



Coordinated Science for the 21st Century Correlation to the Ohio Academic Content Standards for Earth and Space Sciences, Life Sciences, and Physical Sciences, Grades 9-10*

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	Indicator	Location/Page where Standard is found
Benchmark A: Explain how evidence from stars and other celestial objects provide information about the processes that cause changes in the composition and scale of the physical universe.		
<i>The Universe(Grade 10)</i>	1. Describe that stars produce energy from nuclear reactions and that processes in stars have led to the formation of all elements beyond hydrogen and helium.	660-669, 703-713, 714-724, 725-735
	2. Describe the current scientific evidence that supports the theory of the explosive expansion of the universe, the Big Bang, over 10 billion years ago.	660-669, 693-702, 714-724, 725-735

<u>Benchmark B: Explain that many processes occur in patterns within the Earth's systems.</u>		
<i>Earth Systems(Grade9)</i>	4. Explain the relationships of the oceans to the lithosphere and atmosphere (e.g., transfer of energy, ocean currents and landforms).	583-590, 773-780, 781-791, 792-799, 888-897
<i>Earth Systems(Grade10)</i>	1. Summarize the relationship between the climatic zone and the resultant biomes. (This includes explaining the nature of the rainfall and temperature of the mid-latitude climatic zone that supports the deciduous forest.)	740-751, 761-772, 773-780, 922-926
	2. Explain climate and weather patterns associated with certain geographic locations and features (e.g., tornado alley, tropical hurricanes and lake effect snow).	740-751, 761-772, 792-799, 922-926
<u>Benchmark C: Explain the 4.5 billion-year-history of Earth and the 4 billion-year-history of life on Earth based on observable scientific evidence in the geologic record.</u>		
<i>The Universe(Grade 9)</i>	3. Explain that gravitational forces govern the characteristics and movement patterns of the planets, comets and asteroids in the solar system.	670-683, 684-692, 693-702
<i>Earth Systems (Grade 10)</i>	3. Explain how geologic time can be estimated by multiple methods (e.g., rock sequences, fossil correlation and radiometric dating).	693-702, 752-760
	4. Describe how organisms on Earth contributed to the dramatic change in oxygen content of Earth's early atmosphere.	752-760, 781-791
<u>Benchmark D: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources.</u>		
<i>Earth Systems(Grade10)</i>	5. Explain how the acquisition and use of resources, urban growth and waste disposal can accelerate natural change and impact the quality of life.	781-791, 825-834, 843-852, 853-861, 872-883

	6. Describe ways that human activity can alter biogeochemical cycles (e.g., carbon and nitrogen cycles) as well as food webs and energy pyramids (e.g., pest control, legume rotation crops vs. chemical fertilizers).	591-596, 597-605, 781-791, 792-799, 825-834, 843-852, 853-861
<u>Benchmark E: Explain the processes that move and shape Earth's surface.</u>		
<i>Processes That Shape Earth (Grade 9)</i>	5. Explain how the slow movement of material within Earth results from: a. thermal energy transfer (conduction and convection) from the deep interior; b. the action of gravitational forces on regions of different density.	935-941, 946-957, 958-968, 969-978, 979-988
	6. Explain the results of plate tectonic activity (e.g., magma generation, igneous intrusion, metamorphism, volcanic action, earthquakes, faulting and folding).	888-897, 898-906, 958-968, 969-978, 979-988, 989-1001
	7. Explain sea-floor spreading and continental drift using scientific evidence (e.g., fossil distributions, magnetic reversals and radiometric dating).	898-906, 958-968, 969-978, 979-988, 989-1001
<u>Benchmark F: Summarize the historical development of scientific theories and ideas, and describe emerging issues in the study of Earth and space sciences.</u>		
<i>Historical Perspectives and Scientific Revolutions(Grade 9)</i>	8. Use historical examples to explain how new ideas are limited by the context in which they are conceived; are often initially rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly through contributions from many different investigators (e.g., heliocentric theory and plate tectonics theory).	660-669, 670-683, 693-702, 714-724, 725-735, 989-1001

