This course supports the assessment for General Chemistry I. The course covers 5 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 diseases, 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 curriculums. Many states have followed the NSTA's lead and are increasingly requiring that these concepts be taught to the 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 is the first term of a two-term sequence in chemistry. This course is designed to provide you with a broad overview of chemistry, and a fundamental understanding of basic lab techniques. To master these topics, you will utilize online learning resources and a physical lab kit.

Watch the following welcome video for an introduction to this course:

*Note: To download this video, right-click the following link and choose "Save as...": download video.*

**Getting Started**
General Chemistry I is the first course in a two-part series. In this course, you will learn about the fundamental concepts of general chemistry, including the structure of the atom, dimensional analysis, states of energy and matter, geometry of molecules, and trends on the periodic table. You will learn using WileyPLUS, which involves reading and problem solving. Completion of the chapter problems is essential to your success on the Objective Assessment. 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 white board 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 I Laboratory should be completed at the same time as General

Chemistry I. The labs from the lab course will provide hands-on experience and real-world examples to supplement the problems from the WileyPLUS learning resource.

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

- **Competency 216.1.2: Elements and Compounds**
  The graduate analyzes the structure of atoms and compounds and applies systems for naming compounds.
  - List the postulates of the atomic theory.
  - List the components of an atom and their relative masses, charges, and location in the atom.
  - From the percent abundance of specific isotopes of an element, determine the atomic mass of the element and the number of protons, neutrons and electrons in each isotope.
  - Write the formulas of simple ionic compounds given the charges on the ions.
  - Write the names and formulas of ionic compounds between metals and nonmetals using the IUPAC.
  - Write the names and formulas of compounds containing polyatomic ions.
  - Name binary molecular (nonmetal–nonmetal) compounds using proper Greek prefixes or common names.
  - Write the names and formulas of acids.
- **Competency 216.1.3:  Matter and Energy**
  The graduate applies the principles of measurement and the concepts of matter and energy to solve problems.
  - List several properties of matter and distinguish them as physical or chemical.
  - Perform calculations involving the density of liquids and solids.
  - Perform calculations involving the percent of a pure substance in a mixture.
  - Define terms associated with energy exchanges in physical and chemical processes.
  - Perform calculations involving the specific heat of a substance.
- **Competency 216.1.5: Stoichiometry**
  The graduate determines quantities of materials consumed and produced in chemical reactions using moles and stoichiometry.
  - Calculate the masses of equivalent numbers of atoms of different elements.
  - Define the mole in terms of the numbers of atoms and atomic masses of elements.
  - Perform calculations involving masses, moles, and number of molecules of formula units for compounds.
  - Given the formula of a compound, determine the mole, mass, and percent composition of its elements.
  - Given the percent or mass composition determine the empirical formula and also the molecular formula if the mass is provided.
  - Perform stoichiometry calculations using mole ratios from balanced equations.
  - Determine the limiting reactant and the yield in a reaction given the masses of two different reactants.

    - Calculate the percent yield of a reaction from the measured actual yield and the calculated theoretical yield.
    - Write balanced chemical equations for simple reactions from inspection.
    - Write the ions formed when ionic compounds or acids dissolve in water.
    - Given the activity series, represent several single-replacement reactions with balanced molecular, total ionic, and net ionic equations.
    - Write balanced molecular, total ionic, and net ionic equations for precipitation reactions.
    - Write balanced molecular, total ionic, and net ionic equations for neutralization reactions.
- **Competency 216.1.7: Modern Atomic Theory**
  The graduate applies the modern atomic theory to explain the structure of atoms and periodic trends.
    - Describe how Bohr's model of the atom accounts for observed wavelengths and energies of emission spectra.
    - Describe the electronic structure of an atom, including shells, subshells, and various types of orbitals.
    - Using the periodic table, write the outer electron configuration of the atoms of a specific element.
    - Using orbital diagrams, determine the distribution of electrons in an atom.
    - Using the periodic table, predict trends in atomic and ionic radii, ionization energy, and electron affinity.
- **Competency 216.1.8: The Chemical Bond**
  The graduate predicts the nature of chemical bonds formed between atoms from various elemental groups.
    - Write the Lewis dot symbols of atoms and monatomic ions by following the octet rule.
    - Using the Lewis dot structure and the octet rule, predict the charges on the ions of representative elements and the formulas of binary ionic compounds.
    - Apply the octet rule to determine the number of bonds formed in simple compounds.
    - Draw Lewis structures of a number of molecular compounds and polyatomic ionic compounds.
    - Write multiple Lewis structures for molecules capable of resonance.
    - Determine the validity of a Lewis structure based on formal charge considerations.
    - Classify a bond as being nonpolar, polar, or ionic.
    - Determine the bond angles and geometries present in simple molecules or ions from the Lewis structure.
    - Classify a molecule as polar or nonpolar based on geometry and electronegativity.

