Chemistry with Labs

Edgenuity, Inc ()

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Pending

Submission Feedback

APPROVED

Basic Course Information

School(s) Offering This Course:

School Name	Course Learning Environment	Transcript Code(s)	
Edgenuity, Inc ()	Online	Abbreviation	Course Code

Title:	Chemistry with Labs
Transcript abbreviations:	
Length of course:	Full Year
Subject area:	Laboratory Science (D) / Chemistry
UC honors designation?	No
Non-honors equivalent course:	{{ getNonHonorsEquivalentDisplayValue() }}
Non-honors exemption details:	
Prerequisites:	Algebra I (Required) English Language Arts 9 (Required) Physical Science or Biology (Recommended) None
Co-requisites:	None

Integrated (Academics / CTE)?	No
Does your course include lab activities in your course description?	Yes
Grade levels:	10th
Course learning environment:	Online

Online course self assessment

A. Content (13)

B. Instructional Design (11)

C. Student Assessment (7)

D. Technology (11)

E. Course Evaluation and Support (10)

Course Description

Course overview:

This Course Overview is not available on the A-G Course Management Portal. For more information about this course, you need to contact the institution that authored this course.

This laboratory science course is aligned to the Next Generation Science Standards for California Public Schools, and is designed to introduce students to collegiate-level principles and concepts of Chemistry, as well as prepare them for collegiate-level science coursework. Concepts discussed include atomic theory, elements and the periodic table, properties of matter, chemical bonding and reactions,

stoichiometry, energy in chemical reactions, solutions, acids and bases, organic chemistry, and nuclear chemistry. Students also conduct a variety of laboratory activities that develop skills in observation, use of scientific tools and techniques, data collection and analysis, and mathematical applications.

Course content:

This Course Content is not available on the A-G Course Management Portal. For more information about this course, users should directly contact the institution that authored this course.

Atoms and the Atomic Theory

This course includes a variety of laboratory activities. These include wet labs that account for at least 20% of the course and additional virtual labs that can be used for extended practice. Wet labs are completed in a lab setting and are teacher-supervised, hands-on activities. Students are required to conduct the labs according to the lab procedures provided in the Student Guide and the Teacher Guide for the labs, to analyze outcomes, and to formally write about their findings and possible improvements. Lab materials for the wet lab must be provided by the school. The lab descriptions are provided in the assignment summary descriptions for each unit. All labs require students to participate in inquiry, observation, analysis and write-up. Labs begin with a question and formation of a hypothesis, students conduct systematic observations about the lab and design experiments or data collection strategies, then they analyze the data and lab results through several assignments that help them draw conclusions, and complete an extensive formal lab report to report their findings and conclusions. Student lab reports must demonstrate strong scientific reasoning and writing. In these reports students state the purpose of the experiment, questions posed before the experiment, their hypothesis, and independent, dependent, and controlled variables. They list their materials used and the procedure. They collect and organize data into tables, charts, graphs, etc., checking for accuracy. They interpret their data and graphs, determine whether the data supported or refuted their hypothesis. They describe sources of error and possible ways to improve or further their investigation, ensuring that they write without bias. They also further develop their ideas, designs, and solutions through discussion with other students in Collaboration Corner, the online discussion forum.

Each unit in this rigorous laboratory science course contains lessons that include a warm-up activity to review background knowledge and introduce new scientific concepts that will be discussed, direct instruction, assignments, and a summary. Integrated laboratory activities and projects provide students with the opportunity to demonstrate knowledge of scientific concepts and habits of mind important for university-level studies. Scientific texts are also incorporated throughout the course, providing opportunities for development of writing and literacy skills. In addition, students experience multiple opportunities to apply a variety of scientific inquiry skills, including those outlined in the Laboratory science subject area “d” requirements found in the UCOP A-G subject requirements. Please note that specific examples of how this course provides ample opportunity for student participation in all phases of the scientific process and develop scientific habits of mind by participating in all eight practices of science identified in the Next Generation Science Standards are outlined below the unit description of this unit.

In addition to student collaboration in hands on laboratory experiments, students regularly engage in higher-order thinking and discuss scientific ideas with other students in a threaded discussion format. The discussion, which is open only to students in each class, is monitored by the teacher, who can ask questions of the group or of individual students. This provides students the opportunity to communicate with each other in order to share understanding, insight, and ideas.

Throughout the course, the student's Course Map, provided through the learning management system, serves as a dynamic and interactive scope and sequence for all course assignments. The Course Map includes course objectives and student learning outcomes, content scope and sequence, and a comprehensive outline of assignments. Students can also access an online digital notebook, or eNotes. They have a full menu of text formatting tools and can return to their notes or print them at any time for review. Additionally, the unique direct instruction video presentations embedded in every lesson throughout the course feature highly qualified, certified instructors presenting instructional content via recorded video. Instructors guide students through concepts and skills with clear and engaging audio and visual supports that include white board demonstrations, bulleted key points, highlighted vocabulary, diagrams and photography. The video tool allows students to pause, go back, and repeat instruction as-needed. They stop at intervals throughout instruction to complete interactive tasks, self-assessing their learning progress and keeping students engaged.

Unit Description:

In this unit, students investigate the development of the modern atomic theory, as well as examining the important structures of the atom. Students differentiate between scientific experiments to determine the structure of the atom, including those performed by Thomson and Bohr, and explain the modern quantum theory of the atom. Students then compare and contrast the charges and sizes of the parts of the atom, and examine the nuclear forces that hold protons and neutrons in the nucleus.

Summary of Assignment: Lesson: The Modern Atomic Theory

In this assignment, students examine the development of the modern atomic theory and its applications to real-world phenomena. Students examine the dual nature of light and how it explains the photoelectric effect, as well as apply mathematical analysis to quantization of energy. They then explore the advantages and disadvantages of the Bohr model of the atom, its relationship to atomic spectra, and how it led to the electron cloud model of the atom. Students also further develop scientific literacy skills through creating written analyses comparing and contrasting various models of the atom.