<i>Historical Perspectives and Scientific Revolutions(Grade 10)</i>	7. Describe advances and issues in Earth and space science that have important long-lasting effects on science and society (e.g., geologic time scales, global warming, depletion of resources and exponential population growth).	781-791, 792-799, 825-834, 843-852, 872-883
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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	Indicator	Location/Page where Standard is found
Benchmark A: Explain that cells are the basic unit of structure and function of living organisms, that once life originated all cells come from pre-existing cells, and that there are a variety of cell types.		
<i>Characteristics and Structure of Life (Grade 10)</i>	1. Explain that living cells a. are composed of a small number of key chemical elements (carbon, hydrogen, oxygen, nitrogen, phosphorus and sulfur) b. are the basic unit of structure and function of all living things c. come from pre-existing cells after life originated, and d. are different from viruses	552-558, 591-596, 597-605, 610-619, 620-626
	2. Compare the structure, function and interrelatedness of cell organelles in eukaryotic cells (e.g., nucleus, chromosome, mitochondria, cell membrane, cell wall, chloroplast, cilia, flagella) and prokaryotic cells.	532-543, 552-558, 610-619, 620-626

Benchmark B: Explain the characteristics of life as indicated by cellular processes and describe the process of cell division and development.		
<i>Characteristics and Structure of Life (Grade 10)</i>	3. Explain the characteristics of life as indicated by cellular processes including a. homeostasis b. energy transfers and transformation c. transportation of molecules d. disposal of wastes e. synthesis of new molecules	532-543, 544-551, 552-558, 568-582, 591-596, 597-605, 610-619
	4. Summarize the general processes of cell division and differentiation, and explain why specialized cells are useful to organisms and explain that complex multicellular organisms are formed as highly organized arrangements of differentiated cells.	620-626
Benchmark C: Explain the genetic mechanisms and molecular basis of inheritance.		
<i>Heredity(Grade 10)</i>	5. Illustrate the relationship of the structure and function of DNA to protein synthesis and the characteristics of an organism.	620-626
	6. Explain that a unit of hereditary information is called a gene, and genes may occur in different forms called alleles (e.g., gene for pea plant height has two alleles, tall and short).	620-626, 627-636
	7. Describe that spontaneous changes in DNA are mutations, which are a source of genetic variation. When mutations occur in sex cells, they may be passed on to future generations; mutations that occur in body cells may affect the functioning of that cell or the organism in which that cell is found.	620-626, 627-636
	8. Use the concepts of Mendelian and non-Mendelian genetics (e.g., segregation, independent assortment, dominant and recessive traits, sex-linked traits and jumping genes) to explain inheritance.	620-626, 627-636
Benchmark D: Explain the flow of energy and the cycling of matter through biological and ecological systems (cellular, organismal and ecological).		

<i>Diversity and Interdependence of Life (Grade 10)</i>	9. Describe how matter cycles and energy flows through different levels of organization in living systems and between living systems and the physical environment. Explain how some energy is stored and much is dissipated into the environment as thermal energy (e.g., food webs and energy pyramids).	544-551, 552-558, 559-567, 568-582, 591-596, 597-605, 714-724, 804-815, 843-852, 872-883
	10. Describe how cells and organisms acquire and release energy (photosynthesis, chemosynthesis, cellular respiration and fermentation).	544-551, 552-558, 559-567, 568-582, 591-596, 597-605, 825-834
	11. Explain that living organisms use matter and energy to synthesize a variety of organic molecules (e.g., proteins, carbohydrates, lipids and nucleic acids) and to drive life processes (e.g., growth, reacting to the environment, reproduction and movement).	544-551, 552-558, 559-567, 591-596, 597-605, 714-724
<u>Benchmark E:</u> Explain how evolutionary relationships contribute to an understanding of the unity and diversity of life.		
<i>Diversity and Interdependence of Life (Grade 10)</i>	12. Explain how an object's kinetic energy depends on its mass and its speed ($KE = \frac{1}{2}mv^2$).	33-46, 47-51, 101-106, 107-112, 124-130
	13. Explain that the variation of organisms within a species increases the likelihood that at least some members of a species will survive under gradually changing environmental conditions.	610-619, 627-636, 637-646, 647-653
	14. Relate diversity and adaptation to structures and their functions in living organisms (e.g., adaptive radiation).	610-619, 627-636, 637-646, 647-653
<u>Benchmark F:</u> Explain the structure and function of ecosystems and relate how ecosystems change over time.		
<i>Diversity and Interdependence of Life (Grade 10)</i>	15. Explain how living things interact with biotic and abiotic components of the environment (e.g., predation, competition, natural disasters and weather).	532-543, 544-551, 552-558, 559-567, 568-582, 591-596, 597-605, 804-815

