Diocese of Phoenix

The Catholic Schools: New Diocesan Science Standards (NDSS)

NDSS-New Diocesan Science Standards: Middle School

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 Christian values. The skills and knowledge afford students to make these types of decisions and should reflect their 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.

Phoenix New Diocesan Science Standards - Middle School

The Diocese of Phoenix Catholic Schools- Faith in Education

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ELEMENTARY SCIENCE CURRICULUM

Diocese of Phoenix

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It is with much gratitude and praise that the Catholic Schools Office of the Diocese of Phoenix would like to recognize and thank the Elementary Science Curriculum Committee. In times when school curriculum is being more carefully scrutinized by the public and revised more meticulously by educators in ways that will greatly impact the rigor of our Catholic school educational programs, this committee has done excellent work creating Diocesan science standards that are robust in content, reflective of interdisciplinary goals set forth in the English Language Arts standards, and reflective of core Catholic values.

As Catholic educators, we value the perspective that science provides in the lens of our Catholic worldview. Our revised curriculum stresses the value we place on student inquiry, critical thinking and questioning, open-minded investigation, and reflective practice. Through science we hope to inspire curiosity and depth of understanding.

It is our intent as a committee to challenge our students and assist our teachers by providing the strongest curriculum guidance infused with our faith. In the end, we hope to produce students formed by Catholic philosophies who will be equipped to solve problems, think deeply, and make informed, scientifically literate decisions rooted in responsibility. Our students will be well prepared to face the world in every regard.

Sincerely,

MaryBeth Mueller, Ed. Specialist

Executive Director of the Division of Education and Evangelization

and Superintendent of Catholic Schools

ELEMENTARY SCIENCE

CURRICULUM STANDARDS COMMITTEE

2013-2015

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Special Thanks! The Catholic Schools Office would like to express deepest gratitude to Father Tom Eckert, pastor of St. Vianney Catholic Church and School, for spending time on the Catholic Identity review of these standards. His time and recommendations are appreciated!

National Standards and Benchmarks for effective Catholic Elementary and Secondary Schools March 2012

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: An excellent Catholic school has a clearly articulated, rigorous curriculum aligned with relevant standards, 21st century skills, and Gospel values, implemented through effective instruction. *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 the 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 global 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 effective 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 access 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.

INTRODUCTION

Science Teachers as Moral Educators *Updated 2014*

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 a 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-8

CODE:	
Elementary Science Standards 1.S5.C2.DPO1 (2008) = Grade 1, Strand 5, Concept 2, Diocesan Performance Objective 1. Explanations and Related materials are color coded:	
Green	Catholic Identity
Orange	Science and Engineering Practices
Blue	Disciplinary ideas
Highlighted sections show Diocesan curriculum committee additions.	

*The highlighted sections were added by the committee due to a recognition that content that they viewed as crucial had been omitted by the NGSS. Additionally, there are a number of NGSS that were omitted by the diocesan curriculum committee because they were viewed as developmentally inappropriate or contrary to the teachings of the Catholic faith.

Note to the teachers:

In developing the 2013/2014 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.

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Diocese of Phoenix
Elementary Science Curriculum K-8

Philosophy Statement

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 Christian values. The skills and knowledge afford students to make these types of decisions and should reflect their 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 Christian 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 is an integrated study that strongly involves religious beliefs, communication, and applies across the curriculum. The process also involves "hands-on" student participation.

4. Develop an interest, a sense of wonder, and curiosity about the study of the universe while recognizing the objective nature of science with respect to God as our Creator.

5. Develop an understanding of the scientific process and understand the structure of science, which includes organizing data into facts, principles, models, laws, and theories.

6. Realize the practical relationship of science to everyday life.

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 to 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.

Diocesan Middle School: Physical Science

DMS- Structure and Properties of Matter

Students who demonstrate understanding can:	
DMS.PS1.1.	**Develop models to describe the atomic composition of simple molecules and extended structures** Emphasize developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete depiction of all individual atoms in a complex molecule or extended structure.]
DMS.PS1.3.	**Collect and analyze information to describe that synthetic materials come from natural resources and impact society.** Emphasize natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.] [Assessment Boundary: Assessment is limited to qualitative information.]
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.** Emphasize qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]
DMS.PS1.4.1.	**Investigate how the transfer of energy can affect the physical and chemical properties of matter**

Catholic Identity

Implementing 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.**

Physical Science- Structure and Properties of Matter: Correlations to Minimum Standards.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
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 supported by evidence. (MS.PS1.3)	**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 locations. (MS.PS1.4) • 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) **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.PS1.3) (Note: This Disciplinary Core Idea is also addressed by MS.PS1.2 and MS.PS1.5.) **PS3.A: Definitions of Energy** • 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)	**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** • 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) **Influence of Science, Engineering and Technology on Society and the Natural World** • 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)

