Archdiocese of Denver Catholic Schools Science Standards
Revised June 2020

Table of Contents

Introduction and Philosophy

Archdiocese of Denver Catholic Schools exist to be sanctuaries of education for young men and women, supporting parents and empowering families in forming their children in wisdom and virtue as faithful disciples of Jesus Christ, who are fully alive and serve the common good. We provide an integrated whole-person formation that aims not merely to help students be college and career ready, but to awaken in students wonder and awe via a course of study where students are led to know God and his plan for them by encountering what is true, good, and beautiful. The mission of Catholic schools though is not confined within the walls of a catechesis class, and this mission is not separate from the intellectual formation of students in a Catholic schools.

The science curriculum and the environment in which it is taught should draw from the following beliefs:

- God created an ordered, beautiful universe that is good and is worth studying. The beauty and grandeur of creation points to the creator. Blessed John Henry Cardinal Newman observed, "All branches of knowledge are connected together, because the subject-matter of knowledge is intimately united in itself, as being the acts and the work of the Creator. Hence it is that the Sciences, into which our knowledge may be said to be cast, have multiplied bearings one on another, and an internal sympathy, and admit, or rather demand, comparison and adjustment. They complete, correct, [and] balance each other."[1]
- The complexity and beauty and harmony of creation inspire awe and wonder. Students come to us with awe and wonder. Science education should respect and develop that natural human tendency.
- There is a truth, and it is God. The human mind can know truth. The process of growth leads us towards the fullness of truth.
- Religion and science are not two separate worlds. Faith goes beyond reason, but does not contradict it. Scientific study and knowledge strengthen our awareness of God. "By the very nature of creation, material being is endowed with its own stability, truth and excellence, its own order and laws. These man must respect as he recognizes the methods proper to every science and technique…Whoever labors to penetrate the secrets of reality with a humble and steady mind, even though he is unaware of the fact, is nevertheless being led by the hand of God, who holds all things in existence, and gives them their identity."[2]

Teachers of science in the Archdiocese of Denver Catholic schools must hold a Catholic worldview, believe and understand the above beliefs, have a clear understanding of how the Catholic faith does not oppose science, and understand how the intellectual formation of students is bound up in their formation as disciples of Jesus Christ. It is critically important that teachers of science engage in continuous learning to always draw deeper into understand the created world, engaging in their own intellectual formation on science from a Catholic worldview. Resources to support the teacher in this intellectual formation of their own can be found in this standards document.

[1] Newman, J. (1873). *The idea of a university: Defined and illustrated.* London, England: Pickering.
[2] Vatican II (1965). *Gaudium et spes: Pastoral constitution on the Church in the modern world*. Retrieved from http://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_const_19651207_gaudium-et-spes_en.html

The formation of students as Catholic thinkers and in a Catholic worldview requires an integration of what is taught and learned such that the student is formed in a coherent vision of reality. Particular attention to teaching science standards, in particular those that specifically relate to the human body and the human person, must be to the integration the Christian Anthropology standards in the catechesis/theology standards.

The guiding principles found in this document are intended to be explicitly taught, guiding students towards understanding the purpose and role of God in his creation of the created world. The topics in the guiding principles go beyond a typical scientific inquiry, bringing students to see and understand that which transcends the scientific content in front of them. Each principle was taken from the Cardinal Newman Society (CNS) standards, which is linked in each grade-level's set of standards. Teachers must familiarize themselves with the Cardinal Newman Society standards, drawing back to the standards and resources contained in the CNS standards.

Practically a teacher might use the guiding principles as the basis of the object of lessons in the form of essential questions: *How is the beauty and goodness of God reflected in the levels of organization of living things? What truths does the human body reveal to us about the God the Creator?* These guiding principles should not be hidden from students, rather, they can also be used as the basis of a teacher's orientation of scientific study—to understand that which is before us in our study, but to also point us to what's beyond the thing itself. These guiding principles should be used in daily planning, and should be talked about in the science classroom. The guiding principles include dispositional standards which should be the mental habits and dispositions teachers foster and help form students in.

In our 2019 science standards review, we looked at contemporary science standards from a variety of local, state, and national sources, taking what we felt was best about each one that would serve our work of teaching science in a Catholic school. The committee engaged in its own intellectual formation, reading many key Catholic scientific thinkers, to guide our work. We also surveyed science teachers across the archdiocese and found three overwhelming teacher responses: 1) teachers preferred depth over breadth, that is, to teach fewer concepts in more depth each school year which teachers will see reflected in the standards below and in particular in the middle school level. Each middle school grade now has one branch of science as the basis of study with recommendations for which grade in which to teach each branch. 2) to remove the integrated health standards from our science standards, and leave the teaching of integrated health standards to the local-level school to decide when/how to teach integrated health standards, 3) to have more resources for teaching science from a Catholic worldview.

The committee members worked diligently on this set of standards, resources, and curriculum recommendations, and we are all grateful for their work. The members of the committee were: Paige Schwetz (Shrine of St. Anne), Catherine Wurts (JPII Outdoor Lab), Lynn Grandon (Respect Life Office), Mitch Albyn (Holy Trinity), Marianne Aiken (St. Joseph) Deanne Martinez (Our Lady of Loreto), Laura McGinn (Sacred Heart), Kathy Dubois (Sacred Heart), Annette Humphrey (Good Shepherd), Micah Greenmyer (Holy Family HS), Christi Arellano (St. Pius X), Abriana Chilelli (Director of Curriculum and Instruction, Office of Catholic Schools).

Curricular and textbook recommendations can be found in a separate document to this set of standards, in the shared folder on the cloud. Please reach out to your principal or Office of Catholic Schools if you need that link.

High School Science - Biology

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
GS4 – Share how the beauty and goodness of God is reflected in nature and the study of the natural sciences. IS4 – Relate how the search for truth, even when it concerns a finite reality of the natural world or of man, is never-ending and always points beyond to something higher than the immediate object of study. IS5 – Explain the processes of conservation, preservation,	**Biology (Bio)**	**Introduction to Biology (IB)**: 1. define Biology and some of the major fields of Biology. 2. explain and analyze the characteristics of living organisms. 3. explain, analyze and evaluate the scientific method. 4. identify the units of SI measurement. 5. identify and summarize the parts of the light microscope. 6. demonstrate the proper usage of the microscope and preparation of wet mounts and staining. **Biology and Chemistry (BC)**: 1. identify and describe the importance of the main elements necessary for living organisms 2. identify and analyze the chemical structure of carbohydrates, lipids, proteins, and nucleic acids	1. Formulate and create a written plan to conduct a scientific investigation using the scientific method. 2. Use appropriate tools, equipment, technology and SI measurement units to gather and organize data. Incorporate controls and variables into scientific investigation. 3. Interpret and evaluate data in order to formulate conclusions from scientific investigation. 4. Debate and or defend certain ethical standards associated with scientific study. 5. Incorporate official Catholic Church teachings that directly relate to ethical standards dealing

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
overconsumption, and stewardship as it relates to creation and to caring for that which God has given to sustain and delight us. IS9 – Distinguish the difference between the use of the scientific method and the use of theological inquiry to know and understand God's creation and universal truths. IS10 – Articulate the limitations of science (the scientific method and constraints of the physical world) to know and understand God and transcendent reality. IS11 – Identify key Catholic scientists such as Copernicus, Mendel,		**Cell Structure and Function (CSF)** 1. describe and analyze the structure and function of cells and cell organelles. 2. describe and explain levels of organization of living organisms. 3. analyze the fluid mosaic model of the plasma membrane. 4. compare and contrast diffusion, osmosis, and active transport. 5. describe the use of cell energy (ADP-ATP) 6. analyze the chemical process of photosynthesis, including materials, products 7. analyze the process of cellular respiration, including the materials, products 8. evaluate and compare aerobic and anaerobic respiration. 9. compare and differentiate between the processes of mitosis, cell cycle, and meiosis. 10. describe the process of mitosis and the cell cycle. 11. distinguish between sexual and asexual reproduction. **Genetics (G)** 1.describe and explain the laws of genetics as introduced by Mendel. 2. demonstrate the use of the Punnett Square for monohybrid and dihybrid crosses.	with science (equitable use of resources among peoples of the world, faith-based understanding of creation, etc.) 6. Describe how certain scientific ideas have evolved over time. 7. Describe contributions to the advancement of science by people in different cultures and at different times in history. 8. Describe how people use science and technology in their professions. 9. Relate the historic conditions that led to various scientific contributions. **SCIENCE READING LITERACY** 10. cite specific textual evidence to support analysis of scientific and technical texts. Including analysis of important distinctions the author makes between ideas or pieces of information.