**Teaching Dispositions 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**

Take a moment to enroll in the learning resources listed in this section.

**Laboratory Kit**

The "General Chemistry I" 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 assessments for General Chemistry I Lab. This kit includes all of the science equipment, supplies, and chemicals necessary to complete the following laboratory experiments at home:

- Measurement and Uncertainty
- Exploring Physical and Chemical Changes
- Fundamentals of Calorimetry
- Introduction to Molecules: Molecular Bonding and Shapes Investigation
- Investigating Chemical Reactions
- Single Replacement Reactions

The lab manual with lab instructions can be found using the link below. It can also be found in Taskstream and the course search feature. Editable copies of the lab report sheets are also available for download in Taskstream. Save your lab reports for submission in Taskstream at the end of the course. 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 I 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.). John Wiley & Sons. ISBN-13: 978-0-470-93845-4

**Additional Learning Resources**

The General Chemistry I exam is designed to test your understanding and ability to apply concepts from chemistry. The Constants and Formulas for Chemistry I sheet lists examples of information that you are expected to know on the exam.  Please use this form as a guide to what material you will be expected to memorize and what will be provided within the questions. The Periodic Table below is the same as the one that will be available to you as an aid from within the assessment.

- Constants and Formulas for General Chemistry I
- Periodic Table for General Chemistry I

## 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 pacing guide outlines important activities in the course and TSP1 and suggests a weekly structure to pace your completion of learning activities. The pacing guide is provided as a suggestion and does not represent a mandatory schedule.

The following pacing guide is available as a reference to help you plan your studies as you engage with the activities in this course. Follow the pacing guide carefully to complete the General Chemistry I and General Chemistry I Laboratory courses in the suggested timeframe.

Please refer to the Enhanced Pacing Guide for a comprehensive view of the WileyPLUS General Chemistry learning resources that align with 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 Test Prep I Questions 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 I and General Chemistry I Laboratory courses and to talk about when to take the first pre-assessment for General Chemistry I. It is generally not recommended that you take the pre-assessment immediately upon starting a chemistry course. The Test Prep I 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 Numbers Used in Chemistry (WileyPLUS 02 1RA Resources)
    - complete "Measurement and Uncertainty" lab for General Chemistry Laboratory I
- The Numbers Used in Chemistry (WileyPLUS 03 1QA Questions)
- Elements and their Composition (WileyPLUS 04 2RA Resources)
- Elements and their Composition (WileyPLUS 05 2QA Questions)
- Compounds and their Composition (WileyPLUS 06 2RB Resources)
- Compounds and their Composition (WileyPLUS 07 2QB Questions)

**Week 2**

- Properties of Matter (WileyPLUS 08 3RA Resources)
    - complete "Chemical and Physical Changes" lab for General Chemistry Laboratory I
- Properties of Matter (WileyPLUS 09 3QA Questions)
- Properties of Energy (WileyPLUS 10 3RB Resources)
- Properties of Energy (WileyPLUS 11 3QB Questions)

- Checkpoint Quiz Chapters 1-3 (WileyPLUS 11)

