Core Science Curriculum Framework

An Invitation for Students and Teachers to Explore Science and Its Role in Society

Feedback Edition

Introduction

I. A Vision for Connecticut Science Education in the 21st Century

Toward the end of the 20th century the National Research Council published the National Science Education Standards, which stated that the goal of school science education should be **scientific literacy for all students.** In 2003, the Connecticut State Department of Education convened a committee of experienced educators to redesign its science framework and to define what all students should learn in their school science programs in order to make the vision of 'science literacy for all' a reality for Connecticut students.

The vision of the new framework is based on contemporary trends in science and society, including:

- the growing need for citizens to be scientifically literate in order to deal with science related personal and global issues;
- the growing availability and use of information technologies to access, analyze, share and communicate knowledge;
- the growing role of mission-oriented and applied science research in our society; and
- the evolving interdisciplinary nature of contemporary science knowledge and careers.

All students, regardless of their academic standing or career aspirations, should have access to a rich and challenging science curriculum that will assure them opportunities to acquire fundamental understandings about life, chemistry, physics and earth science content, as well as the ways in which science knowledge is generated and critiqued.

Although school districts will develop their own science curricula to meet the learning needs, interests and values of their own school communities, all school science programs should encourage and support student interest in and excitement about science by providing opportunities for students to become actively engaged with the content and nature of scientific endeavors. Therefore, the framework describes a coherent sequence of fundamental life, chemistry, physics and earth science concepts and skills that all students should learn through engaging intellectual and hands-on explorations of natural phenomena.

The science framework is based on content standards derived from the *National Science Education Standards* and the *Project 2061 Benchmarks for Science Literacy*. Acknowledging the fact that the current body of science knowledge is very large, encompassing different disciplines and continuously growing, the new science framework attempts to reduce the breadth of the content and identify the most important science concepts, processes and applications that all students should learn in order to become scientifically literate and pursue more advanced science studies.

II. Framework Goals

The science framework has three main goals:

1. Articulating a vision for science education in Connecticut in which all students are engaged in the study of basic science concepts and processes, and explore the interrelationship among science, technology and society.
2. Providing school districts and science educators with a contemporary basis for the development of their own science programs and curricula.
3. Defining the core science knowledge and performances that are expected from all students and that will be assessed through statewide science assessments.

It is hoped that, as a result of science education in Connecticut schools, all students will develop scientific literacy and will be able to:

- Understand and apply basic concepts, principles and theories of biology, chemistry, physics, and earth (including ecology) and space sciences and their interrelationships;
- Recognize and participate in scientific endeavors which are evidence-based, and use inquiry skills that lead to a greater understanding of the world;
- Identify and solve problems through scientific exploration, including the formulation of hypotheses, design of experiments, use of technology, analysis of data and drawing of conclusions;
- Select and properly use appropriate laboratory technology, equipment and materials, including measuring and sensing devices;
- Understand and use, when appropriate, existing and emerging technologies which have an effect on society and our quality of life, including personal, academic and work environments;
- Analyze the possibilities and limits of science and technology in order to make and defend decisions about societal issues; and
- Understand that the way in which scientific knowledge is formulated is crucial to the validity of that knowledge.

III. The Structure of the Science Framework

The science framework describes an approach to science learning that starts with simple explorations of the natural world by elementary school students, moves into explorations and explanations of foundational science concepts in the middle school, and advances to explorations of science concepts and related global issues during the high school years. Schools will use the framework to develop their own science curriculum, including specific objectives, learning activities and assessments.

The Core Science Curriculum Framework is organized around *Content* S*tandards* and *Expected Performances* for elementary grades (preK-2, 3, 4 & 5), middle grades (6, 7 & 8), and high school (9-10*). Content Standards* are broad statements of main science concepts; *Expected Performances* define the more specific knowledge or abilities that will enable students to build these understandings. The *Expected Performances* provide a "blueprint" for the knowledge and skills that will be measured on the statewide science assessments.

