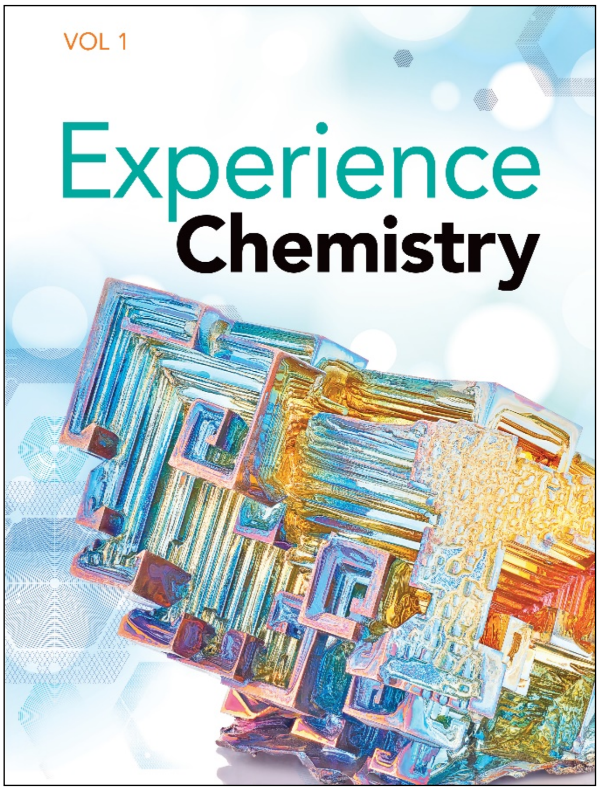
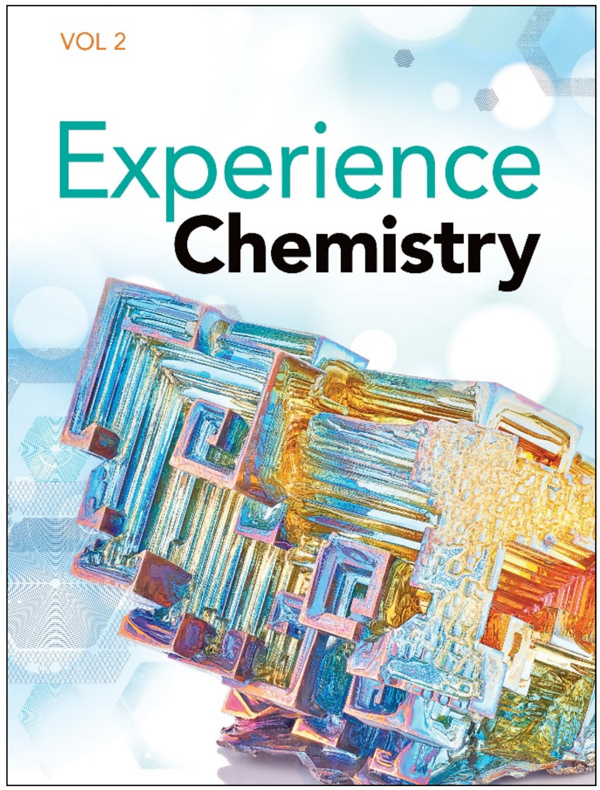
A Correlation of

Experience Chemistry
©2021





To the

Utah 2019 Science with Engineering Education Standards (SEEd)

High School Chemistry

Prepared by Savvas Learning Company LLC, formerly Pearson K-12 Learning

A Correlation of Experience Chemistry ©2021
to the
Utah Science with Engineering Education Standards (SEEd) for Chemistry

Resource Title: National Experience Chemistry ©2021

Publisher: Savvas Learning Company LLC, formerly known as Pearson K-12 Learning.

ISBN (10 or 13 digit unique identifier):

Experience Notebook Vol. 1 & 2 bundle: 9781418327231

Teacher Guide Vol. 1 & 2 bundle: 9781418327248

Media (text, software, internet, multimedia): Multimedia

Author: Christopher More, Ph.D., Michael Wysession, Pd.D., Bryn Lutes, Pd.D.

