

## Chemistry/High School

### Curriculum Guide

Tennessee's K-12 science standards are intended to guide the development and delivery of educational experience that prepare all students for the challenges of the 21<sup>st</sup> Century. You may access these documents using the **Best for All Central** website:

<https://bestforall.tnedu.gov/lessons-and-learning-item?content-id=9109>

| 1 <sup>st</sup> Quarter                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                    |                                                                                                                                                                                                                                                                                                                                                                      |        |
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| Standard(s)                                                                                    | Learning Objective(s)                                                                                                                                                                                                                                                                                                                                                                                  | CCC/SEP                                                                                                                                                                                                                                                                                                                                                                                                                 | Savvas Alignment                                   | Assessments                                                                                                                                                                                                                                                                                                                                                          | Pacing |
| <b>Storyline 1: Atoms, Elements, and Molecules</b><br><b>Investigation 1: Atomic Structure</b> |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                    |                                                                                                                                                                                                                                                                                                                                                                      |        |
| Chem1.PS1.1                                                                                    | <b>Experience 1:</b> <ul style="list-style-type: none"> <li>Investigate and compare various properties of elements.</li> <li>Develop models to describe the atomic composition of simple molecules.</li> <li>Use particle level models to explain interactions of energy and matter within a system.</li> <li>Use evidence to determine whether a physical or chemical change has occurred.</li> </ul> | <b>Investigation 1:</b><br>CCC: Pattern, observation and explanation<br>SEP: Obtaining, evaluating, and communicating information from scientific texts in order to derive meaning, evaluate validity, and integrate information.<br><br>Students deepen their understanding of energy and matter through a study of atomic structure. Students apply the laws of conservation of energy and matter as they investigate | <b>Experience 1:</b> The Particle Nature of Matter | <b>Investigation 1:</b><br><b>Performance based Assessment:</b> Evaluate Atomic Structure with Flame Tests<br><b>3-D Assessment:</b> Atomic Structure<br><b>Experience Handbook:</b> Performance-Based Assessment, p. 51; Revisit Anchoring Phenomenon, p. 51; Appendix C Problem Bank, pp. R10-R11<br><br><b>Experience 1:</b> Quiz – The Particle Nature of Matter | 3 days |

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| Chem1.PS1.1 | <b>Experience 2:</b> <ul style="list-style-type: none"> <li>Describe atomic structure using a model of the atom that includes protons neutrons and electrons.</li> <li>Compare and contrast atoms of different elements and isotopes of the same element.</li> <li>Calculate the atomic mass of an element given isotope data.</li> <li>Explain how Dalton's postulates, Thomson's cathode ray experiment and Rutherford's model have shaped understanding of the atom.</li> </ul>                                                                                                                                                                                                     | and develop system models of the types of atoms and isotopes and other related phenomena. | <b>Experience 2:</b><br>Modeling Atoms                             | <b>Experience 2:</b> Quiz –<br>Modeling Atoms                             | 3 days |
| Chem1.PS1.3 | <b>Experience 3:</b> <ul style="list-style-type: none"> <li>Investigate light as waves and the mathematical relationship between speed of light frequency and wavelength.</li> <li>Use the electromagnetic spectrum to identify wavelengths for different types of electromagnetic radiation.</li> <li>Develop and use Bohr models for atoms, illustrating electron energy levels and the placement of electrons within those levels.</li> <li>Use the Bohr model to explain why elements have unique atomic emission spectra.</li> <li>Relate the spectra of elements to the structure of their atoms, particularly the patterns of electrons and changes in their energy.</li> </ul> |                                                                                           | <b>Experience 3:</b><br>Atomic Emission Spectra and the Bohr Model | <b>Experience 3:</b> Quiz -<br>Atomic Emission Spectra and the Bohr Model | 3 days |
| Chem1.PS1.3 | <b>Experience 4:</b> <ul style="list-style-type: none"> <li>Investigate how the quantum mechanical nature of the electron gave rise to modern atomic orbital theory.</li> <li>Evaluate how the quantum mechanical nature of the electron can be used to refine models of the atom.</li> <li>Investigate how Heisenberg's uncertainty principle led to the electron cloud model of the atom.</li> </ul>                                                                                                                                                                                                                                                                                 |                                                                                           | <b>Experience 4:</b><br>Modern Atomic Theory                       | <b>Experience 4:</b> Quiz -<br>Modern Atomic Theory                       | 2 days |

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| Chem1.PS1.3                                                                                      | <b>Experience 5:</b> <ul style="list-style-type: none"> <li>Predict the electron configuration of atoms using the periodic table as a model.</li> <li>Use electron dot structures to represent an atom's valence electrons</li> </ul>                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Experience 5:</b><br>Electrons in Atoms                   | <b>Experience 5:</b> Quiz -<br>Electrons in Atoms                                                                                                                                                                                                                                                                                                                      | 3 days |
| <b>Storyline 1: Atoms, Elements, and Molecules</b><br><b>Investigation 2: The Periodic Table</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                              |                                                                                                                                                                                                                                                                                                                                                                        |        |
| Chem1.PS1.5                                                                                      | <b>Experience 1:</b> <ul style="list-style-type: none"> <li>Describe how elements in the periodic table are arranged by the numbers of protons in atoms.</li> <li>Identify how the arrangement of the main groups of the periodic table reflect the patterns of outermost electrons.</li> <li>Explain how the position of an element in the table can be used to predict some of its chemical properties.</li> </ul>                                                                                                              | <b>Investigation 2:</b><br>CCC: Pattern, observation, and explanation<br>SEP: Obtaining, evaluating, and communicating information from scientific texts in order to derive meaning, evaluate validity, and integrate information. Planning and carrying out controlled investigations to collect data that is used to test existing theories and explanations, revise and develop new theories and explanations, or assess the effectiveness, efficiency, and durability of designs under various conditions<br><br>Students deepen their understanding of patterns through a study of the periodic table. Students apply their understanding of the observed patterns of nature as they investigate and develop models on | <b>Experience 1:</b> The Periodic Table: An Overview         | <b>Investigation 2:</b><br><b>Performance based Assessment:</b> Gravimetric Analysis of Periodic Trends<br><b>3-D Assessment:</b> The Periodic Table<br><b>Experience Handbook:</b> Performance-Based Assessment, p. 75; Revisit Anchoring Phenomenon, p. 153; Appendix C Problem Bank, pp. R11-R12<br><br><b>Experience 1:</b> Quiz - The Periodic Table: An Overview | 2 days |
| Chem1.PS1.2                                                                                      | <b>Experience 2:</b> <ul style="list-style-type: none"> <li>Describe how electron configurations give rise to trends in the periodic table.</li> <li>Explain how the periodic table can be used to predict electron configuration of an element.</li> <li>Use Coulomb's law to explain the effective nuclear charge and why the positive charge exerted by an atomic nucleus is not equal to the charge of its protons</li> <li>Explain patterns of effective nuclear charge across the period of main group elements.</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Experience 2:</b> The Periodic Table and Atomic Structure | <b>Experience 2:</b> Quiz - The Periodic Table and Atomic Structure                                                                                                                                                                                                                                                                                                    | 2 days |

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| Chem1.PS1.2                                                                                    | <b>Experience 3:</b> <ul style="list-style-type: none"> <li>Investigate and explain reactivity patterns in the periodic table using concepts of ionization energy, net effective charge, and atomic radius.</li> <li>Use models of elements to explain the formation of ions.</li> <li>Use periodic trends to explain some chemical properties of elements.</li> </ul>           | periodic trends as well as other related phenomena.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Experience 3:</b><br>Periodic Trends | <b>Experience 3:</b> Quiz -<br>Periodic Trends                                                                                                                                                                                                                                                                                                      | 3 days |
| <b>Storyline 1: Atoms, Elements, and Molecules</b><br><b>Investigation 3: Chemical Bonding</b> |                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         |                                                                                                                                                                                                                                                                                                                                                     |        |
| Chem1.PS1.3<br>Chem1.PS1.4                                                                     | <b>Experience 1:</b> <ul style="list-style-type: none"> <li>Explain that atoms gain or lose electrons to form ions so that they have a full valence shell, which makes them more stable.</li> <li>Explain that ionic bonds are electrostatic attractions between cations and anions.</li> <li>Describe how the structures of ionic compounds affect their properties.</li> </ul> | <b>Investigation 3:</b><br>CCC: Structure and function of systems and their parts<br><br>SEP: Analyzing and interpreting data with appropriate data presentation (graph, table, statistics, etc.), identifying sources of error and the degree of certainty. Data analysis is used to derive meaning or evaluate solutions.<br><br>Students investigate the types of chemical bonds and how they affect the properties of a molecule. They explore the types of attractions between molecules and how intermolecular attractions influence the bulk properties of a material. | <b>Experience 1:</b> Ionic Bonds        | <b>Investigation 3:</b><br><b>Performance based Assessment:</b> Qualitative Analysis and Chemical Bonding<br><b>3-D Assessment:</b> Chemical Bonding<br><b>Experience Handbook:</b> Performance-Based Assessment, p. 117; Revisit Anchoring Phenomenon, p. 117; Appendix C Problem Bank, pp. R12-R13<br><br><b>Experience 1:</b> Quiz - Ionic Bonds | 2 days |
| Chem1.PS1.4                                                                                    | <b>Experience 2:</b> <ul style="list-style-type: none"> <li>Describe the electron sea model of metallic bonds.</li> <li>Explain how the bonding in metals and alloys affects their properties.</li> </ul>                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Experience 2:</b> Metallic Bonds     | <b>Experience 2:</b> Quiz -<br>Metallic Bonds                                                                                                                                                                                                                                                                                                       | 2 days |
| Chem1.PS1.3<br>Chem1.PS1.4                                                                     | <b>Experience 3:</b> <ul style="list-style-type: none"> <li>Explain how nonmetals share electrons to complete their valence shell octet, resulting in the formation of a covalent bond.</li> </ul>                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Experience 3:</b> Covalent Bonds     | <b>Experience 3:</b> Quiz -<br>Covalent Bonds                                                                                                                                                                                                                                                                                                       | 2 days |

