

Course: Chemistry 1

Course Code: 2003340

Quarter: 1 Unit 1

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**Topic of Study:** Approaches to Science

**Standards:** N1 – Scientific Practices N2 – Scientific Knowledge N3 – Theories, Models, Laws

**Concepts:** Lab Safety, Lab procedures and equipment, Math review, Measurement, Theory and Law

**Essential Question:** What is the relationship between scientific practice, scientific explanations and scientific knowledge?

**Key Learning:** Science disciplines may differ from one another in what is studied, techniques used, and outcomes sought, but they share a common purpose and philosophy. Scientists construct explanations based on well-reasoned, logical arguments built upon multiple lines of valid scientific evidence using what they already know as a foundation.

Unit 1: 16 days (8 blocks)

NGSSS	Content	Target
<p>SC.912.N.1.2 Describe and explain what characterizes science and its methods.</p> <p>Cognitive Complexity: Moderate</p>	<p>I What are the essential components of laboratory safety?</p> <p>A. Safety equipment in classroom</p> <ol style="list-style-type: none"> <li>1. location</li> <li>2. usage</li> <li>3. Safety contract</li> </ol> <p>B. Chemicals</p> <ol style="list-style-type: none"> <li>1. reading chemical labels</li> <li>2. determining hazards</li> <li>3. reading MSDS</li> <li>4. disposing of hazardous chemical</li> </ol> <p>C. Proper procedures in lab</p> <ol style="list-style-type: none"> <li>1. dress code</li> <li>2. rules and behaviors</li> <li>3. accidents and reporting</li> </ol>	<p>Describe safety practices in the chemistry laboratory (rules, procedures, and safety symbols).</p> <p>Comply with both oral and written directions during lab.</p> <p>Assess risk of chemical using labeling clues.</p> <p>Recognize that different types of wastes are disposed of in specific ways.</p> <p>Value the need for safety during lab by way of required dress code.</p> <p>Explain the need for safety contract.</p>
<p>SC.912.N.1.2 Describe and explain what characterizes science and its methods.</p> <p>Cognitive Complexity: Moderate</p> <p>SC.912.N.1.1 Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:</p> <ol style="list-style-type: none"> <li>6. use tools to gather, analyze, and interpret data</li> </ol> <p>(this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),</p> <p>Cognitive Complexity: High</p>	<p>II How are various types of equipment useful in the laboratory?</p> <p>A. Scales</p> <ol style="list-style-type: none"> <li>1. measuring on triple beam</li> <li>3. proper moving procedures</li> <li>4. proper storage</li> </ol> <p>B. Glassware</p> <ol style="list-style-type: none"> <li>1. use and measuring</li> <li>2. reading the meniscus</li> </ol> <p>For:</p> <ol style="list-style-type: none"> <li>a. beaker</li> <li>b. flasks</li> <li>c. graduated cylinders</li> </ol> <p>C. Burners and hot plates</p> <ol style="list-style-type: none"> <li>1. proper use</li> <li>2. proper moving procedures</li> <li>3. proper storage</li> </ol> <p>III How do we use lab equipment to make accurate and precise measurements?</p> <p>A. Accuracy</p> <ol style="list-style-type: none"> <li>1. determined by equipment</li> <li>2. determined from measurements</li> </ol>	<p>Distinguish between different volumetric glassware based on relevancy.</p> <p>Demonstrate proper lighting and extinguishing of gas burner.</p> <p>Demonstrate proper transfer of chemicals from container to scale.</p> <p>Demonstrate accurate measurement reading from scales, thermometers and graduated cylinders.</p> <p>Restate the definitions of accuracy and precision.</p> <p>Illustrate the major difference between accuracy and precision in measurement</p> <p>Apply significant figures and rounding to reflect the certainty of data.</p> <p>Calculate and determine the % error of the data.</p>
<p>SC.912.N.1.1 Define a problem based</p>	<p>B. Precision</p>	<p>Calculate using rules of significant</p>