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
DaVinci, Bacon, Pasteur, Volta, St. Albert the Great–those particularly important to the contribution of biological study- and the witness and evidence they supply against the false claim that Catholicism is not compatible with science. DS1 – Display a deep sense of wonder and delight about the natural universe.		3. describe and explain the inheritance of sex-linked traits, incomplete dominance, multiple alleles and polygenic inheritance. 4. interpret how the laws of genetics apply to common human, plant, and animal genetic traits **Nucleic Acids (NA)** 1.describe and explain the relationship of genes and chromosomes. 2. analyze the Watson-Crick model of the structure of DNA. 3. discuss the process of DNA replication. 4. explain the structure of RNA and how it relates to protein synthesis. 5. describe and interpret how mutations occur and explain their causes and effects. 6. discuss current advances in DNA technology, including recombinant DNA, DNA cloning, DNA fingerprinting, gene therapy, human genome project, etc. Include Catholic Church teachings and ethical implications. **Evolution (Evo)** 1. describe and explain spontaneous generation 2. describe and explain the theories of evolution proposed by Darwin. 3. analyze evidence for evolution, including fossil record, homologous and vestigial structures, DNA similarities and embryology.	11. summarize complex information or ideas presented in a text, paraphrasing it in simpler but still accurate terms. 12. follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the causes of the specific results based on information from the text 13. determine the meaning of key terms, symbols, and scientific vocabulary used in the text, attending to the precise meaning of terms as they are used in particular scientific and technical contexts. 14. analyze the relationships among concepts in a text. 15. analyze the scope and purpose of an experiment or explanation and determine which related issues remain unresolved or uncertain. 16. integrate and synthesize quantitative or technical information presented graphically with other information text. 17. assess the extent to which the evidence in text supports a

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
		4. describe the fossil evidence for human evolution. 5. describe the current theories for human evolution 6. describe and explain the Church's position on evolution, including reading papal writings on evolution 7. explain possibilities within Church teaching for an explanation of the human soul in relation to evolutionary processes 8. *Relate how the human soul is specifically created by God for each human being, does not evolve from lesser matter, and is not inherited from our parents.* 9. Explain how understanding the physiological properties of a human being does not address the existence of the transcendent spirit of the human person	scientific claim or a recommendation for solving a technical problem. 18. compare experimental findings presented in a text to information found in other sources, noting when the findings support or contradict previous explanations or accounts. 19. read informational text independently, proficiently and at appropriate grade level. **SCIENCE WRITING LITERACY** 20. write arguments on scientific content which: a) introduce a precise or substantive claim, distinguish it from alternate or opposing claims, and provides an organization that establishes clear relationships among the claim, reasons, data, and evidence. b) develop a claim thoroughly and fairly with logical reasoning, supplying the most relevant data and evidence
		Ecology (Eco) 1. distinguish between communities, populations, ecosystems, and biomes. 2. distinguish between the major biomes. 3. compare and interpret the interactions of organisms with the biotic and abiotic environment.	
		Taxonomy (T) 1. describe and explain the classification system of living organisms. 2. compare the use of a phylogenetic tree and a cladogram.	

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	Strand	High School Science Standard (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	Connection (Con)
		Bacteria, Viruses, Protists, Fungi (BVPF) 1. summarize the characteristics and diversity of the organisms in these kingdoms. 2. identify common organisms of this group. 3. evaluate the relationship and importance of this group to other living organisms 4. hypothesize the relationship between these organisms and humans	acquired in scientifically acceptable form. c) use precise words phrases as well as scientific vocabulary to make clear relationships between claims and reasons and between reasons and the data and evidence. d) sustain an objective style and tone while attending to the norms and conventions of scientific writing. d) provide a concluding statement or section that follows logically from the argument. 21. perform short, focused research projects and more sustained research; synthesize multiple authoritative sources on a subject to answer a question or solve a problem. 22. gather relevant information from multiple print and digital sources; assess its credibility and accuracy and its usefulness in terms of purpose, task, and audience; and integrate selected information into the text, avoiding overreliance on

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	Strand	High School Science Standard (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	Connection (Con)
			any one source, avoiding plagiarism, and following a standard format citation. 23. write in response to informational sources, drawing on textual evidence to support and analysis and reflection as well as to describe what they have learned.
		Plant Kingdom (PK) 1. describe and explain the characteristics and diversity of this kingdom. 2. identify common organisms of this group. 3. distinguish and compare vascular and non-vascular plants. 4. analyze and evaluate the function of roots, stems, and leaves in vascular plants. 5. hypothesize the relationship and importance of this group to other living organisms	
		Animal Kingdom (AK) 1. describe and explain the characteristics and diversity of the animal kingdom and the major phyla of animals. 2. identify common organisms of each major phylum. 3. compare and differentiate the evolutionary advantages of each major phylum (e.g., symmetry, development of coelom, germ layers, cephalization, etc.). 4. compare and evaluate vertebrates and invertebrates.	

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
GS1 – Exhibit a primacy of care and concern at all stages of life for each human person as an image and likeness of God. GS3 – value the human body as the temple of the Holy Spirit. IS14- Explain how understanding the physiological properties of a human being does not address the existence of the transcendent spirit of the human person		5. describe the relationship and importance of each major phylum to other living organisms.	
		Human Anatomy and Physiology (HAP) 1. identify and summarize the systems of the human body and analyze and evaluate the functions of each system. 2. summarize and describe the function of the major organs of the body. 3. identify and describe causes of infectious diseases and the body's immune response. 4. compare the structure and function of the male and female reproductive systems, including hormone and fertility cycles. 5. explain the Church's teaching on contraceptives in light of the design of sex to be a spouse's full gift of self to the other, and the way contraception blocks that gift of self to the other 6. . describe the process of fertilization and development of the human embryo, including unique DNA sequence, the start of human life at the moment of fertilization, milestones and stages of development of children in the womb. 7. . Demonstrate an understanding of the moral issues involving in vitro fertilization, human cloning, human genetic manipulation, and human experimentation and what the Church teaches regarding work in these areas.	

High School Science - Chemistry

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
S712,DS2. Share how natural phenomena have more than a utilitarian meaning and purpose and exemplify the handiwork of the Creator. DS3. Subscribe to the premise that nature should not be manipulated at will, but should be respected for its natural purpose and end as destined by the creator God. DS1 – Display a deep sense of wonder and delight about the natural universe. IS11 – Identify key Catholic scientists such as Copernicus, Mendel, DaVinci, Bacon, Pasteur,	**Chemistry (Chem)**	**Matter (M)** A. Structure and Properties of Atoms, Molecules, and Compounds 1. explain the organization of matter to include atomic structure, periodic law, and chemical bonding. 2. differentiate between empirical and molecular formulas. 3. write chemical formulas. 4. write and explain the differences between the types of chemical reactions (i.e., synthesis, decomposition, single displacement, double displacement, and combustion reactions). 5. explain how chemical formulas are used in describing chemical equations and reactions. 6. explain the physical and chemical properties of solids, liquids, and gases. 7. list the three basic assumptions of the Kinetic Theory of Matter. 8. describe the characteristics of polar and the non-polar combination. B. Interaction of Matter 1. explain the effect of ions in solutions as they effect pH.	1. Formulate and create a written plan to conduct a scientific investigation using the scientific method. 2. Use appropriate tools, equipment, technology and SI measurement units to gather and organize data. Incorporate controls and variables into scientific investigation. 3. Interpret and evaluate data in order to formulate conclusions from scientific investigation 4. Debate and or defend certain ethical standards associated with scientific study. 5. Incorporate official Catholic Church teachings that directly relate to ethical standards dealing with science (equitable use of resources among peoples of the world, faith-

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
Volta, St. Albert the Great–those particularly important to the contribution of the study of chemistry- and the witness and evidence they supply against the false claim that Catholicism is not compatible with science		2. demonstrate a knowledge of chemical properties of acids and bases. 3. explain chemical equilibrium. 4. demonstrate an understanding of gas laws (Charles, Boyles, etc.) and stoichiometry (including moles) by working related problems. **Energy (E)** 1. differentiate between the meaning of energy, force, work and heat (thermo chemistry). 2. describe the classes and forces of energy and energy changes. 3. Explain the supernatural design hypothesis in terms of the Second Law of Thermodynamics, entropy, and anthropic coincidences	based understanding of creation, etc.) 6. Describe how certain scientific ideas have evolved over time. 7. Describe contributions to the advancement of science by people in different cultures and at different times in history. 8. Describe how people use science and technology in their professions. 9. Relate the historic conditions that led to various scientific contributions. **Science Reading Literacy** 10. cite specific textual evidence to support analysis of scientific and technical texts. Including analysis of important distinctions the author makes between ideas or pieces of information. 11. summarize complex information or ideas presented

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	Strand	High School Science Standard (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	Connection (Con)
			in a text, paraphrasing it in simpler but still accurate terms. 12. follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the causes of the specific results based on information from the text. 13. determine the meaning of key terms, symbols, and scientific vocabulary used in the text, attending to the precise meaning of terms as they are used in particular scientific and technical contexts. 14. analyze the relationships among concepts in a text. 15. analyze the scope and purpose of an experiment or explanation and determine which related issues remain unresolved or uncertain. 16. integrate and synthesize quantitative or technical information presented graphically with other information text.

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
			17. assess the extent to which the evidence in text supports a scientific claim or a recommendation for solving a technical problem. 18. compare experimental findings presented in a text to information found in other sources, noting when the findings support or contradict previous explanations or accounts. 19. read informational text independently, proficiently and at appropriate grade level. **Science Writing Literacy** 20. write arguments on scientific content which: a) introduce a precise or substantive claim, distinguish it from alternate or opposing claims, and provides an organization that establishes clear relationships among the claim, reasons, data, and evidence. b) develop a claim thoroughly and fairly with logical reasoning, supplying the most relevant data and evidence

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
			acquired in scientifically acceptable form. c) use precise words phrases as well as scientific vocabulary to make clear relationships between claims and reasons and between reasons and the data and evidence. d) sustain an objective style and tone while attending to the norms and conventions of scientific writing. e) provide a concluding statement or section that follows logically from the argument. 21. perform short, focused research projects and more sustained research; synthesize multiple authoritative sources on a subject to answer a question or solve a problem. 22. gather relevant information from multiple print and digital sources; assess its credibility and accuracy and its usefulness in terms of purpose, task, and audience; and integrate selected information

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	Strand	High School Science Standard (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	Connection (Con)
			into the text, avoiding overreliance on any one source, avoiding plagiarism, and following a standard format citation. 23. write in response to informational sources, drawing on textual evidence to support and analysis and reflection as well as to describe what they have learned. **Scientific Process, Investigation, Design (PID)** 15. Nature of Scientific Knowledge a. distinguish between pure and applied science. b. create and defend a written plan of action for scientific investigation. c. identify sources of error within an investigation. d. recognize and analyze alternative explanations. e. identify and/or demonstrate use of lab equipment. f. use safety procedures in lab. 16. Scientific Measurement a. use standard SI units in collecting and processing data.