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|                                                                                            | <ul style="list-style-type: none"> <li>Identify single, double, and triple covalent bonds and draw electron dot diagram for each.</li> <li>Describe how elements of different electronegativities can share electrons unequally, leading to the formation of a polar covalent bond.</li> </ul>                                                                                                                  |                                                                                                                                                                                                                                                                                                        |                                                         |                                                             |        |
| Supports Chem1.PS1.2                                                                       | <b>Experience 4:</b> <ul style="list-style-type: none"> <li>Describe the types of attractions between molecules.</li> <li>Explain how intermolecular attractions between molecules influence the bulk properties of a material.</li> </ul>                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                        | <b>Experience 4:</b><br>Intermolecular Attractions      | <b>Experience 4:</b> Quiz - Intermolecular Attractions      | 2 days |
| Chem1.PS1.4<br>Chem1.PS1.5                                                                 | <b>Experience 5:</b> <ul style="list-style-type: none"> <li>Explain the rules for naming molecular compounds, ionic compounds, and acids.</li> <li>Demonstrate how to determine a neutral compound's formula using its name and the periodic table.</li> <li>Explain how to name a chemical compound when given its formula.</li> <li>Predict bond types in a compound based on its name or formula.</li> </ul> |                                                                                                                                                                                                                                                                                                        | <b>Experience 5:</b><br>Names and Formulas of Compounds | <b>Experience 5:</b> Quiz - Names and Formulas of Compounds | 4 days |
| <b>Storyline 2: Understanding Chemical Reactions</b><br><b>TN 1</b> Solutions and Mixtures |                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                        |                                                         |                                                             |        |
| Chem1.PS1.14<br>Chem1.PS1.15                                                               | <b>Experience TN1:</b> <ul style="list-style-type: none"> <li>Calculate a concentration in units of ppm.</li> <li>Explain and give examples of the process of filtration.</li> <li>Explain and give examples of the process of distillation.</li> </ul>                                                                                                                                                         | <b>TN 1:</b><br>CCC: Scale, proportion, and quantity that integrate measurement and precision of language<br>SEP: Asking questions (for science) and defining problems (for engineering) to determine what is known, what has yet to be satisfactorily explained, and what problems need to be solved. | <b>Experience TN1:</b><br>Solutions and Mixtures        | <b>TN 1:</b><br>Quiz – Interactive Worksheet                | 1 day  |

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|                                                                                                   |                                                                                                                                                                                                                                                                                          | Students learn how to calculate concentrations using units of ppm as an alternative to molarity. Students should recognize the similarity to calculating a percentage and should understand that parts per million is a useful unit for extremely small concentrations. Students will also learn about filtration and distillation as examples of separation methods. Filtration is used to separate inhomogeneous mixtures of a solid and a liquid or gas while distillation is used to purify a liquid or to separate a mixture of several liquids. |                                                         |                                              |       |
| <b>Storyline 2: Understanding Chemical Reactions</b><br><b>TN 2 Specific Heat and Calorimetry</b> |                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                         |                                              |       |
| Chem1.PS3.3                                                                                       | <b>Experience TN2:</b> <ul style="list-style-type: none"> <li>Compare the specific heats of different substances.</li> <li>Perform calculations using the equation <math>Q = mc\Delta T</math></li> <li>Explain and perform calculations related to calorimetry measurements.</li> </ul> | <b>TN 2:</b><br>CCC: Cause and effect relationships that can be explained through a mechanism<br>SEP: Using mathematics and computational thinking as tools to represent variables and their relationships in models, simulations, and data analysis in order to make and test predictions.<br><br>Students learn about the physical property of specific heat by observing that the same amount of heat produces different changes in temperature for different                                                                                      | <b>Experience TN2:</b><br>Specific Heat and Calorimetry | <b>TN 2:</b><br>Quiz – Interactive Worksheet | 1 day |

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|                                                                                                                  |                                                                                                                                                                                                                                                                                                                                             | <p>materials. This includes using the equation <math>Q=mc\Delta T</math>, to perform calculations based on the relationship between heat lost or gained, temperature change, and the mass of a substance.</p> <p>Students will also learn how to apply this equation to measure the heat released or absorbed during a chemical or physical change period by applying the principle of conservation of energy, students can equate the energy change to the change in temperature of the water in a simple calorimeter.</p> |                                                |                                                                                                                                                                                                                                                                                                                                         |        |
| <b>Storyline 2: Understanding Chemical Reactions</b><br><b>Investigation 4: Physical Properties of Materials</b> |                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                |                                                                                                                                                                                                                                                                                                                                         |        |
| Chem1.PS1.11<br>Chem1.PS3.1                                                                                      | <b>Experience 1:</b> <ul style="list-style-type: none"> <li>Investigate and describe 3 states of matter (solid, liquid, gas).</li> <li>Develop models to explain behaviors of gases with changes in temperature, pressure, and volume.</li> <li>Develop a model of intermolecular forces and use it to explain states of matter.</li> </ul> | <b>Investigation 4:</b><br>CCC: Systems and system models with defined boundaries that can be investigated and characterized by the next three concepts <ul style="list-style-type: none"> <li>Energy and matter conservation through transformations that flow or cycle into, out of, or within a system</li> <li>Structure and function of systems and their parts</li> <li>Stability and change of systems</li> </ul>                                                                                                    | <b>Experience 1:</b><br>States of Matter       | <b>Investigation 4:</b><br><b>Performance based Assessment:</b> Road Deicers<br><b>3-D Assessment:</b> Physical Properties of Materials<br><b>Experience Handbook:</b> Performance-Based Assessment, p 181; Revisit Anchoring Phenomenon, p181; Appendix C Problem Bank, pp R13-R14<br><br><b>Experience 1:</b> Quiz – States of Matter | 1 day  |
|                                                                                                                  | <b>Experience 2:</b> <ul style="list-style-type: none"> <li>Describe how variations in kinetic energy among particles result in constant evaporation and condensation, even without heating or cooling.</li> <li>Summarize the mechanisms by which gas bubbles in a heated liquid exert enough</li> </ul>                                   | SEP: Analyzing and interpreting data with appropriate data presentation (graph, table, statistics, etc.), identifying sources of error and the degree of                                                                                                                                                                                                                                                                                                                                                                    | <b>Experience 2:</b><br>Modeling Phase Changes | <b>Experience 2:</b> Quiz – Modeling Phase Changes                                                                                                                                                                                                                                                                                      | 3 days |