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<p>on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following: 6. use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),</p> <p>Cognitive Complexity: High</p>	<ol style="list-style-type: none"> <li>1. significant figures</li> <li>2. reflects accuracy in calculations using measured data.</li> </ol> <p>IV How can the accuracy of the experimental results be determined and interpreted?</p> <ol style="list-style-type: none"> <li>A. Error             <ol style="list-style-type: none"> <li>1. determine accuracy from equipment</li> <li>2. interpret accuracy of experimental results</li> </ol> </li> </ol>	<p>figures and measurement data.</p> <p>Collect and organize data in charts, tables, and graphics.</p> <p>Collect and organize data in charts, tables, and graphics.</p> <p>Calculate theoretical values to use to determine percent error of given data.</p>
<p>SC.912.N.1.1 Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following: 1. pose questions about the natural world, 5. plan the investigation, 6. use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs), 10. communicate results of scientific investigations, 11. evaluate the merits of the explanations produced by others.</p> <p>Cognitive Complexity: High</p>	<p>V How is numerical data converted between units, and how can we express and calculate using very large or small numbers?</p> <ol style="list-style-type: none"> <li>A. Scientific Notation             <ol style="list-style-type: none"> <li>1. placing numbers into notation</li> <li>2. multiplying and dividing with scientific notation</li> </ol> </li> <li>B. Standard system of measurement             <ol style="list-style-type: none"> <li>1. units for length, volume, mass, time, energy</li> <li>2. prefixes – kilo-, deci-, centi-, milli-</li> </ol> </li> </ol> <p>VI. How can an equation be altered to solve for different variables?</p> <ol style="list-style-type: none"> <li>A. Density             <ol style="list-style-type: none"> <li>1. solve for different variable</li> <li>2. units of density</li> </ol> </li> </ol>	<p>Convert between units in standard system.</p> <p>Write numbers in scientific notation, and use scientific notation in calculations.</p> <p>Demonstrate the ability to change an equation to solve for a different variable.</p> <p>Determine tools and methods that should be used to collect valid data to determine density.</p> <p>Determine how data will be collected to analyze the data.</p> <p>Determine appropriate and consistent standards of measurement for the data to be collected in the experiment.</p> <p>Produce lab report which includes, question and hypothesis, data, conclusions and error analysis</p>
<p>Vocabulary: accuracy, precision, theoretical yield, experimental yield, percent error, percent yield, inferring, empirical evidence, investigation, dependent and independent variables, mass, volume, density,</p>		
<p>SC.912.N.2.1 Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science). Cognitive Complexity: High</p> <p>SC.912.N.2.2 Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion. Cognitive Complexity: High</p> <p>SC.912.N.2.3 Identify examples of pseudoscience (such as astrology, phrenology) in society. Cognitive Complexity: Low</p> <p>SC.912.N.2.4 Explain that scientific</p>	<p>VII How does science impact society?</p> <ol style="list-style-type: none"> <li>A. Science             <ol style="list-style-type: none"> <li>1. explain natural phenomena</li> <li>2. new information impact</li> <li>3. characteristics</li> <li>4. does not answers all problems</li> </ol> </li> <li>B. Compare to pseudoscience and non-science             <ol style="list-style-type: none"> <li>1. similarities</li> <li>2. differences</li> <li>3. socially relevant questions not investigated by science</li> <li>4. arts, philosophy, religion</li> </ol> </li> </ol>	<p>Explain that scientific knowledge is fluid – ever changing as new evidence is encountered.</p> <p>Distinguish science from other activities involving thought.</p>

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<p>knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new <u>investigations</u> and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability. Cognitive Complexity: High</p>			
<p>Vocabulary: inferring, empirical evidence, philosophy</p>			
<p>SC.912.N.3.1 Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer. Cognitive Complexity: High</p> <p>SC.912.N.3.3 Explain that scientific <u>laws</u> are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships. Cognitive Complexity: Moderate</p> <p>SC.912.N.3.4 Recognize that theories do not become laws, nor do laws become <u>theories</u>; theories are well supported explanations and <u>laws</u> are well supported descriptions. Cognitive Complexity: Moderate</p>	<p>VII What is the relationship between a theory and a law</p> <p>A. Theories</p> <p>a. reflect scientific explanations</p> <p>b. effect of new evidence</p> <p>B. Laws</p> <p>a. illustrate the patterns of the natural world</p> <p>b. describe phenomena</p>	<p>Distinguish a scientific theory from a hypothesis.</p> <p>Understand that theories change as new evidence becomes available.</p> <p>Distinguish a scientific theory from a scientific law.</p> <p>Assemble the path required for theories to form.</p>	
<p>Vocabulary: law, theory, hypothesis, guess, prediction</p>		<p>Unit 1 – 16 days 8 block periods</p>	
<p>Suggested Laboratories for Unit 1</p>	<p>Title</p>	<p>Lab Type</p>	<p>Resources: <b>P</b>-Pearson Textbook <b>G</b>-Glencoe Textbook <b>H</b>-Holt Textbook Reference pages</p>
<p>SC.912.N.1.1 Scientific Method</p>	<p><u>Bubbles</u></p>	<p>Quick Lab</p>	<p>P – page 17</p>
	<p><u>Developing Observation Skills</u></p>	<p>Mini Lab</p>	<p>G – page 15</p>
<p>SC.912.N.1.1 Density</p>	<p><u>Thickness of Aluminum Foil</u></p>	<p>Quick Lab</p>	<p>H – page 18</p>
	<p><u>Density of an Irregular Solid</u></p>	<p>Mini Lab</p>	<p>G – page 28</p>

