Diocese of Jackson
Office of Education

Science
Curriculum Standards

Diocese of Jackson
Curriculum Revision Committee

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Mission Statement of the Catholic Diocese of Jackson Office of Education

Mission

The mission of the Diocese of Jackson- Office of Catholic Education is to foster centers of learning that are rooted in Gospel values and Catholic teachings as we pursue academic excellence in a safe and caring environment.

Vision

Utilizing technology to collaborate and communicate clearly and consistently and reflective practice to guide future goals, we will enable students to become more service oriented, more globally aware through technological connections, and more academically prepared for a constantly changing world.

Our vision will be accomplished by

1. Providing opportunities for all students to model Gospel teachings
2. Utilizing data-driven decision making and alignment of curriculum, standards, etc. to meet the individual needs of students
3. Engaging in current methodology regarding the teaching and learning process to provide a transformative education

Values

1. Embody and model Gospel values- respect, love, dignity, truth, mercy, forgiveness, morality
2. Quality education with academic success
3. Christ-centered service to the community

Curriculum Revision Process

The curriculum standards of the Catholic Diocese of Jackson are the result of a collaborative effort among teachers, administrators, and education professionals who have closely studied the previous standards of the Diocese of Jackson, current state and national standards in all subject areas, diocesan student performance on standardized tests, and current trends in performance and assessment in the realm of education. After thorough review of multiple source documents, the subject area committees began constructing a set of curriculum standards and objectives that are rigorous while also remaining developmentally appropriate for each grade level.

Source Documents Consulted

Within the curriculum revision process the following source documents were utilized in constructing the Diocese of Jackson Curriculum Standards for Science:

1. Mississippi College and Career Readiness Standards for Science
2. Next Generation Science Standards
3. National Standards and Benchmarks for Effective Catholic Schools
4. ACT Aspire Performance Level Descriptors
5. Diocese of Jackson's Catechist Companion
6. Curriculum Standards of the Diocese of Owensboro, Kentucky

Catholic Identity Integration

Throughout the curriculum revision process, each committee held our schools' Catholic identity as the focal point of their work. Each committee looked for natural opportunities to integrate standards from the Diocese of Jackson's Catechist's Companion, the Catechism of the Catholic Church, and other religious education materials to outline concrete ways to help students connect the academic information they are learning with their spiritual growth and development. The connections were then written as academic standards within each subject, and these connections are noted throughout the curriculum standards document.

Domains

For each subject, the standards and objectives of the Diocese of Jackson are divided into domains, based on the Anchor Standards of the Mississippi College and Career Readiness Standards. These domains are consistent across grade levels to ensure vertical alignment within each subject.

Science Domains:

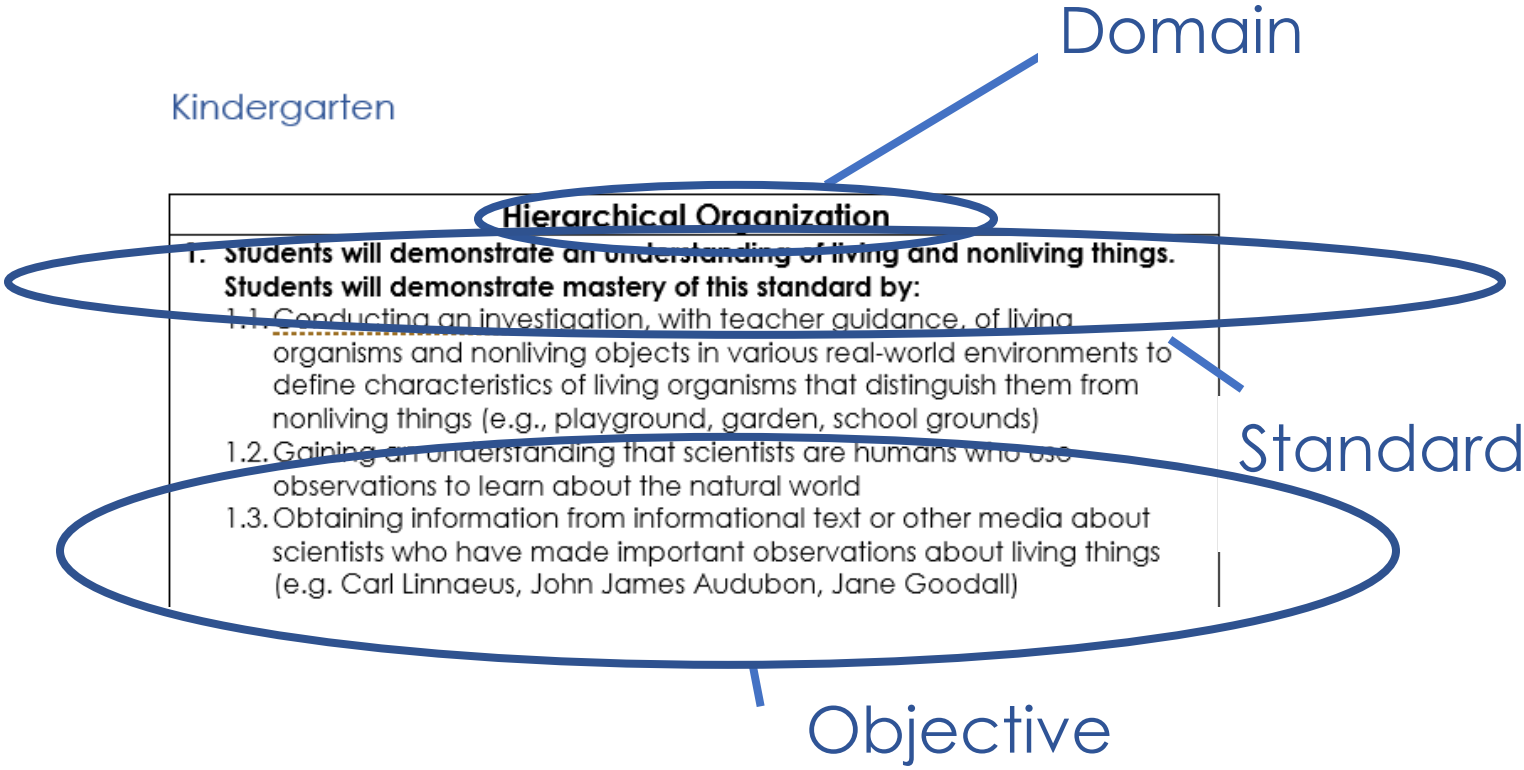
1. Hierarchical Organization
2. Reproduction & Heredity
3. Ecology & Interdependence
4. Adaptations & Diversity
5. Organization of Matter & Chemical Interactions
6. Earth's Resources
7. Earth & The Universe
8. Scientific Processes (beginning in 3rd grade)

Standards

Within each domain the curriculum is broken into overarching standards, that represent what a student should be able to do by the end of the year. These standards are broad and cannot be assessed with just one type of assessment. This knowledge is developed over multiple lessons and takes time to master.

Objectives

Each standard is broken into smaller objectives. These objectives represent what a student should be able to master within a shorter period of time. As the students master each individual objective, they will acquire the skills needed to master the overarching standard within the domain.



Curriculum Revision Schedule

In order to ensure that our academic standards are current and relevant to the ever-changing fields of education and work force preparation, the Diocese of Jackson has outlined a continuous review process for academic standards. Beginning with the complete revision of all subjects in 2019, a timeline was established to annually review the standards of one core subject each year. Each year a selected committee will conduct a review focused on student learning and achievement and make recommendations for changes or additions to the diocesan standards for their subjects.

Subject Area	**Standards Review and Revision**	**Approval by Office of Catholic Education & Principals**	**Implemented**
All	2018-2019 Completed by Spring of 2019	Spring of 2019	2019-2020 School Year
Mathematics	2021-2022 Completed by Spring of 2022	Spring of 2022	2022-2023 School Year
Science	2022-2023 Completed by Spring of 2023	Spring of 2023	2023-2024 School Year
English Language Arts	2023-2024 Completed by Spring of 2024	Spring of 2024	2024-2025 School Year
Social Studies	2024-2025 Completed by Spring of 2025	Spring of 2025	2025-2026 School Year
Mathematics	2025-2026 Completed by Spring of 2026	Spring of 2026	2026-2027 School Year

Pre-Kindergarten

*The following standards should be used for both Pre-K3 and Pre-K4 classes. Keeping in mind the developmental stages that students progress through at ages three and four, teachers should provide scaffolding and support as needed, particularly in Pre-K3 programs. Students in Pre-K3 are not expected to master the standards, but rather the standards are provided to ensure students are exposed to concepts to allow for success the following year in Pre-K4. Students should master the following standards by the end of their Pre-K4 academic year.

Hierarchical Organization

1. **Students will be introduced to the concept of hierarchical organization and how different plants, animals, and objects fit together in our world.**
   Students will demonstrate mastery of this standard by:
   1.1. Making observations, making predictions, and asking questions about natural occurrences or events
   1.2. Describing, comparing, sorting, classifying, and ordering objects
   1.3. Exploring materials, objects, and events and noticing cause and effect
   1.4. Using a variety of simple tools to make investigations
   1.5. Describing and communicating observations results, and ideas

Reproduction & Heredity

1. **Students will begin to understand the differences between plants, animals, and people.**
   Students will demonstrate mastery of this standard by:
   1.1. Naming, describing, and distinguishing plants, animals, and people by observable characteristics
   1.2. Describing plant, animal, and human life cycles.

Ecology & Interdependence

1. **Students will begin to understand that different plants and animals depend on one another for survival.**
   Students will demonstrate mastery of this standard by:
   1.1. Examining animal needs as they relate to plants (e.g., plants need bees for pollination, animals use plants for food)

Adaptations & Diversity

1. **Students will begin to understand the difference between living and non-living things and how they interact.**
   Students will demonstrate mastery of this standard by:
   1.1. Comparing and contrasting characteristics of living and nonliving things
   1.2. Identifying the body parts associated with the use of each of the five senses

Organization of Matter & Chemical Interactions

1. **Students will begin to understand that people, animal, and objects are made of smaller parts that work together to create unique characteristics.**
   Students will demonstrate mastery of this standard by:
   1.1. Manipulating and exploring a wide variety of objects and materials
   1.2. Describing and comparing objects and materials by observable properties

Forces and Motion

1. **Students will begin to explore different types of forces and the impact they have on different objects.**
   Students will demonstrate mastery of this standard by:
   1.1. Identifying position and movement of people and objects
   1.2. Exploring what happens to objects in relation to other forces

Earth's Resources

1. **Students will explore how humans interact with nature.**
   Students will demonstrate mastery of this standard by:
   1.1. Collecting, sorting, identifying, and describing natural objects in the natural world

Earth & the Universe

1. **Students will begin to understand that Earth is part of a larger universe.**
   Students will demonstrate mastery of this standard by:
   1.1. Identifying characteristics of the clouds, sun, moon, and stars

Earth's Systems & Cycles

1. **Students will recognize patterns and changes in the environment.**
   Students will demonstrate mastery of this standard by:
   1.1. Describing daily weather changes and seasonal patterns using weather vocabulary

Catholic Identity Integration in Science
Pre-Kindergarten 3 & 4

Core Values of Classroom Behavior and Culture
1. Students will understand God created all things. 2. Students will show reverence for all creation by showing respect to each other and adults.
Integration of Scripture and Church Teaching
1. Students will listen to and discuss Bible stories which include the story of Creation in the book of Genesis.
Historic Church Figures and Events
1. Students will learn about Catholic scientists and saints.

Kindergarten

Hierarchical Organization

1. **Students will demonstrate an understanding of living and nonliving things.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Conducting an investigation, with teacher guidance, of living organisms and nonliving objects in various real-world environments to define characteristics of living organisms that distinguish them from nonliving things (e.g., playground, garden, school grounds)
   - 1.2. Gaining an understanding that scientists are humans who use observations to learn about the natural world
   - 1.3. Obtaining information from informational text or other media about scientists who have made important observations about living things (e.g. Carl Linnaeus, John James Audubon, Jane Goodall)
2. **Students will demonstrate an understanding of how animals (including humans) use their physical features and their senses to learn about their environment.**
   Students will demonstrate mastery of this standard by:
   - 2.1. Developing and using models to exemplify how animals use their body parts to obtain food and other resources, protect themselves, and move from place to place
   - 2.2. Identifying and describing examples of how animals use their sensory body parts (eyes to detect light and movement, ears to detect sound, skin to detect temperature and touch, tongue to taste, and nose to detect smell)

Reproduction & Heredity

1. **Students will demonstrate an understanding of how living things change in form as they go through the general stages of a life cycle.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Using informational text or other media to make observations about plants as they change during the life cycle (e.g., germination, growth, reproduction, and death) and using models (e.g., drawing, writing, dramatization, or technology) to communicate findings
   - 1.2. Constructing explanations using observations to describe and model the life cycle (birth, growth, adulthood, death) of a familiar mammal (e.g., dog, squirrel, rabbit, deer)
   - 1.3. Conducting, with teacher guidance, a structured investigation to observe and measure (comparison of lengths) the changes in various individuals of a single plant species from seed germination to adult plant and recording observations using drawing or writing
   - 1.4. Using observations to explain that young plants and animals are similar to, but not exactly like their parents (i.e., puppies look similar, but not exactly like their parents)

Ecology & Interdependence

1. **Students will demonstrate an understanding of what animals and plants need to live and grow.**
   Students will demonstrate mastery of this standard by:
   1.1. Conducting a structured investigation to determine what plants need to live and grow (water, light, and a place to grow) and measuring growth by directly comparing plants with other objects, with teacher guidance when necessary
   1.2. Constructing explanations using observations to describe and report what animals need to live and grow (food, water, shelter, and space)
2. **Students will demonstrate an understanding of the interdependence of living things and the environment in which they live.**
   Students will demonstrate mastery of this standard by:
   2.1. Observing and communicating that animals get food from plants or other animals and plants make their own food and need light to live and grow
   2.2. Creating a model habitat which demonstrates interdependence of plants and animals using the engineering design process to define the problem, design, construct, evaluate, and improve the habitat

Adaptations & Diversity

1. **Students will demonstrate an understanding that some groups of plants and animals are no longer living (extinct) because they were unable to meet their needs for survival.**
   Students will demonstrate mastery of this standard by:
   1.1. Obtaining information from informational text or other media to document and report examples of different plants or animals that are extinct
   1.2. Observing and reporting how some present-day animals resemble extinct animals (i.e., elephants resemble wooly mammoths)

Organization of Matter & Chemical Interactions

1. **Students will demonstrate an understanding of the solid and liquid states of matter.**
   Students will demonstrate mastery of this standard by:
   1.1. Generating questions and investigating the differences between solids and liquids and developing awareness that a liquid can become a solid and vice versa
   1.2. Describing and comparing the properties of different materials (e.g., wood, plastic, metal, cloth, paper) and classifying these materials by their observable characteristics (visual, aural, or natural texture) and by their physical properties (weight, volume, solid or liquid, and sink or float)
2. **Students will demonstrate an understanding of how solid objects can be constructed from a smaller set.**
   Students will demonstrate mastery of this standard by:
   2.1. Using basic shapes and spatial reasoning to model large objects in the environment using a set of small objects (e.g., blocks, construction sets)

2.2. Analyzing a large composite structure to describe its smaller components using drawing and writing
2.3. Explaining why things may not work the same if some of the parts are missing

Earth's Resources

1. Students will demonstrate an understanding of how humans use Earth's resources.

Students will demonstrate mastery of this standard by:

1.1. Participating in a teacher-led activity to gather, organize and record recyclable materials data on a chart or table using technology and communicating the results
1.2. Developing questions to conduct a structured investigation to determine ways to conserve Earth's resources (i.e., reduce, reuse, and recycle) and communicating results with teacher guidance
1.3. Creating a product from the reused materials that will meet a human need (e.g., pencil holder, musical instrument, bird feeder) using the engineering design process to define the problem, design, construct, evaluate, and improve the product

Earth & the Universe

1. Students will demonstrate an understanding of the pattern of seasonal changes on the Earth.

Students will demonstrate mastery of this standard by:

1.1. Constructing an explanation of the pattern of the Earth's seasonal changes in the environment using evidence from observations

2. Students will demonstrate an understanding that the Sun provides the Earth with heat and light.

Students will demonstrate mastery of this standard by:

2.1. With teacher guidance, generating and answering questions to develop a simple model, which describes observable patterns of sunlight on the Earth's surface (day and night)
2.2. With teacher guidance, developing questions to conduct a structured investigation to determine how sunlight affects the temperature of the Earth's natural resources (e.g., sand, soil, rocks, and water)
2.3. Developing a device (i.e., umbrella, shade structure, or hat) which would reduce heat from the sun (temperature) using the engineering design process to define the problem, design, construct, evaluate, and improve the device

Catholic Identity Integration in Science
Kindergarten

Core Values of Classroom Behavior and Culture
1. Students will understand God created all things. 2. Students will show reverence for all creation by showing respect to each other and adults.
Integration of Scripture and Church Teaching
1. Students will listen to and discuss Bible stories which include the story of Creation in the book of Genesis.
Historic Church Figures and Events
1. Students will learn about Catholic scientists and saints.