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| Chem1.PS3.2  | <p>pressure to break free of the surface, resulting in boiling.</p> <ul style="list-style-type: none"> <li>Relate the melting point of different solids to the strength of intermolecular forces or bonds between their particles, and apply that understanding to predict the bond energy of a compound with a known melting point.</li> <li>Interpret phase diagrams to determine the state of water at various pressure and temperature points, and apply that understanding to predict the state of carbon dioxide at STP based on its phase diagram.</li> </ul> | <p>certainty. Data analysis is used to derive meaning or evaluate solutions.</p> <p>Students deepen their understanding of structures and functions of matter through a study the physical properties of materials. Students investigate and develop system models of intermolecular forces, bond energies and melting points, solubility and pressure, as well as other related phenomena.</p> |                                                                 |                                                                     |        |
| Chem1.PS1.4  | <p><b>Experience 3:</b></p> <ul style="list-style-type: none"> <li>Differentiate between the representative units of molecular and ionic compounds.</li> <li>Identify patterns in the location of elements making up ionic and molecular compounds on the periodic table.</li> <li>Relate the properties of molecular and ionic compounds at the bulk scale to the intermolecular forces and bonds between their particles.</li> </ul>                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Experience 3:</b><br>Comparing Ionic and Molecular Compounds | <b>Experience 3:</b> Quiz - Comparing Ionic and Molecular Compounds | 2 days |
| Chem1.PS1.2  | <p><b>Experience 4:</b></p> <ul style="list-style-type: none"> <li>Analyze data comparing metals and non metals and construct explanations for their differences.</li> <li>Summarize defining properties of metals.</li> <li>Describe how delocalized electrons give rise to metallic properties.</li> </ul>                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Experience 4:</b><br>Comparing Metals and Nonmetals          | <b>Experience 4:</b> Quiz - Comparing Metals and Nonmetals          | 1 day  |
| Chem1.PS1.13 | <p><b>Experience 5:</b></p> <ul style="list-style-type: none"> <li>Investigate the role of polarity in hydrogen bonding using water molecules.</li> <li>Discover how hydrogen bonding affects surface tension, boiling point, and the formation of ice.</li> <li>Develop a model that demonstrates the process of solvation within an aqueous solution.</li> </ul>                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Experience 5:</b><br>Water and Aqueous systems               | <b>Experience 5:</b> Quiz - Water and Aqueous systems               | 2 days |

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|  | <ul style="list-style-type: none"> <li>Diagram and explain why electrolytes conduct electricity and nonelectrolytes do not.</li> <li>Analyze the role of pressure and the efflorescence of hydrates.</li> </ul> |  |  |  |  |
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**44 days for standard based curriculum.**

**1-2 days should be taken for Lab Safety (before the start of the 1<sup>st</sup> lab procedure) and Pre-Assessment.**

**REQUIRED: Each student must have a signed safety contract on file to perform analyses in the laboratory.**

## 2nd Quarter

| Standard(s)                                                                                                                  | Learning Objective(s)                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | CCC/SEP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Savvas Alignment                                | Assessments                                            | Timeframe |
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| <b>Storyline 2: Understanding Chemical Reactions</b><br><b>Investigation 4: Physical Properties of Materials (Continued)</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                 |                                                        |           |
| Chem1.PS1.13                                                                                                                 | <b>Experience 6:</b> <ul style="list-style-type: none"> <li>Investigate the role of temperature and surface area in the formation of solutions.</li> <li>Develop a model to explain how solutions can become supersaturated.</li> <li>Construct and interpret graphs depicting solubility curves.</li> <li>Use Henry's law to discover the relationship between the solubility of a gas and pressure.</li> <li>Differentiate between solutions, suspensions, and colloids.</li> </ul> | <b>Investigation 4:</b><br>CCC: Pattern observation and explanation<br>SEP: Using mathematics and computational thinking as tools to represent variables and their relationships in models, simulations, and data analysis in order to make and test predictions.<br><br>Students deepen their understanding of structures and functions of matter through a study the physical properties of materials. Students investigate and develop system models of solubility as well as other related phenomena. | <b>Experience 6:</b><br>Properties of Solutions | <b>Experience 6: Quiz –</b><br>Properties of Solutions | 4 days    |

**Storyline 2: Understanding Chemical Reactions**

**Investigation 5: Chemical Quantities**

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| Chem1.PS1.7<br>Chem1.PS1.14  | <b>Experience 1:</b> <ul style="list-style-type: none"> <li>Investigate the 3 methods used to measure matter – count, mass and volume.</li> <li>Develop models of the mole that encompass atoms, molecules, and formula units.</li> <li>Explain the relationship between the mole and Avogadro's number.</li> <li>Use Avogadro's number to convert from moles to particles and particles to moles.</li> <li>Use the periodic table to find the molar mass of elements and compounds.</li> </ul> | <b>Investigation 5:</b><br>CCC: Pattern observation and explanation<br>SEP: Using mathematics and computational thinking as tools to represent variables and their relationships in models, simulations, and data analysis in order to make and test predictions.<br><br>Students deepen their understanding of scale, proportion and quantity through a study of chemical quantities. Students apply knowledge of the differences in size and energy as they investigate develop system models of the mole concept, molar relationships, percent composition, concentrations of solutions as well as other related phenomena. | <b>Experience 1:</b> The Mole Concept                           | <b>Investigation 5:</b><br><b>Performance Based Assessment:</b> Analysis of Basic Copper Carbonate<br><b>3-D Assessment –</b> Chemical Quantities<br><b>Experience Handbook:</b> Performance-Based Assessment, p. 223; Revisit Anchoring Phenomenon, p. 223; Appendix C Problem Bank, pp. R14-R15<br><br><b>Experience 1:</b> Quiz - The Mole Concept | 2 days |
| Chem1.PS1.7                  | <b>Experience 2:</b> <ul style="list-style-type: none"> <li>Use the mole concept to convert between mass, volume (of a gas), and representative particles.</li> <li>Convert mole quantities to masses and mass quantities to moles.</li> <li>Explain the relationship between moles and volumes of gases at STP.</li> <li>Calculate the density of a gas at STP, given the molar mass of the gas.</li> </ul>                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Experience 2:</b> Molar Relationships                        | <b>Experience 2:</b> Quiz - Molar Relationships                                                                                                                                                                                                                                                                                                       | 3 days |
| Chem1.PS1.7<br>Chem1.PS1.14  | <b>Experience 3:</b> <ul style="list-style-type: none"> <li>Explain how to find the percent composition of a compound.</li> <li>Develop models to illustrate the law of definite proportion and law of constant composition.</li> <li>Find the empirical and molecular formulas for a compound.</li> <li>Use subscripts with in a chemical formula to represent a mole ratio.</li> </ul>                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Experience 3:</b> Percent Composition and Empirical Formulas | <b>Experience 3:</b> Quiz - Percent Composition and Empirical Formulas                                                                                                                                                                                                                                                                                | 2 days |
| Chem1.PS1.13<br>Chem1.PS1.14 | <b>Experience 4:</b> <ul style="list-style-type: none"> <li>Find the molarity of a solution.</li> <li>Investigate how the ratio of solute to solvent affects the concentration of a solution.</li> </ul>                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Experience 4:</b> Concentrations of Solutions                | <b>Experience 4:</b> Quiz - Concentrations of Solutions                                                                                                                                                                                                                                                                                               | 2 days |

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|                                                                                                    | <ul style="list-style-type: none"> <li>Devise a method to make a solution of a specific concentration.</li> <li>Calculate the percentage of a solution by mass and by volume.</li> </ul>                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                   |                                                                                                                                                                                                                                                                                                                                                                      |        |
| <b>Storyline 2: Understanding Chemical Reactions</b><br><b>Investigation 6: Chemical Reactions</b> |                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                   |                                                                                                                                                                                                                                                                                                                                                                      |        |
| Chem1.PS1.6<br>Chem1.PS3.4<br>Chem1.PS3.5                                                          | <b>Experience 1:</b> <ul style="list-style-type: none"> <li>Write balanced equations for chemical reactions.</li> <li>Distinguish between endothermic reactions and exothermic reactions.</li> <li>Explain what causes chemical reactions.</li> <li>Develop a basic conceptual and mathematical model for the generation of energy from the reaction of 2 substances.</li> </ul> | <b>Investigation 6:</b><br>CCC: Energy and matter conservation through transformations that flow or cycle into, out of, or within a system<br>SEP: Developing and using models to develop explanations for phenomena, to go beyond the observable and make predictions or to test designs.<br><br>Students deepen their understanding of energy and matter through a study of chemical reactions. Students investigate and write reaction equations of combination, decomposition, single replacement, double replacement, and combustion reactions and reactions in aqueous solutions, as well as other related phenomena. | <b>Experience 1:</b><br>Modeling Chemical Reactions               | <b>Investigation 6:</b><br><b>Performance Based Assessment:</b> Identify Evidence of Chemical Reactions<br><b>3-D Assessment –</b> Chemical Reactions<br><b>Experience Handbook:</b> Performance-Based Assessment, p. 259; Revisit Anchoring Phenomenon, p. 259; Appendix C Problem Bank, pp. R15-R16<br><br><b>Experience 1:</b> Quiz - Modeling Chemical Reactions | 2 days |
| Chem1.PS1.9                                                                                        | <b>Experience 2:</b> <ul style="list-style-type: none"> <li>Identify the 5 general types of chemical reactions and describe components that are reactants and products in these reactions.</li> <li>Predict the outcome of certain reactions based on these components, and make a claim about why the reactants react and why the products are formed.</li> </ul>               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Experience 2:</b><br>Predicting outcomes of chemical reactions | <b>Experience 2:</b> Quiz - Predicting outcomes of chemical reactions                                                                                                                                                                                                                                                                                                | 2 days |
| Chem1.PS1.9                                                                                        | <b>Experience 3:</b> <ul style="list-style-type: none"> <li>Investigate and explain formation of precipitates using knowledge of solubility and intermolecular forces.</li> </ul>                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Experience 3:</b><br>Reactions in Aqueous Solution             | <b>Experience 3:</b> Quiz - Reactions in Aqueous Solution                                                                                                                                                                                                                                                                                                            | 2 days |