Scientific Process and Practices of Science Samples:
Note: The following examples are from the whole course to provide a comprehensive overview.

Specific examples of how this course provides ample opportunity for student participation in all phases of the scientific process and develop scientific habits of mind by participating in all eight practices of science identified in the Next Generation Science Standards are outlined below:

Practice 1: Asking questions (for science) and defining problems (for engineering):

Lab Reports

Throughout the course, students participate in a variety of laboratory experiments and compose written lab reports discussing individual procedures and results. The lab reports include components such as the question posed to develop the experiment, the hypothesis formulated, all variables, a list of necessary materials, the steps involved in and any changes to the procedure, identification of experimental and control groups, organized data (i.e., in tables, graphs, etc.), data analysis, discussion of support or lack of support for the hypothesis, possible sources of error, and ways to improve or further the lab investigation. Below are two examples of labs which require students to formulate an investigative question before starting the experiments.

Lab: Reaction Rate

In the warm up of this lab, students formulate an investigative question that would be answered by completing the experiment. Students plan and perform controlled tests of multiple variables using repeated trials during an investigation about reaction rate.

Lab: Solubility

In this lab, during the warm up students formulate an investigative question to scientifically investigate how temperature affects solubility. Students investigate how the temperature of a solvent affects the solubility of a solid, and students accurately read the temperature in Celsius to know how temperature affects saturation. Students then plan and carry out an investigation to test factors affecting solubility.

Practice 2: Developing and using models:

Lesson: The Modern Atomic Theory

In this lesson, students describe the experimental basis for Einstein's explanation of the photoelectric effect. Students also explain Bohr's model for the atom and how it accounts for the existence of spectral lines. Students learn how different models were developed and how these models have helped form the modern atomic theory. In the assignment students compare Dalton's atomic model with the current quantum model of the atom.

Lesson: Covalent Bonding

In this lesson, students use the periodic table to determine the number of electrons available for bonding. Students learn how to use the octet rule to predict covalent compounds. Students also learn how to develop/construct electron-dot structures to illustrate the arrangements of electrons in covalent structures. In the assignment, students develop and use electron-dot models, and explain their usefulness and limitations.

Lesson: Types of Chemical Reactions

In the project portion of this lesson, students design, construct, test, and modify a device that releases thermal energy by chemical processes. Students are provided specific materials by the instructor, and students use these materials to design a device that releases energy to the environment. Next, students build the device and test it by gathering temperature data. Finally, students use their data to evaluate the design and decide how to improve the device.

Practice 3: Planning and carrying out investigations:

Lesson: Types of Chemical Reactions

In the project portion of this lesson, students design, construct, test, and modify a device that releases thermal energy by chemical processes. Students are provided specific materials by the instructor, and students use these materials to design a device that releases energy to the environment. Next, students build the device and test it by gathering temperature data. Finally, students use their data to evaluate the design and decide how to improve the device.

Lab Reports

Throughout the course, students participate in a variety of laboratory experiments and compose written lab reports discussing individual procedures and results. The lab reports include components such as the question posed to develop the experiment, the hypothesis formulated, all variables, a list of necessary materials, the steps involved in and any changes to the procedure, identification of experimental and control groups, organized data (i.e., in tables, graphs, etc.), data analysis, discussion of support or lack of support for the hypothesis, possible sources of error, and ways to improve or further the lab investigation. Below are two examples of labs which state in the objectives that students will plan and carry out investigations:

Lab: Reaction Rate

In this lab students plan and perform controlled tests of multiple variables using repeated trials during an investigation about reaction rate.

Lab: Solubility

In this lab, during the warm up students formulate an investigative question to scientifically investigate how temperature affects solubility. Students investigate how the temperature of a solvent affects the solubility of a solid, and students accurately read the temperature in Celsius to know how temperature affects saturation. Students then plan and carry out an investigation to test factors affecting solubility.

Practice 4: Analyzing and interpreting data:

Lab: Types of Reactions

In this lab students explore different types of chemical reactions in a laboratory procedure. Students carry out four different reactions with at least one key piece of information for each reaction. Students complete the experiments to determine the remaining pieces. Within the

student guide the procedure walks the students through the steps of a lab procedure, as they prepare, observe, predict, react, observe and analyze. Students then communicate what they have learned by completing a lab report.

Lesson: Types of Chemical Reactions

In the project portion of this lesson, students design, construct, test, and modify a device that releases thermal energy by chemical processes. Students are provided specific materials by the instructor, and students use these materials to design a device that releases energy to the environment. Next, students build the device and test it by gathering temperature data. Finally, students use their data to evaluate the design and decide how to improve the device.

Lesson: Fuel Cells

In this lesson students explore the benefits and drawbacks of fuel-cell cars. Students investigate this issue by researching the literature and analyzing the data. Students then construct an argument for or against the immediate introduction of fuel-cell cars. Students are asked to include likely points of objection from those with opposing views (such as environmental and economic impacts) as well as counterarguments to those objections.

Lesson: Calorimetry

In this lesson students learn how to solve problems involving heat flow and temperature changes to calculate the specific heat of a substance. Stdents define calorimetry and explain how calorimeters work, and students use calorimetry to calculate the heat of a chemical process. In the assignment, students are provided heat values, which they analyze and interpret to answer questions. Students also describe how to determine the specific heat of a sample of a solid substance assuming that the substance does not react with water. Students are asked to include a description of what equipment would be use and how students would interpret the data collected.

<u>Practice 5: Using mathematics and computational thinking:</u>

Lesson: Half-Life

In the lesson, “Half-Life”, students explore the question “Why is it important to know the amount of time that it takes for half a radioisotope’s nuclei to decay?” As students investigate this question students are introduced to information regarding isotopes and nuclear equations. Throughout the instruction students use mathematics and computational thinking to complete half-life calculations. In the assignment, students identify parent and daughter isotopes, describe the range of half-lives, perform several calculations, and identify unknown radioisotope using mass data and a table of half-lives.

