

Course Syllabus
CHEM 103 - General Chemistry I with Lab
4 credits

Prerequisites: High school chemistry (recommended, but not required)

Instructor: Kenneth Hartman, PhD

Facilitator: Rodney Austin, PhD
H Elaine Frey, MHA
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Contact Info: Faculty may be contacted through the Portage messaging system

Course web site address: www.portagelearning.com

Course meeting times: CHEM 103 is offered continuously

Course Description: A systematic exploration of the fundamental laws, theories and mathematical concepts of inorganic, organic and biological chemistry designed to contain comprehensive information needed for health professions study. The laboratory component of this course is delivered using virtual labs and interactive simulations.

Course Outcomes: As a result of this course experience a student should be able to:

- Apply the principles of the scientific method and measurement
- Describe the electron structure and chemical periodicity of atoms
- Name and write formulas for common inorganic compounds
- Perform stoichiometric, thermochemical and molarity calculations
- Determine the bonding, geometry and polarity of molecules and use these to explain the physical properties of these molecules
- Balance simple and redox chemical equations
- Understand gases and perform gas law calculations
- Explain solid and liquid properties and phase diagrams

Lab Outcomes: As a result of this laboratory experience a student should be able to:

- Practice safe procedures in the chemical laboratory
- Perform accurate volume and mass measurement
- Carry out and describe chemical reactions
- Perform gas manipulations and calculations
- Carry out temperature and thermochemical measurements
- Carry out filtration and distillation procedures
- Analyze and apply solubility data

The CHEM 103 student learning outcomes are measured:

- Directly by:
- (1) module application problems (with instructor feedback)
 - (2) exams
 - (3) lab reports and lab exams
 - (4) comparison of pre-course / post-course exam results

Indirectly by an end of course student-completed evaluation survey

Course Delivery: This course is asynchronously delivered online and is composed of 10-15 hours of module assignments, 20-25 hours of video lectures, 10-15 hours of secure online exams, 10-15 hours of demonstration labs, 5-10 hours of lab notebook maintenance, 10-15 hours of written lab reports/exams.

Course Progression: It is the policy for all Portage Learning courses that only one lecture module and the accompanying exam be completed each day. Research on the best practices in learning indicates that time is needed to process material for optimal learning. This means that once an exam has been completed, the next exam will *not* unlock until the following day. This allows for instructor feedback/class expectations as the student moves through the material. Instructors, like the College, are not available during the weekend; grading, therefore, is M-F and may take up to 72 hours during these days. Also, it is the policy of Portage Learning to support a minimum of 21 days; this is not a negotiable time period. Please plan your time accordingly.

Required readings, lectures and assignments: Portage courses do not use paper textbooks. Students are required to read the online lesson modules written by the course author which contain the standard information covered in a typical course. Please note the exam questions are based upon the readings. Video lectures which support each lesson module subject should be viewed as many times as is necessary to fully understand the material.

Module Review Questions: The practice problems within the modules are not quantitatively part of your final grade, but the module work is a pass/fail component of the course and will be reviewed for completeness by the instructor. **Be sure to answer all of the problems, being careful to answer the questions in your own words at all times since this is an important part of adequate preparation for the exams.** After you answer the practice problems, compare your answers to the solutions at the end of the module. If your answers do not match those at the end, attempt to figure out why there is a difference. If you have any questions please contact the instructor via the My Messages tab.

Academic Integrity is a serious matter. In the educational context, any dishonesty violates freedom and trust, which are essential for effective learning. Dishonesty limits a student's ability to reach his or her potential. Portage places a high value on honest independent work. In a distance learning situation, we depend on the student's desire to succeed in the program he or she is entering. It is in a student's own best

interests not to cheat on an exam, as this would compromise the student's preparation for future work. It is required of each student to take exams without consulting course materials or study aids including another person, the lesson pages, printed materials, or the Internet. **Students may not copy and paste responses in the answer boxes from any source, including their own notes or drafts in a word processing document, unless explicitly instructed to do so.** To this end, your instructor will be alert to any indications that a student may be violating this principle. It will be necessary to show all your work on exams. When the nature of the course does not require numerical or symbolic determination (perhaps instead just requires recitation of learned descriptions), our experienced staff is able to detect the unauthorized consultation of study aids when answering exam questions. A violation of the academic integrity policy may result in a score of zero on the exam and possible expulsion from the course, at the discretion of the instructor with consultation with an administrative-instructional committee.