Copyright: 2021

Review Date: August 19, 2020

Core Subject Area: Science

A Correlation of Experience Chemistry ©2021
to the
Utah Science with Engineering Education Standards (SEEd) for Chemistry

Introduction

This document demonstrates how **Experience Chemistry ©2021** supports Utah's 2019 Science with Engineering Education Standards (SEEd) for 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.

Table of Contents

A Correlation of Experience Chemistry ©2021
to the
Utah Science with Engineering Education Standards (SEEd) for Chemistry

Utah Science with Engineering Education Standards (SEEd) for Chemistry	Experience Chemistry ©2021
(CHEM.1) The Structure and Properties of Atoms	
(CHEM.1.1) Obtain, evaluate, and communicate information regarding the structure of the atom on the basis of experimental evidence. Emphasize the relationship between proton number and element identity, isotopes, and electrons in atoms. Examples of experimental evidence could include the gold foil experiment, cathode ray tube, or atomic spectrum data.	**Experience Notebook, Volume 1:** **Investigation 1** Visualizing the Atom, 12 Types of Atoms, 13-14 Mass Number, 15 Isotopes, 16 Atomic Emission Spectra, 22-23 The Bohr Model, 24-25 Revisit Investigative Phenomenon, 27 **Teacher Guide:** **Inquiry Labs:** Bean Bag Isotopes; Evaluate Atomic Spectra **Performance Based Assessment:** Evaluate Atomic Structure with Flame Tests **Digital Activities:** Explore Atomic Particles; Model Isotopes; A Quick Look at the Parts of an Atom; Emission Spectra of Elements
(CHEM.1.2) Analyze and interpret data to identify patterns in the stability of isotopes and predict likely modes of radioactive decay. Emphasize that different isotopes of the same element decay by different modes and at different rates depending on their nuclear stability. Examples of data could include band of stability charts, mass or nuclear binding energy per nucleon, or the inverse relationship between half-life and nuclear stability.	**Experience Notebook, Volume 2:** **Investigation 17** Strong and Weak Nuclear Forces, 361-365 Radioactive Half-Lives, 365-366 Radioactive Decay Chains, 367 **Teacher Guide:** **Inquiry Labs:** Radioactive Decay **Digital Activities:** What Happens When an Atom Decays; Stability of small and Large Nuclei
(CHEM.1.3) Use mathematics and computational thinking to relate the rates of change in quantities of radioactive isotopes through radioactive decay (alpha, beta, and positron) to ages of materials or persistence in the environment. Emphasize a conceptual understanding of half-life. Examples could include radiocarbon dating, nuclear waste management, or nuclear medicine.	**Experience Notebook, Volume 2:** **Investigation 17** Radioactive Half-Lives, 365-366 Radiometric Dating, 368 Carbon-14 Age Dating, 370 Radiometric Dating of Old Materials, 371-372 Nuclear Accidents and Radioactive Waste, 394 Radiation and Medicine, 396-397 **Teacher Guide:** **Digital Activities:** Geologic Age and Half-Life; Ionizing Radiation Hazards

A Correlation of Experience Chemistry ©2021
to the
Utah Science with Engineering Education Standards (SEEd) for Chemistry

Utah Science with Engineering Education Standards (SEEd) for Chemistry	Experience Chemistry ©2021
(CHEM.1.4) Construct an explanation about how fusion can form new elements with greater or lesser nuclear stability. Emphasize the nuclear binding energy, with the conceptual understanding that when fusion of elements results in a more stable nucleus, large quantities of energy are released, and when fusion results in a less stable nucleus, large quantities of energy are required. Examples could include the building up of elements in the universe starting with hydrogen to form heavier elements, the composition of stars, or supernovae producing heavy elements.	**Experience Notebook, Volume 2:** **Investigation 17** Conservation of Mass and Energy, 373-374 Mass and Energy at the Big Bang, 376-377 Nuclear Fusion, 380 Solar Fusion, 381 Fusion in Large Stars, 382 Nucleosynthesis, 383-384 **Teacher Guide:** **Digital Activities:** Comparing Nuclear and Chemical Reactions; Energy From Nuclear Processes; The Compositions of Stars
(CHEM.1.5) 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. Emphasize conceptual understanding of trends and patterns. Examples could include trends in ionization energy, atomic radius, or electronegativity. Examples of properties for main group elements could include general reactivity, bonding type, or ion formation.	**Experience Notebook, Vol 1:** **Investigation 1** Types of Atoms, 13-14 Patterns in Electron Configurations, 36-38 Valence Electrons, 39 Revisit Investigative Phenomenon, 40 **Investigation 2** The Periodic Table as a Predictive Model, 50-51 Coulomb's Law, 52 The Shielding Effect and Effective Nuclear Charge, 53-55 Atomic Radius, 56-58 Ionization Energy, 59 Successive Ionization Energies, 60 Electron Affinity, 61 Common Charges in Representative Elements, 62 Connecting the Trends, 63 Revisit Investigative Phenomenon, 64 **Teacher Guide:** **Inquiry Labs:** Develop a Periodic Table; Elemental Metals, Nonmetals, and Metalloids; Periodic Trends and Properties **Performance Based Assessment:** Evaluate Atomic Structure with Flame Tests; Gravimetric Analysis of Periodic Trends **Digital Activities:** Graphing Periodic Properties; Periodic Trends; Make a Claim About Periodic Trends; Size Trends and Shielding Effect; Predict Reactivity Using Periodic Trends

