Pace

Charter School of Hamilton

SCIENCE CURRICULUM GUIDE

4TH GRADE

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This curriculum may be modified through varying techniques, strategies and materials as per an individual student's Individualized Educational Plan (IEP).

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Introduction

This guide has been prepared to meet the requirements of the Pace Charter School of Hamilton and the New Jersey Department of Education. This document will serve as a guide for lesson planning. It sets forth a framework upon which each school can build a program suited both to the needs of the students and to the expectations of the community.

Fourth Grade Next Generation Science Standards

The performance expectations in fourth grade help students formulate answers to questions such as: "What are waves and what are some things they can do? How can water, ice, wind and vegetation change the land? What patterns of Earth's features can be determined with the use of maps? How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals? What is energy and how is it related to motion? How is energy transferred? How can energy be used to solve a problem?" Fourth grade performance expectations include PS3, PS4, LS1, ESS1, ESS2, ESS3, and ETS1 Disciplinary Core

Ideas from the NRC Framework. Students are able to use a model of waves to describe patterns of waves in terms of amplitude and wavelength, and that waves can cause objects to move. Students are expected to develop understanding of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. They apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of such processes on humans. In order to describe patterns of Earth's features, students analyze and interpret data from maps. Fourth graders are expected to develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. By developing a model, they describe that an object can be seen when light reflected from its surface enters the eye. Students are able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. Students are expected to develop an understanding that energy can be transferred from place to place by sound, light, heat, and electric currents or from object to object through collisions. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. The crosscutting concepts of patterns; cause and effect; energy and matter; systems and system models; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In the fourth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.

Course Description

Science is a content area that is taught to all fourth grade students. The units of study include soils, rocks and landforms; energy & electromagnetism; Earth and sun. Other topics to be taught throughout the year

include; simple machines, moon phases, solar system, and plants. Appropriate Next Generation Science Standards are addressed while investigating the nature of science. Students are given opportunities to explore the world around them while coming to understand the fundamentals of scientific principles and inquiry. Knowledge from previous grades is reinforced and built upon, laying the foundation for deeper understanding of basic scientific principles.

Topic I
Soils Rocks & Landforms
Approximate # of Weeks: 6

Topic II
Energy & Electromagnetism
Approximate # of Weeks: 6

Topic III
Earth & Sun
Approximate # of Weeks: 6

TOPIC I
SOILS ROCKS & LANDFORMS
APPROXIMATE # OF WEEKS: 6

Essential Questions

What is soil?
How do big rocks break down into smaller rocks?
How are rocks affected by acid rain?
What's in our schoolyard soils?
How do weathered rock pieces move form one place to another?
How does slope affect erosion and deposition?
How do floods affect erosion and deposition?
Where are erosion and deposition happening in our schoolyard?
What events can change Earth's surface quickly?
How can we best describe rocks for later identification?
How does the property of hardness help us identify minerals?
What other properties can help us identify minerals?
What minerals make up the rock granite?
What are natural resources and what is important to know about them?
How are natural resources used to make concrete?
How do people use natural resources to make or build things?

Objectives

Upon completion of this unit, students will be able to:

1) Summarize the process involved in the rock cycle and describe the characteristics of the rocks involved.
2) Utilize various tools such as map projections and topographical maps to interpret features of Earth's surface.

3) Interpret a representation of a rock layer sequence to establish oldest and youngest layers, geological events, and changing life forms.
4) Examine Earth's surface features and identify those created on a scale of human life or on a geologic time scale.
5) Determine if landforms were created by processes of erosion (e.g. wind, water, and/or ice) based on evidence in pictures, video, and/or maps.
6) Describe methods people use to reduce soil erosion.
7) Distinguish physical properties of sedimentary, igneous, or metamorphic rocks and explain how one kind of rock could eventually become a different kind of rock.
8) Apply understanding of the motion of lithospheric plates to explain why the Pacific Rim is referred to as the Ring of Fire.
9) Deduce the story of the tectonic conditions and erosion forces that created sample rocks or rock formation.

Next Generation Science Standards

Students who demonstrate understanding can:

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

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

4-ESS2-2. Analyze 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.]

4-ESS3-2. 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.]