	16. Relate how distribution and abundance of organisms and populations in ecosystems are limited by the ability of the ecosystem to recycle materials and the availability of matter, space and energy.	532-543, 544-551, 552-558, 559-567, 568-582, 591-596, 597-605, 804-815
	17. Conclude that ecosystems tend to have cyclic fluctuations around a state of approximate equilibrium that can change when climate changes, when one or more new species appear as a result of immigration or when one or more species disappear.	532-543, 544-551, 552-558, 559-567, 568-582, 591-596, 597-605, 804-815
<u>Benchmark G:</u> Describe how human activities can impact the status of natural systems.		
<i>Diversity and Interdependence of Life (Grade 10)</i>	18. Describe ways that human activities can deliberately or inadvertently alter the equilibrium in ecosystems. Explain how changes in technology/biotechnology can cause significant changes, either positive or negative, in environmental quality and carrying capacity.	597-605, 804-815, 843-852, 853-861, 862-871
	19. Illustrate how uses of resources at local, state, regional, national, and global levels have affected the quality of life (e.g., energy production and sustainable vs. nonsustainable agriculture).	804-815, 843-852, 853-861, 862-871
<u>Benchmark H:</u> Describe a foundation of biological evolution as the change in gene frequency of a population over time. Explain the historical and current scientific developments, mechanisms and processes of biological evolution. Describe how scientists continue to investigate and critically analyze aspects of evolutionary theory. (The intent of this benchmark does not mandate the teaching or testing of intelligent design.)		
<i>Evolutionary Theory (Grade 10)</i>	20. Recognize that a change in gene frequency (genetic composition) in a population over time is a foundation of biological evolution.	627-636, 637-646, 647-653

	21. Explain that natural selection provides the following mechanism for evolution; undirected variation in inherited characteristics exist within every species. These characteristics may give individuals an advantage or disadvantage compared to others in surviving and reproducing. The advantaged offspring are more likely to survive and reproduce. Therefore, the proportion of individuals that have advantageous characteristics will increase. When an environment changes, the survival value of some inherited characteristics may change.	627-636, 637-646, 647-653
	22. Describe historical scientific developments that occurred in evolutionary thought (e.g., Lamarck and Darwin, Mendelian Genetics and modern synthesis).	627-636, 637-646, 647-653
	23. Describe how scientists continue to investigate and critically analyze aspects of evolutionary theory. (The intent of this indicator does not mandate the teaching or testing of intelligent design.)	637-646, 647-653
<u>Benchmark I:</u> Explain how natural selection and other evolutionary mechanisms account for the unity and diversity of past and present life forms.		
<i>Evolutionary Theory (Grade 10)</i>	24. Analyze how natural selection and other evolutionary mechanisms (e.g. genetic drift, immigration, emigration, mutation) and their consequences provide a scientific explanation for the diversity and unity of past life forms, as depicted in the fossil record, and present life forms.	627-636, 637-646, 647-653, 693-702, 752-760
	25. Explain that life on Earth is thought to have begun as simple, one celled organisms approximately 4 billion years ago. During most of the history of Earth only single celled microorganisms existed, but once cells with nuclei developed about a billion years ago, increasingly complex multicellular organisms evolved.	637-646, 647-653, 693-702, 752-760
<u>Benchmark J:</u> Summarize the historical development of scientific theories and ideas, and describe emerging issues in the study of life sciences.		

