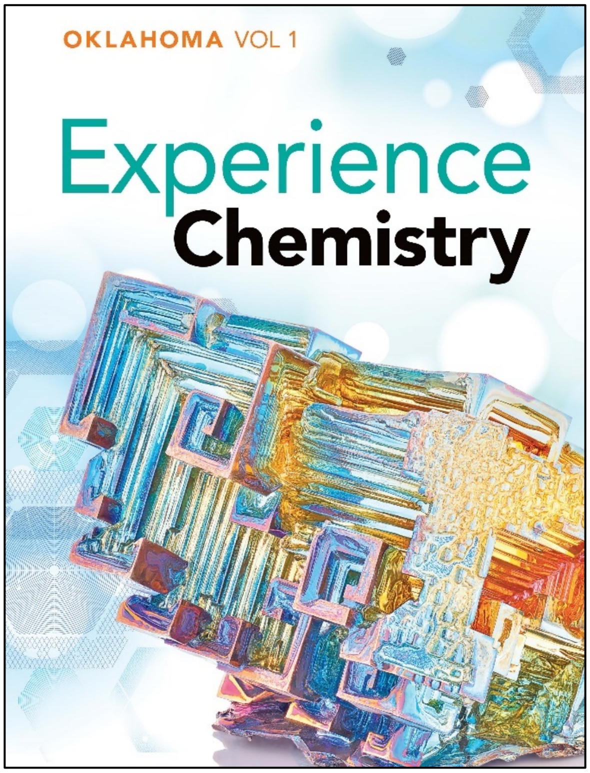
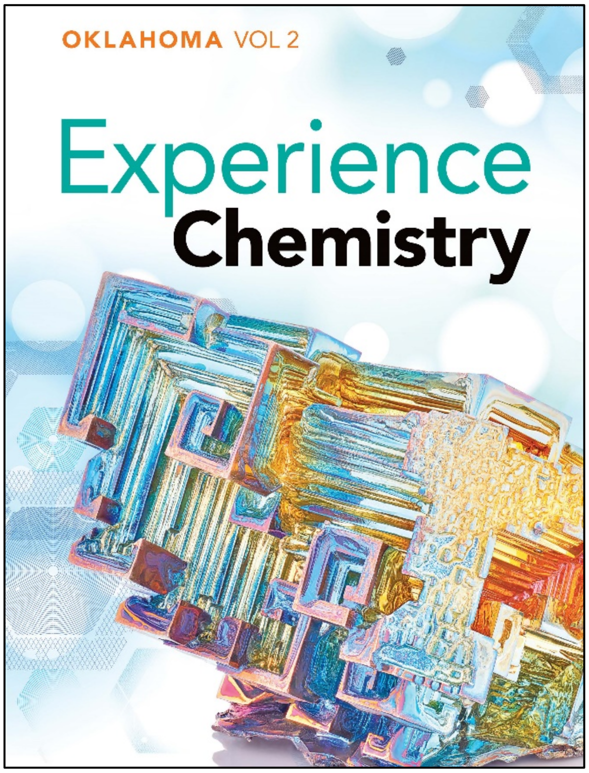
A Correlation of

Oklahoma
Experience Chemistry
©2022





To the

Oklahoma
2020 Academic Standards for Science
High School Chemistry

Prepared by Savvas Learning Company, formerly Pearson K12 Learning

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Introduction

This document demonstrates how ***Oklahoma Experience Chemistry ©2022*** supports Oklahoma's 2020 Academic Standards for Science: High School Chemistry. Correlation references include the Experience Notebook (Vol. 1 and 2), Teacher Guide, and online digital assets.

Savvas Learning Company is excited to introduce **Experience Chemistry!** From climate change, water quality, and the newest energy sources, to the foods we grow and eat, your students will experience chemistry like never before. The program uses cool, weird, and amazing phenomena to engage students in 3-D science. Give students an up-close, first-hand experience they'll never forget.

Be the first to *Experience It!*

Storylines are organized around a real-world Anchoring Phenomena that sparks student curiosity, gives a purpose to learning and connects chemistry concepts through a unifying unique occurrence. Students encounter everyday phenomena through Claims-Evidence Reasoning Exercises, Authentic Readings, STEM Projects, and Engineering Performance Tasks.

Explore Phenomena with Flinn Scientific!

Experience Chemistry and Flinn Scientific partner to deliver high-quality inquiry opportunities to chemistry classrooms. Lab Experiments, Engineering Challenges, Performance Tasks, Virtual Reality Simulations, and Lab Videos by Flinn Scientific immerse students in hands-on chemistry.

Hands-On Labs
• Assign student-friendly labs focused on real-world phenomena in every learning experience.
• Customize your lessons with four versions of every lab including Open-Ended, Guided, Shortened, and Advanced.

Lab Videos
• Background videos, demo videos and summary videos engage and connect students to the phenomena, prepare students and instructors for set-up and revisit concepts before assessments.

Design Challenges and Performance Tasks
• Students mimic the real-world activities of engineers as they define and solve problems and design, test and evaluate solutions.
• Students demonstrate mastery of three-dimensional learning at the end of every Investigation with a Performance-Based assessment.

