# Course Description

Introduction to the experimental techniques of chemistry applying the principles of stoichiometry, gas laws, thermochemistry

and solution chemistry to the study of the composition and reactions of compounds.

# University Learning Outcomes (ULO)

* **ULO1:**Knowledge of Human Cultures and the Physical and Natural World
* **ULO2:**Intellectual and Practical Skills
* **ULO3:**Personal and Social Responsibility
* **ULO4:**Integrative and Applied Learning­
* **ULO5:**Immersed in the Critical Concerns of the Sisters of Mercy of the Americas

# Program Learning Outcomes (PLO)

* **PLO1**: Express an appreciation and understanding of a variety of aesthetic, literary, cultural and ideological traditions.(ULO 2, 3)
* **PLO2**: Engage meaningfully in a community of scholarship through inquiry, research and the communication of ideas. (ULO 2, 4)
* **PLO3**: Evaluate historical, political, economic and scientific data while recognizing the interrelatedness of events and processes. (ULO 1, 2, 3, 4)
* **PLO5**: Reflect upon the relationship of the Divine to the human experience. (ULO 2, 3, 4)
* **PLO6**: Examine and understand the dynamics of individual and group behavior. (ULO 2, 4)
* **PLO7**: Demonstrate an understanding of quantitative reasoning. (ULO 1, 2, 4)
* **PLO8**: Engage in constructive activities of service to the community in light of the Gospel tradition as experienced through the Mercy charism that shapes the College. (ULO 2, 3, 4)

# Course Learning Outcomes (CLO)

* **CLO1:** Demonstrate the quantitative and qualitative skills needed to succeed in chemistry, including the ability to read and interpret graphs, the ability to apply algorithms to problem solving, and the ability to employ critical-thinking skills. The student will demonstrate these abilities through performance on formative and summative assignments on MasteringChemistry and performance on examinations.
* **CLO2:** Demonstrate the mastery of specific knowledge and skills in chemistry listed in the learning objectives for each chapter posted on the Blackboard site and the ability to make connections between concepts in chemistry. The student will demonstrate this mastery through performance on formative and summative assignments on MasteringChemistry and performance on examinations.
* **CLO3:** Apply the fundamental principles of chemistry to the composition, structures, and processes of human physiology. The student will demonstrate this ability through performance on formative and summative assignments on MasteringChemistry and performance on examinations.

# Student Expectations

Students are expected to:

* Ask probing and insightful questions related to course content.
* Make meaningful and relevant connections and application to their own learning process.
* Be productive and contributing members of class discussions.

# Required Course Materials

* **HOLSciences Mail-Order Lab Kit #BR-1036-CK-02**
* Go to [www.holscience.com](http://www.holscience.com).
* Under the **Lab Kits** drop-down menu at the top, click on **Student Ordering**.
* When it asks if you have a log-in and password, click **Yes**.
* Enter the following:
  + Login: *C002464*
  + Password: *labpaq*
* Click **Login**.
* Under the **LABPAQS** section in the left-hand column, select **CHEMISTRY**.
* Select **Custom Chemistry Premium (SKU: BR-1036-CK-02)** and follow the prompts to complete your order.
* Contact Hands-On Learning immediately if you notice you received any missing, spoiled, or damaged materials in your lab kit:
  + **Email**: [info@holscience.com](mailto:info@holscience.com)
  + **Phone**: 866-206-0773
  + [HOL Web Form Contact](http://holscience.com/contact/)
  + [Hands-On Learning FAQ Page](http://holscience.com/orders/faq/)
  + [Hands-On Learning Returns and Refunds Policy](http://holscience.com/orders/returns-refunds/)
  + [Hands-On Learning Safety Information](http://holscience.com/safety/)

