A Planning Guide of

Experience Chemistry

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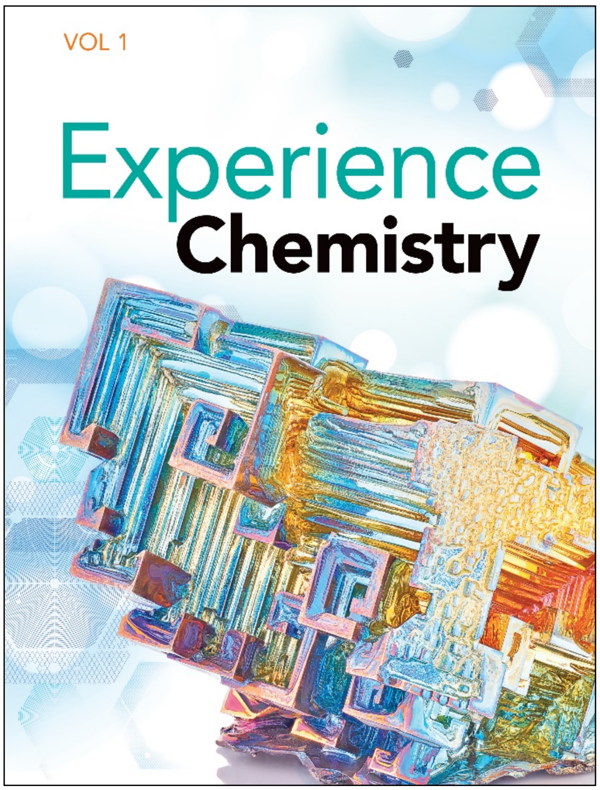

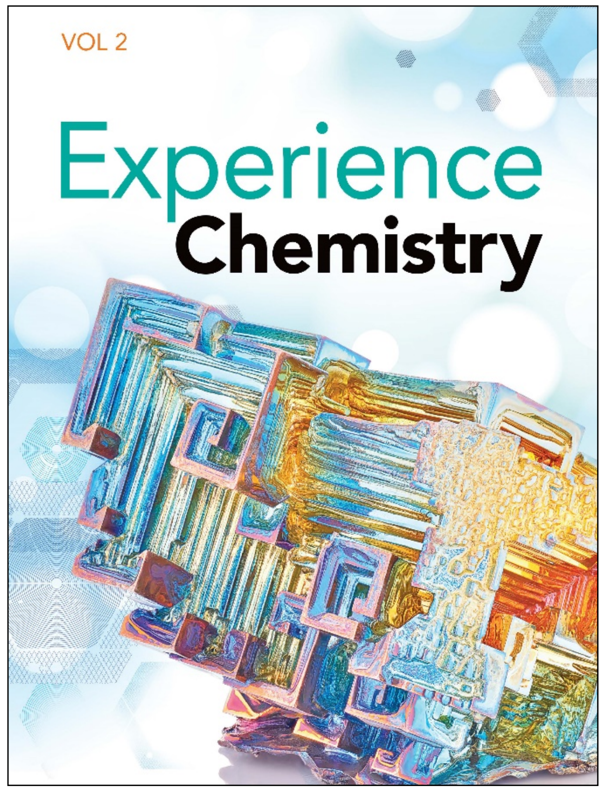

To the

Wisconsin
2017 Standards for Science
High School Physical Science

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

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Introduction

This document demonstrates how the **Experience Chemistry ©2021Student Experience Notebook** supports Wisconsin's 2017 Standards for Science: High School Physical Science**.**

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.

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Experience 5: Electrons in Atoms, Volume 1, p. 33	**SCI.PS1.A.h:** The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter, including chemical reactions and nuclear processes. Repeating patterns of the periodic table reflect patterns of outer electrons. A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy to take the molecule apart. **HS-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. **SCI.PS2.B.h.ii:** 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. **SCI.PS3.A.h:** Systems move towards more stable states

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Experience 2: The Periodic Table and Atomic Structure, Volume 1, p. 50	**SCI.PS1.A.h:** The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter, including chemical reactions and nuclear processes. Repeating patterns of the periodic table reflect patterns of outer electrons. A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy to take the molecule apart. **HS-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. **SCI.PS2.B.h.ii:** 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.

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Experience 3: Covalent Bonds, Volume 1, p. 81	**SCI.PS1.A.h:** The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter, including chemical reactions and nuclear processes. Repeating patterns of the periodic table reflect patterns of outer electrons. A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy to take the molecule apart. **HS-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. **SCI.PS2.B.h.ii:** 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.