Interdisciplinary Standards

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: Biogeology

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

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: Designing Solutions to Engineering Problems

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

Activities

- Investigate the composition of soils from four different locations.
- Investigate the processes of physical and chemical weathering.
- Observe and compare local soils.
- Use stream tables to investigate how the slow processes of erosion and deposition alter landforms over time.
- Make predictions about a stream table investigation and compare results to the predictions.
- Use physical tools and a table of diagnostic properties to make observations and identify minerals.
- Make observations and interpret them to develop explanations in the way that scientists do.
- Observe how earth materials are used in the community around the school.
- Consider the ways people impact natural resources and how humans can conserve them.

Enrichment/Extension Activities

- Contact the U.S. Geological Survey to read short publications about geology and soil.
- Invite a geologist or soil scientist to class, contact local universities.
- Use the Acid-Rain test
- Look for soil profiles in the community and have students/teachers bring to class.
- Watch videos on flash floods, or how rock formations have been created in time lapse format.
- Take stream table photos in sequence and construct a written report.
- Find a local erosion-control expert, contact beach authorities.

- Research natural resources in our region, what they are, where they are located, how they are used and managed, if there are any issues etc.
- Make 'concrete' with plaster of paris.
- Contact your local NRCS office 'Natural Resources Conservation Service'
- Discuss 'fracking' have a local group come in to discuss its effects on the environment.

Methods of Assessment/Evaluation

- Interactive whiteboard lessons
- KWL Charts
- Exit Slips
- Labs
- Class work/ Independent Work
- Science Notebooks
- Focus Question Answers
- Power Point Presentations
- Oral Presentations
- Poster/Display
- Tests/Quizzes

Text Resources & Online Resources

Access Google Drive for *"Science Curriculum Hyper Links"*

Vocabulary

Abrasion the rubbing, grinding, and bumping of rocks that cause physical weathering (SRB, IG) **Acid** a substance that geologists use to identify rocks that contain calcite (SRB)
Acid Rain a form of precipitation containing acid, which forms when carbon dioxide gas in the air dissolves in water droplets; a form of chemical weathering (IG)

Aggregate a mass of rock particles, such as pebbles, gravel, and sand (IG)
Alluvial Fan a fan-shaped deposit of rocks formed where a stream flows from a steep slope onto flatter land
Basalt a dark rock formed from cooling lava (IG)
Bauxite an ore that has aluminum in it (SRB)
Birthstone a gem mineral that is identified with a month of the year
Break to smash or split into pieces (IG)
Calcite a common rock-forming mineral in Earth's crust (SRB, IG)
Canyon a V-shaped gorge with steep sides eroded by a stream (IG)
Cement a fine gray powder made from limestone; component of concrete (IG)
Chemical reaction a process in which two or more materials mix in a way that forms new materials (IG)
Chemical Weathering the process by which the minerals in a rock can change due to chemicals in water and air.
Chemical Weathering can cause rocks to break apart. (SRB, IG)
Clay the smallest category of rock pieces; component of soil (IG)
Cleavage the flat surfaces of freshly broken minerals (SRB, IG)
Concrete a mixture of gravel, sand, cement, and water (SRB, IG)
Conglomerate a rock composed of smaller pieces like clay, silt, sand, gravel, and pebbles core the center of Earth, made mostly of iron and nickel (SRB)
Crust Earth's outer layer of solid rock (SRB, IG)
Decay when dead plants or animals break down into small pieces (SRB)
Delta a fan-shaped deposit of earth materials at the mouth of a stream (IG)
Deposition the settling of sediments (SRB, IG)
Dissolve when a material mixes uniformly into another (SRB)
Earth Material any natural resource that makes up Earth, including soil and water (SRB, IG)
Earthquake a sudden movement of Earth's crust along a fault (SRB, IG)
Erosion the carrying away of weathered earth materials by water, wind, or ice (SRB,
Expand when the volume of a substance increases or gets bigger (IG)
Fault a break in Earth's crust along which blocks of rock move past each other
Feldspar a common rock-forming mineral in Earth's crust (SRB, IG)
Flood a large amount of water flowing over land that is usually dry (SRB, IG)
Floodplain land covered by water during a flood. Small particles, like sand and silt, are deposited on a floodplain (IG)

