

Science Curriculum



Saint Gerard Majella School

Updated July 2019

Primary Engineering Design Processes

GOALS: Students will...

I. Engineering Design

- A. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- B. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- C. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

SUBJECT: Science
GRADE: Kindergarten

GOALS: Students will...

I. Matter and Its Interactions

A. Structure and Properties of Matter

1. Make qualitative observations of the physical properties of objects (i.e., size, shape, color, mass).

II. Motion and Stability: Forces and Interactions

A. Forces and Motion

1. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.
 - a) Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.
2. Describe ways to change the motion of an object (i.e., how to cause an object to go slower, go faster, go farther, change direction, stop).

III. Energy

A. Definitions of Energy

1. Make observations to determine the effect of sunlight on Earth's surface.

B. Conservation of Energy and Energy Transfer

1. With prompting and support, use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area

IV. Molecules to Organisms: Structure and Processes

A. Organization for Matter and Energy Flow in Organisms

1. Use observations to describe patterns of what plants and animals (including humans) need to survive. Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.

V. Earth's Place in the Universe

A. Earth and the Solar System

1. Make observations during different seasons to relate the amount of daylight to the time of year.
 - a) Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.

VI. Earth's Systems

A. Weather and Climate

1. Use and share observations of local weather conditions to describe patterns over time.
 - a) Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, and warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months.

B. Biogeology

1. With prompting and support, construct an argument using evidence for how plants and animals (including but not limited to humans) can change the environment to meet their needs.

VII. Earth and Human Activity

A. Natural Resources

1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

B. Natural Hazards

1. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.

SUBJECT: Science

GRADE: 1st Grade

GOALS: Students will...

I. Energy

A. Definitions of Energy

1. Identify the source of energy that causes an increase in the temperature of an object

II. Waves and Their Applications in Technologies for Information Transfer

A. Wave Properties

1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
 - a) Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.

B. Information Technologies and Instrumentation

1. Use tools and materials to design and build a device that used light or sound to solve the problem of communicating over a distance.
 - a) Clarification Statement: Examples of devices could include a light source to send signals, paper cup and string “telephones,” and a pattern of drum beats.

III. From Molecules to Organisms: Structure and Processes

A. Structure and Function

1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
 - a) Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and, detecting intruders by mimicking eyes and ears.

B. Inheritance of Traits

1. Make observations to construct an evidence based account that young plants and animals are like, but not exactly like, their parents.

- a) Clarification Statement: Examples of patterns could include features plants or animals share. Examples of observations could include leaves from the same kind of plant are the same shape but can differ in size; and, a particular breed of dog looks like its parents but is not exactly the same.]

IV. Earth's Place in the Universe

A. Universe and its Stars

1. Describe the presence of the Sun, Moon, and stars in the sky over time.
2. Use observations of the sun; moon, and stars to describe patterns that can be predicted.

- a) Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars other than our sun are visible at night but not during the day.

V. Earth's Systems

A. Weather and Climate

1. Identify patterns indicating relationships between observed weather data and weather phenomena

SUBJECT: Science

GRADE: 2nd Grade

Students will...

I. Matter and Its Interactions

A. Structure and Properties of Matter

1. Plan and conduct an investigation to describe and classify kinds of materials by their observable properties.
 - a) Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.
2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
 - a) Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.

B. Force and Motion

1. Analyze data to determine how the motion of an object changed by an applied force or the mass of an object.

C. Wave Properties

1. Plan and conduct investigations to provide evidence that changes in vibration create change in sound.

II. Ecosystems: Interactions, Energy, and Dynamics

A. Interdependent Relationships in Ecosystems

1. Plan and conduct investigations on the growth of plants when growing conditions are altered.
2. Develop a simple model that mimics the function of an animal in dispersing seeds of pollinating plants

III. Earth's Place in the Universe

A. The History of Planet Earth

1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly.
 - a) Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.

IV. Earth's Systems

A. Earth Materials and Systems

1. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.
 - a) Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.

B. Plate Tectonics and Large Scale Systems

1. Develop a model to represent the shapes and kinds of land and bodies of water in an area.

C. The Role of Water in Earth's Surface Processes

1. Obtain information to identify where water is found on Earth and that it can be solid or liquid.

Intermediate Engineering Processes

GOALS: Students will...