Utah Science with Engineering Education Standards (SEEd) for Chemistry	**Experience Chemistry ©2021**
(CHEM.2) The Structure and Properties of Molecules	
(CHEM.2.1) Analyze data to predict the type of bonding most likely to occur between two elements using the patterns of reactivity on the periodic table. Emphasize the types and strengths of attractions between charged particles in ionic, covalent, and metallic bonds. Examples could include the attraction between electrons on one atom and the nucleus of another atom in a covalent bond or between ions in an ionic compound.	**Experience Notebook, Volume 1:** **Investigation 3** Ions and the Octet Rule, 68-69 Ionic Bonds, 70-71 Ionic Compounds, 72-73 Sea of Electrons Model, 77 Molecular Compounds, 81 The Octet Rule in Molecules, 82-83 Types of Covalent Bonds, 85 Sample Problem: Electron Dot Structures for Molecular Substances, 85 Geometry and Polar Molecules, 88-90 **Teacher Guide:** **Digital Activities:** Electron Dot Structures for Ionic Compounds; Formation of Ionic Compounds; Electron Dot Structures for Molecular Substances; Formation of Covalent Bonds
(CHEM.2.2) Plan and carry out an investigation to compare the properties of substances at the bulk scale and relate them to molecular structures. Emphasize using models to explain or describe the strength of electrical forces between particles. Examples of models could include Lewis dot structures or ball and stick models. Examples of particles could include ions, atoms, molecules, or networked materials (such as graphite). Examples of properties could include melting point and boiling point, vapor pressure, solubility, or surface tension.	**Experience Notebook, Volume 1:** **Investigation 3** Ionic Bonds, 70-71 Ionic Compounds, 72-73 Properties of Ionic Compounds, 74-76 Revisit Investigative Phenomenon, 76 Properties of Metals, 78-80 Revisit Investigative Phenomenon, 80 The Octet Rule in Molecules, 82-83 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 Revisit Investigative Phenomenon, 96 **Investigation 4** Liquids and Intermolecular Forces, 118-119 Solids and Attractive Force, 120-121 Heating a Liquid, 127 Vapor Pressure and Boiling, 130-131 Properties of Ionic and Molecular Compounds, 138 Covalent Network Solids, 139-140 Revisit Investigative Phenomenon, 140, 147 Ductility and Malleability, 142 Crystalline Structure and Properties of Metals, 144 Water and Hydrogen Bonding, 148 Surface Tension, 149-150 Hydrogen Bonding and Boiling Point, 151 Structure Affects Properties of Ice, 152-153

A Correlation of Experience Chemistry ©2021
to the
Utah Science with Engineering Education Standards (SEEd) for Chemistry