Review the Student Handbook for more specifics. If you have any questions regarding the academic integrity policy, please consult your instructor **prior** to taking module exam one.

Required Computer Accessories: It is recommended that students use a desktop or laptop computer, PC or Mac, when taking the course. Some tablet computers are potentially compatible with the course, but not all features are available for all tablet computers. The latest full version of Google Chrome, Firefox, Edge, or Safari browser is required for the optimal operation of the Canvas Learning Management System. In addition, some courses will use the Respondus Lockdown Browser for exams. Instructions on downloading and installing this browser will be given at the start of the course. It is recommended to also have the latest version of Flash installed as a browser plugin as some sections of the course may require it. We highly recommend using a high-speed Internet connection to view the video lectures and labs. You may experience significant difficulties viewing the videos using a dial-up connection.

For more information on basic system and browser requirements, please reference the following:

System requirements: <https://community.canvaslms.com/docs/DOC-10721-67952720328>

Browser requirements: <https://community.canvaslms.com/docs/DOC-10720>

Modules and Labs

Module 1: This module introduces the science of chemistry by examining its fundamental terminology and measurement system. The metric system is explained, compared to the English customary system and applied. Matter is classified and atomic theory is introduced. The Periodic Table is presented as a foundation for discussion of the elements and their application to the naming of chemical compounds and writing of their formulas.

- Module 2: Chemical reactions are considered in this module including balancing and listing of common types and redox equations. Percent composition and determination of empirical and molecular formulas are presented. The mole concept is explained and applied to stoichiometric equation calculations. Molarity solution concentration is also discussed as an application of the mole concept.
- Module 3: The module begins with a discussion of thermochemistry, including temperature-change and phase-change calorimetry, thermochemical equations, heats of reaction and Hess's Law. This module also contains a detail treatment of the kinetic-molecular theory of gases as an introduction to the presentation of and application of the combined and ideal gas laws and use of these in determination of gas volume stoichiometry. The topic of gases is extended further to include an examination of the law of partial pressures and diffusion and effusion.
- Module 4: This module contains a detail treatment of atomic structure including determination of electron configuration and orbital diagrams. The wave theory of the electron is presented along with the quantum theory of the atom leading to the determination of quantum numbers and use of this material to predict periodic trends in the atomic properties of ionization energy, electronegativity and atomic size.
- Module 5: This module includes a detailed treatment of ionic and covalent intra-molecular bonding and various types of inter-molecular bonding. Lewis structures are discussed and used to determine electron geometry, hybridization and molecular shape. This information is then applied to predict molecular polarity and used to predict physical properties and solubility.
- Module 6: The properties and detailed structure of the liquid and solid phases of matter are studied in this module and used to illustrate and explain phase changes and phase change diagrams of water. Homogeneous and heterogeneous mixtures are illustrated and discussed. Solubility is discussed and applied to explain the solution concentration terms mass percent, molarity and molality. Various colligative properties of solutions are discussed and calculations are done to illustrate these, including the determination of molar mass. Ionization in electrolyte solutions is discussed and used to illustrate the conductivity and special colligative properties of these solutions.
- Lab 1: Safety Equipment. This lab includes a presentation of safety and equipment aspects of the chemistry laboratory as well as an examination of mass and volume measurement. Each of the common items of lab equipment are presented and discussed. Mass measurement is carried out using the various types of balances commonly used in the lab. Volume is measured using cylinders, pipettes and burettes and the accuracy of these devices is compared.

