



## Course Syllabus

### **CHEM 1407 – Introduction to Chemistry II**

*Revision Date: 8/21/2014*

**Catalog Description:** Introduction to Chemistry II is an introductory course in inorganic chemistry that relates the principles and concepts of chemistry to man and his environment. This course is a basic introduction to chemistry, with chemical calculations, making it appropriate for health science students.

**Lecture hours = 3 Lab hours = 3**

**Prerequisites:** CHEM 1405

**Semester Credit Hours:** 4

**Lecture Hours per Week:** 3

**Lab Hours per Week:** 3

**Contact Hours per Semester:** 112

**State Approval Code:** 40.0501.51 03

#### **Core Components and Related College Student Learning Outcomes**

This course counts as part of the academic requirements of the Panola College Core Curriculum and an Associate of Arts or Associate of Science degree.  Yes  No: If no, skip to Instructional Goals.

The items below marked with an X reflect the state-mandated outcomes for this course **IF this is a CORE course:**

- Critical Thinking Skills – to include creative thinking, innovation, inquiry and analysis, evaluation and syntheses of information
  - CT1: Generate and communicate ideas by combining, changing, or reapplying existing information
  - CT2: Gather and assess information relevant to a question
  - CT3: Analyze, evaluate, and synthesize information
- Communication Skills – to include effective development, interpretation, and expression of ideas through written, oral, and visual communication
  - CS1: Develop, interpret, and express ideas through written communication
  - CS2: Develop, interpret, and express ideas through oral communication
  - CS3: Develop, interpret, and express ideas through visual communication
- Empirical and Quantitative Skills – to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions
  - EQS1: Manipulate and analyze numerical data and arrive at an informed conclusion
  - EQS2: Manipulate and analyze observable facts and arrive at an informed conclusion
- Teamwork – to include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal

- TW1: Integrate different viewpoints as a member of a team
- TW2: Work with others to support and accomplish a shared goal
- Personal Responsibility – to include the ability to connect choices, actions, and consequences to ethical decision-making
  - PR1: Evaluate choices and actions and relate consequences to decision-making
- Social Responsibility – to include intercultural competence, knowledge of civic responsibility, and the ability to engage effectively in regional, national, and global communities
  - SR1: Demonstrate intercultural competence
  - SR2: Identify civic responsibility
  - SR3: Engage in regional, national, and global communities

### **Instructional Goals and Purposes:**

Chemistry 1407 is the second semester of a two semester introductory course in chemistry for non-science majors. This course is the continuation of fundamental concepts in chemical language and applications. The material for this course assumes a background in chemical nomenclature, equation writing, and simple stoichiometric calculations involving reacting masses, moles and gas volumes as related by balancing chemical equations. Familiarity with molecular structure and typical descriptive chemistry is desirable. This second semester includes extensive units on organic and biochemical nomenclature and applications. Chemistry 1407 has a required laboratory component that forms an important portion of this study. Most of the experiments for the lab will be selected from the manual that accompanies the text. Experiment results will be reported in forms found in the lab manual.

### **General Course Objectives:**

1. Understand and be able to explain the general principles, laws, and theories of chemistry that are discussed and presented throughout the semester
2. Use critical thinking and logic in the solution of problems
3. Apply learned chemistry skills to new situations
4. Demonstrate an understanding of chemistry through technological advancement
5. Apply chemical principles in the laboratory setting
6. Develop independent and cooperative learning skills
7. Recognize and acquire attitudes that are characteristic of the successful worker regardless of the major field of study
8. Develop an awareness of the value of chemistry in our daily living

### **Learning Outcomes:**

After studying all materials and resources presented in the course, the student will be able to:

1. Identify the characteristic properties of organic or inorganic compounds.
2. Write IUPAC names and draw structures of organic compounds.
3. Classify organic molecules according to their functional groups.
4. Name products of basic organic reactions.
5. Explain the differences in the properties of alcohols, phenols, and ethers.
6. Identify chiral and achiral carbon atoms in an organic molecule.

7. Use Fischer projections to draw D or L stereoisomers of sugars.
8. Explain the differences in the properties of monosaccharides, disaccharides, and polysaccharides.
9. Describe the properties of an ester.
10. Describe the classes of lipids.
11. Draw structures of fatty acids, waxes, and triacylglycerols.
12. Describe the structure of phospholipids and steroids.
13. Describe the composition and function of the lipid bilayer in cell membranes.
14. Describe the properties of amines.
15. Classify proteins by their functions.
16. Describe the hydrolysis and denaturation of proteins.
17. Describe, classify and name enzymes.
18. Describe the properties of enzymes.
19. Describe the properties, functions, and processes of DNA and RNA.
20. Describe the stages of metabolism.
21. Describe the functions and processes of metabolic pathways, digestion and other related metabolic conversions.
22. Describe the citric acid cycle.
23. Describe all metabolic pathways for lipids and amino acids.