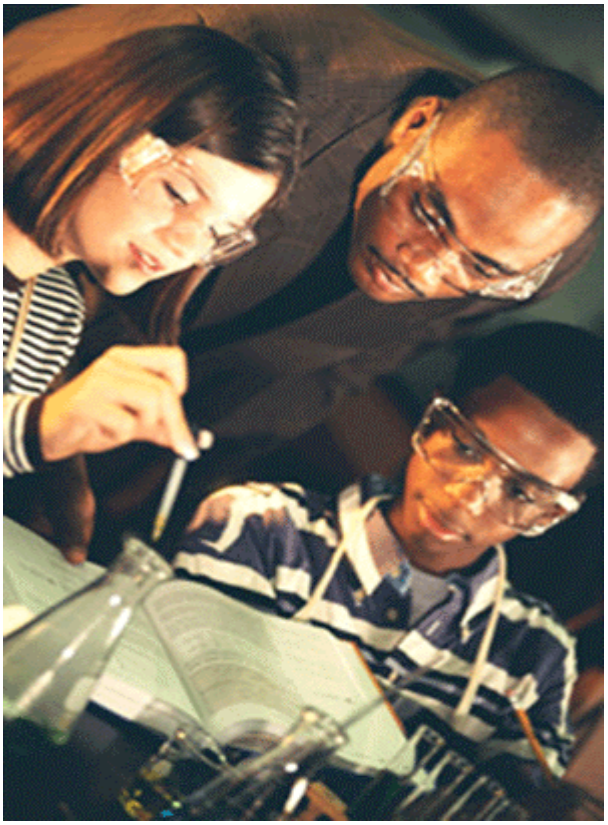
Each grade level includes content from the earth, life and physical sciences, with suggested explorations of science-related questions and issues. The main science concepts spiral through the grade clusters, each time treated with more depth and breadth, as developmentally appropriate for the students.

The intent of the framework is to describe a core body of science knowledge expected to be learned by all students, and assessed at elementary, middle and high school levels. Although the framework introduces concepts from the life, physical and earth sciences in each grade level, schools may choose to design yearly courses that focus on one science discipline at a time, allowing districts flexibility based on the needs of students and available instructional resources.

"The important thing is not to stop questioning." (Albert Einstein)

Content Standards and Expected Performances for

Elementary School Science



Feedback Edition

Pre K-2: Observing Our World	
Content Standards	**Expected Performances**
Inquiry: How Do We Make Sense of Our World? **preK-2.1** Answers to questions about the natural world can come from reliable sources of scientific information and from our own observations and investigations.	**preK-2(a)** Make observations and ask questions about nature. **preK-2(b)** Seek information in books, magazines and pictures. **preK-2(c)** Make predictions based on observed patterns. **preK-2(d)** Use senses and simple measuring tools to collect data. **preK-2(e)** Describe natural phenomena by words and drawings.
Properties of Solid Materials: How Can We Explore Them? **preK-2.2** Properties of objects and materials can be observed using our senses and measured using simple tools. **preK-2.3** We use materials that have suitable properties for the jobs that we want them to do.	**preK-2(f)** Learn how to use simple measuring tools (e.g., balances, rulers and thermometers) to quantify properties of objects and materials (e.g., weight, length, temperature). **preK-2(g)** Sort different *materials* by their properties (e.g., how strong, stiff, flexible and transparent are objects made out of wood, glass, plastic or metal) and relate the properties to the uses of objects made out of these materials. **preK-2(h)** Observe, measure and classify the properties of different *objects* (e.g., the color, texture, size, shape and weight of common classroom objects). **preK-2(i)** Sort different soils by their properties (e.g., particle size, color, composition) and relate the properties to soils' ability to retain water and support the growth of plants.
Properties of Plants and Animals: How Are They Alike and Different? **preK-2.4** Living things have certain characteristics that distinguish them from nonliving things. **preK-2.5** Many different kinds of living things inhabit the earth. **preK-2.6** Plants and animals have characteristic life cycles that include birth, maturation and death. **preK-2.7** Organisms have basic needs and different body parts that help them to satisfy those needs (e.g., plants need water, light and nutrients; animals need air, water and food).	**preK-2(j)** Observe and classify things as living or nonliving based on their physical and behavioral traits. **preK-2(k)** Observe and classify plants and animals based on their external features. **preK-2(l)** Observe and compare the defining characteristics of birds, fish, insects and mammals. **preK-2(m)** Grow and observe different organisms (e.g., insects, amphibians, plants), record data and describe the appearance of these organisms in different stages of their life cycle. **preK-2(n)** Perform simple experiments to explore and describe the effects of water and light on seed germination and plant growth.
Weather and the Sky: What Is Going On Up There? **preK-2.8** Weather conditions can be measured, described and predicted. **preK-2.9** Most objects in the solar system are in regular and predictable motion.	**preK-2(o)** Use instruments to measure daily weather conditions (e.g., thermometer, wind vane, rain gauge). **preK-2(p)** Record the daily weather conditions, and describe the relationship between temperature and precipitation in different seasons. **preK-2(q)** Observe and describe the apparent movement of the sun and moon across the sky.
Staying Healthy: What Keeps Our Bodies Healthy? **preK-2.10** To keep your body healthy you need a balanced diet, regular physical exercise and appropriate rest.	**preK-2(r)** Describe the basic components of a balanced diet (e.g., dairy products, meat, grains, fruits, and vegetables). **preK-2(s)** Relate the importance of physical activity, rest and sleep to maintaining good health.