**Week 3**

- Relationships Among the Elements and the Periodic Table (WileyPLUS 12 4RA Resources)
- Relationships Among the Elements and the Periodic Table (WileyPLUS 13 4QA Questions)
- Formulas and Names of Compounds (WileyPLUS 14 4RB Resources)
- Formulas and Names of Compounds (WileyPLUS 15 4QB Questions)

**Week 4**

- The Measurement of Masses of Elements and Compounds (WileyPLUS 16 5RA Resources)
- The Measurement of Masses of Elements and Compounds (WileyPLUS 17 5QA Questions)
    - complete " Fundamentals of Calorimetry" lab for General Chemistry Laboratory I
- Component Elements of Compounds (WileyPLUS 18 5RB Resources)
- Component Elements of Compounds (WileyPLUS 19 5QB Questions)
- Checkpoint Quiz Chapter 4-5 (WileyPLUS 19)
- The Representation of Chemical Changes and Three Types of Changes (WileyPLUS 20 6RA Resources)
    - complete "Investigating Chemical Reactions" lab for General Chemistry Laboratory I
- The Representation of Chemical Changes and Three Types of Changes (WileyPLUS 21 6QA Questions)

**Week 5**

- Ions in Water and How They React (WileyPLUS 22 6RB Resources)
- Ions in Water and How They React (WileyPLUS 23 6QB Questions).
- Mass Relationships in Chemical Reactions (WileyPLUS 24 7RA Resources)
    - complete "Replacement Reaction to Stoichiometry" lab for General Chemistry Laboratory I
- Mass Relationships in Chemical Reactions (WileyPLUS 25 7QA Questions)
- Checkpoint Quiz Chapters 6-7 (WileyPLUS 25)

**Week 6**

- The Energy of the Electron in the Atom (WileyPLUS 26 8RA Resources)
- The Energy of the Electron in the Atom (WileyPLUS 27 8QA Questions)
- The Periodic Table and Electron Configuration (WileyPLUS 28 8RB Resources)
- The Periodic Table and Electron Configuration (WileyPLUS 29 8QB Questions)

**Week 7**

- Chemical Bonds and the Nature of Ionic Compounds (WileyPLUS 30 9RA Resources)
- Chemical Bonds and the Nature of Ionic Compounds (WileyPLUS 31 9QA Questions)
- Chemical Bonds and the Nature of Molecular Compounds (WileyPLUS 32 9RB Resources)
- Chemical Bonds and the Nature of Molecular Compounds (WileyPLUS 33 9QB Questions)

**Week 8**

- The Distribution of Charge in Chemical Bonds (WileyPLUS 34 9RC Resources)
    - complete "Bonding and Molecular Geometry" lab for General Chemistry Laboratory I
- The Distribution of Charge in Chemical Bonds (WileyPLUS 35 9QC Questions)
- Checkpoint Quiz Chapters 8-9 (WileyPLUS 35)
- Prepare for Chem I exam for General Chemistry I (WileyPLUS 36)
- Test prep I questions for General Chemistry I (WileyPLUS 37)

**Week 9**

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

**Week 10**

- Take the objective assessment for General Chemistry I

*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.*

# General Chemistry I

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:

- Formulas and Names of Compounds
- Elements and their Composition
- Compounds and Their Composition
- Properties of Energy
- Properties of Matter
- The Representation of Chemical Changes and 3 Types of Changes
- Ions in Water and How They React
- The Measurement of Masses of Elements and Compounds
- Mass Relationships in Chemical Reactions
- Component Elements of Compounds
- The Periodic Table and Electron Configuration

- The Energy of the Electron in the Atom
- Chemical Bonds and the Nature of Ionic Compounds
- Chemical Bonds and the Nature of Molecular Compounds
- The Distribution of Charge in Chemical Bonds

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 the first assignment and work through the assignments sequentially through Assignment 37.

Access the learning resource by clicking the following link:

- WileyPLUS General Chemistry

# Final Steps

Congratulations on completing the activities in this course! This course has prepared you to complete the assessments associated with this course. If you have not already been directed to complete the assessments, schedule and complete your assessments now.