Lesson: Scientific Notation and Significant Figures

In this lesson students write measruemetns in scientific notation, and students use appropriate numbers of significant figures for calculated data. In the assignment, students solve science-related math problems using scientific notation with the correct number of significant figures.

Lesson: Stoichiometric Calculations

In this lesson students use molar mass to write conversion factors that convert between mass and moles. Students then identify and solve stoichiometric problems that relate mass to moles and mass to mass. In the assignment, students use mathematical procedures, including dimensional analysis and significant figures, when solving mole-to-mass, mass-to-mole, and mass-to-mass stoichiometric problems.

Lesson: Calorimetry

In this lesson students learn how to solve problems involving heat flow and temperature changes to calculate the specific heat of a substance. Stdents define calorimetry and explain how calorimeters work, and students use calorimetry to calculate the heat of a chemical process. In the assignment, students are provided heat values, which they analyze and interpret to answer questions. Students also describe how to determine the specific heat of a sample of a solid substance assuming that the substance does not react with water. Students are asked to include a description of what equipment would be use and how students would interpret the data collected.

Practice 6: Constructing explanations (for science) and designing solutions (for engineering):

Lesson: Titration Reactions

In this lesson, students learn how to measure pH with indicators and meters, as well as how to describe the steps of the titration process. Students explore the use of titration in chemistry. In the assignment, students are provided information recorded by a fictional student. Students then write an analysis of the quality of the information recorded in the student lab notebook for the titration experiment. Students are asked to include an explanation of any problems that would be encountered by someone trying to use the information to calculate the concentration of the acid.

Lab: Types of Reactions

In this lab students explore different types of chemical reactions in a laboratory procedure. Students carry out four different reactions with at least one key piece of information for each reaction. Students complete the experiments to determine the remaining pieces. Within the student guide the procedure walks the students through the steps of a lab procedure, as they prepare, observe, predict, react, observe and analyze. Students then communicate what they have learned by completing a lab report.

Lesson: Gases

In this lesson students interpret the behavior of ideal gases in terms of kinetic-molecular theory, including diffusion and effusion. Students also describe how kinetic-molecular theory explains the properties of gases, including temperature, pressure, compressibility, and volume. In the assignment, students apply what they have learned as the construct explanations for particle's motions in terms of kinetic-molecular theory, using real world examples.

Practice 7: Engaging in argument from evidence:

Lesson: Nuclear Energy

In this lesson students explore how nuclear power plants work and explore how to 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. Students are provided evidence regarding the positives and negatives associated with nuclear energy. In the assignment, students are asked to "Write an essay to explain your position on whether or not nuclear power should be continued in the US. Support your position with specific reasons and justifications."

Lesson: Fuel Cells

In this lesson students explore the benefits and drawbacks of fuel-cell cars. Students investigate this issue by researching the literature and analyzing the data. Students then construct an argument for or against the immediate introduction of fuel-cell cars. Students are asked to include likely points of objection from those with opposing views (such as environmental and economic impacts) as well as counterarguments to those objections.

Practice 8: Obtaining, evaluating, and communicating information:

Lesson: Properties of Acids and Bases

In this lesson students describe the observable properties of both acids and bases, as well as the applications of acids and bases. Students explore how concentration of specific ions affect the properties of a solution. In the assignment students evaluate what they have learned and communicate information regarding acids and bases that they come into contact with in an average week. Students also obtain further information regarding acids and bases in digestion, which they evaluate, and use to explain how antacids with calcium carbonate function.

Lab Reports

Throughout the course, students participate in a variety of laboratory experiments and compose written lab reports discussing individual procedures and results. The lab reports include components such as the question posed to develop the experiment, the hypothesis formulated, all variables, a list of necessary materials, the steps involved in and any changes to the procedure, identification of experimental and control groups, organized data (i.e., in tables, graphs, etc.), data analysis, discussion of support or lack of support for the hypothesis, possible sources of error, and ways to improve or further the lab investigation. Below are examples of two labs which require students to obtain, evaluate, and communicate information:

Lab: Types of Reactions

In this lab students explore different types of chemical reactions in a laboratory procedure. Students carry out four different reactions with at least one key piece of information for each reaction. Students complete the experiments to determine the remaining pieces. Within the student guide the procedure walks the students through the steps of a lab procedure, as they prepare, observe, predict, react, observe and analyze. Students then communicate what they have learned by completing a lab report.

Lab: Physical and Chemical Changes

In this lab students distinguish between chemical changes and physical changes. Students describe indicators of chemical change, and students conduct systematic observations during an experiment. In this lab, students obtain, evaluate and communicate information regarding the types of changes they observe.

Unit Lab Activities:

Labs appear throughout the course focusing on the major concepts presented in the course. Some units include additional labs while other units, such as this one, are shorter and do not contain any labs, but instead focus on activities such as extended reading to explore additional perspectives and real world application of concepts.

After each lab, students write complete detailed lab reports that demonstrate strong scientific reasoning and writing. In these reports students state the purpose of the experiment, questions posed before the experiment, their hypothesis, and independent, dependent, and controlled variables. They list their materials used and the procedure. They collect and organize data into tables, charts, graphs, etc., checking for accuracy. They interpret their data and graphs, determine whether the data supported or refuted their hypothesis. The describe sources of error and possible ways to improve or further their investigation. And they also write without bias.

All extended writing is completed in the eWriting environment, which is designed to scaffold students through the writing process from pre-writing to the final draft. Students may also access the rubric and checklist. A research tab allows students to gather information about their topic when enabled.

Elements and the Periodic Table

In this unit, students investigate the relationship between atoms and the periodic table, as well as differentiate between elements, compounds, and mixtures. Students apply graphical analysis to specific elements in order to create electron configurations and determine quantum numbers for electrons using atomic orbitals, as well as number of valence electrons available for bonding. Students also examine the historical development of the periodic table and analyze the arrangement of the periodic table to determine properties such as electronegativity, ionization energy, and atomic radius size for specific elements.