Lab Kits
• Simplify lab set-up and solution preparation with time-saving lab kits.

Virtual Reality
• Immerse your students in 360º simulations that bring chemistry to life.

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Table of Contents

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	**Oklahoma Experience Chemistry ©2022**
Matter and Its Interactions (PS1)	
Performance Expectation	
CH.PS1.1: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.	**Experience Notebook, Volume 1:** **Investigation 1** Types of Atoms, 13-14 Patterns in Electron Configurations, 36-38 Valence Electrons, 39 Revisit Investigative Phenomenon, 40 **Teacher Guide:** **Inquiry Labs:** Develop a Periodic Table; Periodic Trends and Properties; Elemental Metals, Nonmetals, and Metalloids **Digital Activities:** Periodic Properties; Predict Reactivity Using Periodic Trends **Performance-Based Assessments**: Evaluate Atomic Structure with Flame Tests; Gravimetric Analysis of Periodic Trends
Disciplinary Core Ideas	
CH.PS1.1.DCI.1: Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons.	**Experience Notebook, Volume 1:** **Investigation 1** Visualizing the Atom, 12 Atomic Number, 13 Revisit Investigative Phenomenon, 21 The Quantum Mechanical Model, 28
CH.PS1.1.DCI.2: The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.	**Experience Notebook, Volume 1:** **Investigation 1** Types of Atoms, 13-14 Patterns in Electron Configurations, 36-38 Valence Electrons, 39 **Investigation 2** The Modern Periodic Table, 46-48 Revisit Investigative Phenomenon, 49 The Periodic Table as a Predictive Model, 50-51

Oklahoma 2020 Academic Standards for Science High School Chemistry	**Oklahoma Experience Chemistry ©2022**
Science and Engineering Practices	
CH.PS1.1.SEP.1: Developing and Using Models: Use a model to predict the relationships between systems or between components of a system.	**Experience Notebook, Volume 1:** **Investigation 1** SEP Construct an Explanation, 5 **Investigation 2** SEP Develop Models, 57 SEP Use Models, 58 SEP Develop and Use Models, 61 **Teacher Guide:** **Inquiry Labs:** Bean Bag Isotopes; Evaluate the Bohr Model of the Atom; Model Electron Configuration; Develop a Periodic Table; Elemental Metals, Nonmetals, and Metalloids; Periodic Trends and Properties **Digital Activity:** The Quantum Mechanical Model and Atomic Orbitals
Crosscutting Concepts	
CH.PS1.1.CCC.1: Patterns: Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.	**Experience Notebook, Volume 1:** **Investigation 1** CCC Patterns, 26 CCC Patterns, 36 CCC Patterns, 39 **Investigation 2** CCC Patterns, 43 CCC Patterns, 45 CCC Patterns, 49 CCC Patterns, 59 CCC Patterns, 62 CCC Patterns, 63 **Investigation 3** CCC Patterns, 67 CCC Patterns, 69 CCC Patterns, 82 CCC Patterns, 86 CCC Patterns, 93 **Teacher Guide:** **Inquiry Labs:** Evaluate Atomic Spectra; Evaluate the Bohr Model of the Atom; Develop a Periodic Table; Periodic Trends and Properties **Digital Activities:** Periodic Properties; Predict Reactivity Using Periodic Trends **Performance-Based Assessments:** Evaluate Atomic Structure with Flame Tests; Gravimetric Analysis of Periodic Trends

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
Performance Expectation	
CH.PS1.2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, knowledge of the patterns of chemical properties, and formation of compounds.	**Experience Notebook, Volume 1:** **Investigation 2** The Periodic Table, 43 Connecting the Trends, 63 **Investigation 6** Activity Series, 232 Predicting the Products of Reactions, 238-239 Revisit Investigative Phenomenon, 240 **Experience Notebook, Volume 2:** **Investigation 15** Redox vs. Non-redox Reactions, 284 **Teacher Guide:** **Inquiry Labs:** Evaluate Chemical Reactions; Predict Chemical Reactions; Explore Iron Corrosion; Metal Activity **Engineering Design Challenge:** Water Purification **Digital Activities:** Reactivity of Metals; Cation Meets Anion **Performance-Based Assessments:** Identify Evidence of Chemical Reactions; Battery Challenge
Disciplinary Core Ideas	
CH.PS1.2.DCI.1: The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.	**Experience Notebook, Volume 1:** **Investigation 1** Types of Atoms, 13-14 Patterns in Electron Configurations, 36-38 Valence Electrons, 39 **Investigation 2** The Modern Periodic Table, 46-48 The Periodic Table as a Predictive Model, 50-51 Revisit Investigative Phenomenon, 55 **Investigation 3** The Octet Rule in Molecules, 82-83 Types of Covalent Bonds, 84 Sample Problem: Electron Dot Structures for Molecular Substances, 85 Electronegativity and Bonding, 86-87 **Investigation 4** Determining Compound Type, 137 Properties of Ionic and Molecular Compounds, 138 Covalent Network Solids, 139-140 Revisit Investigative Phenomenon, 140 **Investigation 6** Activity Series, 232

