**CHEM 1111 - Lower Division AGCM Spring 2012 Course Description**

Basic laboratory experiments supporting theoretical principles presented in CHEM 1311; introduction of the scientific method, experimental design, data collection and analysis, and preparation of laboratory reports.

(*http://www.thecb.state.tx.us/aar/undergraduateed/workforceed/acgm.htm)*

**University of North Texas Course Description**

Laboratory techniques, weighing, errors and significant figures, identification and purification of substances, and elementary quantitative analysis.

Should be taken concurrently with CHEM 1311.

*(CHEM 1430: General Chemistry I for Science Majors Laboratory course description from the 2011-12 University of North Texas Course Catalog)*

**Hours of Credit:** One (1)

**Required Co-requisite**

* CHEM 1311: General Chemistry I for Science Majors must be taken concurrently.

**Suggested Co-requisite**

* MATH 2312: Pre-Calculus is strongly suggested to be taken concurrently.

**Prior Knowledge and Prerequisites**

* Prior to enrolling in this course, students must satisfy Texas Success Initiative (TSI) requirements set by the institution as described in Coordinating Board rule (Texas Administrative Code, Chapter 4, Subchapter C).
* MATH 1314: College Algebra is required.

**Student Learning Outcomes**

*(According to the Spring 2012 ACGM)*

1. Use basic apparatus and apply experimental methodologies used in the chemistry laboratory.

2. Demonstrate safe and proper handling of laboratory equipment and chemicals.

3. Conduct basic laboratory experiments with proper laboratory techniques.

4. Make careful and accurate experimental observations.

5. Relate physical observations and measurements to theoretical principles.

6. Interpret laboratory results and experimental data, and reach logical conclusions.

7. Record experimental work completely and accurately in laboratory notebooks and communicate experimental results clearly in written reports.

8. Design fundamental experiments involving principles of chemistry.

9. Identify appropriate sources of information for conducting laboratory experiments involving principles of chemistry.

**Course Policies and Practices**

There are **no make-up laboratories**.

If you miss a lab due to one of the following five reasons it will be excused. Otherwise, a missed laboratory will result in a zero for that experiment.

Acceptable reasons for missing an experiment are:

1. Illness (with physician’s note)

2. Death of a close family member or friend

3. Religious holiday (preplanned and cleared with instructor in advance)

4. An official University activity (preplanned and cleared with instructor in advance)

5. Cancellation of classes by the University

**Turn in the documentation for the missed laboratory to the Teaching Assistant.**

*Please Note:* The Chemistry Department believes in reasonably accommodating individuals with disabilities and complies with university policy established under Section 504 of the *Rehabilitation Act of 1973* and the *Americans with Disabilities Act (1990)* to provide for equal access and opportunity. Please communicate with your professor as to you specific needs so that the appropriate arrangements/accommodations can be made.

**Course Texts and Materials**

1. Acree, W. E. (2005). *Modern General Chemistry Laboratory: Incorporating Computer-Oriented Data Acquisition and Evaluation Approach into the Student Laboratory Experiment.* Denton, TX: Eagle Image Publishing.
2. Chemical safety glasses or chemical splash goggles that meet ANSI standards must be purchased before the first lab. You can purchase them at the university bookstore or through AΧ∑, the chemistry honor society.

**Grading Practices: Assessments and Assignments**

Your grade will be determined entirely by your performance in the laboratory (completed laboratory reports and TA assessment of safe laboratory practices). This semester 12 laboratory experiments will be performed. The 230 total points in the laboratory are broken down as follows:

Best 11 of 12 Laboratory experiments Points Possible = 11 x 20 = 220

TA Assessment of Safe Laboratory Practices Points Possible = 10

Total: = 230

90 – 100 % of the total points Grade = A

80 – 89 % of the total points Grade = B

70 – 79 % of the total points Grade = C

60 – 69 % of the total points Grade = D

Below 60 % Grade = F

**Laboratory reports must be turned in within one week of when the laboratory experiment is completed. The last laboratory report must be turned in to the TA no later than 5:00 pm on the last day of classes.**

For individuals with a single excused absence, the total possible points in the laboratory will be adjusted appropriately to reflect the one excused absence.

