Physical Science - Chemistry (one semester)
High School
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).**	**Properties of Atoms and the Periodic Table** • 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 metallic character of an element based on its location on the Periodic Table.** Structure of the Atom - Scientific Shorthand - Atomic Components - Quarks - Models		Chapter 17

		• Democritus • Thomson • Rutherford • Bohr • Quantum (electron cloud) Masses of Atoms - Atomic Number - Mass Number Isotopes Organize the Elements - Mendeleev's Table - Moseley's Improvement of Periodic Table Atoms and the Periodic Table - Electron Cloud Structure - Energy Leels - Rows on the Table - Electorns Dot Diagrams		

		Regions of the Periodic Table - Groups (Families) - Periods - Metals, Nonmetals, Metalloids Elements in the Universe **Radioactivity and Nuclear Reactions** Radioactivity - Nucleus • Protons and Neutrons • Strong Force • Radioactivity **Elements and Their Properties** Metals - Properties of Metals • Ionic Bonding		Chapter 18 Chapter 19

		Non Metals - Properties of Nonmetals - Hydrogen - Halogen - Noble Gasses Mixed Groups - Metalloids - Boron Group - Carbon Group • Allotropes of Carbon - Nitrogen Group - Oxygen Group - Synthetic Elements • Transuranium elements • Why make them? • Seeking Stability		

(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 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.	Metals - Metallic Bonding Alkali Metals Alkaline Earth Metals Transition Elements Inner Transition Elements • Lanthanides • Actinides Metals in the Crust • Ores: minerals and mixtures Stability in Bonding Combined Elements - compounds - new properties Formulas Atomic Stability - Unique Noble Gases - Chemical Stability - Energy Levels and other elements - Outer Levels – Getting their		Chapter 19 Chapter 20

		fill - Stability is reached Types of bonds - Gain or loss of electorns - Ionic Bond • Zero Net Charge - Sharing Electrons • Single Covalent Bond • Multiple Bonds • Unequal Sharing • Tug-of-War • Nonpolar vs. Polar Writing Formulas and Naming Compounds - Binary Ionic compounds • are electrons gained or lost? • Oxidation Numbers • Compounds are Neutral • Writing Formulas • Writing Names		

		- Compounds with Complex Ions • Writing Names • Writing Formulas - Compounds with Added Water • Common Hydrates - Naming Binary Covalent Compounds • Using Prefixes		
(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 - Combustion Reaction - Synthesis Reactions - Decompositions Reactions - Single Displacement - Activity Series - Double Displacement - Oxidation-Reduction Reactions		Chapter 21

		Chemical Reactions and Energy - Exothermic - Endothermic - Catalyst vs. Inhibitors Factors affecting the rate of reaction		
(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 equations. Example: Write out an equation with symbols: $Mg + 2HCL \rightarrow MgCl_2 + 2H_2$	**Chemical Reactions** - Chemical Change • Describe chemical reactions • Conservation of mass Lavoisier's Contributions Father of Modern Chemistry Nomenclature - Writing Equations - Unit Managers * Metals and the atmosphere		Chapter 21
(Comprehension)	**9-12.P.1.5. Students are able to distinguish among chemical, physical, and nuclear changes.** • Differentiate between physical and chemical properties	Nature of Matter - Composition of matter • pure substances elements & compounds - Mixtures		Chapter 15

	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 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	• Heterogeneous vs. Homogeneous • Solutions, Colloid, Suspension • Rate of mixing - Properties of Matter • Physical Properties -Appearance vs Behavior - Physical Change • Identification • Separation - Chemical Properties - Chemical Changes - Conservation of Mass Behaviors of Gases - pressure - Boyle's Law - Charles' Law Test the viscosity of common liquids Radioactivity - isotopes - Stable vs. Unstable		Chapter 16 Chapter 18

	rate: agitation, heating, particle size, pictures of particles	- Nucleus Numbers Discovery of Radioactivity Nuclear Decay - Nuclear Radiation - Alpha Particles • damage • smoke detectors • transmutation - Beta Particles • damage - Gamma Rays - Radioactive Half-Life - Radioactive Dating • carbon dating • uranium dating Detecting Radioactivity - Radiation Detectors • Cloud Chambers • Bubble Chambers • Electroscopes - Measuring Radiation		

		• Geiger Counters - Background Radiation • Sources of Background Radiation • Radiation in Your Body Nuclear Reactions - Nuclear Fission • Mass and energy • Chain reactions - Nuclear Fusion • Temperature and fusion • Nuclear Fusion and the sun - Nuclear Reactions in Medicine • Iodine tracers in the thyroid • Treating cancer with radioactivity		

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.**	Visualizing with Models Scientific Theories and Laws 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

(Synthesis)	**9-12.N.1.2. Students are able to describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws.**	Scientific Method • Starting a problem • Researching/gathering info • Hypothesis • Variables • Constants and controls • Analyzing data • Drawing conclusions • Research, communicate, and support a scientific argument. • Recognize and analyze alternative explanations and models. • Evaluate the scientific accuracy of information relevant to a specific issue (pseudo-science).		Chapter 1

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.**	What is science - categories of science - Investigations Scientific Method Standards of Measurement • Units and standards • Measurement systems - International System of Units - SI Prefixes - Converting SI units Measuring Distance Measuring Volume Measuring Matter - density - derived units Measuring time and temperature		Chapter 1

		- Kelvin vs. Fahrenheit Communicating with graphs • visual display • line graph • bar graph • circle graph Using Scientific Method - Testing the viscosity of common liquids • 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 enhance investigations, communicate results, and		Chapter 16

		defend conclusions. Examples: Computer-based data collection Graphical analysis and representation • Use appropriate technology to display data (i.e. spreadsheets, PowerPoint, web).		
(Application)	**9-12.N.2.2. Students are able to practice safe and effective laboratory techniques.** •	Lab safety Investigation Design Density (accuracy vs. precision) Open-ended Density (Archimede's Principle) • Handle hazardous materials properly. • Use safety equipment		

		correctly. • Practice emergency procedure. • Wear appropriate attire. • 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.**	Ethical Issues Examples: • Sharing of data Accuracy of data Acknowledgement of sources Following laws Animal research Human research Managing hazardous materials and wastes		Chapter 1
(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		

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.