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
CH.PS1.2.DCI.2: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.	**Experience Notebook, Volume 1:** **Investigation 6** Balancing Equations, 220-221 Types of Reactions, 227 Activity Series, 232 Sample Problem: Writing Chemical Equations for Single-Replacement Reactions, 233 Predicting the Products of Reactions, 238-239 Revisit Investigative Phenomenon, 240 Ions in Aqueous Solution, 241-242 Formation of a Precipitate, 245 Predicting the Formation of a Precipitate, 246
Science and Engineering Practices	
CH.PS1.2.SEP.1: Constructing Explanations: Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	**Experience Notebook, Volume 1:** **Investigation 6** SEP Construct an Explanation, 221 SEP Construct an Explanation, 224 SEP Construct an Explanation, 244 SEP Construct an Explanation, 246 **Teacher Guide:** **Inquiry Labs:** Chemical Names and Formulas; Evaluate Chemical Reactions; Predict Chemical Reactions **Digital Activities:** Ions and Electroplating; Analyzing Chemical Reactions; Predict Whether a Precipitate Will Form
Crosscutting Concepts	
CH.PS1.2.CCC.1: Patterns: Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.	**Experience Notebook, Volume 1:** **Investigation 6** General Types of Chemical Reactions, 227 SEP Interpret Data, 228 SEP Interpret Data, 229 **Teacher Guide:** **Inquiry Labs:** Evaluate Chemical Reactions; Types of Chemical Reactions; Predict Chemical Reactions **Performance-Based Assessment:** Identify Evidence of Chemical Reactions

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	**Oklahoma Experience Chemistry ©2022**
Performance Expectation	
CH.PS1.3: Plan and conduct an investigation to compare the structure of substances at the bulk scale level to infer the strength of electrical forces between particles.	**Experience Notebook, Volume 1:** **Investigation 4** Ductility and Malleability, 142 **Teacher Guide:** **Inquiry Labs:** Correlate Material Properties and Bond Type; Melt Ionic and Covalent Compounds; Compressibility; Relationships Between Gas Variables; The Ideal Gas Law; Gas Diffusion **Digital Activities:** Intermolecular Forces in Liquids; Tough Tools; Gas Behavior in Popping Candy **Performance-Based Assessments:** Qualitative Analysis and Chemical Bonding, Identify Evidence of Chemical Reactions, Cartesian Divers
Disciplinary Core Ideas	
CH.PS1.3.DCI.1: The structure and interactions of matter at the bulk- scale are determined by electrical forces within and between atoms.	**Experience Notebook, Volume 1:** **Investigation 2** Coulomb's Law, 52 The Shielding Effect and Effective Nuclear Charge, 53-55 Ionization Energy, 59 **Investigation 3** Ionic Compounds, 72-73 Properties of Ionic Compounds, 74-75 Revisit Investigative Phenomenon, 76 Properties of Metals, 78-79 Revisit Investigative Phenomenon, 80 Electronegativity and Bonding, 86-87 Geometry and Polar Molecules, 88-90 Revisit Investigative Phenomenon, 90 Van der Waals Forces, 91-92 Hydrogen Bonds, 93 Properties of Molecular Substances, 94-95 **Investigation 4** Liquids and Intermolecular Forces, 118-119 Solids and Attractive Force, 120-121 Phase Changes, 125-126 Evaporation and Condensation, 128-129 Heating a Solid, 132 Properties of Ionic and Molecular Compounds, 138 Covalent Network Solids, 139-140 Revisit Investigative Phenomenon, 140 Ductility and Malleability, 142 Conductivity and Luster, 143 Crystalline Structure and Properties of Metals, 144 Defects and Properties of Metals, 145-146 Revisit Investigative Phenomenon, 147 Water and Hydrogen Bonding, 148

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
CH.PS1.3.DCI.1 Continued:	**Investigation 4 Continued:** Surface Tension, 149-150 Hydrogen Bonding and Boiling Point, 151 Continued: Structure Affects Properties of Ice, 152-153 Aqueous Solutions, 154-155 **Experience Notebook, Volume 2:** **Investigation 9** Real Gases, 27–28
Science and Engineering Practices	
CH.PS1.3SEP.1: Planning and Carrying Out Investigations	**Teacher Guide:** **Inquiry Labs:** Characteristics of Ionic Bonds; Investigate Metallic Bonds; Investigate Covalent Bonds; Intermolecular Forces; Correlate Material Properties and Bond Type; Measure the Energy of a Phase Change; Melt Ionic and Covalent Compounds; Modeling Metals, Ceramics, and Polymers; Investigate Surface Tension; Aqueous Solutions; The Thermodynamics of Hand Warmers; Compressibility; Relationships Between Gas Variables; The Ideal Gas Law; Gas Diffusion **Engineering Design Challenges:** Evaluate Metals for a Commercial Application; Abrasive Compounds; Building a Better Bike **Digital Activities:** Intermolecular Forces in Liquids; States of Matter; Tough Tools; Gas Behavior in Popping Candy **Performance-Based Assessments:** Qualitative Analysis and Chemical Bonding; Road Deicers; Identify Evidence of Chemical Reactions; Cartesian Divers
Crosscutting Concepts	
CH.PS1.3.CCC.1: Structure and Function: The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.	**Experience Notebook, Volume 1:** **Investigation 3** CCC Structure and Function, 78 CCC Structure and Function, 79 **Investigation 4** CCC Structure and Function, 123 CCC Structure and Function, 155 **Teacher Guide:** **Inquiry Labs:** Correlate Material Properties and Bond Type; Melt Ionic and Covalent Compounds **Performance-Based Assessments:** Qualitative Analysis and Chemical Bonding, Identify Evidence of Chemical Reactions

