

SCIENCE CURRICULUM



DIOCESE OF PHOENIX
CATHOLIC SCHOOLS OFFICE

2024

SCIENCE CURRICULUM

Diocese of Phoenix

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TABLE OF CONTENTS

Contents

Philosophy and Goals.....	4
Standards and Benchmarks for effective Catholic Elementary and Secondary Schools	5
Introduction.....	6
The Science Process Terminology.....	7
Science Curriculum Standards.....	9
Standards Coding.....	9
Kindergarten Science Standards	11
Grade 1 Science Standards.....	17
Grade 2 Science Standards.....	23
Grade 3 Science Standards.....	30
Grade 4 Science Standards.....	39
Grade 5 Science Standards.....	48
Grade 6 Science Standards.....	57
Grade 7 Science Standards.....	67
Grade 8 Science Standards.....	78
Grades 9-12 Science Standards.....	88
Appendices.....	105

Philosophy and Goals

The universe is a place subject to fundamental scientific principles. An understanding of these principles will better prepare an individual to cope with a world in which rapid technological developments are taking place. As knowledge rapidly expands, it is most important for students to learn to make rational and moral decisions based upon scientific principles and their Catholic values. The skills and knowledge afforded students to make these types of decisions should reflect an appropriate level of intellectual and emotional growth. This curriculum is designed to stimulate curiosity and to develop morally responsible, scientifically literate citizens. This curriculum stresses the process of science as a way of learning and further emphasizes that scientific knowledge is always subject to change based on additional knowledge.

Goals

All students will:

1. Develop an understanding of the processes and skills necessary for scientific investigation, problem solving, and critical thinking.
2. Develop responsible Catholic decision making skills in matters related to science and technology's impact on society with respect for the environment and all living things.
3. Recognize that science integrates mathematics, reading, oral and written communication, which are influenced by religious beliefs.
4. Develop interest, wonder, and curiosity about the study of the universe while recognizing the objective nature of science as created by God.
5. Develop an understanding of the scientific process and the structure of science, which includes organizing data into facts, principles, models, laws, and theories.
6. Realize the practical application of science in everyday life through technology and engineering.

Explanation of Engineering Standards

Engineering standards do not have a separate section in the Livebinders for lesson plans. These standards should be considered by teachers when lesson planning and integrated into lessons as seen fit along the way. They are not to be approached as separate from the curriculum but connected in a natural way. The goal is embed a deep understanding of each of the ETS standards within students for each section (K-2, 3-5, 6-8) by the end of each three year cycle.

Standards and Benchmarks for effective Catholic Elementary and Secondary Schools

Academic Excellence:

The United States Conference of Catholic Bishops affirms the message of the Congregation on Catholic Education that intellectual development of the person and growth as a Christian go forward hand in hand. Rooted in the mission of the Church, the Catholic school brings faith, culture and life together in harmony. In 2005, the bishops noted that “young people of the third millennium must be a source of energy and leadership in our church and our nation. And, therefore, we must provide young people with an academically rigorous and doctrinally sound program of education” (*Renewing Our Commitment to Catholic Elementary and Secondary School is in the Third Millennium, 2005*).

The essential elements of “an academically rigorous and doctrinally sound program” mandate curricular experiences-including co-curricular and extra-curricular activities-which are rigorous, relevant, research-based, and infused with Catholic faith and traditions. The following essential elements provide a framework for the design, implementation, and assessment of authentic academic excellence in Catholic school education from pre-kindergarten through secondary school.

Standard 7: The curriculum adheres to appropriate, delineated standards and is vertically aligned to ensure that every student successfully completes a rigorous and coherent sequence of academic courses based on the standards and rooted in Catholic values.

BENCHMARKS:

7.1	The curriculum adheres to appropriate, delineated standards and is vertically aligned to ensure that every student successfully completes a rigorous and coherent sequence of academic courses based on the standards and rooted in Catholic values.
7.2	Standards are adopted across the curriculum and include integration of the religious, spiritual, moral, and ethical dimensions of learning in all subjects.
7.3	Curriculum and instruction for 21st century learning provide students with the knowledge, understanding and skills to become creative, reflective, literate, critical and moral evaluators, problem solvers, decision makers, and socially responsible citizens.
7.4	Curriculum and instruction for 21st century learning prepares students to become expert users of technology, able to create, publish, and critique digital products that reflect their understanding of the content and their technological skills.
7.5	Classroom instruction is designed to intentionally address the affective dimensions of learning, such as intellectual and social dispositions, relationship building, and habits of mind.
7.6	Classroom instruction is designed to engage and motivate all students, addressing the diverse needs and capabilities of each student and accommodating students with special needs as fully as possible.
7.7	Faculty collaborate in professional learning communities to develop, implement, and continuously improve the effectiveness of the curriculum and instruction to result in high levels of student achievement.
7.8	The faculty and professional support staff meet (arch) diocesan, state, and/or national requirements for academic preparation and licensing to ensure their capacity to provide effective curriculum and instruction.
7.9	Faculty and professional support staff demonstrate and continuously improve knowledge and skills necessary for effective instruction, cultural sensitivity, and modeling of Gospel values.
7.10	Faculty and staff engage in high quality professional development, including religious formation, and are accountable for implementation that supports student learning.

Standard 8: An excellent Catholic school uses school-wide assessment methods and practices to document student learning and program effectiveness, to make student performances transparent, and to inform the continuous review of curriculum and the improvement of instructional practices. **BENCHMARKS:**

8.1	School-wide and student data generated by a variety of tools are used to monitor, review, and evaluate the curriculum and co-curricular programs; to plan for continued and sustained student growth; and to monitor and assess faculty performance.
8.2	School-wide and aggregated student data are normed to appropriate populations and are shared with all stakeholders.
8.3	Faculty use a variety of curriculum-based assessments aligned with learning outcomes and instructional practices to assess student learning, including formative, summative, authentic performance, and student self-assessment.
8.4	Criteria used to evaluate student work and the reporting mechanisms are valid, consistent, transparent, and justly administered.
8.5	Faculty collaborate in professional learning communities to monitor individual and class-wide student learning through methods such as common assessments and rubrics.

Standard 9: An excellent Catholic school provides programs and services aligned with the mission to enrich the academic program and support the development of student and family life. **BENCHMARKS:**

9.1	School-wide programs for parents/guardians provide opportunities for parents/guardians to partner with school leaders, faculty, and other parents/guardians to enhance the educational experiences for the school community.
9.2	Guidance services, wellness programs, behavior management programs, and ancillary services provide the necessary support for students to successfully complete the school program.
9.3	Co-curricular and extra-curricular activities provide opportunities outside the classroom for students to further identify and develop their gifts and talents and to enhance their creative, aesthetic, social/emotional, physical, and spiritual capabilities.

NATIONAL STANDARDS AND BENCHMARKS FOR EFFECTIVE CATHOLIC ELEMENTARY AND SECONDARY SCHOOLS

INTRODUCTION

Science Teachers as Moral Educators

Updated 2015

The introduction of ethics in science classes is not the only way to portray science as receptive to open-mindedness and critical questioning. But it is an effective way, and it places science squarely in the context in which it actually operates in society. In addition, the very methods of inquiry and standards of public reasoning that science advances can make a valuable contribution to the moral education of students, beginning whenever the study of science begins.

Although ethical questions cannot be answered by science alone it seems clear that a reasonable approach to an ethical question requires carefully attending to, and seeking out, all the relevant facts.* We strive to seek God in all things, recognizing parents as the primary moral educators of the child.**

*Michael S. Pritchard

<http://www.onlineethics.org/CMS/edu/precol/childrenreason.aspx#teacher>

***(The Catechism of the Catholic Church #2221)*

THE SCIENCE PROCESS TERMINOLOGY

The processes of science are skills that develop knowledge, concepts, and application across the curriculum. The processes are often referred to as the “hands-on” laboratory approach to science and must be used throughout the program. Each of the terms has been adapted from American Association for the Advancement of Science and Science Curriculum Improvement Studies and implies active student participation.

OBSERVING: Using the senses to gather information about objects and events in the environment. This skill includes using scientific instruments to extend the range of the human senses and the ability to differentiate relevant from non-relevant.

INQUIRING: Emanates from a student generated question. The student desires to understand scientific ideas or to develop knowledge. The student develops authentic, real world investigations which foster a deeper understanding.

CLASSIFYING: A method for establishing order on collections of objects or events. Students use classification systems to identify objects or events, to show similarities, differences, and interrelationships. It is important to realize that all classification systems are subjective and may change as criteria change. The test for a good classification system is whether others can use it.

MEASURING: A procedure for using instruments to determine the length, area, volume, mass, or other physical properties of an unknown quantity. It requires the proper use of instruments and the ability to calculate the measured results.

QUANTIFYING: The skill includes: number sense, computation, estimation, spatial sense, and higher order mathematical operations.

COMMUNICATING: Transmitting the results of observations and experimental procedures to others through the use of such devices as: graphs, charts, tables, written descriptions, technology, oral presentations, expository writing, etc. Communication is fundamental to science, because it is in exchanging ideas and results of experiments that knowledge is validated by others.

QUESTIONING: The formulating of original questions based on observations and experiences with an event in such a way that one can experiment to seek the answers.

RELATING: In the sciences, information about relationships can be descriptive or experimental. relationships are based on logical arguments that encompass all data. Hypothetical reasoning, deductive reasoning, coordinate graphing, the managing of variables, and the comparison of effects of one variable upon another contribute to understanding the major concepts of science.

INFERRING: An inference is a tentative explanation that is based on partial observations. Available data is gathered and an evaluation made based on the observed data. These judgments are never absolute and reflect what appears to be the most probable explanation at the time and are subject to change as new data is accumulated.

PREDICTING: Using previously-observed information to determine probable outcomes about future events.

FORMULATING HYPOTHESES: Stating a probable outcome for an occurrence based on observations and inferences. The validity of the hypothesis is determined from testing and data analysis.

IDENTIFYING AND CONTROLLING VARIABLES: Determining what elements in a given investigation will vary or change and what will remain constant. Ideally scientists will attempt to identify all the variables before an investigation is conducted. By manipulating one variable at a time they can determine how that variable will affect the outcome.

EXPERIMENTING: Experimentation often begins with observations, which lead to questions that need answers. The steps for proceeding may include forming a hypothesis, identifying and controlling variables, designing the procedure for conducting tests, implementing tests, collecting and interpreting the data and reaching a conclusion.

APPLYING: The process of inventing, creating, problem solving, and determining probabilities are applications of using knowledge to discover further information.

CONSTRUCTING MODELS: Developing physical or mental representations to explain an idea, object or event. Models are usually developed on the basis of an acceptable hypothesis.

SCIENCE CURRICULUM STANDARDS

Grades K-12

Standards Coding

Science Standards 1.S5.C2.DPO1 (2008) = Grade 1, Strand 5, Concept 2, Diocesan Performance Objective 1.

Note to the teachers:

In developing the 2024 science standards for the Catholic Schools of the Diocese of Phoenix, the science teachers of the committee recognized the recurring theme of student-led discovery learning. While there is merit and research to support the importance of student engagement through developing models and trial and error through testing hypotheses, we want to make it clear that it is with the support of the teachers' expertise and guidance that students must still experience a good amount of instruction, assessment, and evaluation of the quality of solutions attempted through discovery. We also believe it is essential that the teacher is the moral guide in the classroom to guide students' understanding of the moral and ethical aspects of science. These elements of the Diocesan curriculum are the core of our mission and may not be found in your textbooks or in your teaching materials. Therefore, it is with great faith that we place the intent of the Diocesan curriculum in the hands of our teachers to teach process, content, and effective problem solving through high expectations and with the Catholic worldview at the center of it all.

Kindergarten Science Standards

Domain: Forces and Interactions: Pushes and Pulls			
Code:	Strand:	Rating	Completed
K.PS1	Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. [Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.] [Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.]	Priority	
K.PS2.DPO.1	Demonstrate the various ways that objects can move (e.g. straight line, zigzag, back and-forth, round-and-round, fast, slow. Formerly 1.S5.C2.DPO1	Supporting	
K.PS2	Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.* [Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.] [Assessment Boundary: Assessment does not include friction as a mechanism for change in speed.	Priority	

<p>Catholic Identity</p> <ul style="list-style-type: none"> Share materials and work together in small groups, listen to the ideas of others. Show respectful interaction. Use simple tools to make tasks easier. Use God given intellect to approach the tasks. 	<p>Science and Engineering Practices</p> <p><u>Planning and Carrying Out Investigations</u> Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. With guidance, plan and conduct an investigation in collaboration with peers. (K.PS2.1)</p> <p><u>Analyzing and Interpreting Data</u> Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. Analyze data from tests of an object or tool to determine if it works as intended. (K.PS2.2)</p>	<p>Disciplinary Ideas</p> <p><u>PS2.A: Forces and Motion</u></p> <ul style="list-style-type: none"> Pushes and pulls can have different strengths and directions. (K.PS2.1), (K.PS2.2) Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. (K.PS2.1),(K.PS2.2) <p><u>PS2.B: Types of Interactions</u></p> <ul style="list-style-type: none"> When objects touch or collide, they push on one another and can change motion. (K.PS2.1) <p><u>PS3.C: Relationship Between Energy and Forces</u></p> <ul style="list-style-type: none"> A bigger push or pull makes things speed up or slow down more quickly. (secondary to K.PS2.1) <p><u>ETS1.A: Defining Engineering Problems</u> A situation that people want to change or create can be approached as a problem to be solved</p>
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	<p style="text-align: center;">-----</p> <p style="text-align: center;"><i>Connections to the Nature of Science</i></p> <p>Scientific Investigations Use a Variety of Methods Scientists use different ways to study the world. (K.PS2.1)</p>	<p>through engineering. Such problems may have many acceptable solutions. (secondary to K.PS2.2)</p>
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Domain: Interdependent Relationships in Ecosystems: Animals, Plants, and their Environment

Code:	Strand:	Rating	Completed
K.LS1	Use observations to describe patterns of what plants and animals (including humans) need to survive. [Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]	Priority	
K.LS1. DPO1	Identify plants and animals that exist in the local environment. Formerly 1.S4.C3.DPO1	Supporting	
K.LS2	Compare habitats (e.g. desert, forest, prairie, water underground) in which plants and animals live. Formerly 1.S4.C3.DPO2.	Supporting	
K.ESS1	Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs. [Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digs in the ground to hide its food and tree roots can break concrete.]	Priority	
K.ESS1.DPO1	Describe how plants and animals within a habitat are dependent on each other. Formerly 1.S4.C3. DPO3.	Supporting	
K.ESS2	Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live. [Examples of relationships could include that deer eat buds and leaves, therefore, they usually live in forested areas; and, grasses need sunlight so they often grow in meadows. Plants, animals, and their surroundings make up a system.]	Priority	
K.ESS3 DPO1	Know that animals require air, water, food, and shelter; plants require air, water, nutrients, and light. Formerly 1.S4.C3.DPO4.	Priority	
K.ESS3.1	Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.* [Clarification Statement: Examples of human impact on the land could include cutting trees to produce paper and using resources to produce bottles. Examples of solutions could include reusing paper and recycling cans and bottles.]	Supporting	
K.ESS4.DPO2	Identify ways to conserve natural resources (e.g. reduce, reuse, recycle, find alternatives. Formerly 1.S6.C1.DPO5.	Priority	

Catholic Identity

- Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated.
- Share Biblical stories related to weather and climate: creation story or Noah. Consider what it would be like to spend 40 days out in the desert.
- How do other life forms utilize the sun for sustenance?
- Relate various seasons to different cycles of the Church.
 - Why did God create the sun?
 - What do we use the sun for?
 - What other life forms, (e.g. plants and insects) need the sun?

Science and Engineering Practices

Developing and Using Models

Analyzing Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, storyboard) that represent concrete events or design solutions.

- Use a model to represent relationships in the natural world. (K.ESS3.1)

Analyzing and Interpreting Data

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K.LS1.1)

Engaging in Argument from Evidence

- Engaging in argument from evidence in K– 2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).
- Construct an argument with evidence to support a claim. (K.ESS2.2)

Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.

- Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas. (K.ESS3.3)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

Scientists look for patterns and order when making observations about the world. (K.LS1.1)

Disciplinary Ideas

LS1.C: Organization for Matter and Energy Flow in Organisms

- All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. (K.LS1.1)

ESS2.E: Biogeology

- Plants and animals can change their environment. (K.ESS2.2)

ESS3.A: Natural Resources

- Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. (K.ESS3.1)

ESS3.C: Human Impacts on Earth Systems

- Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things. (K.ESS3.3)

ETS1.B: Developing Possible Solutions

Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem’s solutions to other people. (secondary to K.ESS3.3)

Domain: Weather and Climate			
Code:	Strand:	Rating	Completed
K.PS3.1	Make observations to determine the effect of sunlight on Earth's surface. [Clarification Statement: Examples of Earth's surface could include sand, soil, rocks, and water] [Assessment Boundary: Assessment of temperature is limited to relative measures such as warmer/cooler.]	Priority	
K.PS3.DPO1	Identify evidence that the Sun is the natural source of heat and light on the Earth (e.g., warm surfaces, shadows, shade). Formerly 1.S6.C2.DPO1	Priority	
K.PS3.2	Use tools and materials provided to design and build a structure that will reduce the warming effect of sunlight on Earth's surface.* [Clarification Statement: Examples of structures could include umbrellas, canopies, and tents that minimize the warming effect of the sun.]	Supporting	
K.ESS2.1	Use and share observations of local weather conditions to describe patterns over time. [Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, and warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months.] [Assessment Boundary: Assessment of quantitative observations limited to whole numbers and relative measures such as warmer/cooler.]	Supporting	
K.ESS2.DPO1	Identify the following characteristics of seasonal weather patterns: temperature, type of precipitation, and wind. Formerly 1.S6.C3.DPO1.	Priority	
K.ESS2.DPO2	Analyze how the weather affects daily activities. Formerly 1.S6.C3.DPO2.	Supporting	
K.ESS3.2	Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.* [Clarification Statement: Emphasis is on local forms of severe weather.]	Supporting	
K.ESS3.DPO1	Know that short-term weather conditions (e.g. temperature, rain, snow) can change daily and weather patterns can change over the seasons. Formerly 1.S6.C3.DPO3.	Supporting	

<p>Catholic Identity</p> <ul style="list-style-type: none"> • Share materials and work together in small groups, listen to the ideas of others. Show respect to others. Treat others as you want to be treated. • Share Biblical stories related to weather and climate: creation story or Noah. Consider what it would be like to spend 40 days out in the desert. • How do other life forms utilize the sun for sustenance? • Relate various seasons to 	<p>Science and Engineering Practices</p> <p><u>Asking Questions and Defining Problems</u> Asking questions and defining problems in grades K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.</p> <ul style="list-style-type: none"> • Ask questions based on observations to find more information about the designed world. (K. ESS3.2) <p><u>Planning and Carrying Out Investigations</u></p>	<p>Disciplinary Ideas</p> <p><u>PS3.B: Conservation of Energy and Energy Transfer</u></p> <ul style="list-style-type: none"> • Sunlight warms Earth's surface. (K.PS3.1), (K.PS3.2) <p><u>ESS2.D: Weather and Climate</u></p> <ul style="list-style-type: none"> • Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time. (K.ESS2.1) <p><u>ESS3.B: Natural Hazards</u></p>
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different cycles of the Church.