# Suggested Point Values

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| --- | --- | --- |
| **Assessment** | **Point Value** | **Due** |
| **Week 1** |  |  |
| Laboratory: Getting Started | 5 |  |
| Laboratory: Laboratory Safety | 5 |  |
| Laboratory Techniques and Measurements – Exploration | 24 |  |
| Laboratory Techniques and Measurements – Experimentation | 62 |  |
| Laboratory Techniques and Measurements – Evaluation | 24 |  |
| **Week 2** |  |  |
| Separation of a Mixture of Solids – Exploration | 24 |  |
| Separation of a Mixture of Solids – Experimentation | 62 |  |
| Separation of a Mixture of Solids – Evaluation | 24 |  |
| **Week 3** |  |  |
| Caloric Content of Food – Exploration | 24 |  |
| Caloric Content of Food – Experimentation | 62 |  |
| Caloric Content of Food – Evaluation | 24 |  |
| **Week 4** |  |  |
| Molecular Modeling and Lewis Structures – Exploration | 24 |  |
| Molecular Modeling and Lewis Structures – Experimentation | 62 |  |
| Molecular Modeling and Lewis Structures – Evaluation | 24 |  |
| **Week 5** |  |  |
| Stoichiometry of a Precipitation Reaction – Exploration | 24 |  |
| Stoichiometry of a Precipitation Reaction – Experimentation | 62 |  |
| Stoichiometry of a Precipitation Reaction – Evaluation | 24 |  |
| **Week 6** |  |  |
| Boyle’s Law – Exploration | 24 |  |
| Boyle’s Law – Experimentation | 62 |  |
| Boyle’s Law – Evaluation | 24 |  |
| **Week 7** |  |  |
| Anions, Cations, and Ionic Reactions – Exploration | 24 |  |
| Anions, Cations, and Ionic Reactions – Experimentation | 62 |  |
| Anions, Cations, and Ionic Reactions – Evaluation | 24 |  |
| Equilibrium and Le Châtelier’s Principle – Exploration | 24 |  |
| Equilibrium and Le Châtelier’s Principle – Experimentation | 62 |  |
| Equilibrium and Le Châtelier’s Principle – Evaluation | 24 |  |
| **Week 8** |  |  |
| Antacid Analysis and Titration – Exploration | 24 |  |
| Antacid Analysis and Titration – Experimentation | 62 |  |
| Antacid Analysis and Titration – Evaluation | 24 |  |
| **Total Points** | **1000** |  |

**Grading Scale**

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| **Grade** | **Range** |
| A | 93-100 |
| A- | 90-92 |
| B+ | 87-89 |
| B | 83-86 |
| B- | 82-80 |
| C+ | 77-79 |
| C | 73-76 |
| C- | 70-72 |
| D+ | 67-69 |
| D | 63-66 |
| D- | 60-62 |
| F | 59 |

# Course Schedule

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| --- | --- | --- |
| **Week** | **Start** | **End** |
| One | <insert start date> | <insert end date> |
| Two |  |  |
| Three |  |  |
| Four |  |  |
| Five |  |  |
| Six |  |  |
| Seven |  |  |
| Eight |  |  |

