Advanced High School Physical Science - Chemistry (one year)
Standards, Supporting Skills, Assessments, and Resources

Indicator 1: Describe structures and properties of, and changes in, matter

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Analysis)	**9-12.P.1.1. Students are able to use the Periodic Table to determine the atomic structure of elements, valence number, family relationships, and regions (metals, nonmetals, and metalloids).** • Determine protons, neutrons, electrons, mass number, and atomic number from the Periodic Table. • Determine the number of valence electrons for elements in the main (s&p) blocks of the Periodic Table. • Identify the relative	Early Theories of Matter • Early Philosophers • John Dalton • Defining the Atom Subatomic Particles and the Nuclear Atom • Discovering the electron • The nuclear atom How Atoms Differ • Atomic number • Isotopes and mass number • Mass of individual atoms Development of the modern Periodic Table • History of the Periodic Table		Chapter 4 Chapter 6

	metallic character of an element based on its location on the Periodic Table.	Development - Newland - Meyer Mendevleev - Moseley • Modern Periodic Table - Classifying Elements Group (family) -Alkali -Alkaline Earth -Halogen -Noble Gases • Metal vs. Nonmetal • Representative vs. Transition • Transition vs. Inner Transition -Lanthanide vs. Actinide Classifications of Elements • Organize elements by configuration - Valance Electrons - Valance Electrons and Perios - Valence Electrons and		Chapter 6

		Group Numbers Periodic Trends • Atomic Radius -period vs. group trend • Ionic Radius -period vs. group trend • Ionization energy - period vs. group trend • Electronegativity - period vs. group trend		
(Comprehension)	**9-12.P.1.2. Students are able to describe ways that atoms combine.** • Name and write formulas for binary ionic and covalent compounds. Example: sodium	Forming Chemical Bonds • Chemical bonds - formation of positive ions - formation of negative ions Formation and nature of Ionic Bonds • Ionic bonds		Chapter 8 & 9

	chloride (NaCl), carbon dioxide (CO_2) • Compare the roles of electrons in covalent, ionic, and metallic bonding. • Discuss the special nature of carbon covalent bonds.	• Properties of Ionic Bonds -energy and the Ionic Bond Names and formulas for Ionic Compounds • formulas for Ionic compounds - determine the charge (oxidation number) - Compounds with Polyatomic Ions • naming Ions and Ionic compounds Metallic bonds and Properties of Metals • Metallic Bonds - properties of metals • Alloys Covalent Bond • Why do atoms bond? • Covalent bond formation • Single covalent bond • Multiple covalent bonds - Sigma vs. Pi Bond Naming Molecules		

		• Naming binary molecular compounds • Naming acids - binary - ternary or oxyacids • Writing formulas from names Forces of Attraction • Intramolecular Forces - ionic - covalent - metallic • Intermolecular Forces - Dispersion Force (London Forces) - Dipole-Dipole - Hydrogen Bonds Liquids and Solids • Liquids - density and comopession - fluidity - viscosity		Chapter 13

		- viscosity and temp - surface tension - capillary action Solids • density • crystalline solids - unit cells simple vs. body-centered vs. Face centered • molecular solids • covalent network solids • ionic solids • metallic solids Phase Changes • endothermic phase changes - melting - vaporization - sublimation • exothermic phase changes - condensation		

		- deposition - freezing • phase diagram		
(Application)	**9-12.P.1.3. Students are able to predict whether reactions will speed up or slow down as conditions change.** **Examples**: temperature, concentration, surface area, and catalysts	Classifying chemical reactions • synthesis reaction • combustion reaction • decomposition reaction • replacement reactions - single vs. double Rate of reaction factors		Chapter 10
(Application)	**9-12.P.1.4. Students are able to balance chemical equations by applying the Law of Conservation of Matter.** • Trace number of particles in diagrams and pictures of balanced	Reaction and Equations • evidence of chemical reactions • representing chemical reactions - word equation - skeleton equation - chemical equation		Chapter 10

	equations. Example: Write out an equation with symbols: $Mg + 2HCL \rightarrow MgCl_2 + 2H_2$	• balancing chemical equations conversation of mass		Chapter 3
(Comprehension)	**9-12.P.1.5. Students are able to distinguish among chemical, physical, and nuclear changes.** • Differentiate between physical and chemical properties used to describe matter. • Identify key indicators of chemical and physical changes. • Describe the effects of changing pressure, volume, or temperature upon gases. • Identify characteristics of a solution and factors	Properties of Matter • Pure substances - element vs. compound • physical properties of matter - intensive vs. extensive • chemical properties of matter • observing properties of matter • states of matter - gas vs. liquid vs. solid Changes in Matter • physical changes • chemical changes - evidence of chemical reaction Mixtures of Matter		Chapter 3