Diocesan Middle School: Physical Science

DMS- Chemical Reactions

Students who demonstrate understanding can:	
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.** [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]
DMS.PS1.2.1.	**Identify different kinds of matter based on the following physical properties: states, density, boiling point, melting point, solubility.**
DMS.PS1.2.2.	**Identify different kinds of matter based on the following chemical properties: reactivity, pH, oxidation (corrosion)**
DMS.PS1.2.3.	**Investigate how the transfer of energy can affect the physical and chemical properties of matter**
DMS.PS1.2.4.	**Classify matter in terms of elements, compounds, or mixtures (homogeneous, heterogeneous mixtures)**
DMS.PS1.2.5.	**Explain the systematic organization of the periodic table**
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.** [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms that represent atoms.] [Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.]
DMS.PS1.6.	**Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.*** [Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride.] [Assessment Boundary: Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.]
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).**
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.)**

Catholic Identity

Integrating 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.**

Physical Science- Chemical Reactions: Correlations to Minimum Standards.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
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) **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.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.) **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)	**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) • The transfer of energy can be tracked as energy flows through a designed or natural system. (MS.PS1.6)

Diocesan Middle School: Physical Science

DMS- Forces and Interactions

Students who demonstrate understanding can:	
DMS.PS2.1.	**Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.*** [Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]
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.** [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]
DMS.PS2.3.	**Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.** [Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor. Because of the placement of this standard in the curriculum guide, teachers must be aware of student's potential confusion between gravity as a force and magnetism. Gravity is not a type of magnetism.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.]
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.** [Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.] [Assessment Boundary: Assessment does not include Newton's Law of Gravitation or Kepler's Laws.]
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.** [Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.] [Assessment Boundary: Assessment is limited to electric and magnetic fields, and is limited to qualitative evidence for the existence of fields.]

Catholic Identity

Integrating Catholic Identity

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

Physical Science- Forces and Interactions: Correlations to Minimum Standards.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
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 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.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) **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 an object, tool, process or system. (MS.PS2.1) **Engaging in Argument from Evidence** 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) **Scientific Knowledge is Based on Empirical Evidence** Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS.PS2.2),(MS.PS2.4)	**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 other people, these choices must also be shared.(MS.PS2.2) **PS2.B: Types of Interactions** • 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)	**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 Technology on Society and the Natural World

Students who demonstrate understanding can:	
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.** [Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.]
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.**
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.** [Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.] [Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions.]
DMS.PS3.3	**Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.*** [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]
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.** [Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]
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.** [Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [Assessment Boundary: Assessment does not include calculations of energy.]

Catholic Identity

Integrating 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.

Physical Science-Energy: Correlations to Minimum Standards.

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.PS3.2)

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 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)

Disciplinary Ideas

PS3.A: Definitions of Energy

- 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 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)

Crosscutting Concepts

Scale, Proportion, and Quantity

- 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)

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.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)

Diocesan Middle School: Physical Science

DMS- Waves and Electromagnetic Radiation

Students who demonstrate understanding can:	
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.** [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] [Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.]
DMS.PS4.2.	**Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.** [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]
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.** [Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen.] [Assessment Boundary: Assessment does not include binary counting. Assessment does not include the specific mechanism of any given device.]

Catholic Identity

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

Physical Science-Waves and Electromagnetic Radiation: Correlations to Minimum Standards.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
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 written text with that contained in media and visual displays to clarify claims and findings. (MS.PS4.3) -- ***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.PS4.1)	**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** • Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS.PS4.3)	**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) -- ***Connections to Nature of Science*** **Science is a Human Endeavor** • Advances in technology influence the progress of science and science as influenced advances in technology. (MS.PS4.3)

Diocesan Middle School: Earth & Space Science

DMS- Space Systems

Students who demonstrate understanding can:	
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.** [Clarification Statement: Examples of models can be physical, graphical, or conceptual.] Identify the major constellations visible from the Northern Hemisphere: Orion, Ursa Major (Great Bear), Cygnus (Swan), Scorpius, Cassiopeia.
DMS.ESS1.2.	**Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.** [Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy, Alpha Centauri and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).] [Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.]
DMS.ESS1.3.	**Analyze and interpret data to determine scale properties of objects in the solar system.** [Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.
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.**

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.

Earth & Space Science - Space Systems: Correlations to Minimum Standards.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
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 Similarities and differences in findings. (MS. ESS1.3)	**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 t hem. (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 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)	**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** • 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) --- ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** • 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)

Diocesan Middle School: Earth & Space Science

DMS- History of Earth

Students who demonstrate understanding can:	
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.** [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]
DMS.ESS2.2.	**Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.** [Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.
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.**
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.** [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).]
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.	

