| Options EHS Chemistry B | Scope and Sequence |
|---|---|
| **Unit Lesson** | **Objectives** |
| **States of Matter** | |
| Gases | |
| | Describe the postulates of kinetic-molecular theory. |
| | Interpret the behavior of ideal gases in terms of kinetic-molecular theory, including diffusion and effusion. |
| | Describe how kinetic-molecular theory explains the properties of gases, including temperature, pressure, compressibility, and volume. |
| | Science Practice: Identify the limitations of kinetic-molecular theory. |
| Liquids | |
| | Describe how the postulates of kinetic-molecular theory apply to liquids. |
| | Describe how kinetic-molecular theory explains the properties of liquids, including compressibility and shape. |
| | Science Practice: Use the kinetic-molecular theory model to explain the behavior of liquids. |
| Solids and Plasmas | |
| | Use kinetic-molecular theory to compare and contrast atomic or molecular motion in solids and plasmas. |
| | Describe how kinetic-molecular theory explains the properties of solids, including compressibility, shape, and volume. |
| | Describe how kinetic-molecular theory explains the properties of plasmas. |
| | Science Practice: Give examples of plasmas in nature and technology. |
| Phase Changes | |
| | Describe phase changes in terms of kinetic-molecular theory. |
| | Describe the energy changes that happen during changes of state. |
| | Science Practice: Make and interpret graphs of temperature vs. time for changes of state. |
| Gas Laws | |
| | State Boyle’s law, Charles’s law, and Gay-Lussac’s law, and apply these laws to calculate the relationships among volume, temperature, and pressure. |

| Options EHS Chemistry B | | Scope and Sequence |
|---|---|---|
| **Unit** | **Lesson** | **Objectives** |
| | | Derive the combined gas law from Boyle’s law, Charles’s law, and Gay-Lussac’s law. |
| | | Define partial pressure. |
| | | Apply Dalton’s law of partial pressures to describe the composition of gases. |
| | | Science Practice: Make a table to compare the various gas laws. |
| | Lab: Charles's Law | |
| | | Science Practice: Analyze and interpret data gathered in an investigation about Charles's law. |
| | | Calculate relationships between volume and temperature according to Charles's law. |
| | Lab: Boyle’s Law | |
| | | Calculate relationships between volume and pressure according to Boyle's law. |
| | | Science Practice: Obtain, evaluate, and communicate information gathered in an investigation about Boyle's law. |
| | The Ideal Gas Law | |
| | | Explain how Avogadro’s law, or principle, can be combined with other gas laws to describe the relationships among pressure, temperature, volume, and number of moles of a gas. |
| | | State the ideal gas law, which relates pressure, temperature, and volume of an ideal gas. |
| | | Solve problems using the ideal gas law. |
| | | Science Practice: Use math to solve ideal gas law problems. |
| | Unit Test | |
| **Thermodynamics** | | |
| | Energy | |
| | | Differentiate among the various forms of energy, including kinetic energy, potential energy, chemical energy, and thermal energy. |
| | | Explain that energy can be transformed from one form to another. |
| | | Describe the law of conservation of energy. |

| Options EHS Chemistry B | | Scope and Sequence |
|---|---|---|
| **Unit** | **Lesson** | **Objectives** |
| | | Science Practice: Integrate concepts from both chemistry and physics to analyze energy transformations and the conservation of energy. |
| | Heat | |
| | | Relate temperature to the average molecular kinetic energy. |
| | | Describe heat flow in terms of the motion of atoms or molecules. |
| | | Distinguish between exothermic chemical processes and endothermic chemical processes. |
| | | Science Practice: Analyze and interpret information about a reaction to classify the reaction as either an exothermic process or an endothermic process. |
| | Calorimetry | |
| | | Differentiate between heat capacity and specific heat. |
| | | Solve problems involving heat flow and temperature changes to calculate the specific heat of a substance. |
| | | Define calorimetry and explain how calorimeters work. |
| | | Use calorimetry to calculate the heat of a chemical process. |
| | | Science Practice: Perform mathematical calculations involving heat, mass, temperature change, and specific heat. |
| | Lab: Calorimetry and Specific Heat | |
| | | Determine the specific heat of a metal using a calorimeter. |
| | | Systematically collect, organize, record, and analyze data. |
| | | Demonstrate safe laboratory practices while using a calorimeter. |
| | | Identify possible sources of procedural and mathematical errors in an experiment. |
| | | Science Practice: Precisely follow a multistep procedure to build and use a calorimeter. |
| | Thermochemical Equations | |
| | | Understand the use of enthalpy in thermochemistry. |
| | | Use thermochemical equations to calculate energy changes (i.e., enthalpy changes) that occur in a chemical reaction. |