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
Performance Expectation	
CH.PS1.4: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.	**Experience Notebook, Volume 1:** **Investigation 6** Energy of Reactions, 223-224 What Causes Reactions?, 225 Revisit Investigative Phenomenon, 226 Combination Reactions, 228 Decomposition Reactions, 229 **Investigation 8** Bond Enthalpy, 285-286 Activation Energy, 287 Representations of Enthalpy, 288 Hess's Law, 291 Heat Summation, 292 Standard Enthalpy of Formation, 293 Standard Enthalpy of Reaction, 294 Enthalpy of Solution, 296-297 **Teacher Guide:** **Inquiry Labs:** The Thermodynamics of Hand Warmers; Hess's Law and the Combustion of a Metal **Performance-Based Assessment:** Enthalpy of a Neutralization Reaction
Disciplinary Core Ideas	
CH.PS1.4.DCI.1: A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart.	**Experience Notebook, Volume 1:** **Investigation 8** Bond Enthalpy, 285-286 Activation Energy, 287 **Experience Notebook, Volume 2:** **Investigation 12** Energy Diagrams, 169

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
CH.PS1.4.DCI.2: Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy.	**Experience Notebook, Volume 1:** **Investigation 6** Energy of Reactions, 223-224 What Causes Reactions?, 225 **Investigation 8** Collisions in Reactions, 282 Hess's Law, 291 Heat Summation, 292 Standard Enthalpy of Formation, 293 Standard Enthalpy of Reaction, 294 Sample Problem: Calculating the Standard Enthalpy of Reaction, 295 Enthalpy of Solution, 296-297 Sample Problem: Calculating the Enthalpy Change in Solution Formation, 297 **Experience Notebook, Volume 2:** **Investigation 12** Collision Theory – a Review, 163 Effect of Concentration on Reaction Rates, 164 Effect of Temperature on Reaction Rates, 165 Energy Diagrams, 169 One-Step and Multistep Reactions, 170 Lowering Activation Energy, 171
Science and Engineering Practices	
CH.PS1.4.SEP.1: Developing and Using Models: Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	**Experience Notebook, Volume 1:** **Investigation 6** SEP Develop a Model, 226 **Investigation 8** SEP Use a Model, 282 SEP Use a Model, 286 **Teacher Guide:** **Inquiry Labs:** Evaluate Chemical Reactions; Types of Chemical Reactions; The Thermodynamics of Hand Warmers; Hess's Law and the Combustion of a Metal

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
Crosscutting Concepts	
CH.PS1.4.CCC.1: Energy and Matter: Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.	**Experience Notebook, Volume 1:** **Investigation 6** CCC Energy and Matter, 215 **Investigation 8** CCC Energy and Matter, 281 CCC Energy and Matter, 290 CCC Energy and Matter, 307 **Teacher Guide:** **Digital Activities:** Temperature Changes in Chemical Reactions; Heat of Fusion **Engineering Design Challenge:** Flameless Heating Systems **Performance-Based Assessments:** Enthalpy of a Neutralization Reaction
Performance Expectation	
CH.PS1.5: Apply scientific principles and evidence to provide an explanation about the effects of changing the conditions of the reacting particles on the rate at which a reaction occurs.	**Teacher Guide:** **Inquiry Lab:** Reaction Rates: Iodine Clock **Digital Activity:** Reaction Rates and Activation Energy **Performance-Based Assessments:** Rates of Reaction and Dissolution; Calcium Carbonate and Shell Production
Disciplinary Core Ideas	
CH.PS1.5.DCI.1: Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangement of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy.	**Experience Notebook, Volume 1:** **Investigation 6** Energy of Reactions, 223-224 What Causes Reactions?, 225 **Experience Notebook, Volume 2:** **Investigation 12** Calculating Reaction Rates, 161 Sample Problem: Calculating Reaction Rates, 162 Collision Theory – a Review, 163 Effect of Concentration on Reaction Rates, 164 Effect of Temperature on Reaction Rates, 165 Effect of Particle Size on Reaction Rates, 166 Revisit Investigative Phenomenon, 167 Activation Energy, 168 Energy Diagrams, 169