Course: Chemistry 1

Course Code: 2003340

Quarter: 1 Unit 2

**Topic of Study:** Atomic Structure

**Standards:** P8 – Matter P10 – Electromagnetic Energy L15 – Evolution and Radioactivity

**Concepts:** Atomic Theory, Atomic Structure, Radioactivity, Quantum Theory

**Essential Question:** How did development of atomic theory lead to an understanding of the structure and behavior of matter?

**Key Learning:** An understanding of atomic structure is essential to the study of chemistry.

Unit 2: 18 days (9 blocks)

NGSSS	Content	Target
<p>SC.912.P.8.3 Explore the scientific theory of atoms(also known as atomic theory) by describing changes in the atomic model over time and why those changes were necessitated by experimental evidence.</p> <p>Cognitive Complexity: High</p> <p>SC.912.N.2.4 Describe how data and knowledge was shared and interpreted by various scientists over time to lead to the atomic theory. <b>(restated for this unit)</b></p> <p>Cognitive Complexity: High</p> <p>SC.912.N.2.5 Describe how the backgrounds, talents, interests, and goals of a scientist impacted their interpretation and explanations of scientific discoveries.</p> <p>Cognitive Complexity: High</p>	<p>I How have atomic theories led to our understanding of atomic models?</p> <p>A. Historic Atomic Theories</p> <ol style="list-style-type: none"> <li>1. Democritus</li> <li>2. Dalton</li> </ol> <p>B. Historic Atomic Models</p> <ol style="list-style-type: none"> <li>1. Thomson's Plum Pudding</li> <li>2. Rutherford's Nuclear                             <ol style="list-style-type: none"> <li>a. gold-foil experiment</li> </ol> </li> <li>3. Bohr's Planetary</li> </ol> <p>C. Changes through time</p> <ol style="list-style-type: none"> <li>1. new technologies</li> <li>2. influenced by the background of atomic theorists</li> <li>3. new investigative techniques</li> </ol>	<p>Compare and contrast the atomic theories of Democritus and Dalton</p> <p>Sketch the three historic models with labels</p> <p>Understand how the experimental evidence supported Thomson's, Rutherford's and Bohr's models.</p>
<p>Vocabulary: atom (atomos), definite proportions, indivisible, proton, electron, nucleus, photon</p>		
<p>SC.912.P.8.4 Explore the scientific theory of atoms by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.</p> <p>Cognitive Complexity: High</p> <p>SC.912.P.8.5 Relate properties of atoms and their position in the periodic table to the arrangement of their electrons.</p> <p>Cognitive Complexity: Moderate</p>	<p>II What is the arrangement and properties of the subatomic particles within the Bohr model?</p> <p>A. Protons</p> <ol style="list-style-type: none"> <li>1. mass</li> <li>2. electrical charge</li> <li>3. location</li> </ol> <p>B. Electrons</p> <ol style="list-style-type: none"> <li>1. mass</li> <li>2. electrical charge</li> <li>3. location</li> </ol> <p>C. Neutrons</p> <ol style="list-style-type: none"> <li>1. mass</li> <li>2. electrical charge</li> <li>3. location</li> </ol> <p>D. Atomic properties</p> <ol style="list-style-type: none"> <li>1. atomic number</li> <li>2. mass number</li> <li>3. neutrality</li> <li>4. isotope</li> <li>5. average atomic mass</li> </ol>	<p>Distinguish between the subatomic particles.</p> <p>Examine the importance of both Moseley and Millikan experiments to current atomic theory.</p> <p>Describe the role of atomic number in determining the identity of an atom and element.</p> <p>Examine the relationship of atomic number and mass number to isotopes of an element.</p> <p>Use atomic number and mass number to determine isotopes of elements.</p> <p>Calculate average atomic mass from isotopic data for an element.</p>