**For students with more than one excused absence, please see the Professor in charge to see if any of the missed work can be made up.**

**Methods of Instruction**

1. Laboratory Work - 75%
   1. Laboratory work is defined as a method of instruction in which students use appropriate tools and instrumentation to experimentally determine results. This work can be either open ended in nature (unknown outcomes) or closed in nature (pre-determined outcomes).
   2. Laboratory work is accomplished by the students under the guidance and supervision of aboratory instructors.
   3. Students will be expected to come to lab ready to participate in the laboratory work and to follow all safety rules.
   4. Students will be expected to listen and respond appropriately to each other's comments.
2. Laboratory Lecture - 25%
   1. Laboratory lecture is defined as pre-laboratory explanation of upcoming lab experiments that the students will accomplish that week.
   2. Lab instructors conduct lab lectures. Pertinent topics include theory behind the experiments, safety issues, and demonstration of new lab techniques.
   3. Students are expected to attend recitation and are expected to listen and implement instructions in the laboratory.

**Class Schedule**

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| --- | --- | --- | --- |
| **General Chemistry I Lab** | **Experiments** | **Texas CCRSs Chemistry** | **Supporting CCRSs** |
| **Lecture Topics (recitation)** |  |  |  |
| Week 2:  Discuss Laboratory Safety Rules and Lecture on Experiment 1 | Laboratory Safety Rules |  | **SCIENTIFIC WAYS OF KNOWING AND LEARNING**  **Collaborative and safe working practices**  **1. Collaborate on joint projects.**  **2. Understand and apply safe procedures in the laboratory and field, including chemical, electrical, and fire safety and safe handling of live or preserved organisms.**  **3. Demonstrate skill in the safe use of a wide variety of apparatuses, equipment, techniques, and procedures.**  **SCIENTIFIC WAYS OF KNOWING AND LEARNING**  **Current scientific technology**  **1. Demonstrate literacy in computer use.**  **2. Use computer models, applications and simulations.**  **3. Demonstrate appropriate use of a wide variety of apparatuses, equipment, techniques, and procedures for collecting quantitative and qualitative data.**  **SCIENTIFIC WAYS OF KNOWING AND LEARNING**  **General Chemistry I Lab Experiments Texas CCRSs CHEMISTRY Supporting CCRSs**  **E. Effective communication of scientific information**  **1. Use several modes of expression to describe or characterize natural patterns and phenomena. These modes of expression include narrative, numerical, graphical, pictorial, symbolic, and kinesthetic.**  **2. Use essential vocabulary of the discipline being studied.**  **MATHEMATICS**  **Interpretation of mathematical work**  **1. Model and interpret mathematical ideas and concepts using multiple representations.**  **2. Summarize and interpret mathematical information provided orally, visually, or in written form within the given context.** |
| Week 3:  Lecture on Experiments 2 and 3 | Experiment 1A: Statistical Analysis on Different Types of Pennies  Experiment 1B: Statistical analysis of the Density of CocaCola® versus Diet Coke® | **A. Matter and its properties**  **1. Know that physical and chemical properties can be used to describe and classify matter.**  **2. Recognize and classify pure substances (elements, compounds) and mixtures.** | **MATHEMATICS**  **E. Scientific application of probability and statistics**  **1. Understand descriptive statistics.**  **MATHEMATICS**  **Measurement Reasoning**  **Measurement involving physical and natural attributes**  **1. Select or use the appropriate type of unit for the attribute being measured.**  **PHYSICS**  **A. Matter**  **General Chemistry I Lab Experiments Texas CCRSs CHEMISTRY Supporting CCRSs**  **1. Demonstrate familiarity with length scales from sub-atomic particles through macroscopic objects.**  **2. Understand states of matter and their characteristics.**  **3. Understand the concepts of mass and inertia.**  **4. Understand the concept of density.**  **5. Understand the concepts of gravitational force and weight.**  **CROSS-DISCIPLINARY THEMES**  **Classification**  **1. Understand that scientists categorize things according to similarities and differences.**  **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATIC**  **F. Scientific measurement**  **1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.** |
| Week 4:  Review Experiment 3 and Lecture on Experiment 4 | Experiment 2: Physical and Chemical Properties of Liquid Compounds | **A. Matter and its properties**  **1. Know that physical and chemical properties can be used to describe and classify matter.**  **2. Recognize and classify pure substances (elements, compounds) and mixtures.** | **MATHEMATICS**  **Measurement Reasoning**  **Measurement involving physical and natural attributes**  **1. Select or use the appropriate type of unit for the attribute being measured.**  **CROSS-DISCIPLINARY THEMES**  **Classification**  **1. Understand that scientists categorize**  **General Chemistry I Lab Experiments Texas CCRSs CHEMISTRY Supporting CCRSs**  **things according to similarities and differences.** |