Earth & Space Science - History of Earth: Correlations to Minimum Standards.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
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. ESS1.4),(MS.ESS2.2) ------------------------ ***Connections to Nature of Science*** **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)	**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 land and underground–cause weathering and erosion, which change the land's surface features and create underground formations. (MS-ESS2-2)	**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)

Diocesan Middle School: Earth & Space Science

DMS- Earth's Systems

Students who demonstrate understanding can:	
DMS.ESS2.1.	**Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.** [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] [Assessment Boundary: Assessment does not include the identification and naming of minerals.] deposition of rock).]
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.** [Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]
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.** [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]
DMS.ESS3.2.	**Distinguish the components and characteristics of the rock cycle for the following types of rocks, igneous, metamorphic, sedimentary.**
DMS.ESS3.3.	**Identify the different spheres: Trophosphere, stratosphere, mesosphere, thermosphere, ionosphere, exosphere.**

Catholic Identity

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

Earth & Space Science- Earth's Systems: Correlations to Minimum Standards.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
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 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)	**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 Earths land, ocean, atmosphere, and biosphere for many different resources. 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)	**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 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)

Students who demonstrate understanding can:	
DMS.ESS2.5.	**Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.** [Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]
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.** [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]
DMS.ESS3.5.	**Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.** [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]

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.

Earth & Space Science - Weather and Climate: Correlations to Minimum Standards.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
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 to answer scientific questions or test design solutions under a range of conditions. (MS.ESS2.5)	**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 globally redistributing it through ocean currents. (MS.ESS2.6) ESS3.D: Global Climate Change • 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)	**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)

Diocesan Middle School: Earth & Space Science

DMS- Human Impact

Students who demonstrate understanding can:	
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.** [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]
DMS.ESS3.3.	**Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*** [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]
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.**

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.

Earth & Space Science - Human Impact: Correlations to Minimum Standards.

<table>
<tr><th>Science and Engineering Practices</th><th>Disciplinary Ideas</th><th>Crosscutting Concepts</th></tr>
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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 or system. (MS.ESS3.3)
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 world(s).
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)
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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)
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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 environment. (MS.ESS3.4)
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)

Connections to Nature of Science
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- ESS3-4)
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Diocesan Middle School: Life Science

DMS- Structure, Function and Information Processing

Students who demonstrate understanding can:	
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.** [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.]
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.** [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.]
DMS.LS1.2.1	**Describe how single-celled and multi-celled organisms carry on basic life processes. Ex… osmosis, diffusion.**
DMS.LS1.3.	**Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.** [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, reproductive and nervous systems.]
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.** [Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]
DMS.LS1.5	**Identify ways in which living things can be classified.** Eg. Taxonomic groups of plants, animals, and fungi; groups based on details of organism's internal and external features; groups based on functions served within an ecosystem such as producers, consumers, and decomposers.
DMS.LS1.6.1	**Relate the following structures to their functions for plants.** Transpiration- stomata, roots, xylem, phloem. Absorption-roots, xylem, phloem, Response to stimulus-phototropism, hydrotropism, geotropism, gravitropism. Dormancy, pollination, seed dispersal.

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.

Life Science - Structure, Function and Information Processing: Correlations to Minimum Standards.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
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** 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. • Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS.LS1.1) **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). • Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS.LS1.3) **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. • 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)	**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 membrane forms the boundary that controls what enters and leaves the cell. (MS.LS1.2) • 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) **LS1.D: Information Processing** • 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)	**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) **Structure and Function** • 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) --- ***Connections to Engineering, Technology, and Applications of Science*** **Interdependence of Science, Engineering, and Technology** • 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) --- ***Connections to Nature of Science*** **Science is a Human Endeavor** • 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)

Diocesan Middle School: Life Science

DMS- Matter and Energy in Organisms and Ecosystems

Students who demonstrate understanding can:	
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.** [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.]
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.** [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.]
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.** [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]
DMS.LS2.3.	**Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem**. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems (Biomes), and on defining the boundaries of the system.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]
DMS.LS2.4.	**Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.** [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

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 ie food webs, nitrogen cycle, carbon cycle.
- Perform acts of good stewardship.

Life Science - Matter and Energy in Organisms and Ecosystems: Correlations to Minimum Standards.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
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. • Analyze and interpret data to provide evidence for phenomena. (MS.LS2.1) **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 knowledge, 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.LS1.6) **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). • 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) --- ***Connections to Nature of Science*** Scientific Knowledge is Based on Empirical Evidence • 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)	**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) • 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) **LS2.B: Cycle of Matter and Energy Transfer in Ecosystems** • 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) **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • 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) **PS3.D: Energy in Chemical Processes and Everyday Life** • 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)	**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) -- ***Connections to Engineering, Technology, and Applications of Science*** **Interdependence of Science, Engineering, and Technology** • 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) -- ***Connections to Nature of Science 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)

Diocesan Middle School: Life Science

DMS- Interdependent Relationships in Ecosystems

Students who demonstrate understanding can:	
DMS.LS2.2.	**Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.** [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]
DMS.LS2.2.1	**Compare the symbiotic and parasitic relationships in organisms within an ecosystem.**
DMS.LS2.5.	**Evaluate competing design solutions for maintaining biodiversity and ecosystem services.*** [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]

Catholic Identity

- 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.

