Introduction

Science, Technology & Engineering, and Environmental Literacy & Sustainability (STEELS) Standards guide the study of the natural and human-made world through inquiry, problem-solving, critical thinking, and authentic exploration. This document displays a curriculum framework for Grade 4 Science. It is designed to focus curriculum and teaching, provide guidance for multiple approaches to curriculum development, encourage less reliance on textbooks as curriculum, and avoid activity-oriented teaching without focus/purpose.

Science Long Term Transfer Goals

In support of the Curriculum Framework, Long Term Transfer Goals (LTTG) provide the overarching practices that ground the foundation for a robust curriculum; thus, all curriculum should relate to one or more of the LTTGs detailed below – as they highlight the effective uses of understanding, knowledge, and skill that we seek in the long run; i.e., what we want students to be able to do when they confront new challenges – both in and outside of school.

Students will be able to engage as technological and engineering literate members of a global society, using their learning to:

1. Approach science as a reliable and tentative way of knowing and explaining the natural world and designed world.
2. Weigh evidence and use scientific approaches to ask questions, investigate, and make informed decisions.
3. Make and use observations to analyze relationships and patterns in order to explain phenomena, develop models, and make predictions.
4. Evaluate systems, in order to connect how form determines function and how any change to one component affects the entire system.
5. Explain how the natural and designed worlds are interrelated and the application of scientific knowledge and technology can have beneficial, detrimental, or unintended consequences.

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Grade 4 Science

Structure and Function

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
Organisms have characteristic structures, functions, and behaviors that allow them to grow, reproduce, and die.	How do the structures of organisms enable life's functions?	**3.1.4.A Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.**	**Engaging in Argument from Evidence** Construct an argument with evidence, data, and/or a model.	Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.	**Systems and System Models** A system can be described in terms of its components and their interactions.	internal structures external structures system argument model evidence behavior reproduction

Information Processing

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
Animals have external and internal sensory receptors that detect different kinds of information that then gets processed by the brain.	How do organisms detect, process, and use information about the environment?	**3.1.4.B 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.**	**Developing and Using Models** Use a model to test interactions concerning the functioning of a natural system.	Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.	**Systems and System Models** A system can be described in terms of its components and their interactions.	senses processes model system sense receptors information perceptions

Definition of Energy

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
Energy can be modeled as either motions of particles or as being stored in force fields.	What is energy?	**3.2.4.A Use evidence to construct an explanation relating the speed of an object to the energy of that object.**	**Constructing Explanations and Designing Solutions** Use evidence (e.g., measurements, observations, patterns) to construct an explanation.	The faster a given object is moving, the more energy it possesses.	**Energy and Matter** Energy can be transferred in various ways and between objects.	evidence speed energy

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Conservation of Energy and Energy Transfer

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
The total change of energy in any system is always equal to the total energy transferred into or out of the system.	What is meant by conservation of energy? How is energy transferred between objects or systems?	**3.2.4.B** **Make and communicate observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.**	**Planning and Carrying Out Investigations** Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. **Asking Questions and Defining Problems** Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.	Energy can be moved from place to place by moving objects or through sound, light, or electric currents. Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result the air gets heated and sound is produced.	**Patterns** Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena. Cause and effect relationships are routinely identified. **Connections to Engineering, Technology, and Applications of Science** Interdependence of Science, Engineering, and Technology Knowledge of relevant scientific concepts and research findings is important in engineering.	observations energy transformation transferred sound energy light energy heat energy electric currents patterns

Relationship Between Energy and Forces

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
Forces between objects can result in transfer of energy between these objects.	How are forces related to energy?	**3.2.4.C** **Ask questions and predict outcomes about the changes in energy that occur when objects collide.**	**Constructing Explanations and Designing Solutions** Apply scientific ideas to solve design problems.	Energy can be moved from place to place by moving objects or through sound, light, or electric currents. Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can	**Energy and Matter** Energy can be transferred in various ways and between objects.	change of energy energy transformation collision solve design problems

				be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result the air gets heated and sound is produced. When objects collide, the contact forces transfer energy so as to change the objects' motions.		

Energy in Chemical Processes and Everyday Life

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
Producing energy useful in everyday life means to convert some available energy into a desired form, which is then delivered to users.	How do food and fuel provide energy? If energy is conserved, why do people say it is produced or used?	**3.2.4.D** **Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.**	**Constructing Explanations and Designing Solutions** Apply scientific ideas to solve design problems.	Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. **Energy in Chemical Processes and Everyday Life** The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use.	**Connections to Nature of Science** Science is a Human Endeavor. Most scientists and engineers work in teams. Science affects everyday life.	conserved produced refine convert current energy transformation design problems

				Defining Engineering Problems Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.		

