

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

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

<b>Bloom's Taxonomy Level</b>	<b>Standard</b>	<b>Supporting Skills</b>	<b>Assessments</b>	<b>Resources</b>
(Analysis)	<b>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).</b>	<p><b>Properties of Atoms and the Periodic Table</b></p> <ul style="list-style-type: none"> <li>• Determine protons, neutrons, electrons, mass number, and atomic number from the Periodic Table.</li> <li>• Determine the number of valence electrons for elements in the main (s&amp;p) blocks of the Periodic Table.</li> </ul> <p><b>Identify the relative metallic character of an element based on its location on the Periodic Table.</b></p> <p>Structure of the Atom</p> <ul style="list-style-type: none"> <li>- Scientific Shorthand</li> <li>- Atomic Components</li> <li>- Quarks</li> <li>- Models</li> </ul>		Chapter 17

		<ul style="list-style-type: none"> <li>• Democritus</li> <li>• Thomson</li> <li>• Rutherford</li> <li>• Bohr</li> <li>• Quantum (electron cloud)</li> </ul> <p>Masses of Atoms</p> <ul style="list-style-type: none"> <li>- Atomic Number</li> <li>- Mass Number</li> </ul> <p>Isotopes</p> <p>Organize the Elements</p> <ul style="list-style-type: none"> <li>- Mendeleev's Table</li> <li>- Moseley's Improvement of Periodic Table</li> </ul> <p>Atoms and the Periodic Table</p> <ul style="list-style-type: none"> <li>- Electron Cloud Structure</li> <li>- Energy Levels</li> <li>- Rows on the Table</li> <li>- Electrons Dot Diagrams</li> </ul>		
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		<p>Non Metals</p> <ul style="list-style-type: none"> <li>- Properties of Nonmetals</li> <li>- Hydrogen</li> <li>- Halogen</li> <li>- Noble Gasses</li> </ul> <p>Mixed Groups</p> <ul style="list-style-type: none"> <li>- Metalloids</li> <li>- Boron Group</li> <li>- Carbon Group <ul style="list-style-type: none"> <li>• Allotropes of Carbon</li> </ul> </li> <li>- Nitrogen Group</li> <li>- Oxygen Group</li> <li>- Synthetic Elements <ul style="list-style-type: none"> <li>• Transuranium elements</li> <li>• Why make them?</li> <li>• Seeking Stability</li> </ul> </li> </ul>		
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		<p>fill</p> <ul style="list-style-type: none"> <li>- Stability is reached</li> </ul> <p>Types of bonds</p> <ul style="list-style-type: none"> <li>- Gain or loss of electrons</li> <li>- Ionic Bond <ul style="list-style-type: none"> <li>• Zero Net Charge</li> </ul> </li> <li>- Sharing Electrons <ul style="list-style-type: none"> <li>• Single Covalent Bond</li> <li>• Multiple Bonds</li> <li>• Unequal Sharing</li> <li>• Tug-of-War</li> <li>• Nonpolar vs. Polar</li> </ul> </li> </ul> <p>Writing Formulas and Naming Compounds</p> <ul style="list-style-type: none"> <li>- Binary Ionic compounds <ul style="list-style-type: none"> <li>• are electrons gained or lost?</li> <li>• Oxidation Numbers</li> <li>• Compounds are Neutral</li> <li>• Writing Formulas</li> <li>• Writing Names</li> </ul> </li> </ul>		
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		<ul style="list-style-type: none"> <li>- Compounds with Complex Ions             <ul style="list-style-type: none"> <li>• Writing Names</li> <li>• Writing Formulas</li> </ul> </li> <li>- Compounds with Added Water             <ul style="list-style-type: none"> <li>• Common Hydrates</li> </ul> </li> <li>- Naming Binary Covalent Compounds             <ul style="list-style-type: none"> <li>• Using Prefixes</li> </ul> </li> </ul>		
(Application)	<p><b>9-12.P.1.3. Students are able to predict whether reactions will speed up or slow down as conditions change.</b></p> <p><b>Examples:</b> temperature, concentration, surface area, and catalysts</p>	<p>Classifying Chemical Reactions</p> <ul style="list-style-type: none"> <li>- Combustion Reaction</li> <li>- Synthesis Reactions</li> <li>- Decompositions Reactions</li> <li>- Single Displacement</li> <li>- Activity Series</li> <li>- Double Displacement</li> <li>- Oxidation-Reduction Reactions</li> </ul>		Chapter 21

