DIOCESE OF TOLEDO

SCIENCE
COURSE OF STUDY
GRADE FOUR

Catholic Youth and School Services
1933 Spielbusch Avenue, P.O. Box 985
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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.

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DIOCESE OF TOLEDO PHILOSOPHY

"The duty of human perfection, like the whole universe, has been renewed, recast, supernaturalized, 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 a 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 not 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 which 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 3-5

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: Explain the characteristics, cycles and patterns involving Earth and its place in the solar system.

Grade Three

No indicators present for this benchmark.

Grade Four

No indicators present for this benchmark.

Grade Five

The Universe

1. Describe how night and day are caused by Earth's rotation.
2. Explain that Earth is one of several planets to orbit the sun, and that the moon orbits Earth.
3. Describe the characteristics of Earth and its orbit about the sun (e.g., three-fourths of Earth's surface is covered by a layer of water [some of it frozen], the entire planet surrounded by a thin blanket of air, elliptical orbit, tilted axis and spherical planet).
4. Explain that stars are like the sun, some being smaller and some larger, but so far away that they look like points of light.

Benchmark B: Summarize the processes that shape Earth's surface and describe evidence of those processes.

Grade Three

No indicators present for this benchmark.

Grade Four

Processes That Shape Earth	8.	Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).
	9.	Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.
	10.	Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g. volcanic eruptions, earthquakes and landslides).

Grade Five

No indicators present for this benchmark.

Benchmark C: Describe Earth's resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved.

Grade Three

Earth Systems	1.	Compare distinct properties of rocks (e.g., color, layering and texture).
	2.	Observe and investigate that rocks are often found in layers.
	3.	Describe that smaller rocks come from the breakdown of larger rocks through the actions of plants and weather.
	4.	Observe and describe the composition of soil (e.g., small pieces of rock and decomposed pieces of plants and animals, and products of plants and animals).
	5.	Investigate the properties of soil (e.g., color, texture, capacity to retain water, ability to support plant growth).
	6.	Investigate that soils are often found in layers and can be different from place to place.

Grade Four

No indicators present for this benchmark.

Grade Five

Earth Systems	5.	Explain how the supply of many non-renewable resources is limited and can be extended through reducing, reusing and recycling but cannot be extended indefinitely.
	6.	Investigate ways Earth's renewable resources (e.g., fresh water, air, wildlife and trees) can be maintained.

Benchmark D: Analyze weather and changes that occur over a period of time.

Grade Three

No indicators present for this benchmark.

Grade Four

Earth Systems

1. Explain that air surrounds us, takes up space, moves around us as wind, and may be measured using barometric pressure.
2. Identify how water exists in the air in different forms (e.g., in clouds, fog, rain, snow and hail).
3. Investigate how water changes from one state to another (e.g., freezing, melting, condensation and evaporation).
4. Describe weather by measurable quantities such as temperature, wind direction, wind speed, precipitation and barometric pressure.
5. Record local weather information on a calendar or map and describe changes over a period of time (e.g., barometric pressure, temperature, precipitation symbols and cloud conditions).
6. Trace how weather patterns generally move from west to east in the United States.
7. Describe the weather which accompanies cumulus, cumulonimbus, cirrus and stratus clouds.

Grade Five

No indicators present for this benchmark.

Grades 3-5

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: Differentiate between the life cycles of different plants and animals.

Grade Three

Heredity	1.	Compare the life cycles of different animals including birth to adulthood, reproduction and death (e.g., egg-tadpole-frog, egg-caterpillar-chrysalis-butterfly).

Grade Four

Heredity	1.	Compare the life cycles of different plants including germination, maturity, reproduction and death.
	5.	Describe how organisms interact with one another in various ways (e.g., many plants depend on animals for carrying pollen or dispersing seeds).

Grade Five

No indicators present for this benchmark.

Benchmark B: Analyze plant and animal structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive.

Grade Three

Diversity and Interdependence of Life	2.	Relate animal structures to their specific survival functions (e.g., obtaining food, escaping or hiding from enemies).
	3.	Classify animals according to their characteristics (e.g., body coverings and body structure).

Grade Four

Diversity and Interdependence of Life	2.	Relate plant structures to their specific functions (e.g., growth, survival and reproduction).
	3.	Classify common plants according to their characteristics (e.g., tree leaves, flowers, seeds, roots and stems).

Grade Five

Diversity and Interdependence of Life	1.	Describe the role of producers in the transfer of energy entering ecosystems as sunlight to chemical energy through photosynthesis.
	2.	Explain how almost all kinds of animals' food can be traced back to plants.
	3.	Trace the organization of simple food chains and food webs (e.g., producers, herbivores, carnivores, omnivores and decomposers).