Fluorite a mineral that comes in a variety of colors, can be scratched with a paper clip, and glows under an ultraviolet light source (IG)
Fossil any remains, trace, or imprint of animal or plant life preserved in Earth's crust (SRB, IG) **Fossil Fuel** plants and animals that became buried under sediments millions of years ago, then slowly transformed into deposits of carbon-rich substances, such as coal, petroleum, and natural gas
Fracture the uneven, rounded, or splintered surfaces of some minerals when they break
Freeze to become hard or stiffened due to loss of heat (IG)
Galena an ore mineral for lead and silver that has a metallic luster and is heavy for its size (IG) **Gem** a hard mineral that can be cut into beautiful shapes (SRB)
Geologist a scientist who studies Earth, its materials, and its history (SRB)
Geoscientist a scientist who studies the use, distribution, and conservation of Earth's natural resources
Geothermal power alternative energy source that comes from the internal heat of the earth (IG) **Glacier** a large mass of ice moving slowly over land (SRB)
Gold a valuable dense metal that is found in ore and nuggets (SRB)
Granite an igneous rock that forms inside Earth (SRB, IG)
Gravel rocks that are smaller than pebbles but bigger than sand; component of soil
Gypsum a mineral that forms rosettes or fibers, can be scratched with a fingernail, and is used to make plaster (IG)
Hardness a property of minerals determined by resistance to scratching (SRB, IG)
Hematite an iron ore mineral that has a metallic luster and leaves a reddish-brown streak (IG) **Hornblende** a mineral that is a component of granite that has long crystals with parallel sides **Humus** (HEW-mus) bits of dead plant and animal parts in the soil (SRB, IG)
Igneous rock a rock that forms when melted rock (magma) hardens (SRB, IG)
Landform a feature of the land, such as a mountain, canyon, or beach (SRB, IG)
Landslide the sudden movement of earth materials down a slope (SRB, IG)
Lava melted rock erupting onto Earth's surface, usually from a volcano (SRB, IG)
Limestone a sedimentary rock made mostly of calcite (SRB, IG)
Luster a description of the way light reflects off the surface of a mineral (SRB, IG)
Magma melted rock below Earth's surface (SRB, IG)
Magnetic a property of minerals that are attracted to magnets (SRB)
Magnetism a property of certain kinds of materials that causes them to attract iron or steel (IG) **Magnetite** a mineral that

contains iron and sticks to magnets (IG)
Mantle the solid rock material between Earth's core and crust (SRB, IG)
Marble a metamorphic rock formed when limestone is subjected to heat and pressure (SRB, IG) **Meander** a curve or loop in a river or stream (IG)
Metallic describing the luster of a mineral that shines like metal (SRB, IG)
Metamorphic rock a rock that forms when rocks and minerals are subjected to heat and pressure **Mica** a mineral that pulls apart in thin, flexible sheets and is one of the components of granite
Mineral ingredient of a rock (SRB, IG)
Model a representation of the features and actions of a natural system or process
Mohs' scale a numerical scale used by geologists to rank minerals according to their hardness, with 10 being the hardest mineral (diamond), and 1 being the softest mineral (talc) (IG)
Mountain a high, steeply sloped area where rock is uplifted along a fault or created by a volcano
Natural resource a material such as soil or water that comes from the natural environment (SRB,
Nonmetallic describing the luster of a mineral that does not shine like a metal
Nonrenewable resource a resource that is not replenished because it takes extended geological periods to form, such as rocks, minerals, and fossil fuels (IG)
Nutrient something that living things need to grow and stay healthy (SRB) opaque describing matter that does not let light shine through it (SRB)
Ore a rock or mineral that has a valuable substance in it, such as gold (SRB)
Ore mineral a mineral from which a valuable material, usually a metal, is extracted particle a very small piece or part (SRB)
Pebble the largest category of rock pieces; component of soil (IG)
Physical Weathering the process by which rocks are broken down by breaking and banging
Property something that you can observe about an object or a material. Size, color, shape, texture, and smell are properties. (SRB)
Pumice a type of rock that forms when lava erupts from volcanoes (SRB)
Pyrite a yellow mineral with a metallic luster; also known as fool's gold (IG)
Quartz a common mineral in igneous rocks (SRB, IG)
React to act or change in response to something (SRB)
Renewable Resource a resource that is naturally replenished continuously and quickly, such as sunlight, water, and air (IG)

