DIOCESE OF TOLEDO

SCIENCE
COURSE OF STUDY
GRADE SEVEN

Catholic Youth and School Services
1933 Spielbusch Avenue, P.O. Box 985
Toledo, Ohio 43697-0985
January 2005

REVIEW PROCESS

Under the direction of the superintendent, the Assistant Superintendent and Curriculum Consultant facilitated the Science Course of Study Revision process. During the spring and fall of 2004, the review committee aligned the Ohio Academic Content Standards, Science, with Catholic Social Teaching. Committee members sought to find the nexus of faith and morals, building a just society, and Science content.

Superintendent	**Mr. Jack Altenburger**
Assistant Superintendent	**Mrs. Carolyn Schmidbauer**
Curriculum Consultant	**Mrs. Ann Sardeson**

Members of the Science Course of Study Committee

Beth Restivo	Blessed Sacrament, Toledo
Karen Mahr	St. Joan of Arc, Toledo
Sara Fitzgerald	St. Paul Elem., Norwalk
Marty Smith	Central Catholic, Toledo
Thomas Farrell	Lial, Whitehouse
Tammy Hinkle	Little Flower, Toledo
Theresa Martin	Christ the King, Toledo
Craig McRedmond	Calvert H.S., Tiffin
Nancy Henkel	Gesu, Toledo
Lesley King	Gesu, Toledo
Anna Huffstetler	Gesu, Toledo
Kristopher Witker	Christ the King, Toledo
Bonnie-Jean Chudzinski	Our Lady of Lourdes, Toledo
Susan Bastian	Sylvania Franciscan Academy, Sylvania
Tracy Frederick	Sandusky Central Catholic
Mary Russell	St. Aloysius, Bowling Green

DIOCESE OF TOLEDO PHILOSOPHY

"The duty of human perfection, like the whole universe, has been renewed, recast, super naturalized, in the Kingdom of God. It is a truly Christian duty to grow... and to make one's talents bear fruit...It is a part of the essentially Catholic vision to look upon the world as maturing--not only in each individual or in each nation, but in the whole human race." (Teilhard de Chardin, The Divine Milieu)

The schools of the Catholic Diocese of Toledo assist parents in preparing their youngsters to assume their Christian vocation. The schools enable youngsters to perfect and grow in the knowledge, skills, values and attitudes to which they are called by Jesus Christ. This vocation begins and grows as each member hears the message of the Gospel, seeks to achieve a personal relationship with Jesus Christ, and shares in a commitment of love and service of God and others in order to transform self and society.

Christian education in the Toledo diocesan schools is intended to make students become people of faith who can experience--inside and outside the school setting--learning and living in the light of this faith commitment. Students are instructed in human knowledge and skills in order to best relate human culture to God's plan for his evolving creation. Religious education, i.e., instruction in truths and development of values, is of primary concern. This religious education serves as the basis by which students can integrate their experiences of learning and living at each stage of their development.

This integration thrives in a thoroughly Christian atmosphere where faculties and staffs share and demonstrate in their professional and private lives this same commitment to personal perfection and growth in Jesus Christ.

Toledo diocesan schools enable students to extend their personal faith commitment through prayer and by serving others. Together with faculty and staff, students participate in liturgical activities, which foster community. Students explore ways to meet the challenges of tensions and conflicts, which occur in community, especially in peacemaking and the achievement of justice. Gospel values impel students to special concern for all who suffer any disadvantage. Students are enabled to commit themselves to the public interest by developing the skills and talents needed to contribute to the life of the nation.

This experience of integrating learning and living a commitment of faith is a reason for hope. It is the duty of the schools of the diocese of Toledo to continually explore and rekindle hope for the future in the light of the present reality of the universe. Engaging our members--and the community-at-large--in a search for growth and perfection is our never-ending obligation. Our ultimate goal is union with Jesus Christ, "the way, the truth and the life."

Science Education Philosophy

As Catholic School Educators we believe that…

Science education provides, helps, and shares the understanding of God's creation through exploration and inquiry.

Earth and Space science is the understanding of the composition of the parts of the universe, their interactions and our responsibility as stewards of creation.

Life science is knowledge, understanding and exploration of all living systems, in their physical environment. It includes the creation process, respect for life and the responsibility for human animal and plant life of our earth.

Physical science is knowledge of the structures, the processes and the interactions that drive our natural world. It includes stewardship of creation and the responsibility to protect God's creation.

Space and Technology is the interdisciplinary connection of our understanding of science and how we make and use tools to progress in scientific knowledge; involving assessment and investigation to communicate knowledge and exploration. It should include the understanding of the benefits, risks, costs, and responsibility of using technology.

Scientific Inquiry is the ability to ask valid questions; gather and analyze information; develop and understand a hypothesis; make projections; develop a plan of action; and evaluate a variety of conclusions. It should include the teaching that life has dignity and in the process of study there is responsibility and respect.

Scientific knowledge is the ability to understand the relationship and interaction between living and non-living components. It is based on evidence, prediction and logic, and is subject to modification, and <u>not</u> subject to the natural world. It includes the understanding that God is the author of all life and there will be growth and advances as new evidence is discovered.

Excerpts from the Catechism of the Catholic Church

295 We believe that God created the world according to his wisdom.141 It is not the product of any necessity whatever, nor of blind fate or chance. We believe that it proceeds from God's free will; he wanted to make his creatures share in his being, wisdom and goodness: "For you created all things, and by your will they existed and were created."142 Therefore the Psalmist exclaims: "O LORD, how manifold are your works! In wisdom you have made them all"; and "The LORD is good to all, and his compassion is over all that he has made."143

302 Creation has its own goodness and proper perfection, but it did not spring forth complete from the hands of the Creator. The universe was created "in a state of journeying" (*in statu viae*) toward an ultimate perfection yet to be attained, to which God has destined it. We call "divine providence" the dispositions by which God guides his creation toward this perfection:

By his providence God protects and governs all things that he has made, "reaching mightily from one end of the earth to the other, and ordering all things well". For "all are open and laid bare to his eyes", even those things which are yet to come into existence through the free action of creatures.161

306 God is the sovereign master of his plan. But to carry it out he also makes use of his creatures; co-operation. This use is not a sign of weakness, but rather a token of almighty God's greatness and goodness. For God grants his creatures not only their existence, but also the dignity of acting on their own, of being causes and principles for each other, and thus of co-operating in the accomplishment of his plan.

307 To human beings God even gives the power of freely sharing in his providence by entrusting them with the responsibility of "subduing" the earth and having dominion over it.168 God thus enables men to be intelligent and free causes in order to complete the work of creation, to perfect its harmony for their own good and that of their neighbors. Though often unconscious collaborators with God's will, they can also enter deliberately into the divine plan by their actions, their prayers and their sufferings.169 They then fully become "God's fellow workers" and co-workers for his kingdom.170

308 The truth that God is at work in all the actions of his creatures is inseparable from faith in God the Creator. God is the first cause who operates in and through secondary causes: "For God is at work in you, both to will and to work for his good pleasure."171

Creation Accounts in Genesis

The first story of Genesis describes the creation of the universe, a world that is all good. The writers of this story present an explanation of the universe that is based neither on historical events nor on facts of natural science. Instead, the writers present religious truths, because their focus is God, not cultures and peoples, and not nature or science. God creates the first man and woman in his image as human beings with dignity and free will.

For the Genesis writers, the religious truths presented are more important than the literal, scientific accuracy of the details of the stories: God created the world and all that is in it; how he made it is not their focus.

Creationism

Creationism is the teaching of the origins of the world through a literal interpretation of the creation stories in Genesis. This means that God created the world literally in six days and rested on the seventh.