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	<p>E. Periodic Table – arranged by</p> <ol style="list-style-type: none"> <li>1. number of protons</li> <li>2. number of valence electrons</li> </ol>	<p>Describe the role of atomic number in determining the identity of an atom</p> <p>Describe the organization of elements on the periodic table</p>
<p>Vocabulary: electron cloud, atomic number, average atomic mass, mass number, isotope, electron spectrum, valence electrons, weighted average</p>		
<p>SC.912.P.10.18 Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, energy, and frequency and relate them to phenomena and applications. Cognitive Complexity: High</p> <p style="text-align: right;"><b>NOTE:</b></p>	<p>III What is the electromagnetic spectrum?</p> <ol style="list-style-type: none"> <li>A. Wave functions             <ol style="list-style-type: none"> <li>1. wavelength</li> <li>2. frequency</li> <li>3. energy</li> </ol> </li> <li>B. application to Bohr’s Hydrogen spectrum data</li> </ol> <p><b>Provides background for quantum theory.</b></p>	<p>Diagram wave functions and differentiate its parts.</p> <p>Contrast continuous electromagnetic spectra and atomic emission spectra.</p> <p>Explain how a vibrating charge produces an electromagnetic wave.</p> <p>Interpret the relationships among electromagnetic quantities.</p>
<p>Vocabulary: crest, trough, amplitude, wavelength, frequency,</p>		
<p>SC.912.P.10.9 Describe the quantization of energy at the atomic level. Cognitive Complexity: Moderate</p> <p>SC.912.P.10.9 Describe the quantization of energy at the atomic level. Cognitive Complexity: Moderate</p>	<p>IV How does electron configuration illustrate electron placement using the quantum model?</p> <ol style="list-style-type: none"> <li>A. Energy at the atomic level             <ol style="list-style-type: none"> <li>1. Matter can gain or lose energy only in small, specific amounts</li> <li>2. A quantum is the smallest amount of energy that can be gained or lost by an atom</li> </ol> </li> <li>B. Electron Cloud Theory             <ol style="list-style-type: none"> <li>1. valence electrons                 <ol style="list-style-type: none"> <li>a. electron arrangement</li> <li>b. quantum numbers                     <ol style="list-style-type: none"> <li>i. n = shell (level)</li> <li>ii. l = sublevel (state)</li> <li>iii. m = orbital</li> <li>iv. s = spin</li> </ol> </li> </ol> </li> <li>3. orbital fill diagrams</li> <li>4. Lewis dot structures for atoms</li> </ol> </li> </ol>	<p>Define a quantum of energy</p> <p>Devise the relationship between a quantum to an energy change of matter</p> <p>Compare the Bohr and quantum mechanical models of the atom.</p> <p>Explain the relationships among a hydrogen’s energy levels, sublevels, and atomic orbitals.</p> <p>Locate the four blocks of the periodic table based on electron configuration.</p> <p>Construct an electron configuration using the four blocks located on the periodic table.</p> <p>Apply the Pauli’s exclusion principle, the Aufbau principle, and Hund’s rule to write electron configuration notation.</p> <p>Predict electron placement in orbitals for an element using its electron configuration.</p>
<p>Vocabulary: electron configuration, energy level, shell, orbital, quantum, exclusion principle, aufbau principle, Hund’s rule</p>		
<p>The placement of the nuclear chemistry section after the subatomic particles is left to the teacher who is the best judge of sequencing of these sections for the students.</p>		