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|                                                                                               | <ul style="list-style-type: none"> <li>Use evidence to make a claim about whether a reaction will form a precipitate in a chemical reaction.</li> </ul>                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                            |                                                                                                                                                                                                                                                                                                                                                             |        |
| <b>Storyline 2: Understanding Chemical Reactions</b><br><b>Investigation 7: Stoichiometry</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                            |                                                                                                                                                                                                                                                                                                                                                             |        |
| Chem1.PS1.6<br>Chem1.PS1.7                                                                    | <b>Experience 1:</b> <ul style="list-style-type: none"> <li>Analyze data on proportionality of reactants and products to predict their stoichiometric ratios in the corresponding chemical reaction.</li> <li>Develop a model that demonstrates conservation of mass in a chemical equation.</li> <li>Apply mathematical concepts to interpret a chemical equation.</li> </ul>                                                   | <b>Investigation 7:</b><br><b>CCC:</b> Pattern observation and explanation<br><b>SEP:</b> Analyzing and interpreting data with appropriate data presentation (graph, table, statistics, etc.), identifying sources of error and the degree of certainty. Data analysis is used to derive meaning or evaluate solutions. Using mathematics and computational thinking as tools to represent variables and their | <b>Experience 1:</b><br>Quantifying Reactants and Products | <b>Investigation 7:</b><br><b>Performance Based Assessment:</b> The Stoichiometry of Filling a Balloon<br><b>3-D Assessment – Stoichiometry Experience Handbook:</b> Performance-Based Assessment, p. 289; Revisit Anchoring Phenomenon, p. 289; Appendix C Problem Bank, pp. R17-R19<br><br><b>Experience 1:</b> Quiz – Quantifying Reactants and Products | 3 days |
| Chem1.PS1.7                                                                                   | <b>Experience 2:</b> <ul style="list-style-type: none"> <li>Use dimensional analysis to determine the mass of reactant required to obtain a given amount of product.</li> <li>Use the mole ratio in a chemical reaction to relate amounts of participating substances.</li> <li>Develop and use a model of different units of measurement.</li> <li>Calculate and communicate data on different units of measurement.</li> </ul> | relationships in models, simulations, and data analysis in order to make and test predictions.<br><br><b>Students</b> deepen their understanding of energy and matter through a study of stoichiometry. Students interpret equations of chemical reactions. They complete calculations of mold, mass, and volume for chemical equations. Students investigate and determine                                    | <b>Experience 2:</b><br>Chemical Calculations              | <b>Experience 2:</b> Quiz – Chemical Calculations                                                                                                                                                                                                                                                                                                           | 4 days |
| Chem1.PS1.7<br>Chem1.PS1.8                                                                    | <b>Experience 3:</b> <ul style="list-style-type: none"> <li>Explain the concept of limiting reactant and how it affects the amount of product produced in a reaction.</li> </ul>                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Experience 3:</b><br>Limiting Reagent and Percent Yield | <b>Experience 3:</b> Quiz – Limiting Reagent and Percent Yield                                                                                                                                                                                                                                                                                              | 3 days |

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|                                                                                                 | <ul style="list-style-type: none"> <li>Explain theoretical and actual yield and why the former is usually larger than the latter.</li> <li>Use computational thinking to predict the grams of product given the grams of reactant.</li> </ul>                                                                                                                                                                                                                           | limiting reagents and excess reagents as well as other related phenomena.                                                                                                                                                                                                                                                                                            |                                                              |                                                                                                                                                                                                                                                                                                                                                    |        |
| <b>Storyline 2: Understanding Chemical Reactions</b><br><b>Investigation 8: Thermochemistry</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                      |                                                              |                                                                                                                                                                                                                                                                                                                                                    |        |
| Chem1.PS3.4<br>Chem1.PS3.5                                                                      | <b>Experience 1:</b> <ul style="list-style-type: none"> <li>Explain how molecules must collide with each other with sufficient energy and in the correct orientation for a chemical reaction to take place.</li> <li>Represent energy changes in exothermic and endothermic reactions using an enthalpy diagram.</li> <li>Calculate enthalpy of reaction from bond energies and molar enthalpy of reaction data.</li> </ul>                                             | <b>Investigation 8:</b><br>CCC: Systems and system models with defined boundaries that can be investigated and characterized by the next three concepts<br>-Energy and matter conservation through transformations that flow or cycle into, out of, or within a system<br>-Structure and function of systems and their parts.<br>Stability and change of systems     | <b>Experience 1:</b><br>Energy in Chemical Bonds             | <b>Investigation 8:</b><br><b>Performance Based Assessment:</b> Enthalpy of a Neutralization Reaction<br><b>3-D Assessment – Thermochemistry Experience Handbook:</b> Performance-Based Assessment, p. 317; Revisit Anchoring Phenomenon, p. 317; Appendix C Problem Bank, pp. R19-R20<br><br><b>Experience 1:</b> Quiz - Energy in Chemical Bonds | 3 days |
| Chem1.PS3.4<br>Chem1.PS3.5                                                                      | <b>Experience 2:</b> <ul style="list-style-type: none"> <li>Explain how hess's law can be used to calculate the change in enthalpy for a chemical reaction using any number of intermediate compounds.</li> <li>Calculate the change in enthalpy for a reaction using the sum of a system of chemical equations or a table of enthalpies of formation.</li> <li>Calculate the change in enthalpy for a dissolution process using molar enthalpy of solution.</li> </ul> | SEP: Developing and using models to develop explanations for phenomena, to go beyond the observable and make predictions or to test designs.<br><br>Students deepen their understanding of energy and matter through a study of thermochemistry. Students investigate and develop system models of collisions, enthalpy, and activation energy of chemical reactions | <b>Experience 2:</b><br>Enthalpies of Formation and Reaction | <b>Experience 2:</b> Quiz - Enthalpies of Formation and Reaction                                                                                                                                                                                                                                                                                   | 2 days |
| Chem1.PS3.2                                                                                     | <b>Experience 3:</b> <ul style="list-style-type: none"> <li>Understand how and why substances change in enthalpy when transitioning between physical states.</li> </ul>                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                      | <b>Experience 3:</b><br>Enthalpy in Changes of State         | <b>Experience 3:</b> Quiz - Enthalpy in Changes of State                                                                                                                                                                                                                                                                                           | 2 days |

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|  | <ul style="list-style-type: none"> <li>Calculate the change in enthalpy for state changes between solid, liquid, and gas.</li> <li>Describe the link between state change enthalpies and the strength of intermolecular forces.</li> </ul> | as well as other related phenomena |  |  |  |
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**36 days for standard based curriculum.**

**3 days for Semester 1 Exam.**

### 3rd Quarter

| Standard(s)                                                                                          | Learning Objective(s)                                                                                                                                                                                                                                                                                                                                                               | CCC/SEP                                                                                                                                                                                                                                                                                                                                                        | Savvas Alignment                            | Assessments                                                                                                                                                                                                                                                                                                          | Timeframe |
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| <b>Storyline 3: The Chemistry of Climate Change</b><br><b>Investigation 9: The Behavior of Gases</b> |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                |                                             |                                                                                                                                                                                                                                                                                                                      |           |
| Chem1.PS1.10<br>Chem1.PS1.11<br>Chem1.PS3.1                                                          | <b>Experience 1:</b> <ul style="list-style-type: none"> <li>Investigate and explain how the compressibility of gases differ from the compressibility of solids and liquids.</li> <li>Use the kinetic theory to explain the properties of gases.</li> <li>Describe the effects on gases of changes in volume, temperature, pressure, and the number of particles.</li> </ul>         | <b>Investigation 9: The Behavior of Gases</b><br>CCC: Energy and matter conservation through transformations that flow or cycle into, out of, or within a system<br>SEP: Using mathematics and computational thinking as tools to represent variables and their relationships in models, simulations, and data analysis in order to make and test predictions. | <b>Experience 1:</b><br>Properties of Gases | <b>Investigation 9: Performance Based Assessment:</b> Cartesian Divers<br><b>3-D Assessment – The Behavior of Gases Experience Handbook:</b> Performance-Based Assessment, p. 357; Revisit Anchoring Phenomenon, p. 357; Appendix C Problem Bank, pp. R21-R23<br><br><b>Experience 1:</b> Quiz – Properties of Gases | 3 days    |
| Chem1.PS1.10<br>Chem1.PS1.11<br>Chem1.PS3.1                                                          | <b>Experience 2:</b> <ul style="list-style-type: none"> <li>Investigate and explain the relationship between the volume, temperature, and pressure of a gas.</li> <li>Develop and use models to explain the gas laws.</li> <li>Relate the patterns of interaction between gas particles at the molecular scale to the patterns of gas behavior at the macroscopic scale.</li> </ul> | To analyze the structure and interactions of matter by investigating the relationships between the pressure, temperature, and volume of a gas. Students develop models and construct explanation of the cause and effect                                                                                                                                       | <b>Experience 2:</b> The Gas Laws           | <b>Experience 2:</b> Quiz – The Gas Laws                                                                                                                                                                                                                                                                             | 4 days    |