Life Science- Interdependent Relationships in Ecosystems: Correlations to Minimum Standards.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
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 an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS.LS2.2) **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). • Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS.LS2.5)	**LS2.A: Interdependent Relationships in Ecosystems** • 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) **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • Biodiversity describes the variety of species found in Earths 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) **LS4.D: Biodiversity and Humans** • Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (secondary to MS.LS2.5) **ETS1.B: Developing Possible Solutions** • 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)	**Patterns** • Patterns can be used to identify cause and effect relationships. (MS.LS2.2) **Stability and Change** • Small changes in one part of a system might cause large changes in another part. (MS.LS2.5) --- ***Connections to Engineering, Technology, and Applications of Science*** **Influence of Science, Engineering, and Technology on Society and the Natural World** • 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) -- ***Connections to Nature of Science*** **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.LS2.5)

Diocesan Middle School: Life Science

DMS- Growth, Development, and Reproduction in Organisms

Students who demonstrate understanding can:	
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.** [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.]
DMS.LS1.5.	**Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.** [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]
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.** [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]
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.** [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]
DMS.LS3.2.1	**Explain the purposes of cell division: growth and repair and reproduction.**
DMS.LS3.2.2	**Explain basics of mitosis and meiosis**
DMS.LS3.2.3	**Explain the basic principles of heredity using the human examples of eye color, widows peak, blood type**
DMS.LS3.2.4	**Distinguish between the nature of dominant and recessive traits in humans.**
DMS.LS4.5.	**Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.** [Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.]
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.**

Catholic Identity

- Use argument supported by evidence to discriminate between life-affirming technology and reckless technological progress such as:
  - 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;
  - Limiting exposure to radiation (solar and x-rays).

Life Science - Growth, Development, and Reproduction in Organisms: Correlations to Minimum Standards

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
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. LS3.1),(MS.LS3.2) **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. • 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) **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	**LS1.B: Growth and Development of Organisms** • 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) **LS3.A: Inheritance of Traits** • 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) **LS3.B: Variation of Traits** • 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 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)	**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.LS 4. 5) **Structure and Function** • 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) --- ***Connections to Engineering, Technology, and Applications of Science*** **Interdependence of Science, Engineering, and Technology** • 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) --- ***Connections to Nature of Science*** **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)

Diocesan Middle School: Life Science

DMS- Natural Selection and Adaptations

Students who demonstrate understanding can:	
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.** [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.]
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.** [Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.]
DMS.LS4.3.	**Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.** Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.]
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.** [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations
DMS.LS4.6.	**Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.** [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not include Hardy Weinberg calculations.]

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

Life Science - Natural Selection and Adaptations: Correlations to Minimum Standards.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
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. (MS.LS4.1) **Using Mathematics and Computational Thinking** 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. • Use mathematical representations to support scientific conclusions and design solutions. (MS.LS4.6) **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 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)	**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 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) • Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS.LS4.3) **LS4.B: Natural Selection** • Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4) **LS4.C: Adaptation** • 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)	**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) --- ***Connections to Nature of Science*** *Scientific Knowledge Assumes an* Order and Consistency in Natural Systems • 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)

Diocesan Middle School: Engineering

DMS- Engineering Design

Students who demonstrate understanding can:	
MS.ETS1.1.	**Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**
MS.ETS1.1.1	**Explain the ethics and morality associated with scientific study and engineering design.**
MS.ETS1.2.	**Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**
MS.ETS1.3.	**Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**
MS.ETS1.4.	**Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**

Catholic Identity

- Explain the ethical and moral responsibilities associated with scientific study and engineering design.
- Understand the importance of an Internal Review Board (IRB) for the Ethical practices in experimentation.
- Demonstrate personal integrity.
- Outline the ethical constrains and considerations in regards to possible solutions to a problem.
- Demonstrate respect and consider different ideas with compassion, justice and kindness.
- Research the historical contributions of Catholic scientists, e.g. Albertus Magnus, Roger Bacon, Gregor Mendel.

Engineering - Engineering Design: Correlations to Minimum Standards.

<table>
<tr><th>Science and Engineering Practices</th><th>Disciplinary Ideas</th><th>Crosscutting Concepts</th></tr>
<tr>
<td>Asking Questions and Defining Problems
Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.
• Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS.ETS1.1)
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 generate data to test ideas about designed systems, including those representing inputs and outputs. (MS. ETS1.4)
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.ETS1.3)
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 world.
• Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1.2)</td>
<td>ETS1.A: Defining and Delimiting
Engineering Problems
• The more precisely a design tasks 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 are likely to limit possible solutions. (MS.ETS1.1)
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. (MS.ETS1.4)
• There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS.ETS1.2), (MS.ETS1.3)
• Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors.(MS.ETS1.3)
• Models of all kinds are important for testing solutions. (MS. ETS1.4)
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 those characteristics may be incorporated into the new design. (MS.ETS1.3)
• 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. (MS.ETS1.4)</td>
<td>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 environment. (MS. ETS1.1)
• The uses of technologies and 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. (MS.ETS1.1)</td>
</tr>
</table>