# Weekly Learning Modules

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| **Week One: Topic** | | |
| ***Learning Objectives*** | ***Alignment*** | |
| * 1. Write the names and abbreviations for International System of Units (SI) or metric units used to measure length, mass, volume, temperature, and time. | CLO1, CLO2 | |
| * 1. Calculate metric equalities using numerical prefixes. | CLO1, CLO2 | |
| * 1. Write conversion factors to change metric and/or English units to another. | CLO1, CLO2 | |
| * 1. Classify a number as exact or measured. | CLO1, CLO2 | |
| * 1. Determine the number of significant figures in a measurement and in the result of a calculation. | CLO1, CLO2 | |
| * 1. Record measurements to the correct number of significant figures. | CLO1, CLO2 | |
| * 1. Calculate density and specific gravity using mass and volume measurements. | CLO1, CLO2 | |
| ***Resources, Activities, and Preparation***  *Utilize these resources and complete these activities in preparation for your graded assignments.* | ***Alignment*** | ***AIE*** |
| **HOLCloud Registration**  **Complete** the laboratory assignments (listed under the *Laboratory* section in each week of the syllabus) using your Hands-On Learning lab kit and its companion site HOLCloud. Complete the following as early as possible in Week 1:   * After receiving HOLSciences lab kit, confirm all materials are present. * Ensure that you have the following information before attempting registration:   + HOLCLOUD ACCESS CODE: An ACCESS CODE will be included with your lab kit, but if you have difficulty locating, please contact HOLSciences Support (Email: [info@holscience.com](mailto:info@holscience.com), Phone: 866-206-0773).   + HOLCLOUD COURSE LINK: Your instructor will post a link to this course’s instance of HOLCloud in the Announcements forum. * Navigate to HOLCloud using the course link provided by your instructor. * Follow directions as outlined in HOLCloud Getting Started on the HOLSciences website to complete the registration using your HOLCloud access code. * For questions, please contact HOLSciences support (email: info@holscience.com, Phone: 866-206-0773).   Once you have registered, begin completing the lab assignments listed in the Laboratory section of each week of this syllabus. This week, you must start with the *Getting Started* and *Laboratory Safety* assignments. As you complete your labs, remember to the following precautions:   * Follow all lab and safety guideline as described in the HOLCloud Lesson procedures. * Wear the appropriate safety gear during labs, including gloves, goggles, and any other designated equipment. * Conduct each lab as described in the HOLCloud Lesson procedures. * Use lab equipment only in the specifically designated manner. | N/A | Review technology tools and tutorials =  **.5 hours** |
| ***Laboratory***  *Students must complete the laboratory assignment(s) using the Hands-On Lab kit.* | ***Alignment*** | ***AIE*** |
| **Laboratory: Getting Started**  **Complete** the Getting Started Lab as described in the HOLCloud Lesson procedures.  *Note*: This lab will take a minimum of 1 hour to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | CLO1, CLO2 | Complete the lab and review instructor feedback =  **.5 hours** |
| **Laboratory: Laboratory Safety**  **Complete** the Laboratory Safety Lab as described in the HOLCloud Lesson procedures.  *Note*: This lab will take a minimum of 1.5 hours to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | CLO1, CLO2 | Complete the lab and review instructor feedback =**.5 hours** |
| **Laboratory: Laboratory Techniques and Measurements – Exploration**  **Complete** the Laboratory Techniques and Measurements – Exploration Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 2.1 | Complete the lab and review instructor feedback = **.5 hours** |
| **Laboratory: Laboratory Techniques and Measurements – Experimentation**  **Complete** the Laboratory Techniques and Measurements – Experimentation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 3 hours to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 2.1 | Complete the lab and review instructor feedback =  **.5 hours** |
| **Laboratory: Laboratory Techniques and Measurements – Evaluation**  **Complete** the Laboratory Techniques and Measurements – Evaluation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 2.1 | Complete the lab and review instructor feedback = **.5 hours** |

# Faculty Notes

**Instructors should contact their HOLScience’s area representatives before the classes begin to conform their class information and access to the instructor version of the online software. Post a link to the course’s instance of HOLCloud in the Announcements forum.**