1st Grade

Hierarchical Organization

1. **Students will demonstrate an understanding of the basic needs and structures of plants.**
   Students will demonstrate mastery of this standard by:
   1.1. Constructing explanations using first-hand observations or other media to describe the structures of different plants (root, stem, leaves, flowers, and fruit) and reporting findings using drawings, writings, or models
   1.2. Obtaining information from informational text and other media to describe the function of each plant part (roots absorb water and anchor the plant, leaves make food, the stem transports water and food, petals attract pollinators, flowers produce seeds, and seeds produce new plants)
   1.3. Designing and conducting an experiment that shows the absorption of water and how it is transported through the plant and reporting observations using drawings, sketches, or models
   1.4. Creating a model which explains the function of each plant structure (roots, stem, leaves, petals, flowers, seeds)
   1.5. With teacher support, gaining an understanding that scientists are humans who use observations and experiments to learn about the natural world
   1.6. Obtaining information from informational text or other media about scientists who have made important observations about plants (e.g., Theophrastus, Gregor Mendel, George Washington Carver, Katherine Esau)

Reproduction & Heredity

1. **Students will demonstrate an understanding of how living things change in form as they go through the general stages of a life cycle.**
   Students will demonstrate mastery of this standard by:
   1.1. Investigating, using observations and measurements (non-standard units), flowering plants (pumpkins, peas, marigolds, or sunflowers) as they change during the life cycle (e.g., germination, growth, reproduction, and seed dispersal) and communicating their findings using drawings, writings, or models
   1.2. Obtaining, evaluating, and communicating information through labeled drawings of the life cycles of pollinating insects (e.g. bees, butterflies)

Ecology & Interdependence

1. **Students will demonstrate an understanding of what plants need from the environment for growth and repair.**
   Students will demonstrate mastery of this standard by:
   1.1. Conducting structured investigations to make and test predictions about what plants need to live, grow, and repair including water, nutrients, sunlight, and space

1.2. Developing explanations, comparing results and reporting findings related to their investigations

2. **Students will demonstrate an understanding of the interdependence of flowering plants and pollinating insects.**
   Students will demonstrate mastery of this standard by:
   2.1. Identifying the body parts of a pollinating insect and describing how insects use these parts to gather nectar or disperse pollen and reporting their findings using drawings, writing or models

Adaptations & Diversity

1. **Students will demonstrate an understanding of the ways plants adapt to their environment to survive.**
   Students will demonstrate mastery of this standard by:
   1.1. Exploring the cause and effect relationship between plant adaptations and environmental changes (e.g., leaves turning toward the sun, leaves changing color, leaves wilting, or trees shedding leaves)
   1.2. Describing how the different characteristics of plants help them to survive in distinct environments (e.g. rain forests, deserts, grasslands, deciduous forests)
   1.3. Creating a solution for an agricultural problem (e.g., pollination, seed dispersal, over-crowding) and using the engineering design process to define the problem, design, construct, evaluate, and improve the solution

Motions, Forces and Energy

1. **Students will demonstrate an understanding that light is required to make objects visible.**
   Students will demonstrate mastery of this standard by:
   1.1. Constructing explanations using first-hand observations or other media to describe how reflected light makes an object visible
   1.2. Using evidence from observations to explain how shadows form and change with the position of the light source
2. **Students will demonstrate an understanding of sound.**
   Students will demonstrate mastery of this standard by:
   2.1. Conducting an investigation to provide evidence that vibrations create sound and that sound can create vibrations
   2.2. Creating a device that uses sound to communicate over a distance and using the engineering design process to define the problem, design, construct, evaluate, and improve the device

Earth's Systems and Cycles

1. **Students will demonstrate an understanding of the patterns of weather by describing, recording, and analyzing weather data to answer questions about daily and seasonal weather patterns.**
   Students will demonstrate mastery of this standard by:
   1.1. Analyzing and interpreting data from observations and measurements to describe local weather conditions (including temperature, wind, and forms of precipitation)
   1.2. Developing and using models to predict weather conditions associated with seasonal patterns and changes

1.3. Constructing an explanation for the general patterns of change in daily temperatures by measuring and calculating the difference between morning and afternoon temperatures

2. Students will demonstrate an understanding of models (drawings or maps) to describe how water and land are distributed on Earth.
Students will demonstrate mastery of this standard by:

2.1. Locating, classifying, and describing bodies of water (oceans, rivers, lakes, and ponds) on the Earth's surface using maps, globes, or other media

2.2. Generating and answering questions to explain the patterns and locations of frozen and liquid bodies of water on earth using maps, globes or other media

2.3. Planning and conducting a structured investigation to determine how the movement of water can change the shape of the land on Earth

Earth's Resources

1. Students will demonstrate an understanding of human dependence on clean and renewable water resources.
Students will demonstrate mastery of this standard by:

1.1. Obtaining and evaluating informational texts and other media to generate and answer questions about water sources and human uses of clean water

1.2. Communicating solutions that will reduce the impact of humans on the use and quality of water in the local environment

1.3. Creating a device that will collect free water to meet human need, using the engineering design process to define the problem, design construct, evaluate, and improve the device

Catholic Identity Integration in Science
1st Grade

Core Values of Classroom Behavior and Culture
1. Students will continue to develop an awareness of being special and unique persons created by God. 2. Students will understand that diversity is a good thing because it is part of God's plan, and no one plant, animal, or human can totally reflect God's goodness alone. 3. Students will treat one another and adults with respect
Integration of Scripture and Church Teaching
1. Students will recognize that God gave us ours senses to hear, see, and feel vibrations. 2. Students will recognize that we are called to let our lights shine and will discuss the science of light and how it can be related to God's love and Christ's mission. 3. Students will relate the liturgical calendar to scientific seasons (i.e. Spring and Easter are both associated with new life; Christmas comes shortly after the darkest days of the year and shows that Baby Jesus was the light coming back to the world)
Historic Church Figures and Events
1. Students will study saints within the Church who were scientists or experts in the areas of science that they are studying.

2nd Grade

Hierarchical Organization

1. **Students will be able to demonstrate an understanding of the classification of animals based on physical characteristics.**
   Students will demonstrate their understanding by:
   1.1. Comparing and sorting groups of animals with backbones (vertebrates) from groups of animals without backbones (invertebrates)
   1.2. Classifying vertebrates (mammals, fish, birds, amphibians, and reptiles) based on their physical characteristics
   1.3. Comparing and contrasting physical characteristics that distinguish classes of vertebrates (e.g., reptiles compared to amphibians)
   1.4. Constructing a scientific argument for classifying vertebrates that have unusual characteristics, such as bats, penguins, snakes, salamanders, dolphins, and duck-billed platypuses (I.e., bats have wings; yet they are mammals)

Reproduction & Heredity

1. **Students will be able to demonstrate an understanding of how living things change in form as the general stages of a life cycle.**
   Students will demonstrate their understanding by:
   1.1. Using observations through informational texts and other media to observe the different stages of the life cycle of trees (e.g., pines, oaks) to construct explanations and compare how trees change and grow over time
   1.2. Constructing explanations using first-hand observations or other media to describe the life cycle of an amphibian (birth, growth/development, reproduction, and death) and communicating their findings

Ecology & Interdependence

1. **Students will be able to demonstrate an understanding of the interdependence of living things and the environment in which they live.**
   Students will demonstrate their understanding by:
   1.1. Evaluating and communicating findings from informational text or other media to describe how animals change and respond to rapid or slow changes in their environment (fire, pollution, changes in tide, availability of food/water)
   1.2. Constructing scientific arguments to explain how animals can make major changes (e.g., beaver dams obstruct streams, or large deer populations destroying crops) and minor changes to their environments (e.g., ant hills, crawfish burrows, mole tunnels) and communicating their findings

2. Students will demonstrate an understanding of the interdependence of living things.

Students will demonstrate their understanding by:

2.1. Evaluating and communicating findings from informational text or other media to describe and to compare how animals interact with other animals and plants in the environment (I.e., predator-prey relationships, herbivore, carnivore, omnivore)

2.2. Conducting an investigation to find evidence where plants and animals compete or cooperate with other plants and animals for food or space and presenting their findings (e.g., using technology or models)

Adaptations & Diversity

1. Students will demonstrate an understanding of the ways animals adapt to their environment in order to survive.

Students will demonstrate their understanding by:

1.1. Evaluating and communicating findings from informational text or other media to describe how plants and animals use adaptations to survive (e.g., ducks use webbed feet to swim in lakes and ponds, cacti have waxy coatings and spines to grow in the desert) in distinct environments (e.g., polar lands, saltwater and freshwater, desert, rainforest, woodlands)

1.2. Creating a solution exemplified by animal adaptations to solve a human problem in a specific environment (e.g., snowshoes are like hare's feet or flippers are like duck's feet) using the engineering design process to define the problem, design, construct, evaluate, and improve the solution

Organization of Matter & Chemical Interactions

1. Students will demonstrate an understanding of the properties of matter.

Students will demonstrate their understanding by:

1.1. Conducting a structured investigation to collect, represent, and analyze categorical data to classify matter as a solid, liquid, or gas and report findings

1.2. Describing a variety of materials according to observable physical properties (e.g., size, color, texture, opacity, solubility)

1.3. Comparing and measuring the length of solid objects using technology and mathematical representations and analyzing and communicating their findings

1.4. Comparing the weight of solid objects and the volume of liquid objects and analyzing and communicating their findings

1.5. Constructing scientific arguments to support claims that some changes to matter caused by heating can be reversed, and some changes cannot be reversed

Motions, Forces, & Energy

1. **Students will demonstrate an understanding of how the motion of objects is affected by pushes, pulls, and friction on an object.**
   Students will demonstrate their understanding by:
   1.1. Conducting a structured investigation to collect, represent, and analyze data from observations and measurements to demonstrate the effects of pushes and pulls with different strengths and directions
   1.2. Generating and answering questions about the relationship between friction and the motion of objects and friction and the production of heat
   1.3. Developing a plan to change the force (push or pull) of friction to solve a human problem (e.g., improve the ride on a playground slide or make a toy car or truck go faster) using the engineering design process to define the problem, design, construct, evaluate, and improve the plan

Earth's Resources

1. **Students will demonstrate an understanding of how humans use Earth's resources.**
   Students will demonstrate mastery of this standard by:
   1.1. Using informational text, other media, and first-hand observations to investigate, analyze and compare the properties of Earth materials (including rocks, soils, sand, and water)
   1.2. Conducting an investigation to identify and classify everyday objects that are resources from the Earth (e.g., drinking water, granite countertops, clay dishes, wood furniture, or gas grill)
   1.3. Using informational text and other media to summarize and communicate how Earth materials are used (e.g., soil and water to grow plants; rocks to make roads, walls or building; or sand to make glass)
   1.4. Using informational text, other media, and first-hand observations to investigate and communicate the process and consequences of soil erosion
   1.5. Investigating possible solutions to prevent or repair soil erosion with teacher guidance

Earth & the Universe

1. **Students will demonstrate an understanding of the appearance, movements, and patterns of the sun, moon, and stars.**
   Students will demonstrate their understanding by:
   - 1.1. Recognizing that there are many stars that can be observed in the night sky and the Sun is the Earth's closest star
   - 1.2. Observing, describing, and predicting the seasonal patterns of sunrise and sunset
   - 1.3. Collecting, representing, and interpreting data from internet sources to communicate findings related to seasonal patterns of sunrise and sunset
   - 1.4. Observing and comparing the details in images of the moon and planets using perspective of the naked eye, telescopes, and data from space exploration
   - 1.5. Gaining an understanding that scientists are humans who use observations and experiments to learn about space
   - 1.6. Obtaining information from informational text or other media about scientists who have made important discoveries about objects in space (e.g., Galileo Galilei, Johannes Kepler, George Ellery Hale, Jill Tarter) or the development of technologies (e.g., various telescopes and detection devices, computer modeling, and space exploration)
   - 1.7. Using informational text and other media to observe, describe and predict the visual patterns of motion of the sun (sunrise, sunset) and Moon (phases)
   - 1.8. Creating a model that will demonstrate the observable pattern of motion of the Sun or Moon. Use the engineering design process to define the problem, design, construct, evaluate, and improve the model

Catholic Identity Integration in Science
2nd Grade

Core Values of Classroom Behavior and Culture
1. Students will continue to develop an awareness of being special and unique persons created by God. 2. Students will understand that diversity is a good thing because it is part of God's plan, and no one plant, animal, or human can totally reflect God's goodness alone.
Integration of Scripture and Church Teaching
1. Students will describe the relationships, elements, underlying order, harmony, and meaning in God's creation. 2. Students will relate the liturgical calendar to scientific seasons (i.e. Spring and Easter are both associated with new life; Christmas comes shortly after the darkest days of the year and shows that Baby Jesus was the light coming back to the world). 3. Students will understand that natural processes occur according to God's timing and wisdom. 4. Students will describe God's relationship with humans and nature. 5. Students will make a connection between water taking on different forms in the water cycle, and God taking on different forms within the Blessed Trinity.
Historic Church Figures and Events
1. Students will study saints within the Church who were scientists or experts in the areas of science that they are studying.

3rd Grade

Scientific Processes

1. **Students will apply science knowledge, skills, and practices to locate, translate, infer and extend from, and evaluate data and information in scientific graphs, tables, and diagrams of varying complexity.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Selecting one piece of data from a moderately complex data presentation
   - 1.2. Finding information in text that describes a moderately complex data presentation
   - 1.3. Selecting two or more pieces of data from a moderately complex data presentation
   - 1.4. Identifying features of a moderately complex table, graph, or diagram (e.g., axis labels, units of measure)
   - 1.5. Understanding common scientific terminology, symbols, and units of measure used in a simple scientific context
   - 1.6. Translating simple information into a table, graph, or diagram
   - 1.7. Determining how the value of a variable changes as the value of another variable changes in a simple data presentation
   - 1.8. Comparing data from a simple data presentation (e.g., find the highest/lowest value; order data from a table)
   - 1.9. Combining data from a simple data presentation (e.g., sum data from a table)
   - 1.10. Performing an interpolation using data in a simple table or graph
2. **Students will apply science knowledge, skills, and practices to understand the tools, procedures and design of scientific experiments and compare, extend, and modify those experiments.**
   Students will demonstrate mastery of this standard by:
   - 2.1. Finding information in text that describes a moderately complex experiment
   - 2.2. Identifying similarities and differences between moderately complex experiments
   - 2.3. Determining which moderately complex experiments utilized a given tool, method, or aspect of design
   - 2.4. Understanding the methods, tools, and functions of tools used in a simple experiment
   - 2.5. Understanding a simple experimental design
   - 2.6. Determining the scientific question that is the basis for a simple experiment
   - 2.7. Predicting the results of an additional trial or measurement in a simple experiment

3. Students will apply science knowledge, skills, and practices to evaluate the validity of scientific information and formulate conclusions and predictions based on that information.

Students will demonstrate mastery of this standard by:

3.1. Determining which hypothesis, prediction, or conclusion is, or is not, consistent with a simple data presentation or piece of information in text

3.2. Determining which results of a simple experiment support or contradict a hypothesis, prediction, or conclusion.

Basics of Science

1. Students will review and understand basic concepts integral to science and its processes.

Students will demonstrate mastery of this standard by:

1.1. Defining and explaining the steps in the scientific method

1.2. Practicing lab safety skills when necessary

Hierarchical Organization

1. Students will demonstrate an understanding of internal and external structures in plants and animals and how they relate to their growth, survival, behavior, and reproduction within an environment.

Students will demonstrate mastery of this standard by:

1.1. Examining evidence to communicate information that the internal and external structures of animals (e.g., heart, stomach, bone, lung, brain, skin, ears, appendages) function to support survival, growth, and behavior

1.2. Examining evidence to communicate information that the internal and external structures of plants (e.g., thorns, leaves, stems, roots, or colored petals) function to support survival, growth, behavior, and reproduction

1.3. Obtaining and communicating examples of physical features or behaviors of vertebrates and invertebrates and how these characteristics help them survive in particular environments (e.g., animals hibernate, migrate, or estivate to stay alive when food is scarce, or temperatures are not favorable)

Reproduction & Heredity

1. Students will demonstrate an understanding that through reproduction, the survival and physical features of plants and animals are inherited traits from parent organisms but can also be influenced by the environment.

Students will demonstrate mastery of this standard by:

1.1. Identifying traits and describing how traits are passed from parent organism(s) to offspring in plants and animals

1.2. Describing and providing examples of plant and animal offspring from a single parent organism (e.g., bamboo, fern, or starfish) as being an exact replica with identical traits as the parent organism

1.3. Describing and providing examples of offspring from two parent organisms as containing a combination of inherited traits from both parent organisms

1.4. Obtaining and communicating data to provide evidence that plants and animals have traits inherited from both parent organisms and that variations of these traits exist in groups of similar organisms (e.g., flower colors in pea plants or fur color and pattern in animal offspring)
1.5. Researching to justify the concept that traits can be influenced by the environment (e.g., stunted growth in normally tall plants due to insufficient water, changes in an arctic fox's fur color due to light and/or temperature, or flamingo plumage

Adaptations & Diversity

1. Students will demonstrate an understanding of how adaptations allow animals to satisfy life needs and respond both physically and behaviorally to their environment.