I. Engineering Design

- A. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- B. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- C. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

SUBJECT: Science

GRADE: 3rd Grade

GOALS: Students will...

I. Matter and Its Interactions

A. Structure and Properties of Matter

1. Predict and investigate that water can change from a liquid to a solid (freeze), and back again (melt), or from a liquid to a gas (evaporation), and back again (condensation) as the result of temperature changes.

B. Types of Interactions of Matter

1. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

II. Motion and Stability: Forces and Interactions

A. Types of Interactions

1. Plan and conduct investigations to determine the cause and effect relationship of electric or magnetic interactions between two objects not in contact with each other.
 - a) Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paper clips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.

III. From Molecules to Organisms: Structure and Processes

A. Growth and Development of Organisms

1. Develop a model to compare and contrast observations on the life cycle of different plants and animals.
 - a) Clarification Statement: Changes organisms go through during their life form a pattern.

IV. Heredity: Inheritance and Variation of Traits

A. Inheritance of Traits

1. Construct scientific arguments to support claims that some characteristics of organisms are inherited from parents and some are influenced by the environment.

- a) Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.

B. Natural Selection

1. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving and finding mates.
 - a) Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.

C. Adaption

1. Construct an argument with evidence that in a particular ecosystem some organisms -- based on structural adaptations or behaviors -- can survive well, some survive less well, and some cannot.
 - a) Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.

D. Biodiversity and Humans

1. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
 - a) Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.

V. Earth's Systems

A. Weather and Climate

1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
 - a) Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction
2. Obtain and combine information to describe climates in different regions of the world.

B. Natural Hazards

1. Make a claim about the merit of an existing design solution (e.g. levies, tornado shelters, sea walls, etc.) that reduces the impacts of a weather -related hazard.
 - a) Clarification Statement: Examples of design solutions to weather -related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.

SUBJECT: Science

GRADE: 4th Grade

GOALS: Students will...

I. Motion and Stability: Forces and Interactions

A. Forces and Motion

1. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
2. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
 - a) Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.

B. Types of Interactions

1. Plan and conduct a fair test to compare and contrast the forces (measured by a spring scale in Newtons) required to overcome friction when an object moves over different surfaces (i.e., rough/smooth).
2. Predict how changes in either the amount of force applied to an object or the mass of the object affects the motion (speed and direction) of the object

II. Energy

A. Definitions of Energy

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

B. Conservation of Energy Transfer

1. Provide evidence to construct an explanation of an energy transformation(e.g. temperature change, light, sound, motion, and magnetic effects)
2. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
 - a) 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.

C. Relationship Between Energy and Forces

1. Use models to explain that simple machines change the amount of effort force and/or direction of force.
 - a) Clarification Statement: memorization of a simple machine is not the focus, concept builds on the application of force and motion.

III. Waves and Their Applications in technologies for Information Transfer

A. Wave Properties

1. Develop a model of waves to describe patterns in terms of amplitude or wavelength and that waves can cause objects to move.
 - a) Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.

IV. From Molecules to Organisms: Structure and Processes

A. Structure and Function

1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
 - a) Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.

B. Information Processing

1. 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.
 - a) Clarification Statement: Emphasis is on systems of information transfer.

V. Earth's Place in the Universe

A. The History of Planet Earth

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

B. Earth Materials and Systems

1. Plan and conduct scientific investigations or simulations to provide evidence how natural processes (e.g. weathering and erosion) shape Earth's surfaces.

C. Plate Tectonics and Large-Scale Systems

1. Analyze and interpret data from maps to describe patterns of Earth's features.
 - a) 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.

VI. Earth and Human Activity

A. Natural Resources

1. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
 - a) Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic Natural Resources activity.

SUBJECT: Science

GRADE: 5th Grade

GOALS: Students will...

I. Matter and Its Interactions

A. Structure and Properties of Matter

1. Develop a model to describe that matter is made of particles too small to be seen.
 - a) Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.
2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.
 - a) Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.

B. Type of Interactions of Matter

1. Plan and conduct investigations to separate the components of a mixture/solution by their physical properties (i.e., sorting, filtration, magnets, screening).
2. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

II. Motion and Stability: Forces and Interactions

A. Types of Interaction

1. Support an argument that the gravitational force exerted by Earth on objects is directed toward the planet's center.
 - a) Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.