- Why did God create the sun?
- What do we use the sun for?
- What other life forms, (e.g. plants and insects) need the sun?

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Make observations (firsthand or from media) to collect data that can be used to make comparisons. (K.PS3.1)

Analyzing and Interpreting Data

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K.ESS2.1)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Use tools and materials provided to design and build a device that solves a specific problem or a solution to a specific problem. (K.PS3.2)

Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.

- Read grade-appropriate texts and/or use media to obtain scientific information to describe patterns in the natural world. (K.ESS3.2)

Connections to Nature of Science

Scientific Investigations Use a Variety of Methods

- Scientists use different ways to study the world. (K.PS3.1)

Science Knowledge is Based on Empirical Evidence

Scientists look for patterns and order when making observations about the world. (K.ESS2.1)

- Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events. (K.ESS3.2)

ETS1.A: Defining and Delimiting an Engineering Problem

- Asking questions, making observations, and gathering information are helpful in thinking about problems. (secondary to K.ESS3.2)

Domain: K-2 Engineering Design			
Code:		Rating	Completed
K-2.ETS1.1.	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool	Priority	
K-2.ETS1.2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	Priority	
K-2.ETS1.3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	Priority	

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
<ul style="list-style-type: none"> Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated. Use simple tools to make tasks easier. Use God given intellect to approach the tasks. Consider Biblical stories that highlight building, moving structures, etc., such as the building of the pyramids. (Consider: Can a mountain be moved? A building? A brick? Demonstrate.) Compare engineering design and God's intellectual design of life forms. Compare designs of cathedral structures and their components. Use blocks to show complexity of design elements. 	<p>Asking Questions and Defining Problems Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions.</p> <ul style="list-style-type: none"> Ask questions based on observations to find more information about the natural and/or designed world(s). (K- 2.ETS1.1) Define a simple problem that can be solved through the development of a new or improved object or tool. (K- 2.ETS1.1) <p>Developing and Using Models Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.</p> <ul style="list-style-type: none"> Develop a simple model based on evidence to represent a proposed object or tool. (K-2.ETS1.2) <p>Analyzing and Interpreting Data Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.</p> <ul style="list-style-type: none"> Analyze data from tests of an object or tool to determine if it works as intended. (K-2.ETS1.3) 	<p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2.ETS1.1) Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2.ETS1.1) Before beginning to design a solution, it is important to clearly understand the problem. (K-2.ETS1.1) <p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2.ETS1.2) <p>ETS1.C: Optimizing the Design Solution</p> <ul style="list-style-type: none"> Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2.ETS1.3)

Grade 1 Science Standards

Domain: Structure, Function, and Information Processing			
Code:	Strand:	Rating	Completed
1.LS1	Identify the following as characteristics of living things: Growth and Development, Reproduction, Response to Stimulus. Formerly 1.S4.C1.DPO1	Priority	
1.LS1.1	Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.* [Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and, detecting intruders by mimicking eyes and ears.	Supporting	
1.LS1.2	Compare the following observable features of living things: Movement (legs, wings), Protection (skin, feathers, tree bark), Respiration (lungs, gills), Support (plant stems, tree trunks). Formerly 1.S4.C1.DPO2.	Supporting	
1.LS1.3	Identify observable similarities and differences (e.g., number of legs, body, coverings, size) between/among different groups of animals. Formerly 1.S4.C1.DPO3	Supporting	
1.LS2	Understand the function and importance of the five senses. Formerly 1.S4.C1.DPO4	Priority	
1.LS2.1	Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.[Clarification Statement: Examples of patterns of behaviors could include the signals that offspring make (such as crying, cheeping, and other vocalizations) and the responses of the parents (such as feeding, comforting, and protecting the offspring).]	Supporting	
1.LS3	Identify stages of human life (e.g., infancy, adolescence, adult). Formerly 1.S4.C2.DPO1.	Priority	
1.LS3.1	Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents. [Clarification Statement: Examples of patterns could include features plants or animals share. Examples of observations could include leaves from the same kind of plant are the same shape but can differ in size; and, a particular breed of dog looks like its parents but is not exactly the same.] [Assessment Boundary: Assessment does not include inheritance or animals that undergo metamorphosis or hybrids.]	Supporting	
1.LS4	Identify similarities and differences between animals and their parents. Formerly 1.S4.C2.DPO2.	Priority	

Catholic Identity

- Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated.
- Use simple tools to make tasks easier. Use God given intellect to approach the tasks.
- Understand that God created man in his own image.
- Reference Genesis. Identify aspects of the creation story and how all living things came to be.
- Use the five senses to appreciate skin, fur, feathers, etc. in understanding the creation story.
- Consider “creating” animals from materials and the care that goes into forming a creation. Consider how a creator cares for a creation and keeps it safe?

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (1.LS3.1)
- Use materials to design a device that solves a specific problem or a solution to a specific problem. (1.LS1.1)

Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.

- Read grade-appropriate texts and use media to obtain scientific information to determine patterns in the natural world. (1.LS1.2)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Scientists look for patterns and order when making observations about the world. (1.LS1.2)

Disciplinary Ideas

LS1.A: Structure and Function

- All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. (1.LS1.1)

LS1.B: Growth and Development of Organisms

- Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive. (1.LS1.2)

LS1.D: Information Processing

- Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs. (1.LS1.1)

LS3.A: Inheritance of Traits

- Young animals are very much, but not exactly like, their parents. Plants also are very much, but not exactly, like their parents. (1.LS3.1)

LS3.B: Variation of Traits

- Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways. (1.LS3.1)

Domain: Waves: Light and Sound			
Code:		Rating	Completed
1.PS 1	Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate. [Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.]	Priority	
1.PS 1.2	Demonstrate that vibrating objects produce sound. Formerly 3.S5.C3.DPO3	Supporting	
1.PS 2	Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated. [Clarification Statement: Examples of observations could include those made in a completely dark room, a pinhole box, and a video of a cave explorer with a flashlight. Illumination could be from an external light source or by an object giving off its own light.]	Priority	
1PS 3	Describe how light behaves on striking objects that are: Transparent (clear plastic), Translucent (waxed paper), Opaque (cardboard). Formerly 3.S5.C3.DPO2	Priority	
1.PS 3.1	Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light. [Clarification Statement: Examples of materials could include those that are transparent (such as clear plastic), translucent (such as wax paper), opaque (such as cardboard), and reflective (such as a mirror).] [Assessment Boundary: Assessment does not include the speed of light.]	Supporting	
1.PS3.2	Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.* [Clarification Statement: Examples of devices could include a light source to send signals, paper cup and string “telephones,” and a pattern of drum beats.] [Assessment Boundary: Assessment does not include technological details for how communication devices work.]	Supporting	

<p>Catholic Identity</p> <ul style="list-style-type: none"> Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated. Use simple tools to make tasks easier. Use God given intellect to approach the tasks. Consider Biblical stories that highlight building, moving 	<p>Science and Engineering Practices</p> <p><u>Planning and Carrying Out Investigations</u> Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.</p>	<p>Disciplinary Ideas</p> <p><u>PS4.A: Wave Properties</u></p> <ul style="list-style-type: none"> Sound can make matter vibrate, and vibrating matter can make sound. (1.PS4.1) <p><u>PS4.B: Electromagnetic Radiation</u></p> <ul style="list-style-type: none"> Objects can be seen if light is available to illuminate them or if they give off their own light. (1.PS4.2)
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<p>structures, etc., such as the building of the pyramids. (Consider: Can a mountain be moved? A building? A brick? Demonstrate.)</p> <ul style="list-style-type: none"> • Compare engineering design and God’s intellectual design of life forms. • Compare designs of cathedral structures and their components. Use blocks to show complexity of design elements. 	<ul style="list-style-type: none"> • Plan and conduct investigations collaboratively to produce evidence to answer a question. (1.PS4.1),(1.PS4.3) <p><u>Constructing Explanations and Designing Solutions</u> Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.</p> <ul style="list-style-type: none"> • Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (1.PS4.2) • Use tools and materials provided to design a device that solves a specific problem. (1.PS4.4) <hr style="border-top: 1px dashed black;"/> <p style="text-align: center;"><i>Connections to Nature of Science</i></p> <p>Scientific Investigations Use a Variety of Methods</p> <ul style="list-style-type: none"> • Science investigations begin with a question. (1.PS4.1) • Scientists use different ways to study the world. (1.PS4.1) 	<ul style="list-style-type: none"> • Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam. (Boundary: The idea that light travels from place to place is developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.) (1.PS4.3) <p><u>PS4.C: Information Technologies and Instrumentation</u> People also use a variety of devices to communicate (send and receive information) over long distances. (1.PS4.4)</p>
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Domain: Space Systems: Patterns and Cycles			
Code:		Rating	Completed
1.ESS1	Use observations of the sun, moon, and stars to describe patterns that can be predicted. [Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars other than our sun are visible at night but not during the day.] [Assessment Boundary: Assessment of star patterns is limited to stars being seen at night and not during the day.]	Priority	
1.ESS1.1	Compare celestial objects (e.g., Sun, Moon, stars) and transient objects in the sky (e.g., clouds, birds, airplanes, contrails). Formerly 1.S6.C2.DPO2	Supporting	
1.ESS2	Describe observable changes that occur in the sky. (e.g., clouds forming and moving, the position of the Moon. Formerly 1.S6.C2.DPO3	Priority	
1.ESS3	Make observations at different times of year to relate the amount of daylight to the time of year. [Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.] [Assessment Boundary: Assessment is limited to relative amounts of daylight, not quantifying the hours or time of daylight.]	Priority	

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
<ul style="list-style-type: none"> Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated. Reference creation of the sun and moon in Genesis. Reference the star of Bethlehem as the heavenly body that brought the wise men to Jesus and the stars as the guide for Columbus crossing the ocean. Identify how diverse people and/or cultures, past and present, have made important contributions to scientific innovations using God’s gifts (e.g., Sally Ride [scientist], Neil Armstrong [astronaut, engineer]. They were inspired by their intellect and drawn to the heavens out of curiosity. Introduce the term “Heavenly Bodies” and explain the phrase in relation to their place in the universe. 	<p><u>Planning and Carrying Out Investigations</u> Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.</p> <ul style="list-style-type: none"> Make observations (firsthand or from media) to collect data that can be used to make comparisons. (1.ESS1.2) <p><u>Analyzing and Interpreting Data</u> Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.</p> <ul style="list-style-type: none"> Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (1.ESS1.1) 	<p><u>ESS1.A: The Universe and its Stars</u></p> <ul style="list-style-type: none"> Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. (1.ESS1.1) <p><u>ESS1.B: Earth and the Solar System</u></p> <ul style="list-style-type: none"> Seasonal patterns of sunrise and sunset can be observed, described, and predicted. (1.ESS1.2)

Domain: K-2 Engineering Design			
Code:		Rating	Completed
K-2.ETS1.1.	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool	Priority	
K-2.ETS1.2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	Supporting	
K-2.ETS1.3.	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	Supporting	

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
<ul style="list-style-type: none"> Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated. Use simple tools to make tasks easier. Use God given intellect to approach the tasks. Consider Biblical stories that highlight building, moving structures, etc., such as the building of the pyramids. (Consider: Can a mountain be moved? A building? A brick? Demonstrate.) Compare engineering design and God’s intellectual design of life forms. Compare designs of cathedral structures and their components. Use blocks to show complexity of design elements. 	<p><u>Asking Questions and Defining Problems</u> Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions.</p> <ul style="list-style-type: none"> Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2.ETS1.1) Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2.ETS1.1) <p><u>Developing and Using Models</u> Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.</p> <ul style="list-style-type: none"> Develop a simple model based on evidence to represent a proposed object or tool. (K-2.ETS1.2) <p><u>Analyzing and Interpreting Data</u> Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.</p> <ul style="list-style-type: none"> Analyze data from tests of an object or tool to determine if it works as intended. (K-2.ETS1.3) 	<p><u>ETS1.A: Defining and Delimiting Engineering Problems</u></p> <ul style="list-style-type: none"> A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2.ETS1.1) Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2.ETS1.1) <p>Before beginning to design a solution, it is important to clearly understand the problem. (K-2.ETS1.1)</p> <p><u>ETS1.B: Developing Possible Solutions</u></p> <ul style="list-style-type: none"> Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem’s solutions to other people. (K-2.ETS1.2) <p><u>ETS1.C: Optimizing the Design Solution</u></p> <ul style="list-style-type: none"> Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2.ETS1.3)

Grade 2 Science Standards

Domain: Structure and Properties of Matter			
Code:	Strand:	Rating	Completed
2.PS.1	Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. [Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]	Priority	
2.PS.2	Know that different objects are made up of many different types of materials (e.g., cloth, paper, wood, metal) and have many different observable properties (e.g., color, size, shape, weight). Formerly 1.S5.C1.DPO3.	Supporting	
2.PS.3	Describe objects in terms of measurable properties (e.g., length, volume, weight, temperature) using scientific tools. Formerly 2.S5.C1.DPO1	Supporting	
2.PS.4	Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.* [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [Assessment Boundary: Assessment of quantitative measurements is limited to length.]	Supporting	
2.PS.5	Compare the following physical properties of basic Earth materials: color, texture, capacity to retain water. Formerly 1.S6.C1.DPO2.	Supporting	
2.PS.6	Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]	Supporting	
2.PS.7	Identify common uses (e.g., construction, decoration) of basic Earth materials (e.g., rocks, water, soil). Formerly 1.S6.C1.DPO3.	Priority	
2.PS.8	Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. [Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper.]	Priority	
2.PS.9	Classify materials solids, liquids, or gasses. Formerly 2.S5.C1.DPO2.	Priority	
2.PS.10	Know that water can be a liquid or a solid and can be made to change from one form to the other, but the amount of water stays the same. Formerly 2.S5.C1.DPO3	Priority	
2.PS.11	Demonstrate that water can exist as a: gas-vapor, liquid-water, solid-ice. Formerly 2.S5.C1.DPO4.	Priority	
2.PS.12	Demonstrate that solids have a definite shape and that liquids and gases take the shape of their containers. Formerly 2.S5.C1.DPO5.	Priority	

Catholic Identity

- Listen respectfully to others when they present their findings. Ask appropriate questions. Be respectful. Treat others as you would like to be treated.
- Reference the omnipotence and power of God in the multiplying loaves and fishes, the parting of the Red Sea, and water to wine at the wedding at Cana stories (and others). Compare the reality of physical properties, such as melting, freezing, and evaporating, and compare how God’s intervention, miracles, can defy natural order.
- In preparation for receiving the Eucharist, reference the concept of Transubstantiation as a miracle that happens at mass. Man cannot change a physical property without changing its components, but God can and does when the body and blood change into Jesus.

Science and Engineering Practices

Planning and Carrying Out Investigations

- Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.(2.PS1.1)

Analyzing and Interpreting Data

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Analyze data from tests of an object or tool to determine if it works as intended. (2.PS1.2)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2.PS1.3)

Engaging in Argument from Evidence

Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).