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<p>SC.912.P.10.10 Compare the magnitude and range of the four fundamental forces Cognitive Complexity: Moderate</p> <p>SC.912.P.10.11 Explain and compare nuclear reactions the energy changes associated with them and their associated safety issues. Cognitive Complexity: High</p> <p>SC.912.L.15.2 Recognize that radioactivity is caused by a break-down of atomic nuclei. (restated for this unit) Cognitive Complexity: Moderate</p> <p>SC.912.N.3.2 Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science. Cognitive Complexity: Moderate</p> <p>SC.912.N.4.1 Explain how scientific knowledge and reasoning provide an empirically- based perspective to inform society's decision making. Cognitive Complexity: Moderate</p> <p>SC.912.N.4.2 Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental. Cognitive Complexity: High</p> <p>SC.912.L.17.11 Evaluate the costs and benefits of renewable and nonrenewable resources for energy. <b>(restated for unit)</b> Cognitive Complexity: High</p>	<p>V What are the different ways that the atomic nucleus can change?</p> <p>A. Four Fundamental Forces</p> <ol style="list-style-type: none"> <li>1. magnitude and range for:             <ol style="list-style-type: none"> <li>a. gravitational</li> <li>b. electromagnetic</li> <li>c. weak nuclear</li> <li>d. strong nuclear</li> </ol> </li> </ol> <p>B. Theory of Radioactivity</p> <ol style="list-style-type: none"> <li>1. half-life</li> <li>2. radiation</li> <li>3. experiments with uranium ore and/or alpha rays from radium</li> </ol> <p>C. Nuclear reactions</p> <ol style="list-style-type: none"> <li>1. radioactive decay</li> <li>2. fission</li> <li>3. fusion</li> <li>4. safety and ethical issues             <ol style="list-style-type: none"> <li>a. include Chernobyl, Three Mile Island, Fukushima, Hiroshima</li> </ol> </li> <li>5. Benefits             <ol style="list-style-type: none"> <li>a. fuel for electricity generation</li> <li>b. medicine</li> </ol> </li> </ol>	<p>Describe the four fundamental forces</p> <p>Compare and contrast the magnitude and range of the four fundamental forces</p> <p>Analyze how the theory of radioactivity used experimental evidence of Curies, Becquerel, Soddy, and Rutherford.</p> <p>Determine the amount of radioactive material remaining after a certain amount of time or certain number of half-lives.</p> <p>Compare the penetrating ability of the different types of radiation both particle and energy.</p> <p>Write nuclear equations containing alpha, beta and gamma radiation.</p> <p>Relate conservation of matter to nuclear equations.</p> <p>Predict products of alpha and beta decay reactions.</p>
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Vocabulary: radioactivity, radioisotope, half-life, fission, fusion, alpha particle, gamma radiation, beta particle, heavy water, isotopic tracers, nuclear stability

Unit 2 – 18 days  
9 block periods

Suggested Laboratories for Unit 2	Title	Lab Type	Resources: <b>P</b> -Pearson Textbook <b>G</b> -Glencoe Textbook <b>H</b> -Holt Textbook Reference pages
SC.912.P.10.18 Electron Spectra	<u>Flame Tests</u>	Quick Lab	P – page 142
	<u>Flame Tests</u>	Mini Lab	G – page 125
SC.912.P10.11 Radioactivity	<u>Radioactivity &amp; Half-Lives</u>	Small Scale	P – page 887
	<u>Modeling Radioactive Decay</u>	Mini Lab	G – page 819
	<u>Half-Lives &amp; Pennies</u>	Start Up	H – page 641

Course: Chemistry 1

Course Code: 2003340

Quarter: 1 Unit 3

**Topic of Study:** Periodicity

**Standards:** P8 – Matter

**Concepts:** Periodic Law, Periodic Trends, Metals and Nonmetals

**Essential Question:** How does the periodic table predict the properties and behavior of elements?

**Key Learning:** The development of the periodic table has led to a better understanding of the relationship between elemental trends and properties

Unit 3: 12 days (6 blocks)