Diocesan Middle School: Engineering

DMS- The Scientific Process

Students who demonstrate understanding can:	
DMS.TSP1.1.	**OBSERVING: Use 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.**
DMS.TSP1.2.	**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.**
DMS.TSP1.3.	**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.**
DMS.TSP1.4.	**FORMULATING HYPOTHESIS: Stating a probable outcome for an occurrence based on observations and inferences. The validity of the hypothesis is determined from testing of data analysis.**
DMS.TSP1.5.	**EXPERIMENTAL DESIGN: The process is the culmination of all the science process skills.** **Experimentation often begins with observations, which lead to questions that need answers. The steps for proceeding may include forming a hypothesis, identifying and controlling dependent and independent variables, designing the procedure for conducting tests, implementing tests, collecting and interpreting the data and reaching a conclusion.**
DMS.TSP1.6.	**MEASURING: Use instruments to determine the length, area, volume, mass, temperature, density** **or other physical properties of an unknown quantity in SI units.**
DMS.TSP1.7.	**ORGANIZING AND ANALYZING DATA: Reveal patterns and relationships in data through tabulating, graphing or statistical analysis.**
DMS.TSP1.8.	**COMMUNICATING: Clearly and persuasively transmit the results of observations and experimental procedures to others through the use of graphs, charts, tables, written descriptions, technology, oral presentations, expository writing, etc.**

Catholic Identity

- Understanding the importance of an IRB for the Ethical practices in experimentation.
- Demonstrate personal integrity.
- Outline the ethical constrains and considerations in regards to possible solutions to a problem .
- Demonstrate respect and consider different ideas with compassion, justice and kindness.
- Research the historical contributions of Catholic scientists, e.g. Albertus Magnus, Roger Bacon, Gregor Mendel.

Glossary

The purpose of this glossary is to help the user better understand and implement the NDSS- New Diocesan Science Standards of the Diocese of Phoenix. It is not intended to be an exhaustive list of all scientific terms.

abiotic	Nonliving
absorb	to take up (e.g., plant roots absorb water)
adaptation	hereditary features of organisms that allow them to live in a particular environment
affect	to have an influence on
affluence	plentiful supply of material goods; wealth
analyze	to examine methodically by separating into parts and studying their interrelations
applied science	research aimed at answering questions that have practical applications, e.g., determining the causes of diseases so that cures might be found
asteroid	small rocky body orbiting the Sun
atmosphere	gaseous envelope surrounding the Earth
atom	smallest particle of an element that retains the chemical nature of the element
barometric pressure	atmospheric pressure as indicated by a barometer, used especially in weather forecasting
basic science	research designed to describe or explain nature to satisfy one's curiosity
bias	statistical sampling or testing error caused by systematically favoring some outcomes over others
biodiversity	1. number and variety of organisms found within a specified geographic region 2. variability among organisms, including the variability within and between species and within and between ecosystems
biome	broad area of the Earth's surface characterized by distinctive vegetation and associated animal life; e.g., broad-leaf forest biome, grassland biome, desert biome
biotic	relating to life or living organisms
calorimetric	relating to the measurement of heat energy by means of temperature

measurements

camouflage — concealment by disguise or protective coloring

carrying capacity — maximum number of individuals that a given environment can support for a sustained period of time

catalyst — substance, usually used in small amounts relative to the reactants, that modifies and increases the rate of a reaction without being consumed in the process

celestial — of or in the sky or universe, as planets or stars

cell membrane — The thin membrane that forms the outer surface of the protoplasm of a cell and regulates the passage of materials in and out of the cell. It is made up of proteins and lipids and often contains molecular receptors.

cell wall — The definition of a cell wall is the protective coating for a plant cell.

cellular respiration — metabolic processes which break down nutrients into usable energy

circuit — 1. closed path followed or capable of being followed by an electric current
2. configuration of electrically or electromagnetically connected components or devices

cirrus — high-altitude cloud composed of narrow bands or patches of thin, generally white, fleecy parts

Characteristic — distinguishing trait, feature, quality, or property

chloroplasts — A plastid in the cells of green plants and green algae that contains chlorophylls and carotenoid pigments and creates glucose through photosynthesis.

cladistics

classification

Climate

Comet

Communicate — about; make known; express oneself in such a way that one is readily and clearly understood

Community	group of plants and animals living and interacting with one another in a specific region under relatively similar environmental conditions
Compare	to examine in order to note the similarities or differences of
Compound	substance formed from two or more elements chemically united in fixed proportions
Conclusion	statement, or statements, that summarize the extent to which hypotheses have been supported or not supported
Conduction	process by which heat or electrical energy is transmitted through a material or body without gross motion of the medium itself
Conifer	any of various mostly needle-leaved or scale-leaved, chiefly evergreen, cone-bearing gymnosperm trees or shrubs such as pines, spruces, and firs
Conservation	Life science: the protection, preservation, management, or restoration of wildlife and of natural resources such as forests, soil, and water, to prevent exploitation, destruction or neglect Physical science: a unifying principle of constancy of a quantity under specified conditions
Constellation	formation of stars perceived as a figure or design, especially one of 88 recognized groups named after characters from classical mythology and various common animals and objects
Consumer	organisms requiring complex organic compounds for food, which is obtained by preying on other organisms or by eating particles of organic matter
Contrail	artificial cloud created by an aircraft, caused either by condensation due to the reduction in air pressure above the wing surface, or by water vapor in the engine exhaust
Controlled investigation	investigation in which all but one variable remain constant
Convection	transfer of heat energy in a gas or liquid by the circulation of currents of matter from one region to another
Crystallization	to cause to form crystals or take on a crystalline structure
Cumulus	dense, white, fluffy, flat-based cloud with a multiple rounded top and a well-defined outline, usually formed by the ascent of thermally unstable air masses
Data	factual information, from observations, organized for analysis
Decomposer	organisms such as bacteria and fungi that feed and break down dead organisms, returning constituents of organic substances to the environment
Deformation	alteration of shape, as by pressure or stress
Demonstrate	to prove or make evident by reasoning or adducing evidence