However, to a non-creationist, the important truth in the Creation accounts is religious truth: God made the world and all that is in it. It is more important to a "non-creationist" to know THAT God created the world, rather than to know literally HOW he created it. "Non-creationists" know that in the story of creation, the writers presented religious truth, but the details of the creation stories are not to be interpreted literally. In reading them, one must consider the culture, literary forms, and the author's purpose in telling or writing the story.

Evolution Theory

The evolution theory seeks to explain the origins of the world and of humans through science. Evolution teaches that humans and other forms of life have evolved from lower forms.

Natural science has enriched our knowledge of the development of life on earth, the appearance of humans, and the structure of the world.

However, today's scientific knowledge was unknown and unimportant to the writers of the Creation accounts in the Bible.

Catholics and the Evolution Theory

If Catholics choose to accept the theory of evolution, they must also believe that God began the entire process of creation. If human life has taken its form from a pre-existent living form, as evolution teaches, Catholics believe that the spiritual soul has been created immediately by God and did not evolve.

With all of the developments in science, however, the truths underlying the stories in Genesis are still valid today:

God created human life and infused a human soul.
Life is to be lived in right relationship to Himself and in right relationship to other people and nature.
God chose to have a special people and made a covenant with them.

These eternal truths are central to the faith community and tell us a great deal about God, about human nature, and about the relationship between God and humans.

Excerpts from
SHARING CATHOLIC SOCIAL TEACHING
Challenges and Directions
RELECTIONS OF THE U.S. CATHOLIC BISHOPS

The church's social teaching is a rich treasure of wisdom about building a just society and living lives of holiness amidst the challenges of modern society. Modern Catholic social teaching has been articulated through a tradition of papal, conciliar, and episcopal documents. The depth and richness of this tradition can be understood best through a direct reading of these documents. In these brief reflections, we wish to highlight several of the key themes that are at the heart of our Catholic social tradition.

LIFE AND DIGNITY OF THE HUMAN PERSON
The Catholic Church proclaims that human life is sacred and that the dignity of the human person is the foundation of a moral vision for society. Our belief in the sanctity of human life and the inherent dignity of the human person is the foundation of all the principles of our social teaching. In our society, human life is under direct attack from abortion and assisted suicide. The value of human life is being threatened by increasing use of the death penalty. We believe that every person is precious, that people are more important than things, and that the measure of every institution is whether it threatens or enhances the life and dignity of the human person.

CALL TO FAMILY, COMMUNITY, AND PARTICIPATION
The person is not only sacred but also social. How we organize our society-in economics and politics, in law and policy-directly affects human dignity and the capacity of individuals to grow in community. The family is the central social institution that must be supported and strengthened, not undermined. We believe people have a right and a duty to participate in society, seeking together the common good and well-being of all, especially the poor and vulnerable.

RIGHTS AND REPSONSIBILITIES
The Catholic tradition teaches that human dignity can be protected and healthy community can be achieved only if human rights are protected and responsibilities are met. Therefore, every person has a fundamental right to life and a right to those things required for human decency. Corresponding to these rights are duties and responsibilities to one another, to our families, and to the larger society.

OPTION FOR THE POOR AND VULNERABLE
A basic moral test is how our most vulnerable members are faring. In a society marred by deepening divisions between rich and poor, our tradition recalls the story of the Last Judgment (Mt 25:31-46) and instructs us to put the needs of the poor and vulnerable first.

THE DIGNITY OF WORK AND THE RIGHTS OF WORKERS
The economy must serve people, not the other way around. Work is more than a way to make a living; it is a form of continuing participation in God's creation. If the dignity of work is to be protected, then the basic rights of workers must be respected-the right to productive work, to decent and fair wages, to organize and join unions to private property, and to economic initiative.

SOLIDARITY
We are our brothers' and sisters' keepers, wherever they live. We are one human family, whatever our national, racial, ethnic, economic, and ideological differences. Learning to practice the virtue of solidarity means learning that "loving our neighbor" has global dimensions in an interdependent world.

CARE FOR GOD'S CREATION
We show our respect for the Creator by our stewardship of creation. Care for the earth is not just an Earth Day slogan, it is a requirement of our faith. We are called to protect people and the planet, living our faith in relationship with all of God's creation. This environmental challenge has fundamental moral and ethical dimensions that cannot be ignored.

This summary should only be a starting point for those interested in Catholic social teaching. A full understanding can only be achieved by reading the papal, conciliar, and episcopal documents that make up this rich tradition.

Grades 6-8

Earth and Space Sciences
Students demonstrate an understanding about how Earth systems and processes interact in the geosphere resulting in the habitability of Earth. This includes demonstrating an understanding of the composition of the universe, the solar system and Earth. In addition, it includes understanding the properties and the interconnected nature of Earth's systems, processes that shape Earth and Earth's history. Students also demonstrate an understanding of how the concepts and principles of energy, matter, motion and forces explain Earth systems, the solar system and the universe. Finally, they grasp an understanding of the historical perspectives, scientific approaches and emerging scientific issues associated with Earth and space sciences.

Benchmark A: Describe how the positions and motions of the objects in the universe cause predictable and cyclic events.

Grade Six

No indicators present for this benchmark.

Grade Seven

No indicators present for this benchmark.

Grade Eight

The Universe

1. Describe how objects in the solar system are in regular and predictable motions that explain such phenomena as days, years, seasons, eclipses, tides and moon cycles.
2. Explain that gravitational force is the dominant force determining motions in the solar system and in particular keeps the planets in orbit around the sun.
3. Compare the orbits and composition of comets and asteroids with that of Earth.
4. Describe the effect that asteroids or meteoroids have when moving through space and sometimes entering planetary atmospheres (e.g., meteor-"shooting star" and meteorite).

Benchmark B: Explain that the universe is composed of vast amounts of matter, most of which is at incomprehensible distances and held together by gravitational force. Describe how the universe is studied by the use of equipment such as telescopes, probes, satellites and spacecraft.

Grade Six

No indicators present for this benchmark.

Grade Seven

No indicators present for this benchmark.

Grade Eight

The Universe

5. Explain that the universe consists of billions of galaxies that are classified by shape.
6. Explain interstellar distances are measured in light years (e.g., the nearest star beyond the sun is 4.3 light years away).
7. Examine the life cycle of a star and predict the next likely stage of a star.
8. Name and describe tools used to study the universe (e.g., telescopes, probes, satellites and spacecraft).

Benchmark C: Describe interactions of matter and energy throughout the lithosphere, hydrosphere and atmosphere (e.g., water cycle, weather and pollution).

Grade Six

No indicators present for this benchmark.

Grade Seven

Earth Systems

1. Explain the biogeochemical cycles which move materials between the lithosphere (land), hydrosphere (water) and atmosphere (air).
2. Explain that Earth's capacity to absorb and recycle materials naturally (e.g., smoke, smog and sewage) can change the environmental quality depending on the length of time involved (e.g. global warming).
3. Describe the water cycle and explain the transfer of energy between the atmosphere and hydrosphere.
4. Analyze data on the availability of fresh water that is essential for life and for most industrial and agricultural processes. Describe how rivers, lakes and groundwater can be depleted or polluted becoming less hospitable to life and even becoming unavailable or unsuitable for life.
5. Make simple weather predictions based on the changing cloud types associated with frontal systems.
6. Determine how weather observations and measurements are combined to produce weather maps and that data for a specific location at one point in time can be displayed in a station model.
7. Read a weather map to interpret local, regional and national weather.
8. Describe how temperature and precipitation determine climatic zones (biomes) (e.g., desert, grasslands, forests, tundra and alpine).
9. Describe the connection between the water cycle and weather-related phenomenon (e.g., tornadoes, floods, droughts and hurricanes).

