



This course supports the assessments for General Chemistry II. The course covers 7 competencies and represents 4 competency units.

Introduction

Overview

Chemistry is the study of matter. Everything you see, and many of the things you don't see, are made up of atoms. By understanding these atoms and their interactions, chemists have been able to cure disease, travel to the moon, and feed a growing world. By understanding chemistry, you will find your own world expanded. You will find boiling water interesting and the back of the shampoo bottle fascinating.

The National Science Teachers Association (NSTA) has published principles and standards addressing important chemistry topics that should be covered through the K-12 curriculum. Many states have followed the NSTA's lead and are increasingly requiring that these concepts be taught to students throughout the course of their science education. A firm grasp of the concepts covered in this course will allow you to confidently teach this material when you enter the classroom.

This course is designed to build on the concepts mastered in General Chemistry I and expand your understanding of chemistry and lab techniques. To master these topics you will utilize online learning resources and a physical lab kit.

Getting Started

General Chemistry II is the second course in a two-part series. In this course, you will learn about the characteristics of solutions, acids and bases reactions, redox, equilibrium, nuclear chemistry, and organic and biochemistry. This course requires strong understanding of dimensional analysis. Completion of the chapter problems in WileyPLUS is essential to your success on the objective assessment. WileyPLUS provides online reading and practice problems. When you submit answers to problems, you will receive immediate feedback and will be directed to the appropriate reading section if additional review is required. Optional videos provide an alternative presentation of the concepts you are expected to know, but these do not replace the reading and practicing on your own.

You will need a scientific calculator for this course. A calculator and whiteboard are allowed on the objective assessment, so please become comfortable using these tools prior to the exam. Course instructors are available to answer questions and discuss concepts.

The General Chemistry II Laboratory should be completed at the same time as General Chemistry II. The lab course will provide hands on experience and real-world examples to supplement the problems from the WileyPLUS learning resource.

Competencies and Objectives



This course provides guidance to help you demonstrate the following 7 competencies:

Competency 217.1.2: Physical States

The graduate applies models to explain the properties and behavior of gases, liquids, and solids and explore the process by which matter changes state.

- Use kinetic molecular theory to distinguish the physical properties of solids and liquids from gases.
- Describe the types and relative strengths of intermolecular forces that can occur between two molecules.
- Describe the relationship between intermolecular forces and the physical properties of the liquid state.
- Given the appropriate heats of fusion and vaporization, calculate the energy required to melt and vaporize a given compound.
- Calculate the energy absorbed or released as a substance progresses along a heating curve.
- List the general properties of gases based on the postulates of the kinetic molecular theory.
- Using the gas laws, perform calculations involving the relationships volume, pressure, and temperature.
- Using the ideal gas law, calculate one condition of a gas given the other stated conditions.

Competency 217.1.3: Aqueous Solutions

The graduate analyses factors that affect the solubility of compounds and the composition and properties of aqueous solutions.

- Describe the forces that interact during the formation of aqueous solutions of ionic compounds, strong acids, and polar molecules.
- Describe the effects of temperature and pressure on solubility of solids and gases in a liquid.
- Perform calculations of concentration involving percent by mass, ppm and ppb.
- Perform calculations involving molarity and the dilution of solutions.
- Perform calculations involving titrations and other solution stoichiometry.
- Explain the differences between nonelectrolytes, strong electrolytes, and weak electrolytes.
- Calculate the boiling and melting points of aqueous solutions of electrolytes and nonelectrolytes.

Competency 217.1.4: Acids, Bases, and Salts

The graduate applies acid-base models to analyze the properties, relative acidities, and



reactions of acids and bases.

- List the general properties of acids and bases.
- Identify the Bronsted acids and bases in a proton exchange reaction.
- Calculate the hydronium ion concentration in a solution of a strong acid and a weak acid given the initial concentration of the acid and the percent ionization of the weak acid.
- Write the molecular, total ionic, and net ionic equations for neutralization reactions.
- Using the ion product of water, relate the hydroxide ion and the hydronium ion concentrations.
- Given the hydronium or hydroxide concentrations, calculate the pH and pOH and vice versa.
- Write a hydrolysis reaction, if one occurs, for salt solutions to determine whether they are acidic or basic.
- Write equations illustrating how a buffer solution can absorb either added acid or base.

Competency 217.1.5: Oxidation-Reduction Reactions

The graduate examines practical applications of redox reactions by analysing, predicting, and balancing oxidation-reduction reactions.