Core Scientific Reasoning and Communication Skills for Elementary School Students*	
Content Standards	**Expected Performances**
SRC 3-5.1 Scientific investigation is a thoughtful and coordinated attempt to search out, describe and explain the natural world	**SRC 3-5.1(a)** Make observations and ask questions about objects, organisms and the environment. **SRC 3-5.1(b)** Seek relevant information in books, magazines and electronic sources of information. **SRC 3-5.1(c)** Design and conduct simple investigations. **SRC 3-5.1(d)** Employ simple equipment and measuring tools to gather data and extend the senses. **SRC 3-5.1(e)** Use data to construct reasonable explanations. **SRC 3-5.1(f)** Analyze, critique and communicate investigations using words, graphs and drawings.
SRC 3-5.2 Science literacy includes speaking, listening, presenting, interpreting, reading and writing about science.	**SRC 3-5.2(a)** Communicate ideas and support arguments about science-related matters using relevant science vocabulary, evidence and logic. **SRC 3-5.2(b)** Read fiction and non-fiction science-related text, and compose narrative, expository and persuasive texts. **SRC 3-5.2(c)** Search the web and locate relevant science information.
SRC 3-5.3 Mathematics provides useful tools for the description, analysis and presentation of scientific data and ideas.	**SRC 3-5.3(a)** Use measurement tools and units to describe objects and materials. Use mathematics to analyze, interpret and present data.

*** NOTE: THE CONTENT STANDARDS FOR SCIENTIFIC REASONING AND COMMUNICATION SHOULD BE LEARNED WITHIN THE CONTEXT OF THE CONTENT STANDARDS AND EXPECTED PERFORMANCES FOR LIFE, PHYSICAL AND EARTH SCIENCES.**

Grade 3: Exploring Our World	
Content Standards	**Expected Performances**
Changes in Matter: Is It There If We Can't See It? **3.1** Materials can exist in different states (e.g., solids, liquids or gases), and can be changed by heating or cooling. **3.2** Substances have characteristic properties and a mixture of substances can be separated using one or more of these characteristics.	**3(a)** Explore the properties of water in solid, liquid and gas states. **3(b)** Explore and describe the effect of heating and cooling on water properties (e.g., freezing, melting, evaporation, condensation). **3(c)** Explain how physical properties of materials (e.g., floating and sinking, magnetism, particle size) can be used to separate mixtures to their components.
Habitats: How Do They Support Life? **3.3** Organisms can survive and reproduce only in environments that meet their basic needs. **3.4** All animals depend on plants. Some animals eat plants and others eat the animals that eat plants.	**3(d)** Explore how different animals obtain water, food and shelter in specific habitats. **3(e)** Describe the relationships among different organisms (e.g., producers and consumers, predator and prey) in simple food chains.
Water: What Makes the Rain? **3.5** Water covers the majority of the Earth's surface and it circulates through the crust, oceans and atmosphere.	**3(f)** Explore the properties of water (e.g., transparency, shapelessness, flow) and how it moves through different types of earth materials. **3(g)** Explore the relationship between the water cycle, cloud formation and precipitation.
Earth Materials: How Do We Use Them to Improve Our Lives? **3.6** Earth materials provide resources for all living things, but these resources are not unlimited and should be conserved.	**3(h)** Relate the properties of rocks, soils and minerals to their potential uses. **3(i)** Explore various ways to conserve earth resources (e.g., reduce, reuse, and recycle).