NGSSS	Content Limits	Target
<p>SC.912.P.8.5 Relate properties of atoms and their position in the periodic table to the arrangement of their electrons. Cognitive Complexity: Moderate</p>	<p>I What can we learn about an element based on its position in the periodic table?</p> <p>A. Periodic Table</p> <ol style="list-style-type: none"> <li>1. Discovery</li> <li>2. Rearrangements</li> <li>3. Organization                             <ol style="list-style-type: none"> <li>a. groups or families</li> <li>b. periods</li> </ol> </li> <li>4. Element nomenclature and symbol</li> </ol> <p>B. Valence electrons</p> <ol style="list-style-type: none"> <li>1. s, p, d, f blocks</li> <li>2. groups and configuration</li> <li>3. energy levels and periods</li> </ol> <p>C. Metals, Nonmetals, Metalloids</p> <ol style="list-style-type: none"> <li>1. definition                             <ol style="list-style-type: none"> <li>a. Octet rule</li> </ol> </li> <li>2. location</li> <li>3. characteristics and properties</li> <li>4. Metallic bonding                             <ol style="list-style-type: none"> <li>a. electron sea</li> </ol> </li> </ol>	<p>Explain Mendeleev's method of organizing the elements in his table.</p> <p>Analyze the contributions of Moseley and Seaborg to the Periodic Table's rearrangement.</p> <p>Identify location of groups and periods on the Modern Periodic table.</p> <p>Describe how elements are named and symbols are determined.</p> <p>Describe the organization of elements on periodic table.</p> <p>Determine location of element by its orbital and amount of valence electrons</p> <p>Discuss the various placements of the elements hydrogen and helium.</p> <p>Indicate the location of metals, nonmetals, and metalloids</p> <p>Use the Octet Rule to define metals and nonmetals.</p> <p>Compare properties of metals and nonmetals.</p> <p>Explain how delocalized electrons produce metallic bonding in metals.</p>
<p>Vocabulary: alkali metals, alkaline earth metals, halogens, lanthanide/actinide series, metalloids, noble gases, transition metals, period, Mendeleev, Moseley, Seaborg, periodic groups, Octet Rule, electron sea, metallic bonding, delocalized electrons</p>		
<p>SC.912.P.8.5 Relate properties of atoms and their position in the periodic table to the arrangement of their electrons. Cognitive Complexity: Moderate</p>	<p>II How do periodic trends relate to the electron structure of an element?</p> <p>A. Periodic trends – in a group</p> <ol style="list-style-type: none"> <li>1. Atomic radius</li> <li>2. Ionization Energy</li> </ol>	<p>Determine the change in atom size within a group or period.</p> <p>Describe the effects of shielding and energy levels on atomic size.</p>

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	<p>3. Electronegativity 4. Electron affinity</p> <p>B. Periodic trends – in a period 1. Atomic radius 2. Ionization Energy 3. Electronegativity 4. Electron affinity</p> <p>C. Ion Formation 1. within a group 2. within a period 3. ionic size</p>	<p>Arrange based on similarities within a group and/or period the trends of ionization energy, electron affinity and electronegativity.</p> <p>Apply the Octet Rule to determine charge of the representative elements.</p> <p>Predict the ionic charges based on an element's position on the periodic table.</p> <p>Organize the change in ion charge within the A groups as you move from left to right on periodic table.</p> <p>Compare the size of metals to their ions.</p> <p>Compare the size of nonmetals to their ions.</p>	
<p>Vocabulary: periodic law, atomic radius, ionic radius, ionization energy, electronegativity, electron affinity, representative elements</p> <p style="text-align: right;">Unit 3 – 12 days 6 block periods</p>			
Suggested Laboratories for Unit 3	Title	Lab Type	Resources: <b>P</b> -Pearson Textbook <b>G</b> -Glencoe Textbook <b>H</b> -Holt Textbook Reference pages
SC.912.P.8.5    Periodic Table	<u>Periodic Trends in Atomic Radii</u>	Quick Lab	P – page 180
	<u>Periodicity in Three Dimensions</u>	Small Scale	P – page 184
	<u>The Mendeleev Lab in 1869</u>	Skills Lab	H – page 778
	<u>Periodicity of Molar Heats</u>	Mini Lab	G – page 164

End of First Quarter – 45 days

Unit 4 is next and should be used throughout the first quarter and the remaining three quarters.

Course: Chemistry 1

Course Code: 2003340

Quarter: 1 Unit 4

**Topic of Study:** Experimental Design

**Standards:** N – Nature of Science

**Concepts:** Pose a Question, Conduct Research, Develop a Hypothesis, Design the Experiment, Collect and Analyze Data, Draw Conclusions, Communicate Results

**Essential Question:** What influence does the scientific method have on the practice of science?

**Key Learning:** Scientists conduct investigations for a wide variety of reasons. The practice of science is a multifaceted activity employing certain principles scientists use to guide scientific research and experimentation.

