

BIG IDEAS: Students are expected to understand the following...

All living things have internal and external features that serve various functions in their lives.	Earth's surface is constantly changing, and it's materials can be used as natural resources.	Energy cannot be created or destroyed; however, it can be transformed from one form to another.	Scientific understanding enhances the ability to make ethical and sustainable choices in how people live their lives.
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Science Learning Outcomes Y5

Learning Strand	Knowledge Content Students are expected to know the following...	Concepts	Curricular Competencies Students are expected to do the following...
Living Things	- Structure and function of living things - Information processing of sense receptors and memory - Electromagnetic radiation of light reflection	structure, function, processing	Science and Engineering Practices developed throughout the year: 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, or to test a design solution. Analysing and Interpreting Data - Analyse and interpret data to make sense of phenomena using logical reasoning. Asking Questions and Defining Problems - Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. Constructing Explanations and Designing Solutions - Use evidence (e.g., measurements, observations, patterns) to construct an explanation. - Apply scientific ideas to solve design problems. - Identify the evidence that supports particular points in an explanation. - Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. Obtaining, Evaluating, and Communicating Information - Obtain and combine information from books and other reliable media to explain phenomena. Developing and Using Models - Develop a model to describe phenomena. - Use a model to test interactions concerning the functioning of a natural system. - Develop a model using an analogy, example, or abstract representation to describe a scientific principle. Engaging in Argument from Evidence - Construct an argument with evidence, data, and/or a model. Connections to Nature - Science findings are based on recognizing patterns
Earth and Space	- History of planet Earth: fossils and fossil fuels - Earth materials and systems - Plate tectonics and large-scale system - Bio-geology: the impact of living things on a region - Natural hazards and reducing impact - Designing solutions to engineering problems	Earth, natural hazards, forces, weathering, erosion, engineering	
Forces and Energy	- Definitions of energy - Conservation of energy and energy transfer - Natural resources: renewable and non - Relationship between energy and forces - Energy in chemical processes and everyday life - Defining engineering problems - Wave properties - Electromagnetic radiation - Information technologies and instrumentation - Optimising the design solution	energy, waves, forces, energy transfer, transformation, resources, fuel, sound, light, heat	

Big Ideas- Elaborations	Year 5
- All living things have internal and external features that serve various functions in their lives. - How does the structure of an organism determine its growth, survival, behaviour and reproduction? - What is the connection between the internal and external features and their effects on our identity? - Earth's surface is constantly changing, and its materials can be used as natural resources. - What is the history of the planet? - How does the movement of Earth's materials impact the large-scale systems in place? - How can knowing the systems that interact on Earth's surface benefit our development of possible solutions? - Energy cannot be created or destroyed; however, it can be transformed from one form to another. - What is energy, and how does it transfer? - What are some examples of transformations of energy, and how is it that they can never be destroyed? - Scientific understanding enhances the ability to make ethical and sustainable choices in how people live their lives. - How can engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands?	

Curricular Competencies : Elaboration	Year 5
<u>Earth and Space</u> The History of Planet Earth - Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. (Clarification Statement: Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock. Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time). Earth Materials and Systems - Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. (Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow. Assessment Boundary: Assessment is limited to a single form of weathering or erosion). Bio-geology - Analyse and interpret data from maps to describe patterns of Earth's features. (Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes). Natural Hazards - Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. (Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels).	

Designing Solutions to Engineering Problems

- Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. (Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity. Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions).

Science and Engineering Practices

- **Patterns** Patterns can be used as evidence to support an explanation.
- **Cause and Effect** Cause and effect relationships are routinely identified, tested, and used to explain change.
- **Energy and Matter** Energy can be transferred in various ways and between objects.
- **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.
- **Analysing and Interpreting Data** Analyse and interpret data to make sense of phenomena using logical reasoning.
- **Constructing Explanations and Designing Solutions** to Identify the evidence that supports particular points in an explanation. Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.
- **Obtaining, Evaluating, and Communicating Information** Obtain and combine information from books and other reliable media to explain phenomena.
- **Connections to Nature of Science** Science assumes consistent patterns in natural systems.
- **Connections to Engineering, Technology, and Applications of Science** Knowledge of relevant scientific concepts and research findings is important in engineering. Over time, people's needs and wants change, as do their demands for new and improved technology. Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands.

Forces and Energy**Definitions of Energy**

- Use evidence to construct an explanation relating the speed of an object to the energy of that object. (Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy).

Conservation of Energy and Energy Transfer

- Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. (Assessment Boundary: Assessment does not include quantitative measurements of energy).

Relationship Between Energy and Forces

- Ask questions and predict outcomes about the changes in energy that occur when objects collide. (Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact. Assessment Boundary: Assessment does not include quantitative measurements of energy).