| Week 5:  Review Experiment 4 and Lecture on Experiment 5 | Experiment 3A: Determination of Simple Empirical Formula and Waters of Hydration  Experiment 3B: Determination of Simple Empirical Formula—Comparison of Red and Black Copper oxide Formulas | **G. The mole and stoichiometry**  **1. Understand the mole concept.**  **2. Understand molar relationships in reactions, stoichiometric calculations, and percent yield.** | **MATHEMATICS**  **Measurement Reasoning**  **Measurement involving physical and natural attributes**  **1. Select or use the appropriate type of unit for the attribute being measured.** |
| Week 6:  No lecture | Experiment 4: Determination of the Molar Mass of a Volatile Liquid | **G. The mole and stoichiometry**  **1. Understand the mole concept.**  **2. Understand molar relationships in reactions, stoichiometric calculations, and percent yield.**  **I. Properties and behavior of gases, liquids, and solids**  **1. Understand the behavior of matter in its various states: solid, liquid, gas.**  **2. Understand properties of solutions.**  **5. Know properties of liquids and solids.** | **MATHEMATICS**  **Measurement Reasoning**  **Measurement involving physical and natural attributes**  **1. Select or use the appropriate type of unit for the attribute being measured.**  **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATIC**  **F. Scientific measurement**  **1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.** |
| Week 7:  Lecture on Experiments 6 and 7 | Experiment 5: Preparation of Alum | **A. Matter and its properties**  **1. Know that physical and chemical properties can be used to describe and classify matter.**  **2. Recognize and classify pure substances (elements, compounds) and mixtures.**  **General Chemistry I Lab Experiments Texas CCRSs CHEMISTRY Supporting CCRSs**  **D. Chemical bonding**  **1. Characterize ionic bonds, metallic bonds, and covalent bonds. Describe the properties of metals and ionic and covalent compounds.** | **MATHEMATICS**  **Measurement Reasoning**  **Measurement involving physical and natural attributes**  **1. Select or use the appropriate type of unit for the attribute being measured.**  **FOUNDATION SKILLS:**  **SCIENTIFIC APPLICATIONS OF MATHEMATIC**  **F. Scientific measurement**  **1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.** |
| Week 8:  No lecture | Experiment 6: Densities of Solids—Identification of Unknown Materials and Density Determinations through Linear Regression Analysis |  | **MATHEMATICS**  **E. Scientific application of probability and statistics**  **1. Understand descriptive statistics.**  **MATHEMATICS**  **Measurement Reasoning**  **Measurement involving physical and natural attributes**  **1. Select or use the appropriate type of unit for the attribute being measured.**  **PHYSICS**  **A. Matter**  **2. Understand states of matter and their characteristics.**  **4. Understand the concept of density.**  **CROSS-DISCIPLINARY THEMES**  **Classification**  **1. Understand that scientists categorize things according to similarities and differences.**  **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATIC**  **1. Select and use appropriate Standard**    **General Chemistry I Lab Experiments Texas CCRSs CHEMISTRY Supporting CCRSs**  **International (SI) units and prefixes to express measurements for real-world problems.** |
| Week 9:  Lecture on Experiment 8 | Experiment 7: Gas Law—Verification of Boyle's Law, Charles' Law and Avogadro's Law | **I. Properties and behavior of gases, liquids, and solids**  **1. Understand the behavior of matter in its various states: solid, liquid, gas.**  **2. Understand properties of solutions.**  **3. Understand principles of ideal gas behavior and kinetic molecular theory.**  **4. Apply the concept of partial pressures in a mixture of gases.**  **5. Know properties of liquids and solids.** | **MATHEMATICS**  **Measurement Reasoning**  **Measurement involving physical and natural attributes**  **1. Select or use the appropriate type of unit for the attribute being measured**  **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATIC**  **F. Scientific measurement**  **1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.** |