NGSSS	Content	Target
<p>SC.912.N.1.1 Define a problem based on a specific body of knowledge, for example: chemistry and do the following</p> <ol style="list-style-type: none"> <li>1. pose questions about the natural world,</li> <li>2. conduct systematic observations,</li> <li>3. examine books and other sources of information to see what is already known,</li> <li>4. review what is known in light of empirical evidence,</li> </ol> <p>Cognitive Complexity: High</p> <p>SC.912.N.1.2 Describe and explain what characterizes science and its methods.</p> <p>Cognitive Complexity: Moderate</p>	<p>I How can I use prior empirical evidence to develop a testable question?</p> <p>A. Develop the Question</p> <ol style="list-style-type: none"> <li>1. Safety precautions, equipment need, cost, school rules</li> <li>2. identification of variables, topic interest, availability of research</li> <li>3. prior empirical evidence</li> </ol> <p>B. Conduct research</p> <ol style="list-style-type: none"> <li>1. Develop research questions                             <ol style="list-style-type: none"> <li>a. key words from testable question as a guide for your search</li> <li>b. questions on prior empirical evidence.</li> </ol> </li> <li>2. keep continual bibliography                             <ol style="list-style-type: none"> <li>a. use books, journals, periodicals</li> <li>b. online reputable websites – educational, periodicals, organization</li> <li>c. possible sources – writing companies, organization, or local scientists</li> <li>d. information is used in reporting your experiment.</li> </ol> </li> </ol>	<p>Define a scientific problem or question based on the specific body of knowledge correlated to chemistry.</p> <p>Explain the difference between an experiment and other types of scientific investigations.</p> <p>Recognize systematic inference as one form of scientific investigation.</p> <p>Use appropriate reference materials to support scientific investigations of various types, such as systematic observation or experiments.</p> <p>Describe the creative means scientists must use to design an investigation.</p> <p>Explain that science is based on evidence based facts.</p>
<p>SC.912.N.1.1 Define a problem based on a specific body of knowledge, for example: chemistry and do the following</p> <ol style="list-style-type: none"> <li>5. plan <u>investigations</u>,</li> <li>6. use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data, tables, and graph</li> <li>8. generate explanations that explicate or describe natural phenomena (inferences),</li> <li>9. use appropriate evidence and reasoning to justify these explanations to others,</li> <li>10. communicate results of scientific</li> </ol>	<p>II How does a hypothesis reflect the relationship between my independent and dependent variable?</p> <p>A predict</p> <ol style="list-style-type: none"> <li>1. use research collect to help</li> <li>2. contain the variables</li> <li>3. must be testable                             <ol style="list-style-type: none"> <li>a. measure what you do</li> <li>b. measure what will happen</li> </ol> </li> </ol>	<p>Develop a hypothesis with one independent variable (tested variable).</p> <p>Distinguish between dependent variables (outcome variable), independent variables (tested variable), controls, and variables that are held constant in a variety of activities.</p> <p>Develop hypotheses and determine what data should be collected to test</p>

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<p>investigations, and 11. evaluate the merits of the explanations produced by others. Cognitive Complexity: High</p>		<p>Explain why scientific investigations should be replicable.</p> <p>Conduct, discuss, and compare similar investigations by working cooperatively in groups.</p> <p>Distinguish the difference between a scientific law and theory vs. a societal law.</p>
<p>SC.912.N.1.1 Define a problem based on a specific body of knowledge, for example: chemistry and do the following 6. use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data, tables, and graph Cognitive Complexity: High</p>	<p>III How can I use experiment ? A. Design the Experiment 1. procedures and materials 2. technology and math     a. measurement in metric 3. Groups – experimental and control 4. number of trials or sample size  B. Conduct the Experiment 1. follow your design 2. record     a. quantitative – data in chart or table     b. qualitative – detailed notes throughout the experiment     c. potential problems or procedural adjustments</p>	<p>Determine tools and methods that should be used to collect valid data.</p> <p>Determine how data will be collected to analyze the data.</p> <p>Determine appropriate and consistent standards of measurement for the data to be collected in a survey or experiment.</p> <p>Calculate and determine the % error of the data.</p>
<p>SC.912.N.1.1 Define a problem based on a specific body of knowledge, for example: chemistry and do the following 7. pose answers, explanations, or descriptions of events, 8. generate explanations that explicate or describe natural phenomena (inferences), 9. use appropriate evidence and reasoning to justify these explanations to others, 10. communicate results of scientific investigations, and 11. evaluate the merits of the explanations produced by others Cognitive Complexity: High</p>	<p>IV How does my data impact what I predicted? A. Analyze Data 1. examine data mathematically     a. percentages, means, median, range and mode     b. average your trials 2. Graphing     a. labeling axes     x- axis(independent variable)     y-axis (dependent variable)  B. Draw Conclusion 1. Explanations     a. what you learned     b. data collected     c. support/lack of support for hypothesis     d. evaluation of procedures and equipment     e. discuss ideas or further testing</p>	<p>Present individual or group data after a scientific investigation, analyze the evidence, and reach a class consensus.</p> <p>Justify conclusions based upon all the available evidence, not on expressed opinions.</p> <p>Collect, organize, and analyze data sets.</p> <p>Determine the best format for the data as: bar graphs, line graphs, scatter plots, cumulative frequency graphs.</p>
<p>Vocabulary: independent variable, dependent variable, hypothesis, inference, predict, data, x-axis, y-axis</p>		
<p>SC.912.N.1.3 Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative</p>	<p>V. What is the role of the scientist? Educational training Interests Work ethic Peer Reviewer</p>	<p>Identify that a scientist's interest and educational background influence their research.</p> <p>Understand that variations in both personal and educational background</p>

