement systems (e.g., time, mass, distance, volume, temperature) to record and interpret observations under varying conditions.

S8.A.2.2.3 Describe ways technology (e.g., microscope, telescope, micrometer, hydraulics, barometer) extends and enhances human abilities for specific purposes.

Overarching Understandings

- Use graduated cylinders to measure the liquid volume a container can hold

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• The graduated cylinder is a scientific instrument that measures a liquid volume	<ul style="list-style-type: none">• What does a graduated cylinder measure?• What unit of measurement does a graduated cylinder use?
Knowledge	Skills
<ul style="list-style-type: none">• The graduated cylinder measures liquid volume in millimeters• The level of liquid should be read from the bottom of the meniscus	<ul style="list-style-type: none">• Identify and read the appropriate scale• Identify and read the bottom of the meniscus

Assessment

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Unit The Nature of Science

S8.A.3 Systems, Models, and Patterns

S8.A.3.1 Explain the parts of a simple system, their roles, and their relationships to the system as a whole.

S8.A.3.1.1 Describe a system (e.g., watershed, circulatory system, heating system, agricultural system) as a group of related parts with specific roles that work together to achieve an observed result.

S8.A.3.1.2 Explain the concept of order in a system [e.g., (first to last: manufacturing steps, trophic levels); (simple to complex: cell, tissue, organ, organ system)].

S8.A.3.1.3 Distinguish among system inputs, system processes, system outputs, and feedback (e.g., physical, ecological, biological, informational).

S8.A.3.1.4 Distinguish between open loop (e.g., energy flow, food web) and closed loop (e.g., materials in the nitrogen and carbon cycles, closed-switch) systems.

S8.A.3.1.5 Explain how components of natural and human-made systems play different roles in a working system.

Overarching Understandings

- A system is a group of related parts with specific roles that work together to achieve an observable result

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Scientists use models to represent current understandings, aid in developing questions and communicate ideas	<ul style="list-style-type: none">• How do scientists develop and use models?• How do patterns help explain concepts?• What are common systems in science?
Knowledge	Skills
<ul style="list-style-type: none">• Key vocabulary: simulation, system, model, pattern, process, input, output, open-system, closed-system, feedback, ecological, chemical, biological• How systems are the whole and not necessarily the parts with regards to results	<ul style="list-style-type: none">• Students will be able to determine the groupings of a system• Students will be able to select and use simulations• Students will be able to investigate aspects of a system• Students will be able to explain the roles of components of a system

Assessment

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Unit The Nature of Science

S8.A.3 Systems, Models, and Patterns

S8.A.3.2 Apply knowledge of models to make predictions, draw inferences, or explain technological concepts.

S8.A.3.2.1 Describe how scientists use models to explore relationships in natural systems (e.g., an ecosystem, river system, the solar system).

S8.A.3.2.2 Describe how engineers use models to develop new and improved technologies to solve problems.

S8.A.3.2.3 Given a model showing simple cause-and-effect relationships in a natural system, predict results that can be used to test the assumptions in the model (e.g., photosynthesis, water cycle, diffusion, infiltration).

Overarching Understandings

- Interpretation of models, patterns and systems for applicable information

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Scientists interpret information from models and systems• Scientists solve problems by applying knowledge• Cause and effect scenarios can help predict results	<ul style="list-style-type: none">• How does a model compare to real world• How does the system act in comparison to the individual parts• What conclusions can be drawn by observing models or systems
Knowledge	Skills
<ul style="list-style-type: none">• Key vocabulary: ecosystem, solar system, technology, photosynthesis, water cycle, diffusion, infiltration, carbon cycle, nitrogen cycle• The main cycles for the earth system are water, carbon and nitrogen• Models and systems are designed and used by professionals to assist in solving problems and improving technology	<ul style="list-style-type: none">• Students will be able to construct and use a model to test a design• Students will be able to understand aspects of a system• Students will be able to compare and contrast the given system or model to a comparable real world scenario• Students will be able to interpret cause and effect relationships when testing models

Assessment

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Unit The Nature of Science

S8.A.3 Systems, Models, and Patterns

S8.A.3.3 Describe repeated processes or recurring elements in natural, scientific, and technological patterns.

S8.A.3.3.1 Identify and describe patterns as repeated processes or recurring elements in human-made systems (e.g., trusses, hub-and-spoke system in communications and transportation systems, feedback controls in regulated systems).

