

## University of Houston-Downtown

**Course Prefix, Number, and Title:** CHEM 1308: General Chemistry II

**Credits/Lecture/Lab Hours:** 3/0/0

**Foundational Component Area:** Life and Physical Sciences

**Prerequisites:** A grade of C or better in CHEM 1307 and credit or enrollment in CHEM 1108.

**Co-requisites:** None

**Course Description:** The second in a two-course survey of the fundamentals of general chemistry for students majoring in the sciences. Topics include liquids and solids, intermolecular forces, chemical kinetics, thermodynamics, homogeneous, heterogeneous and ionic equilibrium, modern concepts of acids and bases, electrochemistry, coordination chemistry, nuclear chemistry and selected topics.

**TCCNS Number:** CHEM 1312

**Demonstration of Core Objectives within the Course:**

Assigned Core Objective	Learning Outcome Students will be able to:	Instructional strategy or content used to achieve the outcome	Method by which students' mastery of this outcome will be evaluated
Critical Thinking  Empirical & Quantitative Reasoning	Utilize scientific processes to identify questions pertaining to natural phenomena.	1. Hypothesis Testing – students will generate hypothesis questioning the claim in chemical kinetics that “Reaction orders are not necessarily the stoichiometric coefficients of the reactants.”  2. Students will complete online assignments which require the students to examine and solved questions concerning chemical phenomena. The online system used is Mastering Chemistry.  3. Knowledge and Comprehension of Chemical Principles – Students will use scientific processes to solve problems and examine sets of questions regarding chemical phenomena and they will identify the correct answers accordingly.	1. The students will work in teams to collect data to examine the effect of changes in concentration in the determination of reaction orders to test the hypothesis that reaction orders are not the same as reactant coefficients and they must be experimentally determined. Teams will complete a worksheet showing their calculations which will be included in a lab report for grading.  2. The assessment consists of scores calculated based on the number of problems solved correctly per online

		<p>The problems and sets of questions will be based on all the following topics:</p> <ul style="list-style-type: none"> <li>• Solution Chemistry</li> <li>• Intermolecular forces among liquids and solids</li> <li>• Chemical Kinetics</li> <li>• Chemical Equilibrium</li> <li>• Acids and Bases</li> <li>• Aqueous Ionic Equilibrium</li> <li>• Thermodynamics</li> <li>• Electrochemistry</li> <li>• Nuclear Chemistry</li> <li>• Coordination Chemistry</li> </ul>	<p>assignment.</p> <p>3. The knowledge and comprehension of chemical principles will be assessed by the use of a standardized exam prepared by the American Chemical Society. The results of the examination will be compared and analyzed against national norms and statistics, and will be used as an indicator for overall student performance in general chemistry. The use of exams prepared by the ACS is required in the chemistry courses in order to maintain the ACS accreditation for the chemistry degree programs.</p>
<p>Critical Thinking</p> <p>Empirical &amp; Quantitative Reasoning</p>	<p>Utilize scientific processes to develop hypotheses, collect and analyze data using quantitative and qualitative measures.</p>	<p>1. Laboratory experiments - students will perform laboratory experiments in CHEM 1108 to collect data in the laboratory, create graphs, compare quantitative data and draw conclusions about the data obtained.</p> <p>2. Hypothesis Testing: Colligative properties – students will form hypotheses regarding the claim made in Solutions Chemistry regarding “Quantity matters while identity does not”. Student will analyze and use numerical methods to data collected in a group activity.</p>	<p>1. Students will keep a laboratory notebook and learn to record careful observations, draw appropriate conclusions and reflect on what they have learned. The assessment will be carried out by grading lab reports using defined rubrics.</p> <p>2. The students will work in teams to record the temperature of solutions as a function of time. They will graph cooling curves which they will use to determine the cryoscopic constant of</p>