Grade 4: Exploring Changes	
Content Standards	**Expected Performances**
Electricity, Magnetism and Motion: How Are They Related? **4.1** Electricity in circuits can produce light, heat, sound and magnetic effects. **4.2** Changes in speed or direction of motion are caused by forces; the greater the force is, the greater the change.	**4(a)** Explore the flow of current in simple circuits, and the transformation of electrical energy into light, heat, and sound. **4(b)** Explore the properties of magnets and how they can be used to make objects move. **4(c)** Explore the effects of pushes and pulls on the motion of objects. **4(d)** Explore the effect of force and mass on the motion of objects.
Biomes: How Do Plants and Animals Survive In Different Places? **4.3** The living and nonliving things in a region interact with each other. **4.4** Organisms have physical and behavioral adaptations that improve their chances to survive in different environments.	**4(e)** Compare the environmental conditions in New England to those of tropical rain forest, desert, and arctic tundra. **4(f)** Explore and describe the anatomical and behavioral adaptations of plants and animals to variations in environmental conditions such as temperature and precipitation.
Land Formations: What Shapes the Face of the Earth? **4.5** The Earth's surface is shaped by slow processes, such as erosion and weathering, and by rapid processes, such as earthquakes and volcanoes.	**4(g)** Explore and describe the role of water in erosion and river formation. **4(h)** Describe the role of volcanoes and earthquakes in shaping the Earth's surface.
How Do Human Activities Affect Ecosystems? **4.6** When the environment changes, some organisms survive and reproduce and others die or move to another location.	**4(i)** Describe the relationship between changes in the environment and the extinction of organisms, and explore efforts to save endangered species.

Grade 5: Exploring Energy & Life Cycles	
Content Standards	**Expected Performances**
Light and Sound: How Do We Sense Them? **5.1** Sound is a form of energy that is produced by the vibration of objects and is transmitted by the vibration of air and objects. **5.2** Light is a form of energy that travels in a straight line and can be reflected by a mirror, refracted by a lens, or absorbed by objects.	**5(a)** Explore how sound is produced and transmitted. **5(b)** Explore and explain how the pitch and volume of sound can be changed. **5(c)** Explore the transmission, absorption, reflection and refraction of light. **5(d)** Explore how the structures of the human ear and eye enable hearing and seeing.
Nature and Nurture: How Do They Affect the Characteristics of Plants? **5.3** Many characteristics of an organism are inherited from the parents, but others result from interactions with the environment and cannot be passed to the next generation.	**5(e)** Explore the life cycles of flowering plants (i.e., germination, pollination, seed production and dispersal.)
Earth, Moon and Sun: How Do They Interact? **5.4** The predictable movement of the Earth and the moon relative to the sun explains cycles such as day/night, years, moon phases and eclipses.	**5(f)** Explore and describe the role of the sunlight in the appearance of the moon. **5(g)** Explore the pattern of the lunar cycle to explain the orbit of the moon around the Earth. **5(h)** Explore the movement of the Earth (e.g., rotation and revolution) around the sun and its relation to day, night and the seasons.
Technology: How Does It Help Us to Extend Our Senses? **5.5** Humans have the capacity to build and use tools to advance the quality of their lives.	**5(i)** Compare and contrast the structures of the human eye and the camera. **5(j)** Compare and contrast the structures of the human ear and the telephone.