Deposition	act of depositing, especially the laying down of matter by a natural process something deposited; a deposit
Describe	to transmit a mental image or impression with words
Distinguish	to perceive or indicate differences; discriminate
Dominant	of, relating to, or being an allele that produces the same phenotypic effect whether inherited with a homozygous or heterozygous allele
DNA	(Deoxyribonucleic acid) double strand of nucleotides that is a self-replicating molecule present in living organisms as the main constituent of chromosomes; contains the genetic code and transmits the heredity pattern
Ecology	study of the interactions and relationships between and among organisms and their environment
Ecosystem	all the organisms in a given area and the abiotic factors with which they interact
Eclipse	partial or complete obscuring, relative to a designated observer, of one celestial body by another
e.g.	abbreviation for example; precedes a non-exhaustive list of examples provided as options; other examples may be appropriate but not included (compare to i.e.)
Electron	negatively charged fundamental particle in an atom
element	any of more than 100 fundamental substances that consist of atoms of only one atomic number and that singly or in combination constitute all matter
Environment	sum of all external conditions affecting the life, development and survival of an organism, including the biotic (living) and abiotic (non-living) elements
Erosion	group of natural processes, including weathering, dissolution, abrasion, corrosion, and transportation, by which material is worn away from the Earth's surface
Eukaryotic	referring to a cell with a nucleus and other internal structure
Evaluate	to examine and judge carefully; appraise
Experimentation	act of conducting a controlled test or investigation
Extinct	no longer in existence
Fertilization	1. act or process of initiating biological reproduction by insemination or pollination 2. union of male and female gametes to form a zygote
food chain	arrangement of the organisms of an ecological community according to the order of predation in which each uses the next as a food source
food web	totality of interacting food chains in an ecological community
Force	K-6: push or pull that change the motion or shape of an object 7- HS: vector quantity that tends to produce an acceleration of a body in the direction of its application

Formulate	to devise or invent
Frequency	ratio of the number of times an event occurs in a series of trials of a chance experiment to the number of trials of the experiment performed; the number of cycles an oscillating system executes in one second
Friction	force that resists relative motion between two bodies in contact
Front (weather)	interface between air masses of different temperatures or densities
Gas	state of matter that does not have a definite shape or volume and is much less dense than a liquid because its molecules are far apart compared to their diameters
Genotype	particular combination of genes in an organism
Geoscience	the geological sciences as a whole; geology
Gravitation	universal force by which everybody in the universe attracts every other body
Gravity	attraction of the mass of the Earth, the Moon or a planet for bodies at or near its surface
Greenhouse gas	atmospheric gas such as carbon dioxide, water vapor, and methane that allows incoming sunlight to pass through but absorbs infrared radiation radiated back from the Earth's surface, leading to the phenomenon whereby the Earth's atmosphere traps solar radiation
Guided investigation	teacher-directed investigation
Habitat	place or environment where a plant or animal naturally or normally lives and grows
Hazardous waste	substance, such as nuclear waste or an industrial byproduct, that is potentially damaging to the environment and harmful to humans and other organisms
Heredity	genetic transmission of characteristics from parent to offspring
Heterogeneous	consisting of dissimilar elements or parts
Homogeneous	uniform in structure or composition throughout
hydrosphere	aqueous envelope of the Earth, including the oceans, all lakes, streams, and underground waters, ice, and the aqueous vapor in the atmosphere
Hydrologic	the science dealing with the waters of the earth, their distribution on the surface and underground, and the cycle involving evaporation, precipitation, flow to the seas, etc.
Hypothesis	statement of an anticipated result of an investigation proposed relationship among observable phenomena or an inferred explanation for those phenomena
Identify	to find out the origin, nature, or definitive elements of
i.e.	abbreviation for that is; precedes a specific list of items in which all of the items should be used (compare to e.g.)