Students will demonstrate mastery of this standard by:

1.1. Obtaining data from informational text to explain how changes in habitats (both those that occur naturally and those caused by organisms) can be beneficial or harmful to the organisms that live there
1.2. Asking questions to predict how natural or man-made changes in a habitat cause plants and animals to respond in different ways, including hibernating, migrating, responding to light, death, or extinction (e.g., sea turtles, the dodo bird, or nocturnal species)
1.3. Analyzing and interpreting data to explain how variations in characteristics among organisms of the same species may provide advantages in surviving, finding mates, and reproducing (e.g., plants with larger thorns being less likely to be eaten by predators or animals with better camouflage colorations being more likely to survive and bear offspring)
1.4. Defining and improving a solution to a problem created by environmental changes and any resulting impacts on the types of density and distribution of plant and animal populations living in the environment (e.g., replanting sea oats in coastal areas or developing or preserving wildlife corridors and green belts)
1.5. Using the engineering design process to define the problem, design, construct, evaluate, and improve the environment
1.6. Constructing scientific argument using evidence from fossils of plants and animals that lived long ago to infer the characteristics of early environments (e.g., marine fossils on dry land, tropical plant fossils in arctic areas, or fossils of extinct organisms in any environment)

Organization of Matter & Chemical Interactions

1. **Students will demonstrate an understanding of the physical properties of matter to explain why matter can change states between a solid, liquid, or gas dependent upon the addition or removal of heat.**
   Students will demonstrate mastery of this standard by:
   1.1. Planning and conducting scientific investigations to determine how changes in heat (i.e., an increase or decrease) change matter from one state to another (e.g., melting, freezing, condensing, boiling, or evaporating)
   1.2. Developing and using models to communicate the concept that matter is made of particles too small to be seen that move freely around in space (e.g., inflation and shape of a balloon, wind blowing leaves, or dust suspended in the air)
   1.3. Planning and conducting investigations that particles speed up or slow down with the addition or removal of heat

Motions, Forces, & Energy

1. **Students will demonstrate an understanding of magnets and the effects of pushes, pulls, and friction on the motion of objects.**
   Students will demonstrate mastery of this standard by:
   1.1. Comparing and contrasting the effects of different strengths and directions of forces on the motion of an object (e.g., gravity, polarity, attraction, repulsion, or strength)
   1.2. Planning an experiment to investigate the relationship between a force applied to an object (e.g., friction, gravity) and resulting motion of the object
   1.3. Researching and communicating information to explain how magnets are used in everyday life
   1.4. Defining and solving a simple design problem by applying scientific ideas about magnets (e.g., can opener, door latches, paperclip holders, finding studs in walls, magnetized paint)
   1.5. Using the engineering design process to define the problem, design, construct, evaluate, and improve the magnet

Earth's Resources

1. **Students will demonstrate an understanding that all materials, energy, and fuels that humans use are derived from natural sources.**
   Students will demonstrate mastery of this standard by:
   1.1. Identifying some of Earth's resources that are used in everyday life such as water, wind, soil, forests, oil, natural gas, and minerals and classify as renewable or nonrenewable
   1.2. Obtaining and communicating information to exemplify how humans attain, use, and protect renewable and nonrenewable Earth resources
   1.3. Using maps and historical information to identify natural resources in the state connecting (a) how resources are used for human needs and (b) how the use of those resources impacts the environment

1.4. Designing a process for cleaning a polluted environment (e.g., simulating an oil spill in the ocean or a flood in a city and creating a solution for containment and/or cleanup)
1.5. Using the engineering design process to define the problem, design, construct, evaluate, and improve the environment

Earth's Systems & Cycles

1. **Students will demonstrate an understanding of how the Earth's systems (i.e., geosphere, hydrosphere, atmosphere, and biosphere) interact in multiple ways to affect Earth's surface materials and processes.**
   Students will demonstrate mastery of this standard by:
   1.1. Developing models to communicate the characteristics of the Earth's major systems, including the geosphere, hydrosphere, atmosphere, and biosphere (e.g., digital models, illustrations, flip books, diagrams, charts, tables)
   1.2. Constructing explanations of how different landforms and surface features result from the location and movement of water on Earth's surface (e.g., watersheds, drainage basins, deltas, or rivers)
   1.3. Using graphical representations to communicate the distribution of freshwater and saltwater on Earth (e.g., oceans, lakes, rivers, glaciers, groundwater, or polar ice caps)

Earth's Structure and History

1. **Students will demonstrate an understanding of the various processes involved in the rock cycle, superposition of rock layers, and fossil formation. Students will demonstrate mastery of this standard by:**
   1.1. Planning and conducting controlled scientific investigations to identify the processes involved in forming the three major types of rock and investigating common techniques used to identify them
   1.2. Developing and using models to demonstrate the processes involved in the development of various rock formations, including superposition, and how those formations can fracture and move over time
   1.3. Asking questions to generate testable hypotheses regarding the formation and location of fossil types, including their presence in some sedimentary rock
2. **Students will demonstrate an understanding of the composition of Earth and the processes which change Earth's landforms.**
   Students will demonstrate mastery of this standard by:
   2.1. Obtaining and evaluating scientific information (e.g. using technology) to describe the four major layers of Earth and the varying compositions of each layer
   2.2. Developing and using models to describe the characteristics of Earth's continental landforms and classify landforms as volcanoes, mountains, valleys, canyons, planes, and islands

2.3. Developing and using models of weathering, erosion, and deposition processes which explain the appearance of various Earth features (e.g., the Grand Canyon, Arches National Park in Utah, Plymouth Bluff in Columbus, or Red Bluff in Marion County, Mississippi)
2.4. Comparing and contrasting constructive (e.g., deposition, volcano, and destructive, e.g., weathering, erosion, earthquake) processes of the Earth

Catholic Identity Integration in Science
3rd Grade

Core Values of Classroom Behavior and Culture
1. Students will understand that even when we are not in direct contact with another, our actions can still have an impact. 2. All parts of creation are interdependent. 3. Students will exhibit care and concern at all stages of life for each human person as an image and likeness of God. 4. Students will recognize that as Catholics, we seek out environments that support healthy physical, emotional, and spiritual growth.
Integration of Scripture and Church Teaching
1. Students will understand that birth, growth, reproduction, and death are God's design for all living things in creation. Our spiritual lives have cycles too. 2. Students will understand that the Church has cycles and seasons that help us to enter deeply into the life of Christ. 3. Students will differentiate between death on Earth and Jesus's death, understanding that the life cycle of living things on Earth ends with death, but Jesus rose from the dead, and in doing so, he made it possible for us to have life after death. 4. Students will recognize that fossils provide evidence that God created a world that continues to change over time.
Historic Church Figures and Events
1. Students will study saints within the Church who were scientists or experts in the areas of science that they are studying.

4th Grade

The Process of Science

1. **Students will apply science knowledge, skills, and practices to locate, translate, infer and extend from, and evaluate data and information in scientific graphs, tables, and diagrams of varying complexity.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Selecting one piece of data from a complex data presentation
   - 1.2. Finding information in text that describes a complex data presentation
   - 1.3. Selecting two or more pieces of data from a complex data presentation
   - 1.4. Identifying features of a complex table, graph, or diagram (e.g., axis labels, units of measure)
   - 1.5. Understanding common scientific terminology, symbols, and units of measure used in a moderately complex scientific context
   - 1.6. Translating moderately complex information into a table, graph, or diagram
   - 1.7. Determining how the value of a variable changes as the value of another variable changes in a moderately complex data presentation
   - 1.8. Comparing data from a moderately complex data presentation (e.g., finding the highest/lowest value; ordering data from a table)
   - 1.9. Combining data from a moderately complex data presentation (e.g., sum data from a table)
   - 1.10. Performing an interpolation using data in a simple table or graph
   - 1.11. Performing an extrapolation using data in a simple table or graph
   - 1.12. Analyzing presented data when given new, simple information (e.g., reinterpreting a graph when new findings are provided.)
2. **Students will apply science knowledge, skills, and practices to understand the tools procedures and design of scientific experiments and to compare, extend, and modify those experiments.**
   Students will demonstrate mastery of this standard by:
   - 2.1. Finding information in text that describes a complex experiment
   - 2.2. Identifying similarities and differences between complex experiments
   - 2.3. Determining which complex experiments utilized a given tool, method, or aspect of design
   - 2.4. Understanding the methods, tools, and functions of tools used in a moderately complex experiment
   - 2.5. Understanding a moderately complex experimental design
   - 2.6. Determining the scientific question that is the basis for a moderately complex experiment (e.g., the hypothesis)
   - 2.7. Predicting the results of an additional trial or measurement in a moderately complex experiment

2.8. Determining what conditions in a simple experiment would produce specified results

3. Students will apply science knowledge, skills, and practices to evaluate the validity of scientific information and formulate conclusions and predictions based on that information.

Students will demonstrate mastery of this standard by:

3.1. Determining which hypothesis, prediction, or conclusion is, or is not, consistent with a simple data presentation or piece of information in text

3.2. Determining which results of a moderately complex experiment support or contradict a hypothesis, prediction, or conclusion

3.3. Determining which hypothesis, prediction, or conclusion is or is not consistent with two or more simple data presentations and/or pieces of information in text.

Basics of Science

1. Students will review and understand basic concepts integral to science and its processes.

Students will demonstrate mastery of this standard by:

1.1. Defining and explaining the steps in the scientific method

1.2. Practicing lab safety skills when necessary

Literacy in Science

Standards for K–5 reading in history/social studies, science, and technical subjects are integrated into the K–5 Reading standards.

Hierarchical Organization

1. Students will demonstrate an understanding of the organization, functions, and interconnections of the major human body systems.

Students will demonstrate mastery of this standard by:

1.1. Using technology or other resources to research and discover general system functions (e.g., machines, water cycle) as they relate to human organ systems and identify organs that work together to create organ systems

1.2. Obtaining and communicating data to describe patterns that indicate the nature of relationships between human organ systems, which interact with one another to control digestion, respiration, circulation, excretion, movement, coordination, and protection from infection

1.3. Constructing models of organ systems (e.g. circulatory, digestive, respiratory, muscular, skeletal, nervous) to demonstrate both the unique function of the system and how multiple organs and organ systems work together to accomplish more complex functions

1.4. Researching and communicating how noninfectious diseases (e.g. diabetes, heart disease) and infectious diseases (e.g. cold, flu) serve to disrupt the function of the body system

1.5. Using informational text, investigating how scientific fields, medical specialties, and research methods help us find new ways to maintain a healthy body and lifestyle (e.g. diet, exercise, vaccines, and mental health)

Reproduction & Heredity

1. **Students will demonstrate an understanding of life cycles, including familiar plants and animals (e.g., reptiles, amphibians, or birds).**
   Students will demonstrate mastery of this standard by:
   1.1. Comparing and contrasting life cycles of familiar plants and animals
   1.2. Developing and using models to explain the unique and diverse life cycles of organisms other than humans (e.g., flowering plants, frogs, or butterflies) including commonalities (e.g., birth, growth, reproduction, or death)

Motions, Forces, & Energy

1. **Students will demonstrate an understanding of the common sources and uses of heat and electric energy and the materials used to transfer heat and electricity.**
   Students will demonstrate mastery of this standard by:
   1.1. Obtaining and communicating information to compare how different processes (including burning, friction, and electricity) serve as sources of heat energy
   1.2. Planning and conducting scientific investigations to classify different materials as either an insulator or conductor of electricity
   1.3. Developing models demonstrating how heat and electrical energy can be transformed into other forms of energy (e.g., motion, sound, heat, or light)
   1.4. Developing models that demonstrate the path of an electric current in a complete, simple circuit (e.g., lighting a light bulb or making a sound)
   1.5. Using informational text and technology resources to communicate technological breakthroughs made by historical figures in electricity (e.g. Alessandro Volta, Michael Faraday, Nicola Tesla, Thomas Edison, incandescent light bulbs, batteries, Light Emitting Diodes)
   1.6. Designing a device that converts any form of energy from one form to another form (e.g. constructing a musical instrument that will convert vibrations to sound by controlling varying pitches, a solar oven that will convert energy from the sun to heat energy, or a simple circuit that can be used to complete a task)
   1.7. Using the engineering design process to define the problem, design, construct, evaluate, and improve the device
2. **Students will demonstrate an understanding of the properties of light as forms of energy.**
   Students will demonstrate mastery of this standard by:
   2.1. Constructing scientific evidence to support the claim that white light is made up of different colors, including the work of Sir Isaac Newton to communicate results

2.2. Obtaining and communicating information to explain how the visibility of an object is related to light
2.3. Developing and using models to communicate how light travels and behaves when it strikes an object, including reflection, refraction, and absorption
2.4. Planning and conducting scientific investigations to explain how light behaves when it strikes transparent, translucent, and opaque materials

3. Students will demonstrate an understanding of the properties of sound as a form of energy.

Students will demonstrate mastery of this standard by:

3.1. Planning and conducting scientific investigations to test how different variables affect the properties of sound (i.e., pitch and volume)
3.2. In relation to how sound is perceived by humans, analyzing and interpreting data from observations and measurements to report how changes in vibration affect the pitch and volume of sound
3.3. Obtaining and communicating information about scientists who pioneered in the science of sound, (e.g., Alexander Graham Bell, Robert Boyle, Daniel Bernoulli, and Guglielmo Marconi)

Earth's Resources

1. Students will demonstrate an understanding of the various sources of energy used for human needs along with their effectiveness and possible impacts.

Students will demonstrate mastery of this standard by:

1.1. Organizing simple data sets to compare energy and pollution output of various traditional, non-renewable resources (e.g. coal, crude oil, wood)
1.2. Using technology or informational text to investigate, evaluate, and communicate various forms of clean energy generation

Earth's Systems & Cycles

1. Students will demonstrate an understanding of how the water cycle is propelled by the sun's energy.

Students will demonstrate mastery of this standard by:

1.1. Developing and using models to explain how the sun's energy drives the water cycle. (e.g., evaporation, condensation, precipitation, transpiration, runoff, and groundwater)

2. Students will demonstrate an understanding of weather and climate patterns.

Students will demonstrate mastery of this standard by:

2.1. Analyzing and interpreting data (e.g., temperature, precipitation, wind speed/direction, relative humidity, or cloud types) to predict changes in weather over time
2.2. Constructing explanations about regional climate differences using maps and long-term data from various regions
2.3. Designing weather instruments utilized to measure weather conditions (e.g., barometer, hygrometer, rain gauge, anemometer, or wind vane)

2.4. Using the engineering design process to define the problem, design, construct, evaluate, and improve the weather instrument

3. Students will demonstrate an understanding of how natural processes and human activities affect the features of Earth's landforms and oceans. Students will demonstrate mastery of this standard by:

3.1. Analyzing and interpreting data to describe and predict how natural processes (e.g., weathering, erosion, deposition, earthquakes, tsunamis, hurricanes, or storms) affect Earth's surface

3.2. Developing and using models of natural processes to explain the effect of the movement of water on the ocean shore zone, including beaches, barrier islands, estuaries, and inlets (e.g., marshes, bays, lagoons, fjord, or sound)

3.3. Constructing scientific arguments from evidence to support claims that human activities, such as conservation efforts or pollution, affect the land, oceans, and atmosphere of Earth

3.4. Researching and explaining how systems (i.e., the atmosphere, geosphere, and/or hydrosphere), interact and support life in the biosphere

3.5. Obtaining and communicating information about severe weather phenomena (e.g., thunderstorms, hurricanes, or tornadoes) to explain steps humans can take to reduce the impact of severe weather events

Catholic Identity Integration in Science
4th Grade

Core Values of Classroom Behavior and Culture
1. Students will make connections between energy transfers and our relationships with others (When we "collide with others are we spreading positive energy, like God's message?) 2. Students will treat one another and adults with respect, recognizing that we are all created by God in His image.
Integration of Scripture and Church Teaching
1. Students will make the connection that the sacraments are outward signs, instituted by Christ, to give grace. They indicate the energy of God's love and presence in our lives, just as light, sound, heat and motion indicate energy transfers. 2. Students will recognize that just as energy moves through a wave, the movements of the Holy Spirit move through the Church and through us. They can be set in motion through reading the Scriptures, prayer, reflection, teachers and ministers of the Church, Mass, the sacraments, sacramentals, and each other.
Historic Church Figures and Events
1. Students will study saints within the Church who were scientists or experts in the areas of science that they are studying.

5th Grade

The Process of Science

1. **Students will apply science knowledge, skills, and practices to locate, translate, infer and extend from, and evaluate data and information in scientific graphs, tables, and diagrams of varying complexity.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Selecting one piece of data from a complex data presentation.
   - 1.2. Finding information in text that describes a complex data presentation
   - 1.3. Selecting two or more pieces of data from a complex data presentation
   - 1.4. Identifying features of a complex table, graph, or diagram (e.g., axis labels, units of measure)
   - 1.5. Understanding common scientific terminology, symbols, and units of measure used in a moderately complex scientific context
   - 1.6. Translating moderately complex information into a table, graph, or diagram
   - 1.7. Determining how the value of a variable changes as the value of another variable changes in a moderately complex data presentation
   - 1.8. Comparing data from a moderately complex data presentation (e.g., finding the highest/lowest value; ordering data from a table)
   - 1.9. Combining data from a moderately complex data presentation (e.g., sum data from a table)
   - 1.10. Comparing data from two or more simple data presentations (e.g. comparing a value in a table to a value in a graph)
   - 1.11. Combining data from two or more simple data presentations (e.g., categorizing data from a table using a scale from another table)
   - 1.12. Performing an interpolation using data in a moderately complex table or graph
   - 1.13. Performing an extrapolation using data in a simple table or graph
   - 1.14. Analyzing presented data when given new, simple information (e.g. reinterpreting a graph when new findings are provided)
2. **Students will apply science knowledge, skills, and practices to understand the tools procedures and design of scientific experiments and to compare, extend, and modify those experiments.**
   Students will demonstrate mastery of this standard by:
   - 2.1. Finding information in text that describes a complex experiment
   - 2.2. Identifying similarities and differences between complex experiments
   - 2.3. Determining which complex experiments utilized a given tool, method, or aspect of design
   - 2.4. Understanding the methods, tools, and functions of tools used in a moderately complex experiment
   - 2.5. Understanding a moderately complex experimental design

2.6. Determining the scientific question that is the basis for a moderately complex experiment (e.g., the hypothesis)
2.7. Evaluating the design or methods of a simple experiment (e.g., possible flaws or inconsistencies; precision and accuracy issues)
2.8. Predicting the results of an additional trial or measurement in a moderately complex experiment
2.9. Determining what conditions in a simple experiment would produce specified results

3. Students will apply science knowledge, skills, and practices to evaluate the validity of scientific information and formulate conclusions and predictions based on that information.
Students will demonstrate mastery of this standard by:
3.1. Determining which hypothesis, prediction, or conclusion is, or is not, consistent with a moderately complex data presentation or piece of information in text
3.2. Determining which results of a moderately complex experiment support or contradict a hypothesis, prediction, or conclusion
3.3. Determining which hypothesis, prediction, or conclusion is, or is not, consistent with two or more simple data presentations and/or pieces of information in text

Basics of Science

1. Students will review and understand basic concepts integral to science and its processes.
Students will demonstrate mastery of this standard by:
1.1. Defining and explaining the steps in the scientific method
1.2. Practicing lab safety skills when necessary

Literacy in Science

Standards for K–5 reading in history/social studies, science, and technical subjects are integrated into the K–5 Reading standards.

Ecology & Interdependence

1. Students will demonstrate an understanding of photosynthesis and the transfer of energy from the sun into chemical energy necessary for plant growth and survival.
Students will demonstrate mastery of this standard by:
1.1. Researching and communicating the basic process of photosynthesis that is used by plants to convert light energy into chemical energy that can be stored and released to fuel an organism's activities
1.2. Analyzing environments that do not receive direct sunlight and devise explanations as to how photosynthesis occurs, either naturally or artificially

2. Students will demonstrate an understanding of a healthy ecosystem with a stable web of life and the roles of living things within a food chain and/or food web, including producers, primary and secondary consumers, and decomposers.