III. Energy

A. Energy in Chemical Process and Everyday

1. Use models to describe that energy stored in food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.
 - a) Clarification Statement: Examples of models could include diagrams, and flow charts.

IV. Waves and Their Applications in technologies for Information Transfer

A. Wave Properties

1. Develop a model to describe that objects can be seen only when light is reflected off them or when they produce their own light.

V. From Molecules to Organisms: Structure and Processes

A. Structure and Function

1. Compare and contrast the major organs/organ systems (e.g. support, reproductive, digestive, transport/circulatory, excretory, response) that perform similar functions for animals belonging to different vertebrate classes

B. Organization for Matter and Energy Flow in Organisms

1. Support an argument that plants get the materials they need for growth chiefly from air and water.
 - a) Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil. [Do not assess photosynthesis.]

VI. Ecosystems: Interactions, Energy, and Dynamics

- A. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

1. Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. 16 Cycles of matter and Energy Transfer in Ecosystems Examples of systems could include organisms, ecosystems, and the Earth.

VII. Earth's Place in the Universe

A. The Universe and its Stars

1. Support an argument that relative distances from Earth affects the apparent brightness of the sun compared to other stars.

B. Earth and the Solar System

1. Make observations during different seasons to relate the amount of daylight to the time of year.
 - a) Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.
2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

- a) Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.

VIII. **Earth's Systems**

A. **Earth Materials and Systems**

1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
 - a) Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.

B. **The Role of Water in Earth's Surface Processes**

1. Describe and graph the amounts of saltwater and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.
2. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Middle School Engineering Practices

I. Engineering Design

- A. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- B. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- C. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- D. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

SUBJECT: Science

GRADE: 6th Grade-Earth and Space Science

GOALS: Students will...

I. Earth's Place in the Universe

A. The Universe and Its Stars

1. Develop and use a model of the Earth-sun-moon system to explain the cyclic patterns of lunar phases and eclipses of the sun and moon.
 - a) Clarification Statement: Examples of models can be physical, graphical, or conceptual and should emphasize relative positions and distances.
2. Develop and use a model of the Earth-sun system to explain the cyclical pattern of seasons, which includes the Earth's tilt and directional angle of sunlight on different areas of Earth across the year.
 - a) Clarification Statement: Examples of models can be physical, graphical, or conceptual.
3. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
 - a) Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical or conceptual.

B. Earth and the Solar System

1. Analyze and interpret data to determine scale properties of objects in the solar system.
 - a) Clarification Statement: Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.

C. History of Planet Earth

1. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's history.
 - a) Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.

II. Earth's Systems

A. Earth Materials and Systems

1. Develop and use a model to illustrate that energy from the Earth's interior drives convection which cycles Earth's crust leading to melting, crystallization, weathering and deformation of large rock formations, including generation of ocean sea floor at ridges, submergence of ocean sea floor at trenches, mountain building and active volcanic chains.
 - a) Clarification Statement: The emphasis is on large-scale cycling resulting from plate tectonics that includes changes in rock types through erosion, heat and pressure.
2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
 - a) Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.

B. Plate Tectonics and Large-Scale Systems

1. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
 - a) Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).

C. The Role of Water in Earth's Surface Processes

1. Design and develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
 - a) Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.
2. Research, collect, and analyze data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
 - a) Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by

temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within possible ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).

3. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
 - a) Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.

III. Earth and Human Activity

A. Natural Resources

1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes and human activity.
 - a) Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).

B. Natural Hazards

1. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
 - a) Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor

hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).

C. Human Impacts on Earth's Systems

1. Analyze data to define the relationship for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
 - a) Clarification Statement: Examples of data include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change.
2. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

D. Global Climate Change

1. Analyze evidence of the factors that have caused the change in global temperatures over the past century.

SUBJECT: Science

GRADE: 7th Grade-Life Science

GOALS: Students will...

I. From Molecules to Organisms: Structure and Processes

A. Structure and Function

1. Provide evidence that organisms (unicellular and multicellular) are made of cells and that a single cell must carry out all of the basic functions of life.
 - a) Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.
2. Develop and use a model to describe the function of a cell as a whole and ways parts of the cells contribute to that function.
 - a) Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.
3. Develop an argument supported by evidence for how multicellular organisms are organized by varying levels of complexity; cells, tissue, organs, organ system.
4. Present evidence that body systems interact to carry out key body functions, including providing nutrients and oxygen to cells, removing carbon dioxide and waste from cells and the body, controlling body motion/activity and coordination, and protecting the body.