Utah Science with Engineering Education Standards (SEEd) for Chemistry	Experience Chemistry ©2021
CHEM 2.2 Continued:	Continued: **Teacher Guide:** **Inquiry Labs:** Characteristics of Ionic Bonds; Investigate Metallic Bonds; Characteristics of Covalent Bonds; Intermolecular Forces; Correlate Material Properties and Bond Type; Melt Ionic and Covalent Compounds; Investigate Surface Tension **Performance Based Assessment:** Types of Chemical Bonds **Digital Activities:** Ions and Electroplating; Formation of Ionic Compounds; Describe Ionic Bonding and Properties; Electron Dot Structures for Molecular Substances; Intermolecular Forces in Liquids; Water's Behavior on Earth; Relate Intermolecular Forces to States of Matter; Phase Changes and Intermolecular Forces; Tough Tools; Model Surface Tension and Polarity
(CHEM.2.3) Engage in argument supported by evidence that the functions of natural and designed macromolecules are related to their chemical structures. Emphasize the roles of attractive forces between and within molecules. Examples could include non-covalent interactions between base pairs in DNA allowing it to be unzipped for replication, the network of atoms in a diamond conferring hardness, or the nonpolar nature of polyester (PET) making it quick-drying.	**Experience Notebook, Volume 1:** **Investigation 4** Solids and Attractive Force, 120-121 Covalent Network Solids, 139-140 **Experience Notebook, Volume 2:** **Investigation 16** Saturation, 319 Isomers, 320-321 Revisit Investigative Phenomenon, 326 Alcohols, 329 Ethers and Amines, 330 Aldehydes and Ketones, 331 Organic Chemical Reactions, 335-336 Polymers, 337-339 Proteins, 347-348 Lipids, 349-351 Nucleic Acids, 352 **Teacher Guide:** **Engineering Design Challenge:** Polymers: Bouncy Balls **Digital Activities:** Structure and Properties of Hydrocarbons; Energy Density; Polymerization; Protein Structure and Food Design; Energy Density of Foods

Utah Science with Engineering Education Standards (SEEd) for Chemistry	**Experience Chemistry ©2021**
(CHEM.2.4) Evaluate design solutions where synthetic chemistry was used to solve a problem (cause and effect). Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution. Emphasize the design of materials to control their properties through chemistry. Examples could include pharmaceuticals that target active sites, teflon to reduce friction on surfaces, or nanoparticles of zinc oxide to create transparent sunscreen.	**Experience Notebook, Volume 2:** **Investigation 16** Polymers, 337-339 **Investigation 18** Green Chemistry, 403 A Greener Vision for Chemistry, 415-416 Revisit Investigative Phenomenon, 416 1. Waste Prevention, 418 3. Less Hazardous Chemical Synthesis, 420 4. Designing Safer Chemicals, 421 7. Use of Renewable Feedstocks, 424 10. Design for Degradation, 427 Sustainable Energy Practices, 434 Sustainable Waste Management, 435 Revisit Investigative Phenomenon, 438 Assessment, 439 **Teacher Guide:** **Inquiry Labs:** Green Chemistry Analysis of a Reaction; How to Recycle Polylactic Acid Plastics **Engineering Design Challenge:** Plastic from Biowaste **Digital Activities:** Getting the Lead Out; From Feedstocks to Medicine; Energy-Efficient Ammonia Production; How Catalysts Promote Greener Chemistry; Revise an Industrial Process
(CHEM.3) Stability and Change in Chemical Systems	
(CHEM.3.1) Use mathematics and computational thinking to analyze the distribution and proportion of particles in solution. Emphasize proportional reasoning and the impact of concentration on solution properties, rather than algorithmic calculations. Examples of concentrations affecting solutions could include the Beer-Lambert Law, colligative properties, or pH.	**Experience Notebook, Vol 1:** **Investigation 5** Molarity, 203-204 Sample Problem: Calculating Molarity, 205 Sample Problem: Calculating Moles of Solute in Solution, 206 Dilutions, 207-208 Sample Problem: Preparing a Dilute Solution, 209 Percent Solution, 210-211 Sample Problem: Calculating Percent by Volume, 211 Revisit Investigative Phenomenon, 212 **Experience Notebook, Volume 2:** **Investigation 13** Calculating pH, 199-200 Sample Problem: Calculating pH from H_3O^+ Concentration, 201 Calculating pH for Weak Acids and Bases, 208 Sample Problem: Estimating pH of a Weak Acid Solution, 209 Acid-Base Titrations, 218 Sample Problem: Determining the Concentration by Titration, 220