- Construct an argument with evidence to support a claim. (2.PS1.4)

Connections to Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Science searches for cause and effect relationships to explain natural events. (2.PS1.4)

Disciplinary Ideas

PS1.A: Structure and Properties of Matter

Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2.PS1.1)

PS1.A: Structure and Properties of Matter

- Different properties are suited to different purposes. (2.PS1.2),(2.PS1.3)
- A great variety of objects can be built up from a small set of pieces. (2.PS1.3)

PS1.B: Chemical Reactions

- Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2.PS1.4)

Domain: Interdependent Relationships in Ecosystems			
Code:	Strand:	Rating	Completed
2.LS2.1	Plan and conduct an investigation to determine if plants need sunlight and water to grow. [Assessment Boundary: Assessment is limited to testing one variable at a time.]	Priority	
2.LS2	Develop a simple model that mimics the function of an animal in dispersing seeds or Pollinating plants.*	Priority	
2.LS3	Make observations of plants and animals to compare the diversity of life in different habitats. [Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.] [Assessment Boundary: Assessment does not include specific animal and plant names in specific habitats.]	Priority	
2.LS4	Identify some plants and animals that exist in the local environment. Formerly 1.S4.C3.DPO1.	Priority	
2.LS5	Compare the habitats (e.g., desert, forest, prairie, water, underground) in which plants and animals live. Formerly 1.S4.C3.DPO2.	Priority	
2.LS6	Describe how plants and animals within a habitat are dependent on each other. Formerly 1.S4.C3.DPO3.	Priority	
2.LS7	Compare life cycles of various plants (e.g., conifers, flowering plants, ferns). Formerly 3.S4.C2.DPO1	Priority	
2.LS8	Explain how growth, death, and decay are part of the plant life cycle. Formerly 3.S4.C2.DPO2.	Priority	

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
<ul style="list-style-type: none"> Listen respectfully to others when they present their findings. Ask appropriate questions. Be respectful. Treat others as you would like to be treated. Understand that plants are a part of God’s creation and require us to care for them. Reference Genesis: In the Garden of Eden, everything was given to Adam and Eve. Once they were banished, they had to work the land. Make a connection to gardening, the cycle of life and death related to growth and decay. Compare the death and resurrection to the life cycle of a 	<p>Developing and Using Models Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.</p> <ul style="list-style-type: none"> Develop a simple model based on evidence to represent a proposed object or tool. (2.LS2.2) <p>Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.</p>	<p>LS2.A: Interdependent Relationships in Ecosystems</p> <ul style="list-style-type: none"> Plants depend on water and light to grow. (2.LS2.1) Plants depend on animals for Pollination or to move their seeds around. (2.LS2.2) <p>LS4.D: Biodiversity and Humans</p> <ul style="list-style-type: none"> There are many different kinds of living things in any area, and they exist in different places on land and in water. (2.LS4.1) <p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem’s solutions to other people. (secondary to 2.LS2.2)

perennial flower (i.e. tulip) or tree that dies and revives with the seasons.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2.LS2.1)
- Make observations (firsthand or from media) to collect data which can be used to make comparisons. (2.LS4.1)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Scientists look for patterns and order when making observations about the world. (2.LS4.1)

Domain: Earth's Systems: Processes that Shape the Earth

Code:	Strand:	Rating	Completed
2.ESS.1	Use information from several sources to provide evidence that Earth events can occur quickly or slowly. [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.] [Assessment Boundary: Assessment does not include quantitative measurements of timescales.]	Priority	
2.ESS.1.2	Classify objects by the following observable properties: shape, texture, size, color, weight. Formerly 1.S5.C1.DPO1.	Supporting	
2.ESS.2	Describe the following basic Earth materials: rocks, soil, water. Formerly 1.S6.C1.DPO1	Priority	
2.ESS2.1	Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.*[Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]	Supporting	
2.ESS2.2	Develop a model to represent the shapes and kinds of land and bodies of water in an area. [Assessment Boundary: Assessment does not include quantitative scaling in models.]	Supporting	
2.ESS.3	Obtain information to identify where water is found on Earth and that it can be solid or liquid.	Priority	
2.ESS.4	Classify materials as solids and liquids. Formerly 1.S5.C1.DPO2.	Priority	

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
<ul style="list-style-type: none"> Listen respectfully to others when they present their findings. Ask appropriate questions. Be respectful. Treat others as you would like to be treated. Relate God's creation and design to current earth systems and structures. 	<p><u>Developing and Using Models</u> Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.</p> <ul style="list-style-type: none"> Develop a model to represent patterns in the natural world. (2.ESS2.2) <p><u>Constructing Explanations and Designing Solutions</u> Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.</p> <ul style="list-style-type: none"> Make observations from several 	<p><u>ESS1.C: The History of Planet Earth</u></p> <ul style="list-style-type: none"> Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe. (2.ESS1. 1) <p><u>ESS2.A: Earth Materials and Systems</u></p> <ul style="list-style-type: none"> Wind and water can change the shape of the land. (2.ESS2.1) <p><u>ESS2.B: Plate Tectonics and Large-Scale System Interactions</u></p> <ul style="list-style-type: none"> Maps show where things are located. One can map the shapes and kinds of land and water in any area. (2.ESS2.2) <p><u>ESS2.C: The Roles of Water in Earth's Surface Processes</u></p> <ul style="list-style-type: none"> Water is found in the ocean, rivers, lakes, and Ponds. Water exists as solid ice and in liquid

	<p>sources to construct an evidence-based account for natural phenomena. (2.ESS1.1)</p> <ul style="list-style-type: none"> • Compare multiple solutions to a problem. (2.ESS2.1) <p><u>Obtaining, Evaluating, and Communicating Information</u></p> <ul style="list-style-type: none"> • Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information. • Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question. (2.ESS2.3) 	<p>form. (2.ESS2.3)</p> <p><u>ETS1.C: Optimizing the Design Solution</u> Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (<i>secondary to 2.ESS2.1</i>)</p>
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Domain: K-2 Engineering Design			
Code:		Rating	Completed
K-2.ETS1.1	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool	Supporting	
K-2.ETS1.2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	Supporting	
K-2.ETS1.3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	Supporting	

<p>Catholic Identity</p> <ul style="list-style-type: none"> Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated. Use simple tools to make tasks easier. Use God given intellect to approach the tasks. Consider Biblical stories that highlight building, moving structures, etc., such as the building of the pyramids. (Consider: Can a mountain be moved? A building? A brick? Demonstrate.) Compare engineering design and God’s intellectual design of life forms. Compare designs of cathedral structures and their components. Use blocks to show complexity of design elements. 	<p>Science and Engineering Practices</p> <p><u>Asking Questions and Defining Problems</u> Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions.</p> <ul style="list-style-type: none"> Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2.ETS1.1) Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2.ETS1.1) <p><u>Developing and Using Models</u> Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.</p> <ul style="list-style-type: none"> Develop a simple model based on evidence to represent a proposed object or tool. (K-2.ETS1.2) <p><u>Analyzing and Interpreting Data</u> Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.</p> <ul style="list-style-type: none"> Analyze data from tests of an object or tool to determine if it works as intended. (K-2.ETS1.3) 	<p>Disciplinary Ideas</p> <p><u>ETS1.A: Defining and Delimiting Engineering Problems</u></p> <ul style="list-style-type: none"> A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2.ETS1.1) Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2.ETS1.1) Before beginning to design a solution, it is important to clearly understand the problem. (K-2.ETS1.1) <p><u>ETS1.B: Developing Possible Solutions</u></p> <ul style="list-style-type: none"> Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem’s solutions to other people. (K-2.ETS1.2) <p><u>ETS1.C: Optimizing the Design Solution</u></p> <ul style="list-style-type: none"> Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K- 2.ETS1.3)
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Grade 3 Science Standards

Domain: Forces and Interactions			
Code:	Strand:	Rating	Completed
3.PS1	Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.	Supporting	
3.PS 1	Define and describe the forces of gravity and friction.	Priority	
3.PS1.2	Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.	Supporting	
3.PS1.3	Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.	Supporting	
3.PS2	Investigate the characteristics of magnets (e.g., opposite poles attract, like poles repel, the force between two magnets poles depends on the distance between them).	Priority	
3.PS2.1	State cause and effect relationships between magnets and circuitry.	Supporting	
3.PS2.2	Identify and explain a simple design problem that can be solved by applying scientific ideas about magnets.*	Supporting	

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Place physical obstacles between a magnet and a metal object. Explain that the greater the object (or obstacle/sin) the more difficult it is for us to feel the draw of God. Talk about obstacles or sins that can keep us from feeling God's invitation for love.

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Ask questions that can be investigated based on patterns such as cause and effect relationships. (3.PS2.3)
- Define a simple problem that can be solved through the development of a new or

Disciplinary Ideas

PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3.PS2.1)
- The patterns of an object's motion in various situations can

Crosscutting Concepts

Patterns

- Patterns of change can be used to make predictions. (3.PS2.2)

Cause and Effect

- Cause and effect relationships are routinely identified. (3.PS2.1)
- Cause and effect relationships are routinely identified, tested, and used to explain change. (3.PS2.3)

Connections to Engineering, Technology, and Applications of Science

<p>improved object or tool. (3.PS2.4)</p> <p>Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.</p> <ul style="list-style-type: none"> Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3.PS2.1) Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3.PS2.2) <p>-----</p> <p><i>Connections to Nature of Science</i></p> <p>Science Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science findings are based on recognizing patterns. (3.PS2.2) Scientific Investigations Use a Variety of Methods <p>Science investigations use a variety of methods, tools, and techniques. (3.PS2.1)</p>	<p>be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3.PS2.2)</p> <p>PS2.B: Types of Interactions</p> <ul style="list-style-type: none"> Objects in contact exert forces on each other. (3.PS2.1) Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3.PS2.3),(3.PS2.4) 	<p>Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. (3.PS2.4)</p>
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Domain: Weather and Climate			
Code:	Strand:	Rating	Completed
3.ESS3.1	Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.	Supporting	
3.ESS3.2	Interpret the symbols on a weather map or chart to identify the following: temperatures, fronts, precipitation.	Supporting	
3.ESS3	Obtain and combine information to describe climates in different regions of the world.	Priority	
3.ESS4	Compare weather conditions and various conditions (e.g., regions of Arizona, various U.S. cities, coastal vs. interior geographical regions).	Priority	
3.ESS4.1	Defend the merit of a design solution that reduces the impacts of a weather-related hazard.	Supporting	

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Evaluate the consequences of environmental occurrences that happen either rapidly or over a long period of time and how we are called in solidarity to help those involved in these events.
- Reference the Corporal and Spiritual Works of Mercy to enhance discussion about the impact of severe weather conditions on living things throughout the world.

<p>Science and Engineering Practices</p> <p>Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.</p> <ul style="list-style-type: none"> • Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3.ESS2.1) <p>Engaging in Argument from Evidence Engaging in argument from evidence in 3– 5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).</p> <ul style="list-style-type: none"> • Make a claim about the 	<p>Disciplinary Ideas</p> <p>ESS2.D: Weather and Climate</p> <ul style="list-style-type: none"> • Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3.ESS2.1) • Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3.ESS2.2) <p>ESS3.B: Natural Hazards</p> <ul style="list-style-type: none"> • A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (3.ESS3.1) <p>(Note: This Disciplinary Core Idea is also addressed by 4.ESS3.2.)</p>	<p>Crosscutting Concepts</p> <p>Patterns</p> <ul style="list-style-type: none"> • Patterns of change can be used to make predictions. (3.ESS2.1),(3.ESS2.2) <p>Cause and Effect</p> <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified, tested, and used to explain change. (3.ESS3.1) <p>-----</p> <p>Connections to Engineering, Technology, and Applications of Science</p> <ul style="list-style-type: none"> • Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (3.ESS3.1)
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merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3.ESS3.1)

Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.

- Obtain and combine information from books and other reliable media to
- explain phenomena. (3.ESS2.2)

Connections to Nature of Science

Science is a Human Endeavor

- Science affects everyday life. (3.ESS3.1)

Domain: Engineering Design			
Code:	Strand:	Rating	Completed
3.5.ETS1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	Priority	
3.5.ETS1.2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem	Supporting	
3.5.ETS1.3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved	Supporting	

Catholic Identity

- Share materials and work together in small groups, listen to the ideas of others. Be respectful and treat others as you wish to be treated.
- Use the God given gift of intellect to be resourceful and use simple tools to make tasks easier.
- Consider the pastoral as well as the practical nature of the problems and solutions we address.

Science and Engineering Practices

Asking Questions and Defining Problems
 Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5.ETS1.1)

Planning and Carrying Out Investigations
 Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of

Disciplinary Ideas

ETS1.A: Defining and Delimiting Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5.ETS1.1)

ETS1.B: Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5.ETS1.2)
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)
- Tests are often designed to

Crosscutting Concepts

Influence of Science, Engineering, and Technology on Society and the Natural World

- People’s needs and wants change over time, as do their demands for new and improved technologies. (3-5.ETS1.1)
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5.ETS1.2)

<p>trials considered. (3-5.ETS1.3)</p> <p>Constructing Explanations and Designing Solutions</p> <p>Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</p> <ul style="list-style-type: none"> • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5.ETS1.2) 	<p>identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5.ETS1.3)</p> <p>ETS1.C: Optimizing the Design Solution</p> <ul style="list-style-type: none"> • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5.ETS1.3) 	
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Domain: Interdependent Relationships in Ecosystems			
Code:	Strand:	Rating	Completed
3.LS2.1.	Construct an argument that some animals form groups that help members survive	Priority	
3.LS4.1	Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.	Supporting	
3.S6.C1.DPO4	Describe fossils as a record of past forms.	Priority	
3.S6.C1.DPO5	Describe how fossils are formed.	Supporting	
3.LS4.3	Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.	Priority	
3.S4.C3.DPO1	Identify the living and nonliving components of an ecosystem.	Supporting	
3.S4.C3.DPO2	Describe the components of an ecosystem.	Priority	
3.S4.C3.DPO3	Examine an ecosystem to identify microscopic and macroscopic organisms.	Supporting	
3.S4.C3.DPO1.1	Describe ways various resources (e.g., air, water, plants, animals, soil) are utilized to meet the needs of population.	Priority	
3.S4.C3.DPO3.1	Analyze the effect that limited resources (e.g., natural gas, minerals) may have on an environment.	Supporting	
3.LS4.4	Defend the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.	Supporting	
3.S4.C3.DPO6	Describe how plants and animals cause changes in their environment	Supporting	
3.S4.C3.DPO7	Describe how environmental factors (e.g., soil composition, range of temperature, quantity and quality of light) in the ecosystem may affect a member organism's ability to grow, reproduce, and thrive.	Priority	

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Understand that all plants and animals are God’s creation and require us to care for it.
- Recognize we are stewards of all God’s creation and that we were made in His image and likeness.
- Identify causes and effect of hunger in the world.
- Describe the development of different technologies (medicine, communication, entertainment, transportation) in response to resources, needs and values.
- Find out how students in your school can help families affected by a natural disaster. Plan a way to help in a small way. Propose a solution, resource, or product that addresses a specific human, animal, or habitat need.

Science and Engineering Practices

Analyzing and Interpreting Data

Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.

- Analyze and interpret data to make sense of phenomena using logical reasoning. (3.LS4.1)

Engaging in Argument from Evidence

Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed worlds.

- Construct an argument with evidence, data, and/or a model. (3.LS2.1)
- Construct an argument with evidence. (3.LS4.3)
- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-LS4-4)

Disciplinary Ideas

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (secondary to 3.LS4.4)

LS2.D: Social Interactions and Group Behavior

- Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.

LS4.A: Evidence of Common Ancestry and Diversity

- Some kinds of plants and animals that once lived on Earth are no longer found anywhere.
- Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. (3.LS4.1)

LS4.C: Adaptation

- For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3)

LS4.D: Biodiversity and Humans

- Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3.LS4.4)

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change. (3.LS2.1),(3.LS4.3)
- Scale, Proportion, and Quantity Observable phenomena exist from very short to very long time periods. (3.LS4.1)

Systems and System Models

- A system can be described in terms of its components and their interactions. (3.LS4.4)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Knowledge of relevant scientific concepts and research findings is important in engineering. (3.LS4.4)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural System

- Science assumes consistent patterns in natural systems. (3.LS4.1)

Domain: Inheritance and Variation of Traits: Life Cycles and Traits

Code:	Strand:	Rating	Completed
3.LS1.1	Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.	Priority	
3.S4.C2.DPO1	Compare life cycles of various plants (e.g., conifers, flowering plants, ferns).	Supporting	
3.S4.C2.DPO2	Explain how growth and decay are part of the plant life cycle.	Supporting	
3.LS3.1	Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.	Priority	
3.S4.C2.DPO3	Define the terms heredity and genes.	Supporting	
3.S4.C2.DPO4	Distinguish between physical characteristics which are and are not inherited.	Supporting	
3.LS3.2	Use evidence to support the explanation that traits can be influenced by the environment.	Supporting	
3.LS4.2	Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.	Priority	

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Recognize that we all have special gifts and talents from God.
- Emphasize the unique trait of having a soul that is specific to humans.
- Recognize respect for all living things as God's creations.

Science and Engineering Practices

Developing and Using Models

Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

- Develop models to describe phenomena (3.LS1.1)

Analyzing and Interpreting Data

Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.

Disciplinary Ideas

LS1.B: Growth and Development of Organisms

Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3.LS1.1)

LS3.A: Inheritance of Traits

- Many characteristics of organisms are inherited from their parents. (3.LS3.1)
- Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3.LS3.2)

Crosscutting Concepts

Patterns

- Similarities and differences in patterns can be used to sort and classify natural phenomena. (3.LS3.1)
- Patterns of change can be used to make predictions. (3.LS1.1)

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change. (3.LS3.2),(3.LS4.2)

Connections to Engineering, Technology, and Applications of Science

<ul style="list-style-type: none"> Analyze and interpret data to make sense of phenomena using logical reasoning. (3.LS3.1) <p>Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</p> <ul style="list-style-type: none"> Use evidence (e.g., observations, patterns) to support an explanation. (3.LS3.2) Use evidence (e.g., observations, patterns) to construct an explanation. (3.LS4.2) <hr/> <p>Connections to Nature of Science</p> <p>Science Knowledge is Based on Empirical Evidence</p>	<p>LS3.B: Variation of Traits</p> <ul style="list-style-type: none"> Different organisms vary in how they look and function because they have different inherited information. (3.LS3.1) The environment also affects the traits that an organism develops. (3.LS3.2) <p>LS4.B: Natural Selection</p> <ul style="list-style-type: none"> Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3.LS4.2) spin axis is fixed in direction over the short- term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS.ESS1. 1) The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS.ESS1.2) 	<ul style="list-style-type: none"> Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (3.ESS3.1) <hr/> <p>Connections to Nature of Science</p> <p>Science is a Human Endeavor</p> <ul style="list-style-type: none"> Science affects everyday life. (3.ESS3.1)
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Grade 4 Science Standards

Domain: Energy			
Code:	Strand:	Rating	Completed
4.PS3.1	Use evidence to construct an explanation relating the speed of an object to the energy of that object.	Supporting	
4.PS3.2	Make conclusions based on observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	Priority	
4.S5.C3.DPO2	Describe how energy is transferred by using Scientific Method.	Supporting	
4.PS3.3.	Ask questions and predict outcomes about the changes in energy that occur when objects collide.	Supporting	
4.PS3.4.	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*	Supporting	
4.S5.C3.DPO1	Demonstrate that electricity flowing in circuits can produce light, heat, sound, and magnetic effects.	Priority	
4.S4.C3.DPO2	Differentiate renewable resources from nonrenewable resources.	Priority	
4.ESS3.1	Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.	Supporting	
4.S4.C3.DPO3	Analyze the effect that limited resources (e.g., natural gas, minerals) may have on an environment.	Supporting	

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Plan and implement responsible stewardship of God’s natural resources.