S8.A.3.3.2 Describe repeating structure patterns in nature (e.g., veins in a leaf, tree rings, crystals, water waves) or periodic patterns (e.g., daily, monthly, annually).

Overarching Understandings

- Nature is ruled by repeating structural patterns

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Models can be physical, mathematical or technological• Models can be used to represent current understandings• Patterns can help predict	<ul style="list-style-type: none">• How do scientists develop and use models?• What are the benefits of predictability?• Can patterns provide the opportunity for controlling elements in nature?
Knowledge	Skills
<ul style="list-style-type: none">• Key vocabulary: cycle, pattern, phases, annually, semiannually, seasons• Nature repeats itself• Patterns can be used to formulate problem solving conditions	<ul style="list-style-type: none">• Students will be able to recognize common patterns in a system• Students will be able to make predictions about future events based on patterns• Students will be able to simulate aspects of a system• Students will be able to construct a pattern based on observable data

Assessment

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Unit Biological Sciences

S8.B.1 Structure and Function of Organisms

S8.B.1.1 Describe and compare structural and functional similarities and differences that characterize diverse living things.

S8.B.1.1.1 Describe the structures of living things that help them function effectively in specific ways (e.g., adaptations, characteristics).

S8.B.1.1.2 Compare similarities and differences in internal structures of organisms (e.g., invertebrate/vertebrate, vascular/nonvascular, single-celled/ multi-celled) and external structures (e.g., appendages, body segments, type of covering, size, shape).

S8.B.1.1.3 Apply knowledge of characteristic structures to identify or categorize organisms (i.e., plants, animals, fungi, bacteria, and protista).

S8.B.1.1.4 Identify the levels of organization from cell to organism and describe how specific structures (parts), which underlie larger systems, enable the system to function as a whole.

Overarching Understandings

- Diversity allows for the continuity of a species

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Classification is based upon evolution and common ancestry• Adaptations allow animals to perform specific functions• The main functions of animals are to obtain food and oxygen, keep internal conditions stable, move in some way and reproduce• Main characteristics of plants are being autotrophic and multicellular	<ul style="list-style-type: none">• What are the functions of animals?• What are adaptations and how do they benefit an animal?• How are animals classified?• How are plants categorized?• What are the differences between vertebrates and invertebrates
Knowledge	Skills
<ul style="list-style-type: none">• Key vocabulary: diversity, organism, adaptation, characteristic, invertebrate, vertebrate, symmetry, vascular, nonvascular, single celled, multicellular, appendages, bacteria, protista, fungi• Adaptations increase the ability to survive and reproduce• How symmetry is related to body structure• Organisms are categorized by characteristic structures	<ul style="list-style-type: none">• Students will be able to identify functions of specific organisms• Students will be able to describe the levels of organization in animal bodies• Students will be able to describe external structures that compliment organism categorizing• Students will be able discuss the role of DNA and how genetics controls characteristics• Students will be able to describe an adaptation• Students will discuss the effects of diversity among species

Assessment

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Unit Biological Sciences

S8.B.2 Continuity of Life

S8.B.2.1 Explain the basic concepts of natural selection.

S8.B.2.1.1 Explain how inherited structures or behaviors help organisms survive and reproduce in different environments.

S8.B.2.1.2 Explain how different adaptations in individuals of the same species may affect survivability or reproduction success.

S8.B.2.1.3 Explain that mutations can alter a gene and are the original source of new variations.

S8.B.2.1.4 Describe how selective breeding or biotechnology can change the genetic makeup of organisms.

S8.B.2.1.5 Explain that adaptations are developed over long periods of time and are passed from one generation to another.

Overarching Understandings

- Natural selection provides for the adaptation of an animal to its environment to survive and produce viable offspring

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Genetic variations that occur due to random mutation may cause some organisms to be better adapted to changing environmental conditions• Traits of a population can change with conditions• Changes in gene sequences can lead to changes in gene expression• Recognize how changes in a species can bring about evolution of a group• Inherited factors can lead to changes in genetic information• Mutations can cause advantages in reproduction	<ul style="list-style-type: none">• What are environmental factors that can lead to survival and reproductive differences?• How do variations occur in a population?• How do new species evolve?• What justifies the evolution of a new species?• Why do species go extinct?• What is selective breeding and how can it affect a population
Knowledge	Skills
<ul style="list-style-type: none">• Key Vocabulary: natural selection, allele, population, species, adaptation, genetic mutation, genotype, phenotype, evolution, overproduction• Genetic mutations can lead to variations• Selective breeding can lead to survivability of a species	<ul style="list-style-type: none">• Students will discuss environmental factors that could affect future generations• Students will predict how changes in alleles can affect populations• Students will analyze how a mutation might lead to a positive adaptation• Student will discuss how selective breeding plays a role in the survival of a population

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Unit Biological Sciences

S8.B.3 Ecological Behavior and Systems

S8.B.3.1 Explain the relationships among and between organisms in different ecosystems and their abiotic and biotic components.