- Lab 2: Chemical Reactions. In this lab, several examples of the six types of chemical reactions are carried out and five types of results are observed during the reactions. The oxidation-reduction of methylene blue indicator is carried out to demonstrate the reversibility of a reaction.
- Lab 3: Quantitative Analysis. This lab examines quantitative chemical analysis by examining two analyses that of a metal carbonate and of a hydrate. The analysis of the metal carbonate is carried out to determine percent CO_2 and used to determine the identity of the metal carbonate. The quantitative analysis of a hydrate is carried out to determine the percent water and used to determine the identity of the metal hydrate. Paper chromatography is performed on an amino acid mixture and used to determine the amino acid components of the artificial sweetener Aspartame. Scanning Electron Microscopy is performed on various materials to determine their qualitative elemental composition and used to determine the identity of two unknown substances.
- Lab 4: Thermochemistry. The heat exchange associated with chemical reactions is examined in this experiment using an instrument called a calorimeter. First, a calorimeter is calibrated and then used to measure the heat exchange of an acid-base reaction. Then a second type of calorimeter is used to measure the heat change for the combustion of a hydrocarbon fuel.
- Lab 5: Gas Law Experiment. This lab covers Boyle's Law, Charles Law, and the Ideal Gas Law. Experiments will explore the pressure-volume relationship and the volume-temperature relationship of gases. Also, the ideal gas law will be used to predict the molar mass of a gas.
- Lab 6: Bonding and Properties. In this lab, a variety of organic compounds are compared in regard to water solubility, boiling points determined by distillation and Infrared spectra to determine what types of inter-molecular and intra-molecular bonding might be present in those materials. The types of materials studied are ionic, polar, no-polar, hydrogen-bonding.
- Lab 7: Molality/Colligative Property Experiment. In this experiment, the properties of solutes dissolved in a solvent will be covered. First, the calculation of molality, m , is covered using two salts to demonstrate. Next, the two salts are investigated for their ability to lower the temperature of ice. Preparation of ice cream is used to show the differing impact of the two salts on lowering the melting point of ice.
- Lab 8: Molar mass. In this experiment, colligative properties are used to determine the molar mass of a compound. Solute tend to lower the freezing point of a solvent with more solutes lowering the freezing point to a greater degree. The freezing point of a pure solvent is determined and then compared to that of the solvent with a solute. The molar mass of the solute is estimated from the freezing point difference.

Required Labs and Assignments:

For the laboratory portion of the course, students will observe an experienced lab instructor. **It is the responsibility of the student to view each lab video in its entirety** and only mark the lab as “done” when it is completed. Do not open all the labs at once; otherwise, they may be reset at the discretion of the instructor. Students are encouraged to keep a lab notebook while watching the videos. The lab notebook, alone, can be used as a resource to the student while taking their lab exam(s). Please note that the use of outside material (i.e. the internet, textbooks, articles, etc.) is not permitted while taking the lab exams. A recommended lab schedule can be found on the home page of each lab; the student should follow this schedule to meet course objectives.

Additional Tools

A built-in **scientific calculator** for the course has been incorporated into the website and can be found in the tool bar above each module and exam page. If you choose to purchase a calculator, keep in mind that you do not need to purchase an expensive calculator as the features you will need are available on basic scientific calculators with a cost of less than \$20. Many mobile phones also include a scientific calculator and you may use a calculator during any exam.

Suggested Timed Course Schedule (to complete the course within a typical college semester)

All Portage courses are offered asynchronously with no required schedule to better fit the normal routine of adult students, but the schedule below is suggested to allow a student to complete the course within a typical college semester. Despite this suggestion, the student may feel free to complete the course at their desired pace and on a schedule determined by them.

<u>Time Period</u>	<u>Assignments</u>	<u>Subject Matter</u>
Days 1-15	Module 1, Exam 1	Matter, metric measurements, atomic theory, periodic table, naming and writing of formulas
	Labs 1, Lab Exams 1	Safety/Mass/Volume
Days 16-30	Module 2, Exam 2	Balancing/writing molecular and ionic reactions, redox balancing, molarity, stoichiometric calculations, percent composition, empirical formula
	Lab 2, Lab Exams 2	Reaction Chemistry
	Lab 3, Lab Exam 3	Quantitative Analysis
Days 31-46	Module 3, Exam 3	Thermochemistry, Gas laws
	Lab 4, Lab Exam 4	Thermochemistry
	Lab 5, Lab Exam 5	Gas laws

Days 47-62	Module 4, Exam 4 Lab 6, Lab Exam 6	Quantum theory of atoms, electron configuration, periodic table, periodic properties Bonding by Spectroscopy and Physical Properties
Days 63-78	Module 5, Exam 5 Lab 7, Lab Exam 7	Ionic and molecular bonding, octet rule, Lewis structures, molecular geometry Molality / Colligative Properties
Days 79-93	Module 6, Exam 6 Lab 8, Lab Exam 8	States of matter, solutions, colligative properties Molar mass
Days 94-108	Final Exam	Comprehensive - including all course material

Grading Rubric:

6 Module exams = 100 pts. each x 6 =	600 pts.
8 Lab exams = 30 pts each x 8 =	240
<u>Final exam = 120 pts.</u>	<u>120 pts.</u>
Total	960 pts.