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| Week Two: Energy, Matter, Atoms, and Elements |  |  |
| ***Learning Objectives*** | ***Alignment*** | |
| * 1. Convert Celsius, Kelvin, and Fahrenheit temperatures into corresponding values on another temperature scale. | CLO1, CLO2 | |
| * 1. Classify examples of matter as either pure substances or as mixtures. | CLO1, CLO2 | |
| * 1. Distinguish between homogeneous and heterogeneous mixtures. | CLO1, CLO2 | |
| * 1. Classify matter according to its state. | CLO1, CLO2 | |
| * 1. Calculate the quantity of heat lost or gained during a temperature change using specific heat. | CLO1, CLO2 | |
| * 1. Calculate the energy value of a given weight of food in kilojoules (kJ) or kilocalories (kcal). | CLO1, CLO2, CLO3 | |
| ***Laboratory***  *Students must complete the laboratory assignment(s) using the Hands-On Lab kit.* | ***Alignment*** | ***AIE*** |
| **Laboratory: Separation of a Mixture of Solids – Exploration**  **Complete** the Separation of a Mixture of Solids – Exploration Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 2.2, 2.3, 2.4, 5.2, 6.5, 6.6, 6.7, 6.8, 7.2, 7.3 | Complete the lab and review instructor feedback = **.5 hours** |
| **Laboratory: Separation of a Mixture of Solids – Experimentation**  **Complete** the Separation of a Mixture of Solids – Experimentation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 2 hours to complete and requires 2 nights of wait time during the experiment.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 2.2, 2.3, 2.4, 5.2, 6.5, 6.6, 6.7, 6.8, 7.2, 7.3 | Complete the lab and review instructor feedback = **.5 hours** |
| **Laboratory: Separation of a Mixture of Solids – Evaluation**  **Complete** the Separation of a Mixture of Solids – Evaluation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 2.2, 2.3, 2.4, 5.2, 6.5, 6.6, 6.7, 6.8, 7.2, 7.3 | Complete the lab and review instructor feedback = **.5 hours** |

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| Week Three: Atoms, Elements, and Nuclear Chemistry |  |  |
| ***Learning Objectives*** | ***Alignment*** | |
| * 1. Draw an electron-dot symbol for any representative element. | CLO1, CLO2 | |
| ***Laboratory***  *Students must complete the laboratory assignment(s) using the Hands-On Lab kit.* | ***Alignment*** | ***AIE*** |
| **Laboratory: Caloric Content of Food – Exploration**  **Complete** the Caloric Content of Food – Exploration Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 2.3, 2.5, 2.6 | Complete the lab and review instructor feedback = **.5 hours** |
| **Laboratory: Caloric Content of Food – Experimentation**  **Complete** the Caloric Content of Food– Experimentation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 1.5 hours to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 2.3, 2.5, 2.6 | Complete the lab and review instructor feedback =  **.5 hours** |
| **Laboratory: Caloric Content of Food – Evaluation**    **Complete** the Caloric Content of Food – Evaluation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 2.3, 2.5, 2.6 | Complete the lab and review instructor feedback = **.5 hours** |

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| Week Four: Nuclear Chemistry and Compounds and Their Bonds |  |  |
| ***Learning Objectives*** | ***Alignment*** | |
| * 1. Write symbols for common ions of the representative elements using the octet rule. | CLO1, CLO2 | |
| * 1. Write the correct formula for a named ionic compound using charge balance. | CLO1, CLO2 | |
| * 1. Classify a compound as ionic or covalent. | CLO1, CLO2 | |
| * 1. Write the name of an ionic compound from its formula and vice versa. | CLO1, CLO2 | |
| * 1. Write the name and formula for a compound containing a polyatomic ion. | CLO1, CLO2 | |
| * 1. Draw electron-dot symbols for the representative elements. | CLO1, CLO2 | |
| * 1. Draw electron-dot structures for covalent compounds, including multiple bonds and resonance structures. | CLO1, CLO2 | |
| ***Laboratory***  *Students must complete the laboratory assignment(s) using the Hands-On Lab kit.* | ***Alignment*** | ***AIE*** |
| **Laboratory: Molecular Modeling and Lewis Structures – Exploration**  **Complete** the Molecular Modeling and Lewis Structures – Exploration Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 45 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 3.1, 4.1, 4.6, 4.7, 5.1 | Complete the lab and review instructor feedback = **.5 hours** |
| **Laboratory: Molecular Modeling and Lewis Structures – Experimentation**  **Complete** the Molecular Modeling and Lewis Structures – Experimentation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 2.5 hours to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 3.1, 4.1, 4.6, 4.7, 5.1 | Complete the lab and review instructor feedback =  **.5 hours** |
| **Laboratory: Molecular Modeling and Lewis Structures – Evaluation**  **Complete** the Molecular Modeling and Lewis Structures – Evaluation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 3.1, 4.1, 4.6, 4.7, 5.1 | Complete the lab and review instructor feedback = **.5 hours** |