**Course Content:**

Students in all sections of this course will learn the following content:

1. Draw electron dot structures of simple alkanes to illustrate that carbon forms four covalent bonds.
2. Recognize structural, condensed, and molecular formulas of the continuous chain hydrocarbons containing up to twelve carbon atoms.
3. Given the structural formula of an alkane, name it according to IUPAC rules.
4. Given the IUPAC name of an alkane, draw its structural formula.
5. Name and draw structural isomers of hydrocarbons.
6. Name and draw structural formulas of cycloalkanes.
7. Tell whether a hydrocarbon is saturated or unsaturated.
8. Identify cis and trans geometric isomers.
9. Describe the bonding, chemical properties, and structure of benzene.
10. Name and draw structures of simple aromatic compounds.
11. Define a functional group.
12. Name and draw structures of simple halocarbons.
13. Contrast an addition reaction of an alkene to a substitution reaction with benzene.
14. Name and draw structures of alcohols, glycols, and phenols.
15. Identify an alcohol as being primary, secondary, or tertiary.
16. Identify the uses of some common alcohols and illustrate the synthesis of alcohols by addition and displacement reactions.
17. Explain the behavior of alcohols and phenols as weak acids.
18. Name and draw structures of ethers and illustrate the synthesis of an ether

- from a halocarbon and an alkoxide ion.
19. Relate trends in boiling point and solubility to the molecular structure of hydrocarbons, halocarbons, alcohols, and ethers.
  20. Identify names, structures, and uses of some common thiols, thioethers, and disulfides.
  21. Define a polyfunctional molecule and recognize the functional groups on a given polyfunctional molecule.
  22. Name and draw structures of simple aldehydes and ketones.
  23. Describe the carbon-oxygen bond of the carbonyl group of aldehydes and ketones.
  24. Explain how the intermolecular interactions of the carbonyl group affect the boiling point and water solubility of aldehydes and ketones.
  25. Relate the energy content of a molecule to its degree of oxidation or reduction.
  26. Describe the process of oxidation and reduction in organic chemistry in the terms of the loss or gain of oxygen, hydrogen, or electrons.
  27. Write structures for the products (if any) of the oxidation of primary, secondary, and tertiary alcohols.
  28. Describe the results of Tollens' or Benedict's test on an aldehyde, a ketone, and an alpha-hydroxy ketone.
  29. Illustrate with equations the formations of a hydrate, a hemiacetal and an acetal, and a hemiketal and a ketal.
  30. State the names and uses of some important aldehydes and ketones.
  31. Name and draw structures of simple aldehydes and ketones.
  32. Describe the carbon-oxygen bond of the carbonyl group of aldehydes and ketones.
  33. Explain how the intermolecular interactions of the carbonyl group affect the boiling point and water solubility of aldehydes and ketones.
  34. Relate the energy content of a molecule to its degree of oxidation or reduction.
  35. Describe the process of oxidation and reduction in organic chemistry in the terms of the loss or gain of oxygen, hydrogen, or electrons.
  36. Write structures for the products (if any) of the oxidation of primary, secondary, and tertiary alcohols.
  37. Describe the results of Tollens' or Benedict's test on an aldehyde, a ketone, and an alpha-hydroxy ketone.
  38. Illustrate with equations the formations of a hydrate, a hemiacetal and an acetal, and a hemiketal and a ketal.
  39. State the names and uses of some important aldehydes and ketones.
  40. Name and draw the structures of simple aliphatic and aromatic amines.
  41. Classify an amine as primary, secondary, or tertiary.
  42. Name and draw the structures of common aliphatic and aromatic heterocyclic amines.
  43. Show, with equations, how amines act as weak bases.
  44. Name and draw the structures of a quaternary ammonium salt.
  45. Name and draw the structures of simple amides.
  46. Write equations for the preparation of amides from ammonium salts and carboxylic acid derivatives.
  47. Predict the products of the hydrolysis of an amide.
  48. Define the terms: analgesic, antihistamine, antipyretic, decongestant, hallucinogen, hypnotic, opiate, sedative.
  49. Recognize compounds of biochemical significance, including catecholamines, alkaloids, and barbiturates.
  50. Classify a carbohydrate as a monosaccharide, disaccharide, or polysaccharide; as a triose, tetrose, pentose, or hexose; as an aldose or a ketose. Also, give the name and structures of common structures.