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Experience 3 continued:	**Continued:** **SCI.PS3.C.h:** Fields contain energy that depends on the arrangement of the objects in the field. **HS-PS3-5:** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
Experience 4: Intermolecular Attractions, Volume 1, p. 91	**SCI.PS1.A.h:** The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter, including chemical reactions and nuclear processes. Repeating patterns of the periodic table reflect patterns of outer electrons. A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy to take the molecule apart. **HS-PS1-3:** Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. **SCI.PS2.B.h.i:** Forces at a distance are explained by fields that can transfer energy and can be described in terms of the arrangement and properties of the interacting objects and the distance between them. These forces can be used to describe the relationship between electrical and magnetic fields. **SCI.PS2.B.h.ii:** 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. **HS-PS3-5:** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

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Experience 3: Comparing Ionic and Molecular Compounds, Volume 1, p. 136	**SCI.PS1.A.h:** The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter, including chemical reactions and nuclear processes. Repeating patterns of the periodic table reflect patterns of outer electrons. A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy to take the molecule apart. **SCI.PS2.B.h.ii:** 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.

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Experience 5 continued:	**Continued:** **SCI.PS2.B.h.ii:** 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. **HS-PS2-6:** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. **HS-PS3-5:** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
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Experience 1: Modeling Chemical Reactions, Volume 1, p. 216	**HS-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. **HS-PS1-5:** 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. **HS-PS1-7:** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. **SCI.PS3.B.h:** The total energy within a system is conserved. Energy transfer within and between systems can be described and predicted in terms of energy associated with the motion or configuration of particles (objects). **HS-PS3-2:** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles objects: and energy associated with the relative position of particles objects.
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Experience 2 continued:	**Continued:** **HS-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. **HS-PS1-7:** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
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Experience 3: Limiting Reagent and Percent Yield, Volume 1, p. 279	**HS-PS1-7:** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
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Experience 1: Energy in Chemical Bonds, p. 282	**SCI.PS1.B.h:** Chemical processes are understood in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved. **HS-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. **SCI.PS3.B.h:** The total energy within a system is conserved. Energy transfer within and between systems can be described and predicted in terms of energy associated with the motion or configuration of particles (objects). **HS-PS3-1:** Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. **HS-PS3-2.** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

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Experience 2: Enthalpies of Formation and Reaction, Volume 1, p. 291	**HS-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. **SCI.PS3.B.h:** The total energy within a system is conserved. Energy transfer within and between systems can be described and predicted in terms of energy associated with the motion or configuration of particles objects. **HS-PS3-1:** Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. **HS-PS3-2:** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles objects: and energy associated with the relative position of particles objects. **HS-PS3-3:** Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
Experience 3: Enthalpy in Changes of State, Volume 1, p. 299	**SCI.PS3.B.h:** The total energy within a system is conserved. Energy transfer within and between systems can be described and predicted in terms of energy associated with the motion or configuration of particles objects. **HS-PS3-2:** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles objects: and energy associated with the relative position of particles objects. **HS-PS3-4.** Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

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Experience 3: Ideal Gases, p. 23	**HS-PS3-2.** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).
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Experience 1 continued:	**Continued:** **SCI.PS4.A.h:** The wavelength and frequency of a wave are related to one another by the speed of the wave, which depends on the type of wave and the medium through which it is passing. Waves can be used to transmit information and energy. **HS-PS4-1.** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
Experience 2: Water and Energy in the Atmosphere, p. 55	**SCI.PS3.B.h:** The total energy within a system is conserved. Energy transfer within and between systems can be described and predicted in terms of energy associated with the motion or configuration of particles objects. **SCI.PS4.A.h:** The wavelength and frequency of a wave are related to one another by the speed of the wave, which depends on the type of wave and the medium through which it is passing. Waves can be used to transmit information and energy.
Experience 3: Atmospheric System Feedbacks, p. 66	**SCI.PS3.A.h:** Systems move towards more stable states. **SCI.PS4.A.h:** The wavelength and frequency of a wave are related to one another by the speed of the wave, which depends on the type of wave and the medium through which it is passing. Waves can be used to transmit information and energy.
Experience 4: Long-Term Climate Factors, p. 76	**HS-PS1-8:** Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. **SCI.PS4.A.h:** The wavelength and frequency of a wave are related to one another by the speed of the wave, which depends on the type of wave and the medium through which it is passing. Waves can be used to transmit information and energy.

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Experience 5: Short-Term Climate Factors, p. 85	**SCI.PS4.A.h:** The wavelength and frequency of a wave are related to one another by the speed of the wave, which depends on the type of wave and the medium through which it is passing. Waves can be used to transmit information and energy.
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Experience 3: Anthropogenic Carbon Emissions, p. 115	**SCI.PS3.D.h:** Photosynthesis is the primary biological means of capturing radiation from the sun; energy cannot be destroyed, but it can be converted to less useful forms.
Investigation 12: Reaction Rates and Equilibrium, Volume 2, p. 158-191	
Experience 1: Rates of Reaction, p. 160	**SCI.PS1.B.h:** Chemical processes are understood in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved. **HS-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. **HS-PS1-5:** 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.