Content Standards and Expected Performances for

Middle School Science

Feedback Edition

Core Scientific Reasoning and Communication Skills for Middle School Students*	
Content Standards	**Expected Performances**
SRC 6-8.1 Scientific investigation is a thoughtful and coordinated attempt to search out, describe and explain the natural world	**SRC 6-8.1(a)** Identify questions that can be answered through scientific investigations **SRC 6-8.1(b)** Seek relevant information in books, magazines and electronic sources of information. **SRC 6-8.1(c)** Design and conduct scientific investigations, including controlled lab experiments. **SRC 6-8.1(d)** Use appropriate tools and techniques to gather, analyze and interpret data. **SRC 6-8.1(e)** Use mathematical operations to analyze the data. **SRC 6-8.1(f)** Develop descriptions, explanations, predictions and models based on evidence and logical thinking **SRC 6-8.1(g)** Analyze, critique and communicate investigations by words, graphs and drawings.
SRC 6-8.2 Science literacy includes speaking, listening, presenting, interpreting, reading and writing about science.	**SRC 6-8.2(a)** Communicate ideas and support arguments about science-related matters using relevant science vocabulary, evidence and logic. **SRC 6-8.2(b)** Develop the interpretive, analytical and critical capacities needed for reading and writing various scientific texts. **SRC 6-8.2(c)** Use web search engines to locate relevant information, and examine the credibility and validity of on-line information sources.
SRC 6-8.3 Mathematics provides useful tools for the description, analysis and presentation of scientific data and ideas.	**SRC 6-8.3(a)** Use mathematics to analyze data, interpret it and present relationships between variables in bar and line graphs.

*** NOTE: THE CONTENT STANDARDS FOR SCIENTIFIC REASONING AND COMMUNICATION SHOULD BE LEARNED WITHIN THE CONTEXT OF THE CONTENT STANDARDS AND EXPECTED PERFORMANCES FOR LIFE, PHYSICAL AND EARTH SCIENCES.**

Grade 6: Energy	
Content Standards	**Expected Performances**
Work: How Much Energy Does It Take to Do the Job? **6.1** Energy is the ability to do work and can be either potential (energy of position) or kinetic (energy of motion). **6.2** Potential energy and kinetic energy can be transformed from one to the other, and both can be used to do work.	**6(a)** Perform experiments to explore the relationship between force, distance, and work. **6(b)** Explore how simple machines (e.g. inclined plane, pulleys and levers) are used to create mechanical advantage. **6(c)** Explore and describe how the transformations of potential and kinetic energy are used to do work.
Ecology: How Do Energy and Matter Flow Through Ecosystems? **6.3** Energy from sunlight is captured and transformed into chemical energy by green plants to support life in most ecosystems.	**6(d)** Explore and describe the exchange of carbon dioxide and oxygen during the process of photosynthesis in green plants. **6(e)** Describe matter and energy flow in food webs. **6(f)** Explore a natural or simulated ecosystem and describe the density and distribution of typical organisms in that ecosystem.
Weather and Climate: How Does the Sun's Energy Affect Phenomena on Earth? **6.4** Variation in the amount of the sun's energy hitting the Earth's surface affects daily and seasonal weather patterns. **6.5** Factors such as latitude, topography and proximity to an ocean affect regional climates.	**6(g)** Describe how the sun's energy affects air pressure in the atmosphere and influences the weather. **6(h)** Explore and describe the gas composition of the atmosphere and its protective effects on Earth. **6(i)** Explore how changes in the temperature of the atmosphere and the oceans affect the climate.
How Do We Design Technological Solutions to Problems? **6.6** People use scientific principles, creativity and careful analysis to invent technological devices to meet human needs.	**6(j)** Design and build simple machines to meet specific needs and make everyday tasks easier to perform.