Energy in Chemical Processes and Everyday Life

- Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. (Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device. Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound).

Natural Resources and Defining & Delimiting Engineering Problems

- Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. (Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels).

WAVES: Wave Properties

- Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. (Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves. Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength).

Optimizing the Design Solution

- Generate and compare multiple solutions that use patterns to transfer information. (Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text).

Science and Engineering Practices

- **Energy and Matter** Energy can be transferred in various ways and between objects.
- **Patterns** Similarities and differences in patterns can be used to sort, classify, and analyse simple rates of change for natural phenomena. Similarities and differences in patterns can be used to sort and classify designed products.
- **Cause and Effect** Cause and effect relationships are routinely identified and used to explain change.
- **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 or to test a design solution.
- **Constructing Explanations and Designing Solutions** Use evidence (e.g., measurements, observations, patterns) to construct an explanation. Apply scientific ideas to solve design problems. Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.
- **Obtaining, Evaluating, and Communicating Information** Obtain and combine information from books and other reliable media to explain phenomena.
- **Asking Questions and Defining Problems** Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
- **Develop and Using Models** Develop a model using an analogy, example, or abstract representation to describe a scientific principle.
- **Connections to Engineering, Technology, and Applications of Science** Engineers improve existing technologies or develop new ones. Over time, people's needs and wants change, as do their demands for new and improved technologies. Knowledge of relevant scientific concepts and research findings is important in engineering.
- **Connections to Nature of Science** Science affects everyday life. Most scientists and engineers work in teams.

Living Things

Structure and Function

- Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behaviour, and reproduction. (Clarification Statement: Examples of structures could include thorns, stems, roots, coloured petals, heart, stomach, lung, brain, and skin. Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems).

Information Processing

- 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. (Clarification Statement: Emphasis is on systems of information transfer. Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function).
- Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. (Assessment Boundary: Assessment does not include knowledge of specific colours reflected and seen, the cellular mechanisms of vision, or how the retina works).

Electromagnetic Radiation

- Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. (Assessment Boundary: Assessment does not include knowledge of specific colours reflected and seen, the cellular mechanisms of vision, or how the retina works).

Science and Engineering Practices

- **Developing and Using Models** Develop a model to describe phenomena. Use a model to test interactions concerning the functioning of a natural system.
- **Engaging in Argument from Evidence** Construct an argument with evidence, data, and/or a model.
- **Cause and Effect** Cause and effect relationships are routinely identified.
- **Systems and System Models** A system can be described in terms of its components and their interactions.

Knowledge Content- Elaborations

Year 5

ESS1.C: The History of Planet Earth

- 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. (4-ESS1-1)

ESS2.A: Earth Materials and Systems

- 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. (4-ESS2-1)

ESS2.B: Plate Tectonics and Large-Scale System Interactions

- 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 and water features areas of Earth (4-ESS2-2)

ESS2.E: Bio-geology

- Living things affect the physical characteristics of their regions. (4-ESS2-1)

ESS3.A: Natural Resources

- 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. (4-ESS3-1)

ESS3.B: Natural Hazards

- 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. (4-ESS3-2) (Note: This Disciplinary Core Idea can also be found in 3.WC.)

ETS1.B: Developing Possible Solutions

- Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4-ESS3-2)

PS3.A: Definitions of Energy

- The faster a given object is moving, the more energy it possesses. (4-PS3-1)
- Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2),(4-PS3-3)

PS3.B: Conservation of Energy and Energy Transfer

- 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. (4-PS3-2), (4-PS3-3)
- Light also transfers energy from place to place. (4-PS3-2)
- 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. (4-PS3-2),(4-PS3-4)

PS3.C: Relationship Between Energy and Forces

- When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3- 3)

PS3.D: 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. (4-PS3-4)

ESS3.A: Natural Resources

- 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. (4-ESS3-1)

ETS1.A: 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. (secondary to 4-PS3-4)

PS4.A: Wave Properties

- 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 except when the water meets a beach. (Note: This grade band endpoint was moved from K–2.) (4-PS4-1)
- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1)

PS4.C: Information Technologies and Instrumentation

- 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 form to voice—and vice versa. (4-PS4-3)

ETS1.C: Optimizing The Design Solution

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (secondary to 4-PS4-3)

PS4.B: Electromagnetic Radiation

- An object can be seen when light reflected from its surface enters the eyes. (4-PS4-2)

LS1.A: Structure and Function

- Plants and animals have both internal and external structures that serve various functions in growth, survival, behaviour, and reproduction. (4-LS1-1)

LS1.D: Information Processing

- 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. (4-LS1-2)