- Using oxidation states, determine the species oxidized, the species reduced, the oxidizing agent, and the reducing agent in an electron exchange reaction.
- Balance redox reactions by the oxidation state (bridge) method.
- Balance redox reactions by the ion-electron (half-reaction) method in both acidic and basic media.
- Using a table of relative strengths of oxidizing agents, determine whether a specific redox reaction is spontaneous.
- Describe the structure and electricity-generating ability of voltaic cells and batteries.
- Write the reactions that occur when a salt is electrolyzed.

Competency 217.1.6: Reaction Rate and Equilibrium

The graduate applies the collision theory to explain how various factors affect the rate and equilibrium of reactions.

- Describe how a chemical reaction takes place on a molecular level by using an energy diagram.
- List the factors that affect the rate of a chemical reaction.
- Using Le Châtelier's principle, predict what effect changing certain conditions will have on the equilibrium point.
- Perform calculations involving the equilibrium constant and equilibrium concentrations.



- Perform calculations involving equilibrium constants and pH for acid-base reactions.
- Perform calculations involving solubility constants and molar solubility.

Competency 217.1.7: Nuclear Chemistry

The graduate evaluates the dangers and benefits of naturally occurring radioactivity and induced nuclear changes.

- Write balanced nuclear equations for the five types of radiation.
- Using half-lives, estimate the time needed for various amounts of radioactive decay to occur.
- Describe how the three natural types of radiation affect matter.
- Describe the methods and units used to detect and measure radiation.
- Write balanced nuclear equations for the synthesis of specific isotopes by nuclear reactions.
- List and describe the beneficial uses of radioactivity.
- Identify the differences between natural radioactivity, nuclear fission, and nuclear fusion.

Competency 217.1.8: Organic and Biochemistry

The graduate analyses the fundamental concepts of organic chemistry and biochemistry.

- Write balanced nuclear equations for the five types of radiation.
- Using half-lives, estimate the time needed for various amounts of radioactive decay to occur.
- Describe how the three natural types of radiation affect matter.
- Describe the methods and units used to detect and measure radiation.
- Write balanced nuclear equations for the synthesis of specific isotopes by nuclear reactions.
- List and describe the beneficial uses of radioactivity.
- Identify the differences between natural radioactivity, nuclear fission, and nuclear fusion.

Teaching Disposition Statement

Please review the [Statement of Teaching Dispositions](#).

Course Instructor Assistance

As you prepare to demonstrate competency in this subject, remember that course instructors stand ready to help you reach your educational goals. As subject matter experts, mentors enjoy and take pride in helping students become reflective learners, problem solvers, and critical



thinkers. Course instructors are excited to hear from you and eager to work with you.

Successful students report that working with a course instructor is the key to their success. Course instructors are able to share tips on approaches, tools, and skills that can help you apply the content you're studying. They also provide guidance in assessment preparation strategies and troubleshoot areas of deficiency. Even if things don't work out on your first try, course instructors act as a support system to guide you through the revision process. You should expect to work with course instructors for the duration of your coursework, and you are encouraged to contact them as soon as you begin. Course instructors are fully committed to your success!

Preparing for Success

The information in this section is provided to detail the resources available for you to use as you complete this course.

Learning Resources

The learning resources listed in this section are required to complete the activities in this course. For many resources, WGU has provided automatic access through the course. However, you may need to manually enroll in or acquire other resources independently. Read the full instructions provided to ensure that you have access to all of your resources in a timely manner.

Manually Enrolled Learning Resources

Do not enroll in the Laboratory Kit resource until you have spoken to your program mentor or course instructor. Your lab kit from General Chemistry I Lab may have already included the General Chemistry II Lab materials. See below for more information on how to determine if this is the case.

Laboratory Kit

The "General Chemistry II" lab kit from Carolina Biologicals is a physical shipment. This lab kit is covered by your program lab fee and is required to complete the performance assessment for General Chemistry II Lab. This kit includes all of the science equipment, supplies, and chemicals necessary to complete the following laboratory experiments at home:

- Engineering a Better Air Bag
- Molar Mass by Freezing Point Depression
- Characteristics of Buffered Solutions
- Developing an Activity Series
- Faster Plop, Plop, Fizz, Fizz
- Equilibrium and Le Chatelier's Principle
- Qualitative Synthesis of Aspirin



Take a moment to check whether the lab kit you received for General Chemistry I Lab also contains materials for the experiments above. If it does, then you already have all of the General Chemistry II Lab materials you need and should not re-enroll in lab resource below. If your General Chemistry I Laboratory kit did not come with the experiments above, then you should go ahead and use the link below to enroll in the General Chemistry II Lab resource separately.