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4.PS3.3)

Planning and Carrying Out Investigations

Disciplinary Ideas

PS3.A: Definitions of Energy

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

PS3.B: Conservation of Energy and Energy Transfer

- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change. (4.ESS3.1)

Energy and Matter

- Energy can be transferred in various ways and between objects. (4.PS3.1), (4. PS3.2), (4.PS3.3), (4. PS3---.4)

Connections to Engineering,

<p>Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.</p> <ul style="list-style-type: none"> • Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4.PS3.2) <p>Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</p> <ul style="list-style-type: none"> • Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4.PS3.1) • Apply scientific ideas to solve design problems. (4.PS3.4) <p>Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluate the merit and accuracy of ideas and methods.</p> <ul style="list-style-type: none"> • Obtain and combine information from books and other reliable media to explain phenomena. (4.ESS3.1) 	<p>collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4.PS3.2),(4.PS3.3)</p> <ul style="list-style-type: none"> • Light also transfers energy from place to place. (4.PS3.2) • Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4.PS3.2),(4.PS3.4) <p>PS3.C: Relationship Between Energy and Forces</p> <ul style="list-style-type: none"> • When objects collide, the contact forces transfer energy so as to change the objects’ motions. (4.PS3.3) <p>PS3.D: Energy in Chemical Processes and Everyday Life</p> <ul style="list-style-type: none"> • The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use. (4.PS3.4) <p>ESS3.A: Natural Resources</p> <ul style="list-style-type: none"> • Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4.ESS3.1) <p>ETS1.A: Defining Engineering Problems</p> <ul style="list-style-type: none"> • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). • Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how • well each takes the constraints into account. (secondary to 4.PS3.4) 	<p><i>Technology, and Applications of Science Interdependence of Science, Engineering</i></p> <ul style="list-style-type: none"> • Knowledge of relevant scientific concepts and research findings is important in engineering. (4.ESS3.1) Influence of Engineering, Technology, and Science on Society and the Natural World • Over time, people’s needs and wants change, as do their demands for new and improved technologies. (4.ESS3.1) • Engineers improve existing technologies or develop new ones. (4.PS3.4) <hr/> <p><i>Connections to Nature of Science</i></p> <p>Science is a Human Endeavor</p> <ul style="list-style-type: none"> • Most scientists and engineers work in teams. (4.PS3.4) • Science affects everyday life. (4.PS3.4)
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Domain: Waves and Information			
Code:	Strand:	Rating	Completed
4.PS4.1	Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.	Priority	
4.PS4.2	Discuss how changes in amplitude and wavelength can affect how an object moves.	Supporting	
4.PS4.3	Generate and compare multiple solutions that use patterns to transfer information.	Supporting	

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
<p>Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.</p> <ul style="list-style-type: none"> Develop a model using an analogy, example, or abstract representation to describe a scientific principle. (4-PS4-1) <p>Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</p> <ul style="list-style-type: none"> Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-PS4-3) <hr/> <p><i>Connections to Nature of Science</i></p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science findings are based on recognizing patterns. (4-PS4-1) 	<p>PS4.A: Wave Properties</p> <ul style="list-style-type: none"> Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. (4-PS4-1) Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1) <p>PS4.C: Information Technologies and Instrumentation</p> <ul style="list-style-type: none"> Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. (4-PS4-3) <p>ETS1.C: Optimizing The Design Solution</p> <ul style="list-style-type: none"> Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (secondary to 4-PS4-3) 	<p>Patterns</p> <ul style="list-style-type: none"> Similarities and differences in patterns can be used to sort and classify natural phenomena. (4-PS4-1) Similarities and differences in patterns can be used to sort and classify designed products. (4-PS4-3) <hr/> <p><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p>Knowledge of relevant scientific concepts and research findings is important in engineering. (4-PS4-3)</p>

Domain: Structure, Function, and Information Processing

Code:	Strand:	Rating	Completed
4.LS1.1	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	Priority	
D3.S4.C1.DPO1	Describe the function of the following plant structures: roots-absorb nutrients, stems-provide support, leaves-synthesize food, flowers-attract pollinators and produce seeds for reproduction	Supporting	
D4.S4.C1.DPO1	Compare structures in plants (e.g., roots, stems, leaves, flowers)	Supporting	
D4.S4.C1.DPO2	Compare structures in animals (e.g., muscles, bones, nerves) that serve different functions in growth and survival.	Supporting	
4.LS1.2	Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways	Priority	
4.PS4.2	Develop a model to explain and discuss that light reflecting from objects and entering the eye allows objects to be seen.	Supporting	
4.LS4.1.1	Identify the functions and parts of the skeletal system: protection- rib cage, cranium; support vertebrae; movement- pelvis, femur, hip	Supporting	
4.LS4.1.2	Identify the following types of muscles: cardiac- heart; smooth- stomach; skeletal –biceps	Supporting	

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Recognize that in God’s infinite wisdom He created all living creatures with senses that enable them to survive.
- Respect life at all stages, as a gift given freely by God.

Science and Engineering Practices

Developing and Using Models

Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

- Develop a model to describe phenomena. (4.PS4.2)
- Use a model to test interactions concerning the functioning of a natural system. (4.LS1.2)

Engaging in Argument from

Disciplinary Ideas

PS4.B: Electromagnetic Radiation

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

LS1.A: Structure and Function

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

LS1.D: Information Processing

- Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal’s brain. Animals are able to use their perceptions and memories to guide their actions. (4.LS1.2)

Crosscutting Concepts

Patterns

- Cause and effect relationships are routinely identified. (4.PS4.2)

Systems and System Models

A system can be described in terms of its components and their interactions. (4.LS1.1), (4.LS1.2)

Evidence

Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).

- Construct an argument with evidence, data, and/or a model. (4.LS1.1)

Domain: Earth's Systems: Processes that Shape Earth

Code:	Strand:	Rating	Completed
4.ESS1.1	Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.	Priority	
4.ESS2.1	Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation	Supporting	
4.S6.C2.DPO1	Identify the Earth processes that cause erosion.	Supporting	
4.S6.C2.DPO2	Describe how currents and wind cause erosion and land changes	Supporting	
4.S6.C2.DPO3	Describe the role that water plays in the following processes that alter the Earth's surface features: erosion, deposition, weathering	Supporting	
4.ESS2.2	Analyze and interpret data from maps to describe patterns of Earth's features	Supporting	
4.ESS3.2	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.	Supporting	

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Evaluate the consequences of environmental occurrences that happen either rapidly or over a long period of time and how we are called in solidarity to help those involved in these events.
- Find out how students in your school can help families affected by a natural disaster. Plan a way to help.
- Become lifelong stewards who gratefully share the gifts of time, talent, and treasure.

Science and Engineering Practices

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (4.ESS2.1)

Analyzing and Interpreting Data

Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches

Disciplinary Ideas

ESS1.C: The History of Planet Earth

- Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4.ESS1.1)

ESS2.A: Earth Materials and Systems

- Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4.ESS2.1)

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

- The locations of mountain ranges, deep ocean trenches,

Crosscutting Concepts

Patterns

- Patterns can be used as evidence to support and explain. (4.ESS1.1),(4.ESS2.2)

Cause and Effect

- Cause and effect relationships are routinely identified, tested and used to explain change. (4.ESS2.1),(4.ESS3.2)

Connections to Engineering, Technology, and Applications of Science

Influence of Engineering, Technology, and Science on Society and the Natural World

- Engineers improve existing technologies or develop new ones to increase their benefits,

<p>to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.</p> <ul style="list-style-type: none"> Analyze and interpret data to make sense of phenomena using logical reasoning. (4.ESS2.2) <p>Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</p> <ul style="list-style-type: none"> Identify the evidence that supports particular points in an explanation. (4.ESS1.1) Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4.ESS3.2) 	<p>ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4.ESS2.2)</p> <p>ESS2.E: Biogeology</p> <ul style="list-style-type: none"> Living things affect the physical characteristics of their regions. (4.ESS2.1) <p>ESS3.B: Natural Hazards</p> <ul style="list-style-type: none"> A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. (4.ESS3.2) (Note: This Disciplinary Core Idea can also be found in 3.WC.) <p>ETS1.B: Designing Solutions to Engineering Problems</p> <ul style="list-style-type: none"> Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4.ESS3.2) 	<p>to decrease known risks, and to meet societal demands. (4.ESS3.2)</p> <hr/> <p><i>Connections to Nature of Science</i></p> <p>Scientific Knowledge Assumes an Order and Consistency in Natural systems.</p> <ul style="list-style-type: none"> Science assumes consistent patterns and natural systems. (4.ESS1.1)
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Domain: Engineering Design

Code:	Strand:	Rating	Completed
3.5.ETS1.1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	Priority	
3.5.ETS1.2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	Supporting	
3.5.ETS1.3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	Supporting	

Catholic Identity

- Share materials and work together in small groups, listen to the ideas of others. Be respectful and treat others as you wish to be treated.
- Use the God given gift of intellect to be resourceful and use simple tools to make tasks easier.
- Consider the pastoral as well as the practical nature of the problems and solutions we address.

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5.ETS1.1)

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the

Disciplinary Ideas

ETS1.A: Defining and Delimiting Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5.ETS1.1)

ETS1.B: Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5.ETS1.2)
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5.ETS1.2)

Crosscutting Concepts

Influence of Science, Engineering, and Technology on Society and the Natural World

- People’s needs and wants change over time, as do their demands for new and improved technologies. (3-5.ETS1.1)
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5.ETS1.2)

<p>number of trials considered. (3-5.ETS1.3)</p> <p>Constructing Explanations and Designing Solutions</p> <p>Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</p> <ul style="list-style-type: none"> • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5.ETS1.2) 	<ul style="list-style-type: none"> • Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5.ETS1.3) <p>ETS1.C: Optimizing the Design Solution</p> <ul style="list-style-type: none"> • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5.ETS1.3) 	
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Grade 5 Science Standards

Domain: Structure and Properties of Matter			
Code:	Strand:	Rating	Completed
5.S5.C1.DPO1	Identify that matter is made of smaller units called: molecules and atoms	Priority	
5.PS1.1	Create a model to explain that matter is made of particles too small to be seen.	Supporting	
5.PS1.2	Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.	Supporting	
5.PS1.3	Make observations and measurements to identify materials based on their properties	Supporting	
5.PS1.4	Conduct an investigation to determine whether the mixing of two or more substances results in new substances.	Supporting	
5S5.C1.DPO2	Distinguish between mixtures and compounds	Supporting	

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Discuss how evidence, observations, and logic are essential to scientific explanations, but not necessarily a part of belief based explanations (e.g. You don't need to see God to believe in Him.)
- Reference the story of Doubting Thomas who had to see the Risen Lord in order to believe. Faith, in any discipline, is believing and knowing without actually seeing.

Science and Engineering Practices

Developing and Using Models

Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

Develop a model to describe phenomena. (5.PS1.1)

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

Disciplinary Ideas

PS1.A: Structure and Properties of Matter

- Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5.PS1.1)
- The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5.PS1.2)

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships are routinely identified, test, and used to explain change. (5.PS1.4)

Scale, Proportion, and Quantity

- Natural Objects exist from the very small to the immensely large. (5.PS1.1)
- Standard units are used to measure and describe physical quantities such as weight, time, temperature, volume. (5.PS1.2),(5.PS1.3)

- Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (5.PS1.4)
- Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5.PS1.3)

Using Mathematics and Computational Thinking

Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.

- Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5.PS1.2)

- Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5.PS1.3)

PS1.B: Chemical Reactions

- When two or more different substances are mixed, a new substance with different properties may be formed. (5.PS1.4)
- No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5.PS1.2)

Domain: Matter and Energy in Organisms and Ecosystems

Code:	Strand:	Rating	Completed
5.PS3.1	Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.	Priority	
5.LS1.1	Support an argument that plants get the materials they need for growth chiefly from air and water.	Supporting	
5.LS2.1	Create a model to describe the movement of matter among plants, animals, decomposers, and the environment.	Supporting	
5.S4.C3.DPO5	Explain the interrelationships among plants and animals in different environments: producers, consumers, decomposers.	Priority	

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Understanding that all plants and animals are God's creation.
- Define and apply stewardship to all life on earth.
- Respect life at all stages as a gift given freely by God.

Science and Engineering Practices

Developing and Using Models

Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

- Use models to describe phenomena. (5.PS3.1)
- Develop a model to describe phenomena. (5.LS2.1)

Engaging in Argument from Evidence

Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).

- Support an argument with evidence, data, or a model. (5.LS1.1)

Connections to Nature of Science

Disciplinary Ideas

DPS3.D: Energy in Chemical Processes and PS3.D: Energy in Chemical Processes and Everyday Life

- The energy released [from] food was once energy [from] the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5.PS3.1)

LS1.C: Organization for Matter and Energy Flow in Organisms

- Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5.PS3.1)
- Plants acquire their material for growth chiefly from air and water. (5.LS1.1)

LS2.A: Interdependent Relationships in Ecosystems

- The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and

Crosscutting Concepts

Systems and System Models

- A system can be described in terms of its components and their interactions. (5.LS2.1)

Energy and Matter

- Matter is transported into, out of, and within systems. (5.LS1.1)
- Energy can be transferred in various ways and between objects. (5.PS3.1)

**Science Models, Laws,
Mechanisms, and Theories**

Explain Natural Phenomena

Science explanations describe the mechanisms for natural events.

(5.LS2.1)

other animals eat the animals that eat plants.

- Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5.LS2.1)

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

- Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5.LS2.1)

Domain: Earth Systems			
Code:	Strand:	Rating	Completed
5.ESS2.1	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	Priority	
5.ESS2.2	Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.	Supporting	
5.S6.C3.DPO2	Describe the distribution of water on the Earth's surface.	Supporting	
5.ESS3.1.	Obtain and compare information about ways individual communities use science ideas to protect the Earth's resources and environment.	Supporting	

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Take this opportunity to develop an understanding of what it means to be responsible stewards of God's earthly gifts, both as individuals and as communities.
- Propose a solution, resource, or product that addresses a specific solution to protect the earth's resources and environment.
- Evaluate the possible strengths and weaknesses of a proposed solution relevant to protecting the earth's resources and environment.

Science and Engineering Practices

Developing and Using Models

Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

- Develop a model using an example to describe a scientific principle. (5.ESS2.1)

Using Mathematics and Computational Thinking

Mathematical and computational thinking in 3– 5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.

- Describe and graph quantities such as area and volume to address scientific questions. (5.ESS2.2)

Obtaining, Evaluating, and communicating Information

Disciplinary Ideas

ESS2.A: Earth Materials and Systems

- Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5.ESS2.1)

ESS2.C: The Roles of Water in Earth's Surface Processes

- Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. (5.ESS2.2)

ESS3.C: Human Impacts on Earth Systems

Crosscutting Concepts

Scale, Proportion, and Quantity

- Standard units are used to measure and describe physical quantities such as weight and volume. (5.ESS2.2)

Systems and System Models

- A system can be described in terms of its components and their interactions. (5.ESS2.1),(5.ESS3.1)

Connections to Nature of Science

- Science Addresses Questions About the Natural and Material World
- Science findings are limited to questions that can be answered within Empirical Evidence. (5.ESS3.1)

<p>Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.</p> <ul style="list-style-type: none">• Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. (5.ESS3.1)	<ul style="list-style-type: none">• Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth’s resources and environments. (5.ESS3.1)	
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Domain: Space Systems: Stars and the Solar System

Code:	Strand:	Rating	Completed
5.PS2.1	Support an argument that the gravitational force exerted by Earth on objects is directed toward the center of the planet.	Priority	
5.S.6.C2.DPO1	Describe how the Moon's appearance changes during a four-week lunar cycle.	Priority	
5.S.6.C2.DPO2	Describe how Earth's rotation results in day and night at any particular location.	Priority	
5.ESS1.1	Support an argument that differences in the brightness of the sun compared to other stars is due to their relative distances from Earth.	Supporting	
5.ESS1.2	Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.	Supporting	
5.S.6.C2.DPO3	Distinguish between revolution and rotation.	Supporting	

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Students will relate Easter to the lunar cycle recognizing that Easter is held on the first Sunday After the first full moon occurring on or after the vernal equinox.
- Relate the story in Genesis to Earth's rotation resulting in day and night.
- Reference how the days get shorter during Advent in relation to winter solstice and shortest day of the year while waiting for the light of Christ as Christmas.

Domain: Engineering Design			
Code:	Strand:	Rating	Completed
3.5.ETS1.1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	Priority	
3.5.ETS1.2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	Supporting	
3.5.ETS1.3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	Supporting	

Catholic Identity

- Share materials and work together in small groups, listen to the ideas of others. Be respectful and treat others as you wish to be treated.
- Use the God given gift of intellect to be resourceful and use simple tools to make tasks easier.
- Consider the pastoral as well as the practical nature of the problems and solutions we address.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
<p>Asking Questions and Defining Problems Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.</p> <ul style="list-style-type: none"> • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5.ETS1.1) <p>Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.</p> <ul style="list-style-type: none"> • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the 	<p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5.ETS1.1) <p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5.ETS1.2) • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5.ETS1.2) • Tests are often designed to 	<p>Influence of Science, Engineering, and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> • People’s needs and wants change over time, as do their demands for new and improved technologies. (3-5.ETS1.1) • Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3- 5.ETS1.2)

<p>number of trials considered. (3- 5.ETS1.3)</p> <p>Constructing Explanations and Designing Solutions</p> <p>Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</p> <ul style="list-style-type: none"> • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5.ETS1.2) 	<p>identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5.ETS1.3)</p> <p>ETS1.C: Optimizing the Design Solution</p> <ul style="list-style-type: none"> • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5.ETS1.3) 	
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Grade 6 Science Standards

Domain: Earth & Space Science - Space Systems			
Code:	Strand:	Rating	Completed
DMS.ESS1.1	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.	Priority	
DMS.ESS1.2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.	Supporting	
DMS.ESS1.3	Analyze and interpret data to determine scale properties of objects in the solar system.	Supporting	
DMS.ESS1.3.1	Research how the solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.	Priority	

Catholic Identity

- Relate the liturgical calendar to the natural patterns of God’s universe.
- Appreciate the precision of the universal design which supports life on our planet, e.g. the 23 degree tilt of the Earth, distance from the moon, placement of the Earth to the sun.
- Discuss physical laws as supported by the Old Testament, e.g. Genesis, Job.