	that affect the rate of solution formation. • Explain the differences among nuclear, chemical, and physical changes at the atomic level. Examples: solute, solvent, concentrated, dilute, saturated, unsaturated, supersaturated Factors affecting rate: agitation, heating, particle size, pictures of particles	• mixtures - homogeneous vs. heterogeneous - solution vs. colloid vs. suspension - solution formation • separation of mixtures - filtration - distillation - crystallization - chromatography Pure Substances: elements and compounds • Law of Definite Proportion • Law of Multiple Proportion Gases • Kinetic-Molecular Theory - particle size - particle motion - particle energy • explain the behavior of gases		Chapter 18 Chapter 13

		- low density - compession and expansion - diffusion vs. effusion Graham's Law of Effusion • Gas Pressure - measuring air pressure -Barometer vs. manometer - units of pressure - Dalton's Law of Partial Pressure Unstable Nuclei and radioactive Decay • Radioactivity • Types of radiation - Alpha Radiation - Beta Radiation - Gamma Radiation - Nuclear Stability Nuclear Radiation • Discovery of radioactivity • Types of radiation		

		- Alpha - Beta - Gamma Radioactive Decay • Nuclear Stability • Types of Radioactive Decay - Alpha - Beta - Gamma - Positron Emission - Electron Capture • writing and balancing nuclear equations • Radioactive Series Transmutation • induced transmutation • radioactive decay rates • radioactive dating Fission and Fusion • nuclear reactions and energy		

		• nuclear fission • nuclear reactor • nuclear fusion Applications and effects of Nuclear Reactions • detecting radioactivity • uses of radiation • biological effects of radiation		

Indicator 3: Analyze interactions of energy and matter.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Application)	**9-12.P.3.1. Students are able to describe the relationships among potential energy, kinetic energy, and work as applied to the Law of**	States of Matter - Kinetic Theory - Thermal Energy - Average Kinetic Energy		Chapter 16

	Conservation of Energy. • Describe how energy can be transferred and transformed to produce useful work. Examples: Diagram simple energy transfers, describing the objects and the forms of energy gained and lost. Use simple machines as an example of the transmission of energy. • Given the formulas, calculate the mechanical advantage and efficiency of selected systems. • Explain methods of heat transfer. Examples:	Thermal Expansion Solid or Liquid? - Amorphous Solid vs. Liquid Crystals How thermal energy affects matter Properties of fluids - Archimede's Principle - Pascal's Principle - Bernoulli's Principle		

	conduction, radiation, and convection			

Physical Science
Performance Descriptors

Advanced	**High school students performing at the advanced level:** • predict the type of bonds formed as elements combine; • balance chemical equations involving polyatomic ions; • analyze and solve a problem involving velocity, acceleration, force, work, energy, or power; • construct or design a model that illustrates the Law of Conservation of Energy to show energy changes from potential to kinetic in doing work; • describe electrical effects in terms of motion and concentrations of charged particles.
Proficient	**High school students performing at the proficient level:** • use the Periodic Table to determine the properties of elements and the ways they combine; • given a variable, predict whether reactions will speed up or slow down as conditions change; • balance simple chemical equations; • describe chemical, physical, and nuclear changes at the atomic and macroscopic levels; • calculate velocity, acceleration, force, work, energy, and power given the formulas; • given the forces acting on an object, predict its motion using Newton's Laws; • apply the Law of Conservation of energy to show energy changes from potential to kinetic in doing work; • describe how characteristics of waves are related to one another; • describe electrical effects in terms of motion and concentrations of charged particles.
Basic	**High school students performing at the basic level:** • use the Periodic Table to determine the properties of the 1st 18 elements; • provide the coefficients for an unbalanced synthesis or decomposition equation; • identify chemical and physical changes at the macroscopic level; • calculate velocity and force given the formulas; • given an example, identify which of Newton's Laws is illustrated; • identify the characteristics of waves; • identify electricity as movement of charged particles.