Students will demonstrate mastery of this standard by:

2.1. Obtaining and evaluating scientific information regarding the characteristics of different ecosystems and the organisms they support (e.g., salt and fresh water, deserts, grasslands, forests, rain forests, or polar tundra lands)

2.2. Developing and using a food chain model to classify organisms as producers, consumers, or decomposers and tracing the energy flow to explain how each group of organisms obtains energy

2.3. Designing and interpreting models of food webs to justify what effects the removal or the addition of a species (i.e., introduced or invasive) would have on a specific population and/or the ecosystem as a whole

2.4. Communicating scientific or technical information that explains human positions in food webs and our potential impacts on these systems

Organization of Matter & Chemical Interactions

1. Students will demonstrate an understanding of the physical properties of matter.

Students will demonstrate mastery of this standard by:

1.1. Obtaining and evaluating scientific information to describe basic physical properties of atoms and molecules

1.2. Collecting, analyzing, and interpreting data from measurements of the physical properties of solids, liquids, and gases (e.g., volume, shape, movement, and spacing of particles)

1.3. Analyzing matter through observations and measurements to classify materials (e.g., powders, metals, minerals, or liquids) based on their properties (e.g., color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, solubility, or density)

1.4. Making and testing predictions about how the density of an object affects whether the object sinks or floats when placed in a liquid

1.5. Designing a vessel that can safely transport a dense substance (e.g., syrup, coins, marbles) through water at various distances and under variable conditions and using an engineering design process to define the problem, design, construct, evaluate, and improve the vessel

2. Students will demonstrate an understanding of mixtures and solutions.

Students will demonstrate mastery of this standard by:

2.1. Obtaining and evaluating scientific information to describe what happens to the properties of substances in mixtures and solutions

2.2. Analyzing and interpreting data to communicate that the concentration of a solution is determined by the relative amount of solute versus solvent in various mixtures

2.3. Investigating how different variables (e.g., temperature change, stirring, particle size, or surface area) affect the rate at which a solute will dissolve
2.4. Designing an effective system (e.g., sifting, filtration, evaporation, magnetic attraction, or floatation) for separating various mixtures
2.5. Using the engineering design process to define the problem, design, construct, evaluate, and improve the system

3. Students will demonstrate an understanding of the difference between physical and chemical changes.
Students will demonstrate mastery of this standard by:
3.1. Analyzing and communicating the results of chemical changes that result in the formation of new materials (e.g., decaying, burning, rusting, or cooking)
3.2. Analyzing and communicating the results of physical changes to a substance that results in a reversible change (e.g., changes in states of matter with the addition or removal of energy, changes in size or shape, or combining/separating mixtures or solutions)
3.3. Analyzing and interpreting data to support claims that when two substances are mixed, the total weight of matter is conserved

Motions, Forces, & Energy

1. Students will demonstrate an understanding of the factors that affect the motion of an object through a study of Newton's Laws of Motion.
Students will demonstrate mastery of this standard by:
1.1. Obtaining and communicating information describing gravity's effect on an object
1.2. Predicting the future motion of various objects based on past observation and measurement of position, direction, and speed
1.3. Developing and using models to explain how the amount or type of force, both contact and non-contact, affects the motion of an object
1.4. Planning and conducting scientific investigations to test the effects of balanced and unbalanced forces on the speed and/or direction of objects in motion
1.5. Predicting how a change of force, mass, and/or friction affects the motion of an object to convert potential energy into kinetic energy
1.6. Designing a system to increase the effects of friction on the motion of an object (e.g., non-slip surfaces or vehicle braking systems or flaps on aircraft wings)
1.7. Using the engineering design process to define the problem, design, construct, evaluate, and improve the system

Earth & the Universe

1. **Students will demonstrate an understanding of the locations of objects in the universe.**
   Students will demonstrate mastery of this standard by:
   1.1. Developing and using scaled models of Earth's solar system to demonstrate the size, composition (i.e., rock or gas), location, and order of the planets as they orbit the Sun
   1.2. Using evidence to argue why the sun appears brighter than other stars
   1.3. Describing how constellations appear to move from Earth's perspective throughout the seasons (e.g., Ursa Major, Ursa Minor, and Orion)
   1.4. Constructing scientific arguments to support claims about the importance of astronomy in navigation and exploration, including the use of telescopes, compasses, and star charts
2. **Students will demonstrate an understanding of the principles that govern moon phases, day and night, appearance of objects in the sky, and seasonal changes.**
   Students will demonstrate mastery of this standard by:
   2.1. Analyzing and interpreting data from observations and research (e.g., from NASA, NOAA, or the USGS) to explain patterns in the location, movement, and appearance of the moon throughout a month and over the course of a year
   2.2. Developing and using a model of the Earth-Sun-Moon system to analyze the cyclic patterns of lunar phases, solar and lunar eclipses, and seasons
   2.3. Developing and using models to explain the factors (e.g., tilt, revolution, and angle of sunlight) that result in Earth's seasonal changes
   2.4. Obtaining information and analyzing how our understanding of the solar system has evolved over time (e.g., Earth-centered model of Aristotle and Ptolemy compared to the Sun-centered model of Copernicus and Galileo)

Earth's Resources

1. **Students will demonstrate an understanding of the effects of human interaction with Earth and how Earth's natural resources can be protected and conserved.**
   Students will demonstrate mastery of this standard by:
   1.1. Collecting and organizing scientific ideas that individuals and communities can use to conserve Earth's natural resources and systems (e.g., implementing watershed management practices to conserve water resources, utilizing no-till farming to improve soil fertility, reducing emissions to abate air pollution, or recycling to reduce landfill waste)

1.2. Designing a process for better preparing communities to withstand manmade or natural disasters (e.g., removing oil from water or soil, systems that reduce the impact of floods, structures that resist hurricane forces)
1.3. Using the engineering design process to define the problem, design, construct, evaluate, and improve the disaster plan

Catholic Identity Integration in Science
5th Grade

Core Values of Classroom Behavior and Culture
1. Students will respect one another and adults recognizing that every individual is created by God in His image.
Integration of Scripture and Church Teaching
1. Students will make a connection between their study of gravity and their spiritual lives, recognizing that God pulls us toward Himself. God is the center of gravity of our spiritual lives. We are drawn together as we are pulled collectively toward God. Scripture, tradition, Church, and sacraments pull us toward God. 2. Students will make a connection between their study of life cycles and ecosystems and their spiritual lives recognizing that just as the Sun is the source of energy and nourishment for animals and humans, God is the source of energy and nourishment for the people of God. We receive this food through the Eucharist. Just as Jesus is blessed, broken and given to us, so too are we called to be blessed, broken and given to one another in the service of Christ (Henri Nouwen, *Life of the Beloved*, 2002)
Historic Church Figures and Events
1. Students will study saints within the Church who were scientists or experts in the areas of science that they are studying.

6th Grade

The Process of Science

1. **Students will apply science knowledge, skills, and practices to locate, translate, infer and extend from, and evaluate data and information in scientific graphs, tables, and diagrams of varying complexity.**
   Students will demonstrate mastery of this standard by:
   1.1. Selecting one piece of data from a complex data presentation
   1.2. Finding information in text that describes a complex data presentation
   1.3. Selecting two or more pieces of data from a moderately complex data presentation
   1.4. Identifying features of a moderately complex table, graph, or diagram (e.g., axis labels, units of measure)
   1.5. Understanding common scientific terminology, symbols, and units of measure used in a simple scientific context
   1.6. Translating simple information into a table, graph, or diagram.
   1.7. Determining how the value of a variable changes as the value of another variable changes in a simple data presentation
   1.8. Comparing data from a simple data presentation (e.g., find the highest/lowest value; order data from a table)
   1.9. Combining data from a simple data presentation (e.g., sum data from a table)
   1.10. Performing an interpolation using data in a simple table or graph
2. **Students will apply science knowledge, skills, and practices to understand the tools procedures and design of scientific experiments and to compare, extend, and modify those experiments.**
   Students will demonstrate mastery of this standard by:
   2.1. Finding information in text that describes a complex experiment
   2.2. Identifying similarities and differences between moderately complex experiments
   2.3. Determining which moderately complex experiments utilized a given tool, method, or aspect of design
   2.4. Understanding the methods, tools, and functions of tools used in a simple experiment
   2.5. Understanding a simple experimental design
   2.6. Determining the scientific question that is the basis for a simple experiment (e.g., the hypothesis)
   2.7. Predicting the results of an additional trial or measurement in a simple experiment

3. **Students will apply science knowledge, skills, and practices to evaluate the validity of scientific information and formulate conclusions and predictions based on that information.**

Students will demonstrate mastery of this standard by:

3.1. Determining which hypothesis, prediction, or conclusion is, or is not, consistent with a simple data presentation or piece of information in text

3.1. Determining which results of a simple experiment support or contradict a hypothesis, prediction, or conclusion

3.2. Finding information in a complex theoretical model (a viewpoint proposed to explain scientific observations)

3.3. Identifying implications and assumptions in a moderately complex theoretical model

3.4. Determining which moderately complex theoretical model's presenter imply certain information

3.5. Identifying similarities and differences between simple theoretical models

3.6. Determining which hypothesis, prediction, or conclusion is, or is not, consistent with a simple theoretical model

Basics of Science

1. **Students will review and understand basic concepts integral to science and its processes.**

Students will demonstrate mastery of this standard by:

1.1. Defining and explaining the steps in the scientific method

1.2. Practicing lab safety skills when necessary

Hierarchical Organization

1. **Students will demonstrate an understanding that living things range from simple to complex organisms, are organized hierarchically, and function as whole living systems.**

Students will demonstrate mastery of this standard by:

1.1. Using argument supported by evidence in order to distinguish between living and non-living things, including viruses and bacteria

1.2. Obtaining and communicating evidence to support the cell theory

1.3. Developing and using models to explain how specific cellular components (cell wall, cell membrane, nucleus, chloroplast, vacuole, and mitochondria) function together to support the life of prokaryotic and eukaryotic organisms to include plants, animals, fungi, protists, and bacteria (not to include biochemical function of cells or cell part)

1.4. Comparing and contrasting different cells in order to classify them as a protist, fungus, plant, or animal

1.5. Providing evidence that organisms are unicellular or multicellular

1.6. Developing and using models to show relationships among the increasing complexity of multicellular organisms (cells, tissues, organs, organ systems, organisms) and how they serve the needs of the organism

Ecology & Interdependence

1. **Students will demonstrate an understanding of the relationships among survival, environmental changes, and diversity as they relate to the interactions of organisms, populations, and the environment.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Using scientific reasoning to explain differences between biotic and abiotic factors that demonstrate what living organisms need to survive
   - 1.2. Developing and using models to describe the levels of organization within ecosystems (species, populations, communities, ecosystems, and biomes)
   - 1.3. Analyzing cause and effect relationships to explore how changes in the physical environment (limiting factors, natural disasters) can lead to population changes within an ecosystem
   - 1.4. Investigating organism interactions in a competitive or mutually beneficial relationship (predation, competition, cooperation, or symbiotic relationships)
   - 1.5. Developing and using food chains, webs, and pyramids to analyze how energy is transferred through an ecosystem from producers (autotrophs) to consumers (heterotrophs, including humans) to decomposers
   - 1.6. Using prior knowledge to explain how traits are passed along for survival of the species

Adaptations & Diversity

1. **Students will demonstrate an understanding of classification tools and models such as dichotomous keys to classify representative organisms based on the characteristics of the kingdoms: Archaebacteria, Eubacteria, Protists, Fungi, Plants, and Animals.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Comparing and contrasting modern classification techniques (e.g., analyzing genetic material) to the historical practices used by scientists such as Aristotle and Carolus Linnaeus
   - 1.2. Using classification methods to explore the diversity of organisms in kingdoms (animals, plants, fungi, protists, bacteria) and supporting claims that organisms have shared structural and behavioral characteristics
   - 1.3. Analyzing and interpreting data from observations to describe how fungi obtain energy and respond to stimuli (e.g., bread mold, rotting plant material)
   - 1.4. Conducting investigations using a microscope or multimedia source to compare the characteristics of protists (euglena, paramecium, amoeba) and the methods they use to obtain energy and move through their environment (e.g., pond water)
   - 1.5. Engaging in scientific arguments to support claims that bacteria (Archaebacteria and Eubacteria) and viruses can be both helpful and harmful to other organisms and the environment

Motions, Forces, & Energy

1. **Students will demonstrate an understanding of Newton's laws of motion using real world models and examples.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Using the engineering design process to create or improve safety devices (e.g., seat belts, car seats, helmets) by applying Newton's Laws of motion. Use an engineering design process to define the problem, design, construct, evaluate, and improve the safety device
   - 1.2. Using mathematical computation and diagrams to calculate the sum of forces acting on various objects
   - 1.3. Investigating and communicating ways to manipulate applied/frictional forces to improve movement of objects on various surfaces (e.g., athletic shoes, wheels on cars)
   - 1.4. Comparing and contrasting magnetic, electric, frictional, and gravitational forces
   - 1.5. Conducting investigations to predict and explain the motion of an object according to its position, direction, speed, and acceleration
   - 1.6. Investigating forces (gravity, friction, drag, lift, thrust) acting on objects (e.g., airplane, bicycle helmets). Use data to explain the differences between the forces in various environments
   - 1.7. Determining the relationships between the concepts of potential, kinetic, and thermal energy

Earth & the Universe

1. **Students will demonstrate an understanding of Earth's place in the universe and the interactions of the solar system (sun, planets, their moons, comets, and asteroids) using evidence from multiple scientific resources to explain how these objects are held in orbit around the Sun because of its gravitational pull.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Obtaining, evaluating, and summarizing past and present theories and evidence to explain the formation and composition of the universe
   - 1.2. Using graphical displays or models to explain the hierarchical structure (stars, galaxies, galactic clusters) of the universe
   - 1.3. Evaluating modern techniques used to explore our solar system's position in the universe
   - 1.4. Obtaining and evaluating information to model and compare the characteristics and movements of objects in the solar system (including planets, moons, asteroids, comets, and meteors)
   - 1.5. Constructing explanations for how gravity affects the motion of objects in the solar system and tides on Earth
   - 1.6. Designing models representing motions within the Sun-Earth-Moon system to explain phenomena observed from the Earth's surface (positions of celestial bodies, day and year, moon phases, solar and lunar eclipses, and tides)

1.7. Analyzing and interpreting data from the surface features of the Sun (e.g., photosphere, corona, sunspots, prominences, and solar flares) to predict how these features may affect Earth

Catholic Identity Integration in Science
6th Grade

Core Values of Classroom Behavior and Culture
1. Students will treat one another and adults with respect, recognizing that each individual is created by God in His image.
Integration of Scripture and Church Teaching
1. Students will make a connection between their study of gravity and their spiritual lives, recognizing that God pulls us toward Himself. God is the center of gravity of our spiritual lives. We are drawn together as we are pulled collectively toward God. Scripture, tradition, Church, and sacraments pull us toward God. 2. Students will make a connection between their study of life cycles and ecosystems and their spiritual lives recognizing that just as the Sun is the source of energy and nourishment for animals and humans, God is the source of energy and nourishment for the people of God. We receive this food through the Eucharist. Just as Jesus is blessed, broken and given to us, so too are we called to be blessed, broken and given to one another in the service of Christ (Henri Nouwen, *Life of the Beloved*, 2002)
Historic Church Figures and Events
1. Students will study saints within the Church who were scientists or experts in the areas of science that they are studying.

7th Grade

The Process of Science

1. **Students will apply science knowledge, skills, and practices to locate, translate, infer and extend from, and evaluate data and information in scientific graphs, tables, and diagrams of varying complexity.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Selecting two or more pieces of data from a complex data presentation
   - 1.2. Identifying features of a complex table, graph, or diagram (e.g., axis labels, units of measure)
   - 1.3. Understanding common scientific terminology, symbols, and units of measure used in a moderately complex scientific context
   - 1.4. Translating moderately complex information into a table, graph, or diagram
   - 1.5. Determining how the value of a variable changes as the value of another variable changes in a moderately complex data presentation
   - 1.6. Comparing data from a moderately complex data presentation (e.g., finding the highest/lowest value; ordering data from a table)
   - 1.7. Combining data from a moderately complex data presentation (e.g., sum data from a table)
   - 1.8. Determining and or using a mathematical relationship that exists between simple data (e.g., averaging data, unit conversions)
   - 1.9. Performing an interpolation using data in a simple table or graph
   - 1.10. Performing an extrapolation using data in a simple table or graph
   - 1.11. Analyzing presented data when given new, simple information (e.g., reinterpreting a graph when new findings are provided.)
2. **Students will apply science knowledge, skills, and practices to understand the tools procedures and design of scientific experiments and to compare, extend, and modify those experiments.**
   Students will demonstrate mastery of this standard by:
   - 2.1. Finding information in text that describes a complex experiment
   - 2.2. Identifying similarities and differences between complex experiments
   - 2.3. Determining which complex experiments utilized a given tool, method, or aspect of design
   - 2.4. Understanding the methods, tools, and functions of tools used in a moderately complex experiment
   - 2.5. Understanding a moderately complex experimental design
   - 2.6. Determining the scientific question that is the basis for a moderately complex experiment (e.g., the hypothesis)
   - 2.7. Predicting the results of an additional trial or measurement in a moderately complex experiment

2.8. Determining what conditions in a simple experiment would produce specified results

3. Students will apply science knowledge, skills, and practices to evaluate the validity of scientific information and formulate conclusions and predictions based on that information.