		Chemical Reactions and Energy <ul style="list-style-type: none"> <li>- Exothermic</li> <li>- Endothermic</li> <li>- Catalyst vs. Inhibitors</li> </ul> Factors affecting the rate of reaction		
(Application)	<b>9-12.P.1.4. Students are able to balance chemical equations by applying the Law of Conservation of Matter.</b> <ul style="list-style-type: none"> <li>• Trace number of particles in diagrams and pictures of balanced equations.</li> </ul> Example: Write out an equation with symbols: $\text{Mg} + 2\text{HCL} \rightarrow \text{MgCl}_2 + 2\text{H}_2$	<b>Chemical Reactions</b> <ul style="list-style-type: none"> <li>- Chemical Change               <ul style="list-style-type: none"> <li>• Describe chemical reactions</li> <li>• Conservation of mass                   <ul style="list-style-type: none"> <li>Lavoisier's Contributions</li> <li>Father of Modern Chemistry</li> <li>Nomenclature</li> </ul> </li> </ul> </li> <li>- Writing Equations</li> <li>- Unit Managers               <ul style="list-style-type: none"> <li>* Metals and the atmosphere</li> </ul> </li> </ul>		Chapter 21
(Comprehension)	<b>9-12.P.1.5. Students are able to distinguish among chemical, physical, and nuclear changes.</b> <ul style="list-style-type: none"> <li>• Differentiate between physical and chemical properties</li> </ul>	Nature of Matter <ul style="list-style-type: none"> <li>- Composition of matter               <ul style="list-style-type: none"> <li>• pure substances                   <ul style="list-style-type: none"> <li>elements &amp; compounds</li> </ul> </li> </ul> </li> <li>- Mixtures</li> </ul>		Chapter 15





	<p>rate: agitation, heating, particle size, pictures of particles</p>	<ul style="list-style-type: none"> <li>- Nucleus Numbers</li> </ul> <p>Discovery of Radioactivity</p> <p>Nuclear Decay</p> <ul style="list-style-type: none"> <li>- Nuclear Radiation</li> <li>- Alpha Particles <ul style="list-style-type: none"> <li>• damage</li> <li>• smoke detectors</li> <li>• transmutation</li> </ul> </li> <li>- Beta Particles <ul style="list-style-type: none"> <li>• damage</li> </ul> </li> <li>- Gamma Rays</li> <li>- Radioactive Half-Life</li> <li>- Radioactive Dating <ul style="list-style-type: none"> <li>• carbon dating</li> <li>• uranium dating</li> </ul> </li> </ul> <p>Detecting Radioactivity</p> <ul style="list-style-type: none"> <li>- Radiation Detectors <ul style="list-style-type: none"> <li>• Cloud Chambers</li> <li>• Bubble Chambers</li> <li>• Electroscopes</li> </ul> </li> <li>- Measuring Radiation</li> </ul>		
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		<ul style="list-style-type: none"> <li>• Geiger Counters</li> <li>- Background Radiation <ul style="list-style-type: none"> <li>• Sources of Background Radiation</li> <li>• Radiation in Your Body</li> </ul> </li> </ul> <p>Nuclear Reactions</p> <ul style="list-style-type: none"> <li>- Nuclear Fission <ul style="list-style-type: none"> <li>• Mass and energy</li> <li>• Chain reactions</li> </ul> </li> <li>- Nuclear Fusion <ul style="list-style-type: none"> <li>• Temperature and fusion</li> <li>• Nuclear Fusion and the sun</li> </ul> </li> <li>- Nuclear Reactions in Medicine <ul style="list-style-type: none"> <li>• Iodine tracers in the thyroid</li> <li>• Treating cancer with radioactivity</li> </ul> </li> </ul>		
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**Physical Science  
Performance Descriptors**