| Options EHS Chemistry B | | Scope and Sequence |
|---|---|---|
| **Unit** | **Lesson** | **Objectives** |
| | | Use thermochemical equations to calculate energy changes (i.e., enthalpy changes) that occur in a combustion reaction. |
| | | Science Practice: Examine books and other sources of information to find standard enthalpies of formation to solve thermochemical problems. |
| | Enthalpy and Phase Changes | |
| | | Analyze conceptually the flow of energy during changes of state (phase). |
| | | Analyze quantitatively the flow of energy during changes of state (phase) using the molar enthalpies (heats) of fusion, solidification, vaporization, and condensation. |
| | | Science Practice: Use appropriate scientific tools and techniques to gather and analyze data. |
| | Enthalpy of Reaction | |
| | | Demonstrate how to produce an overall chemical equation from equations for intermediate reaction steps. |
| | | Apply Hess's law to calculate enthalpy change in a reaction. |
| | | Science Practice: Translate quantitative information expressed in words in a text into a visual form by drawing enthalpy diagrams. |
| | Lab: Enthalpy | |
| | | Know specific hazards of chemical substances used in an experiment about enthalpy and entropy as summarized on the MSDS. |
| | | Select and use appropriate tools to gather and analyze data during an experiment about enthalpy and entropy. |
| | | Collect data with accuracy and precision, and organize the data while doing repeated trials in an experiment about enthalpy and entropy. |
| | | Determine the enthalpy change in a reaction by applying Hess's law. |
| | | Science Practice: Develop reasonable conclusions about changes in enthalpy based on data collected. |
| | Enthalpy, Entropy, and Free Energy | |
| | | Compare spontaneous and nonspontaneous reactions. |
| | | Describe and give examples of entropy. |

| Options EHS Chemistry B | | Scope and Sequence |
|---|---|---|
| **Unit** | **Lesson** | **Objectives** |
| | | Differentiate “enthalpy” and “entropy” and describe how enthalpy and entropy affect a reaction's spontaneity. |
| | | Define free energy and use the Gibbs free energy equation to determine whether a reaction is spontaneous. |
| | | Science Practice: Use mathematics to solve problems involving the Gibbs free energy equation. |
| | Unit Test | |
| **Acids and Bases** | | |
| | Properties of Acids and Bases | |
| | | Describe the observable properties of acids. |
| | | Describe the observable properties of bases. |
| | | Describe applications of acids and bases. |
| | | Science Practice: Determine the meaning of the key terms acid and base as they are used in chemistry. |
| | Arrhenius, Bronsted-Lowry, and Lewis Acids and Bases | |
| | | Describe the Arrhenius definitions of acids and bases. |
| | | Describe the Bronsted-Lowry definitions of acids and bases. |
| | | Identify conjugate acids and conjugate bases in a Bronsted-Lowry acid-base reaction. |
| | | Describe the Lewis definitions of acids and bases. |
| | | Science Practice: Describe how Arrhenius’s, Bronsted’s, Lowry’s, and Lewis’s competing interpretations of the same evidence are useful in different ways. |
| | pH | |
| | | Describe the self-ionization of water. |
| | | Define pH and pOH. |
| | | Convert between pH and hydrogen ion concentration, and between pOH and hydroxide ion concentration. |
| | | Convert between pH and pOH, and between hydrogen ion concentration and hydroxide ion concentration. |

| Options EHS Chemistry B | | Scope and Sequence |
|---|---|---|
| **Unit** | **Lesson** | **Objectives** |
| | | Use the pH scale to characterize the acidity and basicity of solutions. |
| | | Science Practice: Solve scientific problems involving pH using logarithmic functions. |
| | Lab: Measuring pH | |
| | | Measure the pH of various substances using a universal indicator and its key. |
| | | Science Practice: Calibrate the scale for a pH indicator by comparing it to data measured using a known scale. |
| | Neutralization Reactions | |
| | | Predict the products of acid-base neutralization reactions. |
| | | Define salt and describe the observable properties of salts and salt solutions. |
| | | Write equations and net ionic equations for neutralization reactions. |
| | | Science Practice: Use domain-specific symbols to correctly write net ionic equations. |
| | Titration Reactions | |
| | | Describe how to measure pH with indicators and meters. |
| | | Describe the steps of the titration process. |
| | | Explain the use of titration in chemistry. |
| | | Science Practice: Construct an explanation of what happens during the titration process, and describe why each step of a titration is performed. |
| | Lab: Titration | |
| | | Select and properly use tools to perform a titration. |
| | | Determine the concentration of an acid using titration. |
| | | Science Practice: Use designated laboratory techniques to perform a titration. |
| | Unit Test | |
| **Organic Chemistry** | | |
| | Organic Compounds | |