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
Science and Engineering Practices	
CH.PS1.5.SEP.1: Constructing Explanations: Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.	**Experience Notebook, Volume 1:** **Investigation 4** CCC Cause and Effect, 165 CCC Cause and Effect, 167 SEP Construct an Explanation, 170 **Investigation 5** SEP Construct an Explanation, 191
Crosscutting Concepts	
CH.PS1.5.CCC.1: Cause and Effect: Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.	**Experience Notebook, Volume 2:** **Investigation 12** CCC Cause and Effect, 165 CCC Cause and Effect, 167 CCC Cause and Effect, 176 **Teacher Guide:** **Inquiry Labs:** Evaluate Chemical Reactions; Types of Chemical Reactions; Reaction Rates: Iodine Clock; Collision Theory; Explore Chemical Equilibrium; Ocean Currents **Digital Activities:** Reactivity of Metals; Reaction Rates and Activation Energy **Performance-Based Assessments:** Rates of Reaction and Dissolution; Calcium Carbonate and Shell Production
Performance Expectation	
CH.PS1.6 : Refine the design of a chemical system by specifying a change in conditions that would produce a change in the amounts of products at equilibrium.*	**Teacher Guide:** **Inquiry Lab:** Explore Chemical Equilibrium **Digital Activity:** Equilibrium Shifting **Performance-Based Assessments:** Rates of Reaction and Dissolution, Calcium Carbonate and Shell Production

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
Disciplinary Core Ideas	
CH.PS1.6.DCI.1: In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present.	**Experience Notebook, Volume 2:** **Investigation 12** Reversible Reactions, 174 Chemical Equilibrium, 175 Le Châtelier's Principle, 176 How Concentration Affects Equilibrium, 177 How Pressure Affects Equilibrium, 178 How Temperature Affects Equilibrium, 179 The Self-Ionization of Water, 198 Calculating pH, 199-200 Sample Problem: Calculating pH from H_3O^+ Concentration, 201 Strong Acids and Bases, 203 Weak Acids, 204-205 Weak Bases, 206-207 **Investigation 14** Carbon Dioxide and Ocean pH, 230-231 Le Châtelier's Principle and Future Ocean pH, 236-237 Temperature, Pressure, and the Carbonate Compensation Depth, 240-241 Biogenic Carbon, 242-243 Calcification, 260-261 Marine Shell Dissolution, 262-263
CH.PS1.6.DCI.2: Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade- offs) may be needed.	**Teacher Guide:** **Engineering Design Challenge:** Use Equilibrium for a Commercial Application
Science and Engineering Practices	
CH.PS1.6.SEP.1: Designing Solutions: Refine a solution to a complex real- world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations.	**Experience Notebook, Volume 2:** **Investigation 12** SEP Design a Solution, 177 **Investigation 13** SEP Design a Solution, 225 **Investigation 14** SEP Design Your Solution, 265 **Teacher Guide:** **Engineering Design Challenge:** Use Equilibrium for a Commercial Application

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
Crosscutting Concepts	
CH.PS1.6.CCC.1: Stability and Change: Much of science deals with constructing explanations of how things change and how they remain stable.	**Experience Notebook, Volume 2:** **Investigation 12** CCC Stability and Change, 159 CCC Stability and Change, 175 CCC Stability and Change, 179 **Investigation 17** CCC Stability and Change, 231 CCC Stability and Change, 237 CCC Stability and Change, 241 **Teacher Guide:** **Inquiry Labs:** Explore Chemical Equilibrium; Measure Acid Strength; Titrations–The Study of Acid-Base Chemistry; Analysis of Buffer Solutions and Ranges; The pH of Seawater **Digital Activities:** Equilibrium Shifting; Explore Buffer Systems; Ocean pH; The Effect of Ocean Acidification on Shells
Performance Expectation	
CH.PS1.7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	**Teacher Guide:** **Inquiry Labs:** Identify Unknowns Through Stoichiometry; Determination of Reaction Output; Formation of Barium Iodate **Digital Activities:** Understanding Stoichiometry; Limiting Reagent **Engineering Design Challenge:** Build a Film Canister Rocket **Performance-Based Assessments:** Analysis of Basic Copper Carbonate, The Stoichiometry of Filling a Balloon

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	**Oklahoma Experience Chemistry ©2022**
Disciplinary Core Ideas	
CH.PS1.7.DCI.1: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.	**Experience Notebook, Volume 1:** **Investigation 6** Balancing Equations, 220-221 Activity Series, 232 Sample Problem: Writing Chemical Equations for Single-Replacement Reactions, 233 Predicting the Products of Reactions, 238-239 Revisit Investigative Phenomenon, 240 **Investigation 7** Equations as a Recipe, 252 Sample Problem: Using a Balanced Equation as a Recipe, 253 Interpreting Chemical Equations, 254 Sample Problem: Interpreting a Balanced Chemical Equation, 255 What Is Conserved?, 256-257 Limiting and Excess Reagents, 270 Mass of Products and Reactants, 271 Percent Yield, 274-275