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
			b. use charts, graphs, etc., to explain and report observations and data collected.

High School Science - Physics

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
DS1 Display a deep sense of wonder and delight about the natural universe. DS2 Share how nat ural phenomena have more than a utilitarian meaning and purpose and exemplify the handiwork of the Creator. DS3. Subscribe to the premise that nature should not be manipulated at will, but should be respected for its natural purpose and end as destined by the creator God. DS5. Adhere to the idea of the simultaneous complexity and simplicity of physical reality. IS10. Articulate the details of the Galileo affair to	**Physics (Phy)**	**Introduction to Physics (I)** A. Measurement, Units, and Conversion 1. demonstrate the ability to measure various quantities in the lab with the appropriate devices and convert these measured quantities to SI units. B. Laboratory Techniques 1. apply the scientific method using inductive and deductive reasoning and intuitive and mathematical analysis to set up and solve, in the lab, problems in physics **Dynamics and Statistics (DS)** A. Straight Line Motion – Velocity and Acceleration 1. describe and explain the difference between velocity and speed. 2.describe and explain the difference between distance and displacement. 3. demonstrate the solution of acceleration problems. 4. solve various types of vector velocity problems. 5. demonstrate the relationship between velocity and acceleration of a free-falling object. 6. apply the equations of velocity and acceleration to two-dimensional problems using projectile motion.	**Connection** 1. Formulate and create a written plan to conduct a scientific investigation using the scientific method. 2. Use appropriate tools, equipment, technology and SI measurement units to gather and organize data. Incorporate controls and variables into scientific investigation. 3. Interpret and evaluate data in order to formulate conclusions from scientific investigation 4. Debate and or defend certain ethical standards associated with scientific study. 5. Incorporate official Catholic Church teachings that directly relate to ethical standards dealing with science (equitable use of resources among

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
counter the assumption that the Church is anti-science. IS11 – Identify key Catholic scientists such as Copernicus, Mendel, DaVinci, Bacon, Pasteur, Volta, St. Albert the Great—those particularly important to the contribution of the study of physical science- and the witness and evidence they supply against the false claim that Catholicism is not compatible with science S712,DS2. Share how natural phenomena have more than a utilitarian meaning and purpose and exemplify the handiwork of the Creator. DS3. Subscribe to the premise that nature should not be		B. Gravity and Falling Objects 1. explain Newton's Law of Motion and Gravitation by solving problems related to them. 2. apply Newton's Law of Motion and Gravitation to problems of satellite and planetary motion. 3. analyze examples of phenomena that demonstrate Newton's Laws. C. Forces and Free Body Diagrams 1. demonstrate the solution of composition of force problems by mathematics and with the use of lab equipment. 2. demonstrate lab and mathematic methods to solve resolution of force problems. D. Vectors and Projectile Motion 1. calculate the component of a vector along a specified axis, or resolve a vector into components along two specified mutually perpendicular axes. 2. analyze the motion of a projectile that is projected above level ground with a specified initial velocity. E. Friction and Simple Machines 1. explain and demonstrate the determination of frictional forces. 2. compare and contrast six simple machines in terms of complexity and determine the efficiency of representative examples F. Work, Power, Energy 1. summarize the work-energy theorem and use it for the case of motion in one dimension.	peoples of the world, faith-based understanding of creation, etc.) 6. Describe how certain scientific ideas have evolved over time. 7. Describe contributions to the advancement of science by people in different cultures and at different times in history. 8. Describe how people use science and technology in their professions. 9. Relate the historic conditions that led to various scientific contributions. **Science Reading Literacy** 10. cite specific textual evidence to support analysis of scientific and technical texts. Including analysis of important distinctions, the author makes between ideas or pieces of information.

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
manipulated at will, but should be respected for its natural purpose and end as destined by the creator God.		2. experiment and use potential, kinetic energy. 3. apply conservation of energy in analyzing the motion of bodies. G. Momentum and Collisions 1. explain the Law of Conservation of Momentum. 2. determine solutions to energy and momentum problems including those involving collisions H. Rotational Motion and Torque 1. differentiate between centripetal and centrifugal force. 2. explain and demonstrate the solution to vertical and horizontal circular motion problems. 3. demonstrate the solution of angular acceleration and rotational inertia problems using lab equipment. I. Supernatural Design 1. Explain the supernatural design hypothesis in terms of the Borde-Vilenkin-Guth Proof **Fluids (F)** A. Pressure and Pascal's Principle 1. explain Pascal's Principle. 2. compute pressure using Pascal's Principle **Waves, Sound and Light (WSL)** A. Simple Harmonic Motion 1. identify and explain periodic and harmonic motion and cite several examples of each. 2. design an experiment to demonstrate periodic motion.	11. summarize complex information or ideas presented in a text, paraphrasing it in simpler but still accurate terms. 12. follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the causes of the specific results based on information from the text. 13. determine the meaning of key terms, symbols, and scientific vocabulary used in the text, attending to the precise meaning of terms as they are used in particular scientific and technical contexts. 14. analyze the relationships among concepts in a text. 15. analyze the scope and purpose of an experiment or explanation and determine which related issues remain unresolved or uncertain.

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
		3. describe how various waves are formed, propagated, and altered in various media. 4. explain and demonstrate wave properties using laboratory equipment. B. Sources of Sound, Intensity, The Doppler Effect, and Ultrasound 1. describe the production, properties, and transmission of waves in the sonic spectrum. 2. describe and solve problems related to the measurement of sound intensity and pitch. 3. recognize examples of the Doppler effect and calculate changes in frequency due to motion. 4. demonstrate the cause and effect of resonance and show how various harmonics of the musical scales are produced from standing waves sounded on strings and tubes. C. Light, Reflection, Mirrors, Snell's Law and Lenses 1. explain the historical development of the theory of light. 2. label the components of the electromagnetic spectrum and list their properties. 3. explain the laws of reflection and their relationship to the formation of images by plane mirrors. 4. compare the relationships between optical refraction and the wave character of light and between optical refraction and speed of light.	16. integrate and synthesize quantitative or technical information presented graphically with other information text. 17. assess the extent to which the evidence in text supports a scientific claim or a recommendation for solving a technical problem. 18. compare experimental findings presented in a text to information found in other sources, noting when the findings support or contradict previous explanations or accounts. 19. read informational text independently, proficiently and at appropriate grade level. **Science Writing Literacy** 20. introduce a precise or substantive claim, distinguish it from alternate or opposing claims, and provides an organization that establishes clear relationships among the

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	Strand	High School Science Standard (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	Connection (Con)
		5. solve various types of wave-speed, wavelength, and frequency problems both by lab methods and by calculation. 6. compare the particle theory with the wave theory of light using demonstrations such as the pinhole camera and the formation of shadows, and properties such as diffraction, interference, and polarization. **Electromagnetism (E)** A. Electrostatics 1. identify and explain the types of electrostatic charges, methods of storage, and transmission and the forces generated. 2. demonstrate the existence of electrostatic forces using laboratory equipment. 3. discuss the effect of Coulomb's Law. B. Direct Current 1. demonstrate how direct current charges are formed, stored, transmitted, and used. 2. describe and explain how electric fields are generated and propagated. 3. analyze direct current circuits using ammeter and voltmeter in the lab. 4. calculate the important aspects of direct currents using Ohm's Law. 5. solve problems in electricity involving heat, energy, and electrical power	claim, reasons, data, and evidence. 21. develop a claim thoroughly and fairly with logical reasoning, supplying the most relevant data and evidence acquired in scientifically acceptable form. 22. use precise words phrases as well as scientific vocabulary to make clear relationships between claims and reasons and between reasons and the data and evidence. 4. sustain an objective style and tone while attending to the norms and conventions of scientific writing. 23. provide a concluding statement or section that follows logically from the argument. 24. perform short, focused research projects and more sustained research; synthesize multiple authoritative sources on a subject to answer a question or solve a problem. 25. gather relevant information from multiple print and digital

Guiding Principles * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**High School Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Biology, Introduction to Biology, Standard 1 could be coded: HS.Bio.IB.1, **or** Biology Connection 1 could be HS.Bio.Con.1)	**Connection (Con)**
		C. Magnetism 1. explain and demonstrate the causes and characteristics of magnetism. 2. demonstrate the relationship between magnetism and electricity using lab equipment. 3. demonstrate knowledge of electromagnetic devices and equipment such as CRT's, transformers, inductors, oscillation and radio transmission, and semiconductors	sources; assess its credibility and accuracy and its usefulness in terms of purpose, task, and audience; and integrate selected information into the text, avoiding overreliance on any one source, avoiding plagiarism, and following a standard format citation. 26. write in response to informational sources, drawing on textual evidence to support and analysis and reflection as well as to describe what they have learned.