Grade Eight

No indicators present for this benchmark.

Benchmark D: Identify that the lithosphere contains rocks and minerals and that minerals make up rocks. Describe how rocks and minerals are formed and/or classified.

Grade Six

Earth Systems

1. Describe the rock cycle and explain that there are sedimentary, igneous and metamorphic rocks that have distinct properties (e.g., color, texture) and are formed in different ways.
2. Explain that rocks are made of one or more minerals.
3. Identify minerals by their characteristic properties.

Grade Seven

No indicators present for this benchmark.

Grade Eight

No indicators present for this benchmark.

Benchmark E: Describe the processes that contribute to the continuous changing of Earth's surface (e.g., earthquakes, volcanic eruptions, erosion, mountain building and lithospheric plate movements).

Grade Six

No indicators present for this benchmark.

Grade Seven

No indicators present for this benchmark.

Grade Eight

Earth Systems

9. Describe the interior structure of Earth and Earth's crust as divided into tectonic plates riding on top of the slow moving currents of magma in the mantle.
10. Explain that most major geological events (e.g., earthquakes, volcanic eruptions, hot spots and mountain building) result from plate motion.
11. Use models to analyze the size and shape of Earth, its surface and its interior (e.g., globes, topographic maps, satellite images).

12. Explain that some processes involved in the rock cycle are directly related to thermal energy and forces in the mantle that drive plate motions.

13. Describe how landforms are created through a combination of destructive (e.g., weathering and erosion) and constructive processes (e.g., crustal deformation, volcanic eruptions and deposition of sediment).

14. Explain that folding, faulting and uplifting can rearrange the rock layers so the youngest is not always found on top.

15. Illustrate how the three primary types of plate boundaries (transform, divergent and convergent) cause different landforms (e.g., mountains, volcanoes and ocean trenches).

Grades 6-8

Life Sciences
Students demonstrate an understanding of how living systems function and how they interact with the physical environment. This includes an understanding of the cycling of matter and flow of energy in living systems. An understanding of the characteristics, structure and function of cells, organisms and living systems will be developed. Students will also develop a deeper understanding of the principles of heredity, biological evolution, and the diversity and interdependence of life. Students demonstrate an understanding of different historical perspectives, scientific approaches and emerging scientific issues associated with the life sciences.

Benchmark A: Explain that the basic functions of organisms are carried out in cells and groups of specialized cells form tissues and organs; the combination of these cells make up multicellular organisms that have a variety of body plans and internal structures.

Grade Six

Characteristics and Structure of Life	1.	Explain that many of the basic functions of organisms are carried out by or within cells and are similar in all organisms.
	2.	Explain that multicellular organisms have a variety of specialized cells, tissues, organs and organ systems that perform specialized functions.
	3.	Identify how plant cells differ from animal cells (e.g., cell wall and chloroplasts).

Grade Seven

Characteristics and Structure of Life	1.	Investigate the great variety of body plans and internal structures found in multicellular organisms.

Grade Eight

No indicators present for this benchmark.

Benchmark B: Describe the characteristics of an organism in terms of a combination of inherited traits and recognize reproduction as a characteristic of living organisms essential to the continuation of the species.

Grade Six

Heredity	4.	Recognize that an individual organism does not live forever; therefore reproduction is necessary for the continuation of every species and traits are passed on to the next generation through reproduction.
	5.	Describe that in asexual reproduction all the inherited traits come from a single parent.
	6.	Describe that in sexual reproduction an egg and sperm unite and some traits come from each parent, so the offspring is never identical to either of its parents.
	7.	Recognize that likenesses between parents and offspring (e.g., eye color, flower color) are inherited. Other likenesses, such as table manners are learned.

Grade Seven

Evolutionary Theory	8.	Investigate the great diversity among organisms.

Grade Eight

Heredity	1.	Describe that asexual reproduction limits the spread of detrimental characteristics through a species and allows for genetic continuity.
	2.	Recognize that in sexual reproduction new combinations of traits are produced which may increase or decrease an organism's chances for survival.
Evolutionary Theory	3.	Explain how variations in structure, behavior or physiology allow some organisms to enhance their reproductive success and survival in a particular environment.

Benchmark C: Explain how energy entering the ecosystems as sunlight supports the life of organisms through photosynthesis and the transfer of energy through the interactions of organisms and the environment.

Grade Six

Diversity and Interdependence of Life	8.	Describe how organisms may interact with one another.

Grade Seven

Diversity and Interdependence of Life	2.	Investigate how organisms or populations may interact with one another through symbiotic relationships and how some species have become so adapted to each other that neither could survive without the other (e.g., predator-prey, parasitism, mutualism and commensalism).
	3.	Explain how the number of organisms an ecosystem can support depends on adequate biotic (living) resources (e.g., plants, animals) and abiotic (non-living) resources (e.g., light, water and soil).
	6.	Summarize the ways that natural occurrences and human activity affect the transfer of energy in Earth's ecosystems (e.g., fire, hurricanes, roads and oil spills).
	7.	Explain that photosynthetic cells convert solar energy into chemical energy that is used to carry on life functions or is transferred to consumers and used to carry on their life functions.

Grade Eight

No indicators present for this benchmark.

Benchmark D: Explain how extinction of a species occurs when the environment changes and its adaptive characteristics are insufficient to allow survival (as seen in evidence of the fossil record).

Grade Six

No indicators present for this benchmark.

Grade Seven

Diversity and Interdependence of Life	4.	Investigate how overpopulation impacts an ecosystem.
	5.	Explain that some environmental changes occur slowly while others occur rapidly (e.g., forest and pond succession, fires and decomposition).

Grade Eight

Evolutionary Theory	4.	Explain that diversity of species is developed through gradual processes over many generations (e.g., fossil record).
	5.	Investigate how an organism adapted to a particular environment may become extinct if the environment, as shown by the fossil record, changes.

Grades 6-8

Physical Sciences
Students demonstrate an understanding of the composition of physical systems and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes demonstrating an understanding of the structure and properties of matter, the properties of materials and objects, chemical reactions and the conservation of matter. In addition, it includes understanding the nature, transfer and conservation of energy; motion and the forces affecting motion; and the nature of waves and interactions of matter and energy. Students demonstrate an understanding of the historical perspectives, scientific approaches and emerging scientific issues associated with the physical sciences.

Benchmark A: Relate uses, properties and chemical processes to the behavior and/or arrangement of the small particles that compose matter.

Grade Six

Nature of Matter	1.	Explain that equal volumes of different substances usually have different masses.
	2.	Describe that in a chemical change new substances are formed with different properties than the original substance (e.g., rusting, burning).
	3.	Describe that in a physical change (e.g., state, shape and size) the chemical properties of a substance remain unchanged.
	4.	Describe that chemical and physical changes occur all around us (e.g., in the human body, cooking and industry).

Grade Seven

Nature of Matter	1.	Investigate how matter can change forms but the total amount of matter remains constant.

Grade Eight

No indicators present for this benchmark.

Benchmark B: In simple cases, describe the motion of objects and conceptually describe the effects of forces on an object.

Grade Six

No indicators present for this benchmark.

Grade Seven

No indicators present for this benchmark.

Grade Eight

Forces and Motion

1. Describe how the change in the position (motion) of an object is always judged and described in comparison to a reference point.

. Explain that motion describes the change in the position of an object (characterized by a speed and direction) as time changes.

3. Explain that an unbalanced force acting on an object changes that object's speed and/or direction.

Benchmark C: Describe renewable and nonrenewable sources of energy (e.g., solar, wind, fossil fuels, biomass, hydroelectricity, geothermal and nuclear energy) and the management of these sources.