<i>Historical Perspectives and Scientific Revolutions (Grade 10)</i>	26. Use historical examples to explain how new ideas are limited by the context in which they are conceived. These ideas are often rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly through contributions from many different investigators (e.g., biological evolution, germ theory, biotechnology and discovering germs).	637-646, 647-653
	27. Describe advances in life sciences that have important long-lasting effects on science and society (e.g., biological evolution, germ theory, biotechnology and discovering germs).	637-646, 647-653
	28. Analyze and investigate emerging scientific issues (e.g., genetically modified food, stem cell research, genetic research and cloning).	637-646, 647-653

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	Indicator	Location/Page where Standard is found
<u>Benchmark A:</u> Describe that matter is made of minute particles called atoms and atoms are comprised of even smaller components. Explain the structure and properties of atoms.		

<i>Nature of Matter(Grade 9)</i>	1. Recognize that all atoms of the same element contain the same number of protons, and elements with the same number of protons may or may not have the same mass. Those with different masses (different numbers of neutrons) are called isotopes.	360-366, 372-376, 396-405, 407-414, 415-424, 425-433, 434-441, 442-448, 449-460
	2. Illustrate that atoms with the same number of positively charged protons and negatively charged electrons are electrically neutral.	360-366, 390-395, 396-405, 407-414
	4. Show that when elements are listed in order according to the number of protons (called the atomic number), the repeating patterns of physical and chemical properties identify families of elements. Recognize that the periodic table was formed as a result of the repeating pattern of electron configurations.	328-337, 390-395, 415-424, 425-433, 434-441, 479-485, 520-523, 666-677
	5. Describe how ions are formed when an atom or a group of atoms acquire an unbalanced charge by gaining or losing one or more electrons.	360-366, 372-376, 407-414, 442-448
<u>Benchmark B: Explain how atoms react with each other to form other substances and how molecules react with each other or other atoms to form even different substances.</u>		
<i>Nature of Matter(Grade 9)</i>	6. Explain that the electric force between the nucleus and the electrons hold an atom together. Relate that on a larger scale, electric forces hold solid and liquid materials together (e.g., salt crystals and water).	338-343, 360-366, 372-376, 396-406, 407-414, 449-460
	7. Show how atoms may be bonded together by losing, gaining or sharing electrons and that in a chemical reaction, the number, type of atoms and total mass must be the same before and after the reaction (e.g., writing correct chemical formulas and writing balanced chemical equations).	360-366, 396-406, 407-414, 415-424, 425-433, 434-441, 442-448, 473-478, 479-485, 486-495, 520-525

	8. Demonstrate that the pH scale (0-14) is used to measure acidity and classify substances or solutions as acidic, basic, or neutral.	473-478, 511-519, 843-852
<u>Benchmark C:</u> Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance.		
<i>Nature of Matter(Grade 9)</i>	9. Investigate the properties of pure substances and mixtures (e.g., density, conductivity, hardness, properties of alloys, superconductors and semiconductors).	320-327, 328-337, 338-343, 360-366, 344-349, 350-359, 367-371, 372-382, 466-472, 473-478, 479-485, 486-495, 510-519, 520-523, 862-871, 872-883
	10. Compare the conductivity of different materials and explain the role of electrons in the ability to conduct electricity.	320-327, 360-366, 872-883, 390-395
<u>Benchmark D:</u> Explain the movement of objects by applying Newton's three laws of motion.		
<i>Forces and Motion(Grade 9)</i>	21. Demonstrate that motion is a measurable quantity that depends on the observer's frame of reference and describe the object's motion in terms of position, velocity, acceleration and time.	6-16, 17-27, 33-46, 47-51, 280-288, 289-295, 296-301, 969-978
	22. Demonstrate that any object does not accelerate (remains at rest or maintains a constant speed and direction of motion) unless an unbalanced (net) force acts on it.	17-27, 33-46, 47-51, 71-76, 101-106, 107-112, 119-123, 124-130, 969-978
	23. Explain the change in motion (acceleration) of an object. Demonstrate that the acceleration is proportional to the net force acting on the object and inversely proportional to the mass of the object. ($F_{net}=ma$. Note that weight is the gravitational force on a mass.)	17-27, 33-46, 47-51, 71-76, 88-95, 101-106, 107-112, 113-118, 119-123, 124-130, 258-264, 969-978