S8.B.3.1.1 Explain the flow of energy through an ecosystem (e.g., food chains, food webs).

S8.B.3.1.2 Identify major biomes and describe abiotic and biotic components (e.g., abiotic: different soil types, air, water sunlight; biotic: soil microbes, decomposers).

S8.B.3.1.3 Explain relationships among organisms (e.g., producers/consumers, predator/prey) in an ecosystem.

Overarching Understandings

- Ecology is the study of interactions between organisms and their environments

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Everything is connected• Living things need energy• Types of interactions	<ul style="list-style-type: none">• What is ecology?• How are producers, consumers and decomposers linked in a food chain?• How do food chains link together to form a food web?• What are the roles of an environment?
Knowledge	Skills
<p>Key Vocabulary: population, community, ecosystem, abiotic, biotic, producer, consumer, decomposer, predator, prey</p> <ul style="list-style-type: none">• Organisms that use sunlight directly to make food are called producers• Consumers eat other organisms to obtain energy• A food chain shows energy flow from one organism to another• Because most organisms eat more than one kind of food, energy paths are represented by food webs• An organism's habitat is the environment in which it lives• An organism's niche is its role in the ecosystem	<ul style="list-style-type: none">• Students will identify biotic and abiotic environments• Students will connect levels of energy use to roles in the environment• Students will be able to distinguish between a food chain and a food web• Students will be able to distinguish between habitats and niches

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Unit Biological Sciences

S8.B.3 Ecological Behavior and Systems

S8.B.3.2 Identify evidence of change to infer and explain the ways different variables may affect change in natural or human-made systems.

S8.B.3.2.1 Use evidence to explain factors that affect changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).

S8.B.3.2.2 Use evidence to explain how diversity affects the ecological integrity of natural systems.

S8.B.3.2.3 Describe the response of organisms to environmental changes (e.g., changes in climate, hibernation, migration, coloration) and how those changes affect survival.

Overarching Understandings

- Human population growth is related to pollution problems.

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• The differences between renewable and nonrenewable resources• Impacts of population growth• The importance of conservation	<ul style="list-style-type: none">• What are renewable and nonrenewable resources?• What role does pollution play in affecting a population?• How does a habitat's destruction affect organisms?• How do specific environmental changes alter an ecosystem?• How does conservation help maintain an ecosystem?
Knowledge	Skills
Key vocabulary: renewable resource, nonrenewable resource, overpopulation, biodiversity, pollution, conservation, biodegradable The three main ways to conserve natural resources Explain how population growth is related to pollution problems	<ul style="list-style-type: none">• Students will investigate types of pollution• Students will describe ways that pollution is harmful• Students will list factors that affect changes in populations• Students will explain the importance of conservation

Assessment

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Unit Biological Sciences

S8.B.3 Ecological Behavior and Systems

S8.B.3.3 Explain how renewable and nonrenewable resources provide for human needs or how these needs impact the environment.

S8.B.3.3.1 Explain how human activities may affect local, regional, and global environments.

S8.B.3.3.2 Explain how renewable and nonrenewable resources provide for human needs (i.e., energy, food, water, clothing, and shelter).

S8.B.3.3.3 Describe how waste management affects the environment (e.g., recycling, composting, landfills, incineration, sewage treatment).

S8.B.3.3.4 Explain the long-term effects of using integrated pest management (e.g., herbicides, natural predators, biogenetics) on the environment.