Wave Properties

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
Waves are repeating patterns of motion that transfer energy and information without transferring matter.	What are the characteristic properties and behaviors of waves?	**3.2.4.E** **Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.**	**Developing and Using Models** Develop a model using an analogy, example, or abstract representation to describe a scientific principle.	Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave.	**Patterns** Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena.	waves amplitude wavelength waves model patterns scientific principle

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Electromagnetic Radiation

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave pattern of changing electric and magnetic fields that interact with matter.	What is light? How can one explain the varied effects that involve light? What other forms of electromagnetic radiation are there?	**3.2.4.F** **Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.**	**Developing and Using Models** Develop a model to describe phenomena.	An object can be seen when light reflected from its surface enters the eyes.	**Cause and Effect** Cause and effect relationships are routinely identified.	reflect light cause and effect

Information Technologies and Instrumentation

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
Useful modern technologies and instruments have been designed based on an understanding of waves and their interactions with matter.	How are instruments that transmit and detect waves used to extend human senses?	**3.2.4.G** **Generate and compare multiple solutions that use patterns to transfer information.**	**Constructing Explanations and Designing Solutions** Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.	Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized to voice–and vice versa.	**Patterns** Similarities and differences in patterns can be used to sort and classify designed products.	patterns transfer technology instrument multiple solutions

The History of Planet Earth

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
We can infer Earth's planetary history by features we observe today.	How do people reconstruct and date events in Earth's planetary history?	**3.3.4.A** **Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.**	**Constructing Explanations and Designing Solutions** Identify the evidence that supports particular points in an explanation.	Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.	**Patterns** Patterns can be used as evidence to support an explanation. **Connections to Nature of Science** Scientific knowledge assumes an order and consistency in natural systems.	rock formations sedimentation weathering evidence fossil types rock layers landscape patterns

					Science assumes consistent patterns in natural systems.	

Earth Materials and Systems

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
Changes we observe on Earth are the result of energy flowing and matter cycling between interconnected systems (the geosphere, hydrosphere, atmosphere, and biosphere).	How and why is Earth constantly changing?	**3.3.4.B** **Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.**	**Planning and Carrying Out Investigations** Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.	Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. Living things affect the physical characteristics of their regions.	**Cause and Effect** Cause and effect relationships are routinely identified, tested, and used to explain change.	weathering erosion vegetation cause and effect phenomenon

Plate Tectonics and Large-Scale System Interactions

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
Plate tectonics explains the past and current movements and features of the rocks at Earth's surface.	Why do the continents move, and what causes earthquakes and volcanoes?	**3.3.4.C** **Analyze and interpret data from maps to describe patterns of Earth's features**	**Analyzing and Interpreting Data** Analyze and interpret data to make sense of phenomena using logical reasoning.	The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land	**Patterns** Patterns can be used as evidence to support an explanation.	data earth's features patterns maps

				and water features areas of Earth.		

Natural Resources

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
All materials, energy, and fuels that humans use are derived from natural sources, some of which are renewable over time and others are not.	How do Earth's surface processes and human activities affect each other? How do humans depend on Earth's resources?	**3.3.4.D** **Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.**	**Obtaining, Evaluating, and Communicating Information** Obtain and combine information from books and other reliable media to explain phenomena.	Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.	**Cause and Effect** Cause and effect relationships are routinely identified and used to explain change. **Connections to Engineering, Technology, and Applications of Science** Interdependence of Science, Engineering, and Technology Knowledge of relevant scientific concepts and research findings is important in engineering.	energy fuels natural resources renewable resources nonrenewable resources alternate energy hydropower geothermal biomass solar power environment

Natural Hazards

Big Idea	Essential Question	Standard	Science and Engineering Practices	Disciplinary Core Idea	Crosscutting Concept	Vocabulary
Natural processes can cause sudden or gradual changes to Earth's systems, some of which may adversely affect humans.	How do natural hazards affect individuals and societies?	**3.3.4.E** **Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.**	**Constructing Explanations and Designing Solutions** Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.	A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. **Designing Solutions to Engineering Problems**	**Cause and Effect** Cause and effect relationships are routinely identified, tested, and used to explain change.	solutions reduce impacts earth processes natural hazard earth processes cause and effect design solution constraints

				Testing a solution involves investigating how well it performs under a range of likely conditions.		