Middle School Physical Science (MSPS) (suggested 8th grade)

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Middle School Physical Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	**Connection**
S.712.GS2 Explain and promote the unity of faith and reason with confidence that there exists no contradiction between the God of nature and the God of the faith. S.712.GS4 Share how the beauty and goodness of God is reflected in nature and the study of the natural sciences. S.712.IS2 Demonstrate confidence in human reason and in one's ability to know the truth about God's creation and the fundamental intelligibility of the world. S.712.IS4 Relate how the search for truth, even when it concerns a finite reality of the natural world or of man, is never-ending and always points beyond to something	**Chemistry (Chem)**	**Physical Properties of Matter: (PPM)** 1. Identify physical properties of matter. 2. Demonstrate and relate concepts of boiling point and melting point. 3. Distinguish between the molecular arrangement of solids, liquids and gases. **Chemical Properties of Matter (CPM)**: 1. Identify the chemical properties of substances. 2. Identify parts of an atom. 3. Explain that atoms are the smallest particle of a substance that retains its properties and can combine to form a molecule. **Atomic Structure (AS)** 1. Identify parts of an atom. 2. Trace the history of atomic models. 3. Explain that atoms are the smallest particle of a substance that retains its properties and can combine to form a molecule.	1. Identify key Catholic scientists such as Copernicus, Mendel, DaVinci, Bacon, Pasteur, Volta, St. Albert the Great, and others and the witness and evidence they supply against the false claim that Catholicism is not compatible with science. 2. Formulate and create a written plan to conduct a scientific investigation using the scientific method. 3. Use appropriate tools, equipment, technology and SI measurement units to gather and organize data. 4. Incorporate controls and variables into scientific investigation. 5. Interpret and discuss the results of experiments conducted in class using graphs, tables, and charts. 6. Debate and or defend certain ethical standards associated with scientific study.

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Middle School Physical Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	**Connection**
higher than the immediate object of study. S712.DS1 Display a deep sense of wonder and delight about the natural universe. S712.DS2. Share how natural phenomena have more than a utilitarian meaning and purpose and exemplify the handiwork of the Creator. S.712.DS5 Adhere to the idea of the simultaneous complexity and simplicity of physical reality. S.K6.IS2 Describe the relationships, elements, underlying order, harmony, and meaning in God's creation.		**Periodic Table of Elements (PTE)** 1. Define elements in the periodic table 2. Describe the development of the periodic table of elements 3. Explain how the elements are arranged in modern tables 4. Name the groups and periods in the periodic table 5. Name the characteristics of the periodic table. **Compounds and Mixtures (CM)** 1. Define molecules, ions, compounds, and mixtures 2. Distinguish between compounds and mixtures. 3. Give the chemical formula for a compound and identify the atoms in the compound. 4. Compare and contrast the characteristics of suspensions and solutions. 5. Compare and contrast colloids and emulsions. **Chemical Reactions (CR)** 1. Prepare and evaluate chemical reactions 2. Describe the chemistry of hydrocarbons as they relate to biological and geological processes. **Chemical Equations (CE)** 1. Identify and illustrate how an atom's valence number affect bonding 2. Compare and contrast ionic and covalent bonding 3. Identify the reactants and the products in a chemical reaction. 4. Demonstrate the Law of Conservation of Energy	7. Incorporate official Catholic Church teachings that directly relate to ethical standards dealing with science (equitable use of resources among peoples of the world, faith-based understanding of creation, etc.) **SCIENCE READING LITERACY** 8. Cite specific textual evidence to support analysis of scientific and technical texts. 9. Summarize the broad ideas and specific conclusions made in a text, basing the summary on textual information rather than on prior knowledge or opinions. 10. Determine the meaning of key terms, symbols and domain specific vocabulary used in a text. 11. Analyze the purpose of an experiment or explanation in a text, including defining the problem or question to be resolved. 12. Integrate information provided by the words in a text with a version of the information expressed graphically (e.g., in a flow chart, diagram, model, graph, or table). 13. Distinguish facts or reasoned judgments based on research findings from opinions.

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Middle School Physical Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	**Connection**
		Properties of Acids and Bases (PAB) 1. Demonstrate and explain pH and conductivity 2. Define and describe neutralization 3. Discuss the formulation of hydronium, and hydroxide ions in water. 4. Describe the relationship of the pH scale and acidity of solution.	14. Compare and contrast the information gained from experiments, simulations, video or multimedia sources with that gained from reading a text on the same topic. 15. Read informational text independently, proficiently, and fluently in the grades 6-8 text level. **SCIENCE WRITING LITERACY** 16. write arguments focused on science content in which they: a. Introduce a claim about a topic or issue, distinguish it from alternate or opposing claims, and organize the reasons, data, and evidence logically to support the claim. b. support the claim with logical reasoning and detailed, accurate data evidenced from investigations. c. use words and phrases as well as specific science vocabulary to make clear the relationships among claims, reasons, data, and evidence. d. sustain an objective style and tone.
	Physics	**Electricity and Magnetism (EM)** 1. List the properties of a magnet. 2. Describe the Earth's magnetic field. 3. Discuss the relationship between electricity and magnetism. 4. Develop a relationship between electric currents and magnetism. 5. Explain how friction and resistance affect electric currents and magnetism.	
		Newton's Three Laws of Motion (N) 1. Explain and give examples of Newton's three laws of motion. 2. Develop and diagram the concept of gravitational force.	

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	Strand	Middle School Physical Science Standard (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	Connection
			e. provide a concluding statement or section that follows logically from the arguments. 17. Perform short, focused research projects in response to question or problem and generate additional related questions that allow for multiple avenues of exploration. 18. Gather relevant information from multiple print and digital sources using effectively tailored searches; assess the credibility and accuracy of each source; and quote or paraphrase the evidence, avoiding plagiarism and following a standard format for citation.

Middle School Life Science (suggested 7th grade)

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	Strand	Middle School Life Science Standard (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	Connection
CNS.S.K6.GS2 Describe the unity of faith and reason with confidence that there exists no contradiction between the	**Life Science (LS)**	**Ecology and the Environment (EE)** 1. discuss the effect of genetic mutation in organisms on population and the community. 2. describe the role of mutation in generating diversity (evolution).	1. Formulate and create, using scientific method, a written plan to conduct scientific experiments.

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Middle School Life Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	**Connection**
God of nature and the God of faith. CNS.S.K6.IS1 Explain what it means to say that God created the world and all matter out of nothing at a certain point in time; how it manifests His wisdom, glory, and purpose; and how He holds everything in existence according to His plan. CNS.S.K6.IS2 Describe the relationships, elements, underlying order, harmony, and meaning in God's creation. CNS.S.K6. IS5 Explain the processes of conservation, preservation, overconsumption, and stewardship in relation to caring for that which God has given to sustain and delight us. CNS.S.K6.IS8 Explain how science properly limits its focus on "how" things physically exist		3. compare and contrast food webs within and between different ecosystems and predict consequences of disrupting one of the organisms in a food web. 4. describe the changes in population due to migration and geographic isolation. 5. explain the processes of succession and the characteristics of a climax community. 6. describe how climate and soil affect an ecosystem. 7. describe the effect on the growth of the human population on ecosystems. 8. discuss appropriate stewardship of the environment. 9. define extinction and identify its importance in biodiversity (when the environment changes, the adaptive characteristics of some species are insufficient to allow for their survival). **ORGANISMS (O)** Characteristics 1. identify living and non-living things. 2. explain the characteristics used to identify living and non-living things. Viruses 3. identify the characteristics of viruses. 4. describe how viruses reproduce. 5. compare and contrast latent and active viruses. 6. compare and contrast viruses and bacteria. Classification 7. list kingdoms and their subdivisions. 8. explain how scientists name species.	2. Use appropriate tools, equipment, technology, and measurement units (metric) to gather and organize data. 3. Describe the function of the microscope. 4. Name and locate the parts of a microscope. 5. Demonstrate the purpose and proper use of a microscope. 6. Incorporate controls and variables into scientific investigation. 7. Interpret and discuss the results of experiments conducted in class and/or at home using graphs, tables, and charts. 8. Formulate conclusions by interpreting and evaluating data from scientific investigations. 9. Debate and/or defend certain ethical standards associated with scientific study. 10. Incorporate official Catholic Church teachings that directly

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Middle School Life Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	**Connection**
and is not designed to answer issues of meaning, the value of things, or the mysteries of the human person. CNS.S.K6.DS1 Display a sense of wonder and delight about the natural universe and its beauty.		9. identify organisms using binomial nomenclature. 10. demonstrate the use of a dichotomous identification key or a field guide to identify an organism. Bacteria, Protista, Fungi 11. list characteristics of each group (prokaryote, eukaryote). 12. identify some common members of each group (protists, fungi, unicellular, multicellular). 13. observe and classify an organism. Plants 14. discuss the distinguishing characteristics of plants. 15. distinguish between vascular and non-vascular plants. 16. explain the characteristics of types of vascular tissue (xylem, phloem, and cambium). 17. describe photosynthesis. 18. distinguish between angiosperms and gymnosperms. 19. compare photosynthesis to cellular respiration. 20. diagram the oxygen cycle. 21. diagram the nitrogen cycle. 22. identify the parts of a complete flower. 23. distinguish between fruits and seeds. 24. demonstrate the difference between monocots and dicots. 25. discuss characteristics and methods of plant reproduction.	relate to ethical standards dealing with science (cloning, abortion, evolution, organ transplant, animal research and experimentation, etc.). **SCIENCE READING LITERACY** 11. Cite specific textual evidence to support analysis of scientific and technical texts. 12. Summarize the broad ideas and specific conclusions mad in a text, basing the summary on textual Information rather than on prior knowledge or opinions. 13. Determine the meaning of key terms, symbols and domain specific vocabulary used in a text. 14. Analyze how each major part of a text contributes to an understanding of the topic discussed in the text. 15. Analyze the purpose of an experiment or explanation in a text, including defining the problem or question to be resolved. 16. Integrate information provided by the words in a text with a version of the information expressed graphically (e.g., in a flow chart, diagram, model, graph, or table).