Grade Six

Nature of Energy	5.	Explain that the energy found in nonrenewable resources such as fossil fuels (e.g., oil, coal and natural gas) originally came from the sun and may renew slowly over millions of years.
	6.	Explain that energy derived from renewable resources such as wind and water is assumed to be available indefinitely.
	7.	Describe how electric energy can be produced from a variety of sources (e.g., sun, wind and coal).
	8.	Describe how renewable and nonrenewable energy resources can be managed (e.g., fossil fuels, trees and water).

Grade Seven

No indicators present for this benchmark.

Grade Eight

No indicators present for this benchmark.

Benchmark D: Describe that energy takes many forms, some forms represent kinetic energy and some forms represent potential energy; and during energy transformations the total amount of energy remains constant.

Grade Six

No indicators present for this benchmark.

Grade Seven

Nature of Energy	2.	Describe how an object can have potential energy due to its position or chemical composition and can have kinetic energy due to its motion.
	3.	Identify different forms of energy (e.g., electrical, mechanical, chemical, thermal, nuclear, radiant and acoustic).
	4.	Explain how energy can change forms but the total amount of energy remains constant.
	5.	Trace energy transformation in a simple closed system (e.g., a flashlight).

Grade Eight

Nature of Energy	4.	Demonstrate that waves transfer energy.
	5.	Demonstrate that vibrations in materials may produce waves that spread away from the source in all directions (e.g., earthquake waves and sound waves).

Grades 6-8

Science and Technology
Students recognize that science and technology are interconnected and that using technology involves assessment of the benefits, risks and costs. Students should build scientific and technological knowledge, as well as the skill required to design and construct devices. In addition, they should develop the processes to solve problems and understand that problems may be solved in several ways.

Benchmark A: Give examples of how technological advances, influenced by scientific knowledge, affect the quality of life.

Grade Six

Understanding Technology

1. Explain how technology influences the quality of life.
2. Explain how decisions about the use of products and systems can result in desirable or undesirable consequences (e.g., social and environmental).
3. Describe how automation (e.g., robots) has changed manufacturing including manual labor being replaced by highly-skilled jobs.
4. Explain how the usefulness of manufactured parts of an object depend on how well their properties allow them to fit and interact with other materials.

Grade Seven

Understanding Technology

1. Explain how needs, attitudes and values influence the direction of technological development in various cultures.
2. Describe how decisions to develop and use technologies often put environmental and economic concerns in direct competition with each other.
3. Recognize that science can only answer some questions and technology can only solve some human problems.

Grade Eight

Understanding Technology	1.	Examine how science and technology have advanced through the contributions of many different people, cultures and times in history.
	2.	Examine how choices regarding the use of technology are influenced by constraints caused by various unavoidable factors (e.g., geographic location, limited resources, social, political and economic considerations).

Benchmark B: Design a solution or product taking into account needs and constraints (e.g., cost, time, trade-offs, properties of materials, safety and aesthetics).

Grade Six

Abilities To Do Technological Design	5.	Design and build a product or create a solution to a problem given one constraint (e.g., limits of cost and time for design and production, supply of materials and environmental effects).

Grade Seven

Abilities To Do Technological Design	4.	Design and build a product or create a solution to a problem given two constraints (e.g., limits of cost and time for design and production or supply of materials and environmental effects).

Grade Eight

Abilities To Do Technological Design	3.	Design and build a product or create a solution to a problem given more than two constraints (e.g., limits of cost and time for design and production, supply of materials and environmental effects).
	4.	Evaluate the overall effectiveness of a product design or solution.

Grades 6-8

Scientific Inquiry
Students develop scientific habits of mind as they use the processes of scientific inquiry to ask valid questions and to gather and analyze information. They understand how to develop hypotheses and make predictions. They are able to reflect on scientific practices as they develop plans of action to create and evaluate a variety of conclusions. Students are also able to demonstrate the ability to communicate their findings to others.

Benchmark A: Explain that there are differing sets of procedures for guiding scientific investigations and procedures are determined by the nature of the investigation, safety considerations and appropriate tools.

Grade Six

Doing Scientific Inquiry	1.	Explain that there are not fixed procedures for guiding scientific investigations; however, the nature of an investigation determines the procedures needed.
	2.	Choose the appropriate tools or instruments and use relevant safety procedures to complete scientific investigations.

Grade Seven

Doing Scientific Inquiry	1.	Explain that variables and controls can affect the results of an investigation and that ideally one variable should be tested at a time; however it is not always possible to control all variables.
	2.	Identify simple independent and dependent variables.
	3.	Formulate and identify questions to guide scientific investigations that connect to science concepts and can be answered through scientific investigations.
	4.	Choose the appropriate tools and instruments and use relevant safety procedures to complete scientific investigations.

Grade Eight

Doing Scientific Inquiry

1. Choose the appropriate tools or instruments and use relevant safety procedures to complete scientific investigations.
2. Describe the concepts of sample size and control and explain how these affect scientific investigations.

Benchmark B: Analyze and interpret data from scientific investigations using appropriate mathematical skills in order to draw valid conclusions.

Grade Six

Doing Scientific Inquiry

3. Distinguish between observation and inference.
4. Explain that a single example can never prove that something is always correct, but sometimes a single example can disprove something.

Grade Seven

Doing Scientific Inquiry

5. Analyze alternative scientific explanations and predictions and recognize that there may be more than one good way to interpret a given set of data.
6. Identify faulty reasoning and statements that go beyond the evidence or misinterpret the evidence.
7. Use graphs, tables and charts to study physical phenomena and infer mathematical relationships between variables (e.g., speed and density).

Grade Eight

Doing Scientific Inquiry

3. Read, construct and interpret data in various forms produced by self and others in both written and oral form (e.g., tables, charts, maps, graphs, diagrams and symbols).
4. Apply appropriate math skills to interpret quantitative data (e.g., mean, median and mode).

Grades 6-8

Scientific Ways of Knowing
Students realize that the current body of scientific knowledge must be based on evidence, be predictive, logical, subject to modification and limited to the natural world. This includes demonstrating an understanding that scientific knowledge grows and advances as new evidence is discovered to support or modify existing theories, as well as to encourage the development of new theories. Students are able to reflect on ethical scientific practices and demonstrate an understanding of how the current body of scientific knowledge reflects the historical and cultural contributions of women and men who provide us with a more reliable and comprehensive understanding of the natural world.

Benchmark A: Use skills of scientific inquiry processes (e.g., hypothesis, record keeping, description and explanation).

Grade Six

Nature of Science	1.	Identify that hypotheses are valuable even when they are not supported.
Ethical Practices	2.	Describe why it is important to keep clear, thorough and accurate records.

Grade Seven

No indicators present for this benchmark.

Grade Eight

Nature of Science	1.	Identify the difference between description (e.g., observation and summary) and explanation (e.g., inference, prediction, significance and importance).

Benchmark B: Explain the importance of reproducibility and reduction of bias in scientific methods.

Grade Six

No indicators present for this benchmark.

Grade Seven

Ethical Practices

1. Show that the reproducibility of results is essential to reduce bias in scientific investigations.
2. Describe how repetition of an experiment may reduce bias.

Grade Eight

Ethical Practices

2. Explain why it is important to examine data objectively and not let bias affect observations.

Benchmark C: Give examples of how thinking scientifically is helpful in daily life.

Grade Six

Science and Society

3. Identify ways scientific thinking is helpful in a variety of everyday settings.
4. Describe how the pursuit of scientific knowledge is beneficial for any career and for daily life.
5. Research how men and women of all countries and cultures have contributed to the development of science.

Grade Seven

Science and Society

3. Describe how the work of science requires a variety of human abilities and qualities that are helpful in daily life (e.g., reasoning, creativity, skepticism and openness).

Grade Eight

No indicators present for this benchmark.