<b>Advanced</b>	<p><b>High school students performing at the advanced level:</b></p> <ul style="list-style-type: none"> <li>• predict the type of bonds formed as elements combine;</li> <li>• balance chemical equations involving polyatomic ions;</li> <li>• analyze and solve a problem involving velocity, acceleration, force, work, energy, or power;</li> <li>• construct or design a model that illustrates the Law of Conservation of Energy to show energy changes from potential to kinetic in doing work;</li> <li>• describe electrical effects in terms of motion and concentrations of charged particles.</li> </ul>
<b>Proficient</b>	<p><b>High school students performing at the proficient level:</b></p> <ul style="list-style-type: none"> <li>• use the Periodic Table to determine the properties of elements and the ways they combine;</li> <li>• given a variable, predict whether reactions will speed up or slow down as conditions change;</li> <li>• balance simple chemical equations;</li> <li>• describe chemical, physical, and nuclear changes at the atomic and macroscopic levels;</li> <li>• calculate velocity, acceleration, force, work, energy, and power given the formulas;</li> <li>• given the forces acting on an object, predict its motion using Newton's Laws;</li> <li>• apply the Law of Conservation of energy to show energy changes from potential to kinetic in doing work;</li> <li>• describe how characteristics of waves are related to one another;</li> <li>• describe electrical effects in terms of motion and concentrations of charged particles.</li> </ul>
<b>Basic</b>	<p><b>High school students performing at the basic level:</b></p> <ul style="list-style-type: none"> <li>• use the Periodic Table to determine the properties of the 1<sup>st</sup> 18 elements;</li> <li>• provide the coefficients for an unbalanced synthesis or decomposition equation;</li> <li>• identify chemical and physical changes at the macroscopic level;</li> <li>• calculate velocity and force given the formulas;</li> <li>• given an example, identify which of Newton's Laws is illustrated;</li> <li>• identify the characteristics of waves;</li> <li>• identify electricity as movement of charged particles.</li> </ul>

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

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

<b>Bloom's Taxonomy Level</b>	<b>Standard</b>	<b>Supporting Skills</b>	<b>Assessments</b>	<b>Resources</b>
(Evaluation)	<b>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.</b>	<p>Visualizing with Models</p> <p>Scientific Theories and Laws</p> <p>Examples: telescope, birth control pill, penicillin, electricity</p> <ul style="list-style-type: none"> <li>Recognize scientific knowledge is not merely a set of static facts but is dynamic and affords the best current explanations.</li> </ul> <p>Examples: spontaneous generation, relativity, geologic time</p> <ul style="list-style-type: none"> <li>Discuss how progress in science can be affected by social issues.</li> </ul>		Chapter 1

(Synthesis)	<b>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.</b>	Scientific Method <ul style="list-style-type: none"> <li>• Starting a problem</li> <li>• Researching/gathering info</li> <li>• Hypothesis</li> <li>• Variables</li> <li>• Constants and controls</li> <li>• Analyzing data</li> <li>• Drawing conclusions</li> <li>• Research, communicate, and support a scientific argument.</li> <li>• Recognize and analyze alternative explanations and models.</li> <li>• Evaluate the scientific accuracy of information relevant to a specific issue (pseudo-science).</li> </ul>		Chapter 1
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**Indicator 2: Apply the skills necessary to conduct scientific investigations.**

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Synthesis)	<b>9-12.N.2.1. Students are able to apply science process skills to design and conduct student investigations.</b>	What is science - categories of science - Investigations Scientific Method Standards of Measurement <ul style="list-style-type: none"> <li>• Units and standards</li> <li>• Measurement systems               <ul style="list-style-type: none"> <li>- International System of Units</li> <li>- SI Prefixes</li> <li>- Converting SI units</li> </ul> </li> </ul> Measuring Distance Measuring Volume Measuring Matter <ul style="list-style-type: none"> <li>- density</li> <li>- derived units</li> </ul> Measuring time and temperature		Chapter 1