Infer	to conclude from evidence or premises
Igneous	relating to, resulting from, or suggestive of the intrusion or extrusion of magma or volcanic activity; rock formed from molten magma
Inorganic	involving neither organic life nor the products of organic life of or relating to compounds not containing carbon
Interdependence	state of organisms depending on each other and the environment for survival
Interpretation	explanation – explain the meaning of
Interrelationships	interactions between two or more objects or organisms
Invertebrate	animal, such as an insect or mollusk, that lacks a backbone or spinal column
Investigation	inquiry, research, or systematic examination
Involuntary	not under the influence or control of the will; not voluntary; as, the involuntary movements of the body (involuntary muscle fibers)
isotope	any of two or more species of atoms of a chemical element with the same atomic number and nearly identical chemical behavior, but with differing atomic mass and mass number and different physical properties
Justify	to demonstrate or prove to be just, right, or valid
Law	statement that summarizes, identifies, or describes a relationship among observable phenomena
Lever	simple machine consisting of a rigid bar pivoted on a fixed point and used to transmit force, as in raising or moving a weight at one end by pushing down on the other
Limiting factor	conditions or resources that control the size of a population
Liquid	state of matter that does not hold a definite shape but occupies a definite volume because its molecules are in close contact
Lithosphere	outer part of the Earth, consisting of the crust and upper mantle, approximately 100 km (62 mi.) thick
Living	state of being alive
Lunar	of, involving, caused by, or affecting the Moon lunar phase
Macroscopic	large enough to be perceived or examined by the unaided eye; large compared to a microscopic object
Mass	property of a body that is a measure of its inertia and causes it to have weight in a gravitational field, that is commonly taken as a measure of the amount of material it contains

Matter	anything that possesses mass and occupies volume
Mean	average value of a set of number
Measure	to ascertain the dimensions, quantity, or capacity of
Meiosis	type of cell division that occurs during the reproduction of diploid organisms to produce the gametes. The double set of genes and chromosomes of the normal diploid cells is reduced during meiosis to a single haploid set in the gametes. Crossing-over and, therefore, recombination occur during a phase of meiosis
Metamorphic	change in the constitution of rock; specifically, a pronounced change affected by pressure, heat and water that results in a more compact and more highly crystalline condition; a rock produced by these processes
meteor	bright trail or streak that appears in the sky when a meteoroid is heated to incandescence by friction with the Earth's atmosphere; also called falling star, meteor burst, shooting star
Microscopic	too small to be seen by the unaided eye but large enough to be studied under a microscope; small compared to a macroscopic object
Mimicry	resemblance of one organism to another or to an object in its surroundings for concealment and protection from predators
Mitosis	cell division; cell division in multicellular organisms occurs by mitosis except for the special division called meiosis that generates the gametes
Mixture	portion of matter consisting of two or more components in varying proportions that retain their own properties
Model	schematic description or representation of a system, theory, or phenomenon that accounts for at least some of its known or inferred properties and may be used for further study of its characteristics
Molecule	smallest particle of a chemical substance that retains all the properties of the substance and is composed of one or more atoms
Mutation	change of the DNA sequence within a gene or chromosome of an organism
Mutualism	close, prolonged association between organisms of two different species in which each member benefits; type of symbiotic relationship natural resource
Natural selection	process by which, in a given environment, individuals having characteristics that aid survival will produce more offspring, so the proportion of individuals having such characteristics will increase with each succeeding generation. Two mechanisms of natural selection include: • gradualism - slow genetic modification (evolution) of a population over long periods of time • punctuated equilibrium - relatively rapid evolution at a speciation event
Neutron	uncharged elementary particle that has a mass a little greater than that of the proton and is present in most atomic nuclei

Nonliving objects that don't reproduce, grow, react, or use food

Nonstandard units of measure units of measurement based on everyday items (e.g., hands, feet, pace, candy, potato, paper clip) used as a precursor to learning and using standard units of measurement

Mitochondria are the structures within cells that produce energy.

Mutualism close, prolonged association between organisms of two different species in which each member benefits

Nucleus *Physical science*: central region of an atom, which contains more than 99% of the atom's mass. *Life science*: cellular organelle in eukaryotes that contains most of the genetic material

Observe to be or become aware of, through one's senses, and may include qualitative or quantitative data

Observation event that is experienced personally or enhanced through measurement or instruments

Opaque not capable of having light pass through or hard to understand.

Openness mind set that allows a person to consider explanations of a phenomena

Organic of, relating to, or derived from living organisms Chemistry: having to do with carbon compounds

organism living individual, such as a plant, animal, bacterium, protist, or fungus; a body made up of organs organelles, or other parts that work together to carry on the various processes of life

Periodic table arrangement of the chemical elements by atomic number, starting with hydrogen in the upper left-hand corner and continuing in ascending order from left to right, arranged in columns according to similar chemical properties

pH numerical measure of the acidity or alkalinity of a chemical solution; the negative of the logarithm of the hydrogen ion concentration

Phenotype physical or visible characteristics of an organism that are determined by its genotype

photosynthesis chemical process by which chlorophyll-containing plants use light to convert carbon dioxide and water into carbohydrates, releasing oxygen as a byproduct

Pitch aurally perceived property of a sound, especially a musical tone that is determined by the frequency of the waves producing it; highness or lowness of sound

Plane flat or level surface

plate tectonics theory that explains the global distribution of geological phenomena such as seismicity, volcanism, continental drift, and mountain building in terms of the formation, destruction, movement, and interaction of the Earth's lithospheric plates; the theory that the earth's crust is broken into fragments (plates) which move in relation to one another, shifting continents, forming new crust, and causing volcanic eruptions