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| Chem1.PS1.10<br>Chem1.PS1.12                                                                        | <b>Experience 3:</b> <ul style="list-style-type: none"><li>Investigate and explain the ideal gas law.</li><li>Construct an explanation of how a real gas differs from an ideal gas.</li><li>Explain how the concept of an ideal gas is helpful.</li><li>Relate the patterns of interaction between gas particles at the molecular scale to the patterns of gas behavior at the macroscopic scale.</li></ul>     | relationships among these factors. They explain how a real gas differs from an ideal gas.                                                                                                                                                                                                                                                                                                                         | <b>Experience 3:</b> Ideal Gases                 | <b>Experience 3:</b> Quiz – Ideal Gases                                                                                                                                                                                                                                                                                     | 3 days |
| Chem1.PS1.10<br>Chem1.PS1.11                                                                        | <b>Experience 4:</b> <ul style="list-style-type: none"><li>Identify the main gases in Earth's atmosphere.</li><li>Explain why some gases diffuse faster than others.</li><li>Explain Dalton's law of partial pressure.</li><li>Explain Graham’s law of effusion.</li><li>Describe the process that causes wind.</li><li>Relate relative humidity to water vapor partial pressure and air temperature.</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Experience 4:</b> Gases in Earth’s Atmosphere | <b>Experience 4:</b> Quiz – Gases in Earth’s Atmosphere                                                                                                                                                                                                                                                                     | 2 days |
| <b>Storyline 3: The Chemistry of Climate Change</b><br><b>Investigation 10: Weather and Climate</b> |                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                  |                                                                                                                                                                                                                                                                                                                             |        |
| Apply chemistry to phenomena                                                                        | <b>Experience 1:</b> <ul style="list-style-type: none"><li>Analyze data to determine how variation in the flow of energy in Earth systems results in changes to Earth systems.</li><li>Analyze data to make a claim that a change to Earth's surface can cause changes to other Earth systems.</li></ul>                                                                                                        | <b>Investigation 10: Weather and Climate</b><br>CCC: Cause and effect relationships that can be explained through a mechanism<br>SEP: Planning and carrying out controlled investigations to collect data that is used to test existing theories and explanations, revise and develop new theories and explanations, or assess the effectiveness, efficiency, and durability of designs under various conditions. | <b>Experience 1:</b> Earth’s Surface Systems     | <b>Investigation 10: Performance Based Assessment:</b> Microhabitat in a bottle.<br><b>3-D Assessment – Weather and Climate Experience Handbook:</b> Performance-Based Assessment, p. 413; Revisit Anchoring Phenomenon, p. 413; Appendix C Problem Bank, p. R23<br><br><b>Experience 1:</b> Quiz - Earth’s Surface Systems | 1 day  |

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|  | <b>Experience 2:</b> <ul style="list-style-type: none"> <li>Investigate and model the effects of changes on Earth's systems, including feedback that accelerates or slows changes to the systems.</li> <li>Investigate the factors that lead to stability in Earth's systems and how changes can disrupt equilibrium systems.</li> <li>Explain how feedback can cause stability and instability in Earth's systems.</li> <li>Analyze and interpret data to make claims about how changes in one system can affect other systems.</li> </ul> | <p>Students deepen their understanding of cause and effect through a study of weather and climate. They apply knowledge of cause and effect as they investigate and develop system models of temperature and pressure in the atmosphere, erosion and carbon dioxide, continent distributions and ocean currents, as well as other related phenomena.</p> | <b>Experience 2:</b><br>Water and Energy in the Atmosphere | <b>Experience 2:</b> Quiz -<br>Water and Energy in the Atmosphere | 1 day |
|  | <b>Experience 3:</b> <ul style="list-style-type: none"> <li>Investigate and model the effects of changes on Earth's systems.</li> <li>Investigate the factors that lead to stability in Earth's systems and how changes can disrupt equilibrium.</li> <li>Explain how feedback can cause stability and instability in Earth's systems.</li> <li>Analyze and interpret data to make claims about how changes in one system can affect other systems.</li> </ul>                                                                              |                                                                                                                                                                                                                                                                                                                                                          | <b>Experience 3:</b><br>Atmospheric System Feedbacks       | <b>Experience 3:</b> Quiz -<br>Atmospheric System Feedbacks       | 1 day |
|  | <b>Experience 4:</b> <ul style="list-style-type: none"> <li>Explain the behavior of water in changing temperatures and its impact on the planet.</li> <li>Describe the factors that affect carbon dioxide concentration in Earth's atmosphere and use these factors to make predictions about the atmosphere under changing conditions.</li> <li>Analyze and interpret data relating to the impact of carbon dioxide in Earth's atmosphere.</li> </ul>                                                                                      |                                                                                                                                                                                                                                                                                                                                                          | <b>Experience 4:</b><br>Long-Term Climate Factors          | <b>Experience 4:</b> Quiz -<br>Long-Term Climate Factors          | 1 day |
|  | <b>Experience 5:</b> <ul style="list-style-type: none"> <li>Use models based on scientific evidence to investigate natural cyclical changes affecting climate and weather.</li> </ul>                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                          | <b>Experience 5:</b><br>Short-Term Climate Factors         | <b>Experience 5:</b> Quiz -<br>Short-Term Climate Factors         | 1 day |

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|                                                                                                       | <ul style="list-style-type: none"> <li>Explain how natural fluctuations control both stability and change in Earth systems over a range of time scales.</li> <li>Understand how changes in solar energy, ocean circulation, tectonic events, and human activity can cause changes in regional and global climate on a variety of time scales.</li> </ul>                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                                                                                                                                                                                                                                                                                                                                          |       |
| <b>Storyline 3: The Chemistry of Climate Change</b><br><b>Investigation 11: Global Climate Change</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                                                                                                                                                                                                                                                                                                                                          |       |
| Apply chemistry to phenomena                                                                          | <b>Experience 1:</b> <ul style="list-style-type: none"> <li>Develop a model to explain what happens when the sun's energy is absorbed by Earth's surface and then converted into infrared radiation.</li> <li>Describe how a greenhouse gas differs from other atmospheric gases such as nitrogen and oxygen.</li> <li>Describe the three ways molecules oscillate as they absorb energy.</li> <li>Identify the most common greenhouse gases.</li> </ul>                 | <b>Investigation 11: Global Climate Change</b><br>CCC: Cause and effect relationships that can be explained through a mechanism<br>SEP: Analyzing and interpreting data with appropriate data presentation (graph, table, statistics, etc.), identifying sources of error and the degree of certainty. Data analysis is used to derive meaning or evaluate solutions. | <b>Experience 1:</b> The Chemistry of Earth's Atmosphere | <b>Investigation 11: Performance Based Assessment:</b> Climate Change and the Carbon Cycle<br><b>3-D Assessment – Global Climate Change Experience Handbook:</b> Performance-Based Assessment, p. 471; Revisit Anchoring Phenomenon, p. 471; Appendix C Problem Bank, pp. R23-R25<br><br><b>Experience 1:</b> Quiz - The Chemistry of Earth's Atmosphere | 1 day |
|                                                                                                       | <b>Experience 2:</b> <ul style="list-style-type: none"> <li>Discover how ice cores can be used to reconstruct a picture of past changes in earth's climate.</li> <li>Investigate the relationship between past sea levels and average global temperatures.</li> <li>Discover how living organisms, such as coral and trees, can be used to make inferences about climate trends.</li> <li>Investigate how natural phenomena can contribute to climate change.</li> </ul> | Students deepen their understanding of patterns in energy and matter through a study of global climate change. Students investigate greenhouse gases, evidence of climate change, emissions, various climate models, and consequences and responses to climate change. Students analyze and interpret climate data                                                    | <b>Experience 2:</b> Evidence of Climate Change          | <b>Experience 2:</b> Quiz - Evidence of Climate Change                                                                                                                                                                                                                                                                                                   | 1 day |