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
Science and Engineering Practices	
CH.PS1.7.SEP.1: Using Mathematics and Computational Thinking: Use mathematical representations of phenomena to support claims.	**Experience Notebook, Volume 1:** **Investigation 5** SEP Use Math, 177 SEP Use Mathematics, 181 SEP Use Mathematics, 185 SEP Use Mathematics, 186 SEP Use Mathematics, 189 SEP Use Mathematics, 193 SEP Use Mathematics, 194 SEP Use Mathematics, 195 SEP Use Mathematics, 197 SEP Use Mathematics, 199 SEP Use Mathematics, 201 SEP Use Mathematics, 205 SEP Use Mathematics, 206 **Investigation 6** SEP Use Mathematics, 223 **Investigation 7** SEP Use Mathematics, 252 SEP Use Mathematics, 257 SEP Use Mathematics, 260 SEP Use Mathematics, 268 SEP Use Mathematics, 279 **Investigation 8** SEP Use Mathematics, 285 SEP Use Mathematics, 292 SEP Use Mathematics, 298 **Teacher Guide:** **Inquiry Labs:** Describe Small-scale Matter Using the Mole; Mole Ratios; Determine an Empirical Formula; Preparation of Solutions; Evaluate Chemical Reactions; Identify Unknowns Through Stoichiometry; Determination of Reaction Output; Formation of Barium Iodate; Hess's Law and the Combustion of a Metal **Digital Activities:** Mole Road Map; Making Dilutions **Performance-Based Assessments:** Analysis of Basic Copper Carbonate; Identify Evidence of Chemical Reactions; Quantitative Analysis of Acid Rain

Oklahoma 2020 Academic Standards for Science High School Chemistry	**Oklahoma Experience Chemistry ©2022**
Crosscutting Concepts	
CH.PS1.7.CCC.1: Energy and Matter: The total amount of energy and matter in closed systems is conserved.	**Experience Notebook, Volume 1:** **Investigation 6** CCC Energy and Matter, 215 **Investigation 7** CCC Energy and Matter, 255 CCC Energy and Matter, 256 **Investigation 8** CCC Energy and Matter, 281 CCC Energy and Matter, 284 CCC Energy and Matter, 290 SEP Energy and Matter, 307 **Teacher Guide:** **Engineering Design Challenges:** An Empirical Formula Challenge; Build a Film Canister Rocket **Performance-Based Assessments:** The Stoichiometry of Filling a Balloon, Enthalpy of a Neutralization Reaction
Performance Expectation	
CH.PS1.8: Develop models to illustrate the changes in composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.	**Teacher Guide:** **Inquiry Labs:** Radioactive Decay; Nuclear Energy **Performance-Based Assessment:** Natural Radiation
Disciplinary Core Ideas	
CH.PS1.8.DCI.1: Nuclear processes, including fusion, fission, and radioactive decay of unstable nuclei, involve release or absorption of energy.	**Experience Notebook, Volume 2:** **Investigation 17** Strong and Weak Nuclear Forces, 361-364 Revisit Investigative Phenomenon, 372 Nuclear Fission, 379 Nuclear Fusion, 380 Solar Fusion, 381 Fusion in Large Stars, 382 **Teacher Guide:** **Digital Activities:** Comparing Nuclear and Chemical Reactions; Geologic Variation and Radon Levels
CH.PS1.8.DCI.2: The total number of neutrons plus protons does not change in any nuclear process.	**Experience Notebook, Volume 2:** **Investigation 17** Radioactive Processes, 363 Nuclear Fission, 379 Nuclear Fusion, 380 Solar Fusion, 381 Fusion in Large Stars, 382

Oklahoma 2020 Academic Standards for Science High School Chemistry	**Oklahoma Experience Chemistry ©2022**
Science and Engineering Practices	
CH.PS1.8.SEP.1: Developing and Using Models: Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	**Experience Notebook, Volume 2:** **Investigation 17** Radioactive Processes, 363 CCC Use Models, 379 Solar Proton-Proton Chain Fusion, 381 SEP Use Models, 382 **Teacher Guide:** **Inquiry Labs:** Radioactive Decay; Nuclear Energy **Performance-Based Assessment:** Natural Radiation
Crosscutting Concepts	
CH.PS1.8.CCC.1: Energy and Matter: In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons are conserved.	**Experience Notebook, Volume 2:** **Investigation 17** Conservation of Mass and Energy, 373-374 CCC Energy and Matter, 380 **Teacher Guide:** **Digital Activities:** Comparing Nuclear and Chemical Reactions; Geologic Variation and Radon Levels
Motion Stability: Forces and Interactions (PS2)	
Performance Expectation	
CH.PS2.6: Communicate scientific and technical information about why the molecular level structure of designed materials determines how the material functions.	**Teacher Guide:** **Inquiry Labs:** Investigate Different Hydrocarbons; Protein and Amino Acid Tests Digital Activity: Protein Structure and Food Design **Engineering Design Challenge:** Polymers: Bouncy Balls **Performance-Based Assessment:** Prepare and Characterize Biodiesel