Utah Science with Engineering Education Standards (SEEd) for Chemistry	**Experience Chemistry ©2021**
CHEM.3.1 Continued:	Continued: **Teacher Guide:** **Inquiry Labs:** Preparation of Solutions; Titrations – The Study of Acid-Base Chemistry **Digital Activities:** Making Dilutions; Solubility and Percent by Mass; Exploring Acid Strength and Concentration; Stoichiometric Analysis of Vinegar
(CHEM.3.2) Analyze data to identify patterns that assist in making predictions of the outcomes of simple chemical reactions. Emphasize patterns based on the outermost electrons of atoms, trends in the periodic table, and knowledge of chemical properties. Examples could include reactions between main group elements, combustion reactions, or reactions between Arrhenius acids and bases.	**Experience Notebook, Volume 1:** **Investigation 3** Ions and the Octet Rule, 68-69 Ionic Bonds, 70-71 Ionic Compounds, 72-73 Revisit Investigative Phenomenon, 76 The Octet Rule in Molecules, 82-83 Types of Covalent Bonds, 84 Electronegativity and Bonding, 86-87 Revisit Investigative Phenomenon, 90 **Investigation 6** Activity Series, 232 Sample Problem: Writing Chemical Equations for Combustion Reactions, 237 Predicting the Products of Reactions, 238-239 Revisit Investigative Phenomenon, 240 Ions in Aqueous Solution, 241-242 Predicting the Formation of a Precipitate, 246 **Experience Notebook, Volume 2:** **Investigation 15** Redox vs. Non-redox Reactions, 284 **Teacher Guide:** **Inquiry Labs:** Characteristics of Ionic Bonds; Characteristics of Covalent Bonds; Evaluate Chemical Reactions; Types of Chemical Reactions; Predict Chemical Reactions; Metal Activity **Engineering Design Challenge:** Water Purification **Digital Activities:** Calculate Bond Polarity; Predicting Bond Type; Reactivity of Metals; Reaction Reasoning; Cation Meets Anion; Predict Whether a Precipitate Will Form

Utah Science with Engineering Education Standards (SEEd) for Chemistry	**Experience Chemistry ©2021**
(CHEM.3.3) Plan and carry out an investigation to observe the change in properties of substances in a chemical reaction to relate the macroscopically observed properties to the molecular level changes in bonds and the symbolic notation used in chemistry. Emphasize that the visible macroscopic changes in chemical reactions are a result of changes on the molecular level. Examples of observable properties could include changes in color or the production of a solid or gaseous product.	**Experience Notebook, Volume 1:** **Investigation 6** Combination Reactions, 228 Decomposition Reactions, 229 Single-Replacement Reactions, 231 Double-Replacement Reactions, 234 Combustion Reactions, 236 Predicting the Products of Reactions, 238-239 Formation of a Precipitate, 245 Revisit Investigative Phenomenon, 248 **Teacher Guide:** **Inquiry Labs:** Types of Chemical Reactions **Performance Based Assessment:** Identify Evidence of Chemical Reactions **Digital Activities:** Reaction Reasoning
(CHEM.3.4) Use mathematics and computational thinking to support the observation that matter is conserved during chemical reactions and matter cycles. Emphasize that chemical reactions occur on both small and global scales, and that matter is always conserved. Examples of small scale reactions could include ratios of reactants and products in a single chemical reaction or simple stoichiometric calculation. Examples of global scale matter cycles could include tracing carbon through the chemical reactions of photosynthesis, combustion, or respiration.	**Experience Notebook, Volume 1:** **Investigation 7** Interpreting Chemical Equations, 254 Sample Problem: Interpreting a Balanced Chemical Equation, 255 What Is Conserved?, 256 Proportionality of Reactants and Products, 257 Revisit Investigative Phenomenon, 258 **Teacher Guide:** **Inquiry Labs:** Identify Unknowns Through Stoichiometry; Determination of Reaction Output; Formation of Barium Iodate **Engineering Design Challenge:** Build a Film Canister Rocket **Performance Based Assessment:** The Stoichiometry of Filling a Balloon **Digital Activities:** Understanding Stoichiometry
(CHEM.3.5) Develop solutions related to the management, conservation, and utilization of mineral resources (matter). Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Emphasize the conservation of matter and minerals as a limited resource. Examples of Utah mineral resources could include copper, uranium, potash, coal, oil, or natural gas. Examples of constraints could include cost, safety, reliability, or possible social, cultural, and environmental impacts.	**Experience Notebook, Volume 2:** **Investigation 11** Sustainability, 151-152 **Investigation 18** Green Chemistry, 403 Supply: Finite Resources, 408-409 Revisit Investigative Phenomenon, 416 Revisit Investigative Phenomenon, 430 Sustainable Resource Management, 433 Sustainable Waste Management, 435 Revisit Investigative Phenomenon, 438