Summary of Assignment: Lesson: Atomic Numbers and Electron Configurations

In this assignment, students examine different methods for representing electron arrangement in atoms, including dot structures, electron configurations, and atomic orbitals. Students explore quantum orbitals and identify how quantum numbers are utilized to indicate an electron's location by specifying orbital size, shape, and orientation. Students then examine electron shells and

subshells and how they are utilized in the creation of electron configuration diagrams, as well as how the Pauli exclusion principle, Hund's rule, and the Aufbau principle are used in writing orbital notations. Students then apply this knowledge to analyze and create electron configurations for given elements.

Formative and Summative Assessments Practices

Evaluation strategies are tightly aligned with the instruction. Students are assessed through traditional comprehension questions, short and extended writing assignments, and their participation in online discussion.

- Formal Assessments: Students take formal assessments at the end of each lesson, unit, semester, and course. These assessments provide robust evidence that students have mastered content.
- Lab reports: Students write complete detailed lab reports that demonstrate strong scientific reasoning and writing. In these reports students state the purpose of the experiment, questions posed before the experiment, their hypothesis, and independent, dependent, and controlled variables. They list their materials used and the procedure. They collect and organize data into tables, charts, graphs, etc., checking for accuracy. They interpret their data and graphs, determine whether the data supported or refuted their hypothesis. They describe sources of error and possible ways to improve or further their investigation. And they also write without bias.
- Students complete other embedded assignments that serve as formative assessments such as interactive activities to self-check understanding of concepts, responding to assignment questions, reading informational texts with assignments, and writing short responses or essays to demonstrate deep content understanding and mastery of scientific practices and skills.

🧪 Unit Lab Activities:

Labs appear throughout the course focusing on the major concepts presented in the course. Some units include additional labs while other units, such as this one, are shorter and do not contain any labs, but instead focus on activities such as extended reading to explore additional perspectives and real world application of concepts.

States and Changes of Matter

In this unit, students investigate the four states of matter and how their properties differ between phases. Students analyze kinetic-molecular theory and its impact on the properties of each of the individual states of matter. Students also examine applications of plasmas in real-world scenarios.

In addition, students describe how energy changes during phase changes and apply graphical analysis to investigate the impact of change in temperature over time on states of matter. Students will also further develop scientific literacy skills through written analysis of the various properties of states of matter and how they impact real-world applications.

Summary of Assignment: Lesson: Liquids

In this assignment, students explore various properties of liquids, including the relationship between these properties and kinetic-molecular theory. Students examine how the intermolecular forces and kinetic energy in liquids affect their ability to change states. Students then investigate how particle size and temperature impact properties such as viscosity, as well as how liquids can be utilized as solvents and to transmit force in real-world applications. Students also further develop scientific literacy skills through developing written analyses of a technical reading on surfactants and their applications and effects on liquids.

Lesson: Gases

In this lesson students interpret the behavior of ideal gases in terms of kinetic-molecular theory, including diffusion and effusion. Students also describe how kinetic-molecular theory explains the properties of gases, including temperature, pressure, compressibility, and volume. In the assignment, students apply what they have learned as the construct explanations for particle's motions in terms of kinetic-molecular theory, using real world examples.

Within reading assignments throughout the course, a text mark-up toolset helps students of all reading levels engage with grade-level text. Because students can access the tools they need for any activity, students can adapt the level of scaffolding for content that they find more challenging or less challenging. These tools include:

- Read-aloud: Students can hear any section of text read aloud.
- Translation: Students can have on-screen text translated into their home languages. Supported languages include Arabic, Armenian, Chinese, French, German, Haitian Creole, Hindi, Italian, Japanese, Korean, Filipino, Polish, Portuguese, Russian, Spanish, Thai, and Vietnamese.
- Word Look-up: Students can look up any word on the page. They can read the definitions themselves or hear the definitions read aloud.
- Highlighters: Students are encouraged to highlight on-screen text as they read. Highlighting tools allow students to highlight in up to four different colors. Once students are finished reading, they can collect all their highlighted text by color and insert it into their notes or into any other document.
- Digital Sticky Notes: Students use digital sticky notes to annotate text as they read. These notes allow students to capture thoughts, insights, and questions for later use.

🧪 Unit Lab Activities:

Labs appear throughout the course focusing on the major concepts presented in the course. Some units include additional labs while other units, such as this one, are shorter and do not contain any labs, but instead focus on activities such as extended reading to explore additional perspectives and real world application of concepts.

Chemical Bonding

In this unit, students investigate the most common types of chemical bonds and how they impact the molecular properties of matter. Students analyze ionic, covalent, and metallic bonds and investigate the impact of electronegativity and ionization energy on bond formation. Students also apply graphical analysis to develop electron-dot structures for given elements and determine how an element's electron configuration impacts bond formation. In addition, students complete a laboratory activity to gain a comprehensive understanding of the properties of ionic and covalent compounds, and further develop scientific literacy skills through the completion of a scientific lab report for the activity. Last, students analyze metallic bonds and intermolecular forces and examine the impact of these bonds on the properties of the substances that contain them.

Summary of Assignment:

Lesson: Covalent Bonding

In this lesson, students use the periodic table to determine the number of electrons available for bonding. Students learn how to use the octet rule to predict covalent compounds. Students also learn how to develop/construct electron-dot structures to illustrate the arrangements of electrons in covalent structures. In the assignment, students develop and use electron-dot models, and explain their usefulness and limitations.

Lesson: Metallic Bonding

After a thorough of chemical bonding, students complete a writing assignment to describe metallic bonding theories and infer metal properties based on their understanding of metallic bonding. They explain concepts such as how the electron sea model of metallic bonding is the same as and different from the band theory, giving examples of each, and they explain why copper might be used for electrical wiring and cooking pans instead of iron if iron is easier to obtain.