Students will demonstrate mastery of this standard by:

3.1. Determining which hypothesis, prediction, or conclusion is, or is not, consistent with a simple data presentation or piece of information in text
3.2. Determining which results of a moderately complex experiment support or contradict a hypothesis, prediction, or conclusion
3.3. Determining which hypothesis, prediction, or conclusion is or is not consistent with two or more simple data presentations and/or pieces of information in text
3.4. Identifying implications and assumptions in a complex theoretical model
3.5. Determining which complex theoretical models present or imply certain information
3.6. Identifying similarities and differences between moderately complex theoretical models
3.7. Determining which hypothesis, prediction, or conclusion is, or is not, consistent with a moderately complex theoretical model
3.8. Determining which hypothesis, prediction, or conclusion is, or is not, consistent with two or more simple theoretical models
3.9. Identifying the strengths and weaknesses of simple theoretical models.
3.10. Determining which simple theoretical models are supported or weakened by new information
3.11. Determining which simple theoretical models support or contradict a hypothesis, prediction, or conclusion

Ecology & Interdependence

1. Students will demonstrate an understanding of the importance that matter cycles between living and nonliving parts of the ecosystem to sustain life on Earth.

Students will demonstrate mastery of this standard by:

1.1. Analyzing diagrams to provide evidence of the importance of the cycling of water, oxygen, carbon, and nitrogen through ecosystems to organisms
1.2. Using models to describe how food molecules (carbohydrates, lipids, proteins) are processed through chemical reactions using oxygen (aerobic) to form new molecules
1.3. Analyzing and interpreting data to explain how the processes of photosynthesis and cellular respiration (aerobic and anaerobic) work together to meet the needs of plants and animals

1.4. Explaining how disruptions in cycles (e.g., water, oxygen, carbon, and nitrogen) affect biodiversity and ecosystem services (e.g., water, food, and medications) which are needed to sustain human life on Earth
1.5. Designing solutions for sustaining the health of ecosystems to maintain biodiversity and the resources needed by humans for survival (e.g., water purification, nutrient recycling, prevention of soil erosion, and prevention or management of invasive species)

Organization of Matter & Chemical Interactions

1. **Students will demonstrate an understanding of the physical and chemical properties of matter.**
   Students will demonstrate mastery of this standard by:
   1.1. Collecting and evaluating qualitative data to describe substances using physical properties (state, boiling/melting point, density, heat/electrical conductivity, color, and magnetic properties)
   1.2. Analyzing and interpreting qualitative data to describe substances using chemical properties (the ability to burn or rust)
   1.3. Comparing and contrasting chemical and physical properties (e.g., combustion, oxidation, pH, solubility, reaction with water)
2. **Students will demonstrate an understanding about the effects of temperature and pressure on physical state, molecular motion, and molecular interaction.**
   Students will demonstrate mastery of this standard by:
   2.1. Making predictions about the effect of temperature and pressure on the relative motion of atoms and molecules (speed, expansion, and condensation) relative to recent breakthroughs in polymer and materials science (e.g. self-healing protective films, silicone computer processors, pervious/porous concrete)
   2.2. Using evidence from multiple scientific investigations to communicate the relationships between pressure, volume, density, and temperature of a gas
   2.3. Asking questions to explain how density of matter (observable in various objects) is affected by a change in heat and/or pressure
3. **Students will demonstrate an understanding of the proper use of the periodic table to predict and identify elemental properties and how elements interact.**
   Students will demonstrate mastery of this standard by:
   3.1. Developing and using models that explain the structure of an atom
   3.2. Using informational text to sequence the major discoveries leading to the current atomic model
   3.3. Collecting, organizing, and interpreting data from investigations to identify and analyze the relationships between the physical and chemical properties of elements, atoms, molecules, compounds, solutions, and mixtures
   3.4. Predicting the properties and interactions of elements using the periodic table (metals, non-metals, reactivity, and conductors)

3.5. Describing concepts used to construct chemical formulas (e.g. CH4, H20) to determine the number of atoms in a chemical formula
3.6. Using the periodic table to make predictions to explain how bonds (ionic and covalent) form between groups of elements (e.g., oxygen gas, ozone, water, table salt, and methane)

4. Students will demonstrate an understanding of chemical formulas and common chemical substances to predict the types of reactions and possible outcomes of the reaction.
Students will demonstrate mastery of this standard by:
4.1. Analyzing evidence from scientific investigations to predict likely outcomes of chemical reactions
4.2. Designing and conducting scientific investigations to support evidence that chemical reactions (e.g., cooking, combustion, rusting, decomposition, photosynthesis, and cellular respiration) have occurred
4.3. Collecting, organizing, and analyzing data using various tools (e.g., litmus paper, pH paper, cabbage juice) regarding neutralization of acids and bases using common substances
4.4. Building a model to explain that chemical reactions can store (formation of bonds) or release energy (breaking of bonds)

5. Students will demonstrate understanding of the law of conservation of mass.
Students will demonstrate mastery of this standard by:
5.1. Conducting simple scientific investigations to show that total mass is not altered during a chemical reaction in a closed system and comparing results of investigations to Antoine-Laurent Lavoisier's discovery of the law of conservation of mass
5.2. Analyzing data from investigations to explain why the total mass of the product in an open system appears to be less than the mass of reactants
5.3. Comparing and contrasting balanced and unbalanced chemical equations to demonstrate the number of atoms does not change in the reaction

Earth's Systems & Cycles

6. Students will demonstrate an understanding of how complex changes in the movement and patterns of air and water molecules caused by the sun, winds, landforms, ocean temperatures, and currents in the atmosphere are major determinants of local and global weather patterns.
Students will demonstrate mastery of this standard by:
6.1. Analyzing and interpreting weather patterns from various regions to differentiate between weather and climate
6.2. Analyzing evidence to explain the weather conditions that result from the relationship between the movement of water and air masses
6.3. Interpreting atmospheric data from satellites, radar, and weather maps to predict weather patterns and conditions

6.4. Constructing an explanation for how climate is determined in an area using global and surface features (e.g. latitude, elevation, shape of the land, distance from water, global winds and ocean currents)
6.5. Analyzing models to explain the cause and effect relationship between solar energy and convection and the resulting weather patterns and climate conditions
6.6. Researching and using models to explain what type of weather (thunderstorms, hurricanes, and tornadoes) results from the movement and interactions of air masses, high- and low-pressure systems, and frontal boundaries
6.7. Interpreting topographic maps to predict how local and regional geography affect weather patterns and make them difficult to predict

7. Students will demonstrate an understanding of the relationship between natural phenomena, human activity, and global climate change.
Students will demonstrate mastery of this standard by:
7.1. Reading and evaluating scientific or technical information assessing the evidence and bias of each source to explain the causes and effects of climate change
7.2. Interpreting data about the relationship between the release of carbon dioxide from burning fossil fuels into the atmosphere and the presence of greenhouse gases
7.3. Engaging in scientific argument based on current evidence to determine whether climate change happens naturally or is being accelerated through the influence of man

8. Students will demonstrate an understanding that the seasons are the direct result of the Earth's tilt and the intensity of sunlight on the Earth's hemispheres.
Students will demonstrate mastery of this standard by:
8.1. Constructing models and diagrams to illustrate how the tilt of Earth's axis results in differences in intensity of sunlight on the Earth's hemispheres throughout the course of one full revolution around the Sun
8.2. Investigating how variations of sunlight intensity experienced by each hemisphere (to include the equator and poles) create the four seasons

Catholic Identity Integration in Science
7th Grade

Core Values of Classroom Behavior and Culture
1. Students will treat one another and adults with respect while recognizing that each individual is created by God in His image.
Integration of Scripture and Church Teaching
1. Students will make a connection between their study of gravity and their spiritual lives, recognizing that God pulls us toward Himself. God is the center of gravity of our spiritual lives. We are drawn together as we are pulled collectively toward God. Scripture, tradition, Church, and sacraments pull us toward God. 2. Students will make a connection between their study of life cycles and ecosystems and their spiritual lives recognizing that just as the Sun is the source of energy and nourishment for animals and humans, God is the source of energy and nourishment for the people of God. We receive this food through the Eucharist. Just as Jesus is blessed, broken and given to us, so too are we called to be blessed, broken and given to one another in the service of Christ (Henri Nouwen, *Life of the Beloved*, 2002)
Historic Church Figures and Events
1. Students will study saints within the Church who were scientists or experts in the areas of science that they are studying.

8th Grade

The Process of Science

1. **Students will apply science knowledge, skills, and practices to locate, translate, infer and extend from, and evaluate data and information in scientific graphs, tables, and diagrams of varying complexity.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Understanding common scientific terminology, symbols, and units of measure used in a complex scientific context
   - 1.2. Translating complex information into a table, graph, or diagram
   - 1.3. Determining how the value of a variable changes as the value of another variable changes in a moderately complex data presentation
   - 1.4. Comparing data from a complex data presentation (e.g., finding the highest/lowest value; ordering data from a table)
   - 1.5. Combining data from a complex data presentation (e.g., sum data from a table)
   - 1.6. Combining data from two or more moderately complex data presentations (e.g., categorize data from a table using a scale from another table)
   - 1.7. Determining and/or using a mathematical relationship that exists between moderately complex data (e.g., averaging data, unit conversions)
   - 1.8. Performing an interpolation using data in a simple table or graph
   - 1.9. Performing an extrapolation using data in a simple table or graph
   - 1.10. Analyzing presented data when given new, simple information (e.g., reinterpreting a graph when new findings are provided)
2. **Students will apply science knowledge, skills, and practices to understand the tools procedures and design of scientific experiments and to compare, extend, and modify those experiments.**
   Students will demonstrate mastery of this standard by:
   - 2.1. Understanding the methods, tools, and functions of tools used in a moderately complex experiment
   - 2.2. Understanding a complex experimental design
   - 2.3. Determining the scientific question that is the basis for a complex experiment (e.g., the hypothesis)
   - 2.4. Evaluating designs or methods of a moderately complex experiment (e.g., possible flaws or inconsistencies, precision and accuracy issues)
   - 2.5. Predicting the results of an additional trial or measurement in a complex experiment
   - 2.6. Determining what conditions in a moderately complex experiment would produce specified results
   - 2.7. Determining an alternate method for testing the scientific question that is the basis for a simple experiment

2.8. Predicting the effects of modifying the design or methods of a simple experiment
2.9. Determining which additional trial or experiment could be performed to enhance or evaluate the results of a simple experiment

3. Students will apply science knowledge, skills, and practices to evaluate the validity of scientific information and formulate conclusions and predictions based on that information.

Students will demonstrate mastery of this standard by:

3.1. Determining which hypothesis, prediction, or conclusion is, or is not, consistent with a complex data presentation or piece of information in text
3.2. Determining which results of a complex experiment support or contradict a hypothesis, prediction, or conclusion
3.3. Determining which hypothesis, prediction, or conclusion is or is not consistent with two or more moderately complex data presentations and/or pieces of information in text
3.4. Explaining why a hypothesis, prediction, or conclusion is, or is not, consistent with a simple data presentation or piece of information in text
3.5. Explaining why simple information already presented or new, supports or contradicts a hypothesis or conclusion
3.6. Explaining why a hypothesis, prediction or conclusion is or is not consistent with two or more data presentations and/or pieces of information in text
3.7. Identifying similarities and differences between complex theoretical models
3.8. Determining which hypothesis, prediction, or conclusion is, or is not, consistent with two or more complex theoretical model
3.9. Determining which hypothesis, prediction, or conclusion is, or is not, consistent with two or more moderately complex theoretical models
3.10. Identifying the strengths and weaknesses of moderately complex theoretical models
3.11. Determining which moderately complex theoretical models are supported or weakened by new information
3.12. Determining which moderately complex theoretical models support or contradict a hypothesis, prediction, or conclusion
3.13. Using new information to make a prediction based on a simple theoretical model
3.14. Explaining why presented information, or new information, or weakens a simple theoretical model
3.15. Explaining why a hypothesis, prediction, or conclusion is, or is not, consistent with a simple theoretical model
3.16. Explaining why a hypothesis, prediction, or conclusion is, or is not, consistent with two or more simple theoretical models

Basics of Science

1. **Students will review and understand basic concepts integral to science and its processes.**
   Students will demonstrate mastery of this standard by:
   1.1. Defining and explaining the steps in the scientific method
   1.2. Practicing lab safety skills when necessary

Hierarchical Organization

Teachers will conduct a brief review of cell biology in order to prepare for High School Biology.

Reproduction & Heredity

1. **Students will demonstrate an understanding of how sexual reproduction results in offspring with genetic variation while asexual reproduction results in offspring with identical genetic information.**
   Students will demonstrate mastery of this standard by:
   1.1. Obtaining and communicating information about the relationship of genes, chromosomes, and DNA and constructing explanations comparing their relationship to inherited characteristics
   1.2. Creating a diagram of mitosis and explaining its role in asexual reproduction, which results in offspring with identical genetic information
   1.3. Comparing and contrasting advantages and disadvantages of asexual and sexual reproduction
   1.4. Engaging in discussion using models and evidence to explain that sexual reproduction produces offspring that have a new combination of genetic information different from either parent
   1.5. Constructing explanations of how genetic information is transferred during meiosis
2. **Students will demonstrate an understanding of the differences in inherited and acquired characteristics and how environmental factors (natural selection) and the use of technologies (selective breeding, genetic engineering) influence the transfer of genetic information.**
   Students will demonstrate mastery of this standard by:
   2.1. Constructing an argument based on evidence for how environmental and genetic factors influence the growth of organisms
   2.2. Using various scientific resources to research and support the historical findings of Gregor Mendel to explain the basic principles of heredity
   2.3. Using mathematical and computational thinking to analyze data and make predictions about the outcome of specific genetic crosses (monohybrid Punnett Squares) involving simple dominant/recessive traits
   2.4. Debating the ethics of artificial selection (selective breeding, genetic engineering) and the societal impacts of humans changing the inheritance of desired traits in organisms and discuss these ethics in relation to the Church's teachings

3. **Students will demonstrate an understanding that chromosomes contain many distinct genes and that each gene holds the instructions for the production of a specific protein, which in turn affects the traits of an individual.**
   Students will demonstrate mastery of this standard by:
   3.1. Communicating through diagrams that chromosomes contain many distinct genes and that each gene holds the instructions for the production of specific proteins, which in turn affects the traits of the individual (not to include transcription or translation)
   3.2. Constructing scientific arguments from evidence to support claims about the potentially harmful, beneficial, or neutral effects of genetic mutations on organisms

Adaptation & Diversity

1. **Students will demonstrate an understanding of the process of natural selection, in which variations in a population increase some individuals' likelihood of surviving and reproducing in a changing environment.**
   Students will demonstrate mastery of this standard by:
   1.1. Using various scientific resources to analyze the historical findings of Charles Darwin to explain basic principles of natural selection
   1.2. Investigating to construct explanations about natural selection that connect growth, survival, and reproduction to genetic factors, environmental factors, food intake, and interactions with other organisms
2. **Students will demonstrate an understanding of how similarities and differences among living and extinct species provide evidence that changes have occurred in organisms over time and that similarity of characteristics provides evidence of common ancestry.**
   Students will demonstrate mastery of this standard by:
   2.1. Analyzing and interpreting data (e.g. pictures, graphs) to explain how natural selection may lead to increases and decreases of specific traits in populations over time
   2.2. Constructing written and verbal explanations to describe how genetic variations of traits in a population increase some organisms' probability of surviving and reproducing in a specific environment
   2.3. Obtaining and evaluating scientific information to explain that separated populations, that remain separated, can evolve through mutations to become a new species (speciation)
   2.4. Analyzing displays of pictorial data to compare and contrast embryological and homologous/analogous structures across multiple species to identify evolutionary relationships

Motions, Forces, & Energy

1. **Students will demonstrate an understanding of the properties, behaviors, and application of waves.**
   Students will demonstrate mastery of this standard by:

1.1. Collecting, organizing, and interpreting about the characteristics of sound and light waves to construct explanations about the relationship between matter and energy
1.2. Investigating research-based mechanisms for capturing and converting wave energy (frequency, amplitude, wavelength, and speed) into electrical energy
1.3. Conducting simple investigations about the performance of waves to describe their behavior (e.g., refraction, reflection, transmission, and absorption) as they interact with various materials (e.g., lenses, mirrors, and prisms)
1.4. Using scientific processes to plan and conduct controlled investigations to conclude sound is a wave phenomenon that is characterized by amplitude and frequency
1.5. Conducting scientific investigations that describe the behavior of sound when resonance changes (e.g., waves in a stretched string and design of musical instruments)
1.6. Obtaining and evaluating scientific information to explain the relationship between seeing color and the transmission, absorption, or reflection of light waves by various materials
1.7. Researching the historical significance of wave technology to explain how digitized tools have evolved to encode and transmit information (e.g., telegraph, cell phones, and wireless computer networks)
1.8. Comparing and contrasting the behavior of sound and light waves to determine which types of waves need a medium for transmission

Earth's Structure and History

1. **Students will demonstrate an understanding of geological evidence to analyze patterns in Earth's major events, processes, and evolution in history. Students will demonstrate mastery of this standard by:**
   1.1. Using scientific evidence to create a timeline of Earth's history that depicts relative dates from index fossil records and layers of rock (strata)
   1.2. Creating a model of the processes involved in the rock cycle and relating it to the fossil record
   1.3. Constructing and analyzing scientific arguments to support claims that most fossil evidence is an indication of the diversity of life that was present on Earth and that relationships exist between past and current life forms
   1.4. Using research and evidence to document how evolution has been shaped both gradually and through mass extinction by Earth's varying geological conditions (e.g., climate change, meteor impacts, and volcanic eruptions)

Earth's Systems & Cycles

1. **Students will demonstrate an understanding that physical processes and major geological events (e.g., plate movement, volcanic activity, mountain building, weathering, erosion) are powered by the Sun and the**

Earth's internal heat and have occurred over millions of years.
Students will demonstrate mastery of this standard by:

1.1. Investigating and explaining how the flow of Earth's internal energy drives the cycling of matter through convection currents between Earth's surface and the deep interior causing plate movements
1.2. Exploring and debating theories of plate tectonics to form conclusions about past and current movements of rocks at Earth's surface throughout history
1.3. Mapping land and water patterns from various time periods and use rocks and fossils to report evidence of how Earth's plates have moved great distances, collided, and spread apart
1.4. Researching and assessing the credibility of scientific ideas to debate and discussing how Earth's constructive and destructive processes have changed Earth's surface at varying time and spatial scales
1.5. Using models that demonstrate convergent and divergent plate movements that are responsible for most landforms and the distribution of most rocks and minerals within Earth's crust
1.6. Designing and conducting investigations to evaluate the chemical and physical processes involved in the formation of soils
1.7. Explaining the interconnected relationship between surface water and groundwater

2. Students will demonstrate an understanding of natural hazards (volcanic eruptions, severe weather, earthquakes) and construct explanations for why some hazards are predictable and others are not.
Students will demonstrate mastery of this standard by:

2.1. Researching and mapping various types of natural hazards to determine their impact on society
2.2. Comparing and contrasting technologies that predict natural hazards to identify which types of technologies are most effective
2.3. Using the engineering design process to create mechanisms to improve community resilience, which safeguard against natural hazards (e.g., building restrictions in flood or tidal zones, regional watershed management, fire wise construction)

Earth's Resources

1. Students will demonstrate an understanding that a decrease in natural resources is directly related to the increase in human population on Earth and must be conserved.
Students will demonstrate mastery of this standard by:

1.1. Reading and evaluating scientific information about advancements in renewable and nonrenewable resources and proposing and defending ways to decrease national and global dependency on nonrenewable resources
1.2. Creating and defending a proposal for reducing the environmental effects humans have on Earth (e.g., population increases, consumer

demands, chemical pollution, deforestation, and change in average annual temperature)

1.3. Using scientific data to debate the societal advantages and disadvantages of technological advancements in renewable energy sources

1.4. Using the engineering design process to develop a system to capture and distribute thermal energy that makes renewable energy more readily available and reduces human impact on the environment (e.g., building solar water heaters, conserving home energy)

Catholic Identity Integration in Science
8th Grade

Core Values of Classroom Behavior and Culture
1. Students will treat one another and adults with respect, recognizing that each individual is created by God in His image.
Integration of Scripture and Church Teaching
1. Students will make connections between their study of reproduction, heredity, and genetics recognizing that we are created in the image and likeness of God. We are all individuals who have a positive or negative impact on Earth's resources. We are charged by God to be good stewards of the Earth. 2. Students will make a connection between their study of life cycles and ecosystems and their spiritual lives recognizing that just as the Sun is the source of energy and nourishment for animals and humans, God is the source of energy and nourishment for the people of God. We receive this food through the Eucharist. Just as Jesus is blessed, broken and given to us, so too are we called to be blessed, broken and given to one another in the service of Christ (Henri Nouwen, *Life of the Beloved*, 2002)
Historic Church Figures and Events
1. Students will study saints within the Church who were scientists or experts in the areas of science that they are studying.