Utah Science with Engineering Education Standards (SEEd) for Chemistry	**Experience Chemistry ©2021**
CHEM 3.5 Continued:	Continued: **Teacher Guide:** **Inquiry Labs:** How to Recycle Polylactic Acid Plastics **Engineering Design Challenge:** Plastic from Biowaste **Digital Activities:** Energy-Efficient Ammonia Production; Choices When Designing Chemical Processes; Paper Mill Wastewater Treatment; Revise an Industrial Process
(CHEM.3.6) Construct an explanation using experimental evidence for how reaction conditions affect the rate of change of a reaction. Emphasize collision theory as an explanatory principle. Examples of reaction conditions could include temperature, concentration, particle size, or presence of a catalyst.	**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 Effect of Particle Size on Reaction Rates, 166 Revisit Investigative Phenomenon, 167 One-Step and Multistep Reactions, 170 Lowering Activation Energy, 171-172 Assessment, 191 **Teacher Guide:** **Inquiry Labs:** Reaction Rates: Iodine Clock; Collision Theory **Performance Based Assessment:** Reaction Rates and Equilibrium **Digital Activities:** Factors that Affect Reaction Rate; Reaction Rate and Molecular Collisions; Glow Sticks and Reaction Rate; Reaction Rates and Activation Energy
(CHEM.3.7) Design a solution that would refine a chemical system by specifying a change in conditions that would produce increased or decreased amounts of a product at equilibrium. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Emphasize a qualitative understanding of Le Châtelier's Principle and connections between macroscopic and molecular level changes.	**Experience Notebook, Volume 2:** **Investigation 12** Le Chatelier's Principle, 176 How Concentration Affects Equilibrium, 177 How Pressure Affects Equilibrium, 178 How Temperature Affects Equilibrium, 179 Revisit Investigative Phenomenon, 180 **Investigation 14** Le Chatelier's Principle and Future Ocean pH, 236-237 **Teacher Guide:** **Inquiry Labs:** Explore Chemical Equilibrium **Engineering Design Challenge:** Use Equilibrium for a Commercial Application **Performance Based Assessment:** Reaction Rates and Equilibrium **Digital Activities:** Equilibrium Shifting

A Correlation of Experience Chemistry ©2021
to the
Utah Science with Engineering Education Standards (SEEd) for Chemistry

Utah Science with Engineering Education Standards (SEEd) for Chemistry	Experience Chemistry ©2021
(CHEM.3.8) Obtain, evaluate, and communicate information regarding the effects of designed chemicals in a complex real-world system. Emphasize the role of chemistry in solving problems, while acknowledging unintended consequences. Examples could include ozone depletion and restoration, DDT, development of medicines, the preservation of historical artifacts, or use of bisphenol-A in plastic manufacturing.	**Experience Notebook, Volume 2:** **Investigation 18** Green Chemistry, 403 Chemicals All Around Us, 404 The Chemical Industry, 405-406 Waste and Unintended Impacts, 412-413 Chemical Disasters, 414 Revisit Investigative Phenomenon, 416 4. Designing Safer Chemicals, 421 10. Design for Degradation, 427 **Teacher Guide:** **Inquiry Labs:** Toxicity of Road Deicers **Digital Activities:** Getting the Lead Out
(CHEM.4) Energy in Chemical Systems	
(CHEM.4.1) Construct an argument from evidence about whether a simple chemical reaction absorbs or releases energy. Emphasize that the overall change in energy is related to the energy absorbed when bonds are broken and the energy released when bonds are formed. Examples could include chemical reactions releasing or absorbing energy to or from the surrounding solution or the metabolism of glucose.	**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 Revisit Investigative Phenomenon, 290 Hess's Law, 291 Heat Summation, 292 Standard Enthalpy of Formation, 293 Standard Enthalpy of Reaction, 294 Enthalpy of Solution, 296-297 Revisit Investigative Phenomenon, 298 **Teacher Guide:** **Inquiry Labs:** The Thermodynamics of Hand Warmers; Hess's Law and the Combustion of a Metal **Engineering Design Challenge:** Flameless Heating Systems **Digital Activities:** Energy Changes in Reactions; Energy in Reactions; Compare Heats of Formation; Bond Energy and Enthalpy; Energy Input for the Rusting of Iron