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	**Oklahoma Experience Chemistry ©2022**
Disciplinary Core Ideas	
CH.PS2.6.DCI.1: Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.	**Experience Notebook, Volume 1:** **Investigation 3** Coulomb's Law and Bond Strength, 73 Properties of Ionic Compounds, 74-75 Revisit Investigative Phenomenon, 76 Sea of Electrons Model, 77 Properties of Metals, 78-79 Revisit Investigative Phenomenon, 80 Molecular Compounds, 81 The Octet Rule in Molecules, 82-83 Types of Covalent Bonds, 84 Sample Problem: Electron Dot Structures for Molecular Substances, 85 Electronegativity and Bonding, 86-87 Geometry and Polar Molecules, 88-90 Revisit Investigative Phenomenon, 90 Van der Waals Forces, 91-92 Hydrogen Bonds, 93 Properties of Molecular Substances, 94-95 **Investigation 4** Delocalized Electrons, 141 Ductility and Malleability, 142 Conductivity and Luster, 143 **Experience Notebook, Volume 2:** **Investigation 16** Hydrocarbon Structures, 314 Alkanes, 315 Isomers, 320 Halocarbons, 328 Alcohols, 329 Ethers and Amines, 330 Aldehydes and Ketones, 331 Proteins, 347-348 Structure and Energy in Lipids, 351
Science and Engineering Practices	
CH.PS2.6.SEP.1: Obtaining, Evaluating, and Communicating Information: Communicate scientific and technical information (e.g., about the process of development and the design and performance of a proposed process or system) in multiple formats (including oral, graphical, textual, and mathematical).	**Experience Notebook, Volume 2:** **Investigation 16** SEP Obtain and Communicate Information, 339 **Teacher Guide:** Digital Activity: Protein Structure and Food Design **Engineering Design Challenge:** Polymers: Bouncy Balls

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
Crosscutting Concepts	
CH.PS2.6.CCC.1: Structure and Function: Investigating or designing net systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and the connections of components to reveal its function and/or solve a problem.	**Experience Notebook, Volume 1:** **Investigation 3** CCC Structure and Function, 79 CCC Structure and Function, 78 **Experience Notebook, Volume 2:** **Investigation 15** CCC Structure and Function, 336 **Teacher Guide:** Digital Activity: Protein Structure and Food Design **Engineering Design Challenge:** Polymers: Bouncy Balls **Performance-Based Assessment:** Prepare and Characterize Biodiesel
Energy (PS3)	
Performance Expectation	
CH.PS3.3: Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.	**Teacher Guide:** **Inquiry Labs:** The Thermodynamics of Hand Warmers; Solar Cell Technology; Build a Micro Battery **Engineering Design Challenge:** Flameless Heating Systems **Performance-Based Assessment:** Battery Challenge
Disciplinary Core Ideas	
CH.PS3.3.DCI.1: At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy.	**Experience Notebook, Volume 1:** **Investigation 1** Energy, 9 **Investigation 8** Thermochemistry, 281 Systems and Surroundings, 283 **Experience Notebook, Volume 2:** **Investigation 10** Flow of Energy in Earth's Systems, 44 Earth's Radiative Energy Budget, 55 **Investigation 11** Radiation: Absorption and Reradiation, 102 Energy Sources, 145–146

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
CH.PS3.3.DCI.2: Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.	**Experience Notebook, Volume 2:** **Investigation 11** SEP Define Problems, 155 **Investigation 18** A Greener Vision for Chemistry, 415
CH.PS3.3.DCI.3: Modern civilization depends on major technological systems. Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks.	**Experience Notebook, Volume 2:** **Investigation 11** Sources of Anthropogenic Carbon, 120-121 Energy Sources, 145-146 Transportation, 147 Infrastructure, 148 Geoengineering, 150 Sustainability, 151-152 **Investigation 18** Demand: Human Population and Consumerism, 410 A Greener Vision for Chemistry, 415 The 12 Principles of Green Chemistry, 417 Tradeoffs and Synergies, 431
Science and Engineering Practices	
CH.PS3.3.SEP.1: Designing Solutions: Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student- generated sources of evidence, prioritized criteria, and trade-off considerations.	**Experience Notebook, Volume 2:** **Investigation 15** SEP Design a Solution, 309 **Teacher Guide** **Inquiry Labs:** The Thermodynamics of Hand Warmers; Solar Cell Technology; Build a Micro Battery **Engineering Design Challenge:** Flameless Heating Systems **Performance-Based Assessment:** Battery Challenge
Crosscutting Concepts	
CH.PS3.3.CCC.1: Energy and Matter: Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.	**Experience Notebook, Volume 2:** **Investigation 15** CCC Energy and Matter, 309 **Teacher Guide** **Performance-Based Assessment:** Battery Challenge

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	**Oklahoma Experience Chemistry ©2022**
Performance Expectation	
CH.PS3.4: Plan and conduct an investigation to provide evidence that the transfer of thermal energy between components in a closed system involves changes in energy dispersal and heat content and results in a more uniform energy distribution among the components in the system (second law of thermodynamics).	**Teacher Guide:** **Inquiry Labs:** The Thermodynamics of Hand Warmers; The Heat of Melting Ice; Supersaturation and Thermodynamics
Disciplinary Core Ideas	
CH.PS3.4.DCI.1: Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems.	**Experience Notebook, Volume 1:** **Investigation 1** Interaction of Matter and Energy, 10 **Investigation 6** Energy of Reactions, 223–224 **Investigation 8** Systems and Surroundings, 283 **Experience Notebook, Volume 2:** **Investigation 110** Flow of Energy in Earth Systems, 44 Biogeochemical Cycles, 45-46
CH.PS3.4.DCI.1: Uncontrolled systems always evolve toward more stable states - that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than surrounding environments cool down).	**Experience Notebook, Volume 1:** **Investigation 1** Interaction of Matter and Energy, 10 **Investigation 6** Energy of Reactions, 223–224 **Investigation 8** Systems and Surroundings, 283 **Experience Notebook, Volume 2:** **Investigation 10** Flow of Energy in Earth Systems, 44 Biogeochemical Cycles, 45-46