Population	group of organisms of the same species living and reproducing in a particular habitat or geographic region
Population density	number of organisms per unit area
Precipitation	any form of water, such as rain, snow, sleet, or hail, which falls to the Earth's surface
Predict	to forecast a future occurrence based on past observations or the extension of an idea
Prediction	statement of an expected (future) outcome of a planned test assuming that the hypothesis being tested is correct; to be compared with observed result to test the hypothesis
Preservation	to keep in perfect or unaltered condition; maintain unchanged
Probability	measure of the likelihood of an event occurring
Procedures	series of steps taken to accomplish an end
Prokaryotic	referring to a cell with no nucleus (e.g., a bacterium)
Property	characteristic attribute possessed by all members of a class
Propose	to put forward for consideration, discussion, or adoption
Proton	stable subatomic particle occurring in all atomic nuclei, with a positive electric charge equal in magnitude to that of an electron
Pulley	simple machine consisting of a wheel with a grooved rim in which a pulled rope or chain can run to change the direction of the pull and thereby lift a load
Pure science	science for the pursuit of scientific knowledge
Qualitative	involving quality or kind
Quantitative	involving the measurement of quantity or amount
Question	to ask
Radiation	transfer of energy by electromagnetic radiation; process of emitting energy in the form of waves or particles (e.g., visible light, X-rays, alpha and beta radiation).the geographic spreading of a species reaction
Recessive	of, relating to, or designating an allele that does not produce a characteristic effect when present with a dominant allele
Reduce, reuse, recycle	help you, your community, and the environment by saving money, energy, and natural resources. Recycling programs are managed at the state and local level
Reflect	to throw or bend back (light, for example) from a surface

Refract	to deflect from a straight path undergone by light or other wave in passing obliquely from one medium (e.g., air) into another (e.g., glass) in which its speed is different
Reliability	to yield the same or compatible results in different clinical experiments or statistical trials
Respiration	physical and chemical processes by which an organism supplies its cells and tissues with the oxygen needed for metabolism and relieves them of the carbon dioxide formed in energy-producing reactions
Result	quantity or expression obtained by calculation
Revolution	orbital motion about a point, especially as distinguished from axial rotation
RNA	(Ribonucleic acid) nucleic acids that contains ribose and uracil as structural components and is associated with the control of cellular chemical activities
Rotation	act or process of turning around a center or an axis; the turning of a body part about its long axis as if on a pivot
Sedimentary	of or relating to rocks formed by the deposition of sediment
Sedimentation	The act or process of depositing or forming a sediment.
Sexual	relating to, produced by, or involving reproduction characterized by the union of male and female gametes
Simple investigation	investigation involving a single variable
Solid	body of definite shape and volume; not liquid or gaseous
Solute	the dissolved matter in a solution; the compound of a solution that changes its state
Solution	a homogeneous mixture of two or more substances
Solvent	a liquid substance capable of dissolving other substances
Species	class of individuals or objects grouped by virtue of their common attributes and their ability to mate and produce fertile offspring, and assigned a common name; a division subordinate to a genus
Spectrophotometer	instrument used to determine the intensity of various wavelengths in a spectrum of light
Stimulus	object or event that causes a response
Strata	a section, level, or division, as of the atmosphere or ocean, regarded as like a stratum
Stratus	low-altitude cloud formation consisting of a horizontal layer of clouds
Structures	way in which parts are arranged or put together to form a whole; makeup arrangement or formation of the tissues, organs, or other parts of an organism; an organ or other part of an organism
Substrate	the substance that is acted upon by an enzyme or ferment; a surface on which an organism grow or is attached

Subsystem	component of a system (e.g., a solar system is a subsystem of a galaxy)
Symbiotic relationship	close, prolonged association between organisms of two different species that may, but does not necessarily, benefit each member; includes mutualism, commensalisms, and parasitism Synthetic
System	1. group of body organs that together perform one or more vital functions 2. organized group of devices, parts or factors that together perform a function or drive a process (e.g., weather system, mechanical system)
Technology	application of science, especially to industrial or commercial objectives; tools and techniques
Temperature	degree of hotness or coldness of a body or environment
Theory	collection of statements (conditions, components, claims, postulates, propositions) that when taken together attempt to explain a broad class of related phenomena; inferred explanations for observable phenomena
Tissues	A large mass of similar cells that make up a part of an organism and perform a specific function.
Transient	not regular or permanent
Transparent	something clear, see through or obvious.
Translucent	allowing light to pass through but not showing the distinct images on the other side.
Tsunami	large sea wave caused by an earthquake, landslide or other disturbance under the ocean.
U.S. customary units	measuring system used most often in the United States (e.g., inches, pounds, gallons)
Valid	correctly inferred or deduced from a premise
Variable	A factor or condition that is subject to change, especially one that is allowed to change in a scientific experiment to test a hypothesis.
Vibrate	To shake or move with or as if with a slight quivering or trembling motion