Grade Seven

1.0 Earth and Space Sciences

Care for God's Creation	**1.1** Know that by our faith we are called to protect people and the planet. **1.2** Recognize that environmental challenges have fundamental ethical and moral dimensions that cannot be ignored. **1.3** Explain the biogeochemical cycles, which move materials between the lithosphere (land), hydrosphere (water) and atmosphere (air). **1.4** Explain that Earth's capacity to absorb and recycle materials naturally (e.g., smoke, smog and sewage) can change the environmental quality depending on the length of time involved (e.g. global warming). **1.5** Describe the water cycle and explain the transfer of energy between the atmosphere and hydrosphere. **1.6** Analyze data on the availability of fresh water that is essential for life and for most industrial and agricultural processes. **1.7** Describe how rivers, lakes and ground water can be depleted or polluted becoming less hospitable to life and even becoming unavailable or unsuitable for life. **1.8** Make simple weather predictions based on the changing cloud types associated with frontal systems. **1.9** Determine how weather observations and measurements are combined to produce weather maps and that data for a specific location at one point in time can be displayed in a station model. **1.10** Read a weather map to interpret local, regional and national weather. **1.11** Describe how temperature and precipitation determine climatic zones/ biomes (e.g., desert, grasslands, forests, tundra and alpine). **1.12** Describe the connection between the water cycle and weather-related phenomena (e.g., tornadoes, floods, droughts and hurricanes).

2.0 Life Sciences

Care for God's Creation *Solidarity* *Life and Dignity of Human Person*	**2.1** Realize that caring for God's creation is a requirement of our faith. **2.2** Know that the Catholic Church proclaims the sanctity of all human life. **2.3** Examine the basic types of cells. **2.4** Review the five life processes. **2.5** Understand and be able to explain cell theory. **2.3** Investigate the great variety of body plans and internal structures found in multicellular organisms. **2.4** Investigate how organisms or populations may interact with one another through symbiotic relationships and how some species have become so adapted to each other that neither could survive without the other (e.g., predator-prey, parasitism, mutualism and commensalisms). **2.5** Explain how the number of organisms an ecosystem can support depends on adequate biotic (living) resources (e.g., plants, animals) and abiotic [non-living] resources (e.g., light, water and soil). **2.4** Investigate how overpopulation impacts an ecosystem. **2.5** Recognize that we are called to protect people and the planet, living our faith in relationship with all of God's creation. **2.8** Explain that some environmental changes occur slowly while others occur rapidly (e.g., forest and pond succession, fires and decomposition). **2.9** Summarize the ways that natural occurrences and human activity affect the transfer of energy in Earth's ecosystems (e.g., fire, hurricanes, roads and oil spills). **2.10** Explain that photosynthetic cells convert solar energy into chemical energy that is used to carry on life functions or is transferred to consumers and used to carry on their life functions. **2.11** Investigate the great diversity among organisms. **2.12** Understand biological evolution with focus on anatomy. **2.13** Identify body systems and their structures. **2.14** Examine the functions of each system.

3.0 Physical Sciences

Nature of Matter	**3.1**	Investigate how matter can change forms but the total amount of matter remains constant.
Nature of Energy	**3.2**	Describe how an object can have potential energy due to its position or chemical composition and can have kinetic energy due to its motion.
Caring for God's Creation	**3.3**	Identify different forms of energy (e.g., electrical, mechanical, chemical, thermal, nuclear, radiant and acoustic).
	3.4	Explain how energy can change forms but the total amount of energy remains constant.

4.0 Science and Technology

	4.1	Know that all of creation is a gift from God, the Creator.
Rights and Responsibilities	**4.2**	Realize that the Catholic tradition teaches that human dignity can be protected only if human rights are protected and responsibilities met.
	4.3	Explain how need, attitudes and values influence the direction of technological development in various cultures.
Abilities To Do Technological Design	**4.2**	Describe how decisions to develop and use technologies often put environmental and economic concerns in direct competition with each other.
	4.5	Recognize that fundamental moral and ethical dimensions cannot be ignored.
	4.6	Recognize that science can only answer some questions and that technology can only solve some human problems.
	4.7	Design and build a product or create a solution to a problem given two constraints (e.g., limits of cost and time for design and production or supply of materials and environmental effects).

5.0 Scientific Inquiry

Doing Scientific Inquiry	**5.1**	Explain how variables and controls can affect the results of an investigation and that ideally only one variable should be tested at a time; however, it is not always possible to control all variables.
Solidarity	**5.2**	Identify simple independent and dependent variables.
Dignity of Work and Rights of Workers	**5.3**	Formulate questions to guide scientific investigations that

		connect to science concepts that can be answered through scientific investigations.
	5.4	Choose the appropriate tools and instruments and use relevant safety procedures to complete scientific investigations.
	5.5	Choose appropriate metric measure.
	5.6	Analyze alternative scientific explanations and predictions and recognize that there may be more than one good way to interpret a given set of data.
	5.7	Identify faulty reasoning and statements that go beyond the evidence or misinterpret the evidence.
	5.8	Use graphs, tables and charts to study physical phenomena and infer mathematical relationships between variables (e.g., speed and density).
	5.9	Appropriately use verbs: Discover, Explore, Investigate, Identify, Explain, Describe, Relate, Summarize, Predict, Compare, Analyze, Recognize, Ask, Trace, Demonstrate.

6.0 Scientific Ways of Knowing

Ethical Practices	**6.1**	Show that the reproducibility of results is essential to reduce bias in scientific investigations.
Life and Dignity of the Human Person	**6.2**	Describe how the work of science requires a variety of human abilities and qualities that are helpful in daily life (e.g., reasoning, creativity, skepticism, faith, and openness).

PERFORMANCE VERBS

analyze	To study the different parts of a problem or situation in order to understand the "big picture".
apply	To put into action.
ask	To make inquiry; seek information.
choose	To select from a number of possible alternatives; decide on and pick out.
cite	To mention or bring forward as support, illustration, or proof.
classify	To arrange or organize according to class or category.
communicate	To convey information about; make known; impart.
compare	To examine similarities and differences.
comprehend	To take in the meaning, nature, or importance of; grasp.
conclude	To arrive at (a logical conclusion or end) by the process of reasoning; infer on the basis of convincing evidence.
construct	To form by assembling or combining parts; build.
decide	To settle conclusively all contention or uncertainty about.
define	To describe the nature or basic qualities of; explain.
demonstrate	To present by experiments, examples, or practical application; explain and illustrate.
derive	To arrive at by reasoning; deduce or infer.
describe	Tell about something in detail.
design	To formulate a plan for.
develop	To cause to become more complex or intricate; add detail and fullness to.
differentiate	To constitute the distinction between.
discover	To notice or learn, especially by making an effort.

discuss	To speak with another or others about; talk over.
draw	To bring to a certain condition or action; lead.
evaluate	To use criteria to judge the role or value of something for a given purpose, such as explaining the pros, cons, or consequences of a decision or an action.
examine	To observe carefully or critically; inspect.
explain	To offer reasons for or a cause of; justify.
explore	To investigate systematically; examine appropriately.
formulate	To express an idea based on examination of information, trends, or patterns, such as devising a category to classify events.
give	To furnish or contribute.
identify	To ascertain the origin, nature, or definitive characteristics of.
illustrate	To clarify, as by use of examples or comparisons.
infer	To go beyond what is stated; draw conclusions based on given information.
interpret	To explain the meaning of.
interact	To act on each other.
justify	To demonstrate or prove to be just, right, or valid.
make	To institute or establish; enact.
measure	An evaluation or a basis of comparison.
name	A word or words by which an entity is designated and distinguished from others.
observe	To watch attentively.
predict	To use knowledge to make a statement about what is to come.
present	To introduce, especially with formal ceremony.
recognize	To know or identify from past experience or knowledge.
record	To set down for preservation in writing or other permanent form.

relate	To establish or demonstrate a connection between.
research	Scholarly or scientific investigation or inquiry.
revise	To prepare a newly edited version of.
select	To take as a choice from among several; pick out.
share	To participate in, use, enjoy, or experience jointly or in turns.
show	To direct one's attention to; point out.
summarize	To condense information such as stating the main points of an argument or the main events in a story.
support	To provide evidence to back a conclusion or argument.
trace	To describe a path or sequence, such as the order of events in a story.
use	To put into service or apply for a purpose.