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| Apply chemistry to phenomena | <b>Experience 3:</b> <ul style="list-style-type: none"> <li>Investigate the relationship between atmospheric carbon dioxide concentrations and global warming.</li> <li>Recognize which greenhouse gases are anthropogenic, and determine the sources of each.</li> <li>Develop a model to explain how population growth can lead to an increase in carbon emissions.</li> <li>Describe how the isotopic composition of atmospheric carbon can be used to predict its source.</li> </ul> | and gain further knowledge of earth as a system as well as other related phenomena. | <b>Experience 3:</b><br>Anthropogenic Carbon Emissions | <b>Experience 3:</b> Quiz - Anthropogenic Carbon Emissions | 1 day |
|                              | <b>Experience 4:</b> <ul style="list-style-type: none"> <li>Discover how computer models are used to predict long term climate trends.</li> <li>Examine specific 21<sup>st</sup> century climate projections.</li> <li>Investigate the relationship between climate change and extreme weather events.</li> </ul>                                                                                                                                                                        |                                                                                     | <b>Experience 4:</b><br>Climate Models                 | <b>Experience 4:</b> Quiz - Climate Models                 | 1 day |
|                              | <b>Experience 5:</b> <ul style="list-style-type: none"> <li>Investigate the negative consequences of climate change, including the melting of glaciers, droughts, and flooding.</li> <li>Explain how global warming can cause deleterious effects to human societies, including famine, the spread of disease, and civil unrest.</li> <li>Describe how climate change can cause harm to plant and animal life.</li> </ul>                                                                |                                                                                     | <b>Experience 5:</b><br>Consequences of Climate Change | <b>Experience 5:</b> Quiz - Consequences of Climate Change | 1 day |
|                              | <b>Experience 6:</b> <ul style="list-style-type: none"> <li>Recognize the five drivers of climate change in our society.</li> <li>Explore the feasibility of strategies designed to reduce global warming.</li> <li>Investigate alternative energy sources.</li> <li>Consider ways to reduce the impact of human activity on the environment.</li> </ul>                                                                                                                                 |                                                                                     | <b>Experience 6:</b><br>Responses to Climate Change    | <b>Experience 6:</b> Quiz - Responses to Climate Change    | 1 day |

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| <b>Storyline 4: The Dynamics of Chemical Reactions and Ocean Acidification</b><br><b>TN3 Names and Formulas of Acids and Bases</b>        |                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                 |                                                                                                                                                                                                               |        |
| Chem1.PS1.5                                                                                                                               | <b>Experience TN3:</b> <ul style="list-style-type: none"> <li>Recognize and write names and formulas for common acids.</li> <li>Recognize and write names and formulas for common bases.</li> </ul>                                                                                                  | <b>TN3 Names and Formulas of Acids and Bases</b><br>CCC: Pattern, observation, and explanation<br>SEP: Developing and using models to develop explanations for phenomena, to go beyond the observable and make predictions or to test designs.<br><br>Students learn to recognize that the formulas of common acids consist of one or more H atoms with a monatomic or polyatomic anion and that the formulas of common bases consist of a metal ion and one or more hydroxide (OH <sup>-</sup> ) ions. They learn the rules for naming acids are based on the suffix for the anion (-ate, -ite, or -ide) and that the name of common bases are just the usual names for ionic compounds. | <b>Experience TN3:</b><br>Names and Formulas of Acids and Bases | <b>Experience TN3:</b><br>Quiz – Interactive Worksheet                                                                                                                                                        | 2 days |
| <b>Storyline 4: The Dynamics of Chemical Reactions and Ocean Acidification</b><br><b>Investigation 12: Reaction Rates and Equilibrium</b> |                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                 |                                                                                                                                                                                                               |        |
| Chem1.PS3.1                                                                                                                               | <b>Experience 1:</b> <ul style="list-style-type: none"> <li>Develop and use a model to show the effect of concentration and temperature on reaction rate.</li> <li>Analyze data on reaction rates and conditions to graph a mathematical description of the relationship between the two.</li> </ul> | <b>Investigation 12: Reaction Rates and Equilibrium</b><br>CCC: Cause and effect relationships that can be explained through a mechanism<br>Stability and change of systems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Experience 1:</b><br>Rates of Reaction                       | <b>Investigation 12:</b><br><b>Performance Based Assessment:</b> Rates of Reaction and Dissolution<br><b>3-D Assessment –</b> Reaction Rates and Equilibrium<br><b>Experience Handbook:</b> Performance-Based | 3 days |

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|                                                                                                                                 | <ul style="list-style-type: none"><li>Assess patterns in the change of reaction rates with changes in conditions.</li><li>Make predictions about changes in reaction with changes in concentration and temperature.</li></ul>                                                                                                                                                                  | SEP: Developing and using models to develop explanations for phenomena, to go beyond the observable and make predictions or to test designs.                                                                                                                                         |                                                              | Assessment, p. 507; Revisit Anchoring Phenomenon, p. 507; Appendix C Problem Bank, pp. R25-R26<br><br><b>Experience 1:</b> Quiz - Rates of Reaction |        |
| Chem1.PS3.4                                                                                                                     | <b>Experience 2:</b> <ul style="list-style-type: none"><li>Explain the relationship between temperature and reaction rate as an endothermic reaction using collision theory.</li><li>Describe activation energy and the conditions required for a reaction to go forward.</li><li>Calculate the change in enthalpy in an endothermic reaction.</li></ul>                                       | Students explore rates of chemical reactions and reversible reactions. Explore the properties and reactions of acids, bases, and salts. They investigate ocean pH levels and the relationship between oceans and climate change and explain the consequences of ocean acidification. | <b>Experience 2:</b><br>The Progress of Chemical Reactions   | <b>Experience 2:</b> Quiz - The Progress of Chemical Reactions                                                                                      | 3 days |
| Apply chemistry to phenomena                                                                                                    | <b>Experience 3:</b> <ul style="list-style-type: none"><li>Use Le Chatelier’s principle to predict the direction a reaction at equilibrium will shift if disrupted by a change in concentration, temperature, or pressure.</li><li>Explain how variables such as temperature and pressure can be adjusted to increase or decrease yield in a reaction.</li></ul>                               |                                                                                                                                                                                                                                                                                      | <b>Experience 3:</b><br>Reversible Reactions and Equilibrium | <b>Experience 3:</b> Quiz - Reversible Reactions and Equilibrium                                                                                    | 2 day  |
| Apply chemistry to phenomena                                                                                                    | <b>Experience 4:</b> <ul style="list-style-type: none"><li>Explain what entropy is.</li><li>Identify the four kinds of changes that increase the disorder or predictability of a system.</li><li>Use particle level models to explain entropy changes.</li><li>Relate entropy, enthalpy, and free energy.</li><li>Use mathematical thinking to determine thermodynamic favorability.</li></ul> |                                                                                                                                                                                                                                                                                      | <b>Experience 4:</b><br>Free Energy and Entropy              | <b>Experience 4:</b> Quiz - Free Energy and Entropy                                                                                                 | 2 day  |
| <b>Storyline 4: The Dynamics of Chemical Reactions and Ocean Acidification</b><br><b>Investigation 13: Acid-Base Equilibria</b> |                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                      |                                                              |                                                                                                                                                     |        |
|                                                                                                                                 | <b>Experience 1:</b>                                                                                                                                                                                                                                                                                                                                                                           | <b>Investigation 13: Acid-Base Equilibria</b>                                                                                                                                                                                                                                        | <b>Experience 1:</b>                                         | <b>Investigation 13:</b>                                                                                                                            | 3 days |

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                         |                                                                                                                                                                                                                                                                                                                                                        |        |
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| Chem1.PS1.16 | <ul style="list-style-type: none"> <li>Define an acid and a base using Arrhenius, Bronsted-Lowry, and Lewis models.</li> <li>Calculate the pH value for a solution given its hydronium ion concentration.</li> <li>Understand the difference between acids and bases.</li> </ul>                                                                                                                                                                                                                                                                           | <p>CCC: Structure and function of systems and their parts<br/>SEP: Analyzing and interpreting data with appropriate data presentation (graph, table, statistics, etc.), identifying sources of error and the degree of certainty. Data analysis is used to derive meaning or evaluate solutions.</p> <p>Students deepen in their understanding of patterns through a study of acid base equilibria. Students explore properties of acids, basis, and salts. They investigate chemical reactions as they develop models of acid based neutralization reactions and other related phenomena.</p> | Acids, Bases and Salts                                  | <p><b>Performance Based Assessment:</b> Qualitative Analysis of Acid Rain<br/><b>3-D Assessment –</b> Combustion – Acid-Base Equilibria<br/><b>Experience Handbook:</b> Performance-Based Assessment, p. 493; Revisit Anchoring Phenomenon, p. 493; Appendix C Problem Bank, pp. R26-R27</p> <p><b>Experience 1:</b> Quiz - Acids, Bases and Salts</p> |        |
| Chem1.PS1.16 | <p><b>Experience 2:</b></p> <ul style="list-style-type: none"> <li>Explain the difference between strong and weak acids and bases.</li> <li>Rank acids in order of strength.</li> <li>Describe how the equilibrium conditions for strong and weak acids and bases are different.</li> <li>Use the acid ionization constant (<math>K_a</math>) to predict the relative concentrations of the acid and hydronium ion at equilibrium.</li> <li>Calculate the pH for weak acids and bases, using <math>K_a</math> and <math>K_b</math> expressions.</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Experience 2:</b><br>Strong and Weak Acids and Bases | <b>Experience 2:</b><br>Quiz - Strong and Weak Acids and Bases                                                                                                                                                                                                                                                                                         | 3 days |