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| Week Five: Compounds and Their Bonds and Chemical Reactions and Quantities |  |  |
| ***Learning Objectives*** | ***Alignment*** | |
| * 1. Predict the three-dimensional molecular shape of a covalent compound, and classify it as polar or nonpolar using the VSEPR (valence shell electron pair repulsion) model. | CLO1, CLO2 | |
| * 1. Describe the attractive forces between ions, polar molecules, and nonpolar molecules. | CLO1, CLO2 | |
| * 1. Balance a chemical equation from the reactant and product formulas. | CLO1, CLO2 | |
| * 1. Classify a reaction as combination, decomposition, single or double replacement, or combustion. | CLO1, CLO2 | |
| * 1. Calculate the number of particles in a given amount of moles and the number of moles in a given number of particles using Avogadro’s number. | CLO1, CLO2 | |
| * 1. Determine the molar mass of a substance using the periodic chart | CLO1, CLO2 | |
| * 1. Convert between mass and moles using molar mass. | CLO1, CLO2 | |
| * 1. Calculate the moles and/or grams of a compound in a reaction given a quantity in moles and/or grams of a reactant or product using a mole–mole factor in the balanced equation for the reaction. | CLO1, CLO2 | |
| * 1. Calculate the theoretical yield and the percent yield for a chemical reaction. | CLO1, CLO2 | |
| * 1. Identify the limiting reactant in a chemical reaction. | CLO1, CLO2 | |
| * 1. Calculate the reaction theoretical yield from the limiting reactant. | CLO1, CLO2 | |
| ***Laboratory***  *Students must complete the laboratory assignment(s) using the Hands-On Lab kit.* | ***Alignment*** | ***AIE*** |
| **Laboratory: Stoichiometry of a Precipitation Reaction – Exploration**  **Complete** the Stoichiometry of a Precipitation Reaction – Exploration Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 45 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11, 7.1, 7.2, 7.3 | Complete the lab and review instructor feedback = **.5 hours** |
| **Laboratory: Stoichiometry of a Precipitation Reaction – Experimentation**  **Complete** the Stoichiometry of a Precipitation Reaction – Experimentation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 2.5 hours to complete and requires an overnight wait period during the experiment.  **Submit** your completed Lab Report to the instructor.   * *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11, 7.1, 7.2, 7.3 | Complete the lab and review instructor feedback =  **.5 hours** |
| **Laboratory: Stoichiometry of a Precipitation Reaction – Evaluation**  **Complete** the Stoichiometry of a Precipitation Reaction – Evaluation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.   * *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11, 7.1, 7.2, 7.3 | Complete the lab and review instructor feedback = **.5 hours** |