Overarching Understandings

- Science depends on natural resources for energy and materials

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Natural resources support human activities• Resources can be conserved and recycled• Energy comes from other natural resources	<ul style="list-style-type: none">• What makes a natural resource renewable or nonrenewable?• What are the benefits and costs of using fossil fuels?• How do people use natural resources in modern life?• How can conservation help people reduce waste and reuse natural resources
Knowledge	Skills
<ul style="list-style-type: none">• Key Vocabulary: natural resources, renewable resources, nonrenewable resources, fossil fuel, conservation, recycling, hydroelectric energy, geothermal energy, biomass• Fossils preserve the remains of living things from long ago	<ul style="list-style-type: none">• Students will name the renewable and nonrenewable resources• Students will give examples of resource products• Students will give examples of programs designed to reduce, reuse and recycle• List and describe the many natural resources that can create electrical energy

Assessment

Evaluation Criteria	Evidence of Understanding
<ul style="list-style-type: none">• Formative assessments: (observations, questioning, response logs, graphic organizers, visual representations, think-pair-share, peer and self assessments)• Summative assessments:• Teacher-generated quizzes and tests	<ul style="list-style-type: none">• Higher level skills: analyze for comprehension, make conclusions, construct models, predict patterns, determine outcomes

Materials and Resources

Source	Description of Use
<ul style="list-style-type: none">• Available classroom materials• Additional teacher found or generated resources	<ul style="list-style-type: none">• Skill building• Reinforcement of material• Assessment of topic

Unit Physical Sciences

S8.C.1 Structure, Properties, and Interaction of Matter and Energy

S8.C.1.1 Explain concepts about the structure and properties (physical and chemical) of matter.

S8.C.1.1.1 Explain the differences among elements, compounds, and mixtures.

S8.C.1.1.2 Use characteristic physical or chemical properties to distinguish one substance from another (e.g., density, thermal expansion/contraction, freezing/melting points, streak test).

S8.C.1.1.3 Identify and describe reactants and products of simple chemical reactions.

Overarching Understandings

- Matter is composed of elements, which are tiny particles called atoms

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Matter is made of atoms• Atom is the smallest part of an element that still has all the properties• Two or more chemically bonded elements may form a compound• Reactants balance products in a chemical reaction	<ul style="list-style-type: none">• What is the relationship of atoms to matter?• What is the smallest part of matter that still exists as a whole?• What are the starting and ending materials of a chemical reaction?
Knowledge	Skills
<ul style="list-style-type: none">• Key Vocabulary: element, atom, property, compound, molecule, reactant, product• How does the arrangement of atoms determine the properties of a sample?	<ul style="list-style-type: none">• Students will name the three parts of an atom• Students will describe the types of reactions• Students will compare and contrast the properties of a single element versus a compound

Assessment

Evaluation Criteria	Evidence of Understanding
<ul style="list-style-type: none">• Formative assessments: (observations, questioning, response logs, graphic organizers, visual representations, think-pair-share, peer and self assessments)• Summative assessments:• Teacher-generated quizzes and tests	<ul style="list-style-type: none">• Higher level skills: analyze for comprehension, make conclusions, construct models, predict patterns, determine outcomes

Materials and Resources

Source	Description of Use
<ul style="list-style-type: none">• Available classroom materials• Additional teacher found or generated resources	<ul style="list-style-type: none">• Skill building• Reinforcement of material• Assessment of topic

Unit Physical Sciences

S8.C.2 Forms, Sources, Conversion, and Transfer of Energy

S8.C.2.1 Describe energy sources, transfer of energy, or conversion of energy.

S8.C.2.1.1 Distinguish among forms of energy (e.g., electrical, mechanical, chemical, light, sound, nuclear) and sources of energy (i.e., renewable and nonrenewable energy)

S8.C.2.1.2 Explain how energy is transferred from one place to another through convection, conduction, or radiation.

S8.C.2.1.3 Describe how one form of energy (e.g., electrical, mechanical, chemical, light, sound, nuclear) can be converted into a different form of energy.

Overarching Understandings

- Society depends on natural resources for energy and materials

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Conservation helps people reduce waste and reuse natural resources• Recycling helps people recover and extend natural resources• Renewable resources are used to produce electricity and fuel	<ul style="list-style-type: none">• What are some alternate forms of energy?• What are the benefits and costs of nuclear power?• How can people use sunlight to produce electricity?• How can we generate power from sound and light?• How can power be produced by moving water?• What is the difference between electrical and mechanical energy?
Knowledge	Skills
<ul style="list-style-type: none">• Key Vocabulary: Renewable energy, nonrenewable energy, electrical, mechanical, light, sound, nuclear, convection, conduction, radiation• Nuclear power is used to produce electricity• Renewable resources are used to generate energy• Recycling can provide additional sources of energy	<ul style="list-style-type: none">• Students will list sources of renewable and nonrenewable energy• Students will distinguish forms of energy and their sources• Students will describe how solar technology converts light energy to electricity and heat• Students will list the methods of energy transfer• Students will give examples of energy from convection, conduction and radiation