A Correlation of Experience Chemistry ©2021
to the
Utah Science with Engineering Education Standards (SEEd) for Chemistry

Utah Science with Engineering Education Standards (SEEd) for Chemistry	Experience Chemistry ©2021
(CHEM.4.2) Construct an explanation of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. Emphasize a qualitative understanding. Examples could include that low energy electromagnetic radiation can increase molecular rotation and bond vibration, visible light can cause electronic transitions, and high energy electromagnetic radiation can result in ionization and bond breaking.	**Experience Notebook, Volume 1:** **Investigation 1** Atomic Structure, 5 Atomic Emission Spectra, 22-23 Revisit Investigative Phenomenon, 27 **Experience Notebook, Volume 2:** **Investigation 10** Flow of Energy in Earth's Systems, 44 Biogeochemical Cycles, 45-46 Earth's Radiative Energy Budget, 55-56 Evaporation and Transpiration, 58 **Investigation 11** Radiation: Absorption and Reradiation, 102 Incoming and Outgoing Radiation, 105-106 **Investigation 17** Radiation Penetration, 387 Radiation and Medicine, 396-397 Radiation and Living Tissue, 398 Radiation and Gene Mutation, 399-400 **Teacher Guide:** **Inquiry Labs:** How Sunscreen Protects Us from Radiation; Nuclear Radiation and Shielding **Digital Activities:** Emission Spectra of Elements; Energy In and Out of Earth's Atmosphere; Ionizing Radiation Hazards
(CHEM.4.3) Design a device that converts energy from one form into another to solve a problem. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Emphasize chemical potential energy as a type of stored energy. Examples of sources of chemical potential energy could include oxidation-reduction or combustion reactions.	**Experience Notebook, Volume 1:** **Investigation 8** Enthalpy of Solution, 296-297 **Teacher Guide:** **Inquiry Labs:** The Thermodynamics of Hand Warmers; Solar Cell Technology; Build a Micro Battery **Engineering Design Challenge:** Flameless Heating Systems

Utah Science with Engineering Education Standards (SEEd) for Chemistry	Experience Chemistry ©2021
(CHEM.4.4) Use models to describe the changes in the composition of the nucleus of the atom during nuclear processes, and compare the energy released during nuclear processes to the energy released during chemical processes. Emphasize a qualitative understanding of nuclear changes. Examples of nuclear processes could include the formation of elements through fusion in stars, generation of electricity in a nuclear power plant, radioactive decay, or the use of radioisotopes in nuclear medicine.	**Experience Notebook, Volume 2:** **Investigation 17** Strong and Weak Nuclear Forces, 361-365 Nuclear Fission, 379 Nuclear Fusion, 380 Solar Fusion, 381 Fusion in Large Stars, 382 Nuclear Fission Power, 392-393 Radiation in Medicine, 396-397 **Teacher Guide:** **Inquiry Labs:** Radioactive Decay; Nuclear Energy **Performance Based Assessment:** Natural Radiation **Digital Activities:** What Happens When an Atom Decays; Comparing Nuclear and Chemical Reactions
(CHEM.4.5) Develop an argument from evidence to evaluate a proposed solution to societal energy demands based on prioritized criteria and trade-offs that account for a range of constraints that could include cost, safety, reliability, as well as possible social, cultural, and environmental impacts.	**Experience Notebook, Volume 2:** **Storyline 5: Industrial Applications** Anchoring Phenomenon, 273 **Investigation 17** Nuclear Fission Power, 392-393 **Investigation 18** Green Chemistry, 403 Revisit Investigative Phenomenon, 416, 430, 438 Revisit Anchoring Phenomenon, 439 **Teacher Guide:** **Digital Activities:** Algae Farm