♟ Unit Lab Activities:

Lab: Ionic and Covalent Bonds

In this assignment, students investigate how the chemical properties of substances can be used to identify the types of bonds they contain utilizing oil, cornstarch, sodium chloride, and sodium bicarbonate. Students will make qualitative observations of each substance, and then test the

solubility and electrical conductivity of each in order to determine which substances contain ionic bonds and which contain covalent bonds. Students will then use this knowledge to analyze applications of ionic and covalent bonds in real-world scenarios, as well as further develop scientific literacy skills through creation of a scientific lab report of the experimental results, including an analysis of possible errors. Throughout the course students complete extended lab reports and writing assignments in the eWriting environment, which is designed to scaffold students through the writing process from prewriting to the final draft. Students may also access the rubric and checklist. A research tab allows students to gather information when necessary. In the detailed lab reports students demonstrate strong scientific reasoning and writing. They state the purpose of the experiment, questions posed before the experiment, their hypothesis, and independent, dependent, and controlled variables. They list their materials used and the procedure. They collect and organize data into tables, charts, graphs, etc., checking for accuracy. They interpret their data and graphs, determine whether the data supported or refuted their hypothesis. They describe sources of error and possible ways to improve or further their investigation. And they also write without bias.

Changes in Matter

In this unit, students examine physical and chemical properties and changes of matter and how both types of properties are affected by chemical reactions. In addition, students complete a laboratory activity to gain a comprehensive understanding of the relationships between physical and chemical changes of matter, and further develop scientific literacy skills through the completion of a scientific lab report for the activity. Students explain what happens during a chemical reaction. They identify indicators that a reaction is taking place.

Summary of Assignment:

Lesson: Changes in Matter

After learning about physical and chemical properties and changes, students identify physical and chemical properties, differentiate intensive and extensive properties, and describe physical and chemical changes in a series of real world scenarios. Then they complete a short writing to respond to the following prompt: "An industrial chemist is studying a sample of an unknown metal. Describe two ways he could change the metal physically and two ways he could change the metal chemically to try to identify it."

♟ Unit Lab Activities:

Lab: Physical and Chemical Changes

In this assignment, students conduct a series of experiments with substances such as calcium carbonate, hydrochloric acid, potassium iodide, and metal shavings to differentiate between physical changes and chemical changes in materials. Students examine the impact of factors such as physical agitation, temperature, and combination of solutes/solvents on changes of matter. They also record qualitative observations of each experiment, and use the observations to construct explanations of each result. Students then use this knowledge to analyze physical and chemical changes of matter in real-world scenarios, as well as further develop scientific literacy skills through completion of a scientific lab report of the experimental results.

Chemical Reactions

In this unit, students describe chemical reactions by writing word equations and formulate equations. They use the law of conservation of mass to balance chemical equations. Additionally, students distinguish among the types of chemical reactions. They predict the product of each type of chemical reaction. Last, students complete a lab in which they identify the reactants and products of a reaction performed in a laboratory setting. Students practice balancing equations for a reaction performed in a laboratory setting.

Summary of Assignment:

Lesson: Types of Chemical Reactions

In the project portion of this lesson, students design, construct, test, and modify a device that releases thermal energy by chemical processes. Students are provided specific materials by the instructor, and students use these materials to design a device that releases energy to the environment. Next, students build the device and test it by gathering temperature data. Finally, students use their data to evaluate the design and decide how to improve the device.

Unit Lab Activities:

Lab: Types of Reactions

In this assignment, students conduct a series of experiments with substances such as copper (II) sulfate, lead (II) nitrate, and sodium carbonate to classify types of chemical reactions. Students are provided the reactant, product, and/or reaction type for four separate experiments, then must determine the missing pieces of each experiment utilizing the given information. Students also record qualitative and quantitative observations for each experiment and evaluate the data in order to construct explanations of the results. Students then apply knowledge to analyze and classify chemical reactions in real-world scenarios.

Stoichiometry

In this unit, students examine the mole concept and its applications to stoichiometry. Students review the importance of significant figures and dimensional analysis in performing calculations, and then apply mathematical analysis to determine mole-to-mole relationships between reactants and products of a reaction. Students find values of molar masses, and convert between moles and mass of reactants and products in chemical reactions. Students also apply these skills to determine the limiting reactant in a chemical reaction, as well as calculate theoretical yield and percent yield of products.

Summary of Assignment: Lesson: Stoichiometric Calculations

In this assignment, students utilize the mole and stoichiometric concepts to determine amounts of reactants used and products created in a variety of chemical reactions. Students review molar mass, then examine how it can be used to convert mass values to mole ratios, as well as how to convert mole values into mass using dimensional analysis. Students then combine these methods in order to calculate masses of products when given a mass of a specific reactant and calculate the mass of one reactant when given the mass of a different reactant. In addition, students analyze given scenarios to determine how the conversion factor for each should be written in order to obtain a specific value from the data.

Unit Lab Activities:

Labs appear throughout the course focusing on the major concepts presented in the course. Some units include additional labs while other units, such as this one, are shorter and do not contain any labs, but instead focus on activities such as extended reading to explore additional perspectives and real world application of concepts.

Reaction Rates

In this unit, students investigate various factors that impact reaction rate, including temperature, concentration, and pressure. Students apply their understanding when they are given a real-world scenario, and they explain observations in the scenario in terms of reaction rates. They complete a laboratory investigation to gain a comprehensive understanding of the impact of temperature and particle size on reaction rate, and further develop scientific literacy skills through the completion of a scientific lab report for each activity. Finally, students examine the impact of catalysts on overall reaction rates. Students are given a scenario and they write their determination of whether a reaction will be catalyzed, explaining their answer.

Summary of Assignment: See hands-on lab activity

🧪 Unit Lab Activities:

Lab: Reaction Rate

In this assignment, students investigate the impact of temperature and particle size on the overall rate of the chemical reaction between water and a sodium bicarbonate tablet. Students conduct a series of experiments in which they change the water temperature to observe its impact on reaction rate, as well as break the tablet into different particle sizes to observe how it impacts the reaction rate. Students then perform mathematical analysis of the collected data to determine which factor has the greatest impact overall. In addition, students analyze collected data to determine the relationship between temperature and reaction rate, as well as between particle size and reaction rate, and to identify potential sources of error.