	24. Demonstrate that whenever one object exerts a force on another, an equal amount of force is exerted back on the first object.	47-51, 101-106, 107-112, 113-118, 119-123, 124-130, 969-978
	25. Demonstrate the ways in which frictional forces constrain the motion of objects (e.g., a car traveling around a curve, a block on an inclined plane, a person running, an airplane in flight).	52-57, 71-76, 969-978
<u>Benchmark E:</u> Demonstrate that energy can be considered to be either kinetic (motion) or potential (stored).		
<i>Nature of Energy(Grade 9)</i>	12. Explain how an object's kinetic energy depends on its mass and its speed ($KE=\frac{1}{2}mv^2$).	33-46, 47-51, 101-106, 107-112, 124-130, 969-978
	13. Demonstrate that near Earth's surface an object's gravitational potential energy depends upon its weight (mg where m is the object's mass and g is the acceleration due to gravity) and height (h) above a reference surface ($PE=mgh$).	33-46, 47-51, 250-257, 258-264, 969-978
<u>Benchmark F:</u> Explain how energy may change form or be redistributed but the total quantity of energy is conserved.		
<i>Nature of Matter(Grade 9)</i>	3. Describe radioactive substances as unstable nuclei that undergo random spontaneous nuclear decay emitting particles and/or high energy wavelike radiation.	449-460, 660-669, 703-713, 816-824
<i>Nature of Energy(Grade 9)</i>	11. Explain how thermal energy exists in the random motion and vibrations of atoms and molecules. Recognize that the higher the temperature, the greater the average atomic or molecular motion, and during changes of state the temperature remains constant.	328-337, 503-509, 804-815, 816-824, 872-883
	14. Summarize how nuclear reactions convert a small amount of matter into a large amount of energy. (Fission involves the splitting of a large nucleus into smaller nuclei; fusion is the joining of two small nuclei into a larger nucleus at extremely high energies.)	449-460, 660-669, 703-713, 816-824

	15. Trace the transformations of energy within a system (e.g., chemical to electrical to mechanical) and recognize that energy is conserved. Show that these transformations involve the release of some thermal energy.	58-62, 63-70, 703-713, 804-815, 816-824, 843-852, 872-883
	16. Illustrate that chemical reactions are either endothermic or exothermic (e.g., cold packs, hot packs and the burning of fossil fuels).	496-502, 503-509, 804-815, 872-883
	17. Demonstrate that thermal energy can be transferred by conduction, convection or radiation (e.g., through materials by the collision of particles, moving air masses or across empty space by forms of electromagnetic radiation).	101-106, 703-713, 804-815, 825-834, 843-852, 872-883
<u>Benchmark G:</u> Demonstrate that waves (e.g., sound, seismic, water and light) have energy and waves can transfer energy when they interact with matter.		
<i>Nature of Energy(Grade 9)</i>	18. Demonstrate that electromagnetic radiation is a form of energy. Recognize that light acts as a wave. Show that visible light is a part of the electromagnetic spectrum (e.g., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays).	172-179, 180-188, 189-194, 195-203, 204-208, 714-724, 872-883, 804-815
	19. Show how the properties of a wave depend on the properties of the medium through which it travels. Recognize that electromagnetic waves can be propagated without a medium.	144-157, 158-163, 164-171, 265-273, 714-724, 804-815
	20. Describe how waves can superimpose on one another when propagated in the same medium. Analyze conditions in which waves can bend around corners, reflect off surfaces, are absorbed by materials they enter, and change direction and speed when entering a different material.	144-157, 158-163, 164-171, 172-179, 265-273, 274-279, 714-724, 804-815
<u>Benchmark H:</u> Trace the historical development of scientific theories and ideas, and describe emerging issues in the study of physical sciences.		