**41 days for standard based curriculum.**

**1 day for Post Test.**

**1 day for ACT.**

**3 days inclement weather/as needed.**

## 4<sup>th</sup> Quarter

| Standard(s) | Learning Objective(s) | CCC/SEP | Savvas Alignment | Assessments | Timeframe |
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| <b>Storyline 4: The Dynamics of Chemical Reactions and Ocean Acidification</b><br><b>Investigation 13: Acid-Base Equilibria</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                      |                                                      |                                                                                                                                                                                                                                                                                                   |        |
| Chem1.PS1.16                                                                                                                    | <b>Experience 3:</b> <ul style="list-style-type: none"> <li>Describe acid-base neutralization reactions, both qualitatively and quantitatively.</li> <li>Determine how some salts can hydrolyze water and change the pH of a given solution.</li> <li>Understand and interpret the results of titration experiments, including finding the equivalence point of the titration, and use that data to find the concentration of unknown solutions.</li> </ul> <p>Analyze pH curves from titration experiments and describe the contents of solution at any point along the titration curve.</p> | <b>Investigation 13: Acid-Base Equilibria</b><br>Students investigate chemical reactions as they develop models of acid based neutralization reactions and other related phenomena.                                                                                                                                                  | <b>Experience 3:</b><br>Reactions of Acids and Bases | <b>Experience 3:</b><br>Quiz - Reactions of Acids and Bases                                                                                                                                                                                                                                       | 3 days |
| Apply chemistry to phenomena                                                                                                    | <b>Experience 4:</b> <ul style="list-style-type: none"> <li>Identify what a buffer solution is, how it is made, and how the chemical equilibrium in a buffer system stabilizes the pH of a solution.</li> </ul> <p>Identify examples of buffers in biological systems, including how the buffering ability of blood is vital to human life.</p>                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                      | <b>Experience 4:</b><br>Buffers and Equilibria       | <b>Experience 4:</b><br>Quiz - Buffers and Equilibria                                                                                                                                                                                                                                             | 2 days |
| <b>Storyline 4: The Dynamics of Chemical Reactions and Ocean Acidification</b><br><b>Investigation 14: Ocean Acidification</b>  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                      |                                                      |                                                                                                                                                                                                                                                                                                   |        |
|                                                                                                                                 | <b>Experience 1:</b> <ul style="list-style-type: none"> <li>Identify global patterns of ocean pH, salinity, and alkalinity.</li> <li>Apply principles of chemical equilibrium to explain ocean pH.</li> <li>Predict the impact of ocean acidification on marine organisms such as corals.</li> </ul>                                                                                                                                                                                                                                                                                          | <b>Investigation 14: Ocean Acidification</b><br>CCC: Cause and effect relationships that can be explained through a mechanism<br>SEP: Analyzing and interpreting data with appropriate data presentation (graph, table, statistics, etc.), identifying sources of error and the degree of certainty. Data analysis is used to derive | <b>Experience 1:</b><br>Ocean pH Levels              | <b>Investigation 14:</b><br><b>Performance Based Assessment:</b> Calcium Carbonate and Shell Production<br><b>3-D Assessment</b> – Ocean Acidification<br><b>Experience Handbook:</b> Performance-Based Assessment, p. 587; Revisit Anchoring Phenomenon, p. 587; Appendix C Problem Bank, p. R27 | 1 day  |

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| Apply chemistry to phenomena |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | meaning or evaluate solutions.                                                                                                                                                                                                                                                                                                           |                                                             | <b>Experience 1:</b> Quiz – Ocean pH Levels                        |       |
|                              | <b>Experience 2:</b> <ul style="list-style-type: none"> <li>Explain the relationship between temperature and dissolved gas in ocean water.</li> <li>Analyze data to explain how human carbon emissions have affected ocean pH.</li> <li>Develop a model of the cycling of carbon in the ocean.</li> <li>Explain dynamic equilibrium between the multiple factors affecting ocean pH.</li> </ul>                                                                                                                                                                                                                                                                                                 | <p>Students deepen their understanding of energy and matter through a study of ocean acidification. Students analyze the cause and effect of changes to pH level, carbon cycling, and currents on the ocean system. They interpret data and use models about disrupted ecosystems, coral bleaching and rates of change in the ocean.</p> | <b>Experience 2:</b><br>The Ocean as a Carbon Sink          | <b>Experience 2:</b><br>Quiz - The Ocean as a Carbon Sink          | 1 day |
|                              | <b>Experience 3:</b> <ul style="list-style-type: none"> <li>Analyze data to explain ways in which climate change affects ocean currents.</li> <li>Explain how heat flow into and out of the ocean leads to extreme weather events.</li> <li>Explain how severe weather can affect the carbon cycle and concentrations of carbon in the ocean.</li> <li>Describe the long and short term effects of additional heat circulating through deep ocean currents.</li> </ul>                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                          | <b>Experience 3:</b><br>The Ocean and Climate Change        | <b>Experience 3:</b><br>Quiz - The Ocean and Climate Change        | 1 day |
|                              | <b>Experience 4:</b> <ul style="list-style-type: none"> <li>Investigate how the presence of carbonate or bicarbonate ions affects the formation and breakdown of calcium carbonate in a marine environment.</li> <li>Argue a claim, using evidence and reasoning, about the impact of temperature and pH on ocean ecosystems.</li> <li>Analyze data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other earth systems.</li> <li>Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs</li> </ul> |                                                                                                                                                                                                                                                                                                                                          | <b>Experience 4:</b><br>Consequences of Ocean Acidification | <b>Experience 4:</b><br>Quiz - Consequences of Ocean Acidification | 1 day |

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| <b>Storyline 5: Industrial Applications</b><br><b>Investigation 15: Oxidation-Reduction Reactions</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                          |                                                  |                                                                                                                                                                                                                                                                                                                                              |        |
| Apply chemistry to phenomena                                                                          | <b>Experience 1:</b> <ul style="list-style-type: none"> <li>Calculate oxidation numbers and compounds in polyatomic ions.</li> <li>Identify a redox reaction by noting changes in oxidation number of specific atoms involved.</li> <li>Use half reactions to show the movement of electrons from one element to another in a reaction.</li> <li>Explain how redox reactions can affect everyday objects in the environment.</li> </ul> | <b>Investigation 15: Oxidation-Reduction Reactions</b><br>CCC: Energy and matter conservation through transformations that flow or cycle into, out of, or within a system<br><br>SEP: Developing and using models to develop explanations for phenomena, to go beyond the observable and make predictions or to test designs.                                                            | <b>Experience 1:</b><br>Oxidation vs. Reduction  | <b>Investigation 15: Performance Based Assessment:</b> Battery Challenge<br><b>3-D Assessment –</b> Oxidation-Reduction Reactions<br><b>Experience Handbook:</b> Performance-Based Assessment, p. 625; Revisit Anchoring Phenomenon, p. 625; Appendix C Problem Bank, pp. R28-R29<br><br><b>Experience 1:</b> Quiz – Oxidation vs. Reduction | 2 days |
| Chem1.PS1.9                                                                                           | <b>Experience 2:</b> <ul style="list-style-type: none"> <li>Express a redox reaction as a balanced chemical equation, identifying the number and types of atoms.</li> <li>Track electrons in a redox reaction.</li> <li>Write balanced equations for redox reactions, using either oxidation numbers or half reactions.</li> <li>Use the activity series to predict how metals will behave in a given reaction.</li> </ul>              | Students are introduced to redox reactions in which the movement of electrons transfers potential energy into electrical energy. They make, critique and revise equation based models of redox reactions, while learning how to balance redox reactions using oxidation states and half reactions. They explore the energy transformations that occur in voltaic and electrolytic cells. | <b>Experience 2:</b><br>Modeling Redox Reactions | <b>Experience 2:</b><br>Quiz - Modeling Redox Reactions                                                                                                                                                                                                                                                                                      | 3 days |
| Apply chemistry to phenomena                                                                          | <b>Experience 3:</b> <ul style="list-style-type: none"> <li>Describe the cause and effect relationship between reactivity of elements, valence electrons of those elements, and element electronegativity.</li> <li>Describe the overall flow of charge in a voltaic cell and relate it to the underlying chemical reaction.</li> </ul>                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                          | <b>Experience 3:</b><br>Electrochemical Cells    | <b>Experience 3:</b><br>Quiz - Electrochemical Cells                                                                                                                                                                                                                                                                                         | 2 days |

