

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

**Instructor:** Kenneth Hartman, PhD  
Rodney Austin, PhD  
Heather Dorman, PhD  
H. Elaine Frey, MHA  
Kathy Austin, MEd  
Jessica Schiren, MS, MEd

**Contact Information:** Faculty may be contacted through the Canvas messaging system

**Additional Information:** [www.portagelearning.com](http://www.portagelearning.com)\*

**Course meeting times:** CHEM 121 is offered continuously

**Course Description:** A single-semester, comprehensive 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 with detailed instruction and demonstrations from an experienced chemist.

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

- Perform basic scientific and measurement calculations.
- 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
- Predict the effect of various stresses on chemical equilibria
- Explain acid/base properties and perform pH and titration calculations
- Describe the structures and properties of simple organic compounds and name or write formulas for these compounds
- Predict and describe the typical reactions of simple organic compounds
- Recognize the structures of carbohydrates, lipids, proteins and nucleic acids and their building-block molecules

\*Please see the *Module & Lab Topics* section below for expanded course outcomes.

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\* Portage Learning college courses are offered by Geneva College, which is regionally accredited by the Middle States Commission on Higher Education. Portage Learning is included in the College's Department of Professional and Online Graduate Studies; courses are delivered through the [PortageLearning.com](http://PortageLearning.com) platform.

**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
- Carry out extraction and distillation procedures
- Perform pH measurements
- Carry out acid-base titrations
- Carry out organic and inorganic synthesis
- Perform qualitative and quantitative analyses

The CHEM 121 student learning outcomes are measured:

Directly by: (1) Module application problems (with instructor feedback)  
(2) Module exams  
(3) Lab reports and lab exams  
(4) Cumulative final exam

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.

**Required Computer Accessories:** It is recommended that students use **a desktop or laptop computer, PC or Mac, and working webcam, when taking the course.** Some tablet computers are potentially compatible with the course, but not all features are available for all tablet computers; iPads are not compatible as the full version of Google Chrome cannot be downloaded on them.

**Honorlock will proctor your exams this semester.** Honorlock is an online proctoring service that allows you to take your exam from the comfort of your home. You DO NOT need to create an account, download software or schedule an appointment in advance. Honorlock is available 24/7 and **all that is needed is a computer, a working webcam, stable Internet connection, quiet location and good lighting.** Additionally, if you are using a desktop, you may need to use your cell phone to complete the initial room scan and show that you have turned it off and place it behind you prior to beginning the exam.

To get started, you will need Google Chrome and to download the Honorlock Chrome Extension. You can download the extension at [www.honorlock.com/extension/install](http://www.honorlock.com/extension/install). When you are ready to test, log into Canvas, go to your course, and click on your exam. Clicking "Launch Proctoring" will begin the Honorlock authentication process, where you will take a picture of yourself, show your ID, and complete a scan of your room. Honorlock will be recording your exam session by webcam as well as recording your screen. Honorlock also has an integrity algorithm that can detect search-engine use, so please do not attempt to search for answers, even if it's on a secondary device.

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>

**Course Progression:** It is the policy for all Portage Learning courses that only one module (lecture) exam is to be completed within a 48-hour period. 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 may not be opened or taken until 48 hours after the submission of the previous module exam. 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 to complete a course; this is not a negotiable time period. Please plan your time accordingly.

**Note:** Professors reserve the right to reset any exam taken in violation of these guidelines.

**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 at the bottom of each module section and the problem sets at the end of the modules are not quantitatively part of your final grade, but the module work is a pass/fail component of the course. Only the problem sets will need to be submitted and reviewed for completeness by the instructor. **Be sure to answer all 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 underneath. After you answer and submit the problem sets, re-open them and compare your answers to the answer key. If your answers do match the solutions provided, attempt to figure out why there is a difference. If you have any questions, please contact the instructor via the Canvas messaging system (see Inbox icon).

**NOTE:** Module review questions are not an option or a choice; they are required. This means that you must complete all the review questions within the modules. Not only are review questions class participation, they are the best way to prepare for the exams. **Instructors have the option to either not grade your exams until these are completed, or to deduct points from the related exam if blank modules are repeatedly submitted.**

**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 reference or use outside materials from any source, including their own notes or drafts in a word processing document, except for the use of lab notebooks during lab exams only. The Periodic Table provided by the course is the only Periodic Table that should be used throughout the course and on exams. Additionally, as we are required to evaluate the mastery of the material presented in this course, the use of content/processes/methods from a previous course will be considered as the use of an outside resource.** It will be necessary to show all your work on exams.