Retain to hold or continue to hold (SRB)
River Channel a river that flows deeper in the center and moves along a confined path (IG)
River Mouth the area of a river where it flows into sea or lake (IG)
Rock a solid earth material made of two or more minerals (SRB, IG)
Rock Cycle the processes by which rocks change into different kinds of rocks (SRB)
Sand rocks that are smaller than gravel, but bigger than silt; component of soil (IG)
Sandstone a sedimentary rock made of sand particles stuck together (SRB, IG)
Scratch test method used to find out how hard a mineral is compared to other minerals (IG)
Sediment pieces of weathered rock such as sand, deposited by wind, water, and ice
Sedimentary rock a rock that forms when layers of sediments get stuck together
Silt rocks that are smaller than sand, but bigger than clay (SRB, IG)
Slope the angle of the land over which water flows (IG)
Soil a mix of humus, sand, silt, clay, gravel, and/or pebbles (SRB, IG)
Solar Energy an alternative energy source from the sun that drives the water cycle and produces wind, ocean waves, and flowing water in rivers and streams (IG)
Streak the mark left when a mineral sample is rubbed on a tile (SRB, IG) transport to move or carry from one place to another (SRB)
Valley a low area between mountains where a stream or glacier flows. Stream valleys are V-shaped. Glacier valleys are often U-shaped (IG)
Volcano an opening in Earth's crust where lava, cinders, ash, and gases come to the surface
Weathering the process by which larger rocks crack and break apart over time to form smaller rocks (SRB, IG)
Wind Power an alternative energy source that uses the power of the wind (IG)

TOPIC II
ENERGY & ELECTROMAGNETISM
APPROXIMATE # OF WEEKS: 6

Essential Questions

What is needed to light a bulb?
What does energy do in a circuit with a motor?
What is needed to make a complete pathway for current to flow in a circuit?
What do we observe that provides evidence that energy is present?
How can you get two bulbs to light at the same time?
How can you light two bulbs brightly with one D-cell?
Which design is better for manufacturing long strings of lights – series or parallel?
How can you make a motor run faster using solar cells?
What materials stick to magnets?
What happens when two or more magnets interact?
What happens when a piece of iron comes close to or touches a permanent magnet?
What happens to the force of attraction between tow magnets when the distance between them changes?
What do magnets interact with in the outdoor environment?
How can you turn a steel rivet into a magnet that turns on and off?
How does the number of winds of wire around a core affect the strength of the magnetism?
How can you reinvent the telegraph using your knowledge of energy and electromagnetism?
How does light travel?
What happens when light strikes an object?

Objectives

Upon completion of this unit, students will be able to:

1) Record and organize data using appropriate tools for the task and build reasonable explanations.
2) Plan and conduct investigations, organize observations.

3) Ask questions that can be answered. Learn how to share answers appropriately.
4) Experiment to determine how the number of winds in an electromagnet coil affects the strength of the magnetism.
5) Design and build a model telegraph system.
6) Use tools and techniques to make observations and build explanations about light.
7) Use models to help develop explanations, make predictions, and analyze existing systems, and recognize strengths and limitations of proposed solutions to problems.

Next Generation Science Standards

Students who demonstrate understanding can:

4-PS3-1. 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.]

4-PS3-2. 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.]

4-PS3-3. 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.]

4-PS3-4. 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.]

4-ESS3-1. 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.]

Interdisciplinary Standards

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)

Activities

- Conduct experiments creating circuits.
- Create circuits with pathways through which electric current flows from an energy source to its components.
- Discover all metals are conductors of electric current.
- Use solar cells to produce electricity.
- Take solar cells outside to understand transfer of light to energy.
- Discuss renewable and non-renewable resources. Debate whether the use of fossil fuels is practical to our future.
- Differentiate between series and parallel circuits.
- Light bulbs with D-Cells
- Compare the energy flow between solar cells and D-cells.
- Use magnets to attract objects that contain iron.
- Discover what metals contain iron and what do not.
- Learn about magnetic force and attractions.
- Create electromagnet and attract iron filings.
- Conduct experiment with class made telegraph.
- Use mirrors to explore light refraction and reflection.
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Enrichment/Extension Activities

- Make schematic diagrams of circuits that have been built.
- Have students find toys at home that use energy or store energy.
- Explore energy-use meters in school building.
- Discuss how energy can be saved or lessened.
- Invite an electrician to class and discuss how most homes are wired.
- Make a single-pole-double-throw switch.
- Build a flashlight.
- Research solar cell technology and give a presentation.
- Make a floating compass and discuss why the needle turns north.
- Explore different magnets, make magnetic slime to investigate.
- Compare magnets to electromagnets.
- Make a model minimotor with insulated wire and paperclips.
- Construct a periscope.