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|                                                                                           | <ul style="list-style-type: none"><li>Describe the energy conversion that occurs when energy is produced, stored, and used.</li></ul>                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                        |                                                                                                                                                                                                                                                                                                                                 |        |
| <b>Storyline 5: Industrial Applications</b><br><b>Investigation 16: Organic Chemistry</b> |                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                        |                                                                                                                                                                                                                                                                                                                                 |        |
| Apply chemistry to phenomena                                                              | <b>Experience 1:</b> <ul style="list-style-type: none"><li>Use models to represent straight chain, branched, and cyclical hydrocarbons.</li><li>Construct explanations to relate degree of saturation and isomerization to patterns in hydrocarbon properties, including boiling point and energy density.</li></ul> | <b>Investigation 16: Organic Chemistry</b><br>CCC: Pattern, observation, and explanation<br>SEP: Developing and using models to develop explanations for phenomena, to go beyond the observable and make predictions or to test designs.<br><br>Students are introduced to organic chemistry. They develop models to represent the structures and properties of hydrocarbons and the types of interactions between them. They deepen their understanding by identifying patterns in the properties of hydrocarbons and organic molecules that contain various functional groups. | <b>Experience 1:</b><br>Hydrocarbons                   | <b>Investigation 16: Performance Based Assessment:</b> Prepare and Characterize Biodiesel<br><b>3-D Assessment – Organic Chemistry Experience Handbook:</b> Performance-Based Assessment, p. 671; Revisit Anchoring Phenomenon, p. 671; Appendix C Problem Bank, pp. R29-R30<br><br><b>Experience 1:</b><br>Quiz - Hydrocarbons | 2 days |
|                                                                                           | <b>Experience 2:</b> <ul style="list-style-type: none"><li>Identify functional groups in organic molecules.</li><li>Use models to represent various reactions involving organic molecules, including addition, substitution, and condensation reactions.</li><li>Describe the process of polymerization.</li></ul>   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Experience 2:</b><br>Functional Groups and Polymers | <b>Experience 2:</b><br>Quiz - Functional Groups and Polymers                                                                                                                                                                                                                                                                   | 2 days |
|                                                                                           | <b>Experience 3:</b> <ul style="list-style-type: none"><li>Distinguish the structures and functions of the major classes of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids.</li><li>Explain how large biomolecules form from smaller molecules.</li></ul>                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Experience 3:</b><br>The Chemistry of Life          | <b>Experience 3:</b><br>Quiz - The Chemistry of Life                                                                                                                                                                                                                                                                            | 2 days |
| <b>Storyline 5: Industrial Applications</b><br><b>Investigation 17: Nuclear Processes</b> |                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                        |                                                                                                                                                                                                                                                                                                                                 |        |
|                                                                                           | <b>Experience 1:</b> <ul style="list-style-type: none"><li>Describe the particles and forces present in the atomic nucleus.</li></ul>                                                                                                                                                                                | <b>Investigation 17: Nuclear Processes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Experience 1:</b><br>Radioactivity and Half-Lives   | <b>Investigation 17: Nuclear Processes</b>                                                                                                                                                                                                                                                                                      | 4 days |

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| Chem1.PS1.17<br>Chem1.PS1.18                                                                       | <ul style="list-style-type: none"> <li>Develop models to illustrate the changes in the composition of the atomic nucleus and the energy released during radioactive decay.</li> <li>Use mathematics to calculate the half-life of a radioactive substance and the approximate age of old materials.</li> </ul>                                                                                                                                              | <p>CCC: Systems and system models with defined boundaries that can be investigated and characterized by energy and matter conservation through transformations that flow or cycle into, out of, or within a system.</p> <p>SEP: Using mathematics and computational thinking as tools to represent variables and their relationships in models, simulations, and data analysis in order to make and test predictions.</p> |                                                                  | <p><b>Performance Based Assessment:</b> Natural Radiation</p> <p><b>3-D Assessment – Nuclear Processes</b></p> <p><b>Experience Handbook:</b> Performance-Based Assessment, p. 717; Revisit Anchoring Phenomenon, p. 717; Appendix C Problem Bank, pp. R30-R31</p> <p><b>Experience 1:</b> Quiz - Radioactivity and Half-Lives</p> |        |
| Chem1.PS1.17                                                                                       | <p><b>Experience 2:</b></p> <ul style="list-style-type: none"> <li>Develop models to explain the conservation of mass and energy during the processes of fission and fusion.</li> <li>Describe the conversions between mass and energy during The Big Bang.</li> <li>Use mathematics to calculate the energy released during a nuclear process.</li> <li>Explain the role of fusion in the formation of new elements and in the star life cycle.</li> </ul> | Students develop models to explain changes in matter and energy during nuclear processes. They identify patterns in the decay of unstable nuclei and the binding energy of elements in the periodic table. They construct explanations to describe how mass and energy are conserved in nuclear processes. Students consider how nuclear technologies impact individuals and societies.                                   | <b>Experience 2:</b><br>Fission and Fusion                       | <b>Experience 2:</b><br>Quiz - Fission and Fusion                                                                                                                                                                                                                                                                                  | 4 days |
| Chem1.PS1.18                                                                                       | <p><b>Experience 3:</b></p> <ul style="list-style-type: none"> <li>Explain radiation hazards and how they can be measured.</li> <li>Describe the risks and benefits of nuclear technologies.</li> </ul>                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Experience 3:</b><br>Nuclear Technologies                     | <b>Experience 3:</b><br>Quiz - Nuclear Technologies                                                                                                                                                                                                                                                                                | 4 days |
| <p><b>Storyline 5: Industrial Applications</b></p> <p><b>Investigation 18: Green Chemistry</b></p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                  |                                                                                                                                                                                                                                                                                                                                    |        |
|                                                                                                    | <p><b>Experience 1:</b></p> <ul style="list-style-type: none"> <li>Describe the challenges related to supply and demand faced by the chemical industry.</li> </ul>                                                                                                                                                                                                                                                                                          | <b>Investigation 18: Green Chemistry</b>                                                                                                                                                                                                                                                                                                                                                                                  | <b>Experience 1:</b><br>Industrial Chemistry and the Environment | <b>Investigation 18: Green Chemistry</b>                                                                                                                                                                                                                                                                                           | 3 days |

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| Apply chemistry to phenomena                                                                | <ul style="list-style-type: none"> <li>Use mathematics to model the lifetime of finite resources.</li> <li>Explain the environmental impacts of the chemical industry, including the consumption of natural resources and the production of hazardous wastes.</li> <li>Define green chemistry.</li> </ul>                                                              | <p>CCC: Cause and effect relationships that can be explained through a mechanism<br/>SEP: Asking questions (for science) and defining problems (for engineering) to determine what is known, what has yet to be satisfactorily explained, and what problems need to be solved.</p> <p>Students deepen their understanding of the impacts of the chemistry industry on earth's systems and of their own decisions about the use and disposal of various products. They evaluate information and analyze data to understand the practice of green chemistry offers an array of solutions to lessen or eliminate various impacts on earth's systems.</p> |                                                                  | <p><b>Performance Based Assessment:</b> Make the Chemistry Lab Greener<br/><b>3-D Assessment</b> – Green Chemistry<br/><b>Experience Handbook:</b> Performance-Based Assessment, p. 755; Revisit Anchoring Phenomenon, p. 755; Appendix C Problem Bank, pp. R31-R32</p> <p><b>Experience 1:</b><br/>Quiz: Industrial Chemistry and the Environment</p> |        |
|                                                                                             | <p><b>Experience 2:</b></p> <ul style="list-style-type: none"> <li>Describe the principles that guide green chemistry practices.</li> <li>Explain ways to refine a chemical process so that it maximizes chemical yield while minimizing required materials, energy use, or negative impacts on natural systems.</li> </ul>                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Experience 2:</b><br>Principles of Green Chemistry            | <b>Experience 2:</b><br>Quiz - Principles of Green Chemistry                                                                                                                                                                                                                                                                                           | 2 days |
|                                                                                             | <p><b>Experience 3:</b></p> <ul style="list-style-type: none"> <li>Identify tradeoffs and synergies among the principles of green chemistry.</li> <li>Explain how green chemistry practices consider social and environmental factors, as well as economic gains.</li> <li>Describe examples of the sustainable management of waste, energy, and resources.</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Experience 3:</b><br>Designing Sustainable Chemical Processes | <b>Experience 3:</b><br>Quiz: Designing Sustainable Chemical Processes                                                                                                                                                                                                                                                                                 | 2 days |
| <p><b>41 days for standard based curriculum.</b><br/><b>3 days for Semester 2 Exam.</b></p> |                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                  |                                                                                                                                                                                                                                                                                                                                                        |        |