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	Strand	Middle School Life Science Standard (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	Connection
		Animals 26. distinguish between vertebrates and invertebrates and give examples of each (echinoderms, arthropods, mollusks, coelenterates, sponges, worms). 27. compare and contrast cold-blooded and warm-blooded vertebrates and give examples of each. 28. identify basic characteristics of the classes of animals (mammals, birds, reptiles, amphibians, fish).	17. Distinguish facts or reasoned judgments based on research findings from opinions. 18. Compare and contrast the information gained from experiments, simulations, video or multimedia sources with that gained from reading a text on the same topic. 19. Read informational text independently, proficiently, and fluently in the grades 6-8 text level.
		CELL STRUCTURE AND FUNCTION (**CSF**) 1. explain cell theory. 2. describe cell organelles and explain their functions. 3. compare and contrast animal, plant, and bacteria cells. 4. describe the diffusion of molecules by osmosis and active transport. 5. define cellular respiration. 6. explain the difference between single cell and multi-cellular organisms. 7. recognize and define cells, tissues, organs, and organ systems as levels of organization. 8. discuss the process and phases of mitosis. 9. discuss the process and phases of meiosis. 10. compare and contrast sexual and asexual reproduction. *(Note: Assistance in explaining the Catholic Church's stand on reproductive issues may be found in the Catechism of the*	**SCIENCE WRITING LITERACY** 20. Write arguments focused on science content in which they: a) Introduce a claim about a topic or issue, distinguish it from alternate or opposing claims, and organize the reasons, data, and evidence logically to support the claim. b) support the claim with logical reasoning and detailed, accurate data evidenced from investigations. c) use words and phrases as well as specific science vocabulary to make clear the relationships among

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	Strand	Middle School Life Science Standard (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	Connection
CNS.S.K6.DS3 Accept the premise that nature should not be manipulated simply at man's will or only viewed as a thing to be used, but that man must cooperate with God's plan for himself and for nature. CNS.S.712.GS1 Exhibit a primacy of care and concern at all stages of life for each human person as an image and likeness of God. CNS.S.712.IS2 Demonstrate confidence in human reason and in one's ability to know the truth about God's creation and the fundamental intelligibility of the world. S.712.DS1		*Catholic Church. Excerpts on this subject are included in the Appendix of the Science Curriculum Guideline. Religion teachers, the principal, and the pastor may also be appropriate resources if questions arise on this topic.)*	claims, reasons, data, and evidence. d) sustain an objective style and tone. e) provide a concluding statement or section that follows logically from the arguments. 21. perform short, focused research projects in response to question or problem and generate additional related questions that allow for multiple avenues of exploration. 22. gather relevant information from multiple print and digital sources using effectively tailored searches; assess the credibility and accuracy of each source; and quote or paraphrase the evidence, avoiding plagiarism and following a standard format for citation.
		HEREDITY/GENETICS (HG) 1. identify characteristics of chromosomes. 2. define heredity and describe how traits are passed from parent to offspring. 3. describe Mendel's experiments and list his results and conclusions. 4. experiment with determining probability using Punnett squares. 5. describe the functions of DNA, genes, and chromosomes. 6. define dominant, recessive, incomplete dominance, and co-dominance. 7. compare and contrast homozygous and heterozygous traits. 8. discuss the pros and cons of inbreeding, hybridization, and selective breeding. 9. explain how eggs and sperm are produced by meiosis. 10. define and give two examples of X-chromosome linked traits. 11. differentiate between inborn and acquired traits and behaviors (nature versus nurture). 12. identify and explain several examples of genetic disease. 13. explain how mutations take place. 14. describe the transfer of information between generations	

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Middle School Life Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	**Connection**
Display a deep sense of wonder and delight about the natural universe. S.712.DS2 Share how natural phenomena have more than a utilitarian meaning and purpose and exemplify the handiwork of the Creator.			
		HUMAN ANATOMY **Skeletal (S)** 1. describe the four functions of the human skeleton. 2. identify structures of a bone. 3. compare and contrast the types of joints. 4. identify bones of the skeletal system.	
		Muscular (M) 5. identify major muscles of the muscular system. 6. compare and contrast three types of muscle tissue.	
		Skin (Sk) 7. describe the two main layers of skin. 8. identify the five functions of skin.	
		Digestive (D) 9. identify and explain the function of the organs in the digestive system. 10. illustrate the path of a particle of food through the system. 11. list the classes of nutrients and describe their uses.	
		E. Circulatory (C) 12. identify and explain the functions of the circulatory system including heart, blood cells, blood vessels, lymph vessels, and tissue fluid. 13. illustrate the path of blood between the heart and lungs.	

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	Strand	Middle School Life Science Standard (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	Connection
		Respiratory System (RS) 14. identify the parts and function of the respiratory system. 15. compare and contrast cellular respiration and the breathing process. 16. illustrate the pathway of the exchange of gasses in the human body.	
		Excretory System (ExS) 17. list the organs that excrete waste. 18. describe excretion of wastes by lungs, skin, and kidney.	
		Nervous System (NS) 19. identify the parts and functions of the nervous system including the three parts of the brain, the spinal cord, and nerve cells. 20. illustrate the path of an impulse. 21. illustrate the path of a reflex arc. 22. compare and contrast the central and peripheral nervous systems. 23. demonstrate the relationship between stimuli and responses. 24. regarding sight: a) identify and define the parts of the eye. b) explain how the eye processes light. c) discuss some common abnormalities and how they affect sight. 25. regarding hearing: a) identify and define the parts of the ear. b) explain how the ear processes	

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	Strand	Middle School Life Science Standard (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	Connection
		sound. c) discuss some common abnormalities and how they affect hearing. 26. identify the parts of the tongue and how they process taste. 27. describe how the nose processes odors. 28. describe how sensations are transmitted from the skin to the brain.	
		Endocrine System (EnS) 29. identify the endocrine glands and discuss their function.	
		Reproductive System (RS) 30. identify the parts and functions of the reproductive system as unique to either male or female people, designed with intentionality and purpose and meaning. 31. illustrate the growth and development of a human being, from fertilization to birth. 32. discuss the Catholic Church's teachings on the beginning of life. 33. explain the process of conception and embryology, emphasizing the child in the womb as a human person growing in its proper developmental stage. *(Note: Assistance in explaining the Catholic Church's stand on reproductive issues may be found in the Catechism of the Catholic Church. Excerpts on this subject are included in the Appendix of the Science Curriculum Guideline. Religion teachers, the principal, and the pastor may also be appropriate resources if questions arise on this topic. Please refer to the Christian Anthropology strand in the catechesis/Theology standards.)*	

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Middle School Life Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	**Connection**
		Immune System (Im) 34. identify the parts and functions of the immune system. 35. identify t-cells, bone marrow, white blood cells, lymphatic system, etc. 36. discuss some internal causes of disease (viruses, bacteria, cell mutation). 37. discuss some external causes of disease (malnutrition, sanitation, food contamination, etc.) 38. discuss methods of disease prevention. 39. expose myths about infectious and communicable diseases.	
		Interaction of the Human Body Systems (IHBS) 40. discuss how the systems of the human body interact with one another.	

Middle School Earth and Space Science (MSES) (Suggested 6th Grade)

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Middle School Earth and Space Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Earth and Space Science, Earth's Surface, Standard 1 could be coded: MSES.ES.1 **or** Middle School Earth and Space Science Connection 1 could be MSES.Con.1)	**Connection (Con)**
S.712.GS4 – Share how the beauty and goodness of God is reflected in nature and the study of the natural sciences. S.K6.IS2 Describe the relationships, elements, underlying order, harmony, and meaning in God's creation. S.K6.IS3 Explain how creation is an outward sign of God's love and goodness and, therefore, is "sacramental" in nature. S.K6.IS4 Give examples of the beauty evident in God's creation. S.K6.IS5 – Explain the processes of conservation, preservation,	**Earth's Surface (ES)**	**Minerals (M)** 1. Identify properties and characteristics of minerals 2. Rocks a. Differentiate between the different types of rocks. b. Identify the various types of igneous rocks. c. Identify the various types of metamorphic rocks. d. Identify the various types of sedimentary rocks. 3. Water a. Identify ground water structures b. Identify the various types of materials that compose ocean water c. Identify the different types of ocean currents d. Identify the characteristics of waves 4. Atmosphere a. Examine the effects of Earth's revolution/rotation and physical characteristics on weather and climate b. Identify the major gasses present in the Earth's atmosphere c. Identify the layers of Earth's atmosphere	**Nature of Science** 1. Formulate and create a written plan to conduct a scientific investigation using the scientific method. 2. Use appropriate tools, equipment, technology and measurement units to gather and organize data. 3. Introduce controls and variables and their effect on the outcome of a scientific investigation. 4. Interpret and discuss the results of experiments conducted using graphs, tables and charts. 5. Examine data to recognize cause and effect 6. Interpret and evaluate data in order to formulate conclusions from scientific investigation

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Middle School Earth and Space Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Earth and Space Science, Earth's Surface, Standard 1 could be coded: MSES.ES.1 **or** Middle School Earth and Space Science Connection 1 could be MSES.Con.1)	**Connection (Con)**
overconsumption, and stewardship as it relates to creation and to caring for that which God has given to sustain and delight us. S.K6 IS8 Explain how science properly limits its focus to "how" things physically exist and is not designed to answer issues of meaning, the value of things, or the mysteries of the human person. IS9 – Distinguish the difference between the use of the scientific method and the use of theological inquiry to know and understand God's creation and universal truths. S.K6.IS9 Describe how the use of the scientific method to explore and understand nature differs,		d. Explain the effects of the sun on the Earth's surface and its relationship to the atmosphere 5. Landforms a. Identify the landforms b. Identify the types of mountains c. Classify the types of volcanoes d. Differentiate between plains and plateaus e. Interpret landforms using topographical maps f. Describe the topography of the ocean	7. Describe how certain scientific ideas have evolved over time. 8. Describe contributions to the advancement of science by people in different cultures and at different times in history. 9. Relate the historic conditions that led to various scientific contributions. 10. Describe how people use science and technology in their professions. 11. Identify certain ethical standards relating to scientific research and investigation
	Surface Changing Processes (SCP)	1. List the agents of erosion 2. Wind a. Identify wind as an agent of erosion b. Identify the kinds of surface changes made by wind deposits 3. Water	**SCIENCE READING LITERACY** 12. cite specific textual evidence to support analysis of scientific and technical texts. 13. summarize the broad ideas and specific conclusions mad in a text, basing the summary on textual