Methods of Assessment/Evaluation

- Interactive whiteboard lessons
- KWL Charts
- Exit Slips
- Labs
- Class work/ Independent Work
- Science Notebooks
- Focus Question Answers
- Power Point Presentations
- Oral Presentations
- Poster/Display
- Tests/Quizzes

Text Resources & Online Resources

Access Google Drive for *"Science Curriculum Hyper Links"*

Vocabulary

Absorb to take in or soak up (SRB, IG)
Attract to pull toward each other (SRB, IG)
Battery a source of stored chemical energy (SRB, IG)
Bulb base the area on a lightbulb where one of the filament support wires extends down to the metal bead (IG)
Bulb Casing the inside of the metal screw case on a lightbulb where the second filament support wire connects (IG)
Circuit a pathway for the flow of electricity (SRB, IG)
Closed Circuit a complete circuit through which electricity flows (SRB, IG)
Code a set of signals that represents letters or words for sending messages (SRB, IG)
Coil a series of loops (SRB, IG)
Color the result of the light an object radiates or reflects (IG)
Compass an instrument that uses a free-rotating magnetic needle to show direction
Complete Circuit a circuit with all the necessary connections (SRB)
Component one item in a circuit (SRB, IG)
Conductor a substance, commonly a metal such as copper or aluminum, through which electricity will flow (IG)
Contact Point the place in a circuit where connections are made to allow electricity to flow (SRB, IG)
Core in an electromagnet, the material around which a coil of insulated wire is wound (SRB, IG)
D-cell a source of electricity; also known as a battery (IG)
Electrically Neutral an object that has equal numbers of positive and negative charges (SRB)
Electric Current the flow of electricity through a conductor (SRB, IG)
Electricity energy that flows through circuits and can produce heat, light, motion, and sound (SRB, IG)
Electron a tiny particle that has a negative charge and goes around the nucleus of an atom (SRB)
Energy the ability to do work (SRB, IG)
Energy Source a place where energy comes from, such as batteries, food, fuels, and the Sun (SRB, IG)
Filament the material in a lightbulb (usually a thin wire) that makes light when heated by an electric current (SRB, IG)

Force a push or a pull (SRB, IG)
Fossil Fuel the preserved remains of organisms that lived long ago and changed into oil, coal, and natural gas (SRB)
Fuel a source of energy when burned (IG)
Generator a device that produces electricity from motion (SRB)
Gravity a force that pulls objects toward each other (IG)
Heat observable evidence of energy (SRB, IG)
Incomplete Circuit a circuit that has a break in it (SRB)
Induced Magnetism the influence of a magnetic field on a piece of iron, which makes the iron a temporary magnet (SRB, IG)
Insulator a material that prevents the flow of electricity, commonly plastic, rubber, glass, or air (IG)
Interact to act on and be acted upon by one or more objects (SRB, IG)
Iron a metal that sticks to a magnet (SRB, IG)
Key a switch that completes the circuit in a telegraph system (SRB, IG)
Light observable evidence of energy (SRB, IG)
Light Bulb a filament held by two stiff wires and surrounded by a clear glass globe
Light Source anything that makes light, such as the Sun, a lightbulb, or a flame
Magnet an object that sticks to iron or steel (SRB, IG)
Magnetic Field an invisible field around a magnet (SRB, IG)
Magnetism a property of certain kinds of materials that causes them to attract iron or steel
Mirror a shiny surface that reflects light (SRB, IG)
Motion observable evidence of energy (SRB, IG)
Motor a device that produces motion from electricity (SRB, IG)
Negative Charge (–) the charge of an electron (SRB)
North Pole the end of a magnet that orients toward Earth's magnetic north pole
Open Circuit an incomplete circuit through which electricity will not flow (SRB, IG)
Opposite different as in the two poles of magnets (IG)
Orient to position an object in a certain way (SRB)
Parallel Circuit a circuit that has two or more pathways for current to flow (SRB,
Permanent Magnet an object that sticks to iron (SRB, IG)
Pole the end of a magnet (SRB, IG)
Positive Charge (+) the charge of an atom's nucleus (SRB)