B. Growth and Development of Organisms

1. Construct an explanation for how characteristic animal behaviors as well as specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
 - a) Clarification Statement: Examples of animal behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds; and, creating conditions for seed germination and growth. Examples of plant structures that affect the probability of plant reproduction could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.
2. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

- a) Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.

C. Organization for Matter and Energy Flow in Organisms

1. Construct a scientific explanation based on evidence for the role of photosynthesis and cellular respiration in the cycling of matter and flow of energy into and out of organisms.
 - a) Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.

II. Ecosystems: Interactions, Energy, and Dynamics

A. Interdependent Relationships in Ecosystems

1. Analyze and interpret data to provide evidence for the effects of resource availability on individual organisms and populations of organisms in an ecosystem.
2. Construct an explanation that predicts the patterns of interactions among and between the biotic and abiotic factors in a given ecosystem.
 - a) Clarification Statement: Relationships may include competition, predation, and symbiosis.

B. Cycles of Matter and Energy Transfer in Ecosystems

1. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
 - a) Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, including food chains and food webs.

C. Ecosystem Dynamics, Functioning, and Resilience

1. Construct an argument supported by empirical evidence that explains how changes to physical or biological components of an ecosystem affect populations.
 - a) Clarification Statement: Emphasis is on recognizing patterns in data and making inferences about changes in populations, defining the boundaries of the system, and on evaluating empirical evidence supporting arguments about changes to ecosystems.

2. Evaluate benefits and limitations of differing design solutions for maintaining an ecosystem.
 - a) Clarification Statement: Examples of design solutions could include water, land, and species protection, and the prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.

III. Biological Evolution; Unity and Diversity

A. Evidence of Common Ancestry and Diversity

1. Analyze and interpret evidence from the fossil record to infer patterns of environmental change resulting in extinction and changes to life forms throughout the history of the Earth.
 - a) Clarification Statement: Examples of evidence include sets of fossils that indicate an environment, anatomical structures that indicate the function of an organism in the environment, and fossilized tracks that indicate behavior of organisms.

B. Natural Selection

1. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.
 - a) Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.
2. Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.
 - a) Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, and farming practices).

C. Adaptation

1. Interpret graphical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

SUBJECT: Science

GRADE: 8th Grade-Physical Science

GOALS: Students will...

I. Matter and Its Interactions

A. Structure and Properties of Matter

1. Develop models to describe the atomic composition of simple molecules and extended structures.
 - a) Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.
2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
 - a) Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.
3. Gather, analyze, and present information to describe that synthetic materials come from natural resources and how they impact society.
 - a) Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.
4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
 - a) Clarification Statement: Emphasis is on qualitative molecular level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.

B. Chemical Reactions

1. Develop and use a model to describe how the total number of atoms remains the same during a chemical reaction and thus mass is conserved.

- a) Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms that represent atoms.
2. Construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
 - a) Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride.

II. **Motion and Stability: Forces and Interactions**

A. Forces and Motion

1. Apply physics principles to design a solution that minimizes the force of an object during a collision and develop an evaluation of the solution.
2. Plan and conduct an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
 - a) Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.

B. Types of Interaction

1. Analyze diagrams and collect data to determine the factors that affect the strength of electric and magnetic forces
 - a) Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.
2. Create and analyze a graph to use as evidence to support the claim that gravitational interactions depend on the mass of interacting objects.
 - a) Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system
3. Conduct an investigation and evaluate the experimental design to provide evidence that electric and magnetic fields exist between objects exerting forces on each other even though the objects are not in contact.

- a) Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.

III. Energy

A. Definitions of Energy

1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
 - a) Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.
2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
 - a) Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.
3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
 - a) Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.
4. Plan and conduct an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the temperature of the sample.
 - a) Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.

B. Conservation of Energy and Energy Transfer

1. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
 - a) Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.

IV. Waves and Their Application in Technologies for Information Transfer

A. Wave Properties

1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
 - a) Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking
2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
 - a) Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.