Benchmark C: Compare changes in an organism's ecosystem/habitat that affect its survival.

Grade Three

Diversity and Interdependence of Life	4.	Use examples to explain that extinct organisms may resemble organisms that are alive today.
	5.	Observe and explore how fossils provide evidence about animals that lived long ago and the nature of the environment at that time.
	6.	Describe how changes in an organism's habitat are sometimes beneficial and sometimes harmful.

Grade Four

Diversity and Interdependence of Life	4.	Observe and explore that fossils provide evidence about plants that lived long ago and the nature of the environment at that time.

Grade Five

Diversity and Interdependence of Life	4.	Summarize that organisms can survive only in ecosystems in which their needs can be met (e.g., food, water, shelter, air, carrying capacity and waste disposal). The world has different ecosystems and distinct ecosystems support the lives of different types of organisms.
	5.	Support how an organism's patterns of behavior are related to the nature of that organism's ecosystem, including the kinds and numbers of other organisms present, the availability of food and resources, and the changing physical characteristics of the ecosystem.
	6.	Analyze how all organisms, including humans, cause changes in their ecosystems and how these changes can be beneficial, neutral or detrimental (e.g., beaver ponds, earthworm burrows, grasshoppers eating plants, people planting and cutting trees and people introducing a new species).

Grades 3-5

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: Compare the characteristics of simple physical and chemical changes.

Grade Three

No indicators present for this benchmark.

Grade Four

Nature of Matter

1. Identify characteristics of a simple physical change (e.g., heating or cooling can change water from one state to another and the change is reversible).
2. Identify characteristics of a simple chemical change. When a new material is made by combining two or more materials, it has chemical properties that are different from the original materials (e.g., burning paper, vinegar and baking soda).

Grade Five

No indicators present for this benchmark.

Benchmark B: Identify and describe the physical properties of matter in its various states.

Grade Three

No indicators present for this benchmark.

Grade Four

Nature of Matter

3. Describe objects by the properties of the materials from which they are made and that these properties can be used to separate or sort a group of objects (e.g., paper, glass, plastic and metal).
4. Explain that matter has different states (e.g., solid, liquid and gas) and that each state has distinct physical properties.

Grade Five

No indicators present for this benchmark.

Benchmark C: Describe the forces that directly affect objects and their motion.

Grade Three

Forces and Motion

1. Describe an objects position by locating it relative to another object or the background.
2. Describe an objects motion by tracing and measuring its position over time.
3. Identify contact/noncontact forces that affect motion of an object (e.g., gravity, magnetism and collision).
4. Predict the changes when an object experiences a force (e.g., a push or pull, weight and friction).

Grade Four

No indicators present for this benchmark.

Grade Five

No indicators present for this benchmark.

Benchmark D: Summarize the way changes in temperature can be produced and thermal energy transferred.

Grade Three

No indicators present for this benchmark.

Grade Four

Nature of Energy	5.	Compare ways the temperature of an object can be changed (e.g., rubbing, heating and bending of metal).

Grade Five

Nature of Energy	1.	Define temperature as the measure of thermal energy and describe the way it is measured.
	2.	Trace how thermal energy can transfer from one object to another by conduction.

Benchmark E: Trace how electrical energy flows through a simple electrical circuit and describe how the electrical energy can produce thermal energy, light, sound and magnetic forces.

Grade Three

No indicators present for this benchmark.

Grade Four

No indicators present for this benchmark.

Grade Five

Nature of Energy	3.	Describe that electrical current in a circuit can produce thermal energy, light, sound and/or magnetic forces.
	4.	Trace how electrical current travels by creating a simple electric circuit that will light a bulb.

Benchmark F: Describe the properties of light and sound energy.

Grade Three

No indicators present for this benchmark.

Grade Four

No indicators present for this benchmark.

Grade Five

Nature of Energy	5.	Explore and summarize observations of the transmission, bending (refraction) and reflection of light.
	6.	Describe and summarize observations of the transmission, reflection, and absorption of sound.
	7.	Describe that changing the rate of vibration can vary the pitch of a sound.

Grades 3-5

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: Describe how technology affects human life.

Grade Three

Understanding Technology	1.	Describe how technology can extend human abilities (e.g., to move things and to extend senses).
	2.	Describe ways that using technology can have helpful and/or harmful results.
	3.	Investigate ways that the results of technology may affect the individual, family and community.

Grade Four

Understanding Technology	1.	Explain how technology from different areas (e.g., transportation, communication, nutrition, healthcare, agriculture, entertainment and manufacturing) has improved human lives.
	2.	Investigate how technology and inventions change to meet peoples' needs and wants.