Predict to make an educated guess based on data or previous experience (IG)
Prism a piece of transparent material that separates light into a spectrum (IG)
Property something you can observe about an object or a material (SRB)
Ray an electromagnetic wave of light (IG)
Reflect to bounce back (IG)
Reflection the bouncing of light rays off an object (SRB, IG)
Refract to change the speed and direction of travel (IG)
Refraction the bending of light rays (SRB, IG)
Repel to push away from each other (SRB, IG)
Rivet a piece of iron or steel around which a coil is wound (IG)
Series Circuit a circuit that has only one pathway for current to flow (SRB, IG)
Shadow the dark area behind an object that blocks light (SRB)
Short Circuit an unintended pathway that allows current to flow from one terminal of an energy source directly to the other terminal without passing through any other component (IG)
Solar Cell a silicon cell that converts sunlight into electric energy and is used as a power source (IG)
Sound observable evidence of energy (SRB, IG)
South Pole the end of a magnet that orients toward Earth's magnetic south pole
Static Electricity positive and negative electric charges that don't move and are separated from each other (SRB)
Steel a material made mostly of iron (IG)
Stored Energy energy available for use (SRB)
Switch a device used to open and close circuits (IG)
System a set of objects that are related in some way and can be isolated for study
Telegraph a device that uses an electromagnet to send coded messages by closing and opening an electric circuit (SRB, IG)
Temporary Magnet a piece of iron that behaves like a magnet only when it is surrounded by a magnetic field (SRB, IG)
Terminal the term used to refer to the ends of a battery (IG)
Transfer to move from one source to another (IG)
Transmit to pass through (IG)
Vibration a quick back-and-forth movement (SRB)
White Light a mixture of all colors (wavelengths) of visible light (IG)
Wire a metal or other solid substance through which electric current move

TOPIC III
EARTH & SUN
APPROXIMATE # OF WEEKS: 6

Essential Questions

How and why does your shadow change during the day?
What can be learned by studying the length and direction of shadows?
What causes day and night?
How can you explain why we see some natural objects only in the night sky, some only in the day sky, and some at both times?
How would you describe the size of and distance between Earth, the Moon and the Sun?
How does the shape of the Moon change over 4 weeks?
How do the parts of the solar system interact?
Why do stars appear to move across the night sky?
What is air?
What is Earth's atmosphere?
How do meteorologists measure and record weather variables?
What happens to earth materials when they are exposed to sunlight?
How does energy transfer to the air?
What happens when a volume of fluid is warmed at the bottom?
What is the best design for a solar water heater?
What causes condensation to form? How does water vapor get into the air?
What is the water cycle?
What is the difference between weather and climate?

Objectives

Upon completion of this unit, students will be able to:

1) Record and organize data using appropriate tools for the task and build reasonable explanations.
2) Plan and conduct investigations, organize observations.
3) Ask questions that can be answered. Learn how to share answers appropriately.

4) Understand water is found everywhere on Earth.
5) Identify the elements that make up Air.
6) Learn the levels of the Atmosphere.
7) Identify all planets in the solar system.
8) Understand the Sun is a star and the planets are in orbit around it.
9) Identify all phases of the Moon and understand why it is illuminated.

Next Generation Science Standards

Students who demonstrate understanding can:

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

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

4-ESS2-2. Analyze 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.]

4-ESS3-2. 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.)

Interdisciplinary Standards

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

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

Activities

- Trace shadows in the morning and afternoon and monitor Sun's position throughout the day.
- Learn how to use a compass to orient a Sun tracker.
- Discover that rotation of Earth produces day and night.
- Track Moon by completing a Moon Phase Calendar.
- Complete a solar system bulletin board to understand relative location between planets.
- Learn and identify major constellations.
- Discuss gravity and conduct experiments.
- Work with tubes and syringes to discover air takes up space am dos compressible.
- Make weather station to track patterns.
- Graph temperature changes throughout the weeks this unit is being completed.
- Students consider why Earth is called the water planet.
- Learn about world climate regions and global climate change.

Enrichment/Extension Activities

- Build a model of the Earth/Moon/Sun system.
- Take a field trip to the planetarium to continue learning of constellations.
- Discuss gravity on other planets and how our body structure would be affected.
- Have local meteorologist visit school to discuss air quality.

- Debate about global warming and discuss ways to reduce air emissions.
- Simulate the travels of a drop of water through the water cycle to explore the complexities of the process.