Science and Engineering Practices

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS.ESS1.1),(MS.ESS1.2)

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to determine

Disciplinary Ideas

ESS1.A: The Universe and Its Stars

- Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS.ESS1.1)
- Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS.ESS1.2)

ESS1.B: Earth and the Solar System

- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS.ESS1.2),(MS.ESS1.3)
- This model of the solar system can explain eclipses of the sun and the moon. Earth’s spin axis is fixed in direction over the short- term but tilted relative to its orbit around

Crosscutting Concepts

Patterns

Patterns can be used to identify cause and affect relationships. (MS.-ESS1.1)

Scale, Proportion, and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS.ESS1. 3)

Systems and System Models

- Models can be used to represent systems and their interactions. (MS.ESS1.2)

Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and

Technology

<p>Similarities and differences in findings. (MS.ESS1.3)</p>	<p>the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS.ESS1. 1)</p> <ul style="list-style-type: none"> • The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS.ESS1.2) 	<ul style="list-style-type: none"> • Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (MS. ESS1.3) <hr/> <p><i>Connections to Nature of Science</i></p> <p>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</p> <ul style="list-style-type: none"> • Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS.ESS1.1),(MS.ESS1.2)
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Domain: Earth & Space Science - History of Earth

Code:	Strand:	Rating	Completed
DMS.ESS1.4	Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6 -billion-year-old history.	Supporting	
DMS.ESS2.2	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	Supporting	
DMS.ESS2.3	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.	Priority	

Catholic Identity

- Awareness of Catholic services that provide aid to people in need from natural disasters and supporting their work, e.g. Caritas Internationales, Catholic Relief Services, Catholic Charities.

Science and Engineering Practices

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to provide evidence for phenomena. (MS.ESS2.3)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS.

Disciplinary Ideas

ESS1.C: The History of Planet Earth

- The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1- 4)
- Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C GBE) (secondary to MS-ESS2-3)

ESS2.A: Earth's Materials and Systems

- The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2)

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

- Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)

ESS2.C: The Roles of Water in Earth's Surface Processes

- Waters movements—both on the

Crosscutting Concepts

Patterns

- Patterns in rates of change and other numerical relationships can provide information about natural systems. (MS.ESS2.3)

Scale Proportion and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS.ESS1.4),(MS.ESS2.2)

<p>ESS1.4),(MS.ESS2.2)</p> <hr style="border-top: 1px dashed black;"/> <p><i>Connections to Nature of Science</i></p> <p>Scientific Knowledge is Open to Revision in Light of New Evidence Science findings are frequently revised and/or reinterpreted based on new evidence. (MS.ESS2.3)</p>	<p>land and underground—cause weathering and erosion, which change the land’s surface features and create underground formations. (MS-ESS2-2)</p>	
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Domain: Earth & Space Science - Earth's Systems

Code:	Strand:	Rating	Completed
DMS.ESS2.1	Students should understand how materials move through Earth's systems and how energy is involved in these processes. They should be able to create a model to explain the carbon cycle.	Priority	
DMS.ESS2.4	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.	Priority	
DMS.ESS3.1	Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.	Supporting	
DMS.ESS3.2	Distinguish the components and characteristics of the rock cycle for the following types of rocks, igneous, metamorphic, sedimentary.	Priority	
DMS.ESS3.3	Identify the different spheres: Troposphere, stratosphere, mesosphere, thermosphere, ionosphere, exosphere.	Priority	

Catholic Identity

- Discuss the sense of order and balance of the Earth's systems in God's creation.

Science and Engineering Practices

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS.ESS2.1)
- Develop a model to describe unobservable mechanisms. (MS.ESS2.4)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence

Disciplinary Ideas

ESS2.A: Earth's Materials and Systems

- All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS.ESS2.1)

ESS2.C: The Roles of Water in Earth's Surface Processes

- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS.ESS2.4)
- Global movements of water and its changes in form are propelled by sunlight and gravity. (MS.ESS2.4)

ESS3.A: Natural Resources

- Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources.

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS.ESS3.1)

Energy and Matter

- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS.ESS2.4)

Stability and Change

- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MS.ESS2.1)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- All human activity draws on

<p>obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS.ESS3.1)</p>	<p>Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS.ESS3.1)</p>	<p>natural resources and has short and long- term consequences, positive as well as negative, for the health of people and the natural environment. (MS.ESS3.1)</p>
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Domain: Earth & Space Science - Weather and Climate

Code:	Strand:	Rating	Completed
DMS.ESS2.5	Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.	Priority	
DMS.ESS2.6	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.	Priority	
DMS.ESS3.5	Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	Supporting	

Catholic Identity

- Accept God’s creation with gratitude by moderating usage of resources.
- Define environmental stewardship in terms of resources and recognize it as part of Catholic social teaching.

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in 6–8 builds on K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.

- Ask questions to identify and clarify evidence of an argument. (MS.SS3.5)

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS.ESS2.6)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.

- Collect data to produce data to serve as the basis for evidence

Disciplinary Ideas

ESS2.C: The Roles of Water in Earth’s Surface Processes

- The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS.ESS2.5)
- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS.ESS2. 6)

ESS2.D: Weather and Climate

- Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS.ESS2.6) Because these patterns are so complex, weather can only be predicted probabilistically. (MS.ESS2.5)
- The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS.ESS2.5) Systems and System Models
- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS.ESS2.6)

Stability and Change

- Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS.ESS3.5)

<p>to answer scientific questions or test design solutions under a range of conditions. (MS.ESS2.5)</p>	<p>globally redistributing it through ocean currents. (MS.ESS2.6) ESS3.D: Global Climate Change</p> <ul style="list-style-type: none">• Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS.ESS3.5)	
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Domain: Earth & Space Science - Human Impact

Code:	Strand:	Rating	Completed
DMS.ESS3.2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.	Priority	
DMS.ESS3.3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*	Supporting	
DMS.ESS3.3.1	Students will demonstrate ways that they can have a positive impact on climate change by reducing their carbon footprint and being good stewards of the gifts that God gave us.	Supporting	
DMS.ESS.2.1	Describe how people plan for, and respond to the following natural disasters: draught, flooding, tornadoes and hurricanes with an emphasis on our moral obligation to provide aid.	Supporting	

Catholic Identity

- Students will demonstrate ways that they can have a positive impact on climate change by reducing their carbon footprint and being good stewards of the gifts that God gave us.
- Students will recognize the need to help other countries during natural disasters through prayer and material donations.
- Students will consider the Corporal and Spiritual Works of Mercy in providing responsible stewardship to those in need.

Science and Engineering Practices

Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to determine similarities and differences in findings. (MS.ESS3.2)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific principles to design an object, tool, process

Disciplinary Ideas

ESS3.B: Natural Hazards

- Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS.ESS3.2)

ESS3.C: Human Impacts on Earth Systems

- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth’s environments can have different impacts (negative and positive) for different living things. (MS.ESS3.3)
- Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS.ESS3.3),(MS.ESS3.4)

Crosscutting Concepts

Patterns

- Graphs, charts, and images can be used to identify patterns in data. (MS.ESS3.2)

Cause and Effect

- Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (MS.ESS3.3)
- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS.ESS3.4)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural

<p>or system. (MS.ESS3.3)</p> <p>Engaging in Argument from Evidence</p> <p>Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).</p> <ul style="list-style-type: none"> • Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS.ESS3.4) 		<p>environment. (MS.ESS3.4)</p> <ul style="list-style-type: none"> • The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS.ESS3.2),(MS.ESS3.3) <hr/> <p><i>Connections to Nature of Science</i></p> <p>Science Addresses Questions About the Natural and Material World</p> <p>Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS- ESS3-4)</p>
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Grade 7 Science Standards

Domain: Life Science - From Molecules to Organisms: Structures and Function			
Code:	Strand:	Rating	Completed
DMS.LS1.1	Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.	Priority	
DMS.LS1.2	Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.	Support	
DMS.LS1.2.1	Describe how single-celled and multi-celled organisms carry on basic life processes. Ex... osmosis, diffusion.	Priority	
DMS.LS1.3	Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.	Support	
DMS.LS1.4	Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.	Support	
DMS.LS1.6.1	Relate the following structures to their functions for plants.	Priority	

Catholic Identity

- Use argument supported by evidence to discriminate between life-affirming technology and reckless technological progress:
 - Embryonic Stem Cells
 - Human Genetic Modification
 - Cloning
- Demonstrate a respect for the human body through personal choices such as:
 - Refraining from the ingestion of harmful chemicals;
 - Practicing regular exercise, healthful eating and proper hygiene;
 - Practicing chastity;
 - Getting adequate amounts of sleep.

Science and Engineering Practices

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS.LS1.2)

Planning and Carrying Out Investigations

Disciplinary Ideas

LS1.A: Structure and Function

- All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells multicellular). (MS.LS1.1)
- Within cells, special structures are responsible for particular functions, and the cell

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural systems. (MS.LS1.8)

Scale, Proportion, and Quantity

- Phenomena that can be observed at one scale may not be observable at another scale. (MS.LS1.1)

Systems and System Models

- Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS.LS1.3)

<p>Planning and carrying out investigations in 6-8 builds on K- 5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.</p> <ul style="list-style-type: none"> Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS.LS1.1) <p>Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).</p> <ul style="list-style-type: none"> Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS.LS1.3) <p>Obtaining, Evaluating, and communicating Information Obtaining, evaluating, and communicating information in 6-8 builds on K-5 experiences and progresses to evaluating the merit and validity of ideas and methods.</p> <ul style="list-style-type: none"> Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS.LS1.8) 	<p>membrane forms the boundary that controls what enters and leaves the cell. (MS.LS1.2)</p> <ul style="list-style-type: none"> In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS.LS1.3) <p>LS1.D: Information Processing</p> <ul style="list-style-type: none"> Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. (MS.LS1.8) 	<p>Structure and Function</p> <ul style="list-style-type: none"> Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts; therefore complex natural structures /systems can be analyzed to determine how they function. (MS.LS1.2) <hr/> <p><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p>Interdependence of Science, Engineering, and Technology</p> <ul style="list-style-type: none"> Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS.LS1.1) <hr/> <p><i>Connections to Nature of Science</i></p> <p>Science is a Human Endeavor</p> <ul style="list-style-type: none"> Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS.LS1.3)
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Domain: Life Science - Matter and Energy in Organisms and Ecosystems			
Code:	Strand:	Rating	Completed
DMS.LS1.6	Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.	Priority	
DMS.LS1.7	Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.	Supporting	Refer to the carbon cycle
DMS.LS2.1	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem	Priority	
DMS.LS2.3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	Priority	
DMS.LS2.4	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.	Supporting	

Catholic Identity

- Appreciate God’s Creation through the vigilant care of our surroundings.
- Practice the virtue of temperance through the moderate use of resources.
- Discuss the sense of order, balance, biological diversity and interconnectedness of God’s Universe i.e. food webs, nitrogen cycle, carbon cycle.
- Perform acts of good stewardship.

Science and Engineering Practices

Developing and Using Models
Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to describe phenomena. (MS.LS2.3)
- Develop a model to describe unobservable mechanisms. (MS.LS1.7)

Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

Disciplinary Ideas

LS1.C: Organization for Matter and Energy Flow in Organisms

- Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS.LS1.6)
- Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS.LS1.7)

LS2.A: Interdependent Relationships in Ecosystems

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS.LS2.1)

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural systems. (MS.LS3.2)
- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS.LS1.4),(MS.LS1.5),(MS.LS4.5)

Structure and Function

- Complex and microscopic structures and systems can be visualized, modeled, and use to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS.LS3.1)

<ul style="list-style-type: none"> Analyze and interpret data to provide evidence for phenomena. (MS.LS2.1) <p>Constructing Explanations and Designing Solutions</p> <p>Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.</p> <ul style="list-style-type: none"> Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS.LS1.6) <p>Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K– 5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).</p> <ul style="list-style-type: none"> Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS.LS2.4) 	<ul style="list-style-type: none"> In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS.LS2.1) Growth of organisms and population increases are limited by access to resources. (MS.LS2.1) <p>LS2.B: Cycle of Matter and Energy Transfer in Ecosystems</p> <ul style="list-style-type: none"> Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS.LS2.3) <p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <ul style="list-style-type: none"> Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS.LS2.4) <p>PS3.D: Energy in Chemical Processes and Everyday Life</p> <ul style="list-style-type: none"> The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (secondary to MS.LS1.6) Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (secondary to MS.LS1.7) 	<hr/> <p style="text-align: center;"><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p>Interdependence of Science, Engineering, and Technology</p> <ul style="list-style-type: none"> Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS.LS4.5) <hr/> <p style="text-align: center;"><i>Connections to Nature of Science Addresses Questions About the Natural and Material World</i></p> <ul style="list-style-type: none"> Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS.LS4.5)
<hr/> <p style="text-align: center;"><i>Connections to Nature of Science</i></p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science knowledge is based upon logical connections between evidence and explanations. (MS.LS1.6) Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS.LS2.4) 		

Domain: Life Science - Interdependent Relationships in Ecosystems			
Code:	Strand:	Rating	Completed
DMS.LS2.2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.	Priority	
DMS.LS2.2.1	Compare the symbiotic and parasitic relationships in organisms within an ecosystem.	Priority	
DMS.LS2.5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.	Supporting	

Catholic Identity		
<ul style="list-style-type: none"> Discuss the sense of order, balance, biological diversity and interconnectedness of God’s Universe, e.g. food webs, symbiotic relationships. Accept God’s creation with gratitude by moderating usage of resources. 		
<p>Science and Engineering Practices</p> <p>Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.</p> <ul style="list-style-type: none"> Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS.LS2.2) <p>Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).</p> <ul style="list-style-type: none"> Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS.LS2.5) 	<p>Disciplinary Ideas</p> <p>LS2.A: Interdependent Relationships in Ecosystems</p> <ul style="list-style-type: none"> Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS.LS2.2) <p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <ul style="list-style-type: none"> Biodiversity describes the variety of species found in Earth’s terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem’s biodiversity is often used as a measure of its health. (MS.LS2.5) <p>LS4.D: Biodiversity and Humans</p> <ul style="list-style-type: none"> Changes in biodiversity can influence humans’ resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, 	<p>Crosscutting Concepts</p> <p>Patterns</p> <ul style="list-style-type: none"> Patterns can be used to identify cause and effect relationships. (MS.LS2.2) <p>Stability and Change</p> <ul style="list-style-type: none"> Small changes in one part of a system might cause large changes in another part. (MS.LS2.5) <hr/> <p style="text-align: center;"><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p>Influence of Science, Engineering, and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS.LS2.5) <hr/> <p style="text-align: center;"><i>Connections to Nature of Science</i></p>

	<p>water purification and recycling. (secondary to MS.LS2.5)</p> <p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to MS.LS2.5) 	<p>Science Addresses Questions About the Natural and Material World</p> <ul style="list-style-type: none"> • Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS.LS2.5)
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Domain: Life Science - Growth, Development, and Reproduction in Organisms			
Code:	Strand:	Rating	Completed
DMS.LS1.4	Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.	Priority	
DMS.LS1.5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.	Supporting	Change to nature versus nurture
DMS.LS3.1	Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.	Priority	
DMS.LS3.2	Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.	Priority	
DMS.LS3.2.1	Explain the purposes of cell division: growth and repair and reproduction	Priority	
DMS.LS3.2.2	Explain basics of mitosis and meiosis.	Priority	
DMS.LS3.2.3	Explain the basic principles of heredity using the human examples of eye color, widows peak, blood type	Priority	
DMS.LS3.2.4	Distinguish between the nature of dominant and recessive traits in humans.	Priority	
DMS.LS4.5	Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.	Supporting	
DMS.LS4.5.1	Discuss the Church's stance regarding: immorality of artificial insemination, contraception, sterilization, and bioengineering including: cloning, embryonic stem cell research, genetic engineering.	Priority	

Catholic Identity		
<ul style="list-style-type: none"> • Use argument supported by evidence to discriminate between life-affirming technology and reckless technological progress such as: <ul style="list-style-type: none"> ○ Embryonic Stem Cells ○ Human Genetic Modification ○ Cloning • Demonstrate a respect for the human body through personal choices such as: <ul style="list-style-type: none"> ○ Refraining from the ingestion of harmful chemicals; ○ Practicing regular exercise, healthful eating and proper hygiene; ○ Practicing chastity; ○ Getting adequate amounts of sleep; ○ Limiting exposure to radiation (solar and x-rays). 		
Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts

<p>Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.</p> <ul style="list-style-type: none"> Develop and use a model to describe phenomena. (MS.LS3.1),(MS.LS3.2) <p>Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.</p> <ul style="list-style-type: none"> Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS.LS1.5) <p>Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed.</p>	<p>LS1.B: Growth and Development of Organisms</p> <ul style="list-style-type: none"> Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.(secondary to MS.LS3.2) Animals engage in characteristic behaviors that increase the odds of reproduction. (MS.LS1.4) Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS.LS1.4) Genetic factors as well as local conditions affect the growth of the adult plant. (MS.LS1.5) <p>LS3.A: Inheritance of Traits</p> <ul style="list-style-type: none"> Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS.LS3.1) Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS.LS3.2) <p>LS3.B: Variation of Traits</p> <ul style="list-style-type: none"> In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS.LS3.2) In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships may be used to predict phenomena in natural systems. (MS.LS3.2) Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS.LS1.4),(MS.LS1.5),(MS.LS4.5) <p>Structure and Function</p> <ul style="list-style-type: none"> Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS.LS3.1) <hr/> <p style="text-align: center;"><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p>Interdependence of Science, Engineering, and Technology</p> <ul style="list-style-type: none"> Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS.LS4.5) <hr/> <p style="text-align: center;"><i>Connections to Nature of Science</i></p> <p>Science Addresses Questions About the Natural and Material World Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS.LS4.5)</p>
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organism. (MS.LS3.1)

LS4.B: Natural Selection

- In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which
- are then passed on to offspring. (MS.LS4.5)

Domain: Life Science - Natural Selection and Adaptations

Code:	Strand:	Rating	Completed
DMS.LS4.1	Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.	Priority	
DMS.LS4.2	Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.		
DMS.LS4.3	Analyze images to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.	Priority	replace pictorial data with pictures
DMS.LS4.4	Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.	Priority	
DMS.LS4.6	Use Punnett square to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.	Priority	Say punnett square instead of math rep.