Grade 7: Structures and Processes	
Content Standards	**Expected Performances**
Elements, Mixtures and Compounds: How Do Materials React With Each Other? **7.1** Elements are the simplest form of matter and they can be grouped by their chemical and physical properties. **7.2** Mixtures can be made from different combinations of elements and compounds in gases, liquids and solids. **7.3** The elements combine to produce compounds which account for the living and nonliving substances that we encounter.	**7(a)** Describe atomic structure, and explain how the properties of the first 10 elements in the Periodic Table are related to their atomic structure. **7(b)** Explore and describe how mixtures can be separated based on the original properties of the substances, such as density, boiling point and solubility. **7(c)** Explore how elements can combine to form simple compounds such as water, carbon dioxide and salts.
The Human Body: How Does It Work? **7.4** All organisms are made up of one or more cells that have common structures to maintain life. **7.5** Many organisms, including humans, have specialized organ systems that interact with each other to maintain dynamic internal balance.	**7(d)** Explore and describe the structures and function of a basic animal cell (e.g., nucleus, cytoplasm, mitochondria, and cell membrane). **7(e)** Explore and explain how materials move in and out of the cell through passive and active transport processes. **7(f)** Explore the structures of the human digestive, respiratory, and circulatory systems, and describe how they function to support life.
The Earth: Is It Still Changing? **7.6** The Earth is layered with a lithosphere, hot mantle and dense metallic core. **7.7** The rock cycle and soil formation are evidence that the Earth is continuously changing.	**7(g)** Explore and describe how the cycling of water in and out of the atmosphere ("the water cycle") shapes the face of the Earth. **7(h)** Explore how heat flow and movement of materials within the Earth cause the rock cycle, earthquakes and volcanic eruptions.
Infectious Diseases: Where Do They Come From? **7.8** Understanding the transmission of bacterial and viral diseases enables us to prevent, treat and cure many diseases.	**7(i)** Describe the cause and spreading mechanism of viral and bacterial diseases. **7(j)** Explore and explain the role of the immune system and how vaccination and antibiotics are used to enhance the fight against infectious diseases.

Grade 8: Systems and Changes	
Content Standards	**Expected Performances**
Laws of Motion: How Do They Explain Everyday Phenomena? **8.1** An object in motion that is not being subjected to a force will continue to move at a constant speed and in a straight line. **8.2** Unbalanced forces cause change in the speed and/or direction of an object's motion.	**8(a)** Explore how forces (pushes or pulls) speed up, slow down, stop, or change the direction of a moving object. **8(b)** Explore and explain how to measure the speed of objects in motion, calculate average speed, and illustrate the motion of objects in graphs of distance over time. **8(c)** Explore how Newton's laws of motion describe everyday phenomena.
Life: What Are Its Essential Characteristics? **8.3** Life is characterized by continuous transformations of energy and matter. **8.4** Reproduction is one of the defining characteristic of life and different organisms have different strategies for reproduction.	**8(d)** Explore and describe the nutritional needs of human beings in terms of nutrients and calories. **8(e)** Describe the differences between asexual and sexual reproduction and explain how sexual reproduction results in genetic variability. **8(f)** Explore and explain inheritance of traits in living organisms (e.g., genotype/phenotype, dominant/ recessive, sex determination).
The Solar System: What Forces Govern Its Motion? **8.5** The solar system is composed of planets and other objects that orbit the sun in regular and predictable motion. **8.6** Gravity is the force that governs the motions of the solar system, attracts objects to the Earth and influences tides.	**8(g)** Explore and explain the effect of gravity on the orbital movement of planets in the solar system. **8(h)** Explore and explain how the regular motion of the Sun, Earth and Moon explains the day, year, phases of the moon and eclipses. **8(i)** Compare and contrast the characteristics (i.e., orbital patterns, atmosphere, composition, temperature) of the planets in the solar system, and their potential to sustain life.
Space Explorations: What Do We Gain? **8.7** Space explorations provide information about the solar system, the universe and the possibility of life beyond Earth.	**8(j)** Explore how the space program provides new information about the solar system. **8(k)** Explore how life can be sustained in space.

Content Standards and Expected Performances for

High School Science

Grades 9-10

Feedback Edition

Core Scientific Reasoning and Communication Skills for High School Students*	
Content Standards	**Expected Performances**
SRC 9-10.1 Scientific inquiry is a thoughtful and coordinated attempt to search out, describe and explain the natural world.	**SRC 9-10(a)** Identify questions that can be answered through scientific investigations **SRC 9-10(b)** Seek relevant information in books, magazines and electronic sources of information. **SRC 9-10(c)** Design and conduct scientific investigations, including controlled lab experiments. **SRC 9-10(d)** Use appropriate tools and techniques to gather, analyze and interpret data. **SRC 9-10(e)** Use mathematical operations to analyze the data. **SRC 9-10(f)** Develop descriptions, explanations, predictions and models based on evidence and logical thinking **SRC 9-10(g)** Analyze, critique and communicate investigations by words, graphs and drawings.
SRC 9-10.2 Literacy in science education includes speaking, listening, presenting, interpreting, reading and writing about science.	**SRC 9-10(h)** Communicate ideas and support arguments about science-related matters using relevant science vocabulary, evidence and logic. **SRC 9-10(i)** Develop the interpretive, analytical and critical capacities needed for reading and writing various scientific texts. **SRC 9-10(j)** Learn how to efficiently use web search engines, and how to examine the relevance, credibility and validity of on-line information sources.
SRC 9-10.3 Mathematics provides useful tools for the description, analysis and presentation of scientific data and ideas.	**SRC 9-10(k)** Use mathematics to analyze, interpret and present relationships between variables in various forms. **SRC 9-10(l)** Use computer-based tools to collect, graph and analyze data.