Methods of Assessment/Evaluation

- Interactive whiteboard lessons
- KWL Charts
- Exit Slips
- Labs
- Class work/ Independent Work
- Science Notebooks
- Focus Question Answers
- Power Point Presentations
- Oral Presentations
- Poster/Display
- Tests/Quizzes

Text Resources & Online Resources

Access Google Drive for *"Science Curriculum Hyper Links"*

Vocabulary

Absorb to soak in (SRB, IG)
Air the mixture of gases surrounding Earth (SRB, IG)
Air Pressure the force exerted on a surface by the mass of the air above it
Asteroid a small, solid object that orbits the Sun (SRB, IG)
Asteroid Belt a band of orbiting rubble that separates the gas giant planets from the terrestrial planets (IG)

Atmosphere the layer of gases surrounding Earth. The layers include the troposphere, stratosphere, mesosphere, thermosphere, and exosphere. (SRB)
Axis an imaginary line around which a sphere, like a planet, rotates (SRB, IG)
Barometer a weather instrument that measures air pressure (SRB, IG)
Climate the average or typical weather conditions in a region of the world (SRB, IG)
Climatologist scientists who study climate (IG)
Comet a mass of ice, rock, and gas orbiting the Sun (SRB, IG)
Compass an instrument for determining directions, as by means of a freely rotating magnetized needle that indicates magnetic north (IG)
Compress to force air into a smaller space (IG)
Condensation the process by which water vapor changes into liquid water, usually on a surface
Condense when water vapor touches a cool surface and becomes liquid water (IG)
Conduction the transfer of energy from one place to another by contact (SRB, IG)
Constellation a group of stars that humans see as a pattern and give a name (SRB,
Contract to get smaller; to take up less space (IG)
Convection Current a circular movement of fluid (such as air) that is the result of uneven heating of the fluid
Crescent Moon the curved shape of the visible part of the Moon just before and after a new Moon (SRB, IG)
Day the time between sunrise and sunset on Earth (SRB,
Dew water that condenses on a surface when the temperature drops at night
Drought a less-than-normal amount of rain or snow over a period of time (SRB, IG) **Dwarf Planet** a round object that orbits the Sun but does not orbit a planet (SRB, **Earth Material** the various solids, liquids, and gases that make up the earth (IG)
Energy Transfer the movement of energy from one place to another (SRB, IG) **Evaporate** when liquid water in a material dries up and goes into the air (IG) **Evaporation** the process by which liquid water changes into water vapor (SRB, IG) **Expand** to get bigger; to take up more space (IG)
Experiment an investigation designed to find out how variables affect outcomes
First-quarter Moon a phase of the Moon in the lunar cycle halfway between a new Moon and a full Moon
Fluid a liquid or a gas (IG)
Fog water droplets that condense from the air close to the ground (SRB, IG)
Force a push or pull that can change the speed and direction of a moving object (IG)
Forecast a scientific weather prediction (IG)

Fresh Water water that is in lakes, rivers, ground water, soil, and the atmosphere
Frost frozen condensation (SRB, IG)
Full Moon the phase of the Moon when all of the sunlit side of the Moon is visible from Earth
Gas Giant Planet one of the four planets that are made of gas. These are Jupiter, Saturn, Uranus, and Neptune.
Geosphere Earth warmed by solar energy radiates infrared radiation (SRB)
Gibbous Moon the shape of the Moon when it appears to be more than a quarter but not yet full and when it is less than full but not quite a third quarter. (SRB, IG)
Glacier a large mass of ice that along with ice caps contains about seventy percent of Earth's fresh water (IG)
Gravity the force of attraction between two objects (SRB,
Groundwater water found in the spaces between rock particles (sand, gravel, pebbles), and in cracks and spaces in solid rock (IG)
Humidity water vapor in the air (SRB, IG)
Hurricane a severe tropical storm that produces high winds (SRB, IG)
Hydrosphere water particles warmed by radiation coming up from Earth (SRB)
Hygrometer a weather instrument that measures humidity (SRB, IG)
Ice Cap an ice mass that along with glaciers contains about seventy percent of Earth's fresh water (IG)
Kuiper Belt a huge region beyond the gas giant planets, made up of different-size icy chunks of matter IG)
Lake a body of fresh water surrounded by land (IG)
Less Dense when an object floats in water, it is less dense than water (IG)
Lunar Cycle the 4-week period during which the Moon orbits Earth one time and goes through all of its phases (SRB, IG)
Mass the amount of material in something (IG)
Matter anything that takes up space and has mass (IG)
Meteorologist a scientist who studies the weather (SRB, IG)
Moon Earth's natural satellite (SRB, IG)
More Dense when an object has more mass for its size than another object. When an object sinks in water, it is more dense than water. (IG)
New Moon the phase of the Moon when the sunlit side of the Moon is not visible from Earth (SRB, IG)
Night the time between sunset and sunrise on Earth (SRB, IG)
Night Sky the time when the sky is dark and certain astronomical objects can be observed, such as the Moon, stars, and planets (IG)