Catholic Identity

- Reference St. John Paul II's 1996 message to the Pontifical Academy of Sciences & Pope Pius XII's 1950 encyclical Humani Generis on evolution.
- Use argument supported by evidence to discriminate between life-affirming technology and reckless technological progress such as:
 - Embryonic Stem Cells
 - Human Genetic Modification
 - Cloning
 - Eugenics

Science and Engineering Practices

- Analyzing and Interpreting Data**
 Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
- Analyze displays of data to identify linear and nonlinear relationships. (MS.LS4.3)
 - Analyze and interpret data to determine similarities and differences in findings.

Disciplinary Ideas

- LS4.A: Evidence of Common Ancestry and Diversity**
- The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS.LS4.1)
 - Anatomical similarities and differences between various

Crosscutting Concepts

- Patterns**
- Patterns can be used to identify cause and affect relationships. (MS.LS4.2)
 - Graphs, charts, and images can be used to identify patterns in data. (MS.LS4.1), (MS.LS4.3)
- Cause and Effect**
- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS.LS4.4),(MS.LS4.6)

<p>(MS.LS4.1)</p> <p>Using Mathematics and Computational Thinking</p> <p>Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.</p> <ul style="list-style-type: none"> • Use mathematical representations to support scientific conclusions and design solutions. (MS.LS4.6) <p>Constructing Explanations and Designing Solutions</p> <p>Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.</p> <ul style="list-style-type: none"> • Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS.LS4.2) • Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS.LS4.4) 	<p>organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS.LS4.2)</p> <ul style="list-style-type: none"> • Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS.LS4.3) <p>LS4.B: Natural Selection</p> <ul style="list-style-type: none"> • Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4) <p>LS4.C: Adaptation</p> <ul style="list-style-type: none"> • Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS.LS4.6) 	<p style="text-align: center;">-----</p> <p style="text-align: center;"><i>Connections to Nature of Science</i></p> <p><i>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</i> Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS.LS4.1),(MS.LS4.2)</p>
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Grade 8 Science Standards

Domain: Physical Science - Structure and Properties of Matter			
Code:	Strand:	Rating	Completed
DMS.PS1.1	Develop models to describe the atomic composition of simple molecules and extended structures	Supporting	
DMS.PS1.3	Collect and analyze information to describe that synthetic materials come from natural resources and impact society.	Supporting	
DMS.PS1.4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.	Supporting	
DMS.PS1.4.1	Investigate how the transfer of energy can affect the physical and chemical properties of matter	Priority	

Catholic Identity

- Compare solutions that further the Christian goals to best address an identified need or problem.
- Define environmental stewardship and recognize it as part of Catholic social teaching.
- Discuss a sense of order, balance and symmetry in God’s Universe, e.g. symmetry, polarity.

Science and Engineering Practices

Developing and Using Models

Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to predict and/or describe phenomena. (MS.PS1.1),(MS.PS1. 4)

Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in 6–8 builds on K–5 and progresses to evaluating the merit and validity of ideas and methods.

- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not

Disciplinary Ideas

PS1.A: Structure and Properties of Matter

- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS.PS1.1)
- Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3) (Note: This Disciplinary Core Idea is also addressed by MS.PS1.2.)
- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS.PS1.4)
- In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS. PS1.4)

Scale, Proportion, and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS.PS1.1)

Structure and Function

- Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS.PS1.3)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, And Technology

<p>supported by evidence. (MS.PS1.3)</p>	<p>locations. (MS.PS1.4)</p> <ul style="list-style-type: none"> • Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS.PS1.1) • The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS.PS1.4) <p>PS1.B: Chemical Reactions</p> <ul style="list-style-type: none"> • Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS.PS1.3) (Note: This Disciplinary Core Idea is also addressed by MS.PS1.2 and MS.PS1.5.) <p>PS3.A: Definitions of Energy</p> <ul style="list-style-type: none"> • The term “heat” as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MS.PS1.4) • The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system’s material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system’s total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary to MS.PS1.4) 	<ul style="list-style-type: none"> • Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS.PS1.3) <p>Influence of Science, Engineering and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> • The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS.PS1.3)
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Domain: Physical Science - Chemical Reactions			
Code:	Strand:	Rating	Completed
DMS.PS1.2	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.	Priority	
DMS.PS1.2.1	Identify different kinds of matter based on the following physical properties: states, density, boiling point, melting point, solubility.	Priority	
DMS.PS1.2.2	Identify different kinds of matter based on the following chemical properties: reactivity, pH, oxidation (corrosion)	Priority	
DMS.PS1.2.3	Investigate how the transfer of energy can affect the physical and chemical properties of matter	Priority	
DMS.PS1.2.4	Classify matter in terms of elements, compounds, or mixtures (homogeneous, heterogeneous mixtures)	Priority	
DMS.PS1.2.5	Explain the systematic organization of the periodic table	Priority	
DMS.PS1.5	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.	Priority	
DMS.PS1.6	Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.*	Supporting	
DMS.PS1.6.1	Identify various ways in which electrical energy is generated using renewable and nonrenewable resources (e.g., wind, dams, fossil fuels, nuclear reactions).	Priority	
DMS.PS1.6.2	Identify/ Explain several ways in which energy can be transformed, transferred or stored. (E.g. Batteries, mechanical to electrical, electrical to thermal, conduction, convection radiation.)	Priority	

Catholic Identity

- Define environmental stewardship in terms of renewable and non-renewable resources and recognize it as part of Catholic social teaching.
- Evaluate the scientific evidence used in various media to address a social issue using criteria accuracy, logic, bias, relevance of data, and credibility of sources; and discuss ethical implications.
- Discuss the perfection of God's Universe where the laws of chemistry can accurately predict future elements based on what we have discovered so far.

Science and Engineering Practices

Developing and Using Models

Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to describe unobservable mechanisms. (MS.PS1.5)

Disciplinary Ideas

PS1.A: Structure and Properties of Matter

- Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS.PS1.2) (Note: This Disciplinary Core Idea is also addressed by MS- PS1.3.)

Crosscutting Concepts

Patterns

- Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS.PS1.2)

Energy and Matter

- Matter is conserved because atoms are conserved in physical and chemical processes. (MS.PS1.5)

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to determine similarities and differences in findings. (MS.PS1.2)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

- Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MS.PS1.6)

*Connections to Nature of Science***Scientific Knowledge is Based on Empirical Evidence**

- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS.PS1.2)

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Laws are regularities or mathematical descriptions of natural phenomena. (MS-PS1.5)

PS1.B: Chemical Reactions

- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS.PS1.2),(MS.PS1.5) (Note: This Disciplinary Core Idea is also addressed by MS.PS1.3.)
- The total number of each type of atom is conserved, and thus the mass does not change. (MS.PS1.5) Some chemical reactions release energy, others store energy. (MS.PS1.6)

ETS1.B: Developing Possible Solutions

- A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (secondary to MS.PS1.6)

ETS1.C: Optimizing the Design Solution

- Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of the characteristics may be incorporated into the new design. (secondary to MS.PS1.6)
- The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (secondary to MS.PS1.6)

- The transfer of energy can be tracked as energy flows through a designed or natural system. (MS.PS1.6)

Domain: Physical Science - Forces and Interactions

Code:	Strand:	Rating	Completed
DMS.PS2.1	Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects.*	Priority	
DMS.PS2.2	Plan an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object.	Supporting	
DMS.PS2.3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.	Supporting	
DMS.PS2.4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.	Priority	
DMS.PS2.5	Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.	Priority	

Catholic Identity

- Research and describe how forces and gravity affects the design of churches and tall cathedral, e.g. domes, flying buttresses, columns, arches.

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in grades 6–8 builds from grades K–5 experiences and progresses to specifying relationships between Variables, and clarifying arguments and models.

- Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. (MS.PS2.3)

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple

Disciplinary Ideas

PS2.A: Forces and Motion

- For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton’s third law). (MS.PS2.1)
- The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS.PS2.2)
- All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS.-PS2.3),(MS.PS2.5)

Systems and System Models

- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. (MS.PS2.1),(MS.PS2.4)

Stability and Change

- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. (MS.PS2.2)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and

<p>variables and provide evidence to support explanations or design solutions.</p> <ul style="list-style-type: none"> Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS.PS2.2) Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. (MS.P 2.5) <p>Constructing Explanations and Designing Solutions</p> <p>Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.</p> <ul style="list-style-type: none"> Apply scientific ideas or principles to design an object, tool, process or system. (MS.PS2.1) <p>Engaging in Argument from Evidence</p> <p>Engaging in argument from evidence in 6–8 builds from K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS.PS2.4)</p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <p>Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS.PS2.2),(MS.PS2.4)</p>	<p>other people, these choices must also be shared.(MS.PS2.2)</p> <p>PS2.B: Types of Interactions</p> <ul style="list-style-type: none"> Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS.PS2.3) Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. (MS.PS2.4) Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). (MS.PS2.5) 	<p>Technology on Society and the Natural World</p>
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Domain: Energy			
Code:	Strand:	Rating	Completed
DMS.PS3.1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.	Supporting	
DMS.PS3.1.1	Calculate velocity as the rate of change of position over time and create a graph devised from measurements of moving objects and their interactions including: position-time graphs, velocity-time graphs.	Priority	
DMS.PS3.2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.	Supporting	
DMS.PS3.3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.*	Priority	
DMS.PS3.4	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.	Priority	
DMS.PS3.5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.	Priority	

Catholic Identity

- Evaluate the scientific evidence used in various media to address a social issue using criteria accuracy, logic, bias, relevance of data, credibility of sources, and discuss ethical implications.
- Discuss a sense of order, balance and symmetry in God’s Universe, i.e. Law of Conservation of Energy and Mass
- Research explanations regarding the Shroud of Turin related to how it was created.
- Find connections between Catholic researchers and their contributions to the study of energy.

<p>Science and Engineering Practices</p> <p>Developing and Using Models Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.</p> <ul style="list-style-type: none"> • Develop a model to describe unobservable mechanisms. (MS.PS3.2) <p>Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple</p>	<p>Disciplinary Ideas</p> <p>PS3.A: Definitions of Energy</p> <ul style="list-style-type: none"> • Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. (MS.PS3.1) • A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS.PS3.2) • Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts 	<p>Crosscutting Concepts</p> <p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> • Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. (MS.PS3.1),(MS.PS3. 4) <p>Systems and System Models</p> <ul style="list-style-type: none"> • Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems.
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variables and provide evidence to support explanations or design solutions.

- Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS.PS3.4)

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS.PS3.1)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. (MS.PS3.3)

Engaging in Argument from Evidence

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed worlds.

Construct, use and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. (MS.PS3.5)

Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical and conceptual connections between evidence and explanations (MS.-PS3.4),(MS.PS3.5)

of matter present.

(MS.PS3.3),(MS.PS3.4)

PS3.B: Conservation of Energy and Energy Transfer

- When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS.PS3.5)
- The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS.PS3.4)
- Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS.PS3.3)

PS3.C: Relationship Between Energy and Forces

- When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS.PS3.2)

ETS1.A: Defining and Delimiting an Engineering Problem

- The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions. (secondary to MS.PS3.3)

(MS.PS3.2)

Energy and Matter

- Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). (MS.PS3. 5)
- The transfer of energy can be tracked as energy flows through a designed or natural system. (MS. PS3.3)

Domain: Waves and Electromagnetic Radiation			
Code:	Strand:	Rating	Completed
DMS.PS4.1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.	Priority	
DMS.PS4.2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.	Supporting	
DMS.PS4.3	Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.	Supporting	

Catholic Identity

- Demonstrate Catholic responsibility through proper use of digital communication and digital citizenship.

Science and Engineering Practices

Developing and Using Models

Modeling in 6–8 builds on K–5 and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS.PS4.2)

Using Mathematics and Computational Thinking

Mathematical and computational thinking at the 6–8 level builds on K–5 and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.

- Use mathematical representations to describe and/or support scientific conclusions and design solutions. (MS.PS4.1)

Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in 6–8 builds on K–5 and progresses to evaluating the merit and validity of ideas and methods.

- Integrate qualitative scientific and technical information in

Disciplinary Ideas

PS4.A: Wave Properties

- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS.PS4.1)
- A sound wave needs a medium through which it is transmitted. (MS.PS4.2)

PS4.B: Electromagnetic Radiation

- When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object’s material and the frequency (color) of the light. (MS.PS4.2)
- The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS.PS4.2)
- A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS.PS4.2)
- However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS.PS4.2)

PS4.C: Information Technologies and Instrumentation

Crosscutting Concepts

Patterns

- Graphs and charts can be used to identify patterns in data. (MS.PS4.1)

Structure and Function

- Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS.PS4.2)
- Structures can be designed to serve particular functions. (MS.PS4.3)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS.PS4.3)
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<p>written text with that contained in media and visual displays to clarify claims and findings. (MS.PS4.3)</p>	<ul style="list-style-type: none"> Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS.PS4.3) 	<p><i>Connections to Nature of Science</i></p> <p>Science is a Human Endeavor</p> <ul style="list-style-type: none"> Advances in technology influence the progress of science and science as influenced advances in technology. (MS.PS4.3)
<p><i>Connections to Nature of Science</i></p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS.PS4.1) 		

Grades 9-12 Science Standards

Chemistry

Black Font = Diocese of Phoenix

Red Font = Diocese of Chicago

Purple Font = AZ State Standards

Next Generation Standards (National)

Code:	1: Skills and Processes of Chemistry	Rating	Completed
	Students should learn how to conduct scientific investigations ethically and safely, identify necessary resources, develop questions from observations, construct solutions with appropriate tools, formulate hypotheses, design testing protocols, record and analyze data accurately, produce clear graphs, interpret data relationships, evaluate scientific information, and communicate findings effectively.		
CHEM.1.1	Demonstrate safe and ethical procedures in science inquiry activities.	Priority	
Conc 1 DPO2	Differentiate between controlled and natural experiments and identify required resources for investigations.	Supporting	
Conc 1 DPO3	Develop questions based upon observations and construct proposed solutions using various tools.	Supporting	
Conc 1 DPO4	Formulate testable hypotheses and design protocols for testing, identifying variables and data collection methods.	Supporting	
Conc 1 DPO5	Test models, record observations, and complete simulations, making data recordings.	Supporting	
Conc 1 DPO6	Record observations using appropriate tools and methods such as journals, charts, graphs, and computers.	Supporting	
Conc 1 DPO7	Produce graphs to communicate data effectively using technology or handwritten methods.	Supporting	
Conc 1 DPO8	Analyze data relationships both graphically and mathematically. This includes mathematical models and formulas, equations, variables, symbols, graphs, statistics, precision and accuracy, and significant figures. (H.11.16)	Priority	
Conc 1 DPO9	Use both large and small numbers showing decimals or exponents and significant figures to describe and relate objects or events. (H.11.14)	Priority	
Conc 1 DPO10	Interpret data showing various relationships between variables.	Priority	
Conc 1 DPO11	Evaluate scientific information for relevancy to problem-solving.	Supporting	
Conc 1 DPO12	Communicate scientific results clearly and logically.	Priority	
Conc 1 DPO13	Support conclusions with logical scientific arguments citing experimental results.	Priority	
Conc 1 DPO14	Evaluate if investigational data support or refute proposed hypotheses.	Supporting	
Conc 1 DPO15	Evaluate investigation designs and identify possible procedural errors, proposing improvements when required.	Supporting	
Code:	2: The Nature of Matter	Rating	Completed
	Students are expected to understand the different types of properties		

	substances exhibit, differentiate between physical and chemical changes, explore phase changes in relation to molecular motion and energy interactions, apply kinetic molecular theory to analyze states of matter behavior, comprehend particle movement and entropy at absolute zero, distinguish between temperature and heat, examine the microscopic structure for characteristic properties of matter, as well as categorize mixtures based on their physical properties.		
Con 2 DPO 1	Identify and explain various physical and chemical properties of matter.	Priority	
Con 2 DPO 2	Differentiate between physical changes (change in appearance) and chemical changes (change in composition).	Supporting	
Con 2 DPO 3	Illustrate how molecular motion impacts temperature changes and phase transitions.	Supporting	
Con 2 DPO 4	Analyze interactions between matter and energy during phase changes.	Supporting	
Con 2 DPO 5	Apply kinetic molecular theory to explain changes in states of matter quantitatively.	Priority	
Con 2 DPO 6	Demonstrate particle movement and entropy at absolute zero, distinguishing between temperature and heat.	Supporting	
Con 2 DPO 7	Create visual representations and written explanations showing how properties of matter stem from atomic and molecular structures.	Supporting	
Con 2 DPO 8	Classify mixtures as homogeneous or heterogeneous based on observable physical properties.	Supporting	
Code:	3: The Mole Students should define the mole concept and Avogadro's number. Explain how moles relate to mass, particles, volume of gas, and concentrations. Solve problems involving moles, mass, particles, gas volume, and concentrations using appropriate formulas and the mole concept.	Rating	Completed
Con 3 DPO 1	Define the mole concept and explain the relationship to Avogadro's number.	Priority	
Con 3 DPO 3	Convert between moles, mass, particles, volume of a gas, and concentrations.	Supporting	
Con 3 DPO 4	Solve problems that involve moles, mass, particles, gas volume, and concentrations.	Supporting	
Code:	4: Expressing and Measuring Chemical Change Students should understand indicators of chemical changes, demonstrate the law of conservation of matter in chemical reactions, predict products and quantify relationships in reactions, describe energy storage, model energy transfer, analyze heat changes, and apply the principles of enthalpy in reactions.	Rating	Completed
Con 4 DPO 1	Identify and explain various indicators of chemical changes.	Supporting	
Con 4 DPO 2	Apply the law of conservation of matter through balanced chemical equations.	Priority	
Con 4 DPO 3	Predict products of reactions using reaction types (i.e. synthesis, decomposition, single replacement, double replacement, and	Priority	