| Options EHS Chemistry B | | Scope and Sequence |
|---|---|---|
| **Unit** | **Lesson** | **Objectives** |
| | | Describe carbon’s unique bonding characteristics that make the diversity of carbon compounds possible. |
| | | Read and draw structural formulas of organic compounds. |
| | | Explain the difference between structural isomers and geometric isomers. |
| | | Science Practice: Use different models to represent the same idea (ball-and-stick models, space-filling models, and structural formulas) and explain the usefulness and limitations of each kind of model. |
| | Properties and Uses of Saturated Hydrocarbons | |
| | | Describe the properties of straight-chain alkanes, branched-chain alkanes, and cycloalkanes. |
| | | Use the system for naming the ten simplest linear hydrocarbons and isomers that contain single bonds. |
| | | Identify uses of saturated hydrocarbons. |
| | | Science Practice: Build vocabulary knowledge by learning how to name hydrocarbons. |
| | Properties and Uses of Unsaturated Hydrocarbons | |
| | | Describe the properties of alkenes, alkynes, and aromatic hydrocarbons. |
| | | Use the system for naming the ten simplest linear hydrocarbons and isomers that contain double bonds, triple bonds, and benzene rings. |
| | | Identify uses of unsaturated hydrocarbons including uses in pharmaceuticals, petrochemicals, plastics, and food. |
| | | Science Practice: Describe different alkenes and alkynes that can be found in nature. |
| | Functional Groups | |
| | | Identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids. |
| | | Describe uses and natural occurrences of compounds containing functional groups. |
| | | Science Practice: Translate technical information expressed in words in a text about functional groups into a visual form, such as a chart. |
| | Organic Reactions | |

| Options EHS Chemistry B | | Scope and Sequence |
|---|---|---|
| **Unit** | **Lesson** | **Objectives** |
| | | Identify substitution, addition, condensation, and elimination reactions. |
| | | Explain that large molecules (polymers) are formed by repetitive combinations of simple subunits. |
| | | Compare addition polymerization and condensation polymerization. |
| | | Science Practice: Construct explanations on how polymers form. |
| | Unit Test | |
| **Nuclear Chemistry** | | |
| | The Nucleus | |
| | | Explain how protons and neutrons in the nucleus are held together by nuclear forces. |
| | | Differentiate chemical and nuclear reactions in terms of energy released. |
| | | Explain why Einstein's equation E = mc2 is used to determine the nuclear binding energy. |
| | | Identify some naturally occurring isotopes of elements that are radioactive. |
| | | Science Practice: Analyze a sequence (i.e., radioactive decay) that is characteristic of natural phenomena. |
| | Types of Radioactive Decay | |
| | | Differentiate between chemical reactions and nuclear reactions. |
| | | Identify types of radioactive decay. |
| | | Science Practice: Translate technical information expressed in words in a text about nuclear radiation into a visual form, such as a table, to compare the different types of radiation. |
| | Balancing Nuclear Reactions | |
| | | Write symbols for nuclides using mass numbers and atomic numbers. |
| | | Balance nuclear equations by balancing both mass and atomic numbers. |
| | | Science Practice: Determine the meaning of nuclide symbols and use those symbols to balance nuclear equations. |
| | Half-Life | |
| | | Describe what a half-life is. |

| Options EHS Chemistry B | | Scope and Sequence |
|---|---|---|
| **Unit** | **Lesson** | **Objectives** |
| | | Calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed. |
| | | Calculate the number of half-lives that have passed given mass data for the radioactive substance. |
| | | Science Practice: Solve scientific problems by substituting quantitative values. |
| | Lab: Half-Life | |
| | | Understand the concept of half-life through simulation. |
| | | Explain how the half-life of a radioactive element is determined. |
| | | Collect, organize, and record appropriate data while doing an investigation on half-life. |
| | | Communicate valid conclusions for a investigation modeling half-life. |
| | | Science Practice: Develop and use a model for studying half-life. |
| | Nuclear Fission and Nuclear Fusion | |
| | | Explain and compare fission and fusion reactions. |
| | | Relate the role of nuclear fusion to the production of essentially all elements heavier than helium. |
| | | Science Practice: Justify the need for peer review in science. |
| | Nuclear Energy | |
| | | Describe how nuclear power plants work. |
| | | Describe the issues surrounding nuclear waste. |
| | | Science Practice: Weigh the merits of using nuclear energy to solve society’s need for electrical energy by comparing a number of human, economic, and environmental costs and benefits. |
| | Nuclear Radiation | |
| | | Explain that alpha, beta, and gamma radiation produce different amounts and kinds of damage in matter and describe the effects of each kind of radiation on living things. |
| | | Describe how radiation is measured and detected. |
| | | Describe applications of radiation. |

| Options EHS Chemistry B | | Scope and Sequence |
|---|---|---|
| **Unit** | **Lesson** | **Objectives** |
| | | Science Practice: Describe careers that involve working with radioactive substances. |
| | Unit Test | |
| **Cumulative Exam** | | |
| | Cumulative Exam Review | |
| | Cumulative Exam | |