Core High School Nature of Science
Standards, Supporting Skills, Assessments, and Resources

Indicator 1: Understand the nature and origin of scientific knowledge.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Evaluation)	**9-12.N.1.1. Students are able to evaluate a scientific discovery to determine and describe how societal, cultural, and personal beliefs influence scientific investigations and interpretations.**	Scientific Research • Types of Investigations - pure research vs. applied research Examples: telescope, birth control pill, penicillin, electricity • Recognize scientific knowledge is not merely a set of static facts but is dynamic and affords the best current explanations. Examples: spontaneous generation, relativity, geologic time • Discuss how progress in science can be affected by social issues.		Chapter 1 & 2

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Synthesis)	**9-12.N.2.1. Students are able to apply science process skills to design and conduct student investigations.** • Identify the questions and concepts to guide the development of hypotheses. • Analyze primary sources of information to guide the development of the procedure. • Select and use appropriate instruments to extend observations and measurements. • Revise explanations and models based on evidence and logic. • Use technology and mathematic skills to	Scientific Method • Systematic Approach - observation (qualitative vs. quantitative) - hypothesis - experiments (independent vs. dependent variable vs. control) - conclusion • representing data • graphs - bar vs. circle vs. line • line graphs • interpreting graphs • investigation - Density (accuracy vs.		Chapter 1 & 2

	enhance investigations, communicate results, and defend conclusions. Examples: Computer-based data collection Graphical analysis and representation Use appropriate technology to display data (i.e. spreadsheets, PowerPoint, web).	precision) - open-ended density		
(Application)	**9-12.N.2.2. Students are able to practice safe and effective laboratory techniques.** • Handle hazardous materials properly. • Use safety equipment correctly. • Practice emergency procedure. • Wear appropriate attire.	Lab safety		Chapter 1 & 2

	• Practice safe behaviors.			

Core High School Nature of Science
Performance Descriptors

Advanced	**High school students performing at the advanced level:** • given a scientific discovery, evaluate how different societal, cultural, and personal beliefs influenced the investigation and its interpretation; • design and conduct an investigation using an alternative student- developed hypothesis.
Proficient	**High school students performing at the proficient level:** • given a scientific discovery narrative, determine and describe how societal, cultural, and personal beliefs influenced the investigation and its interpretation; • describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws; then apply science process skills to design and conduct student investigations.
Basic	**High school students performing at the basic level:** • describe the role of observation in the development of hypotheses, theories, and laws and conduct student investigations; • given a scientific discovery narrative, identify the cultural and personal beliefs that influenced the investigation.

Core High School Science, Technology, Environment, and Society
Standards, Supporting Skills, and Examples

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Application)	**9-12.S.1.1. Students are able to explain ethical roles and responsibilities of scientists and scientific research.** **Examples:** Sharing of data Accuracy of data Acknowledgement of sources Following laws Animal research Human research Managing hazardous materials and wastes	Units of Measurement • SI units • Base units • Derived units - density • temperature - Kelvin vs. Celsius Scientific Notation • Addition/subtraction with scientific notation • Multiplication/division with scientific notation • dimensional analysis • reliability of measurements • precision vs. Accuracy		Chapter 1

		- percent error • significant figures • rounding numbers		
(Evaluation)	**9-12.S.1.2. Students are able to evaluate and describe the impact of scientific discoveries on historical events and social, economic, and ethical issues.** **Examples**: cloning, stem cells, gene splicing, nuclear power, patenting new life forms, emerging diseases, AIDS, resistant forms of bacteria, biological and chemical weapons, global warming, and alternative fuels			

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Evaluation)	**9-12.S.2.1. Students are able to describe immediate and**	Benefits of Chemistry Examples: environmental,		Chapter 1 & 2

	long-term consequences of potential solutions for technological issues.	communication, internet, entertainment, construction, manufacturing, power and transportation, energy sources, health technology, and biotechnology issues • Describe how the pertinent technological system operates. Example: waste management facility		
(Analysis)	**9-12.S.2.2. Students are able to analyze factors that could limit technological design**. **Examples**: ethics, environmental impact, manufacturing processes, operation, maintenance, replacement, disposal, and liability			
(Synthesis)	**9-12.S.2.3. Students are able to analyze and describe the benefits, limitations, cost, and consequences involved in using, conserving, or recycling resources.**	Examples: mining, agriculture, medicine, school science labs, forestry, energy, disposable diapers, computers, tires		

Core High School Science Technology, Environment, and Society
Performance Descriptors

Advanced	**High school students performing at the advanced level:** • modify a technology taking into consideration limiting factors of design; • given a narrative of a scientific discovery, defend a position on the impact of the ethical issues.
Proficient	**High school students performing at the proficient level:** • given a narrative of a scientific discovery, identify and evaluate the immediate and long-term consequences of scientific issues; • identify and explain ethical roles and responsibilities of scientists conducting a given research project.; • evaluate factors that could limit technological design; • given a narrative description of a resource, analyze and describe the benefits, limitations, cost, and consequences involved in its use, conservation, or recycling.
Basic	**High school students performing at the basic level:** • given a narrative of a scientific discovery, identify the immediate consequences of scientific issues; • identify ethical roles and responsibilities concerning a given research project; • identify factors that could limit technological design; • given a narrative description of a resource, describe a benefit and limitation involved in its use, conservation, or recycling.