Grade Five

Understanding Technology	1.	Investigate positive and negative impacts of human activity and technology on the environment.

Benchmark B: Describe and illustrate the design process.

Grade Three

Abilities To Do Technological Design	4.	Use a simple design process to solve a problem (e.g., identify a problem, identify possible solutions and design a solution).
	5.	Describe possible solutions to a design problem (e.g., how to hold down paper in the wind).

Grade Four

Abilities To Do Technological Design	3.	Describe, illustrate and evaluate the design process used to solve a problem.

Grade Five

Abilities To Do Technological Design	2.	Revise an existing design used to solve a problem based on peer review.
	3.	Explain how the solution to one problem may create other problems.

Grades 3-5

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: Use appropriate instruments safely to observe, measure and collect data when conducting a scientific investigation.

Grade Three

Doing Scientific Inquiry	1.	Select the appropriate tools and use relevant safety procedures to measure and record length and weight in metric and English units.

Grade Four

Doing Scientific Inquiry	1.	Select the appropriate tools and use relevant safety procedures to measure and record length, weight, volume, temperature and area in metric and English units.

Grade Five

Doing Scientific Inquiry	1.	Select and safely use the appropriate tools to collect data when conducting investigations and communicating findings to others (e.g., thermometers, timers, balances, spring scales, magnifiers, microscopes and other appropriate tools).

Benchmark B: Organize and evaluate observations, measurements and other data to formulate inferences and conclusions.

Grade Three

Doing Scientific Inquiry	2.	Discuss observations and measurements made by other people.
	3.	Read and interpret simple tables and graphs produced by self/others.
	5.	Record and organize observations (e.g., journals, charts and tables).

Grade Four

Doing Scientific Inquiry	2.	Analyze a series of events and/or simple daily or seasonal cycles, describe the patterns and infer the next likely occurrence.

Grade Five

Doing Scientific Inquiry	2.	Evaluate observations and measurements made by other people and identify reasons for any discrepancies.
	3.	Use evidence and observations to explain and communicate the results of investigations.

Benchmark C: Develop, design and safely conduct scientific investigations and communicate the results.

Grade Three

Doing Scientific Inquiry	4.	Identify and apply science safety procedures.
	6.	Communicate scientific findings to others through a variety of methods (e.g., pictures, written, oral and recorded observations).

Grade Four

Doing Scientific Inquiry	3.	Develop, design and conduct safe, simple investigations or experiments to answer questions.
	4.	Explain the importance of keeping conditions the same in an experiment.
	5.	Describe how comparisons may not be fair when some conditions are not kept the same between experiments.
	6.	Formulate instructions and communicate data in a manner that allows others to understand and repeat an investigation or experiment.

Grade Five

Doing Scientific Inquiry	4.	Identify one or two variables in a simple experiment.
	5.	Identify potential hazards and/or precautions involved in an investigation.
	6.	Explain why results of an experiment are sometimes different (e.g., because of unexpected differences in what is being investigated, unrealized differences in the methods used or in the circumstances in which the investigation was carried out, and because of errors in observations).

Grades 3-5

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: Distinguish between fact and opinion and explain how ideas and conclusions change as new knowledge is gained.

Grade Three

No indicators present for this benchmark.

Grade Four

Nature of Science	1.	Differentiate fact from opinion and explain that scientists do not rely on claims or conclusions unless they are backed by observations that can be confirmed.

Grade Five

Nature of Science	1.	Summarize how conclusions and ideas change as new knowledge is gained.

Benchmark B: Describe different types of investigations and use results and data from investigations to provide the evidence to support explanations and conclusions.

Grade Three

Nature of Science	1.	Describe different kinds of investigations that scientists use depending on the questions they are trying to answer.

Grade Four

Nature of Science	3.	Explain discrepancies in an investigation using evidence to support findings.

Grade Five

Nature of Science	2.	Develop descriptions, explanations and models using evidence to defend/support findings.
	3.	Explain why an experiment must be repeated by different people or at different times or places and yield consistent results before the results are accepted.
	4.	Identify how scientists use different kinds of ongoing investigations depending on the questions they are trying to answer (e.g., observations of things or events in nature, data collection and controlled experiments).

Benchmark C: Explain the importance of keeping records of observations and investigations that are accurate and understandable.

Grade Three

Ethical Practices	2.	Keep records of investigations and observations and do not change the records that are different from someone else's work.

Grade Four

Nature of Science	2.	Record the results and data from an investigation and make a reasonable explanation.
Ethical Practices	4.	Explain why keeping records of observations and investigations is important.