<p><i>Historical Perspectives and Scientific Revolutions(Grade 9)</i></p>	<p>26. Use historical examples to explain how new ideas are limited by the context in which they are conceived; are often initially rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly through contributions from many different investigators (e.g., atomic theory, quantum theory and Newtonian mechanics).</p>	<p>280-288, 816-824, 888-897, 989-1001</p>
	<p>27. Describe advances and issues in physical science that have important, long-lasting effects on science and society (e.g., atomic theory, quantum theory, Newtonian mechanics, nuclear energy, nanotechnology, plastics, ceramics and communication technology).</p>	<p>96-100, 280-288, 307-312, 781-789, 816-824, 843-852, 872-883</p>

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	Indicator	Location/Page where Standard is found
<u>Benchmark A:</u> Explain the ways in which the processes of technological design respond to the needs of society.		
<i>Abilities To Do Technological Design (Grade 9)</i>	2. Identify a problem or need, propose designs and choose among alternative solutions for the problem.	96-100, 124-130, 888-897, 898-906, 935-941, 958-968, 979-988
	3. Explain why a design should be continually assessed and the ideas of the design should be tested, adapted and refined.	96-100, 124-130, 898-906, 922-926, 979-988
<i>Abilities To Do Technological Design (Grade 10)</i>	3. Explain that when evaluating a design for a device or process, thought should be given to how it will be manufactured, operated, maintained, replaced and disposed of in addition to who will sell, operate and take care of it. Explain how the costs associated with these considerations may introduce additional constraints on the design.	113-118, 119-123, 131-136, 235-243, 989-1001
<u>Benchmark B:</u> Explain that science and technology are interdependent; each drives the other.		
<i>Understanding Technology (Grade 9)</i>	1. Describe means of comparing the benefits with the risks of technology and how science can inform public policy.	107-112, 372-376, 816-824

<i>Understanding Technology (Grade 10)</i>	1. Cite examples of ways that scientific inquiry is driven by the desire to understand the natural world and how technology is driven by the need to meet human needs and solve human problems.	714-724, 781-791, 804-815, 872-883
	2. Describe examples of scientific advances and emerging technologies and how they may impact society.	367-371, 660-669, 714-724, 792-799, 843-852

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	Indicator	Location/Page where Standard is found
<u>Benchmark A:</u> Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations.		
<i>Doing Scientific Inquiry (Grade 9)</i>	1. Distinguish between observations and inferences given a scientific situation.	235-240, 250-257, 989-1001
	2. Research and apply appropriate safety precautions when designing and conducting scientific investigations (e.g., OSHA, Material Safety Data Sheets [MSDS], eyewash, goggles and ventilation).	235-240, 250-257, 898-904, 907-914, 922-926, 979-988
	3. Construct, interpret and apply physical and conceptual models that represent or explain systems, objects, events or concepts.	82-87, 88-95, 258-264, 265-273, 888-897, 898-906, 958-968

	4. Decide what degree of precision based on the data is adequate and round off the results of calculator operations to the proper number of significant figures to reasonably reflect those of the inputs.	350-359, 684-692, 693-702
	5. Develop oral and written presentations using clear language, accurate data, appropriate graphs, tables, maps and available technology.	88-95, 158-163, 195-203, 328-337, 898-906
	6. Draw logical conclusions based on scientific knowledge and evidence from investigations.	96-100, 670-683, 693-702, 627-636
<i>Doing Scientific Inquiry(Grade 10)</i>	1. Research and apply appropriate safety precautions when designing and conducting scientific investigations (e.g. OSHA, MSDS, eyewash, goggles and ventilation).	204-209, 280-288, 320-327, 328-337, 532-543, 862-871
	2. Present scientific findings using clear language, accurate data, appropriate graphs, tables, maps and available technology.	88-95, 158-163, 195-203, 328-337, 898-906
	3. Use mathematical models to predict and analyze natural phenomena.	82-87, 88-95, 258-264, 265-273, 684-692, 888-897, 898-906, 958-968
	4. Draw conclusions from inquiries based on scientific knowledge and principles, the use of logic and evidence (data) from investigations.	637-646, 647-653, 660-669, 684-692, 693-702
	5. Explain how new scientific data can cause any existing scientific explanation to be supported, revised or rejected.	660-669, 684-692, 693-702