Assessment

Evaluation Criteria	Evidence of Understanding
<ul style="list-style-type: none">• Formative assessments: (observations, questioning, response logs, graphic organizers, visual representations, think-pair-share, peer and self assessments)• Summative assessments:• Teacher-generated quizzes and tests	<ul style="list-style-type: none">• Higher level skills: analyze for comprehension, make conclusions, construct models, predict patterns, determine outcomes

Materials and Resources

Source	Description of Use
<ul style="list-style-type: none">• Available classroom materials• Additional teacher found or generated resources	<ul style="list-style-type: none">• Skill building• Reinforcement of material• Assessment of topic

Unit Physical Sciences

S8.C.2 Forms, Sources, Conversion, and Transfer of Energy

S8.C.2.2 Compare the environmental impact of different energy sources chosen to support human endeavors.

S8.C.2.2.1 Describe the Sun as the major source of energy that impacts the environment.

S8.C.2.2.2 Compare the time span of renewability for fossil fuels and the time span of renewability for alternative fuels.

S8.C.2.2.3 Describe the waste (i.e., kind and quantity) derived from the use of renewable and nonrenewable resources and their potential impact on the environment.

Overarching Understandings

- The Sun produces a major source of energy for Earth

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Energy produced by fusion in the Sun's core flows out in the form of radiation and convection• The Sun provides light in our solar system• Fossil fuels provide a majority of society's energy• By-products from energy sources can be harmful to the environment	<ul style="list-style-type: none">• What makes a natural resource renewable or nonrenewable?• What are the benefits and costs involved with using fossil fuels?• How do people use natural resources in modern life?
Knowledge	Skills
<ul style="list-style-type: none">• Key vocabulary: natural resource, renewable, nonrenewable, fossil fuel, by-product• Explain how fossil fuels are formed from ancient organisms• What are ways that natural resources are used to make people's lives more comfortable	<ul style="list-style-type: none">• Students will be able to compare and contrast renewable and nonrenewable resources• Students will be able to explain how fossil fuels are formed• Students will be able to list advantages and disadvantages of using fossil fuels

Assessment

Evaluation Criteria	Evidence of Understanding
<ul style="list-style-type: none">• Formative assessments: (observations, questioning, response logs, graphic organizers, visual representations, think-pair-share, peer and self assessments)• Summative assessments:• Teacher-generated quizzes and tests	<ul style="list-style-type: none">• Higher level skills: analyze for comprehension, make conclusions, construct models, predict patterns, determine outcomes

Materials and Resources

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Unit Physical Sciences

S8.C.3 Principles of Motion and Force

S8.C.3.1 Describe the effect of multiple forces on the movement, speed, or direction of an object.

S8.C.3.1.1 Describe forces acting on objects (e.g., friction, gravity, balanced versus unbalanced).

S8.C.3.1.2 Distinguish between kinetic and potential energy.

S8.C.3.1.3 Explain that mechanical advantage helps to do work (physics) by either changing a force or changing the direction of the applied force (e.g., simple machines, hydraulic systems).

Overarching Understandings

- Forces act on you and everything around you at all times

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Newtons Laws• Classification of forces is according to the agents that causes them• Magnitude and direction of net forces cause changes in an object's motion• Mechanical advantages can be gained by using simple machines	<ul style="list-style-type: none">• What are the forces that act on objects?• What is the difference between kinetic and potential energy?• What are mechanical advantages and how can they be applied through simple machines?
Knowledge	Skills
<ul style="list-style-type: none">• Key vocabulary: force, net force, Newton's first law, Newton's second law and Newton's third law, inertia, equilibrium, free body diagram, potential energy, kinetic, energy, friction, gravity, simple machines, tension• The meaning of Newton's 1st, 2nd and 3rd Laws• Force equals mass times acceleration• Acceleration leads to a change in speed• Mechanical advantage equals force one divided by force two	<ul style="list-style-type: none">• Students will be able to describe Newton's three laws of motion• Students will determine energy as potential versus kinetic• Students will be able to classify forces• Students will calculate force equals mass times acceleration• Students will discuss the benefits of mechanical advantage• Students will be able to describe examples of simple machines