Grade Five

Ethical Practices	5.	Keep records of investigations and observations that are understandable weeks or months later.

Benchmark D: Explain that men and women of diverse countries and cultures participate in careers in all fields of science.

Grade Three

Science and Society	3.	Explore through stories how men and women have contributed to the development of science.
	4.	Identify various careers in science.
	5.	Discuss how both men and women find science rewarding as a career an in their everyday lives.

Grade Four

No indicators present for this benchmark.

Grade Five

Science and Society	6.	Identify a variety of scientific and technological work that people of all ages, backgrounds and groups perform.

Grade Four

1.0 Earth and Space Sciences

Earth Systems	**1.1**	Realize that all of creation is a gift from God.
	1.2	Explain that air surrounds us, takes up space, moves around us as wind, and may be measured using barometric pressure.
	1.3	Identify how water exists in the air in different forms (e.g., in clouds, fog, rain, snow and hail).
	1.4	Investigate how water changes from one state to another (e.g., freezing, melting, condensation and evaporation).
	1.5	Describe weather by measurable quantities such as temperature, wind direction, wind speed, precipitation and barometric pressure.
	1.6	Record local weather information on a calendar or map and describe changes over a period of time (e.g., barometric pressure, temperature, precipitation symbols and cloud conditions).
	1.7	Trace how weather patterns generally move from west to east in the United States.
Processes That Shape Earth	**1.8**	Describe the weather, which accompanies cumulus, cumulonimbus, cirrus and stratus clouds.
	1.9	Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).
	1.10	Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.
	1.11	Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g. volcanic eruptions, earthquakes and landslides).

2.0 Life Sciences

Rights and Responsibilities	**2.1**	Compare the life cycles of different plants including germination, maturation, reproduction and death.
	2.2	Relate plant structures to their specific functions (e.g., growth, survival and reproduction).

	2.3	Classify common plants according to their characteristics (e.g., tree leaves, flowers, seeds, roots and stems).
	2.4	Observe and explore that fossils provide evidence about plants that lived long ago and the nature of the environment at that time.
	2.5	Describe how organisms interact with one another in various ways (e.g., many plants depend on animals for carrying pollen or dispersing seeds).

3.0 Physical Sciences

Nature of Matter	**3.1**	Explain that matter has different states (e.g., solid, liquid, gas , and plasma) and that each state has distinct physical properties.
	3.2	Compare ways the temperature of an object can be changed (e.g., rubbing, heating and bending of metal).
	3.3	Identify characteristics of a simple physical change (e.g., heating or cooling can change water from one state to another, and the change is reversible).
	3.4	Identify characteristics of a simple chemical change when a new material is made by combining two or more materials, it has chemical properties that are different from the original materials (e.g., burning paper, vinegar and baking soda).
Nature of Energy	**3.5**	Describe objects by the properties of the materials from which they are made and that these properties can be used to separate or sort a group of objects (e.g., paper, glass, plastic and metal).

4.0 Science and Technology

Rights and Responsibilities	**4.1**	Explain how technology is used in different ways (e.g., transportation, communication, nutrition, healthcare, agriculture, entertainment and manufacturing) has improved human lives.
Abilities To Do Technological Design	**4.2**	Investigate how technology and inventions change to meet peoples' needs and wants.
	4.3	Describe, illustrate and evaluate the design process used to solve a problem.

5.0 Scientific Inquiry

Doing Scientific Inquiry	**5.1**	Select the appropriate tools and use relevant safety procedures to measure and record length, weight, volume, temperature and area in metric and English units.
	5.2	Analyze a series of events and/or simple daily or seasonal cycles, describe the patterns, and infer the next likely occurrence.
	5.3	Develop, design, and conduct safe, simple investigations or experiments to answer questions.
	5.4	Explain the importance of keeping variables the same in an experiment.
	5.5	Describe how comparisons may not be accurate when some variables are controlled between experiments.
	5.6	Using scientific method, formulate procedures and communicate data in a manner that allows others to understand and repeat an investigation or experiment.
	5.7	Appropriately use verbs: Discover, Explore, Investigate, Identify, Explain, Describe, Relate, Summarize, Predict, Compare, Analyze, Recognize, Ask, Trace, Demonstrate.

6.0 Scientific Ways of Knowing

Nature of Science	**6.1**	Differentiate fact from opinion and explain that scientists do not rely on claims or conclusions unless they are backed by observations that can be confirmed.
	6.2	Record the results and data from an investigation and give a valid conclusion.
	6.3	Explain discrepancies in an investigation using evidence to support findings.
Rights and Responsibilities	**6.4**	Explain why keeping records of observations and investigations is important.

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.