GLOSSARY

A

abiotic Non-living.

acceleration The rate of change of velocity with respect to time.

acid A substance that dissolves in water with the formation of hydrogen ions and reacts with a base to form a salt and water. It neutralizes alkalis, dissolves some metals, and turns litmus red; typically, a corrosive and sour-tasting liquid.

adaptation Adjustment to environmental conditions, modification of an organism or its parts that makes it more fit for existence under the conditions of its environment.

alleles Any of the alternative forms of a gene that may occur at a given locus on a chromosome.

anemometer An instrument for measuring and indicating the force or speed of the wind.

asexual reproduction Involving or reproducing by reproductive processes (as cell division, spore formation, fission or budding) that do not involve the union of germ cells or egg and sperm.

asteroid A small rocky body orbiting the sun.

atmosphere The gaseous envelope surrounding the earth; consists of oxygen, nitrogen and other gases, extends to a height of about 40,744 km (22,000 miles), and rotates with Earth.

atmospheric pressure The pressure exerted by the atmosphere at the surface of the Earth due to the weight of the air.

atom The smallest particle of an element that can exist either alone or in combination.

atomic number the number of protons in the nucleus of an atom.

B

bacteria	Unicellular, prokaryotic microorganisms that lack chlorophyll, multiply by fission, and can be seen only with a microscope; they occur in three main forms: spherical, rod-shaped and spiral. Some bacteria cause diseases such as pneumonia, tuberculosis and anthrax, and others are necessary for fermentation and nitrogen fixation.
balance	An instrument for measuring mass.
barometer	An instrument for determining the pressure of the atmosphere.
base	A substance that dissolves in water with the formation of hydroxyl ions and reacts with an acid to form a salt and water; turns litmus paper blue.
biogeochemical cycles	Relating to the partitioning and cycling of chemical elements and compounds between the living and nonliving parts of an ecosystem.
biological evolution	Changes in the genetic composition of a population through successive generations
biomass	The amount of living matter.
biome	Major ecological community (tropical rain forest, grassland or desert).
biotechnology	Biological science when applied especially in genetic engineering and recombinant DNA technology.
biotic	Relating to life.
body covering	Feature that covers the body, such as fur or feathers.
body system	A system of the body (i.e. digestive system, circulatory system).
boiling point	The temperature at which a liquid boils.

C

capacity	The maximum amount or number that can be contained or accommodated.
carnivore	A flesh-eating animal.
cell	The smallest structural and functional unit of an organism.
cell division	The formation of two daughter cells from one parent cell, mitosis.
cell membrane	The bounding membrane of cells which controls the entry of molecules and the interaction of cells with their environment, plasma membrane.
cell respiration	Metabolic processes which break down nutrients into usable energy.
cell wall	A structure external to the plasma membrane of a plant cell. It provides structure and support.
characteristic	A distinguishing trait, feature, quality or property.
chemical change	A change in a substance resulting in an entirely different substance with different properties from the first.
chemical property	Chemical characteristics of a substance that distinguish it from other substances.
chemical reaction	A process that involves rearrangement of the molecular or ionic structure of a substance, as opposed to a change in physical form or a nuclear reaction.
chemosynthesis	Synthesis of organic compounds (as in living cells) by energy derived from chemical reactions.
chloroplast	A plastid that contains chlorophyll and is the site of photosynthesis.
chromosome	A threadlike structure of nucleic acids and protein found in the nucleus of most living cells, carrying genetic information in the form of genes.
chrysalis	The pupa of a butterfly and some insects.

cilia	Fine hair-like protrusions of the cell surface, which beat in unison to create currents of liquid over cell surface of propel the cell through the medium.
circuit	The complete path of an electric current usually including the source of electric energy.
circular motion	Motion of an object that follows the circumference of a circle.
classification	Systematic arrangement in groups or categories according to established criteria.
climate	The average course or condition of the weather at a place usually over a period of years as exhibited by temperature, wind velocity and precipitation.
comet	A celestial body that consists of a fuzzy head usually surrounding a bright nucleus, that has a usually highly eccentric orbit, and that often, when in the part of its orbit near the sun, develops a long tail which points away from the sun.
community	Interacting populations that live in a defined habitat.
composition	The qualitative and quantitative makeup of a chemical compound.
condensation	The conversion of a substance (such as water) from the vapor state to denser liquid or solid state usually initiated by a reduction in the temperature of the vapor.
conservation	A careful preservation and protection of something; especially planned management of a natural resource to prevent exploitation, destruction or neglect.
consumer	An organism requiring complex organic compounds for food, which it obtains by preying on other organisms or by eating particles or organic matter.
control	A group used as a standard or comparison for checking the results of an experiment.
covalent	chemical bonds formed by the sharing of electrons between atoms.
convection	The circulatory motion that occurs in a fluid at a non-uniform temperature owing to the variation of its density and the action of gravity.

convergent	To come together or tend to come together at a point.
core	The central part of a celestial body (as Earth or sun) usually having different physical properties from the surrounding parts.
crust	The outer part of a planet, moon or asteroid composed essentially of crystalline rocks.
crustal deformation	A change in the crust of a planet, moon or asteroid.
crystal	A piece of homogeneous solid substance having a natural, geometrically regular form with symmetrically arranged plane faces.
current	Continuous flow as of air, water or electric charge.
cycle	An interval of time during which a sequence of a recurring succession of events isotope is formed.

D

decay rate	The rate at which a radioactive isotope disintegrates until a final non-radioactive isotope is formed.
decomposers	Organisms such as bacteria and fungi that feed and breakdown dead organisms returning constituents of organic substances to the environment.
dependent variable	A variable whose values are determined by one or more (independent) variables.
design	To create, fashion, execute or construct according to plan.
differentiation	The sum of the processes whereby apparently indifferent cells, tissues and structures attain their adult form and function.
diversity	A great deal of variety.
DNA	Deoxyribonucleic acid, a double strand of nucleotides, that is a self-replicating material present in living organisms as the main constituent of chromosomes. It contains the genetic code and transmits the heredity pattern.

dominant	A gene, that when present, is expressed in the phenotype.