Suggested Courses of Study for Science

Beginning in grade seven additional course options, such as honors or Advance Placement classes may be offered. The specific standards for honors or AP classes are determined at the local level, but all must meet and exceed curriculum standards and objectives in this document. All standards must be approved by the Superintendent of Education.

Schools may also offer elective science courses that focus on various fields of scientific study. Students should work with their school counselor and administration to determine which science classes are most applicable to their career path and determine the best course of study on an individual basis. While course offerings may vary from school to school, the following classes **must** be available at all high schools:

1. Anatomy and Physiology
2. Biology I
3. Chemistry
4. Environmental Science
5. Physical Science
6. Physics

Any additional courses offered must be approved by the Office of Catholic Education and standards must be held on file in the Office of Catholic Education and readily available to teachers, students, and parents.

Catholic Identity Integration in High School Science Courses

As courses progress at the middle and high school levels, theology and religion classes become more departmentalized and offer a number of opportunities for integration with other subjects. The following are suggested opportunities for integration in the science classroom. In addition to the opportunities listed below, teachers are expected to work cooperatively with religion and theology teachers in their schools to ensure that the strong spirit of our Catholic faith is woven into every academic class.

Core Values of Classroom Behavior and Culture
1. Teachers and students treat one another with dignity and respect acknowledging that each individual is created in the image and likeness of God. 2. Students are expected to complete all assignments honestly - avoiding cheating, plagiarism, and other unethical behaviors. 3. Communal prayer is encouraged to start or end every class.
Integration of Scripture and Church Teaching
1. Teachers and students will look for natural connections between occurrences and accounts told within the Bible and scientific concepts being discussed in class. 2. Teachers will attempt to make connections between topics covered and ways in which students can help our Church and community.
Historic Church Figures and Events
1. Students will research or learn about famous scientists who were saints or historic figures in the Church and analyze their contributions to the field of science.

Anatomy & Physiology

Physiological Functions/ Anatomical Structure
1. The students will demonstrate an understanding of how anatomical structures and physiological functions are organized and described using anatomical position. **Students will demonstrate mastery of this standard by:** 1.1. Applying appropriate anatomical terminology when explaining the orientation of regions, directions, and body planes or sections 1.2. Locating organs and their applicable body cavities and systems 1.3. Investigating the interdependence of the various body systems to each other and to the body as a whole
Cells & Tissues
1. Students will demonstrate an understanding of the relationship of cells and tissues that form complex structures of the body. **Students will demonstrate mastery of this standard by:** 1.1. Analyzing the characteristics of the four main tissue types: epithelial, connective, muscle, and nervous and examining tissues using microscopes and other various technologies 1.2. Constructing a model to demonstrate how the structural organization of cells in a tissue relates to the specialized function of that tissue 1.3. Using the engineering design process to research and develop medications (i.e., targeted cancer therapy drugs) that target uncontrolled cancer cell reproduction
Integumentary System
1. Students will investigate the structures and functions of the integumentary system, including the cause and effect of diseases and disorders. **Students will demonstrate mastery of this standard by:** 1.1. Identifying structures and explaining the functions of the integumentary system, including layers of skin, accessory structures, and types of membranes 1.2. Investigating specific mechanisms (e.g., feedback and temperature regulation) through which the skin maintains homeostasis 1.3. Researching and analyzing the causes and effects of various pathological conditions (e.g., burns, skin cancer, bacterial/viral infections, and chemical dermatitis) 1.4. Using the engineering design process to design and model/simulate effective treatments for skin disorders (e.g., tissue grafts)
Skeletal System
1. Students will investigate the structures and functions of the skeletal system including the cause and effect of diseases and disorders. **Students will demonstrate mastery of this standard by:** 1.1. Using models to compare the structure and function of the skeletal system

1.2. Developing and using models to identify and classify major bones as part of the appendicular or axial skeleton
1.3. Identifying and classifying types of joints and their movement
1.4. Demonstrating an understanding of the growth and development of the skeletal system, differentiating between endochondral and intramembranous ossification
1.5. Constructing explanations detailing how mechanisms (e.g., Ca2+ regulation) are used by the skeletal system to maintain homeostasis.
1.6. Researching and analyzing various pathological conditions (e.g., bone fractures, osteoporosis, bone cancers, various types of arthritis, and carpal tunnel syndrome)
1.7. Using the engineering design process to develop, model, and test effective treatments for bone disorders (i.e., prosthetics)

Nervous System

1. Students will investigate the structures and functions of the nervous system, including the cause and effect of diseases and disorders.
Students will demonstrate mastery of this standard by:

1.1. Describing and evaluating how the nervous system functions and interconnects with all other body systems
1.2. Analyzing the structure and function of neurons and their supporting neuroglia cells (e.g. astrocytes, oligodendroglial cells, microglial cells)
1.3. Discussing the structure and function of the brain and spinal cord
1.4. Comparing and contrasting the structures and functions of the central and peripheral nervous systems and investigating how the systems interact to maintain homeostasis (e.g., reflex responses, sensory responses)
1.5. Planning and conducting an experiment to test reflex response rates under varying conditions and using technology, constructing graphs in order to analyze and interpret data to explain and communicate conclusions
1.6. Describing the major characteristics of the autonomic nervous system and contrasting the roles of the sympathetic and parasympathetic nervous systems in maintaining homeostasis
1.7. Describing the structure and function of the special senses (e.g., vision, hearing, taste, and olfaction)
1.8. Researching and analyzing the causes and effects of various pathological conditions (e.g., addiction, depression, schizophrenia, Alzheimer's, sports-related chronic traumatic encephalopathy [CTE], dementia, chronic migraine, stroke, and epilepsy)
1.9. Using the engineering design process to develop, model, and test preventative devices for neurological injuries and/or disorders (e.g., concussion-proof helmets or possible medications for addiction and depression)

Endocrine System

1. **Students will demonstrate an understanding of the major organs of the endocrine system and the associated hormonal production and regulation.**
   Students will demonstrate mastery of this standard by:
   1.1. Obtaining, evaluating, and communicating information to illustrate that the endocrine glands secrete hormones that help the body maintain homeostasis through feedback mechanisms
   1.2. Discussing the function of each endocrine gland and the various hormones secreted
   1.3. Modeling specific mechanisms through which the endocrine system maintains homeostasis (e.g., insulin/glucagon and glucose regulation; T3 / T4 and metabolic rates; calcitonin/parathyroid and calcium regulation; antidiuretic hormone and water balance; growth hormone; and cortisol and stress)
   1.4. Researching and analyzing the effects of various pathological conditions (e.g., diabetes mellitus, pituitary dwarfism, Graves' disease, Cushing's syndrome, hypothyroidism, and obesity)
   1.5. Using the engineering design process to develop effective treatments for endocrine disorders (e.g., methods to regulate hormonal imbalance)

Male & Female Reproductive Systems

1. **Students will investigate the structures and functions of the male and female reproductive system, including the causes and effects of diseases and disorders.**
   Students will demonstrate mastery of this standard by:
   1.1. Comparing and contrasting the structure and function of the male and female reproductive systems
   1.2. Describing the male reproductive anatomy and relating structure to sperm production and release
   1.3. Describing the female reproductive anatomy and relating structure to egg production and release
   1.4. Constructing explanations detailing the role of hormones in the regulation of sperm and egg development and analyzing the role of negative feedback in regulation of the female menstrual cycle and pregnancy
   1.5. Describing the changes that occur during embryonic/fetal development, birth, and the growth and development from infancy, childhood, and adolescence to adult

Blood

1. **Students will analyze the components of blood and their functions with regard to its role in maintaining homeostasis.**
   Students will demonstrate mastery of this standard by:
   1.1. Describing the structure, function, and origin of the cellular components and plasma components of blood

1.2. Distinguishing the cellular difference between the ABO blood groups and investigating blood type differences utilizing antibodies to determine compatible donors and recipients
1.3. Researching and analyzing the causes and effects of various pathological conditions (e.g., anemia, malaria, leukemia, hemophilia, and blood doping)
1.4. Using the engineering design process to develop effective treatments for blood disorders (e.g., methods to regulate blood cell counts or blood doping tests)

Cardiovascular System

1. **Students will investigate the structures and functions of the cardiovascular system, including the causes and effects of diseases and disorders. Students will demonstrate mastery of this standard by:**
   1.1. Designing and using models to investigate the functions of the organs of the cardiovascular system
   1.2. Describing the flow of blood through the pulmonary system and systemic circulation
   1.3. Investigating the structure and function of different types of blood vessels (e.g., arteries, capillaries, veins), identifying the role each plays in the transport and exchange of materials
   1.4. Demonstrating the role of valves in regulating blood flow.
   1.5. Planning and conducting an investigation to test the effects of various stimuli on heart rate and/or blood pressure and constructing graphs to analyze data and communicate conclusions
   1.6. Researching and analyzing the effects of various pathological conditions (e.g., hypertension, myocardial infarction, mitral valve prolapses, varicose veins, and arrhythmia)
   1.7. Using the engineering design process to develop, model, and test effective treatments for cardiovascular diseases (e.g., methods to regulate heart rate, artificial replacement valves, open blood vessels, or strengthening leaky valves)

Lymphatic System

1. **Students will investigate the structures and functions of the lymphatic system, including the causes and effects of diseases and disorders. Students will demonstrate mastery of this standard by:**
   1.1. Analyzing the functions of leukocytes, lymph, and lymphatic organs in the immune system
   1.2. Comparing the primary functions of the lymphatic system and its relationship to the cardiovascular system
   1.3. Comparing and contrasting the body's non-specific and specific lines of defense, including an analysis of the roles of various leukocytes: basophils, eosinophils, neutrophils, monocytes, and lymphocytes
   1.4. Correlating the functions of the spleen, thymus, lymph nodes, and lymphocytes to the development of immunity

1.5. Differentiating the role of B-lymphocytes and T-lymphocytes in the development of humoral and cell-mediated immunity and primary and secondary immune responses
1.6. Investigating various forms of acquired and passive immunity (e.g., fetal immunity, breastfed babies, vaccinations, and plasma donations)
1.7. Researching and analyzing the causes and effects of various pathological conditions (e.g., viral infections, auto-immune disorders, immunodeficiency disorders, and lymphomas)

Respiratory System

1. **Students will investigate the structures and functions of the respiratory system, including the causes and effects of diseases and disorders.**
   Students will demonstrate mastery of this standard by:
   1.1. Designing and using models to illustrate the functions of the organs of the respiratory system
   1.2. Describing structural adaptations of the respiratory tract and relating these structural features to the function of preparing incoming air for gas exchange at the alveolus
   1.3. Identifying the five mechanics of gas exchange: pulmonary ventilation, external respiration, transport gases, internal respiration, and cellular respiration
   1.4. Using the engineering design process to develop a model of the mechanisms that support breathing and illustrating the inverse relationship between volume and pressure in the thoracic cavity
   1.5. Researching and analyzing the causes and effects of various pathological conditions (e.g., asthma, bronchitis, pneumonia, and COPD)
   1.6. Researching and discussing new environmental causes of respiratory distress (e.g., e-cigarettes, environmental pollutants, and changes in inhaled gas composition)

Digestive System

1. **Students will investigate the structures and functions of the digestive system, including the causes and effects of diseases and disorders.**
   Students will demonstrate mastery of this standard by:
   1.1. Analyzing the structure-function relationship in organs of the digestive system
   1.2. Using models to describe structural adaptations present in each organ of the tract and correlating the structures to specific processing of food at each stage (e.g., types of teeth; muscular, elastic wall and mucous lining of the stomach; villi and microvilli of the small intestine; and sphincters along the digestive tract)
   1.3. Identifying the accessory organs (i.e., salivary glands, liver, gallbladder, and pancreas) for digestion and describing their function
   1.4. Planning and conducting an experiment to illustrate the necessity of mechanical digestion for efficient chemical digestion

1.5. Researching and analyzing the activity of digestive enzymes within different organs of the digestive tract and connecting enzyme function to environmental factors such as pH
1.6. Evaluating the role of hormones (e.g., gastrin, leptin, and insulin) in the regulation of hunger and satiety/fullness
1.7. Researching and analyzing the causes and effects of various pathological conditions (e.g., GERD/acid reflux, stomach ulcers, lactose intolerance, irritable bowel syndrome, gallstones, appendicitis, and hormonal imbalances and obesity)
1.8. Using the engineering design process to develop effective treatments for gastrointestinal diseases (e.g., methods to regulate stomach acids or soothe ulcers, treat food intolerance, and dietary requirements/modifications)

Urinary System

1. Students will investigate the structures and functions of the urinary system, including the causes and effects of diseases and disorders.
Students will demonstrate mastery of this standard by:

1.1. Understanding the structure and function of the urinary system in relation to maintenance of homeostasis
1.2. Describing the processes of filtration and selective reabsorption within the nephrons as it relates to the formation of urine and excretion of excess materials in the blood
1.3. Investigating relationship between urine composition and the maintenance of blood sugar, blood pressure, and blood volume
1.4. Conducting a urinalysis to compare the composition of urine from various "patients"
1.5. Developing and using models to illustrate the path of urine through the urinary tract
1.6. Researching and analyzing the causes and effects of various pathological conditions and other kidney abnormalities (e.g., kidney stones, urinary tract infections, gout, dialysis, and incontinence)

Biology I

Cells as a System
1. Students will demonstrate an understanding of the characteristics of life and biological organization. **Students will demonstrate mastery of this standard by:** 1.1. Developing criteria to differentiate between living and non-living things 1.2. Describing the tenets of cell theory and the contributions of Schwann, Hooke, Schleiden, and Virchow 1.3. Using specific examples, explaining how cells can be organized into complex tissues, organs, and organ systems in multicellular organisms 1.4. Using evidence from current scientific literature to support whether a virus is living or non- living **2. Students will analyze the structure and function of the macromolecules that make up cells.** **Students will demonstrate mastery of this standard by:** 2.1. Developing and using models to compare and contrast the structure and function of carbohydrates, lipids, proteins, and nucleic acids (DNA and RNA) in organisms 2.2. Designing and conducting an experiment to determine how enzymes react given various environmental conditions (i.e., pH, temperature, and concentration) 2.3. Analyzing, interpreting, graphing, and presenting data to explain how those changing conditions affect the enzyme activity and the rate of the reactions that take place in biological organisms **3. Students will relate the diversity of organelles to a variety of specialized cellular functions.** **Students will demonstrate mastery of this standard by:** 3.1. Developing and using models to explore how specialized structures within cells (e.g., nucleus, cytoskeleton, endoplasmic reticulum, ribosomes, Golgi apparatus, lysosomes, mitochondria, chloroplast, centrosomes, and vacuoles) interact to carry out the functions necessary for organism survival 3.2. Investigating to compare and contrast prokaryotic cells and eukaryotic cells, and plant, animal, and fungal cells 3.3. Contrasting the structure of viruses with that of cells, and explain why viruses must use living cells to reproduce **4. Students will describe the structure of the cell membrane and analyze how the structure is related to its primary function of regulating transport in and out of cells to maintain homeostasis.** **Students will demonstrate mastery of this standard by:** 4.1. Planning and conducting investigations to prove that the cell membrane is semi-permeable, allowing it to maintain homeostasis with its environment through active and passive transport processes

4.2. Developing and using models to explain how the cell deals with imbalances of solute concentration across the cell membrane (i.e., hypertonic, hypotonic, and isotonic conditions, sodium/potassium pump)

5. Students will develop and use models to explain the role of the cell cycle during growth, development, and maintenance in multicellular organisms. Students will demonstrate mastery of this standard by:

5.1. Constructing models to explain how the processes of cell division and cell differentiation produce and maintain complex multicellular organisms

5.2. Identifying and describing the changes that occur in a cell during replication and exploring problems that might occur if the cell does not progress through the cycle correctly (cancer)

5.3. Relating the processes of cellular reproduction to asexual reproduction in simple organisms (i.e., budding, vegetative propagation, regeneration, binary fission). Explaining why the DNA of the daughter cells is the same as the parent cell

Energy Transfer

1. **Students will explain that cells transform energy through the processes of photosynthesis and cellular respiration to drive cellular functions. Students will demonstrate mastery of this standard by:**

1.1. Using models to demonstrate that ATP and ADP are cycled within a cell as a means to transfer energy

1.2. Developing models of the major reactants and products of photosynthesis to demonstrate the transformation of light energy into stored chemical energy in cells and emphasizing the chemical processes in which bonds are broken and energy is released, and new bonds are formed and energy is stored

1.3. Developing models of the major reactants and products of cellular respiration (aerobic and anaerobic) to demonstrate the transformation of the chemical energy stored in food to the available energy of ATP, emphasizing the chemical processes in which bonds are broken and energy is released, and new bonds are formed and energy is stored

1.4. Conducting scientific investigations or computer simulations to compare aerobic and anaerobic cellular respiration in plants and animals, using real world examples

1.5. **Enrichment**: Investigating variables (e.g., nutrient availability, temperature) that affect anaerobic respiration and current real-world applications of fermentation

1.6. **Enrichment**: Using the engineering design process to manipulate factors involved in fermentation to optimize energy production

Reproduction & Heredity

1. Students will develop and use models to explain the role of meiosis in the production of haploid gametes required for sexual reproduction. Students will demonstrate mastery of this standard by:

1.1. Modeling sex cell formation (meiosis) and combination (fertilization) to demonstrate the maintenance of chromosome number through each generation in sexually reproducing populations; explaining why the DNA of the daughter cells is different from the DNA of the parent cell
1.2. Comparing and contrasting mitosis and meiosis in terms of reproduction
1.3. Investigating chromosomal abnormalities (e.g., Down syndrome, Turner's syndrome, and Klinefelter syndrome) that might arise from errors in meiosis (nondisjunction) and how these abnormalities are identified (karyotypes)

2. Students will analyze and interpret data collected from probability calculations to explain the variation of expressed traits within a population. Students will demonstrate mastery of this standard by:

2.1. Demonstrating Mendel's law of dominance and segregation using mathematics to predict phenotypic and genotypic ratios by constructing Punnett squares with both homozygous and heterozygous allele pairs
2.2. Illustrating Mendel's law of independent assortment using Punnett squares and/or the product rule of probability to analyze monohybrid crosses
2.3. Investigating traits that follow non-Mendelian inheritance patterns (e.g., incomplete dominance, codominance, multiple alleles in human blood types, and sex-linkage)
2.4. Analyzing and interpreting data (e.g., pedigrees, family, and population studies) regarding Mendelian and complex genetic traits (e.g., sickle-cell anemia, cystic fibrosis, muscular dystrophy, color-blindness, and hemophilia) to determine patterns of inheritance and disease risk

3. Students will construct an explanation based on evidence to describe how the structure and nucleotide base sequence of DNA determines the structure of proteins or RNA that carry out essential functions of life. Students will demonstrate mastery of this standard by:

3.1. Developing and using models to explain the relationship between DNA, genes, and chromosomes in coding the instructions for the traits transferred from parent to offspring
3.2. Evaluating the mechanisms of transcription and translation in protein synthesis
3.3. Using models to predict how various changes in the nucleotide sequence (e.g., point mutations, deletions, and additions) will affect the resulting protein product and the subsequent inherited trait
3.4. Researching and identifying how DNA technology benefits society
3.5. Engaging in scientific argument from evidence over the ethical issues surrounding the use of DNA technology (e.g., cloning, transgenic organisms, stem cell research, and the Human Genome Project, gel electrophoresis).

3.6. Investigating current biotechnological applications in the study of the genome (e.g., transcriptome, proteome, individualized sequencing, and individualized gene therapy)

Adaptations & Evolution

1. **Students will analyze and interpret evidence to explain the unity and diversity of life.**
   Students will demonstrate mastery of this standard by:
   1.1. Using models to differentiate between organic and chemical evolution and illustrating the steps leading to aerobic heterotrophs and photosynthetic autotrophs
   1.2. Evaluating empirical evidence of common ancestry and biological evolution, including comparative anatomy (e.g., homologous structures and embryological similarities), fossil record, molecular/biochemical similarities (e.g., gene and protein homology), and biogeographic distribution
   1.3. Constructing cladograms/phylogenetic trees to illustrate relatedness between species
   1.4. Designing models and using simulations to investigate the interaction between changing environments and genetic variation in natural selection leading to adaptations in populations and differential success of populations
   1.5. Using Darwin's Theory to explain how genetic variation, competition, overproduction, and unequal reproductive success acts as driving forces of natural selection and evolution
   1.6. Constructing explanations for the mechanisms of speciation (e.g., geographic and reproductive isolation)
   1.7. **Enrichment**: Constructing explanations for how various disease agents (bacteria, viruses, chemicals) can influence natural selection

Interdependence of Organisms & Their Environments

1. **Students will Investigate and evaluate the interdependence of living organisms and their environment.**
   Students will demonstrate mastery of this standard by:
   1.1. Illustrating levels of ecological hierarchy, including organism, population, community, ecosystem, biome, and biosphere
   1.2. Analyzing models of the cycling of matter (e.g., carbon, nitrogen, phosphorus, and water) between abiotic and biotic factors in an ecosystem and evaluating the ability of these cycles to maintain the health and sustainability of the ecosystem
   1.3. Analyzing and interpreting quantitative data to construct an explanation for the effects of greenhouse gases on the carbon dioxide cycle and global climate
   1.4. Developing and using models to describe the flow of energy and amount of biomass through food chains, food webs, and food pyramids

1.5. Evaluating symbiotic relationships (e.g., mutualism, parasitism, and commensalism) and other co-evolutionary (e.g., predator-prey, cooperation, competition, and mimicry) relationships within specific environments
1.6. Analyzing and interpreting population data, both density-dependent and density-independent, to define limiting factors and using graphical representations (growth curves) to illustrate the carrying capacity within ecosystems
1.7. Investigating and evaluating factors involved in primary and secondary ecological succession using local, real world examples
1.8. **Enrichment:** Using the engineering design process to create a solution that addresses changing ecological conditions (e.g., climate change, invasive species, loss of biodiversity, human population growth, habitat destruction, biomagnification, or natural phenomena)
1.9. **Enrichment:** Using the engineering design process to investigate and model current technological uses of biomimicry to address solutions to real-world problems

Chemistry

Mathematical & Computational Analysis
1. Students will use mathematical and computational analysis to evaluate problems. **Students will demonstrate mastery of the standard by:** 1.1. Using dimensional analysis (factor/label) and significant figures to convert units and solve problems 1.2. Designing and conducting experiments using appropriate measurements, significant figures, graphical analysis to analyze data 1.3. Researching information from multiple appropriate sources and assessing the credibility, accuracy, possible bias, and conclusions of each publication
Atomic Theory
1. Students will demonstrate an understanding of the atomic structure and the historical developments leading to modern atomic theory. **Students will demonstrate mastery of the standard by:** 1.1. Investigating the historical progression leading to the modern atomic theory, including, but not limited to, work done by Dalton, Rutherford's gold foil experiment, Thomson's cathode ray experiment, Millikan's oil drop experiment, and Bohr's interpretation of bright line spectra 1.2. Constructing models (e.g., ball and stick, online simulations, mathematical computations) of atomic nuclei to explain the abundance weighted average (relative mass) of elements and isotopes on the published mass of elements 1.3. Investigating absorption and emission spectra to interpret explanations of electrons at discrete energy levels using tools such as online simulations, spectrometers, prisms, flame tests, and discharge tubes; exploring both laboratory experiments and real-world examples 1.4. Researching appropriate sources to evaluate the way absorption and emission spectra are used to study astronomy and the formation of the universe
Periodic Table
1. Students will demonstrate an understanding of the periodic table as a systematic representation to predict properties of elements. **Students will demonstrate mastery of the standard by:** 1.1. Exploring and communicating the organization of the periodic table, including history, groups, families, family names, metals, nonmetals, metalloids, and transition metals 1.2. Analyzing properties of atoms and ions (e.g., metal/nonmetal/metalloid behavior, electrical/heat conductivity, electronegativity and electron affinity, ionization energy, and atomic/ionic radii) using periodic trends of elements based on the periodic table

1.3. Analyzing the periodic table to identify quantum numbers (e.g., valence shell electrons, energy level, orbitals, sublevels, and oxidation numbers)

Bonding

1. **Students will demonstrate an understanding of the types of bonds and resulting atomic structures for the classification of chemical compounds.**
   Students will demonstrate mastery of the standard by:
   1.1. Developing and using models (e.g., Lewis dot, 3-D ball-stick, 3-D printing, or simulation programs such as PhET) to predict the type of bonding between atoms and the shape of simple compounds
   1.2. Using models such as Lewis structures and ball and stick models to depict the valence electrons and their role in the formation of ionic and covalent bonds
   1.3. Predicting the ionic or covalent nature of different atoms based on electronegativity trends and/or position on the periodic table
   1.4. Using models and oxidation numbers to predict the type of bond, shape of the compound, and the polarity of the compound
   1.5. Using models of simple hydrocarbons to exemplify structural isomerism
   1.6. Using mathematical and computational analysis to determine the empirical formula and the percent composition of compounds
   1.7. Using scientific investigation to determine the percentage of composition for a substance (e.g., sugar in gum, water and/or unpopped kernels in popcorn, percent water in a hydrate); comparing results to justify conclusions based on experimental evidence.
   1.8. Planning and conducting controlled scientific investigations to produce mathematical evidence of the empirical composition of a compound

Naming Compounds

1. **Students will investigate and understand the accepted nomenclature used to identify the name and chemical formulas of compounds.**
   Students will demonstrate mastery of the standard by:
   1.1. Using the periodic table and a list of common polyatomic ions as a model to derive chemical compound formulas from compound names and compound names from chemical formulas
   1.2. Generating formulas of ionic and covalent compounds from compound names and discussing compounds in everyday life and compiling lists and uses of these chemicals
   1.3. Generating names of ionic and covalent compounds from their formulas

Chemical Reactions

1. **Students will demonstrate an understanding of the types, causes, and effects of chemical reactions.**
   Students will demonstrate mastery of the standard by:
   1.1. Developing and using models to predict the products of chemical reactions (e.g., synthesis reactions; single replacement; double displacement; and decomposition, including exceptions such as

decomposition of hydroxides, chlorates, carbonates, and acids); discussing and/or compiling lists of reactions used in everyday life

1.2. Planning, conducting, and communicating the results of investigations to demonstrate different types of simple chemical reactions
1.3. Using mathematics and computational analysis to represent the ratio of reactants and products in terms of masses, molecules, and moles (stoichiometry)
1.4. Using mathematics and computational analysis to support the claim that atoms, and therefore mass, are conserved during a chemical reaction and giving real-world examples (e.g., burning wood)
1.5. Planning and conducting a controlled scientific investigation to produce mathematical evidence that mass is conserved and using percent error to analyze the accuracy of results
1.6. Using mathematics and computational analysis to support the concept of percent yield and limiting reagent
1.7. Planning and conducting a controlled scientific investigation to produce mathematical evidence to predict and confirm the limiting reagent and percent yield in the reaction
1.8. Analyzing quantitative data, drawing conclusions, and communicating findings; comparing and analyzing class data for validity.

Gas Laws

1. Students will demonstrate an understanding of the structure and behavior of gases.

Students will demonstrate mastery of the standard by:

1.1. Analyzing the behavior of ideal and real gases in terms of pressure, volume, temperature, and number of particles
1.2. Using the engineering design process to develop models (e.g., online simulations or student interactive activities) and to explain and predict the behavior of each state of matter using the movement of particles and intermolecular forces to explain the behavior of matter
1.3. Analyzing and interpreting heating curve graphs to explain the energy relationship between states of matter (e.g., thermochemistry-water heating from -20oC to 120oC)
1.4. Using mathematical computations to describe the relationships comparing pressure, temperature, volume, and number of particles, including Boyle's law, Charles's law, Dalton's law, combined gas laws, and ideal gas laws
1.5. Using the engineering design process and online simulations or lab investigations to design and model the results of controlled scientific investigations to produce mathematical evidence that confirms the gas-laws relationships
1.6. Using the ideal gas law to support the prediction of volume, mass, and number of particles produced in chemical reactions (i.e., gas stoichiometry)

1.7. Planning and conducting controlled scientific investigations to produce mathematical evidence that confirms that reactions involving gases conform to the law of conservation of mass
1.8. Using gas stoichiometry, calculate the volume of carbon dioxide needed to inflate a balloon to occupy a specific volume and using the engineering design process to design, construct, evaluate, and improve a simulated air bag

Solutions

1. **Students will demonstrate an understanding of the nature of properties of various types of chemical solutions.**
   Students will demonstrate mastery of the standard by:
   1.1. Using mathematical and computational analysis to quantitatively express the concentration of solutions using the concepts such as molarity, percent by mass, and dilution
   1.2. Developing and using models (e.g., online simulations, games, or video representations) to explain the dissolving process in solvents on the molecular level
   1.3. Analyzing and interpreting data to predict the effect of temperature and pressure on solids and gases dissolved in water
   1.4. Designing, conducting, and communicating the results of experiments to test the conductivity of common ionic and covalent compounds in solution
   1.5. Using mathematical and computational analysis to analyze molarity, molality, dilution, and percentage dilution problems
   1.6. Designing, conducting, and communicating the results of experiments to produce a specified volume of a solution of a specific molarity, and dilute a solution of a known molarity
   1.7. Using mathematical and computational analysis to predict the results of reactions using the concentration of solutions (i.e., solution stoichiometry)
   1.8. Investigating parts per million and/or parts per billion as it applies to environmental concerns in your geographic region and referencing laws that govern these factors

Acids & Bases

1. **Enrichment: Students will understand the nature and properties of acids, bases, and salt solutions.**
   Students will demonstrate mastery of the standard by:
   1.1. Analyzing and interpreting data to describe the properties of acids, bases, and salts
   1.2. Analyzing and interpreting data to identify differences between strong and weak acids and bases (i.e., dissociation)
   1.3. Planning and conducting investigations using the pH scale to classify acid and base solutions
   1.4. Analyzing and evaluating the Arrhenius, Bronsted-Lowry, and Lewis acid-base definitions

1.5. Using mathematical and computational thinking to calculate pH from the hydrogen-ion concentration
1.6. Obtaining, evaluating, and communicating information about how buffers stabilize pH in acid-base reactions

Thermochemistry

1. **Students will understand that energy is exchanged or transformed in all chemical reactions.**
   Students will demonstrate mastery of the standard by:
   1.1. Constructing explanations to explain how temperature and heat flow in terms of the motion of molecules (or atoms)
   1.2. Classifying chemical reactions and phase changes as exothermic or endothermic based on enthalpy values and using a graphical representation to illustrate the energy changes involved
   1.3. Analyzing and interpreting data from energy diagrams and investigations to support claims that the amount of energy released or absorbed during a chemical reaction depends on changes in total bond energy
   1.4. Using mathematical and computational thinking to solve problems involving heat flow and temperature changes, using known values of specific heat and latent heat of phase change

Equilibrium

1. **Enrichment: Students will understand that chemical equilibrium is a dynamic process at the molecular level.**
   Students will demonstrate mastery of the standard by:
   1.1. Constructing explanations to explain how to use Le Chatelier's principle to predict the effect of changes in concentration, temperature, and pressure
   1.2. Predicting when equilibrium is established in a chemical reaction
   1.3. Using mathematical and computational thinking to calculate an equilibrium constant expression for a reaction

Organic Nomenclature

1. **Enrichment: Students will understand that the bonding characteristics of carbon allow the formation of many different organic molecules with various sizes, shapes, and chemical properties.**
   Students will demonstrate mastery of the standard by:
   1.1. Constructing explanations to explain the bonding characteristics of carbon that result in the formation of basic organic molecules
   1.2. Obtaining information to communicate the system used for naming the basic linear hydrocarbons and isomers that contain single bonds, simple hydrocarbons with double and triple bonds, and simple molecules that contain a benzene ring
   1.3. Developing and using models to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids

Environmental Science

This is a half-credit course meant to be taken in one semester.