*** NOTE: THE CONTENT STANDARDS FOR SCIENTIFIC REASONING AND COMMUNICATION SHOULD BE LEARNED AND USED WITHIN THE CONTEXT OF THE SCIENCE CONCEPTS DESCRIBED IN STRANDS I THROUGH VI.**

I – Alternative Energy Resources	
Content Standards	**Expected Performances**
HSI.1 Energy: How is it Transferred and Transformed? The total matter and energy of the universe is constant. Energy cannot be created or destroyed, but it can be changed from one form to another.	**I(a)** Describe the transformation and conservation of kinetic and potential energy in mechanical, chemical and electrical systems. **I(b)** Explore and describe how electricity is generated, transferred and used in modern technologies.
HSI.2 Radioactivity: What Are Its Uses and Risks? Radioactive elements decay and emit radiation which can be both beneficial and/or hazardous.	**I(c)** Describe how radioactive isotopes spontaneously decay to produce different atoms and emit radiation. **I(d)** Describe how nuclear fission reactions are used to produce heat in nuclear plants. **I(e)** Explore the benefits and risks of using radioactive materials and radiation in modern technologies (e.g., energy production in nuclear plants, food preservation by irradiation).
HSI.3 Energy Resources: How Can We Meet Global Energy Needs? Current fuel resources are limited and renewable energy sources should be explored.	**I(f)** Investigate the advantages and disadvantages of using fossil fuels, nuclear energy, winds, sunlight, hydrogen and alcohols as sources of energy.

II – A Balanced Environment	
Content Standards	**Expected Performances**
HSII.1- Population Dynamics: What Determines the Size of a Population? Living things have the capacity to produce populations of infinite size, but environments and resources are finite and therefore limit population size.	**II(a)** Explore the factors that affect the growth patterns, density and distribution of populations. **II(b)** Explore how human beings use technology to increase the carrying capacity of their environment (e.g., agriculture, medicine, transportation).
HSII.2 - Chemical Reactions: How Are New Materials Formed? Atoms react with each other to form molecules, and the configuration of atoms and molecules determines the properties of the new materials.	**II(c)** Describe how atoms combine to produce compounds with new properties through the transfer or sharing of electrons. **II(d)** Explore reactants and products (e.g., CO, NOx, SO_2, Ozone, particulates) in combustion reactions. **II(e)** Describe the chemical structure of acids and bases, and explain the change of pH in neutralization reactions.
HSII.3 - The Environment – How Can We Sustain Its Health? The environment becomes degraded due to the increase consumption of natural resources and use of synthetic materials.	**II(f)** Explore and explain the causes of air pollution and the possible effects on human health and the environment. **II(g)** Explore the quality of a local water resource (e.g., level of metal and non-metal ions, pH, concentration of gases), and what can be done to preserve the quality of water resources.

III – Cell Chemistry & Biotechnology	
Content Standards	**Expected Performances**
HSIII.1 Cells: How Do They Carry Out Life Processes? The fundamental cell processes in plants, animals and bacteria depend on cell structure and chemistry.	**III(a)** Explore significant similarities and differences in the structure and function of bacteria, plant and animal cells. **III(b)** Explore and explain matter and energy transformations in photosynthesis and cellular respiration.
HSIII.2 Genetic Code: How Does DNA Provide The Information For Protein Synthesis? The genetic information in most organisms is carried in DNA molecules, and there are differences among the genomes of different species.	**III(c)** Describe the general structure of DNA and how it is transcribed to proteins that carry out the cell functions. **III(d)** Explore and explain the role of proteins as chemical catalysts (enzymes), including the effect of temperature and pH on the rate of enzymatic reactions.
HSIII.3 Biotechnology: How Do We Use It To Improve Life? Cell chemistry is the basis for purposeful modifications of gene compositions and cell products.	**III(e)** Investigate how principles of genetics and cellular chemistry are used to produce new foods and medicines in biotechnological processes.