E

eclipse	The total or partial obscuring of one celestial body by another.
ecological	The interactions and relationships between organisms and their environment.
ecosystem	The complex of a community of organisms and its environment functioning as an ecological unit.
egg	Female gamete; ovum.
electric field	A region associated with a distribution of electric charge or a varying magnetic field, in which forces due to that charge or field, act upon other electric charges.
electric force	A force that exists between two charged objects.
electricity	A form of energy resulting from the existence of charged particles, ether statically as an accumulation of charge or dynamically as a current.
electromagnetic radiation	A kind of radiation including visible light, radio waves, gamma rays and x-rays in which electric and magnetic fields vary simultaneously.
electromagnetic spectrum	The entire range of wavelengths or frequencies of electromagnetic radiation extending from gamma rays to the longest radio waves and including visible light.
electron	A stable subatomic particle with negative electrical charge, found in all atoms and acting as the primary carrier of electricity in solids.
element	Any of more than 100 fundamental substances that consist of atoms of only one kind and that singly or in combination constitute all matter.
emigration	A category of population dispersal covering one-way movement out of the population area.
endothermic	Characterized by or formed with absorption of heat.

energy	The capacity for doing work, can be in various forms such as nuclear, sound, thermal and light.
entropy	A thermodynamic quantity representing the availability of a system's thermal energy for conversion into mechanical work, often interpreted as the degree of disorder or randomness in the system.
environment	The complex of physical, chemical and biotic factors that act upon an organism or an ecological community and ultimately determine its form and survival.
epicenter	The part of the Earth's surface directly above the focus of an earthquake.
equilibrium	A state in which opposing forces or influences are balanced.
eukaryotic	An organism composed of one or more cells containing visibly evident nuclei and organelles.
evaporation	To convert into vapor.
evidence	Facts of observations on which a conclusion can be based.
evolution (biological)	Changes in the genetic composition of a population through successive generations.
exothermic	Characterized by or formed with liberation of heat.
extinct	A species of organisms that no longer exists.

F

faulting	To fracture so as to produce a geologic fault.
fermentation	An enzymatically controlled anaerobic breakdown of an energy-rich compound.
fission	The splitting of an atomic nucleus resulting in the release of large amounts of energy.
flagella	Long hair-like extensions from the cell surface whose movement is used for locomotion.

focus	The place of origin of an earthquake or moonquake (as related to earthquakes).
food chain	An arrangement of the organisms of an ecological community according to the order of predation in which each uses the next usually lower member as a food source.
food web	The totality of interacting food chains in an ecological community; interacting food chains in an ecological community.
force	An influence, that if applied to a free body, results chiefly in an acceleration of that body in the direction of its application.
fossil	Remnant, impression or trace of an organism of past geologic ages that has been preserved in the Earth's crust.
fossil fuel	A fuel (such as coal, oil or natural gas) that is formed in Earth from plant or animal remains.
frame of reference	an arbitrary set of axes with reference to which the position or motion of something is described or physical laws are formulated.
friction	The force that resists relative motion between two bodies in contact.
fungi	Any of a major group of saprophytic and parasitic spore-producing organisms including molds, rusts, mildews, smuts, mushrooms and yeasts.
fusion	The union of atomic nuclei to form heavier nuclei resulting in the release of enormous quantities of energy.

G

galaxy	Any of the very large groups of stars and associated matter that are found throughout the universe.
gas	A fluid (such as air) that has neither independent shape nor volume but tends to expand indefinitely.
gene	A functional hereditary unit located at a particular point on a chromosome that controls or acts in the transmission of hereditary characteristics.
genetic drift	The process by which gene frequencies are changed.

germenation The beginning of growth in a spore, seed, zygote etc., especially following a dormant period.

glaciation To subject to glacial action in which a large body of ice moves slowly down a slope or valley, or spreads outward on a land surface.

gravitation A force manifested by acceleration toward each other of two free material particles or bodies, or of radiant-energy quanta.

gravity The gravitational attraction of the mass of the Earth, the moon or a planet for bodies at or near its surface.

H

habitability Suitable for a dwelling place.

habitat The place or environment where a plant or animal naturally or normally lives and grows.

herbivore A plant-eating animal.

heredity The sum of the qualities and potentialities genetically derived from one's ancestors; the relation between successive generations, by which characteristics persist.

homeostasis A state of equilibrium between different but interrelated functions or elements, as in an organism or group.

humidity The amount of moisture in the atmosphere.

hydrosphere The aqueous envelope of the Earth including bodies of water and aqueous vapor in the atmosphere.

hypothesis A formula derived by inference from scientific data that explains a principle operating in nature.

I

igneous Relating to, resulting from, or suggestive of the intrusion or extrusion of magma or volcanic activity.

immigration	Coming into the population.
independent assortment	Each chromosome in a pair that is independent of other chromosomes.
independent variable	A variable whose value is specified first and determines the value of one or more other values.
infrared radiation	Invisible rays just beyond the red end of the visible spectrum. Their waves are longer than those of the spectrum colors but shorter than radio waves, and have a penetrating heating effect; used in cooking and photography.
interstellar	Located, taking place or traveling among the stars, especially of the Milky Way galaxy.
ion	An atom or group of atoms that carries a positive or negative electric charge as a result of having lost or gained one or more electrons.
isotope	Any of two or more species of atoms of a chemical element with the same atomic number and nearly identical chemical behavior, but with differing atomic mass or mass number and different physical properties.
J	
jumping genes	Genes that move from one position on the chromosome to another.
K	
kinetic energy	Energy associated with motion.
L	
landform	A natural feature of a land surface.
life	An organism that has the capacity for metabolism, growth, reaction to stimuli and reproduction.
life cycle	The series of stages in form and functional activity through which an organism passes from fertilized ovum to the fertilized ovum of the next generation.

liquid A fluid (such as water) that has no independent shape but has a definite volume, does not expand indefinitely and that is only slightly compressible.

lithosphere The solid part of a celestial body (such as Earth), specifically, the outer part of the solid Earth composed of rock essentially like that exposed at the surface and usually considered to be about 80 kilometers (50 miles) in thickness.

M

magma Molten rock of material within the Earth from which igneous rock results by cooling.

magnetic reversal Periods of time in which there was a reversal in direction of the Earth's magnetic field.

mantle The part of the interior of a terrestrial planet, especially the Earth, that lies beneath the lithosphere and above the central core.

mass The property of a body that is a measure of its inertia and that is commonly taken as a measure of the amount of material it contains causing it to have weight in a gravitational field.

matter Material substance that occupies space, has mass and is composed of atoms consisting of protons, neutrons and electrons that constitutes the observable universe, and that is interchangeable with energy.

mean The sum of a set of numbers divided by the number of elements in the set.

median The middle number or item in a set of numbers or objects arranged from least to greatest, or the mean of the two middle numbers when the set has two middle numbers.

metamorphism A change in the constitution of rock; specifically, a pronounced change affected by pressure, heat and water that results in a more compact and more highly crystalline condition.

meteor Any of the small particles of matter in the solar system that are directly observable only by their incandescence from frictional

heating on entry into the atmosphere.

meteoroid One of a large number of celestial bodies of various size that appear as meteors when they enter Earth's atmosphere.

method A systematic procedure, technique or mode of inquiry employed by or proper to a particular discipline or art.

microorganisms An organism of microscopic or ultramicroscopic size.

metric system A decimal system of weights and measures based on the meter and on the kilogram.

Milky Way A broad luminous irregular band of light that stretches completely around the celestial sphere and is caused by the light of myriads of faint stars.

mineral A soiled homogeneous crystalline chemical element or compound that results from the inorganic processes of nature.

mitochondria Cell structure responsible for cellular respiration.

mixture A portion of matter consisting of two or more components in varying proportions that retain their own properties.

mode The number or object that appears most frequently in a set of numbers of objects.

model A description or analogy used to help visualize something (such as an atom) that cannot be directly observed.

molecule The smallest particle of a substance that retains all the properties of the substance and is composed of one or more atoms.

moon cycle The cycle of the moon's phases, from new to full and back.

motion An act, process or instance of changing position through time.

multicellular Having or consisting of many cells.

mutation A relatively permanent change in hereditary material involving either a physical change in chromosome relations or a biochemical change in the codon(s) that make up genes

N

natural	Existing in, or produced by nature.
natural selection	The principle that in a given environment individuals having characteristics that aid survival will produce more offspring, and the proportion of individuals having such characteristics will increase with each succeeding generation.
nesting	To build or occupy a nest; settle in.
neutral	Neither acidic nor basic (as in pH).
neutrons	An uncharged elementary particle that has a mass nearly equal to that of the proton and is present in atomic nuclei.
nuclear	Used in or produced by a nuclear reaction; referring to particles or properties of an atomic nucleus.
nuclear reaction	A change in the identity or characteristics of an atomic nucleus that results when it is bombarded with an energetic particle.
nucleus	1. the positively charged central portion of an atom that comprises nearly all of the atomic mass and that consists of protons and neutrons. 2. The portion of a eukoryotic cell that is surrounded by a nuclear membrane and contains DNA.
nutrient	A nutritive substance or ingredient.