Assessment

Evaluation Criteria	Evidence of Understanding
<ul style="list-style-type: none">• Formative assessments: (observations, questioning, response logs, graphic organizers, visual representations, think-pair-share, peer and self assessments)• Summative assessments:• Teacher-generated quizzes and tests	<ul style="list-style-type: none">• Higher level skills: analyze for comprehension, make conclusions, construct models, predict patterns, determine outcomes

Materials and Resources

Source	Description of Use
<ul style="list-style-type: none">• Available classroom materials• Additional teacher found or generated resources	<ul style="list-style-type: none">• Skill building• Reinforcement of material• Assessment of topic

Unit Earth and Space Sciences

<p>S8.D.1 Earth Features and Processes that Change Earth and Its Resources</p> <p>S8.D.1.1 Describe constructive and destructive natural processes that form different geologic structures and resources.</p> <p>S8.D.1.1.1 Explain the rock cycle as changes in the solid earth and rock types (igneous – granite, basalt, obsidian, pumice; sedimentary – limestone, sandstone, shale, coal; and metamorphic – slate, quartzite, marble, gneiss).</p> <p>S8.D.1.1.2 Describe natural processes that change Earth’s surface (e.g., landslides, volcanic eruptions, earthquakes, mountain building, new land being formed, weathering, erosion, sedimentation, soil formation).</p> <p>S8.D.1.1.3 Identify soil types (i.e., humus, topsoil, subsoil, loam, loess, and parent material) and their characteristics (i.e., particle size, porosity, and permeability) found in different biomes and in Pennsylvania, and explain how they formed.</p> <p>S8.D.1.1.4 Explain how fossils provide evidence about plants and animals that once lived throughout Pennsylvania’s history (e.g., fossils provide evidence of different environments).</p>

<p>Overarching Understandings</p> <ul style="list-style-type: none"> • Natural forces break rocks apart and form soil, which support life

Topical Understandings	Essential Questions
<ul style="list-style-type: none"> • Our world is built of rocks • Heat and pressure change rocks • Mechanical and chemical forces break down rocks • Weathering and organic processes form soil • Fossils are present in soils and rocks 	<ul style="list-style-type: none"> • How do rocks change as they move through the rock cycle? • How do wind and water alter landforms? • What factors affect the rate at which weathering occurs? • What are the differences between mechanical and chemical weathering? • How do properties of soil differ? • How do fossil records help show what was once?
Knowledge	Skills
<ul style="list-style-type: none"> • Key Vocabulary: igneous, sedimentary, metamorphic, rock cycle, chemical weathering, physical weathering, erosion, humus, topsoil, subsoil, horizons, porosity, permeability, texture • Our world is built of rocks • Rocks are made of minerals 	<ul style="list-style-type: none"> • Students will be able to discuss the phases of the rock cycle • Students will be able to name natural processes that can alter the Earth’s surface • Students will be able to differentiate between physical and mechanical weathering factors • Students will be able to discuss the properties of soil that determine texture • Students will be able to analyze fossil records to provide evidence of

	previous environments
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Assessment

Evaluation Criteria	Evidence of Understanding
<ul style="list-style-type: none"> • Formative assessments: (observations, questioning, response logs, graphic organizers, visual representations, think-pair-share, peer and self assessments) • Summative assessments: • Teacher-generated quizzes and tests 	<ul style="list-style-type: none"> • Higher level skills: analyze for comprehension, make conclusions, construct models, predict patterns, determine outcomes

Materials and Resources

Source	Description of Use
<ul style="list-style-type: none"> • Available classroom materials • Additional teacher found or generated resources 	<ul style="list-style-type: none"> • Skill building • Reinforcement of material • Assessment of topic

Unit Earth and Space Sciences

S8.D.1 Earth Features and Processes that Change Earth and Its Resources

S8.D.1.2 Describe the potential impact of human-made processes on changes to Earth's resources and how they affect everyday life.

S8.D.1.2.1 Describe a product's transformation process from production to consumption (e.g., prospecting, propagating, growing, maintaining, adapting, treating, converting, distributing, disposing) and explain the process's potential impact on Earth's resources.

S8.D.1.2.2 Describe potential impacts of human-made processes (e.g., manufacturing, agriculture, transportation, mining) on Earth's resources, both nonliving (i.e., air, water, or earth materials) and living (i.e., plants and animals).