Chemical Equilibrium

In this unit, students explore dynamic equilibrium in reversible reactions. They practice using scientific notation when solving problems to find the equilibrium constant for a reaction, and they write equilibrium expressions, and use them to calculate the equilibrium constant for reactions. Next, students study shifts in equilibrium. They translate technical information expressed in words about Le Chatelier's principle into a chart. They use Le Chatelier's principle to predict shifts in equilibrium caused by changes in pressure, concentration, and temperature. They also use Le Chatelier's principle to predict shifts in equilibrium caused by the addition of a common ion to the system.

Summary of Assignment: Lesson: Shifts in Equilibrium

In this assignment, students determine how a system at equilibrium will be affected by given conditions. They identify a common ion and predict the effect of its addition on equilibrium of a system. Students use the reaction quotient and Le Chatelier's principle to evaluate the direction of a reaction. They summarize the possible values for the reaction quotient and corresponding characteristics of a chemical system by filling in the missing information in tables about systems at equilibrium. Last, students write a description about how to use Le Chatelier's principle to predict the possible ways a chemical system can respond to changes.

🧪 Unit Lab Activities:

Labs appear throughout the course focusing on the major concepts presented in the course. Some units include additional labs while other units, such as this one, are shorter and do not contain any labs, but instead focus on activities such as extended reading to explore additional perspectives and real world application of concepts.

Energy in Chemical Reactions

In this unit, students examine the characteristics of energy and heat and how they are exhibited in chemical reactions and thermochemical equations. Students explore energy transformations and the law of conservation of energy, and then apply this knowledge to gain a conceptual understanding of how heat flow demonstrates these principles within chemical reactions. Students then investigate how calorimetry can be used to calculate the heat of a chemical process. Students also complete a laboratory activity to gain a comprehensive knowledge of how calorimeters are used to determine specific heat of materials, and further develop scientific literacy skills through the completion of a scientific lab report for the activity.

Summary of Assignment:

Lesson: Calorimetry

In this lesson students learn how to solve problems involving heat flow and temperature changes to calculate the specific heat of a substance. Stdents define calorimetry and explain how calorimeters work, and students use calorimetry to calculate the heat of a chemical process. In the assignment, students are provided heat values, which they analyze and interpret to answer questions. Students also describe how to determine the specific heat of a sample of a solid substance assuming that the substance does not react with water. Students are asked to include a description of what equipment would be use and how students would interpret the data collected.

🧪 Unit Lab Activities:

Lab: Calorimetry and Specific Heat

In this assignment, students assemble and utilize a coffee cup calorimeter to measure the specific heat of several metals and determine which is the most appropriate for making cookware. Students heat each metal sample (aluminum, iron, copper, and lead) to 100℃, and then collect data on the temperature change of the metal when it is inserted into the calorimeter. After collecting all quantitative data, students then perform mathematical analysis to calculate the specific heat of each metal and determine which would make the most cost-effective and efficient cookware. In addition, students apply their knowledge to analyze the effectiveness of other cooking materials in real-world scenarios.

Enthalpy in Chemical Reactions and Phase Changes

In this unit, students examine the relationship of enthalpy to chemical reactions and phase changes. Students analyze the flow of energy in phase changes using molar enthalpies, as well as calculate enthalpy changes in chemical reactions and determine chemical equations from intermediate reaction steps. Students also complete a laboratory activity to gain a comprehensive understanding of Hess' law and its relationship to enthalpy, and further develop scientific literacy skills through the completion of a scientific lab report for the activity.

Summary of Assignment: See hands on lab activity.

🧪 Unit Lab Activities:

Lab: Enthalpy

In this assignment, students assemble and utilize a coffee cup calorimeter to investigate the intermediate reactions of magnesium combustion and calculate the overall enthalpy of combustion for magnesium. Students observe the chemical reaction that occurs between magnesium and hydrochloric acid, and collect data on the temperature change of the hydrochloric acid before and after the addition of the magnesium. They also observe the chemical reaction between magnesium oxide and hydrochloric acid and collect similar data. Students then mathematically analyze the data using Hess' Law to determine the enthalpy of magnesium combustion. In addition, students identify potential sources of error and further develop scientific literacy skills through completion of a lab report on the experiment.

The Gas Laws

In this unit, students examine the factors that impact gas behavior and how they relate to the gas laws. Students explore the relationship between pressure, temperature, and volume of a gas, and how the impact of these factors on each other and gas behavior can be determined through various gas laws, including the combined gas law, Boyle's law, Charles' law, and Gay-Lussac's law. Students then apply the ideal gas law to determine how these factors would impact the behavior of an ideal gas. Students also complete two separate laboratory activities to gain a comprehensive understanding of Boyle's Law and Charles' Law, and further develop scientific literacy skills through the completion of a scientific lab report for each activity.

Summary of Assignment: See hands-on lab activities.

🧪 Unit Lab Activities:

Lab: Charles' Law

In this assignment, students investigate the relationship between temperature and volume of a gas using a capillary tube with trapped oil. Students immerse the capillary tube in a water bath, then periodically increase the temperature of the bath and observe the impact of the change in temperature on the volume of gas in the tube. They then perform mathematical and graphical analysis of the data to determine if there is a direct relationship between the temperature and volume of gases. In addition, students identify potential sources of error in the experiment and further develop scientific literacy skills through completing a lab report.

Lab: Boyle's Law

In this assignment, students investigate the relationship between pressure and volume of a gas using a syringe system and changing mass. Students set the initial volume of the syringe to 50.0 mL and add an initial mass in the form of a book, then periodically increase the mass and observe the impact of the change in mass on the volume of the gas in the syringe. They then perform mathematical and graphical analysis of the data to determine if the relationship between pressure and volume indicated by Boyle's law is correct. In addition, students apply their knowledge to analyze the effects of pressure and volume in real-world scenarios.