The current course grade and progress is continuously displayed on the student desktop.

Grading Scale:

89.5% - 100% (859 - 960 pts)	= A
79.5% - 89.4% (763 - 858 pts)	= B
69.5% - 79.4% (667 - 762 pts)	= C
59.5% - 69.4% (571 - 666 pts)	= D
<59.4% (< 570 pts)	= F

Suggested External References:

If the student desires to consult a reference for additional information, the following textbooks are recommended as providing complete treatment of the course subject matter.

- Jean Umland, **General Chemistry**, West Publishing
- Darrell Ebbing, **General Chemistry**, Houghton Mifflin Publishing

Learning Support Services:

Each student should be sure to take advantage of and use the following learning support services provided to increase student academic performance:

Video lectures: Supports diverse learning styles in conjunction with the text material of each module

Messaging system: Provides individual instructor/student interaction

Tech support: Available by submitting a help ticket through the student dashboard

Accommodations for Students with Learning Disabilities:

Students with documented learning disabilities may receive accommodations in the form of an extended time limit on exams, when applicable. To receive the accommodations, the student should furnish documentation of the learning disability at the time of registration, if possible. Scan and e-mail the documentation to studentservices@portagelearning.com. Upon receipt of the learning disability documentation, Portage staff will provide the student with instructions for a variation of the course containing exams with extended time limits. This accommodation does not alter the content of any assignments/exams, change what the exam is intended to measure or otherwise impact the outcomes of objectives of the course.

One-on-one Instruction

Each student is assigned to his/her own instructor. Personalized questions are addressed via the student dashboard messaging system.

Online learning presents an opportunity for flexibility; however, a discipline to maintain connection to the course is required; therefore, communication is essential to successful learning. **Check your messages daily.** Instructors are checking messages daily Monday-Friday to be sure to answer any questions that may arise from you. It is important that you do the same so you do not miss any pertinent information from us.

Holidays:

During the following holidays, all administrative and instructional functions are suspended, including the grading of exams and issuance of transcripts.

New Year's Day

Easter

Memorial Day

Independence Day

Labor Day

Thanksgiving weekend

Christmas Break

The schedule of holidays for the current calendar year may be found under the Student Services menu at www.portagelearning.com

Code of Conduct: Students are expected to conduct themselves in a way that supports learning and teaching and promotes an atmosphere of civility and respect in their interactions with others. Verbal and written aggression, abuse, or misconduct is prohibited and may be grounds for immediate dismissal from the program.

This is a classroom; therefore, instructors have the academic freedom to set forth policy for their respective class. Instructors send a welcome e-mail detailing the policy of their class, which students are required to read prior to beginning the course.

Grievances: If for any reason a student has a complaint about the course work or the instructor, the student is advised to first consult the instructor, who will be willing to listen and consider your concern. However, if you don't feel you have received a satisfactory reply, you are encouraged to contact the Academic Dean of Portage Learning for further consideration of your complaint. The formal grievances process must be initiated via written communication. If desired, please file a written grievance to academics@portagelearning.com to initiate the process.

Remediation: At Portage Learning we allow a "one-time" only opportunity to re-take an alternate version of **one** module exam on which a student has earned a grade lower than 70%. This option must be exercised before the final exam is started. If an exam is retaken, the original exam grade will be erased and the new exam grade will become a permanent part of the course grade. However, before scheduling and attempting this retest, the student must resolve the questions they have regarding the material by reviewing both the old exam and the lesson module material. Once ready to attempt the retest of the exam they must contact their instructor to request that the exam be reset for the retest. Remember, any module retest must be requested and completed **before** the final exam is opened.

Note: Exams on which a student has been penalized for a violation of the academic integrity policy may not be re-taken.