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Experience 2: The Progress of Chemical Reactions, p. 168	**SCI.PS1.B.h:** Chemical processes are understood in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved. **HS-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 3: Reversible Reactions and Equilibrium, p. 174	**HS-PS1-5:** 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. **HS-PS1-6:** Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. **SCI.PS3.A.h:** Systems move towards more stable states.
Experience 4: Free Energy and Entropy, p. 181	**HS-PS1-5:** 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. **SCI.PS3.A.h:** Systems move towards more stable states. **HS-PS3-4:** Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

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Investigation 13: Acid-Base Equilibria, Volume 2, p. 192-227	
Experience 1: Acids, Bases, and Salts, p. 194	**SCI.PS1.A.h:** The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter, including chemical reactions and nuclear processes. Repeating patterns of the periodic table reflect patterns of outer electrons. A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy to take the molecule apart. **HS-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, and knowledge of the patterns of chemical properties.
Experience 2: Strong and Weak Acids and Bases, p. 203	**SCI.PS1.A.h:** The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter, including chemical reactions and nuclear processes. Repeating patterns of the periodic table reflect patterns of outer electrons. A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy to take the molecule apart.
Experience 3: Reactions of Acids and Bases, p. 212	**HS-PS1-7.** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
Experience 4: Buffers and Equilibria, p. 222	**HS-PS1-6:** Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

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Investigation 14: Ocean Acidification, Volume 2, p. 228-271	
Experience 1: Ocean pH Levels, p. 230	**HS-PS1-6:** Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
Experience 2: Earth's Oceans as a Carbon Sink, p. 238	**HS-PS1-5:** 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.
Experience 4: Consequences of Ocean Acidification, p. 260	**SCI.PS3.A.h:** Systems move towards more stable states.
Investigation 15: Oxidation-Reduction Reactions, Volume 2, p. 274-309	
Experience 1: Oxidation vs. Reduction, p. 276	**HS-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, and knowledge of the patterns of chemical properties.
Experience 2: Modeling Redox Reactions, p. 288	**HS-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, and knowledge of the patterns of chemical properties. **HS-PS1-7.** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
Experience 3: Electrochemical Cells, p. 297	**HS-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, and knowledge of the patterns of chemical properties. **HS-PS1-7:** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

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Experience 3 continued:	**Continued:** **HS-PS2-4:** Use mathematical representations (qualitative and quantitative) of Newton's law of gravitation and Coulomb's law to describe and predict the gravitational and electrostatic forces between objects. **SCI.PS3.B.h:** The total energy within a system is conserved. Energy transfer within and between systems can be described and predicted in terms of energy associated with the motion or configuration of particles (objects).
Investigation 16: Organic Chemistry, Volume 2, p. 310-355	
Experience 1: Hydrocarbons, p. 312	**SCI.PS1.A.h:** The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter, including chemical reactions and nuclear processes. Repeating patterns of the periodic table reflect patterns of outer electrons. A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy to take the molecule apart. **SCI.PS1.B.h:** Chemical processes are understood in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved.
Experience 2: Functional Groups and Polymers, p. 327	**SCI.PS1.A.h:** The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter, including chemical reactions and nuclear processes. Repeating patterns of the periodic table reflect patterns of outer electrons. A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy to take the molecule apart. **HS-PS2-6:** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

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Experience 3: Chemistry of Life, p. 340	**SCI.PS1.A.h:** The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter, including chemical reactions and nuclear processes. Repeating patterns of the periodic table reflect patterns of outer electrons. A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy to take the molecule apart. **SCI.PS1.B.h:** Chemical processes are understood in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved. **HS-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, and knowledge of the patterns of chemical properties. **HS-PS3-1:** Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other components: and energy flows in and out of the system are known.
Investigation 17: Nuclear Processes, Volume 2, p. 356-401	
Experience 1: Radioactivity and Half-Lives, p. 358	**SCI.PS1.C.h:** Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. **HS-PS1-8:** Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. **HS-PS4-1.** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

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Experience 2: Fission and Fusion, p. 373	**SCI.PS1.C.h:** Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. **HS-PS1-8:** Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
Experience 3: Nuclear Technologies, p. 387	**SCI.PS1.C.h:** Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. **HS-PS4-1.** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. **HS-PS4-4:** Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. **HS-PS4-5:** Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
Investigation 18: Green Chemistry, Volume 2, p. 402-439	
Experience 1: Industrial Chemicals and the Environment, p. 404	**SCI.PS1.B.h:** Chemical processes are understood in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved. **HS-PS1-5:** 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.

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Experience 2: Principles of Green Chemistry	**SCI.PS1.B.h:** Chemical processes are understood in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved. **HS-PS2-2:** Use mathematical representations (qualitative and quantitative) to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
Experience 3: Designing Sustainable Chemical Processes	**SCI.PS1.B.h:** Chemical processes are understood in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved. **HS-PS1-5:** 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. **HS-PS2-2:** Use mathematical representations (qualitative and quantitative) to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.