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Middle School Earth and Space Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Earth and Space Science, Earth's Surface, Standard 1 could be coded: MSES.ES.1 **or** Middle School Earth and Space Science Connection 1 could be MSES.Con.1)	**Connection (Con)**
yet complements, the theological and philosophical questions one asks in order to understand God and His works. S.K6.DS1 – Display a deep sense of wonder and delight about the natural universe. S.K6.DS2 Share concern and care for the environment as a part of God's creation. S.K6.DS2 Accept the premise that nature should not be manipulated simply at man's will or only viewed as a thing to be used, but that man must cooperate with God's plan for himself and for nature. S.712.IS16 Articulate the details of the Galileo affair		a. Identify the types of changes caused by river and rain erosion b. Discuss the types of erosion caused by ground water 4. Glaciers a. Distinguish between continental and alpine glaciers b. Discuss the development of glacier features in relation to glacial movement c. Identify the types of glacial deposits d. Identify glacier formations 2. Mountain Building a. Compare and contrast mountain building processes 3. Earth Movement a. Describe the different kinds of fossils and how they are formed b. Explain the cause of an earthquake c. Identify the types of waves produced by earthquake activity d. Analyze how seismic episodes give us clues to the composition of the Earth's interior e. Examine the development of the theory of plate tectonics and the theory of continental drift	14. information rather than on prior knowledge or opinions. 15. determine the meaning of key terms, symbols and domain specific vocabulary used in a text. 16. analyze how each major part of a text contributes to an understanding of the topic discussed in the text. 17. analyze the purpose of an experiment or explanation in a text, including defining the problem or question 18. to be resolved. 19. integrate information provided by the words in a text with a version of the information expressed 20. graphically (e.g., in a flow chart, diagram, model, graph, or table). 21. distinguish facts or reasoned judgments based on research findings from opinions. 22. compare and contrast the information gained from experiments, simulations, video or multimedia 23. sources with that gained from reading a text on the same topic. 24. 9. read informational text independently, proficiently, and fluently in the grades 6-8 text level.

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Middle School Earth and Space Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Earth and Space Science, Earth's Surface, Standard 1 could be coded: MSES.ES.1 **or** Middle School Earth and Space Science Connection 1 could be MSES.Con.1)	**Connection (Con)**
to counter the assumption that the Church is anti-science.		f. State the theory of plate tectonics g. Describe the evidence that supports plate tectonics h. Examine the effects of plate tectonics on the Earth (volcanoes, earthquakes, mountains) i. Compare and contrast types of faults	**SCIENCE WRITING LITERACY** 25. write arguments focused on science content in which they: 26. Introduce a claim about a topic or issue, distinguish it from alternate or opposing claims, and organize the reasons, data, and evidence logically to support the claim. 27. support the claim with logical reasoning and detailed, accurate data evidenced from investigations. 28. use words and phrases as well as specific science vocabulary to make clear the relationships 29. among claims, reasons, data, and evidence. 30. sustain an objective style and tone. 31. provide a concluding statement or section that follows logically from the arguments. 32. perform short focused research projects in response to question or problem and generate additional 33. related questions that allow for multiple avenues of exploration. 34. gather relevant information from multiple print and digital sources using effectively tailored searches; assess the credibility and accuracy of each source; and

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	Strand	Middle School Earth and Space Science Standard (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Earth and Space Science, Earth's Surface, Standard 1 could be coded: MSES.ES.1 **or** Middle School Earth and Space Science Connection 1 could be MSES.Con.1)	Connection (Con)
			quote or paraphrase the evidence, avoiding plagiarism and following a standard format for citation.
	Internal Changing Processes (ICP)	**Geological Time Scale (GTS)** 1. Explain the types of evidence used by geologists to measure the age of the Earth 2. Describe the basis for dividing the geological time scale into various subdivisions 3. Describe the major characteristics of each geological era as to their flora and fauna 4. Describe the different kinds of fossils and how they are formed	
	Earth's Resources (ER)	**Renewable and non-renewable resources (RNR)** 1. Identify the renewable natural resources of the Earth 2. Analyze ways that the renewable natural resources can be conserved 3. Identify the earth's non-renewable natural resources 4. Analyze ways that the non-renewable natural resources can be conserved	

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Middle School Earth and Space Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Earth and Space Science, Earth's Surface, Standard 1 could be coded: MSES.ES.1 **or** Middle School Earth and Space Science Connection 1 could be MSES.Con.1)	**Connection (Con)**
		Energy (E) 1. Identify the Earth's energy resources 2. Discuss the use of exploration of resource development 3. Discuss the pros and cons of resource development 4. Describe the use of models in the study of the Earth	
	Astronomy (A)	1. Describe the development and life stages of the stars 2. Describe the different types of galaxies 3. Compare and contrast the universe formation theories 4. Describe the functions of the two types of telescopes 5. Research the current and past space programs and the latest findings within the universe.	

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**5th Grade Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: 5th Grade Earth and Space Science Weather Standard 1 would be coded as 5.ESS.W.1 **or** 5th grade connection 1 could be coded as 5.Con.1)	**Connection**
S.S.K6.DS1 Display a sense of wonder and delight about the natural universe and its beauty. S.K6.GS2 Describe the unity of faith and reason with confidence that there exists no contradiction between the God of nature and the God of faith. S.K6.IS1 Explain what it means to say that God created the world and all matter out of nothing at a certain point in time; how it manifests His wisdom, glory, and purpose; and how He holds everything in existence according to His plan.	**Earth/ Space Science (ESS)**	**Weather**: (W) 1. Collect and record weather data 2. Describe the atmospheric conditions associated with particular weather patterns 3. Identify the types of clouds and discuss their relationship to weather 4. Explain how forecasts of extreme or inclement weather help to ensure safety 5. Discuss safety protocol for severe weather 6. Explain the uses of weather instruments used to forecast weather 7. Relate air pressure to wind and weather 8. Describe the development of thunderstorms 9. Compare and contrast the characteristics of hurricanes and tornadoes 10. Identify the major gasses present in the Earth's atmosphere 11. Identify the layers of Earth's atmosphere 12. Explain the effects of the sun on the Earth's surface and its relationship to the atmosphere 13. Identify how weather affects the process of weathering and erosion 14. Examine the effects of Earth's revolution/rotation and physical characteristics on weather and climate	1. Follow plans to conduct scientific investigation using the scientific method that includes question (problem), hypothesis, gathering data, and drawing conclusions while observing appropriate safety measures. 2. Examine data to recognize cause and effect. 3. Interpret results of experiments conducted in class and/or at home. 4. Explain the predictable "repeatability" of scientific investigation. 5. Use and identify scientific equipment, including but not limited to barometers, thermometers, rain gauges, anemometers, etc...

S.K6.IS2 Describe the relationships, elements, underlying order, harmony, and meaning in God's creation. S.K6.IS2 Describe the relationships, elements, underlying order, harmony, and meaning in God's creation. S.K6.IS3 Explain how creation is an outward sign of God's love and goodness and, therefore, is "sacramental" in nature. S.K6.IS4 Give examples of the beauty evident in God's creation. S.K6.GS1 Exhibit care and concern at all stages of life for each human person	**Life Science (LS)**	**Body Organization (BO):** 1. List the five (5) levels of body organization: cells, tissues, organs, organ systems, organism 2. Describe cells and list cell functions	6. Recognize and discuss the role of ethics in the advancement of science and technology.

as an image and likeness of God. S.K6.GS3 Value the human body as the temple of the Holy Spirit.		3. Compare organelle functions to organ functions 4. Identify the skeletal, muscular, digestive, respiratory, nervous, immune, and circulatory systems, their functions, and their major organs	
S.K6.DS3 Accept the premise that nature should not be manipulated simply at man's will or only viewed as a thing to be used, but that man must cooperate with God's plan for himself and for nature. S.K6.IS5 Explain the processes of conservation, preservation, overconsumption, and stewardship in relation to caring for that which God has given to sustain and delight us.	**Physical Science**	**Energy (E):** 1. Define energy, including the Law of Conservation of Energy 2. Compare and contrast energy and matter 3. Name and describe the properties of light and sound waves 4. Compare and contrast sound and light waves 5. Discuss different types of heat 6. Describe and demonstrate how heat is measured 7. Compare and contrast kinetic energy and potential energy and give examples that have kinetic and potential energy 8. Discuss how friction and resistance affect kinetic and potential energy 9. Identify and discuss energy resources 10. Define, compare, and contrast conduction, convection, and radiation 11. Analyze how solar energy affects life on Earth	7. Compare and contrast advantages and disadvantages of advances in technology. 8. Design charts, graphs, and tables in order to explain results. 9. (For example, students can create a chart for the electromagnetic spectrum)