North Pole one of the ends of an imaginary axle, called an axis**,** on which Earth rotates. The North Pole always points towards the North Star. (IG)
North Star the star positioned directly over Earth's North Pole; also known as Polaris (IG)
Ocean body of salt water that comprises ninety-seven percent of Earth's water (IG)
Orbit to move or travel around an object in a curved path (SRB, IG)
Orientation the direction something points (IG)
Phase the shape of the visible part of the Moon (SRB, IG)
Planet a large, round object orbiting a star (SRB, IG)
Precipitation rain, snow, sleet, or hail that falls to the ground (SRB, IG)
Pressure the force or push caused by moving molecules (IG)
Radiant Energy energy that travels through air and space (SRB, IG)
Radiation energy that travels through air and space (SRB, IG)
Ray a wave; the form that solar energy travels to the Earth in (IG)
Recycle to use again (SRB, IG)
Reflect to bounce off an object or surface (SRB, IG)
Re-radiation when the warmed Earth radiates energy back into the air (IG)
Revolution to travel around something else in a circular path; orbit (IG)
River a large natural stream of water emptying into an ocean, lake, or other body of water (IG)
Rotation turning around on an axis (IG)
Saltwater ocean water (IG)
Severe weather out-of-the-ordinary and extreme weather conditions (SRB, IG)
Shadow the dark area behind an object that blocks light (SRB, IG)
Solar collector any object or material placed in the Sun to absorb solar energy for transfer to water or air (IG)
Solar Energy heat and light from the Sun (SRB, IG)
Solar Energy Exposure the amount of energy from the Sun that falls on an object; dependent upon the intensity (brightness) of the sunlight, and the length of time the sunlight falls on the object (IG)
Solar System the Sun and the planets and other objects that orbit the Sun (SRB, IG)
Solar Water Heater a system designed to use solar energy to heat water (IG)
Star a huge sphere of hydrogen and helium gas that radiates heat and light (SRB, IG)

Sun the star at the center of the solar system around which everything else orbits
Sunrise the point between night (darkness) and day (daylight). The time at which day first happens. (IG)
Sunset the point between day (daylight) and night (darkness). The time at which night first happens. (IG)
Temperature a measure of how hot the air is (SRB, IG)
Terrestrial Planet one of the four small, rocky planets closest to the Sun. These are Mercury, Venus, Earth, and Mars. (SRB, IG)
Thermometer a weather instrument that measures temperature (SRB, IG)
Third-quarter Moon a phase of the Moon in the lunar cycle halfway between the full Moon and the new Moon
Thunderstorm severe weather that results from cold air flowing under a warm, humid air mass over the land (SRB, IG)
Tornado a rapidly rotating column of air that extends from a thunderstorm to the ground. Wind speeds can reach 400 kilometers (km) per hour or more in a tornado.
Troposphere the layer of the atmosphere that begins at Earth's surface and extends upward for 9 to 20 km. Weather happens in the troposphere. (SRB, IG)
Uneven Heating the result of different amounts of energy being transferred to adjacent surfaces (IG)
Variable anything you can change in an experiment that might affect the outcome
Visibility the distance one can see through the air at ground level (IG)
Waning Moon getting smaller (SRB, IG)
Water Cycle the global water-recycling system. Water evaporates from Earth's surface, goes into the atmosphere, and condenses. It returns to Earth's surface as precipitation in a new location. (SRB, IG)
Water Vapor the gaseous state of water (SRB, IG)
Waxing Moon getting larger (SRB, IG)
Weather the condition of the air around us. Heat, moisture, and movement are three important variables that describe weather. (SRB, IG)
Weather Variable data that meteorologists measure. These include temperature, wind speed and direction, air pressure, cloud cover, and precipitation. (SRB, IG)
Wind air in motion (SRB, IG)
Wind Direction the compass direction from which the wind is coming (IG)
Wind Speed how fast the air is moving past an observation point (IG)
Wind Vane a weather instrument that measures wind direction (SRB, IG)