Mixtures, Solutions, and Solubility

In this unit, students examine the properties of mixtures and solutions, as well as how various factors impact solubility in solutions. Students differentiate between heterogeneous and homogeneous mixtures, as well as identify properties of nonaqueous solutions. In addition, students investigate the factors that impact the solubility of a substance, and compare and contrast the three main types of solutions. Students also complete a laboratory activity to gain a comprehensive understanding of the relationship between temperature and solubility, and further develop scientific literacy skills through the completion of a scientific lab report for the activity. Last, students calculate the concentration of solutions in units of molarity. They solve stoichiometry problems involving molarity and use molarity to calculate dilutions of solutions.

Summary of Assignment: See hands-on lab activity.

🧪 Unit Lab Activities:

Lab: Solubility

In this assignment, students investigate the relationship between temperature and solubility of a solute using sugar and water. Students measure how many teaspoons of sugar are able to dissolve in cold water, then change the temperature of the water and observe how much additional sugar is able to dissolve in the solvent before it becomes saturated in a series of three additional

experiments. Students then perform mathematical and graphical analysis of the data to determine if there is a direct relationship between the temperature and solubility of a solute. In addition, students apply their knowledge to analyze solubility in real-world scenarios.

Acids and Bases: Part 1

In this unit, students examine properties of acids and bases, including pH, and their real-world applications. Students identify properties of acids and bases and classify them as Arrhenius, Bronsted-Lowry, or Lewis acids/bases. Students then explore pH and how it is affected by hydrogen and hydroxide ion concentration, as well as apply logarithmic functions in order to solve pH problems. Students also complete a laboratory activity to gain a comprehensive understanding of how solution pH is examined using indicators, and further develop scientific literacy skills through the completion of a scientific lab report for the activity.

Summary of Assignment:

Lesson: Properties of Acids and Bases

In this lesson students describe the observable properties of both acids and bases, as well as the applications of acids and bases. Students explore how concentration of specific ions affect the properties of a solution. In the assignment students evaluate what they have learned and communicate information regarding acids and bases that they come into contact with in an average week. Students also obtain further information regarding acids and bases in digestion, which they evaluate, and use to explain how antacids with calcium carbonate function.

Unit Lab Activities:

Lab: Measuring pH

In this assignment, students investigate the pH of a variety of acids and bases using both a universal pH indicator and a red cabbage pH indicator. Students initially collect data from several solutions composed of various concentrations of hydrochloric acid, sodium hydroxide, and/or distilled water by performing mathematical analysis to calculate the pH of each and then testing the individual solutions with pH indicator paper. Students then retest the solutions using the red cabbage indicator to confirm it is calibrated correctly, and finally use the red cabbage indicator to conduct pH tests on several common household acids and bases. Students collect qualitative and quantitative data on each household solution to determine the acidity or basicity of each.

Acids and Bases: Part 2

In this unit, students continue to examine properties of acids and bases, specifically their interactions in chemical reactions. Students differentiate between neutralization and titration reactions, as well as predict the products that will be formed in specific acid-base reaction scenarios. Students also complete a laboratory activity to gain a comprehensive understanding of the titration process, and further develop scientific literacy skills through the completion of a scientific lab report for the activity.

Summary of Assignment:

Lesson: Titration Reactions

In this lesson, students learn how to measure pH with indicators and meters, as well as how to describe the steps of the titration process. Students explore the use of titration in chemistry. In the assignment arrh, students are provided information recorded by a fictional student. Students then write an analysis of the quality of the information recorded in the student lab notebook for the titration experiment. Students are asked to include an explanation of any problems that would be encountered by someone trying to use the information to calculate the concentration of the acid.

🧪 Unit Lab Activities:

Lab: Titration

In this assignment, students investigate how titration can be utilized to determine the concentration of an unknown acid. Students utilize a known concentration of sodium hydroxide and titrate it into an unknown concentration of hydrochloric acid containing phenolphthalein indicator to show when the amounts of acid and base in the titrated solution are equivalent. After they have performed the titration trial three times, students then conduct mathematical analysis of the values obtained to determine the average concentration of the hydrochloric acid. In addition, students identify potential sources of error and further develop scientific literacy skills through completion of a lab report on the experiment.

Redox Reactions

In this unit, students examine chemical reactions involving oxidation and reduction of compounds. Students identify oxidation-reduction reactions and assign oxidation numbers to atoms in order to determine oxidized and reduced species within individual compounds. They apply mathematical concepts to write and balance redox half-reactions. Students also further develop scientific literacy skills through the completion of a written analysis of the applications of oxidation-reduction reactions in fuel cells to real-world energy needs.

Summary of Assignment: Lesson: Fuel Cells

In this assignment, students examine fuel cells, how they provide energy, and their applications in real-world scenarios. Students explore the structure of a fuel cell and how its parts and organization contribute to its energy production. They then differentiate between types of fuel cells and the amounts of power they produce. In addition, students identify applications of fuel cells in various real-world scenarios. Students also further develop scientific literacy skills through analyzing a technical article on hydrogen fuel and fuel cell cars and composing a written argumentative essay containing evidence either for or against the immediate introduction of fuel cell cars as a transportation source.

🧪 Unit Lab Activities:

Labs appear throughout the course focusing on the major concepts presented in the course. Some units include additional labs while other units, such as this one, are shorter and do not contain any labs, but instead focus on activities such as extended reading to explore additional perspectives and real world application of concepts.

Organic Compounds

In this unit, students compare various models of organic compounds, including structural formulas and ball-and-stick models. They then differentiate between alkanes, alkenes, and alkynes, as well as practice naming saturated and unsaturated hydrocarbons. In addition, students explore the functional groups and their effects on the properties of organic compounds, as well as determine real-world applications of hydrocarbons.