		<p>Example: Molar mass determination of an unknown substance – students will determine the molar mass of an unknown substance. The hypothesis is that it is possible to determine molar masses from the colligative properties of substances when they form solutions.</p>	<p>the solvent. They will utilize the collected data to correctly determine the molar mass of an unknown substance. The students will be provided with the true molar mass and will conclude if the colligative properties are a good measure of molar mass determination. The assessment will consist of pre- and post- assignment quizzes.</p>
<p>Critical Thinking  Empirical &amp; Quantitative Reasoning  Communication</p>	<p>Utilize scientific processes to effectively communicate the analysis and results using written, oral and visual communication.</p>	<p>1. Electrochemical Cell Panel Discussion – Students will design an effective fuel cell or alternative electrochemical cell based on guidelines from the <i>Electrochemical Society</i> (<a href="http://www.electrochem.org/">http://www.electrochem.org/</a>)</p> <p>2. Blackboard Learn Online Discussions – Top student performers from CHEM 1307/1107 will be selected to lead forum discussions on selected chemistry topics via online Blackboard Learn site.</p>	<p>1. Students will design a theoretical fuel cell or alternative electrochemical cell based on guidelines from the Electrochemical Society, follow their plan for one week, and then report their experience. Students will make oral presentations with visual aids which will be assessed using a rubric.</p> <p>2. Blackboard Learn will be used as a platform for students to engage in forum discussions related to the chemistry topics presented in class. Students who earned a grade of B or better will be selected to lead these forum discussions. The level of individual engagement in the discussion will be assessed and assigned a grade.</p>

Teamwork	Collaborate in the evaluation of the quality of scientific evidence from multiple perspectives toward the goal of reaching a shared objective.	<p>1. Chemical Safety – Students will watch a presentation about chemical safety and determine if their safety practices are adequate.</p> <p>2. Professional Ethics in Chemistry: Students will identify one ethical issue in chemistry that can be studied using the scientific method or is the result of scientific misconduct.</p>	<p>1. Student will work in teams to demonstrate examples of best practices in chemical safety.</p> <p>2. Students will write position papers from the perspective of different stakeholders. Position papers will be assessed using a rubric.</p>
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**Additional Course Outcomes:**

Lecture: N/A

Lab:

- Work SAFELY in the laboratory
- Keep an accurate record of laboratory results
- Make careful observations and draw valid conclusions
- Predict the effects of errors on experimental results
- Read laboratory instruments such as a pH meter, a buret, and a spectrophotometer correctly
- Handle liquids, solids, and gases appropriately
- Use correct terminology to describe solutions
- Determine the molar mass of materials using colligative properties of solutions
- Analyze unknown solutions for cations and ions
- Perform titrations with accuracy and precision
- Determine the rate and order of a reaction (reaction kinetics)

**Course Topics**

Lecture:

- Solution Chemistry
- Kinetics
- Equilibrium
- Acid/Base Equilibrium
- Aqueous Ionic Equilibrium
- Thermodynamics Second and Third Laws
- Electrochemistry
- Radioactivity and Nuclear Chemistry
- Organic Chemistry
- Transition Metal Complexes

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Lab

- Lab Safety
- Heat of Neutralization
- Molecular Mass Determination using Freezing Point Depression.
- PROP 344 (continuation)
- KINE 505 – Rate of Reaction
- Chemical Equilibrium
- Standardizing of a Sodium Hydroxide Solution
- Acid/Base Titration
- Determination of pH of strong acid, weak acid, salt and buffer
- Preparing Tetraamine Copper (II) Sulfate
- Monohydrate

**Lecture Grading/Course Content which Demonstrates Student Achievement of Core Objectives:**

<b>Course Grade</b>	<b>A: 90-100</b>	<b>B: 80-89</b>	<b>C: 70-79</b>	<b>D: 60-69</b>	<b>F: 0-59</b>
<b>Summary of Course Exams, Quizzes, Activities, and Final</b>					
	4 Examinations (Final exam grade replaces lowest grade)			50%	
	Mastering General Chemistry			25%	
	1 Final Exam			25%	

**Lab-Grading/Course Content which Demonstrates Student Achievement of Core Objectives:**

<b>Course Grade</b>	<b>A: 90-100</b>	<b>B: 80-89</b>	<b>C: 70-79</b>	<b>D: 60-69</b>	<b>F: 0-59</b>
<b>Summary of Course Exams, Quizzes, Activities, and Final</b>					
	Quizzes			30%	
	Pre-lab Questions			10%	
	Lab Reports/Post Lab Questions			25%	
	Team Projects/Presentations			5%	
	Practical Final Examination			10%	
	Written Final Examination			20%	