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	Indicator	Location/Page where Standard is found
<u>Benchmark A:</u> Explain that scientific knowledge must be based on evidence, be predictive, logical, subject to modification and limited to the natural world.		
<i>Nature of Science(Grade 9)</i>	1. Comprehend that many scientific investigations require the contributions of women and men from different disciplines in and out of science. These people study different topics, use different techniques and have different standards of evidence but share a common purpose - to better understand a portion of our universe.	77, 137, 209, 244, 313, 526, 606, 654, 736, 800, 884, 1002
	3. Demonstrate that reliable scientific evidence improves the ability of scientists to offer accurate predictions.	637-646, 647-653, 946-957
<i>Nature of Science(Grade 10)</i>	1. Discuss science as a dynamic body of knowledge that can lead to the development of entirely new disciplines.	637-646, 647-653, 922-926
	2. Describe that scientists may disagree about explanations of phenomena, about interpretation of data or about the value of rival theories, but they do agree that questioning, response to criticism and open communication are integral to the process of science.	693-702, 725-735, 989-1001

	3. Recognize that science is a systematic method of continuing investigation, based on observation, hypothesis testing, measurement, experimentation, and theory building, which leads to more adequate explanations of natural phenomena.	164-171, 258-264, 280-288, 360-366, 989-1001
<u>Benchmark B: Explain how scientific inquiry is guided by knowledge, observations, ideas and questions.</u>		
<i>Scientific Theories(Grade 9)</i>	5. Justify that scientific theories are explanations of large bodies of information and/or observations that withstand repeated testing.	258-264, 280-288, 289-295, 989-1001
	6. Explain that inquiry fuels observation and experimentation that produce data that are the foundation of scientific disciplines. Theories are explanations of these data.	235-240, 258-264, 280-288, 289-295, 989-1001
	7. Recognize that scientific knowledge and explanations have changed over time, almost always building on earlier knowledge.	235-240, 258-264, 280-288, 289-295
<u>Benchmark C: Describe the ethical practices and guidelines in which science operates.</u>		
<i>Nature of Science(Grade 9)</i>	2. Illustrate that the methods and procedures used to obtain evidence must be clearly reported to enhance opportunities for further investigations.	88-95, 158-163, 258-264, 280-288, 289-295
<i>Ethical Practices(Grade 9)</i>	4. Explain how support of ethical practices in science (e.g., individual observations and confirmations, accurate reporting, peer review and publication) are required to reduce bias.	296-301, 530-531
<i>Ethical Practices(Grade 10)</i>	4. Recognize that ethical considerations limit what scientists can do.	296-301, 530-531
	5. Recognize that research involving voluntary human subjects should be conducted only with the informed consent of the subjects and follow rigid guidelines and/or laws.	620-626
	6. Recognize that animal-based research must be conducted according to currently accepted professional standards and laws.	610-619

<u>Benchmark D: Recognize that scientific literacy is part of being a knowledgeable citizen.</u>		
<i>Science and Society(Grade 9)</i>	8. Illustrate that much can be learned about the internal workings of science and the nature of science from the study of scientists, their daily work and their efforts to advance scientific knowledge in their area of study.	77, 137, 209, 244, 313, 526, 606, 654, 736, 800, 884, 1002
	9. Investigate how the knowledge, skills and interests learned in science classes apply to the careers students plan to pursue.	77, 137, 209, 244, 313, 526, 606, 654, 736, 800, 884, 1002
<i>Science and Society(Grade 10)</i>	7. Investigate how the knowledge, skills and interests learned in science classes apply to the careers students plan to pursue.	77, 137, 209, 244, 313, 526, 606, 654, 736, 800, 884, 1002