	combustion). This includes describing the transfer of electrons between reactants during an oxidation-reduction reaction.		
Con 4 DPO 4	Identify various energy storage mechanisms. Understand the quantification of energy in chemical reactions. Explain how energy is stored in fossil fuels, and describe the release of energy when burning fossil fuels for human consumption.	Supporting	
Con 4 DPO 5	Understand the principles of energy conservation, calculate energy changes in chemical reactions, and explain how the formation and breaking of chemical bonds can lead to temperature changes in a reaction environment.	Supporting	
Con 4 DPO 6	Model how energy is transferred between systems. Analyze data from calorimetric measurements to draw conclusions about energy changes, and interpret how changes in heat for a material reveal important properties through calorimetry.	Supporting	
Con 4 DPO 7	Analyze heat changes in materials and closed systems.	Supporting	
Con 4 DPO 8	Explain energy transfers using enthalpy diagrams in chemical reactions.	Supporting	
Code:	5: A Closer Look at Matter Students should learn about the historical evolution of atomic models, understand the components and characteristics of atoms, analyze changes in the nucleus, evaluate electromagnetic radiation models, explain energy transfer in atoms, construct energy transfer devices, quantify wave relationships, and comprehend atomic structure details.	Rating	Completed
Con 5 DPO 1	Outline the development of atomic models from Democritus to the quantum mechanical model.	Priority	
Con 5 DPO 2	Describe the features and components of atoms, ions, and isotopes; including protons, neutrons, electrons, and mass.	Priority	
Con 5 DPO 3	Illustrate changes in the nucleus of atoms through models.	Supporting	
Con 5 DPO 4	Evaluate and compare wave and particle models of electromagnetic radiation.	Supporting	
Con 5 DPO 5	Explain the relationship between light, wavelength and energy transfer in atoms.	Priority	
Con 5 DPO 6	Design and build devices showcasing energy transfer mechanisms.	Supporting	
Con 5 DPO 7	Calculate wave relationships in the electromagnetic spectrum.	Supporting	
Con 5 DPO 8	Explain atomic structure of elements like electron configurations.	Priority	
Code:	6: Relationships and Patterns in Chemistry Students should learn to predict properties of elements and compounds based on periodic table trends, understand how to model atom size changes using Coulomb's Law, describe atom interactions in chemical reactions involving sharing or transferring of electrons, differentiate between types of bonds, predict molecular shapes and bond angles, predict substance properties, and use electronic structure to predict chemical behavior.	Rating	Completed
Con 6 DPO 1	Analyze periodic table trends to predict properties of elements and compounds.	Priority	

Con 6 DPO 2	Use Coulomb's Law to explain how changes in atomic radius, ionization energy, and electronegativity impact the chemical behavior and properties of elements based on their electronic structure and valence electrons.	Supporting	
Con 6 DPO 4	Describe how atoms interact through sharing or transferring electrons in chemical reactions. Differentiate between intramolecular bonds (ionic, covalent, metallic) and intermolecular forces (e.g., hydrogen bonding).	Priority	
Con 6 DPO 5	Predict molecular shapes and bond angles using VSEPR theory.	Supporting	
Con 6 DPO 6	Predict substance properties based on bond type and intermolecular forces.	Supporting	
Code:	7: Solution Chemistry Students should understand the factors influencing solubility, differentiate between different types of solutions based on saturation levels, interpret solubility curves, predict dissolution based on intermolecular forces, perform dilutions, calculate ion concentrations, explain electrolyte solutions, and conduct acid-base titrations accurately.	Rating	Completed
Con 7 DPO 1	Predict solubility of compounds using a solubility table.	Priority	
Con 7 DPO 2	Differentiate between saturated, unsaturated , and supersaturated solutions.	Supporting	
Con 7 DPO 3	Interpret solubility curves to determine the mass of salt that will dissolve and identify the solution type.	Priority	
Con 7 DPO 4	Apply the "like dissolves like" principle to predict dissolution of substances.	Supporting	
Con 7 DPO 5	Perform a dilution and related calculations.	Priority	
Con 7 DPO 6	Calculate ion concentrations in solution and write balanced dissociation equations.	Supporting	
Con 7 DPO 7	Explain the concept of electrolyte solutions and their relationship to conductivity.	Supporting	
Con 7 DPO 8	Demonstrate steps in a basic acid-base titration and calculate unknown concentrations.	Priority	
Code:	8: Gases Students should learn and achieve an understanding of the basic properties of gases and be able to perform calculations involving various gas laws (Boyle's, Charles's, Gay-Lussac's, Combined Gas Law) and the ideal gas law. They should be able to explain the relationships between pressure, volume, temperature, and moles of gas as outlined in these laws.	Rating	Completed
Con 8 DPO1	Describe the basic properties of gases.	Priority	
Con 8 DPO2	Perform calculations using the gas laws. Explain the relationship between pressure, volume, temperature, and moles of gas using these laws.	Priority	
Con 8 DPO3	Perform calculations using the ideal gas law. (C.12.04)	Priority	
Code:	9: Reaction Kinetics Students should learn how to determine the rate of a chemical reaction through experimentation and observations. They should also understand how changes in temperature, concentration, pressure, and	Rating	Completed

	the presence of a catalyst influence the rate of a chemical reaction.		
Con 9 DPO 1	1. Determine the rate of reaction.	Supporting	
Con10 DPO 2	2. Predict how changes in temperature, concentration, pressure, and the presence of a catalyst will impact the rate of a chemical reaction.	Priority	
Code:	10: Chemical Equilibrium Students should understand how Le Chatelier's principle applies to chemical equilibrium and be able to explain how changing factors like concentration, pressure, volume, and temperature can shift the equilibrium position of a reaction. They should also be able to quantify the relationships between reactants and products when disturbances occur.	Rating	Completed
Con 10 DPO1	Describe how changing concentrations, pressure, volume, and temperature affect the position of a chemical equilibrium using examples.	Supporting	
Con 10 DPO2	Identify and explain how changes in concentration, pressure, volume, and temperature influence the equilibrium position.	Supporting	
Con 10 DPO3	Calculate the effects of disturbances on the equilibrium concentrations of reactants and products.	Supporting	
Con 11 DPO 4	Predict the direction in which a reaction will shift given changes in factors affecting equilibrium.	Supporting	
Code:	11: Thermodynamics Students should learn and achieve an understanding of the movement of thermal energy, the relationship between energy transfer and disorder, the principles of the 2nd and 3rd Laws of Thermodynamics, and the differences between temperature and heat.	Rating	Completed
Con 11 DPO 1	Identify examples of thermal energy movement in a closed system.	Priority	
Con 11 DPO 2	Explain the connection between energy transfer (enthalpy) and disorder (entropy) as per the 2nd Law of Thermodynamics.	Supporting	
Con 11 DPO 3	Create a particle model showcasing the movement and entropy of particles at absolute zero based on the 3rd Law of Thermodynamics.	Supporting	
Con 11 DPO 4	Differentiate between temperature as a measure of kinetic energy and heat, highlighting their distinct characteristics.	Supporting	
Code:	12: Solubility Equilibrium Students should be able to write net ionic equations, identify spectator ions, and determine the color of ions in solution and in a flame as part of qualitative analysis.	Rating	Completed
Con 12 DPO1	Write net ionic equations for chemical reactions in solution.	Supporting	
Con 12 DPO2	Recognize the color of different ions when dissolved in solution and observe the characteristic colors when ions are subjected to a flame test.	Supporting	
Code:	13: Acid-Base Equilibrium Students should be able to identify and explain the properties, behavior, concentration, and strengths of acids and bases. They should also understand how to calculate pH for different solutions and illustrate the particle model differences between strong and weak acids/bases.	Rating	Completed

Con 13 DPO 1	Compare and contrast the characteristics of acids and bases, including Arrhenius and Bronsted-Lowry models.	Supporting	
Con 13 DPO 2	Calculate the pH of various solutions.	Priority	
Con 13 DPO 3	Compare the strengths of strong or weak acids and bases.	Supporting	
Code:	14: Nuclear Chemistry Students should learn about nuclear processes like fission, fusion, and radioactive decay at the nucleus level. They should also understand the ethical considerations related to these scientific pursuits, especially in the context of Catholic ethical teachings.	Rating	Completed
Con 14 DPO1	1. Explain fission in nuclear reactors, fusion in stars, and radioactive decay of elements.	Supporting	
Con 14 DPO2	2. Analyze how nuclear energy issues contradict Catholic ethical teachings.	Supporting	

Domain: Biology			
Code:	Strand: Structure and Function	Rating	Completed
Unit 1	Introduction to Biology		
The Study of Life	<ul style="list-style-type: none"> How is biodiversity distributed (or spread out) throughout the Earth's biosphere? Explain why certain areas are more biodiverse than other areas. List and briefly summarize the FOUR main characteristics that all living things share. 		
Unifying Themes of Biology	<ul style="list-style-type: none"> List and briefly summarize (1-2 sentences each) the FOUR major unifying themes of biology. Explain why homeostasis is important for living organisms. Give a real-life example for EACH of the four major unifying themes of biology. 		
Concept 1	The Cell		
Unit 2	Cell Structure and Function		
UNIT 2: Microscopes	<ul style="list-style-type: none"> Explain how to calculate the total magnification of a specimen being viewed under each of the three objectives (4x, 10x, 40x) Demonstrate how to use a microscope by finding the specimen/object 		
	Cell Theory <ul style="list-style-type: none"> Identify the three parts of the cell theory, and link them to the scientific works that contributed to the development of each: <ul style="list-style-type: none"> Hooke and Leeuwenhoek Schleiden and Schwann Virchow What are the characteristics that ALL cells share with one another? Differentiate between prokaryotic and eukaryotic cells.		
Concept 1	Describe the role of energy in cellular growth, development, and		

PO1	repair, including photosynthesis and respiration.		
UNIT 5: The Cell Cycle	<ul style="list-style-type: none"> List in order and briefly explain the phases that make up the cell cycle, including the sub-phases within Interphase Compare and contrast mitosis and cytokinesis. Explain why cells divide at different rates, including a brief explanation of the phase G0 and how it relates to cell division What is the purpose of checkpoints, and where along the cell cycle do they occur? Explain why cells are so small in terms of surface area-to-volume ratio. What problems arise when a cell is too large? 		
	Illustrate through a particle model the differences between strong and weak acids/bases.		
Concept 1 DPO 2	Describe the form, function and cellular components of: <ul style="list-style-type: none"> Prokaryotic cells Eukaryotic cells 		
UNIT 2: Cell Organelles	<ul style="list-style-type: none"> List (and where needed, distinguish between) the organelle(s) responsible for: <ul style="list-style-type: none"> Controlling all cell functions Maintaining boundaries and shape of cell Storing materials Energy production Packaging and shipping materials Helping with cell division Clean-up Producing proteins Identify and explain the anatomical differences between plant and animal cells 		
Concept 1 DPO 3	Describe how cells maintain homeostasis via feedback mechanisms.		
UNIT 2: Cell Membrane	<ul style="list-style-type: none"> Describe the structure of the cell membrane, including the properties and functions of the following: <ul style="list-style-type: none"> Phospholipids Proteins (marker, receptor, transport) Carbohydrate chains Cholesterol Explain the semipermeable nature of the cell membrane and relate it to the homeostasis of the cell 		
Concept 1 DPO 4	Analyze mechanisms of transport of materials (e.g., water, ions, macromolecules) into and out of cells: <ul style="list-style-type: none"> Passive transport Active transport 		
UNIT 2: Diffusion and	<ul style="list-style-type: none"> Compare and contrast passive and active transport in terms of energy investment of the cell and movement relative to 		

Osmosis	<p>concentration gradients across the membrane.</p> <ul style="list-style-type: none"> Distinguish among osmosis, simple diffusion, and facilitated diffusion 		
UNIT 2: Active Transport, Endocytosis, and Exocytosis	<ul style="list-style-type: none"> Distinguish between endocytosis and exocytosis Distinguish between phagocytosis and pinocytosis 		
Concept 1 DPO 5	Describe the purposes and processes of cellular division (mitosis).		
UNIT 5: Mitosis and Cytokinesis	<ul style="list-style-type: none"> Describe how DNA is organized into chromosomes, taking care to include (and highlight) the following terms: histone, chromatin, chromatid, centromere, and telomere. List the five phases of M phase (cell division) in order, then briefly describe (one sentence for each) what happens in each phase. What are the distinguishing characteristics of each phase of cell division? (Be able to identify each cell division phase if provided with a random assortment of diagrams) 		
UNIT 5: Chromosomes and Meiosis	<ul style="list-style-type: none"> Identify the difference between haploid and diploid (include the process that makes them) Define and identify examples of gametes. Explain how a gamete differs from somatic cells. What are homologous chromosomes and where do they come from? Be sure to include the difference between autosomes and sex chromosomes. 		
UNIT 5: Process of Meiosis	<ul style="list-style-type: none"> Identify the results of meiosis I and meiosis II Compare meiosis and mitosis - List the major differences between the processes of mitosis and meiosis. 		
Code:	Strand: Matter and Energy in Organisms and Ecosystems	Rating	Completed
Concept 5	Matter, Energy, and Organization in Living Systems (including Human Systems). Understand the organization of living systems, and the role of energy within those systems.		
Concept 5 DPO 1	Describe the processes of photosynthesis and cellular respiration (aerobic and anaerobic) in terms of energy flow, reactants, and products.		
UNIT 3: Overview of Photosynthesis	<ul style="list-style-type: none"> Relate producers to photosynthesis. How are consumers different from producers in terms of sources of food? Describe the structure of the chloroplast, using a diagram if needed. Include the function and location of chlorophyll in your description. What is the main purpose of the light-dependent reactions? Where do they take place (be specific)? What do they “use” and what is produced? What is the main purpose of the light-independent reactions? Where do they take place (be specific)? What do they “use” 		

	<p>and what is produced?</p> <ul style="list-style-type: none"> Describe the main overall main purpose of the process of photosynthesis? Write the chemical equation for the process (both in words and in chemical formulas) 		
UNIT 3: Overview of Cellular Respiration	<ul style="list-style-type: none"> Where does the process of glycolysis take place and what is its main purpose? What is the main purpose of the Krebs cycle? Where does it take place (be specific)? What does it “use” and what is produced? What is the main purpose of the Electron Transport Chain? Where does it take place (be specific)? What does it “use” and what is produced? Describe the main overall purpose of aerobic cellular respiration? Write the chemical equation for the process (in both in words and in chemical formulas) Compare cellular respiration to photosynthesis, particularly in terms of their relationship to one another. 		
UNIT 3: Fermentation	<ul style="list-style-type: none"> Under what conditions would the process of fermentation take place in a cell? Compare and contrast the outcome of fermentation in animal and some bacterial cells vs. some plant and yeast cells 		
Concept 5 PO 2	Describe the role of organic and inorganic chemicals (e.g., carbohydrates, proteins, lipids, nucleic acids, water, ATP) important to living things.		
UNIT 1: Atoms, Ions, and Molecules	<ul style="list-style-type: none"> Explain the difference between a(n): <ul style="list-style-type: none"> Atom and element Atom and ion Compound and molecule Describe how ions are formed. Compare and contrast ionic and covalent bonding. 		
UNIT 1: Properties of Water	<ul style="list-style-type: none"> Explain the polar structure of a water molecule and how that relates to the formation of hydrogen bonds. List and briefly explain the following properties of water: <ul style="list-style-type: none"> Cohesion Adhesion Universal solvent High specific heat Explain why many compounds dissolve in water. Compare and contrast acids and bases, particularly in terms of major characteristics, and where they lie on the pH scale. 		
UNIT 1: Macromolecules (Carbon Based Molecules)	<ul style="list-style-type: none"> Differentiate between a monomer and a polymer, both generally speaking and specific to each of the major macromolecules. List and briefly explain the four macromolecules and their basic uses in living organisms. 		