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**4th Grade Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: 5th Grade Earth and Space Science Weather Standard 1 would be coded as 5.ESS.W.1 **or** 5th grade connection 1 could be coded as 5.Con.1)	**Connection**
S. K6. DS1 Display a sense of wonder and delight about the natural universe and its beauty. S.K6.IS5 Explain the processes of conservation, preservation, overconsumption, and stewardship in relation to caring for that which God has given to sustain and delight us. S.K6.DS3 Accept the premise that nature should not be manipulated simply at man's will or only viewed as a thing to be used, but that man must cooperate with God's plan for himself and for nature.	**Earth/ Space Science (ESS)**	**Understanding and Protecting Our Environment** (UPE): 1. Discuss the effects that climates have on weather 2. Diagram the water cycle 3. Compare and contrast climate types 4. Describe the impact of pollution on living organisms and their environment 5. Explain conservation of natural resources and how it impacts pollution and recycling issues 6. Compare forms of environmental protection (water, soil, and air) 7. Evaluate the conservation of natural resources in the United States 8. Describe the effect on the growth of the human population on ecosystems 9. Discuss appropriate stewardship of the environment in response to environmental changes 10. Define extinction and identify its importance in biodiversity (when the environment changes, the adaptive characteristics of some species are insufficient to allow for their survival)	1. Use data to recognize/identify cause and effect. 2. Report results in a variety of ways: graphs, tables, drawings, etc. (For example, students can graph human population growth over time.)
	Life Science (LS)	**Ecology (E):** 1. Identify and model how living things interact with their environment 2. Identify living things from both now and long ago including extinct species 3. Explain how environmental factors lead to species endangerment or extinction 4. Diagram the flow of energy through a food chain	3. Report results in a variety of ways (graphs, tables, drawings, etc.). (i.e. food chain)

S.K6.IS6 Describe God's relationship with man and nature. S.K6.DS2 Share concern and care for the environment as a part of God's creation. S.K6.DS4 Accept that scientific knowledge is a call to serve and not simply a means to gain power, material prosperity, or success.		5. Use evidence and describe patterns of variation in a trait across individuals of the same kind of organism 6. Describe how an organism's behavior is related to the nature of that organism's environment 7. Describe photosynthesis and respiration 8. Describe an ecosystem 9. Compare and contrast food webs within and between different ecosystems and predict consequences of disrupting one of the organisms in a food web 10. Describe the changes in populations due to migration and geographic isolation 11. Explain the processes of succession and the characteristics of a climax community 12. Describe how climate and soil affect an ecosystem	
S.K6.IS1 Explain what it means to say that God created the world and all matter out of nothing at a certain point in time; how it manifests His wisdom, glory, and purpose; and how He holds everything in existence according to His	**Physical Science (PS)**	**Properties of Matter (PM):** 1. Define physical properties of matter 2. Define chemical properties of matter 3. Compare and contrast chemical and physical properties 4. Define smaller particles (atoms, molecules, etc.) 5. Examine and illustrate the properties and composition of matter 6. Explain that atoms are the smallest particle of a substance that retains its properties and can combine to form a molecule	4. Follow plans to conduct scientific investigation using the scientific method that includes question (problem), hypothesis, gathering data, drawing conclusions and observing appropriate safety measures. 5. Use scientific devices (especially metric instruments) to collect data.

plan.		7. Recognize various elements of the Periodic Table of the Elements 8. Distinguish between the molecular arrangement of solids, liquids and gasses	6. Apply metric units for mass, volume and length. 7. Use and identify scientific equipment, including but not limited to flasks, beakers, graduated cylinders, balances, etc... (For example, students can conduct a density experiment where they make predictions about whether an object will sink or float and then calculate the density of the object with mass (using a balance) and volume (using a ruler)). 8. Demonstrate the predictable "repeatability" of scientific investigations. 9. Generalize from a model to scientific reality. (For example, students can discuss the differences between the atomic model and the reality of the atomic structure.)

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**3rd Grade Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	**Connection**
*S.K6.IS1 E*xplain what it means to say that God created the world and all matter out of nothing at a certain point in time; how it manifests His wisdom, glory, and purpose; and how He holds everything in existence according to His plan. S.K6.IS2 Describe the relationships, elements, underlying order, harmony, and meaning in God's creation. S.K6.IS4 Give examples of the beauty evident in God's creation. S.K6.DS1 Display a sense of wonder and delight about the	**Earth/ Space Science (ESS)**	**Space (S)**: 1. Describe the characteristics of the planets (inner rocky planets vs. outer gas giants) 2. Illustrate the order of planets 3. Design and build a model of the solar system 4. Identify and sequence the life cycle of a star 5. Name, measure, and label stars 6. Identify comets, meteors, and asteroids 7. Explain the use of technology in describing the process of space exploration and colonization **Geology (G):** 1. Classify types of rocks (sedimentary, igneous, metamorphic) 2. Explain formation of fossils 3. Compare and contrast geological features and their formations 4. Examine the features of the ocean floor 5. Identify how weather affects the process of weathering and erosion 6. Identify the rock cycle	1. Make predictions based on observations and previous experiences. 2. Explore occupations in science, and discuss why a Catholic worldview is needed in the professional sciences.
	Physical Science (PS)	**Magnetism and Electricity: (ME)** 1. Demonstrate the properties and behavior of magnets 2. Investigate Earth's magnetism, including its relationship to compasses, aurora borealis, etc. 3. Identify the relationship between electricity and magnetism 4. Build a simple electric circuit	3. Use scientific devises to collect data using metric measurements, i.e., thermometers, balances, rulers, etc. 4. Follow a plan to use the scientific method to conduct a scientific investigation that includes question

natural universe and its beauty. S.K6.DS3 Accept the premise that nature should not be manipulated simply at man's will or only viewed as a thing to be used, but that man must cooperate with God's plan for himself and for nature.		5. Define and demonstrate resistance 6. Describe how electricity flows through current 7. Compare and contrast series and parallel circuits	(problem), hypothesis, gathering data, and drawing conclusions. 5. Write a hypothesis using the "if, then, because" statement. 6. Collect data and interpret and communicate results in a variety of ways, i.e., graphs, oral presentations, charts, etc. 7. Explore occupations in science.

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**2nd Grade Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	**Connection**
S.K6.IS4 Give examples of the beauty evident in God's creation. S.K6.IS2 Describe the relationships, elements, underlying order, harmony, and meaning in God's creation. S.K6.IS3 Explain how creation is an outward sign of God's love and goodness and, therefore, is "sacramental" in nature. S.K6.DS1 Display a sense of wonder and delight about the natural universe and its beauty. S.K6.GS1 Exhibit care and concern at	**Earth/Space Science (ESS)**	**Earth, Moon, and Sun (EMS)**: 1. Communicate the characteristics of observable seasonal change 2. Describe how Earth's rotation and revolution determine night, day, and the length of the year 3. Identify the Earth as part of the solar system 4. Identify the sun, moon, and stars in relation to day 5. Identify basic constellations 6. Identify the four (4) major phases of the moon (new, waxing, waning, and full) 7. Describe the relationships of the Earth, moon, and sun (orbit, rotation) 8. Compare and contrast the four seasons 9. Identify the effects of gravity on objects, including tides **Introduction to the Human Body (IHB):** 1. Understanding and using the five senses: touch, taste, hearing, smelling, and sight	1. Make predictions based on observations and previous experiences. 2. Distinguish between man-made and natural resources. (For example, students can discuss the sun as a renewable natural resource and the source of all fossil fuels' energy.)

all stages of life for each human person as an image and likeness of God. S.K6.IS3 Value the human body as the temple of the Holy Spirit. S.K6.IS8 Explain how science properly limits its focus to "how" things physically exist and is not designed to answer issues of meaning, the value of things, or the mysteries of the human person.	**Life Science (LS)**	2. Order the life cycle of a human 3. Identify and locate major organs of the human body and describe their primary functions 4. Identify major systems of the human body (digestive, respiratory, circulatory, skeletal, muscular)	
S.K6.IS9 Describe how the use of the scientific method to explore and understand nature differs, yet complements, the theological and philosophical questions one asks in order to	**Physical Science (PS)**	**Forces (F):** 1. Demonstrate how to apply force and motion 2. Demonstrate the cause and effect of force and motion 3. Investigate the effect of pushes and pulls in different directions on the resulting motion of objects 4. Investigate the effect of pushes and pulls of different strengths on the resulting motion of objects 5. Construct an explanation for why an object subjected to multiple pushes and pulls might stay in one place or move	2. Experiment to test predictions. 3. Record information and data. 4. Represent data on simple graphs. 5. Draw conclusions from simple graphs.

understand God and His works.		6. Analyze data to determine the relationship between friction and the motion of objects (e.g. objects sliding on various surfaces) 7. Develop and share a design solution to reduce friction between two objects 8. Plan and carry out investigations of how the speed of an object determines changes in motion and or shape when the object touches or collides with another object 9. Identify the effects of gravity on objects	6. Demonstrate use of appropriate instruments to collect data.

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**1st Grade Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	**Connection**
S.K6.DS1 Display a sense of wonder and delight about the natural universe and its beauty. S.K6.IS3 Explain how creation is an outward sign of God's love and goodness and, therefore, is "sacramental" in nature. S.K6.IS4 Give examples of beauty evident in God's creation. S.K6.IS2 Describe the relationships, elements, underlying order, harmony, and meaning in God's creation.	**Earth/Space Science (ESS)** **Life Science (LS)**	**Earth's Surface (ES)**: 1. Identify and compare characteristics of the Earth's surface (land, water, air) 2. Identify and compare uses of the Earth's surface (land, water, air) 3. Identify the three layers of the Earth (core, mantle, crust) 4. Identify fresh water and salt water bodies 5. Explain formation of fossils 6. Describe the impact of pollution on living organisms and their environment **Living Things (LT):** 1. Identify structures of plants and animals and how the structures help them live and grow (i.e… roots, stems, body parts) 2. List the needs of plants and animals 3. Compare and contrast characteristics and needs of plants and animals 4. Describe life cycles in plants and animals 5. Describe basic needs of living things 6. Describe a food chain 7. Identify living things from both now and long ago including extinct species 8. Explain how environmental factors lead to species endangerment or extinction 9. Describe the role that oxygen plays in plants and animals	1. Make predictions based on observations and previous experiences (for example, students can look at fossils and make a prediction about the organism that created it). 2. Classify objects according to common properties that may include size, shape, and color. 3. Participate effectively as a member of a team.