		<p>- Kelvin vs. Fahrenheit</p> <p>Communicating with graphs</p> <ul style="list-style-type: none"> <li>• visual display</li> <li>• line graph</li> <li>• bar graph</li> <li>• circle graph</li> </ul> <p>Using Scientific Method</p> <p>- Testing the viscosity of common liquids</p> <ul style="list-style-type: none"> <li>• Identify the questions and concepts to guide the development of hypotheses.</li> <li>• Analyze primary sources of information to guide the development of the procedure.</li> <li>• Select and use appropriate instruments to extend observations and measurements.</li> <li>• Revise explanations and models based on evidence and logic.</li> <li>• Use technology and mathematic skills to enhance investigations, communicate results, and</li> </ul>		Chapter 16
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		<p>defend conclusions.</p> <p>Examples:</p> <p>Computer-based data collection</p> <p>Graphical analysis and representation</p> <ul style="list-style-type: none"> <li>• Use appropriate technology to display data (i.e. spreadsheets, PowerPoint, web).</li> </ul>		
(Application)	<p><b>9-12.N.2.2. Students are able to practice safe and effective laboratory techniques.</b></p> <ul style="list-style-type: none"> <li>•</li> </ul>	<p>Lab safety</p> <p>Investigation Design</p> <p>Density (accuracy vs. precision)</p> <p>Open-ended Density</p> <p>(Archimede's Principle)</p> <ul style="list-style-type: none"> <li>• Handle hazardous materials properly.</li> <li>• Use safety equipment</li> </ul>		

		<p>correctly.</p> <ul style="list-style-type: none"><li>• Practice emergency procedure.</li><li>• Wear appropriate attire.</li><li>• Practice safe behaviors.</li></ul>		
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**Core High School Nature of Science  
Performance Descriptors**

<b>Advanced</b>	<b>High school students performing at the advanced level:</b> <ul style="list-style-type: none"><li>• given a scientific discovery, evaluate how different societal, cultural, and personal beliefs influenced the investigation and its interpretation;</li><li>• design and conduct an investigation using an alternative student- developed hypothesis.</li></ul>
<b>Proficient</b>	<b>High school students performing at the proficient level:</b> <ul style="list-style-type: none"><li>• given a scientific discovery narrative, determine and describe how societal, cultural, and personal beliefs influenced the investigation and its interpretation;</li><li>• 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.</li></ul>
<b>Basic</b>	<b>High school students performing at the basic level:</b> <ul style="list-style-type: none"><li>• describe the role of observation in the development of hypotheses, theories, and laws and conduct student investigations;</li><li>• given a scientific discovery narrative, identify the cultural and personal beliefs that influenced the investigation.</li></ul>

**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.**

<b>Bloom's Taxonomy Level</b>	<b>Standard</b>	<b>Supporting Skills</b>	<b>Assessments</b>	<b>Resources</b>
(Application)	<b>9-12.S.1.1. Students are able to explain ethical roles and responsibilities of scientists and scientific research.</b>	Ethical Issues Examples: <ul style="list-style-type: none"> <li>• Sharing of data</li> <li>Accuracy of data</li> <li>Acknowledgement of sources</li> <li>Following laws</li> <li>Animal research</li> <li>Human research</li> <li>Managing hazardous materials and wastes</li> </ul>		Chapter 1
(Evaluation)	<b>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.</b>	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**

<b>Advanced</b>	<b>High school students performing at the advanced level:</b> <ul style="list-style-type: none"> <li>• modify a technology taking into consideration limiting factors of design;</li> <li>• given a narrative of a scientific discovery, defend a position on the impact of the ethical issues.</li> </ul>
<b>Proficient</b>	<b>High school students performing at the proficient level:</b> <ul style="list-style-type: none"> <li>• given a narrative of a scientific discovery, identify and evaluate the immediate and long-term consequences of scientific issues;</li> <li>• identify and explain ethical roles and responsibilities of scientists conducting a given research project.;</li> <li>• evaluate factors that could limit technological design;</li> <li>• given a narrative description of a resource, analyze and describe the benefits, limitations, cost, and consequences involved in its use, conservation, or recycling.</li> </ul>
<b>Basic</b>	<b>High school students performing at the basic level:</b> <ul style="list-style-type: none"> <li>• given a narrative of a scientific discovery, identify the immediate consequences of scientific issues;</li> <li>• identify ethical roles and responsibilities concerning a given research project;</li> <li>• identify factors that could limit technological design;</li> <li>• given a narrative description of a resource, describe a benefit and limitation involved in its use, conservation, or recycling.</li> </ul>