

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

*** 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
<p>HSI.1 Energy: How is it Transferred and Transformed?</p> <p>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.</p>	<p>I(a) Describe the transformation and conservation of kinetic and potential energy in mechanical, chemical and electrical systems.</p> <p>I(b) Explore and describe how electricity is generated, transferred and used in modern technologies.</p>
<p>HSI.2 Radioactivity: What Are Its Uses and Risks?</p> <p>Radioactive elements decay and emit radiation which can be both beneficial and/or hazardous.</p>	<p>I(c) Describe how radioactive isotopes spontaneously decay to produce different atoms and emit radiation.</p> <p>I(d) Describe how nuclear fission reactions are used to produce heat in nuclear plants.</p> <p>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).</p>
<p>HSI.3 Energy Resources: How Can We Meet Global Energy Needs?</p> <p>Current fuel resources are limited and renewable energy sources should be explored.</p>	<p>I(f) Investigate the advantages and disadvantages of using fossil fuels, nuclear energy, winds, sunlight, hydrogen and alcohols as sources of energy.</p>

II – A Balanced Environment

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<p>HSII.1- Population Dynamics: What Determines the Size of a Population?</p> <p>Living things have the capacity to produce populations of infinite size, but environments and resources are finite and therefore limit population size.</p>	<p>II(a) Explore the factors that affect the growth patterns, density and distribution of populations.</p> <p>II(b) Explore how human beings use technology to increase the carrying capacity of their environment (e.g., agriculture, medicine, transportation).</p>
<p>HSII.2 - Chemical Reactions: How Are New Materials Formed?</p> <p>Atoms react with each other to form molecules, and the configuration of atoms and molecules determines the properties of the new materials.</p>	<p>II(c) Describe how atoms combine to produce compounds with new properties through the transfer or sharing of electrons.</p> <p>II(d) Explore reactants and products (e.g., CO, NO_x, SO₂, Ozone, particulates) in combustion reactions.</p> <p>II(e) Describe the chemical structure of acids and bases, and explain the change of pH in neutralization reactions.</p>
<p>HSII.3 - The Environment – How Can We Sustain Its Health?</p> <p>The environment becomes degraded due to the increase consumption of natural resources and use of synthetic materials.</p>	<p>II(f) Explore and explain the causes of air pollution and the possible effects on human health and the environment.</p> <p>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.</p>

III – Cell Chemistry & Biotechnology

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

IV – Organic & Synthetic Polymers

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<p>HSIV.1 Thermal Energy: How Does It Explain the Behavior of Gases, Liquids and Solids?</p> <p>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.</p>	<p>IV(a) Describe the structure and motion of particles in solids, liquids and gases.</p> <p>IV(b) Explore how changes in the amount of thermal energy in solids, liquids and gases affect their properties.</p>
<p>HSIV.2 Carbon: What Makes It the Building Block of Organic and Synthetic Materials?</p> <p>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.</p>	<p>IV(c) Describe the structure of the carbon atom and simple hydrocarbon compounds (e.g., ethane, ethylene and ethanol).</p> <p>IV(d) Explore how simple monomers are combined to create plastics (e.g., polyethylene, polyvinyl chloride, polystyrene).</p> <p>IV(e) Explore the structure of biopolymers such as proteins and carbohydrates.</p>
<p>HSIV.3 Plastics and Fibers: How Are They Made and Used?</p> <p>Advances in chemistry have personal and societal costs and benefits.</p>	<p>IV(f) Explore and explain the properties and uses of common synthetic polymers such as polyethylene, polyvinyl chloride, and polystyrene.</p>

V – The Physics of Modern Technologies

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

VI – Understanding Evolution

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<p>HSVI.1 Genetics and Evolution: What Makes Us What We Are?</p> <p>Evolution and biodiversity are the result of genetic changes that occur over time in constantly changing environments.</p>	<p>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.</p> <p>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.</p> <p>VI(c) Describe how natural selection leads to a diversity of species that are well suited to survive in their environment.</p>
<p>HSVI.2 Earth History: How and What Can We Learn From It?</p> <p>Interactions among the solid Earth, the oceans, the atmosphere and organisms have resulted in the ongoing evolution of the Earth system.</p>	<p>VI(d) Describe how the evolution of life influenced changes in the composition of the Earth’s atmosphere.</p> <p>VI(e) Explore and explain how geological history can be determined using evidence from fossils, radioactive dating and rock sequences.</p> <p>VI(f) Describe how fossils of plants and animals provide evidence that life and environmental conditions on Earth are continuously changing.</p>
<p>HSVI.3 Plate Tectonics: What Moves the Continents?</p> <p>Energy within the Earth creates forces that drive the movement of plates, which results in changes in the Earth’s surface.</p>	<p>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.</p> <p>VI(h) Explore and explain how earthquakes, volcanic eruptions and mountain building are explained by the theory of plate tectonics.</p>