The lab manual with lab instructions can be found using the link below. It can also be found in [Taskstream](#) using the course search feature. The experiments reinforce science content and teach laboratory techniques. At the completion of the course you will have completed the labs required for your final student project.

- [Ordering Your Chem II Lab Course Kit](#)
- [Lab Manual](#)

Automatically Enrolled Learning Resources

You can access the learning resources listed in this section by clicking on the links provided throughout the course. You may be prompted to log in to the WGU student portal to access the resources.

WileyPLUS

The WileyPLUS General Chemistry learning resource is an online course complete with readings, videos, and interactive exercises. Targeted feedback and self-assessment tools, as well as trackable exercises, will help you assess your strengths and quickly address misconceptions. The assignments are designed to guide you through the full course.

The WileyPLUS General Chemistry learning resource utilizes the following e-text:

- Malone, L. J., & Dolter, T. (2013). *Basic concepts of chemistry* (9th ed.). Hoboken, New Jersey: John Wiley & Sons. ISBN-13: 978-0-470-93845-4

Note: These e-texts are available to you as part of your program tuition and fees, but you may purchase hard copies at your own expense through a retailer of your choice. If you choose to do so, please use the ISBN listed to ensure that you receive the correct edition.

Other Learning Resources

You will use the following learning resources for this course.

Formula Sheet

The General Chemistry II objective exam has been designed to measure your understanding of



topics addressed in the course. Successful passage is an indication of your competencies with the topics. To assist in your preparation for the objective exam, please review the equations and periodic table form. This form will be provided during your objective exam, and covers commonly used equations and the periodic table. There is no need to memorize this information. To become more familiar with the resources available to you, please use the form on your pre-assessment.

- [General Chemistry II Formula Sheet](#)

Course Instructor Support

Your course instructor team is prepared to help you reach your educational goals. As subject matter experts, course instructors are fully committed to your success. You are encouraged to contact your course instructor team as soon as you begin the course. Course instructors are able to share study tips and provide guidance in assessment preparation strategies and troubleshoot specific content areas. You can contact the course instructors at the following email: chemistry@wgu.edu

If you would like to schedule an appointment with one of your course instructors, you can do so by accessing the [team calendar](#).

Pacing Guide

The following pacing guide outlines important activities in the course and suggests a weekly structure to pace your completion of the learning activities. The pacing guide is provided as a suggestion and does not represent a mandatory schedule.

Please refer to the [Enhanced Pacing Guide](#) for a comprehensive view of the WileyPLUS General Chemistry learning resources that align to each of the learning outcomes within this course.

If you think you may be ready to take the pre-assessment right away upon starting the course--or if you've already worked through the material and want a way to check your overall test readiness before attempting the pre-assessment or objective assessment--then you'll want to make use of the Chem II Test Prep in WileyPLUS! Checkpoint Quizzes are also available in WileyPLUS to allow you to check your mastery of concepts every 2-3 chapters.

Week 1

- Meet with a CM to discuss requirements and success tips for the General Chemistry II and General Chemistry II Laboratory courses and to talk about when to take the first pre-assessment for General Chemistry II. It is generally not recommended that you take the pre-assessment immediately upon starting a chemistry course. The Chem II Test Prep assignment is a great way to gauge your readiness for the pre-assessment--be sure and talk with a CM about the results if you decide to use it!
- Set up at least one CM appointment every other week for the first month of the course. Adjust as necessary.



- The Nature of the Gaseous State and the Effects of Conditions (WileyPLUS 39 10RA Resources)
 - Complete "Engineering a Better Air Bag" lab for General Chemistry Laboratory II
- The Nature of the Gaseous State and the Effects of Conditions (WileyPLUS 40 10QA Questions)
- The Solid and Liquid States (WileyPLUS 41 11RA Resources)
- The Solid and Liquid States (WileyPLUS 11QA Questions)

Week 2

- The Liquid State and Changes in State (WileyPLUS 43 11RB Resources)
- The Liquid State and Changes in State (WileyPLUS 44 11QB Questions)
- Checkpoint Quiz Chapters 10-11 (WileyPLUS 44)
- Solutions and the Quantities Involved (WileyPLUS 45 12RA Resources)
- Solutions and the Quantities Involved (WileyPLUS 46 12QA Questions)

Week 3

- The Effects of Solutes on the Properties of Water (WileyPLUS 47 12RB Resources)
 - Complete "Molar Mass by Freezing Point Depression" lab for General Chemistry Laboratory II
- The Effects of Solutes on the Properties of Water (WileyPLUS 48 12QB Questions)
- Acids, Bases, and the Formation of Salts (WileyPLUS 49 13RA Resources)
- Acids, Bases, and the Formation of Salts (WileyPLUS 50 13QA Questions)