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<p>scientific explanations to explain the data presented. Cognitive Complexity: Low</p> <p>SC.912.N.2.5 Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations. Cognitive Complexity: High</p>		<p>are essential when researching a topic.</p> <p>Understand that all scientific discoveries are put through strict peer review by scientists in the same field.</p>
<p>SC.912.N.2.1 Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science). Cognitive Complexity: High</p> <p>SC.912.N.2.3 Identify examples of pseudoscience (such as astrology, phrenology) in society. Cognitive Complexity: Low</p> <p>SC.912.N.2.2 Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion. Cognitive Complexity: High</p>	<p>VI What science cannot answer?</p> <ol style="list-style-type: none"> <li>1. Difference between             <ol style="list-style-type: none"> <li>a. science and art</li> <li>b. science and philosophy</li> </ol> </li> <li>2. Pseudoscience vs. Science             <ol style="list-style-type: none"> <li>a. astronomy vs. astrology</li> <li>b. organic chemistry vs. organic food</li> <li>c. pharmaceutical vs. homeopathic</li> </ol> </li> </ol>	<p>Describe the creative means scientists must use to design an investigation.</p> <p>Explain that science is based on evidence based facts and not opinions.</p> <p>Differentiate between science and pseudoscience.</p> <p>Identify how pseudoscience can mislead people based on the information presentation.</p>
<p>SC.912.N.1.5 Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome. Cognitive Complexity: Moderate</p> <p>SC.912.N.2.4 Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by New investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability. Cognitive Complexity: High</p>	<p>VII How is scientific knowledge presented throughout time?</p> <ol style="list-style-type: none"> <li>1. Theories</li> <li>2. Laws</li> <li>3. Models             <ol style="list-style-type: none"> <li>a. Visual/Physical</li> <li>b. Conceptual</li> <li>c. Mathematical</li> <li>d. Benefits</li> <li>e. Limitations</li> </ol> </li> <li>4. Must be replicable by other scientists around the world</li> </ol>	<p>Explain why scientific investigations should be replicable.</p> <p>Justify conclusions based upon all the available evidence, not on expressed opinions.</p> <p>Distinguish the difference between a scientific law and theory vs. a societal law.</p> <p>Describe the role consensus plays in the historical development of a theory in chemistry.</p>

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<p>SC.912.N.3.1 Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer. Cognitive Complexity: High</p> <p>SC.912.N.3.2 Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science. Cognitive Complexity: Moderate</p> <p>SC.912.N.3.3 Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships. Cognitive Complexity: Moderate</p> <p>SC.912.N.3.4 Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions. Cognitive Complexity: Moderate</p> <p>SC.912.N.3.5 Describe the function of models in science, and identify the wide range of models used in science. Cognitive Complexity: Moderate</p>		
<p>SC.912.N.4.1 Explain how scientific knowledge and reasoning provide an empirically- based perspective to inform society's decision making. Cognitive Complexity: Moderate</p> <p>SC.912.N.1.7 Recognize the role of creativity in constructing scientific questions, methods and explanations. Cognitive Complexity: Low</p> <p>SC.912.N.4.2 Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental. Cognitive Complexity: High</p>	<p>VIII How science affects our society?</p> <ol style="list-style-type: none"> <li>1. Technology based on scientific theories</li> <li>2. Environmental concerns             <ol style="list-style-type: none"> <li>a. hazardous waste</li> <li>b. air quality</li> <li>c. petroleum products</li> <li>d. drilling and mining</li> </ol> </li> </ol>	<p>Give examples of how advances in technology have affected scientific theories and laws.</p> <p>Describe the effects of technology on environmental quality.</p>

NOTE: This unit is used continuously through the quarter and for the remaining 3 quarters.