O

observe	To watch carefully, especially with attention to details or behavior for the purpose or arriving at a judgment.
ocean trench	A long, narrow, deep depression in the ocean bed.
omnivore	An animal that feeds on both animal and vegetable substances.
orbit	A path described by one body in its revolution about another (as by the Earth about the sun or by an electron about an atomic nucleus).

organ	A differentiated structure (such as a heart, kidney, leaf or stem) consisting of cells and tissues, and performing some specific function in an organism.
organ systems	Organs working together for a specific function.
organic	Compounds containing carbon and chiefly or ultimately of biological origin.
organism	An individual constituted to carry on the activities of life by means of organs separate in function but mutually dependent; a living being.
oxidation	Combination of a substance with oxygen.
oxidize	To combine with oxygen.

P

parasite	An organism living in, with or on another organism in which a parasite obtains benefits from a host that it usually injures.
particle	Any of the basic units of matter and energy (such as a molecule, atom, proton, electron or photon).
pattern	A reliable sample of traits, acts, tendencies or other observable characteristics.
periodic table	An arrangement of chemical elements based on the periodic law.
pH scale	A numerical measure of the acidity or alkalinity of a chemical solution.
phenomenon	A fact or event of scientific interest susceptible to scientific description and explanation.
photosynthesis	The chemical process by which chlorophyll-containing plants use light to convert carbon dioxide and water into carbohydrates, releasing oxygen as a byproduct.
physical change	A change in a substance that does not alter its chemical makeup.
physical properties	A property of a material that can be observed without changing the chemical makeup of the material.

physiology	The biological science of essential and characteristic life processes, activities and functions.
pitch	The property of a sound, especially a musical tone, that is determined by the frequency of the waves producing it; highness or lowness of sound.
planet	Any of the large bodies that revolve around the sun in the solar system.
pollution	A substance that, when added to the environment causes the environment to be harmful or unfit for living things.
population	All the plants or animals of the same kind found in a given area.
potential energy	The energy that matter has because of its position or because of the arrangement of atoms or parts.
precipitation	A deposit on Earth of hail, mist, rain, sleet or snow.
predator	An animal that lives by capturing prey as a means of maintaining life.
prey	An animal taken by a predator as food.
producer	Any of various organisms (such as a green plant) which produce their own organic compounds from simple precursors (such as carbon dioxide and inorganic nitrogen) and many of which are food sources for other organisms.
prokaryotic	A cellular organism (such as bacterium or a blue-green alga) that does not have a distinct nucleus.
property	A quality or trait belonging to an individual or thing.
proton	A stable subatomic particle occurring in all atomic nuclei with a positive electric charge equal in magnitude to that of an electron.

Q

qualitative	Involving quality or kind.
quantitative	Involving the measurement of quantity or amount.

R

Radiation	The transfer of heat by radiation (such as energy transfer). The process of emitting radiant energy in the form of waves or particles (such as particle emission).
react	To undergo chemical reaction (chemically).
reactant	A substance that enters into and is altered in the course of a chemical reaction.
recycle	To process (as liquid body waste, glass or cans) in order to regain material for human use.
reference point	A basis or standard for evaluation, assessment or comparison; a criterion.
reflection	The throwing back by a body or surface of light, heat or sound without absorbing it.
refraction	Deflection from a straight path undergone by a light ray or energy wave in passing obliquely from one medium (such as air) into another (such as glass) in which its velocity is different.
repel	To force away or apart, or tend to do so by mutual action at a distance.
replicate	To duplicate experiments, procedures or samples.
reproduction	The process by which organisms give rise to offspring and which fundamentally consists for the segregation of a portion of the parental body by a sexual or an asexual process, and its subsequent growth and differentiation into a new individual.
resource	Industrial materials and capacities (as mineral deposits and waterpower) supplied by nature (earth science) and substances used by an organism for survival (biology).
respiration	The physical and chemical processes by which an organism supplies its cells and tissues with the oxygen needed for

	metabolism and relieves them of the carbon dioxide formed in energy-producing reactions.
rotation	The turning of a body part about its long axis as if on a pivot.
S	
scavenger	An organism that feeds habitually on refuse of carrion.
Scientific law	A statement of an order or relation of phenomena that, so far as is known, is invariable under the given conditions.
scientific method	Principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses.
scientific theory	A plausible or scientifically acceptable general principle or body of principles offered to explain phenomena.
sediment	Material deposited by water, wind or glaciers.
segregation	The separation of two alleles in a heterozygote when gametes are formed.
significant figure	Each of the digits of a number that are used to express it to the required degree of accuracy.
solid	A substance that does not flow perceptibly under moderate stress, has a definite capacity for resisting forces (such as compression or tension) that tend to deform it, and under ordinary conditions retains a definite size and shape.
solubility	The amount of a substance that will dissolve in a given amount of another substance.
solution	An act, or the process by which a solid, liquid or gaseous substance is homogeneously mixed with a liquid or sometimes a gas or solid.
sound waves	Mechanical radiant energy that is transmitted by longitudinal pressure waves in a material medium (such as air) and is the objective cause of hearing.

species A group of organisms consisting of similar individuals capable of exchanging genes or interbreeding.

sperm A male gamete.

star A natural luminous body visible in the sky, especially at night.

structure The arrangement of particles or parts in a substance or body.

survival The continuation of life or existence.

system 1. A group of body organs that together perform one or more vital functions. 2. An organized group of devices, parts or factor that together perform a function or drive a process (weather systems, mechanical systems).

T

technology Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities. The innovation, change, or modification of the natural environment to satisfy perceived human needs and wants.

theory A supposition or a system of ideas intended to explain something, especially one based on general principles independent of the thing to be explained.

tides The alternate rising and falling of the surface of the ocean and water bodies (such as gulfs and bays) connected with the ocean that occurs usually twice a day, and is caused by the gravitational attraction of the sun and moon occurring unequally on different parts of the Earth.

tissue An aggregate of cells usually a particular kind together with their intercellular substance that form one of the structural material of organisms.

tool A device that aids in accomplishing a task, a form of technology.

trait An inherited characteristic.

transform To change in composition or structure.

U

unit A determinate quantity (such as of length, time, heat or value) adopted as a standard of measurement.

unity The state of being united into a whole.

uplift To cause (a portion of Earth's surface) to rise above adjacent areas.

V

variable A quantity that may assume any one of a set of values.

velocity The rate of change of position and direction with respect to time.

virus Any of various submicroscopic pathogens consisting essentially of a particle of nucleic acid enclosed in protein and able to replicate only within a living cell.

volcano A vent in the crust of the Earth or another planet from which usually molten rock, ash and steam are ejected.

W

water cycle The sequence of conditions through which water passes from vapor in the atmosphere through precipitation upon land or water surfaces and ultimately back into the atmosphere as a result of evaporation and transpiration.

wave A disturbance or variation that transfers energy progressively from point to point in a medium, and that may take the from of an elastic deformation or of a variation of pressure, electric or magnetic intensity, electric potential, or temperature.

wavelength The distance between successive crests of a wave.

weather The state of the atmosphere with respect to heat or cold, wetness or dryness, calm or storm, clearness or cloudiness.

weathering To subject to the action of the elements.