Week 4

- The Measurement of Acid Strength (WileyPLUS 51 13RB Resources)
 - Complete "Characteristics of a Buffer" lab for General Chemistry Laboratory II
- The Measurement of Acid Strength (WileyPLUS 52 13QB Questions)
- Salts and Oxides and Acids and Bases (WileyPLUS 53 13RC Resources)
- Salts and Oxides and Acids and Bases (WileyPLUS 54 13QC Questions)
- Checkpoint Quiz Chapters 12-13 (WileyPLUS 54)

Week 5

- Redox Reactions (WileyPLUS 55 14RA Resources)
- Redox Reactions (WileyPLUS 56 14QA Questions)
- Spontaneous and Nonspontaneous Redox Reactions (WileyPLUS 57 14RB Resources)
 - Complete "Developing an Activity Series" lab for General Chemistry Laboratory II
- Spontaneous and Nonspontaneous Redox Reactions (WileyPLUS 58 14QB Questions)

Week 6

- Collisions of Molecules and Reactions at Equilibrium (WileyPLUS 59 15RA Resources)
 - Complete "The Scientific Method" lab for General Chemistry Laboratory II



- Collisions of Molecules and Reactions at Equilibrium (WileyPLUS 60 15QA Questions)
- The Quantitative Aspects of Reactions at Equilibrium (WileyPLUS 61 15RB Resources)
- Complete "Equilibrium and Le Chatelier's Principle" lab for General Chemistry Laboratory II
- The Quantitative Aspects of Reactions at Equilibrium (WileyPLUS 62 15QB Questions)
- Checkpoint Quiz Chapters 14-15 (WileyPLUS 62)

Week 7

- Naturally Occurring Radioactivity (WileyPLUS 63 16RA Resources)
- Naturally Occurring Radioactivity (WileyPLUS 64 16QA Questions)
- Induced Nuclear Changes and Their Uses (WileyPLUS 65 16RB Resources)
- Induced Nuclear Changes and Their Uses (WileyPLUS 66 16QB Resources)

Week 8

- Functional Groups (WileyPLUS 67 17RA Resources)
 - Complete "Aspirin Synthesis" lab for General Chemistry Laboratory II
- Functional Groups (WileyPLUS 68 17QA Questions)
- Three Basic Types of Biochemical Compounds (WileyPLUS 69 18RA Resources)
- Three Basic Types of Biochemical Compounds (WileyPLUS 70 18QA Questions)
- Checkpoint Quiz Chapters 16-18 (WileyPLUS 70)

Week 9

- Prepare for Chem II Test (WileyPLUS 71)
- Chemistry II Test Prep (WileyPLUS 72)
- Take the pre-assessment for General Chemistry II

Week 10

- Write the reflective essay for General Chemistry II Laboratory and submit the completed task in Taskstream
- Take the objective assessment for General Chemistry II

Note: This pacing guide does not replace the course. Please continue to refer to the course for a comprehensive list of the resources and activities course for a comprehensive list of the resources and activities

General Chemistry II

This course is designed to provide you with a broad overview of chemistry and a fundamental understanding of basic lab techniques. Topics include the following:

- solid and liquid states
- liquid state and changes in state



- nature of the gaseous state and the effects of conditions
- solution and the quantities involved
- effects of solutes on the properties of water
- acids, bases and the formation of salts
- measurement of acid strength
- salts and oxides and acids and bases
- redox reactions
- spontaneous and nonspontaneous redox reactions
- collisions of molecules and reactions at equilibrium
- quantitative aspects of reactions at equilibrium
- naturally occurring radioactivity
- induced nuclear changes and their uses
- functional groups
- three basic types of biochemical compounds

To master these topics you will utilize online learning resources and a physical lab kit.

Using the WileyPLUS General Chemistry Learning Resource

In this topic you will learn how to navigate and use the WileyPLUS General Chemistry learning resource.

Learning Resource Navigation

When you enter the WileyPLUS General Chemistry learning resource, you will be directed to the Assignment page. Sort the view by name by clicking on the "Assignment" column heading.

Start work on Assignment 38 Welcome to General Chemistry II and work through the assignments sequentially to the end.

During the course you should refer to the pacing guide to be directed to the labs needed for the student project. Save your lab reports and reflective essay for submission in Taskstream at the end of the course.

Access the learning resource by clicking the following link:

- [WileyPLUS General Chemistry](#)

Final Steps

Congratulations on completing the activities in this course! You are now prepared to complete the associated assessment. If you have not already been directed to do so, schedule and complete the assessment now.