A violation of the academic integrity policy will result in a 10 point deduction per question for the first offense, a "0" on the entire exam for the second offense, and possible expulsion from the course following review by the instructor in consultation with an administrative-instructional committee for the third offense.

If students have questions about this policy, they should contact their instructor. Failure to understand this policy regarding violations of academic integrity will not excuse any student from its consequences. In the enforcement of the policy, **no notification is required between occurrences**. If three occurrences are found in your course prior to your instructor grading your work, each occurrence will be treated as an individual case, and the enforcement will apply as shown above.

**For example:** If you take two exams before your instructor has time to review your work and there are violations on both exams, you will receive a 10 point deduction per question involved in the first exam, and a zero for the second exam. If you have any question about the work you submitted, we recommend that you wait until your instructor has had time to grade your exam prior to taking another one.

**Please consult the course introductory material in the Canvas learning management system for further information on course policies.** If you have further questions regarding the academic integrity policy, please consult your instructor prior to taking module exam one.

## **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 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. This module also contains a detailed 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 4: 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 5: This module contains a detailed examination of kinetics including calculation of reaction rate and its use to determine rate constants and reaction order. Radioactive decay is examined as an example of first order reactions. Collision theory is introduced leading to examination of energy of activation, transition state, reaction spontaneity, heat of reaction, catalysis and enzymes. Reversible reactions are examined so as to discuss equilibrium reactions and determination and use of the equilibrium constant and LeChatelier's principle.
- Module 6: This module contains an extensive treatment of acid-base chemistry beginning with terminology definitions and a discussion and application of the three most common acid-base theories. Relative acid and base strengths are predicted, and types of reactions of acids and bases are considered. pH is defined and determined. Acid-base titration calculations are carried out and expanded to include titration curves and their use to determine endpoints and indicator choice. Weak acid/weak base equilibria are examined and applied to determine pH and percent ionization and extended to explain the effect of acid-base buffers.
- Module 7: This module presents the chemistry of organic compounds beginning with a review of the structure and nomenclature of the four types of hydrocarbons and continuing with structure and nomenclature of nine other common functional group types. The five most common types of organic reactions are listed and discussed. Organic structure determination by spectroscopic analysis is examined including SEM/EDS qualitative elemental analysis, Mass Spectrum

analysis for molecular weight, Infrared (IR) analysis for the presence of certain functional groups and Nuclear Magnetic Resonance ( $^1\text{H}$ -NMR) analysis for H arrangement.

- Module 8: This module includes an examination of biochemistry and nuclear chemistry. The structures and functions of each of the four main classes of biochemical materials (carbohydrates, lipids, proteins and nucleic acids) are presented. The nuclear chemistry section begins with an examination of nuclear particles and their involvement in the balancing of the five types of radioactive decay reaction equations or transmutation reaction equations. This section concludes with a treatment of nuclear half-life processes and mass-energy conversion and binding energy calculations.
- Lab 1: 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 is 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: In this lab, mass and volume measurement are carried out and used to determine the density of many solid and liquids and some materials of biological interest. The determined densities are compared to known values to introduce the concepts of percent error and average deviation.
- Lab 3: This lab examines quantitative and qualitative chemical analysis. The quantitative analysis of a metal carbonate is carried out to determine percent  $\text{CO}_2$  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: 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 5: In this lab, a variety of organic compounds are compared as to their 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, non-polar, hydrogen-bonding.