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
Science and Engineering Practices	
CH.PS3.4.SEP.1: Planning and Carrying Out Investigations: Plan and conduct investigations individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements; consider limitations on the precision of the data (e.g., number of trials, cost, risk, time); and refine the design accordingly.	**Experience Notebook, Volume 2:** **Investigation 15** SEP Plan an Investigation, 300 **Teacher Guide:** **Inquiry Labs:** Measure the Energy of a Phase Change; The Thermodynamics of Hand Warmers; The Heat of Melting Ice; Supersaturation and Thermodynamics **Performance Based Assessment:** Enthalpy of a Neutralization Reaction
Crosscutting Concepts	
CH.PS3.4.CCC.1: Systems and System Models: When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.	**Experience Notebook, Volume 1:** **Investigation 8** SEP Develop a Model, 283 **Experience Notebook, Volume 2:** **Investigation 12** SEP Use Models, 178 CCC Systems and System Models, 183–184
Waves and Their Applications in Technologies for Information Transfer (PS4)	
Performance Expectation	
CH.PS4.1: Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.	**Digital:** Oklahoma Experience 1: Wave Properties **Inquiry Lab:** Mechanical Waves For supporting content, please see: **Experience Notebook, Volume 2:** **Investigation 11** Radiation: Absorption and Reradiation, 102 Incoming and Outgoing Radiation, 105-106 **Investigation 17** Radiation Penetration, 387
Disciplinary Core Ideas	
CH.PS4.1.DCI.1: The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing.	**Digital:** Oklahoma Experience 1: Wave Properties **Inquiry Lab:** Mechanical Waves For supporting content, please see: **Experience Notebook, Volume 1:** **Investigation 1** Atomic Emission Spectra, 22-23 **Experience Notebook, Volume 2:** **Investigation 17** Radiation Penetration, 387

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
Science and Engineering Practices	
CH.PS4.1.SEP.1: Using Mathematics and Computational Thinking: Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.	**Digital:** Oklahoma Experience 1: Wave Properties **Inquiry Lab:** Mechanical Waves
Crosscutting Concepts	
CH.PS4.1.CCC.1: Cause and Effect: Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects	**Digital:** Oklahoma Experience 1: Wave Properties **Inquiry Lab:** Mechanical Waves
Performance Expectation	
CH.PS4.3: Develop an argument for how scientific evidence supports the explanation that electromagnetic radiation can be described either by the wave model or the particle model, and in some situations one model is more useful than the other.	**Digital:** Oklahoma Experience 2: Electromagnetic Waves and Their Properties **Inquiry Lab:** Particle Nature of Life For supporting content, please see: **Experience Notebook, Volume 1:** Investigation 1 Atomic Emission Spectra, 22-23 The Bohr Model, 24-25 **Experience Notebook, Volume 2:** **Investigation 17** The Standard Model, 359-360
Disciplinary Core Ideas	
CH.PS4.3.DCI.1: Waves can add or cancel one another as they cross, depending on their relative phase (i.e., relative position of peaks and troughs of the waves), but they emerge unaffected by each other.	**Digital:** Oklahoma Experience 2: Electromagnetic Waves and Their Properties **Inquiry Lab:** Particle Nature of Life
CH.PS4.3.DCI.2: Boundary: The discussion at this grade level is qualitative only; it can be based on the fact that two sounds can pass a location in different directions without getting mixed up.	**Digital:** Oklahoma Experience 2: Electromagnetic Waves and Their Properties **Inquiry Lab:** Particle Nature of Life
CH.PS4.3.DCI.3: Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features.	**Digital:** Oklahoma Experience 2: Electromagnetic Waves and Their Properties **Inquiry Lab:** Particle Nature of Life For supporting content, please see: **Experience Notebook, Volume 2:** **Investigation 17** The Standard Model, 359-360

A Correlation of Oklahoma Experience Chemistry ©2022
To the
Oklahoma 2020 Standards for Science: High School Chemistry

Oklahoma 2020 Academic Standards for Science High School Chemistry	Oklahoma Experience Chemistry ©2022
Science and Engineering Practices	
CH.PS4.3.SEP.1: Engaging in Argument from Evidence: Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.	**Digital:** Oklahoma Experience 2: Electromagnetic Waves and Their Properties **Inquiry Lab:** Particle Nature of Life For supporting content, please see: **Experience Notebook, Volume 1: Investigation 1** Atomic Emission Spectra, 22-23 The Bohr Model, 24-25 **Experience Notebook, Volume 2: Investigation 17** The Standard Model, 359-360
Crosscutting Concepts	
CH.PS4.3.CCC.1: Systems and System Models: Models (e.g., physical, mathematical, computer) can be used to simulate systems and interactions, including energy, matter, and information flow within and between systems at different scales.	**Digital:** Oklahoma Experience 2: Electromagnetic Waves and Their Properties **Inquiry Lab:** Particle Nature of Life For supporting content, please see: **Experience Notebook, Volume 2: Investigation 17** Radiation Penetration Depths, 387