Summary of Assignment: Lesson: Functional Groups

In this assignment, students examine the various types of functional groups and how they affect the properties of compounds containing them. Students differentiate between alkyl halides, alcohols, ethers, ketones, aldehydes, carboxylic acids, esters, and amines, including rules for naming compounds and comparing structures of each. Students also investigate real-world applications of different functional groups, and identify properties of compounds containing the different functional groups.

🧪 Unit Lab Activities:

Labs appear throughout the course focusing on the major concepts presented in the course. Some units include additional labs while other units, such as this one, are shorter and do not contain any labs, but instead focus on activities such as extended reading to explore additional perspectives and real world application of concepts.

Chemistry of Life

In this unit, students examine macromolecules, identifying and comparing the structures and functions of carbohydrates, lipids, proteins, and nucleic acids. Students also compare and contrast the processes of photosynthesis and cellular respiration. They illustrate and describe the energy conversions that occur during photosynthesis and respiration.

Summary of Assignment: Lesson: Macromolecules

In this lesson, students complete a chart that describes the four kinds of macromolecules. They identify physical characteristics of the macromolecules, such as the elements that make up each macromolecule, as well as the subunits and the functions of the macromolecules.

Unit Lab Activities:

Labs appear throughout the course focusing on the major concepts presented in the course. Some units include additional labs while other units, such as this one, are shorter and do not contain any labs, but instead focus on activities such as extended reading to explore additional perspectives and real world application of concepts.

Nuclear Chemistry: Part 1

In this unit, students gain a comprehensive understanding of introductory concepts related to nuclear physics, including radioactivity and half-life. Students compare the three main types of radioactivity, as well as differentiate between chemical reactions and nuclear reactions. They then apply mathematical concepts in order to balance nuclear equations using mass and atomic numbers. Students also complete a laboratory activity to graphically analyze the process of half-life and further develop scientific literacy skills through the completion of a scientific lab report for the activity.

Summary of Assignment:

Lesson: Half-Life

In the lesson, “Half-Life”, students explore the question “Why is it important to know the amount of time that it takes for half a radioisotope’s nuclei to decay?” As students investigate this question students are introduced to information regarding isotopes and nuclear equations. Throughout the instruction students use mathematics and computational thinking to complete

half-life calculations. In the assignment, students identify parent and daughter isotopes, describe the range of half-lives, perform several calculations, and identify unknown radioisotope using mass data and a table of half-lives.

🧪 Unit Lab Activities:

Lab: Half-Life

In the Lab: Half-Life Model lesson, students will utilize an activity involving pennies or other small everyday objects in order to investigate the impact of half-life on the radioactivity of a sample element over a period of time. Students initially begin with 100 “radioactive” objects. They then simulate each half-life cycle by putting all of the “radioactive” objects in a container and shaking them. Any object that has become “stable” when the simulation occurs is removed. This process is repeated eight times. Students then conduct mathematical and graphical analysis to determine how radioactive decay affects the overall amount of radioactive material remaining and the number of stable atoms created from an initial sample over time or after a certain number of half-lives.

Nuclear Chemistry: Part 2

In this unit, students continue to develop their understanding of concepts related to nuclear physics, including fission, fusion, and applications of nuclear phenomena in everyday scenarios. Students examine the role of nuclear fusion in producing elements heavier than Helium. Students also explore the role of nuclear radiation in various real-world applications, including applications in medicine and industry. Students conduct an analysis of advantages and disadvantages related to the use of nuclear energy as a resource, and then further develop scientific literacy skills through the completion of a written argumentative essay that includes supporting information from scientific research.

Summary of Assignment: Lesson: Nuclear Energy

In the Nuclear Energy lesson, students apply scientific literacy skills to create a written argument establishing their position on the use of nuclear power. They will defend this argument by utilizing supporting information from the lesson on the benefits and disadvantages of nuclear power as an energy source. Students will also identify issues related to disposing of nuclear waste and compare the use of nuclear energy to other resource options.

🧪 Unit Lab Activities:

Labs appear throughout the course focusing on the major concepts presented in the course. Some units include additional labs while other units, such as this one, are shorter and do not contain any labs, but instead focus on activities such as extended reading to explore additional perspectives and real world application of concepts.

Course Materials

Multimedia

Title	Author	Director	Name of video series	Date	Website	Medium of Publication
Edgenuity Course Map	Edgenuity Inc.	[empty]	[empty]	[empty]	[empty]	Online Interactive Resource
Edgenuity Instructional Videos	Edgenuity Inc.	[empty]	[empty]	[empty]	[empty]	Online Interactive Resource
Edgenuity eNotes	Edgenuity Inc.	[empty]	[empty]	[empty]	[empty]	Online Interactive Resource
Edgenuity eWriter Tool	Edgenuity Inc.	[empty]	[empty]	[empty]	[empty]	Online Interactive Resource
Edgenuity Student Support for Text-based Assignments: Literacy Scaffolds and Supports	Edgenuity Inc.	[empty]	[empty]	[empty]	[empty]	Online Interactive Resource
Digital Calculator	Edgenuity Inc.	[empty]	[empty]	[empty]	[empty]	Online Interactive Resource

Title	Author	Director	Name of video series	Date	Website	Medium of Publication
Edgenuity Periodic Table of Elements	Edgenuity Inc.	[empty]	[empty]	[empty]	[empty]	Online Interactive Resource
Edgenuity Collaboration Corner	Edgenuity Inc.	[empty]	[empty]	[empty]	[empty]	Online discussion forum

Other

Title	Authors	Date	Course material type	Website
Surfactants	Edgenuity Inc.	2014	Informational Text	[empty]
Photosynthesis and Cellular Respiration	Edgenuity Inc.	2014	Informational Text	[empty]
Make up Lab: Synthesis and Quantitation of Acetylsalicylic Acid (Aspirin).	Szapacs, Bojan, Keiser	2005	Informational Text	[empty]

Supplemental Materials

Title	Content

No course materials have been added to this course.

Additional Information

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