UNIT 3: Chemical Energy and ATP	<ul style="list-style-type: none"> • What is ATP and what function does it serve in the cell? • Describe the ATP-ADP cycle by: <ul style="list-style-type: none"> ○ Explaining how usable energy is released in an ATP molecule. ○ Explaining how an ATP molecule is converted to an ADP molecule. • Compare and contrast how food is produced in plant cells and in microorganisms that live in places with no sunlight. 		
Concept 5 DPO 5	Describe the levels of organization from atoms, molecules, cells, tissues, organs, organ systems, organisms, populations, communities to ecosystems. (THIS IS MORE ENVIRONMENTAL)		
Code:	Strand: Interdependent Relationships in Ecosystems (THIS IS ENVIRONMENTAL)	Rating	Completed
Concept 3	Interdependence of Organisms		
Concept 3 DPO 1	Analyze the relationships among organisms at different levels of organization: <ul style="list-style-type: none"> • Populations • Communities (group behavior) • Ecosystems • Biomes 		
Concept 3 DPO 2	Describe how organisms are influenced by a particular combination of biotic (living) and abiotic (nonliving) factors in an environment (aerobic and anaerobic) as influenced by the cycling of matter.		
Concept 3 DPO 3	Assess how the size and the rate of growth of a population are determined by birth rate, death rate, immigration, emigration, and carrying capacity of the environment.		
Code:	Strand: Inheritance and Variation of Traits	Rating	Completed
Concept 2	Molecular Basis of Heredity Understand the molecular basis of heredity and resulting genetic diversity.		
UNIT 6: Mendel and Heredity	<ul style="list-style-type: none"> • Describe Mendel’s process of experimentation with pea plants and trait inheritance. • Explain how Parental, First Filial, and Second Filial generations are produced and the results Mendel obtained when he started with two purebred parental plants. • What are the two key points of the law of segregation? 		
UNIT 6: Chromosomes and Phenotype	<ul style="list-style-type: none"> • Explain why a heterozygous genotype is sometime called a “carrier” • Explain and give an example of sex-linked traits. • Describe the pattern of inheritance that can occur in sex-linked traits. 		
UNIT 6: Complex Patterns of Inheritance	<ul style="list-style-type: none"> • List and explain the different factors that can affect the phenotype of an individual. • Differentiate between incomplete dominance and codominance. • Explain how multiple allele inheritance can create different 		

	<p>blood type phenotypes.</p> <ul style="list-style-type: none"> Define and give an example of a polygenic trait. Explain how the expression of epistatic genes differs from the expression of other genes 		
UNIT 6: Human Genetics and Pedigrees	<ul style="list-style-type: none"> Describe how a pedigree is used and explain some of the common symbols found in a pedigree. Explain how a pedigree could be used to determine the genotypes of individuals in a family tree. 		
Concept 2 PO 1	Analyze the relationships among nucleic acids (DNA, RNA), genes, and chromosomes.		
UNIT 6: Traits, Genes, and Alleles	<ul style="list-style-type: none"> Explain how there are multiple versions of a gene. Describe the relationship between genes and traits. Differentiate between dominant and recessive alleles. Differentiate between genotypes and phenotypes. Differentiate between homozygous and heterozygous genotypes. 		
UNIT 7: Structure of DNA	<ul style="list-style-type: none"> Briefly outline the contributions of the following scientists to modern DNA structure theory: <ul style="list-style-type: none"> James Watson and Francis Crick Rosalind Franklin Erwin Chargaff Describe the interaction of the four nucleotides that make up DNA, including the ways they organize according to base-pairing rules Describe the three-dimensional structure of DNA, including the locations/arrangement of sugars, phosphates, and bases. 		
Concept 2 PO 2	Describe the molecular basis of heredity, in viruses and living things, including DNA replication and protein synthesis.		
UNIT 7: DNA Replication	<ul style="list-style-type: none"> Summarize the process of DNA replication, particularly with regards to its semi-conservative nature Describe the role of enzymes in DNA replication, particularly the functions of DNA polymerase and DNA helicase 		
UNIT 7: Transcription and Translation	<ul style="list-style-type: none"> Describe the relationship between RNA and DNA Identify the three kinds of RNA and their functions Compare and contrast the process of transcription and DNA Replication Describe (using an example codon of your choice) how an mRNA codons is “read” and translated into an amino acid chain Explain the relationship between: <ul style="list-style-type: none"> An mRNA codon and a tRNA anticodon A tRNA and an amino acid A start codon and a stop codon 		
Concept 2 PO 3	Explain how genotypic variation occurs and results in phenotypic diversity, applying concepts of statistics and probability.		
UNIT 6: Traits and Probability	<ul style="list-style-type: none"> Illustrate how a punnett square works (Draw an example). Explain the different outcomes of these punnett squares: 		

	<ul style="list-style-type: none"> ○ a.HOD x HOR ○ b. HOD x He ○ c. HOR x He ○ d. He x He <ul style="list-style-type: none"> • Differentiate between genotypic ratio/probability and phenotypic ratio/probability • Describe the law of independent assortment. • Explain how to perform a test cross. 		
Concept 2 PO 4	Describe how cells maintain genetic variation, for example: <ul style="list-style-type: none"> • New genetic combinations through meiosis and fertilization • Viable errors during replication • Mutations caused by environmental factors • Conjugation • Not limited to the above 		
UNIT 7: Mutations	<ul style="list-style-type: none"> • Distinguish between point mutations, frameshift mutations, and chromosomal mutations. • Explain why mutations may or may not affect phenotype • List some factors that can cause mutations 		
Code:	Strand: Evolution by Natural Selection	Rating	Completed
Concept 4	Biological Evolution		
Concept 4 DPO 1	Identify and communicate the following components of natural selection, which can lead to speciation: <ul style="list-style-type: none"> • Potential for a species to increase its numbers • Genetic variability and inheritance of offspring due to mutation and recombination of genes • Finite supply of resources required for life • Selection by the environment of those offspring better able to survive and produce offspring 		
Concept 4 DPO 2	Explain how genotypic and phenotypic variation can result in adaptations that influence an organism's success in an environment by using statistics and probability.		
Concept 4 DPO 3	Describe how the continuing operation of natural selection underlies a population's ability to adapt to changes in the environment and leads to biodiversity and the origin of new species.		
Concept 4 DPO 4	Predict how a change in an environmental factor (e.g., rainfall, habitat loss, and non-native species) can affect the number and diversity of species in an ecosystem, (increases in number of individuals, emergence of new species, and the extinction of other species.)		
Concept 4 DPO 5	Analyze scientific data which supports the theory of evolution through natural selection over billions of years, resulting in present day biodiversity: <ul style="list-style-type: none"> • Fossil record • Nuclear chemistry • Geology • Molecular biology • Geographical distribution • Embryology 		

Concept 4 DPO 6	Analyze the degree of relatedness among various species using a biological classification system, for example: <ul style="list-style-type: none"> • Cladistics • Phylogeny • Morphology • DNA analysis • Not limited to the above 		
Concept 4 DPO 7	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity (threatened or endangered species or genetic variation.)		
Domain: Physics			
Code:	1: Motion - Analyzing how objects move in our universe.	Rating	Completed
PHYS.1.1	Understand, explain and apply the mathematical relationship between position, velocity, acceleration, and time with respect to the concept of rate of change.	Priority	
PHYS.1.2	Graphically analyze and create motion relationships involving position, velocity, and acceleration relative to time. This could involve cartesian coordinate systems, verbal descriptions, or motion maps.	Priority	
PHYS.1.3	Analyze word problems to solve for unknowns in 1D and 2D motion.	Priority	
PHYS.1.4	Execute experiments that explore constant velocity, constant acceleration and/or projectile motion.	Priority	
PHYS.1.5	Use linear regression to develop a model of experimental data for constant velocity, constant acceleration, and/or projectile motion. Evaluate for sources of error and confidence in the model.	Priority	
Code:	2: Forces and Interactions - Using Newton's Laws of Motion, how objects interact with one another and their surroundings.	Rating	Completed
	Explain how Newton's 1st Law of Motion applies to objects at rest or moving at constant velocity.	Priority	
	Using Newton's 2nd Law of Motion, analyze, graphically and mathematically, the relationships among the net force acting on a body, the mass of the body, and the resulting acceleration.	Priority	
	Use Newton's 3rd Law of Motion to explain forces as interactions between objects.	Priority	
	Describe and quantify the nature and magnitude of the following forces and how they operate: <ul style="list-style-type: none"> • Friction • Force of Gravity • Normal Force Tension/Compression	Priority	
	Understand and apply the concept of Systems in order to problem solve using Newton's Laws.	Supporting	
	Use Newton's Laws and Systems to create Free Body Diagrams to assist in problem solving. Include physical situations where the axis of the Free Body Diagram is not typically vertical and horizontal (e.g. an inclined plane).	Priority	

	Problem solve for unknowns using Free Body Diagrams and Newton's 2nd Law for systems under constant velocity (or rest) and systems under non-zero acceleration.	Priority	
	Define, compare/contrast, and apply the concept of mass, inertia, weight and the normal force in relation to each other.	Supporting	
	Execute experiments that explore the relationships between force, mass, and acceleration.	Priority	
	Use linear regression to develop models of experimental data for accelerations for the following scenarios <ul style="list-style-type: none"> a constant mass experiencing a changing net force a changing mass undergoing a constant force. Evaluate for sources of error and confidence in the models.	Priority/Support	
	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.	Supporting	
Code:	3: Circular Motion - The motion of objects rotating with a circular path	Rating	Completed
	Analyze the general relationships among force, acceleration, and motion for an object undergoing uniform circular motion.	Priority	
	Define centripetal acceleration and centripetal force, especially as it relates to Newton's 2nd Law.	Priority	
	Identify and determine the direction of the vector quantities involved in circular motion (i.e. acceleration, and velocity).	Priority	
	Understand and apply the concept that centripetal force is a net force and not an actual force.	Supporting	
	Using Newton's Laws, problem solve for physical situations involving circular motion. Examples might include: <ul style="list-style-type: none"> Motion at the apex of a hill (and the nadir of a valley) A roller coaster loop-the-loop Spinning an object horizontally An airplane turning in a circle	Priority	
	Execute experiments that explore the relationships between mass, velocity, and radius of an object rotating in a circle.	Supporting	
	Use linear regression to develop models of experimental data for the relationships between mass, velocity and radius of circular motion. Evaluate for sources of error and confidence in the models.	Supporting	
Code:	4: Gravitation - How the fundamental interaction of gravity operates in our universe	Rating	Completed
	Using the Law of Universal Gravitation, calculate the gravitational force between two objects changes when (1) the masses change or (2) the distance between the masses changes.	Priority	
	Derive the acceleration of gravity on Earth from the Law of Universal Gravitation. Understand what and why non-idealities cause this derivation to be different from the empirical value we experience on Earth.	Supporting	

	Apply the concept of circular motion to the motion of a satellite orbiting another celestial body in order to calculate the orbital velocity of a satellite.	Priority	
	Use a simulation to model the effects of changing the physical quantities involved in the Law of Universal Gravitation.	Supporting	
Code:	<i>Electrostatics</i>	Rating	Completed
	Understand and describe the concept of Charge. Include how it is characterized, behaves and interacts with other Charge.	Priority	
	Conduct physical investigations that provide evidence Charge exists and is indirectly observable in our universe. Simulations can also be used to explore how charge behaves.	Supporting	
	Describe various historical experiments that helped in discovering the nature and behavior of charge.	Supporting	
	Using Coulomb's Law, calculate and model how the electrical force will change when the distance between two point charges changes or the charge of one of the point charges changes.	Priority	
	Explain and detail on a diagram how electric fields operate. Explain how a test charge would interact with electric fields.	Priority	
	Detail on a diagram how two charges' electric fields interact with one another.	Supporting	
	Understand and explain the concept of Electric Potential Energy.	Priority	
	Using conservation of energy and Electric Potential Energy, problem solve for unknowns (i.e. charges, distances and velocities).	Priority	
Code:	<i>Energy</i>	Rating	Completed
	Define and explain the law of conservation of energy (First Law of Thermodynamics).	Priority	
	Describe the ways in which energy is stored in a system, for example: <ul style="list-style-type: none"> • Mechanical • Thermal • Electrical • Chemical Not limited to the above	Priority	
	Problem solve for the following types of energies: <ul style="list-style-type: none"> • Potential Energy due to Gravity • Potential Energy due to Elasticity Kinetic Energy	Priority	
	Identify and apply the concept of conservative forces and non-conservative forces and how they apply to conservation of energy.	Supporting	
	Define the concept of work and how it applies to energy transfer and the total energy of a system.	Supporting	
	Apply the law of conservation of energy to analyze energy transformations in closed and open systems.	Priority	
	Problem solve for work and frictional losses in a system.	Supporting	
	Execute experiments that explore the transfer of energy. Example	Priority	

	<p>experiments could include combinations of::</p> <ul style="list-style-type: none"> • Potential Due to Gravity • Kinetic Energy <p>Potential Due to Elastic</p>		
	Use linear regression to develop models of experimental data for the relationships between the variables involved in energy transfer. Evaluate for sources of error and confidence in the models.	Priority	
	<p>Describe, design, build, and refine devices and mechanisms that model the various ways in which energy is transferred from one system to another, for example:</p> <ul style="list-style-type: none"> • Mechanical contact • Thermal conduction • Electromagnetic radiation <p>Not limited to the above</p>	Supporting	
Code	<i>Waves and Electromagnetic Radiation</i>	Rating	Completed
	Explain the key characteristics of waves, including: wavelength, frequency, amplitude, and period.	Priority	
	Define and differentiate between mechanical and electromagnetic waves.	Priority	
	Define and compare/contrast longitudinal and transverse waves.	Supporting	
	Mathematically analyze the relationship between wavelength, frequency, and speed using the wave equation.	Priority	
	Identify and explain real-world applications of various types of mechanical waves, such as sound waves and seismic waves.	Supporting	
	Evaluate the evidence and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.	Supporting	
	Define the electromagnetic spectrum and its different regions (radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays).	Priority	
	Explain the relationship between the wavelength of light absorbed and the transfer of a discrete amount of energy.	Supporting	
	Describe the behavior of waves when encountering different mediums, including reflection, refraction, and diffraction.	Priority	
	Compare and contrast the different regions of the electromagnetic spectrum based on their wavelength, frequency, and energy.	Priority	
	Identify and explain real-world applications of different regions of the electromagnetic spectrum, including communication technologies, medical imaging, and energy production.	Priority	
Code:	Momentum	Rating	Completed
	Describe, define, and use the concept of momentum, especially as it is related to Newton's 2nd Law	Priority	
	Describe, define, and use the concept of impulse to problem solve for	Priority	

	momentum, average force, or time.		
	Use graphical methods to determine impulse and momentum.	Priority	
	Using conservation of momentum, analyze and solve for velocities of objects involved in collisions (or explosions). Include both inelastic, elastic and normal collisions (or explosions).	Priority	
	Execute experiments that explore the conservation of momentum. Example experiments could include: <ul style="list-style-type: none"> Elastic Collisions Inelastic Collisions Internal Spring Explosions	Priority	
Code:	Electricity/Circuits	Rating	Completed
	Define and evaluate open and closed loops in an ohmic system	Priority	
	Define the concept of charge and how it behaves in conductors and insulators.	Supporting	
	Describe and evaluate the effect of changing electric potential (voltage) in an ohmic system.	Priority	
	Evaluate resistance in parallel and series in an ohmic system and the associated effects to currents and voltages.	Priority	
	Describe and quantify the relationship among electric potential (voltage), current, and resistance in an ohmic system.	Priority	
	Evaluate electric potential (voltage) in an ohmic system with respect to parallel/series orientation and the potential direction. Describe the associated effects to current.	Supporting	
	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.	Supporting	

Appendices

Appendix A: Science Fair Project Rubric

1. Scientific Thought and Engineering Goals (30 points)
 - Hypothesis/Problem Statement (10 points)
 - Procedure/Method (10 points)
 - Data Analysis/Results (10 points) Does your Data tell a story?
2. Creativity and Originality (20 points)
 - Unique approach or concept (10 points)
 - Creative use of materials and/or presentation (10 points)
3. Scientific Reasoning (30 points)
 - Does Conclusion match your Hypothesis? (10 points)
 - What errors were there? (10 points) ‘
 - What is the real world value of your experiment?
4. Understanding of the Project
 - While presenting, demonstrates understanding of the project –(10 Points)
 - Can explain and answer questions (10 points)
5. Clarity and Presentation (20 points)
 - Clear, concise and engaging presentation of findings (10 points)
 - Effective use of visual aids and/or demonstrations (10 points)
 -

Each category is scored on a scale of 1-10, with 10 being the highest. The maximum total score a project can receive is 100 points.

This rubric is designed to be flexible and can be adjusted based on the specific needs and goals of your science fair.

Appendix B: Lab Report Template

Title: *a brief, concise, yet descriptive title.

Question:

*What question are you trying to answer?

*Optional: you may include any preliminary observations or background information about the subject.

Hypothesis:

***Write a possible solution for the problem.**

*Make sure this possible solution is a complete sentence.

*Make sure the statement is testable, an if-then statement is recommended to illustrate what criteria will support your hypothesis (and what data would not support the hypothesis).

Materials:

*Make a BULLETED list of ALL items used in the lab.

Procedure:

*Add **NUMBERED, step-by-step directions** of your procedure in such a way that anyone else could repeat the experiment.

*Do **NOT** use pronouns in the procedure, use **PRESENT** tense in the procedure.

Data:

*This section should include any data tables, observations, or additional notes you make during the lab.

*You may attach a separate sheet(s) if necessary.

*All tables, graphs and charts should be **Labeled Appropriately** (i.e. **Table 1. Measurement chart**).

Analyze: [IN PARAGRAPH FORM USING AT LEAST THREE (3) COMPLETE SENTENCES]

*Include a **summary of the data - if measurements were taken** list averages, highest, lowest, etc. to help the reader understand your results. **Try not to copy your data here**, you should summarize and reference **KEY** information. Think about the title and the question. Do **NOT** repeat the procedure here.

Conclusion: [IN PARAGRAPH FORM USING AT LEAST THREE (3) COMPLETE SENTENCES] - DO NOT USE NUMBERS IN THIS SECTION. Address the following in your conclusion paragraph:

1. Do you accept or reject your hypothesis?
2. **EXPLAIN** why you accepted or rejected your hypothesis using data from the lab.
3. List one thing you learned and describe how it applies to a real-life situation.
4. Discuss possible errors that could have occurred in the collection of the data (experimental errors)

Communicate: [IN PARAGRAPH FORM USING AT LEAST THREE (3) COMPLETE SENTENCES]

*Explain how you will tell a **LARGE GROUP** about the results who was not a part of the lab (**will you use Google Slides, a poster, a video, a demonstration? Will you include charts, graphs, pictures, etc.?**).