- Lab 6: In this lab, equilibrium reactions are studied quantitatively by first determining the equilibrium constant for the acid-catalyzed esterification of acetic acid with 1-propanol. Then seven reversible reactions are studied to demonstrate the shifting of these equilibrium reactions according to LeChatelier's principle.
- Lab 7: In this lab, six acid-base titrations are carried out for various purposes. (1) The first titration is a weak acid- strong base titration between potassium biphthalate and sodium hydroxide solution for the purpose of standardizing the NaOH. (2) The standard NaOH is then used in another weak acid- strong base titration between vinegar and the NaOH to determine the percent acetic acid in the vinegar. (3) The standard NaOH is then used in a strong acid- strong base titration between a HCl solution and the NaOH to standardize the HCl solution. (4) The standard HCl is then used in a strong acid- weak base titration between household ammonia and the HCl to determine the percent ammonia in the cleaning solution. (5) The standard HCl and standard NaOH are also used in a back-titration procedure between antacid tablets and the HCl to determine the percent  $\text{CaCO}_3$  in the antacid tablet. Lastly, the standard NaOH is used in a titration of acetic acid by pH meter to construct a titration curve to determine the  $K_a$  of acetic acid and demonstrate the suitability of phenolphthalein as an indicator for the titration.
- Lab 8: In this lab organic synthesis is demonstrated as three syntheses are carried out from available precursors. Aspirin is synthesized from salicylic acid and the product's structure is confirmed by chemical test, melting point and Infrared spectroscopy. Urea is synthesized from ammonium cyanate and the product's structure is confirmed by melting point and Infrared spectroscopy. Salicylic acid is synthesized from oil of Wintergreen and the product's structure is confirmed by chemical test, melting point and Infrared spectroscopy. In all syntheses, percent yields are determined.
- Lab 9: In this lab inorganic synthesis is demonstrated as three syntheses are carried out from available precursors. Alum is synthesized from scrap aluminum foil and the product's structure is confirmed by melting point and Infrared spectroscopy. Calcium carbonate is synthesized by mixing solutions of sodium carbonate and calcium chloride and the product's structure is confirmed by Infrared spectroscopy. Zinc iodide is synthesized by a combination reaction between zinc and iodine and the product's structure is confirmed by Infrared spectroscopy. In all syntheses, percent yields are determined.
- Lab 10: In this lab, six qualitative chemical tests are performed on a simulated urine sample to demonstrate urinalysis. The tests performed are for calcium, chloride, ammonium, protein, sugar and ketones.

### 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. A lab notebook template is provided in the course introductory materials in Canvas. Students are required to keep a lab notebook using this template and submit it before taking the lab exam. The lab notebook submission is not quantitatively part of your final grade, but it is a pass/fail component of the course. 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:

The only calculator that is permitted during an exam is the one that is provided in the course introductory materials and within the exam. It would be wise to familiarize yourself with this calculator and use it for both the practice problems and module problem sets. A tutorial is also provided in the course introductory material. You are allowed to copy and paste your answers from the calculator into the answer boxes. If you have any questions regarding how to input numbers or perform certain calculations, please contact your instructor for assistance before moving forward in the course.

### Grading Rubric:

Check for Understanding	1 pts.
8 Module exams = 100 pts. each x 8 =	800 pts.
10 Lab Exam/Reports = 30 pts each x 10 =	300 pts.
<u>Final exam = 160 pts.</u>	<u>160 pts.</u>
Total	1261pts.

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

### Grading Scale:

89.5% - 100% (1129 - 1261 pts)	= A
79.5% - 89.4% (1003 - 1128 pts)	= B
69.5% - 79.4% (877 - 1002 pts)	= C
59.5% - 69.4% (751 - 876 pts)	= D
<59.4% (<751 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](mailto: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 Canvas 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.

### Student Help Line:

Portage students have access to our help-line phone service. The phone service is staffed by instructors who will answer questions regarding material in those courses. Please call 1-888-724-3590 and choose option #2 if you would like assistance with your course work. Due to high call volume, we cannot guarantee that your call can be answered immediately so you may be required to leave a voicemail. The help-line instructors will return the voicemails as soon as possible and within one business day. If the hours above do not fit your personal schedule, please leave a message on the help line voicemail requesting an appointment. In the voicemail,

please leave several dates and times convenient for a return call. If a help line representative cannot call you at one of your preferred times, you will be contacted to set up a mutually suitable time. Appointment slots are limited and will be granted as instructor time becomes available and at the discretion of the help line instructor. No appointments will be scheduled for Sunday.

### Help Line Hours

Mon - Fri: Noon - 9 PM ET

Sat: 9 AM - 11 AM ET

Sun: Closed

### 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](http://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. Class policies for individual instructors can be found in the course introductory material in Canvas. Students are required to read these policies 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, contact the Academic Review Committee of Portage Learning for further consideration. The formal grievances process must be initiated via written communication. If desired, please file a written grievance to [academics@portagelearning.com](mailto: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.