Overarching Understandings

- Human activity is proving to have a serious impact on the sustainability of our Earth resources

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Sustainability is the capacity to maintain a certain process indefinitely• Water, land and air resources are limited• Three uses that change the land are agriculture, mining and development• Pollutants and emissions are released into the air• Wastes produced by agriculture, households, industry, mining, and other human activities can end up in water	<ul style="list-style-type: none">• What kinds of human development can change land?• What negative impacts does agriculture have on our land?• How do people create new farmland?• Why is soil management important?• What causes air pollution?• How are living and nonliving factors affected by human use of resources?• What are some forms of water pollution caused by agriculture and industry?
Knowledge	Skills
<ul style="list-style-type: none">• Key vocabulary: prospecting, propagating, sustainability, distributing, manufacturing, mining, agriculture• People use land for many purposes• Human use may be harming the environment• Fresh water is a limited resource	<ul style="list-style-type: none">• Students will be able to list major land usages• Students will be able to describe several ways of changing the land for human benefit• Students will explain the concept of sustainability• Students will be able to discuss benefits of soil management

Assessment

Evaluation Criteria	Evidence of Understanding
<ul style="list-style-type: none">• Formative assessments: (observations, questioning, response logs, graphic organizers, visual representations, think-pair-share, peer and self assessments)• Summative assessments:• Teacher-generated quizzes and tests	<ul style="list-style-type: none">• Higher level skills: analyze for comprehension, make conclusions, construct models, predict patterns, determine outcomes

Materials and Resources

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<ul style="list-style-type: none">• Available classroom materials• Additional teacher found or generated resources	<ul style="list-style-type: none">• Skill building• Reinforcement of material• Assessment of topic

Unit Earth and Space Sciences

S8.D.1 Earth Features and Processes that Change Earth and Its Resources

S8.D.1.3 Describe characteristic features of Earth's water systems or their impact on resources.

S8.D.1.3.1 Describe the water cycle and the physical processes on which it depends (i.e., evaporation, condensation, precipitation, transpiration, runoff, infiltration, energy inputs, and phase changes).

S8.D.1.3.2 Compare and contrast characteristics of freshwater and saltwater systems on the basis of their physical characteristics (i.e., composition, density, and electrical conductivity) and their use as natural resources.

S8.D.1.3.3 Distinguish among different water systems (e.g., wetland systems, ocean systems, river systems, watersheds) and describe their relationships to each other as well as to landforms.

S8.D.1.3.4 Identify the physical characteristics of a stream and how these characteristics determine the types of organisms found within the stream environment (e.g., biological diversity, water quality, flow rate, tributaries, surrounding watershed).

Overarching Understandings

- Water moves through Earth's atmosphere, oceans, and land in a cycle

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Water continually cycles• Freshwater flows and freezes on Earth• Water flows underground• The water in the ocean is salt water• Oceans are a connected system of water in motion• The ocean supports and contains natural resources	<ul style="list-style-type: none">• What makes water important?• How much of Earth's water is salt water?• How much water moves throughout Earth and its atmosphere?• How does freshwater flow and collect on Earth?• How does frozen water exist on Earth?• What does ocean water contain?• What are the features of water systems?
Knowledge	Skills
<ul style="list-style-type: none">• Key Vocabulary: fresh water, salt water, water cycle, evaporation, condensation, transpiration, precipitation, density, ocean systems, wetland, watershed, water quality, flow rate, tributary, groundwater, aquifer• Water built up on the Earth's surface over time• Water is essential for life• Earth has an atmosphere of gases	<ul style="list-style-type: none">• Students will learn that freshwater is a limited resource and essential for human society• Students will be able to describe the continuous cycle of water• Students will be able to list human activities for which freshwater is essential• Students will be able to discuss the differences in freshwater versus saltwater• Students will be able to describe the environmental characteristics

that determine a given water environment

Assessment

Evaluation Criteria	Evidence of Understanding
<ul style="list-style-type: none">• Formative assessments: (observations, questioning, response logs, graphic organizers, visual representations, think-pair-share, peer and self assessments)• Summative assessments:• Teacher-generated quizzes and tests	<ul style="list-style-type: none">• Higher level skills: analyze for comprehension, make conclusions, construct models, predict patterns, determine outcomes

Materials and Resources

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Unit Earth and Space Sciences

S8.D.2 Weather, Climate, and Atmospheric Processes

S8.D.2.1 Explain how pressure, temperature, moisture, and wind are used to describe atmospheric conditions that affect regional weather or climate.