Biosphere & Biodiversity
1. Students will investigate the interdependence of diverse living organisms and their interactions with the components of the biosphere. **Students will demonstrate mastery of the standard by:** 1.1. Identifying, investigating, and evaluating the interactions of the abiotic and biotic factors that determine the types of organisms that live in major biomes 1.2. Evaluating evidence in nonfiction text to explain how biological or physical changes within biomes affect populations and communities and how changing conditions may result in altered ecosystems 1.3. Using models to explain why the flow of energy through an ecosystem can be illustrated by a pyramid with less energy available at the higher trophic levels compared to lower levels 1.4. Describing symbiotic relationships (e.g., mutualism, parasitism, and commensalism) and other co-evolutionary (e.g., predator-prey, cooperation, competition, and mimicry) relationships within specific environments 1.5. Developing and using models to diagram the flow of nitrogen, carbon, and phosphorus through the environment 1.6. Using mathematics, graphics, and informational text to determine how population density-dependent and density-independent limiting factors affect populations and diversity within ecosystems and using technology to illustrate and compare a variety of population-growth curves. 1.7. Analyzing and interpreting quantitative data to construct explanations of how the carrying capacity of an ecosystem may change as the availability of resources changes 1.8. Utilizing data to communicate changes within a given population and the environmental factors that may have impacted these changes (e.g., weather patterns, natural disasters) 1.9. Evaluating and communicating data that explains how human activity may impact biodiversity (e.g., introduction, removal, and reintroduction of an organism within an ecosystem; land usage) and genetic variations of organisms, including endangered and threatened species 1.10. Engaging in scientific argument from evidence the benefits versus harm of genetically modified organisms
Natural Resource Use & Conservation
1. Students will relate the impact of human activities on the environment, conservation activities, and efforts to maintain and restore ecosystems. **Students will demonstrate mastery of the standard by:** 1.1. Differentiating between renewable and nonrenewable resources and comparing and contrasting the pros and cons of using these resources

1.2. Investigating and researching the pros and cons of using traditional sources of energy (e.g., fossil fuels) and alternative sources of energy (e.g., water, wind, geothermal, biomass/biofuels, solar)
1.3. Comparing and contrasting biodegradable and nonbiodegradable wastes and their significance in landfills
1.4. Examining solutions for developing, conserving, managing, recycling, and reusing energy and mineral resources to minimize impacts in natural systems (e.g., agricultural soil use, mining for coal, construction sites, and exploration of petroleum and natural gas sources)
1.5. Researching various resources related to water quality and pollution (e.g., nonfictional text, EPA's Surf Your Watershed, MDEQ publications) and communicating the possible effects on the environment and human health
1.6. Obtaining water from a local source (e.g., stream on campus, rainwater, ditch water) to monitor water quality over time using a spreadsheet program to graphically represent collected data

Human Activities & Climate Change

1. Students will discuss the direct and indirect impacts of certain types of human activities on the Earth's climate.
Students will demonstrate mastery of the standard by:
1.1. Using a model to describe cycling of carbon through the ocean, atmosphere, soil, and biosphere and how increases in carbon dioxide concentrations have resulted in atmospheric and climate changes
1.2. Interpreting data and climate models to predict how global and regional climate change can affect Earth's systems (e.g., precipitation, temperature, impacts on sea level, global ice volumes, and atmosphere and ocean composition)
1.3. Using satellite imagery and other resources to analyze changes in biomes over time (e.g., glacial retreat, deforestation, desertification) and propose strategies to reduce the impact of human activities leading to these issues
1.4. Determining mathematically an individual's impact on the environment (carbon footprint, water usage, landfill contribution) and develop a plan to reduce personal contribution

Human Sustainability

1. Students will demonstrate an understanding of the interdependence of human sustainability and the environment.
Students will demonstrate mastery of the standard by:
1.1. Identifying human impact and developing a solution for protection of the atmosphere, considering pollutants (e.g., acid rain, air pollution, smog, ozone layer, or increased levels of greenhouse gases) and the impacts of pollutants on human health (e.g., asthma, COPD, emphysema, and cancer)
1.2. Evaluating data and other information to explain how key natural resources (e.g., water sources, fertile soils, concentrations of minerals,

and fossil fuels), natural hazards, and climate changes influence human activity (e.g., mass migrations, human health)

1.3. Researching and analyzing case studies to determine the impact of human-related and natural environmental changes on human health and communicating possible solutions to reduce/resolve the dilemma

1.4. Exploring online resources related to air pollution to determine air quality in a geographic area and communicate the possible effects on the environment and human health

1.5. Using the engineering design process to define a problem, design, construct, evaluate, and improve a device or method to reduce or prevent human impact on a natural resource (e.g., building a water filter, designing an air purifier, developing a method to prevent parking lot pollution from entering a watershed)

Physical Science

Nature of Matter
1. Students will demonstrate an understanding of the nature of matter. **Students will demonstrate mastery of the standard by:** 1.1. Using contextual evidence to describe particle theory of matter and examining the particle properties of solids, liquids, and gases 1.2. Using scientific research to generate models to compare physical and chemical properties of elements, compounds, and mixtures 1.3. Conducting an investigation to determine the identity of unknown substances by comparing properties to known substances 1.4. Designing and conducting investigations to explore techniques in measurements of mass, volume, length, and temperature 1.5. Designing and conducting an investigation using graphical analysis (e.g., line graph) to determine the density of liquids and/or solids 1.6. Using mathematical and computational analysis to solve density problems and manipulating the density formula to determine density, volume, or mass or use dimensional analysis to solve problems
Atomic Theory
1. Students will demonstrate an understanding of both modern and historical theories of atomic structure. **Students will demonstrate mastery of the standard by:** 1.1. Researching and developing models (e.g., 3-D models, online simulations, or ball and stick) to investigate both modern and historical theories of atomic structure and comparing models and contributions of Dalton, Thomson, Rutherford, Bohr, and of modern atomic theory
Periodic Table
1. Students will analyze the organization of the periodic table of elements to predict atomic interactions. **Students will demonstrate mastery of the standard by:** 1.1. Using contextual evidence to determine the organization of the periodic table, including metals, metalloids, and nonmetals; symbols; atomic number; atomic mass; chemical families/groups; and periods/series 1.2. Using the periodic table and scientific method to investigate the formation of compounds through ionic and covalent bonding 1.3. Using naming conventions for binary compounds to write the compound name from the formula and write balanced formulas from the name (e.g., carbon dioxide -CO2, sodium chloride -NaCl, iron III oxide-Fe2O3, and calcium bromide -CaBr2) 1.4. Using naming conventions to name common acids and common compounds used in classroom labs (e.g., sodium bicarbonate (baking soda), NaHCO3; hydrochloric acid, HCl; sulfuric acid, H2SO4; acetic acid (vinegar), HC2H3O2; and nitric acid, HNO3)

1.5. Using mathematical and computational analysis to determine the atomic mass of binary compounds

The Law of Conservation of Matter & Energy

1. Students will analyze changes in matter and the relationship of these changes to the law of conservation of matter and energy.
Students will demonstrate mastery of the standard by:

1.1. Designing and conducting experiments to investigate physical and chemical changes of various household products (e.g., rusting, sour milk, crushing, grinding, tearing, boiling, and freezing) and reactions of common chemicals that produce color changes or gases
1.2. Designing and conducting investigations to produce evidence that mass is conserved in chemical reactions (e.g., vinegar and baking soda in a Ziploc© bag)
1.3. Applying the concept of conservation of matter to balancing simple chemical equations
1.4. Using mathematical and computational analysis to examine evidence that mass is conserved in chemical reactions using simple stoichiometry problems (1:1 mole ratio) or atomic masses to demonstrate the conservation of mass with a balanced equation
1.5. Researching nuclear reactions and their uses in the modern world, exploring concepts such as fusion, fission, stars as reactors, nuclear energy, and chain reactions
1.6. Analyzing and debating the advantages and disadvantages of nuclear reactions as energy sources

Newton's Laws of Motion

1. Students will analyze the scientific principles of motion, force, and work.
Students will demonstrate mastery of the standard by:

1.1. Researching the scientific contributions of Newton, and using models to communicate Newton's principles
1.2. Designing and conducting an investigation to study the motion of an object using properties such as displacement, time of motion, velocity, and acceleration
1.3. Collecting, organizing, and interpreting graphical data using correct metric units to determine the average speed of an object
1.4. Using mathematical and computational analyses to show the relationships among force, mass, and acceleration (i.e., Newton's second law)
1.5. Designing and constructing an investigation using probe systems and/or online simulations to observe relationships between force, mass, and acceleration (F=ma)
1.6. Using the engineering design process and mathematical analysis to design and construct models to demonstrate the law of conservation of momentum (e.g., roller coasters, bicycle helmets, bumper systems)

1.7. Using mathematical and computational representations to create graphs and formulas that describe the relationships between force, work, and energy (i.e., W=Fd, KE=½ mv2, PE=mgh, W=KE)
1.8. Researching the efficiency of everyday machines and debating ways to improve their economic impact on society (e.g., electrical appliances, transportation vehicles)

Waves

1. Students will explore the characteristics of waves.
Students will demonstrate mastery of the standard by:

1.1. Using models to analyze and describe examples of mechanical waves' properties (e.g., wavelength, frequency, speed, amplitude, rarefaction, and compression)
1.2. Analyzing examples and evidence of transverse and longitudinal waves found in nature (e.g., earthquakes, ocean waves, and sound waves)
1.3. Generating wave models to explore energy transference
1.4. Using the engineering design process to design and build a musical instrument to demonstrate the influence of resonance on music
1.5. Designing and conducting experiments to investigate technological applications of sound (e.g., medical uses, music, acoustics, Doppler effects, and influences of mathematical theory on music)
1.6. Researching real-world applications to create models or visible representations of the electromagnetic spectrum, including visible light, infrared radiation, and ultraviolet radiation
1.7. Using the engineering design process to design and construct an apparatus that forms images to project on a screen or magnify images using lenses and/or mirrors
1.8. Debating the particle/wave behavior of light

Energy

1. Students will examine different forms of energy and energy transformations.
Students will demonstrate mastery of the standard by:

1.1. Using digital resources to explore forms of energy (e.g., potential and kinetic energy, mechanical, chemical, electrical, thermal, radiant, and nuclear energy)
1.2. Using scientific investigations to explore the transformation of energy from one type to another (e.g., potential to kinetic energy, and mechanical, chemical, electrical, thermal, radiant, and nuclear energy interactions)
1.3. Using mathematical and computational analysis to calculate potential and kinetic energy based on given data. Use equations such as PE=mgh and KE=½ mv2
1.4. Conducting investigations to provide evidence of the conservation of energy as energy is converted from one form of energy to another (e.g., wind to electric, chemical to thermal, mechanical to thermal, and potential to kinetic)

Thermal Energy
1. Students will demonstrate an understanding of temperature scales, heat, and thermal energy transfer. **Students will demonstrate mastery of the standard by:** 1.1. Comparing and contrasting temperature scales by converting between Celsius, Fahrenheit, and Kelvin 1.2. Applying particle theory to phase change and analyzing freezing point, melting point, boiling point, vaporization, and condensation of different substances 1.3. Relating thermal energy transfer to real world applications of conduction (e.g., quenching metals), convection (e.g., movement of air masses/weather/plate tectonics), and radiation (e.g., electromagnetic) 1.4. Using the engineering design process to construct a simulation of heat energy transfer between systems. Calculate the calories/joules of energy generated by burning food products. Communicate conclusions based on evidence from the simulation
Electricity
1. Students will explore basic principles of magnetism and electricity (e.g., static electricity, current electricity, and circuits). **Students will demonstrate mastery of the standard by:** 1.1. Using digital resources and online simulations to investigate the basic principles of electricity, including static electricity, current electricity, and circuits. 1.2. Using digital resources (e.g., online simulations) to build a model showing the relationship between magnetic fields and electric currents 1.3. Distinguishing between magnets, motors, and generators, and evaluating modern industrial uses of each 1.4. Using the engineering design process to construct a working electric motor to perform a task and communicating the design process and comparisons of task performance efficiencies 1.5. Using the engineering design process to construct and test conductors, semiconductors, and insulators using various materials to optimize efficiency

Physics

One-Dimensional Motion
1. Students will investigate and understand how to analyze and interpret data. Students will demonstrate mastery of the standard by: 1.1. Investigating and analyzing evidence gained through observation or experimental design regarding the one-dimensional (1-D) motion of objects and designing and conducting experiments to generate and interpret graphical evidence of distance, velocity, and acceleration through motion 1.2. Interpreting and predicting 1-D motion based on displacement vs. time, velocity vs. time, or acceleration vs. time graphs (e.g., free-falling objects) 1.3. Using mathematical and computational analysis to solve problems using kinematic equations 1.4. Using graphical analysis to derive kinematic equations 1.5. Differentiating and giving examples of motion concepts such as distance-displacement, speed-velocity, and acceleration 1.6. Designing and mathematically/graphically analyzing quantitative data to explore displacement, velocity, and acceleration of various objects using probe systems, video analysis, graphical analysis software, digital spreadsheets, and/or online simulations 1.7. Designing different scenarios and predicting graph shapes for distance/time, velocity/time, and acceleration/time graphs 1.8. Replicating motion using a 1D motion graph
Newton's Laws of Motion
1. Students will develop an understanding of concepts related to Newtonian dynamics. **Students will demonstrate mastery of the standard by:** 1.1. Identifying forces acting on a system by applying Newton's laws mathematically and graphically (e.g., vector and scalar quantities) 1.2. Using models such as free-body diagrams to explain and predict the motion of an object according to Newton's law of motion, including circular motion 1.3. Using mathematical and graphical techniques to solve vector problems and find net forces acting on a body using free-body diagrams and/or online simulations 1.4. Using vectors and mathematical analysis to explore the 2D motion of objects. (i.e. projectile and circular motion) 1.5. Using mathematical and computational analysis to derive simple equations of motion for various systems using Newton's second law (e.g. net force equations) 1.6. Using mathematical and computational analysis to explore forces (e.g., friction, force applied, normal, and tension)

1.7. Analyzing real-world applications to draw conclusions about Newton's three laws of motion using online simulations, probe systems, and/or laboratory experiences
1.8. Designing an experiment to determine the forces acting on a stationary object on an inclined plane and testing their conclusions
1.9. Drawing diagrams of forces applied to an object and predicting the angle of incline that will result in unbalanced forces acting on the object
1.10. Applying the effects of the universal gravitation law to generate a digital/physical graph and interpreting the forces between two masses, acceleration due to gravity, and planetary motion (e.g., situations where g is constant, as in falling bodies)
1.11. Explaining centripetal acceleration while undergoing uniform circular motion to explore Kepler's third law using online simulations, models, and/or probe systems

Work & Energy

1. Students will develop an understanding of concepts related to work and energy.

Students will demonstrate mastery of the standard by:

1.1. Using mathematical and computational analysis to qualitatively and quantitatively analyze the concept of work, energy, and power to explain and apply the conservation of energy
1.2. Using mathematical and computational analysis to explore conservation of momentum and impulse
1.3. Drawing conclusions through real-world applications about mechanical potential energy and kinetic energy using online simulations and/or laboratory experiences
1.4. Designing and conducting investigations to compare conservation of momentum and conservation of kinetic energy in perfectly inelastic and elastic collisions using probe systems, online simulations, and/or laboratory experiences
1.5. Investigating, collecting data, and summarizing the principles of thermodynamics by exploring how heat energy is transferred from higher temperature to lower temperature until equilibrium is reached
1.6. Designing, conducting, and communicating investigations that explore how temperature and thermal energy relate to molecular motion and states of matter
1.7. Using mathematical and computational analysis to analyze problems involving specific heat and heat capacity
1.8. Researching to compare the first and second laws of thermodynamics as related to heat engines, refrigerators, and thermal efficiency.
1.9. Exploring the kinetic theory in terms of kinetic energy of ideal gases using digital resources
1.10. Researching the efficiency of everyday machines (e.g., automobiles, hair dryers, refrigerators, and washing machines)

1.11. Using the engineering design process to design and build a themed Rube Goldberg-type machine that has six or more steps and complete a desired task (e.g., pop a balloon, fill a bottle, shoot a projectile, or raise an object 35 cm) within an allotted time, including a poster that demonstrates the calculations of the energy transformation or efficiency of the machine

Waves

1. Students will investigate and explore wave properties.
Students will demonstrate mastery of the standard by:

1.1. Analyzing the characteristics and properties of simple harmonic motions, sound, and light
1.2. Describing and modeling through digital or physical means the characteristics and properties of mechanical waves by simulating and investigating properties of simple harmonic motion
1.3. Using mathematical and computational analysis to explore wave characteristics (e.g., velocity, period, frequency, amplitude, phase, and wavelength)
1.4. Investigating and communicating the relationship between the energy of a wave in terms of amplitude and frequency using probe systems, online simulations, and/or laboratory experiences
1.5. Designing, investigating, and collecting data on standing waves and waves in specific media (e.g., stretched string, water surface, and air) using online simulations, probe systems, and/or laboratory experiences
1.6. Exploring and explaining the Doppler effect as it relates to a moving source and to a moving observer using online simulations, probe systems, and/or real-world experiences
1.7. Explaining the laws of reflection and refraction and applying Snell's Law to describe the relationship between the angles of incidence and refraction
1.8. Using ray diagrams and the thin lens equations to solve real-world problems involving object distance from lenses, using a lens bench, online simulations, and/or laboratory experiences
1.9. Researching the different bands of electromagnetic radiation, including characteristics, properties, and similarities/differences
1.10. Researching the ways absorption and emission spectra are used to study astronomy and the formation of the universe
1.11. Researching digital nonfictional text to defend the wave-particle duality of light (i.e., wave model of light and particle model of light)
1.12. Researching uses of the electromagnetic spectrum or photoelectric effect

Electricity & Magnetism

1. Students will investigate the key components of electricity and magnetism.
Students will demonstrate mastery of the standard by:

1.1. Analyzing and explaining electricity and the relationship between electricity and magnetism

1.2. Exploring the characteristics of static charge and how a static charge is generated using simulations
1.3. Using mathematical and computational analysis to analyze problems dealing with electric field, electric potential, current, voltage, and resistance as related to Ohm's Law
1.4. Developing and using models (e.g., circuit drawing and mathematical representation) to explain how electric circuits work by tracing the path of electrons, including concepts of energy transformation, transfer, conservation of energy, electric charge, and resistance using online simulations, probe systems, and/or laboratory experiences
1.5. Designing and conducting an investigation of magnetic poles, magnetic flux and magnetic field using online simulations, probe systems, and/or laboratory experiences
1.6. Using schematic diagrams to analyze the current flow in series and parallel electric circuits, given the component resistances and the imposed electric potential
1.7. Analyzing and communicating the relationship between magnetic fields and electrical current by induction, generators, and electric motors (e.g., microphones, speakers, generators, and motors) using Ampere's and Faraday's laws
1.8. Designing and constructing a simple motor to develop an explanation of how the motor transforms electrical energy into mechanical energy and work
1.9. Designing and drawing a schematic of a circuit that will turn on/off a light from two locations in a room like those found in most homes

Nuclear Energy

1. Students will demonstrate an understanding of the basic principles of nuclear energy.

Students will demonstrate mastery of the standard by:

1.1. Analyzing and explaining the concepts of nuclear physics
1.2. Exploring the mass number and atomic number of the nucleus of an isotope of a given chemical element
1.3. Investigating the conservation of mass and the conservation of charge by writing and balancing nuclear decay equations for alpha and beta decay
1.4. Simulating the process of nuclear decay using online simulations and/or laboratory experiences and using mathematical computations determine the half-life of radioactive isotopes