IV – Organic & Synthetic Polymers	
Content Standards	**Expected Performances**
HSIV.1 Thermal Energy: How Does It Explain the Behavior of Gases, Liquids and Solids? The atoms and molecules of all matter are perpetually in motion, and changes in their average energy of motion result in changes in the temperature of the matter.	**IV(a)** Describe the structure and motion of particles in solids, liquids and gases. **IV(b)** Explore how changes in the amount of thermal energy in solids, liquids and gases affect their properties.
HSIV.2 Carbon: What Makes It the Building Block of Organic and Synthetic Materials? Carbon atoms can bond to one another in chains, rings and branching networks to form a variety of structures, including synthetic polymers, oils, and the large molecules essential to life.	**IV(c)** Describe the structure of the carbon atom and simple hydrocarbon compounds (e.g., ethane, ethylene and ethanol). **IV(d**) Explore how simple monomers are combined to create plastics (e.g., polyethylene, polyvinyl chloride, polystyrene). **IV(e)** Explore the structure of biopolymers such as proteins and carbohydrates.
HSIV.3 Plastics and Fibers: How Are They Made and Used? Advances in chemistry have personal and societal costs and benefits.	**IV(f)** Explore and explain the properties and uses of common synthetic polymers such as polyethylene, polyvinyl chloride, and polystyrene.

V – The Physics of Modern Technologies	
HSV.1 Electromagnetic Spectrum: What Are the Properties of Waves? Waves have energy and can transfer energy when they interact with matter.	**V(a)** Explore and explain how the properties of waves depend on the frequency and amplitude of the waves. **V(b)** Describe different classifications within the electromagnetic spectrum in terms of their wavelengths, frequency and energy. **V(c)** Explore and explain how heat can be transferred through materials and across space.
HSV.2 The Stars: Are They Still Evolving? Technology based on the electromagnetic spectrum is used to collect and interpret evidence about the structure of the universe.	**V(d)** Describe how stars evolved from a cloud of light elements that was condensed by gravity. **V(e)** Explore and describe how the measurement of energy produced by stars provides evidence for the current theory about the birth, development and death of stars.
HSV.3 Modern Technologies: How Do They Work? Important modern technologies are designed based on our understanding of the properties of electromagnetic radiation.	**V(f)** Investigate the use of electromagnetic radiation in communication technologies (e.g., radio, TV, cellular phones).

VI – Understanding Evolution	
Content Standards	**Expected Performances**
HSVI.1 Genetics and Evolution: What Makes Us What We Are? Evolution and biodiversity are the result of genetic changes that occur over time in constantly changing environments.	**VI(a)** Explore and explain how a multi-cellular organism develops from a single zygote, and how its phenotype depends on the genotype that was established at fertilization. **VI(b)** Explain how changes in DNA (mutations) in germ cells are passed to offspring and may affect the offspring's success in its environment. **VI(c)** Describe how natural selection leads to a diversity of species that are well suited to survive in their environment.
HSVI.2 Earth History: How and What Can We Learn From It? Interactions among the solid Earth, the oceans, the atmosphere and organisms have resulted in the ongoing evolution of the Earth system.	**VI(d)** Describe how the evolution of life influenced changes in the composition of the Earth's atmosphere. **VI(e)** Explore and explain how geological history can be determined using evidence from fossils, radioactive dating and rock sequences. **VI(f)** Describe how fossils of plants and animals provide evidence that life and environmental conditions on Earth are continuously changing.
HSVI.3 Plate Tectonics: What Moves the Continents? Energy within the Earth creates forces that drive the movement of plates, which results in changes in the Earth's surface.	**VI(g)** Describe how the outward transfer of Earth's internal heat drives convection and circulation in the mantle that propels the Earth's surface plates. **VI(h)** Explore and explain how earthquakes, volcanic eruptions and mountain building are explained by the theory of plate tectonics.