S8.D.2.1.1 Explain the impact of water systems on the local weather or the climate of a region (e.g., lake effect snow, land/ocean breezes).

S8.D.2.1.2 Identify how global patterns of atmospheric movement influence regional weather and climate.

S8.D.2.1.3 Identify how cloud types, wind directions, and barometric pressure changes are associated with weather patterns in different regions of the country.

Overarching Understandings

- Climates are long term weather patterns that may change over time

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Climate is a long term weather pattern• Earth has a variety of climates• Climates can change suddenly or slowly• Global climate changes can be caused by the Earth's energy budget	<ul style="list-style-type: none">• What factors affect climate?• What are seasonal patterns of temperature and precipitation?• How do natural features and human activity affect climate?• How do climates cool when particles block sunlight?• How do climates repeat over time?
Knowledge	Skills
<ul style="list-style-type: none">• Key Vocabulary: climate, climate controls, latitude, ocean current, marine climate, continental climate, seasons, ice age, El Nino• Oceans affect wind flow• The Sun's energy heats the Earth's surface unevenly	<ul style="list-style-type: none">• Students will explain the difference between climate and weather• Students will discuss the two major characteristics usually focused on to determine climate zones.• Students will describe how length of daylight changes with seasons.• Students will discuss ways in which global warming could affect life on Earth

Assessment

Evaluation Criteria	Evidence of Understanding
<ul style="list-style-type: none">• Formative assessments: (observations, questioning, response logs, graphic organizers, visual representations, think-pair-share, peer and self assessments)• Summative assessments:• Teacher-generated quizzes and tests	<ul style="list-style-type: none">• Higher level skills: analyze for comprehension, make conclusions, construct models, predict patterns, determine outcomes

Materials and Resources

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Unit Earth and Space Sciences

S8.D.3 Composition and Structure of the Universe

S8.D.3.1 Explain the relationships between and among the objects of our solar system.

S8.D.3.1.1 Describe patterns of earth's movements (i.e., rotation and revolution) in relation to the moon and sun (i.e., phases, eclipses, and tides)

S8.D.3.1.2 Describe the role of gravity as the force that governs the movement of the solar system and universe.

S8.D.3.1.3 Compare and contrast characteristics of celestial bodies found in the solar system (e.g., moons, asteroids, comets, meteors, inner and outer planets).

Overarching Understandings

- The Earth and Moon move in predictable ways as they orbit the Sun

Topical Understandings	Essential Questions
<ul style="list-style-type: none">• Earth rotates on a tilted axis and orbits the Sun• The Moon is the Earth's natural satellite• Positions of the Sun and Moon affect Earth• The solar system includes debris such as comets, asteroids and meteoroids• Gravity is one of the forces acting on orbiting objects and projectiles	<ul style="list-style-type: none">• How do positions of the Sun affect the Earth and Moon?• What causes day and night?• What are the phases of the moon?• Why does the Moon's gravity cause tides on Earth?• What is the difference between lunar and solar eclipse?• What is a celestial body?
Knowledge	Skills
<ul style="list-style-type: none">• Earth's rotation causes day and night• Changing angles of sunlight cause seasons• Lunar phases are different views of the Moon's sunlit half• Shadows cause eclipses• The Moon's gravity causes tides on Earth• Small objects are made of ice and rock	<ul style="list-style-type: none">• Students will be able to describe the changing angles of sunlight that produce seasons• Students will describe influence of motion of the Moon on the Earth• Students will describe the phases of the Moon• Students will differentiate between a lunar and solar eclipse• Students will compare and contrast asteroids, comets, meteors and meteorites

Assessment

Evaluation Criteria	Evidence of Understanding
<ul style="list-style-type: none">• Formative assessments: (observations, questioning, response logs, graphic organizers, visual representations, think-pair-share, peer and self assessments)• Summative assessments:• Teacher-generated quizzes and tests	<ul style="list-style-type: none">• Higher level skills: analyze for comprehension, make conclusions, construct models, predict patterns, determine outcomes

Materials and Resources

Source	Description of Use
<ul style="list-style-type: none">• Available classroom materials• Additional teacher found or generated resources	<ul style="list-style-type: none">• Skill building• Reinforcement of material• Assessment of topic