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| Week Six: Gases and Solutions |  |  |
| ***Learning Objectives*** | ***Alignment*** | |
| * 1. Describe the kinetic molecular theory of gases and the physical properties of gases. | CLO1, CLO2 | |
| * 1. Describe the units of measurement used for pressure, and use conversion factors to convert between units. | CLO1, CLO2 | |
| * 1. Calculate the new pressure or volume when the temperature and amount of gas are held constant and either pressure or volume is changed using Boyle’s law. | CLO1, CLO2 | |
| * 1. Calculate the new pressure, volume, or temperature of a gas when changes in two of these properties are given and the amount of gas is constant using the combined gas laws. | CLO1, CLO2 | |
| * 1. Identify the solute and solvent in a solution. | CLO1, CLO2 | |
| * 1. Describe the solvent–solute attractions that result in solutions for ionic and/or polar solutes and for nonpolar solutes and solvents. | CLO1, CLO2 | |
| * 1. Differentiate between saturated and unsaturated solutions. | CLO1, CLO2 | |
| * 1. Identify a salt as either water soluble or insoluble. | CLO1, CLO2 | |
| ***Laboratory***  *Students must complete the laboratory assignment(s) using the Hands-On Lab kit.* | ***Alignment*** | ***AIE*** |
| **Laboratory: Boyle’s Law – Exploration**  **Complete** the Boyle’s Law – Exploration Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 6.1, 6.2, 6.3, 6.4 | Complete the lab and review instructor feedback = **.5 hours** |
| **Laboratory: Boyle’s Law – Experimentation**  **Complete** the Boyle’s Law – Experimentation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 2 hours to complete and requires an overnight wait period during the experiment.  **Submit** your completed Lab Report to the instructor.   * *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 6.1, 6.2, 6.3, 6.4 | Complete the lab and review instructor feedback =  **.5 hours** |
| **Laboratory: Boyle’s Law – Evaluation**  **Complete** the Boyle’s Law – Evaluation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.   * *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 6.1, 6.2, 6.3, 6.4 | Complete the lab and review instructor feedback = **.5 hours** |

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| Week Seven: Solutions, Reaction Rates, and Chemical Equilibrium |  |  |
| ***Learning Objectives*** | ***Alignment*** | |
| * 1. Describe the solvent–solute attractions that result in solutions for ionic and/or polar solutes and for nonpolar solutes and solvents. | CLO1, CLO2 | |
| * 1. Differentiate between saturated and unsaturated solutions. | CLO1, CLO2 | |
| * 1. Identify a salt as either water soluble or insoluble. | CLO1, CLO2 | |
| * 1. Calculate the concentration of a solution in milliequivalents per liter, molarity, and percent concentration: %(*m*/*m*), %(*m*/*v*), %(*v*/*v*). | CLO1, CLO2 | |
| * 1. Write an equilibrium constant expression from a balanced equation. | CLO1, CLO2 | |
| * 1. Distinguish between homogeneous and heterogeneous equilibria. | CLO1, CLO2 | |
| * 1. Calculate the equilibrium constant for a reversible reaction given the concentrations of reactants and products at equilibrium. | CLO1, CLO2 | |
| * 1. Predict the extent of a reaction using an equilibrium constant. | CLO1, CLO2 | |
| ***Laboratory***  *Students must complete the laboratory assignment(s) using the Hands-On Lab kit.* | ***Alignment*** | ***AIE*** |
| **Laboratory: Anions, Cations, and Ionic Reactions – Exploration**  **Complete** the Anions, Cations, and Ionic Reactions – Exploration Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 4.1, 4.2, 4.3, 4.4, 4.5, 5.2, 5.3, 7.3 | Complete the lab and review instructor feedback = **.5 hours** |
| **Laboratory: Anions, Cations, and Ionic Reactions – Experimentation**  **Complete** the Anions, Cations, and Ionic Reactions – Experimentation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 2 hours to complete and requires an overnight wait period during the experiment.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 4.1, 4.2, 4.3, 4.4, 4.5, 5.2, 5.3, 7.3 | Complete the lab and review instructor feedback =  **.5 hours** |
| **Laboratory: Anions, Cations, and Ionic Reactions – Evaluation**  **Complete** the Anions, Cations, and Ionic Reactions – Evaluation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 4.1, 4.2, 4.3, 4.4, 4.5, 5.2, 5.3, 7.3 | Complete the lab and review instructor feedback = **.5 hours** |
| **Laboratory: Equilibrium and Le Ch**â**telier’s Principle – Exploration**  **Complete** the Equilibrium and Le Châtelier’s Principle – Exploration Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 7.1, 7.2, 7.3, 7.4, 8.1, 8.2 | Complete the lab and review instructor feedback = **.5 hours** |
| **Laboratory: Equilibrium and Le Ch**â**telier’s Principle – Experimentation**    **Complete** the Equilibrium and Le Châtelier’s Principle – Experimentation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 1.5 hours to complete and requires an overnight wait period during the experiment.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 7.1, 7.2, 7.3, 7.4, 8.1, 8.2 | Complete the lab and review instructor feedback =  **.5 hours** |
| **Laboratory: Equilibrium and Le Ch**â**telier’s Principle – Evaluation**  **Complete** the Equilibrium and Le Châtelier’s Principle – Evaluation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 7.1, 7.2, 7.3, 7.4, 8.1, 8.2 | Complete the lab and review instructor feedback = **.5 hours** |