| Week 10:  Review Experiment 8 and Lecture on Experiment 9 | Experiment 8: Determination of Cooling Curves for Pure Substances and Mixtures | **I. Properties and behavior of gases, liquids, and solids**  **1. Understand the behavior of matter in its various states: solid, liquid, gas.**  **5. Know properties of liquids and solids.**  **6. Understand the effect of vapor pressure on changes in state; explain heating curves and phase diagrams.**  **H. Thermochemistry**  **1. Understand the Law of Conservation of Energy and processes of heat transfer.**  **General Chemistry I Lab Experiments Texas CCRSs CHEMISTRY Supporting CCRSs**  **2. Understand energy changes and chemical reactions.** | **MATHEMATICS**  **Measurement Reasoning**  **Measurement involving physical and natural attributes**  **1. Select or use the appropriate type of unit for the attribute being measured.**  **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATIC**  **F. Scientific measurement**  **1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.** |
| Week 11:  Lecture on Experiment 10 | Experiment 9: Determination of Molar Mass by Freezing Point Depression | **G. The mole and stoichiometry**  **1. Understand the mole concept.**  **2. Understand molar relationships in reactions, stoichiometric calculations, and percent yield.**  **H. Thermochemistry**  **1. Understand the Law of Conservation of Energy and processes of heat transfer.**  **2. Understand energy changes and chemical reactions.** | **MATHEMATICS**  **Measurement Reasoning**  **Measurement involving physical and natural attributes**  **1. Select or use the appropriate type of unit for the attribute being measured.**  **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATIC**  **F. Scientific measurement**  **1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.** |
| Week 12:  Lecture on Experiment 11 | Experiment 10: Introduction to Calorimetry—Determination of Specific Heats of Solids and Liquids, and Enthalpy of Fusion of Water | **G. The mole and stoichiometry**  **1. Understand the mole concept.**  **2. Understand molar relationships in reactions, stoichiometric calculations, and percent yield.**  **H. Thermochemistry**  **1. Understand the Law of Conservation of Energy and processes of heat transfer.**  **2. Understand energy changes and chemical reactions.** | **MATHEMATICS**  **Measurement Reasoning**  **Measurement involving physical and natural attributes**  **1. Select or use the appropriate type of unit for the attribute being measured.**  **PHYSICS**  **Thermodynamics**  **1. Understand the gain and loss of heat energy in matter.**  **2. Understand the basic laws of thermodynamics.**  **ENVIRONMENTAL SCIENCE**  **Energy**  **1. Understand energy transformations.**  **General Chemistry I Lab Experiments Texas CCRSs CHEMISTRY Supporting CCRSs**  **2. Know the various sources of energy for humans and other biological systems.**  **CROSS-DISCIPLINARY THEMES**  **Energy (thermodynamics, kinetic, potential, and energy transfers)**  **1. Understand the Laws of Thermodynamics.**  **2. Know the processes of energy transfer.**  **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATIC**  **F. Scientific measurement**  **1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.** |
| Week 13:  Lecture on Experiment 12 | Experiment 11A: Calorimetry II—Determination of Heat of Chemical Reactions and Heat of Dissolution  Experiment 11B: Calorimetry III—Determination of Heats of Hydration Based on Hess's Law | **G. The mole and stoichiometry**  **1. Understand the mole concept.**  **2. Understand molar relationships in reactions, stoichiometric calculations, and percent yield.**  **H. Thermochemistry**  **1. Understand the Law of Conservation of Energy and processes of heat transfer.**  **2. Understand energy changes and chemical reactions.** | **MATHEMATICS**  **Measurement Reasoning**  **Measurement involving physical and natural attributes**  **1. Select or use the appropriate type of unit for the attribute being measured.**  **PHYSICS**  **Thermodynamics**  **1. Understand the gain and loss of heat energy in matter.**  **2. Understand the basic laws of thermodynamics.**  **ENVIRONMENTAL SCIENCE**  **Energy**  **General Chemistry I Lab Experiments Texas CCRSs CHEMISTRY Supporting CCRSs**  **1. Understand energy transformations.**  **2. Know the various sources of energy for humans and other biological systems.**  **CROSS-DISCIPLINARY THEMES**  **Energy (thermodynamics, kinetic, potential, and energy transfers)**  **1. Understand the Laws of Thermodynamics.**  **2. Know the processes of energy transfer.**  **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATIC**  **F. Scientific measurement**  **1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.** |
| Week 14:  No lecture | Experiment 12: Introduction to Organic Chemistry—Synthesis of Aspirin and Organic Esters | **J. Basic structure and function of biological molecules: proteins, carbohydrates, lipids, nucleic acids**  **1. Understand the major categories of biological molecules: proteins, carbohydrates, lipids, and nucleic acids.** | **CROSS-DISCIPLINARY THEMES**  **Classification**  **1. Understand that scientists categorize things according to similarities and differences.**  **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATIC**  **F. Scientific measurement**  **1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.** |