S.K6.IS1 Explain what it means to say that God created the world and all matter out of nothing at a certain point in time; how it manifests His wisdom, glory, and purpose; and how He holds everything in existence according to His plan.	**Physical Science (PS)**	**Introduction to Matter (IM):** 1. Observe, classify, and measure matter 2. Investigate properties using the five senses: touch, taste, hearing, smelling, and sight 3. Group common substances according to properties of matter (hard, soft, textured) 4. Describe changes in the states of matter 5. Identify, model, and describe examples of the three states of matter	4. Investigate the use of standard and non-standard measurement. 5. Frame simple scientific questions including the "if", "then", "because" statements 6. Participate in creating a group record of data observed.

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Kindergarten Science Standards** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	**Connection**
S.K6.DS1 Display a sense of wonder and delight about the natural universe and its beauty. S.K6.IS3 Explain how creation is an outward sign of God's love and goodness and, therefore, is "sacramental" in nature. S.K6.GS1 Exhibit care and concern at all stages of life for each human person as an image and likeness of God.	**Earth/Space Science (ESS)**	**Four Seasons (FS)**: 1. Observe and use symbols to describe characteristics of the seasons 2. Identify and describe the four seasons 3. Describe how the seasons affect living things 4. Select dress appropriate for the weather conditions 5. Describe connections between seasons and daily weather	1. Spend much time simply observing beautiful objects from the seasons (colored leaves, spring flowers, a snowflake- quickly!) to learn how to attend and observe.
	Life Science (LS)	**Living vs. Non-Living Things (LNL):** 1. Introduce the understanding that living things need air, water, sun, and food 2. Give examples of living and non-living things 3. Identify characteristics of living and non-living things 4. Identify needs of living and non-living things 5. Identify own body parts: head, ears, eyes, mouth, nose, feet, toes, elbows, knees, etc.	2. Study, draw in careful imitation living things and non-living things. Group objects based on common attributes.
	Physical Science (PS)	**Physical Properties and Change (PPC):** 1. Identify physical properties of matter (soft, hard, heavy, light) 2. Identify the different physical properties of specific items	3. Group objects based on common attributes

S.K6.IS1 Explain what it means to say that God created the world and all matter out of nothing at a certain point in time; how it manifests His wisdom, glory, and purpose; and how He holds everything in existence according to His plan.		3. Demonstrate that physical properties can be changed (ie…solids to liquids, liquids to solids) 4. Compare the way various items respond to change agents such as increasing or decreasing temperature 5. Discuss basic physical properties of matter, i.e., soft, hard, heavy, light, etc. 6. Experience change in properties of matter, i.e., ice/snow melts	4. Introduce and model making "if"-"then"-"because" prediction statements. 5. Identify common elements of scientific investigations.

Guiding Principle * Taken from the Cardinal Newman Society Standards, with their coding included. Please be familiar with their set of standards.	**Strand**	**Preschool Science Standard** (**Code**: Grade.Strand.StandardCategoryInitials.Number or Strand.Connection.Number (ex: Middle School Physical Science, Chemistry Physical Properties of Matter, Standard 1 could be coded: MSPS.Chem.PPM.1 **or** Chemistry Connection 1 could be MSPS.Chem.Con.1)	**Connection**
S.K6.DS1 Display a sense of wonder and delight about the natural universe and its beauty. S.K6.IS3 Explain how creation is an outward sign of God's love and goodness and, therefore, is "sacramental" in nature. S.K6.IS3 Value the human body as the temple of the Holy Spirit. S.K6.GS1 Exhibit care and concern at all stages of life for each human person as an image and likeness of God. S.K6.IS6 Describe God's relationship with man and nature.	**Earth Science (ES)**	**Daily Weather (DW)**: 1. Observe and use symbols to record the weather of the day 2. Demonstrate appropriate dress for the weather using models 3. Discuss the difference between day and night	1. Come to conclusions based on observations.
	Life Science (LS)	**Human Body (HB):** 1. Identify major parts of the body, i.e., face, parts of the face, hands, feet, head, back, shoulders, knees, toes, etc. 2. Discuss the five senses 3. Experience and identify various sounds, smells, textures, and flavors 4. Recognize physical differences and similarities in human beings 5. Discuss skill development/stages of develop	2. Measure things relative to other things, i.e., larger-smaller, higher-lower, etc.
	Life Science (LS)	**Plants and Animals (PA):** 1. Use observation to discuss plant growth 2. Name and identify the ways plants and animals are used by people 3. Introduce the understanding that living things need food, shelter, and water 4. Discuss familiar animals 5. Discuss prehistoric animals	3. Group objects based on common attributes. 4. Make predictions.

Resources for Teachers for Intellectual Formation or to Supplement Teaching

Resources on Bioethics

- National Catholic Bioethics Center: https://www.ncbcenter.org/resources/
- National Catholic Bioethics Center- by topic: https://www.ncbcenter.org/resources/information-topic/

Resources from Catholic Scientists

- List of Catholic Scientists: https://www.catholicscientists.org/catholic-scientists-of-the-past
- Articles and Discussions for students and staff: https://www.catholicscientists.org/ideas/discussions
- List of Catholic scientists & free classroom posters of Catholic scientists: https://www.reasonfaithscience.com/

Resources on the Integration of Faith and Science

Websites

- https://www.reasonfaithscience.com/ A resource created by Bishop Robert Barron, which includes videos, news, media, and articles related to addressing the myth that religion is opposed to science. Also includes a list of Catholic scientists and free classroom posters.
- *https://www.youtube.com/watch?v=GonMs1fjMrI&feature=emb_share&fbclid=IwAR2vVd7G7HdealftKvL5dXIPgdGJQixnlUnQ2TcayTDof6FwXeCgC60JJlM* A resource to explain the world as ordered, and able to be comprehended, and the purpose behind the observable world. This is the first video released in what will be a series.

Organizations

- Notre Dame McGrath Institute for Church Life: https://mcgrath.nd.edu/
- Vatican Observatory: http://www.vaticanobservatory.va/content/specolavaticana/en.html
- Magis Center (Fr. Spitzer) https://magiscenter.com/science-reason-faith/
- JPII Outdoor Lab: https://annunciationheights.org/outdoor-lab/jpii-outdoor-lab/

Documents

- *Catechism of the Catholic Church* https://www.vatican.va/archive/ENG0015/_INDEX.HTM
- *Fides et Ratio*, St. John Paul II Encyclical Letter: http://www.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf_jp-ii_enc_14091998_fides-et-ratio.html
- Letter From St. John Paul II to Fr. George Coyne, S.J., Director of the Vatican Observatory: http://www.vatican.va/content/john-paul-ii/en/letters/1988/documents/hf_jp-ii_let_19880601_padre-coyne.html
- St. John Henry Newman, *The Idea of the University*, 7. Christianity and Physical Science: http://www.newmanreader.org/works/idea/article7.html
- John Paul II. (October 22, 1996). *Message to the Pontifical Academy of Sciences: On evolution.* Retrieved from http://www.ewtn.com/library/papaldoc/jp961022.htm

- Laracy, J. (May-June 2010). *Priestly contributions to modern science: The case of Monseignor Georges Lemaitre*. Faith Magazine. Retrieved from http://www.faith.org.uk/article/may-june-2010-priestly-contributions-to-modern-sciencethe-case-of-monseignor-georges-lemaitre
- Pius XII. (August, 1950). *Humani Generis*. Retrieved from http://w2.vatican.va/content/pius-xii/en/encyclicals/documents/hf_p-xii_enc_12081950_humani-generis.html

Books

- Spitzer, R. (2010). *New proofs for the existence of God: Contributions of contemporary physics and philosophy*. Wm. B. Eerdmans Publishing Co. Grand Rapids, MI.
- Spitzer, R. (2015). *The soul's upward yearning*. Wm. B. Eerdmans Publishing Co. Grand Rapids, MI. Of particular interest might be Chapter 5 on the science behind the transcendent soul and Appendix One on a contemporary view of evidence for an Intelligent Creator.
- Baglow, C. (2012). *Faith, science, and reason: Theology on the cutting edge*. Midwest Theological Forum, Woodridge: IL.

  Designed as a senior-level high school theology course to integrate faith and science, but would also be helpful as a resource for teacher intellectual formation in science from a Catholic worldview. Contains twelve chapters with supplementary reading, study guide (vocabulary, study questions, and practical exercises) and endnotes. Beautiful artwork enhances the scientific content on the sleek pages of this textbook yet coffee table-styled volume. The supplementary readings would work well to teach the guiding principles in AOD standards, and could be used from middle school through high school.

  Sample from Christopher Baglow's book:

  "What do we have to believe before we can hope to become scientists? We must believe that the world is in some sense good, so that it is worthy of careful study. We must believe that his order is open to the human mind, for otherwise there would be no point in trying to find it. We must believe that this order is not a necessary order that could be found out by pure thought like the truths of mathematics, but is rather a contingent or dependent order that can only be found by making experiments. …the development of science depends on moral convictions such as the obligation freely to share any knowledge that is gained." (pp. 19-21)

Textbook and Curricular Materials Recommendations

Please email the Office of Catholic Schools for the list of recommended science textbooks and curricular materials.