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| Week Eight: Reaction Rates and Chemical Equilibrium and Acids and Bases |  |  |
| ***Learning Objectives*** | ***Alignment*** | |
| * 1. Calculate equilibrium concentrations from equilibrium constants. | CLO1, CLO2 | |
| * 1. Describe the changes made in equilibrium concentrations using Le Châtelier's principle when reaction conditions of volume, temperature, or concentration change. | CLO1, CLO2 | |
| * 1. Identify Arrhenius and Brønsted–Lowry acid and base pairs. | CLO1, CLO2 | |
| * 1. Write equations for the dissociation of strong and weak acids. | CLO1, CLO2 | |
| * 1. Write an equilibrium constant expression for a weak acid. | CLO1, CLO2 | |
| * 1. Calculate the [H3O+] and [OH-] in an aqueous solution using the ion product constant for water. | CLO1, CLO2 | |
| * 1. Calculate the pH from [H3O+]. | CLO1, CLO2 | |
| * 1. Calculate the [H3O+] and [OH-] of an aqueous solution given the pH. | CLO1, CLO2 | |
| * 1. Write balanced equations for the reactions of acids with metals, carbonates, and bases. | CLO1, CLO2 | |
| * 1. Calculate the molarity or volume of an acid from titration data. | CLO1, CLO2 | |
| * 1. Describe the role of buffers in maintenance of aqueous solution pH. | CLO1, CLO2 | |
| ***Resources, Activities, and Preparation***  *Utilize these resources and complete these activities in preparation for your graded assignments.* | ***Alignment*** | ***AIE*** |
| **Laboratory: Antacid Analysis and Titration – Exploration**  **Complete** the Antacid Analysis and Titration – Exploration Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 8.10, 8.11 | Complete the lab and review instructor feedback = **.5 hours** |
| **Laboratory: Antacid Analysis and Titration – Experimentation**  **Complete** the Antacid Analysis and Titration – Experimentation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 2 hours to complete and requires an overnight wait period during the experiment.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 8.10, 8.11 | Complete the lab and review instructor feedback =  **.5 hours** |
| **Laboratory: Antacid Analysis and Titration – Evaluation**  **Complete** the Antacid Analysis and Titration – Evaluation Lab as described in the HOLCloud Lesson procedures.  *Note*: This portion of the lab will take a minimum of 30 minutes to complete.  **Submit** your completed Lab Report to the instructor.  *Note:* Confirm with your instructor for the preferred method of submitting your completed Lab Reports. | 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 8.10, 8.11 | Complete the lab and review instructor feedback = **.5 hours** |

# Breakdown of Academic Instructional Equivalencies

|  |  |
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|  | **AIE Hours** |
| **Week 1** |  |
| Required | 3 |
| Supplemental |  |
| **Week 2** |  |
| Required | 1.5 |
| Supplemental |  |
| **Week 3** |  |
| Required | 1.5 |
| Supplemental |  |
| **Week 4** |  |
| Required | 1.5 |
| Supplemental |  |
| **Week5** |  |
| Required | 1.5 |
| Supplemental |  |
| **Week 6** |  |
| Required | 1.5 |
| Supplemental |  |
| **Week 7** |  |
| Required | 3 |
| Supplemental |  |
| **Week 8** |  |
| Required | 1.5 |
| Supplemental |  |
|  |  |
| **Total Required Hours** | 15 |
| **Total Supplemental Hours** |  |
| **Total Hours** | 15 |