51. Use the term asymmetric carbon and stereoisomer to explain what is meant by the handedness of a molecule.
52. Interpret two-dimensional Fischer projection formulas of sugars as three dimensional structures.
53. State whether a sugar is in the D or L form by looking at its Fischer projection formula.
54. Draw Haworth projections of common simple sugar.
55. Classify simple sugars as an alpha or beta anomer; as a pyranose or a furanose and as a hemiacetal or a hemiketal.
56. Explain the interconversion of closed-chain forms of sugars.
57. Describe the formation of glycosidic bonds and the products of their hydrolysis.
58. List the structure, sources, and uses of these polysaccharides: starch, amylose, amylopectin, glycogen, and cellulose.
59. Draw the structures and list the sources and uses of these disaccharides: maltose, cellobiose, sucrose, and lactose.
60. Predict, on the basis of molecular structure, whether a carbohydrate is reducing or nonreducing.
61. Characterize these lipids by source, structure, and use: waxes, triglycerides, fats, and oils.
62. Describe the production of soap by saponification.
63. Recognize the general structures of these three types of lipid molecules: phosphoglycerides, sphingomyelins, and glycolipids.
64. Sketch sections of the liposomal bilayer in water, labeling the polar end of the lipid molecules.
65. Draw the fundamental chemical structure of all steroid molecules.
66. State the source and at least one function of each of these steroids or classes of steroids (most of which are hormones): cholesterol, cortisone, prednisone, aldosterone, androgens, estrogens, testosterone, progesterone and digitoxin.
67. Recognize prostaglandins and state several of their biologic effects.
68. Classify the 20 common amino acids according to their side-chain structures.
69. Describe the formation of zwitterions and their effect on the properties of amino acids.
70. List at least four functions of proteins.
71. Distinguish between simple and conjugated proteins and between fibrous and globular proteins.
72. Describe the forces that help determine the chain conformation of proteins and distinguish between fibrous and globular proteins.
73. State three ways to denature proteins.
74. Discuss the mechanism of oxygen transport by hemoglobin.
75. Explain the molecular basis for sickle cell anemia and the chemical basis for carbon monoxide poisoning.
76. State three properties of enzymes which show that they are catalysts.
77. Describe the function of coenzymes.
78. Give the names and one-letter symbols for the five major nitrogen bases found in nucleic acids.
79. State two differences between the molecular composition of DNA and RNA.
80. Name and draw structures of nucleosides and nucleotides, and describe the bonding that joins nucleotides together in nucleic acids.
81. Discuss the significance of  $A = T$  and  $G = C$  as it relates to the formation of the double-helical structure of DNA.
82. Outline the process of replication and transcription.
83. List five essential needs of the human body.
84. Name the type of chemical reaction which is common to the digestion of carbohydrates, proteins, lipids, and nucleic acids.
85. Name the trace elements found in the body, and state some of their possible functions.

86. Define homeostasis and cite some examples of homeostatic control in the body.
87. Describe the distribution of body water, and compare the electrolyte compositions of blood plasma, interstitial fluid, and intracellular fluid.
88. List the functions of blood, the formed elements of blood and the plasma proteins, and distinguish between blood serum and blood plasma.
89. Name the major blood buffer systems and describe how each maintains a constant blood pH.
90. State two important functions of the kidneys.
91. Describe how the pH of urine is controlled.
92. Differentiate among metabolism, catabolism, and anabolism.
93. Briefly describe what happens in photosynthesis and the energy and carbon cycle.

**Methods of Instruction/Course Format/Delivery:** Lecture, class discussion, lecture activities, reading and homework problem assignments, canvas quizzes, and laboratory experimentation

**Assessment:**

1. Homework - Homework will be completed and turned in using the online system, Mastering Chemistry. This online access pass can be purchased separately or in a bundle with the textbook. This system is separate from Canvas. For homework to be most useful in preparing for in class work and exams, it must be submitted by the date due. Late work is not accepted. Registration instructions are in a handout given the first day of class and are posted on canvas
2. Lecture Activities – are exercises/activities performed in class as a participation in the lesson, quizzes in class or online. No late or makeup work will be accepted for lecture activities.
  - For online classes- lecture activities are extra assignments completed at home and turned in to my office. Also, lecture quizzes will be given online. Watch the tutorial and answer a couple of questions about it.
  - Study Groups - are recommended to encourage peer tutoring and cooperative learning. Groups will form by student choice and meet at times chosen by the group. Reports of study group activity will be turned in to me once a week for extra credit in the homework/lecture activities grade portion. Report forms may be downloaded via Canvas.
3. Laboratory Experiments – Laboratory experiments will be performed in order to apply the general principles, laws and theories of chemistry learned during lecture. Experimental results will be recorded and submitted on the forms found in the lab manual. Lab expectations will be discussed in the laboratory orientation by your lab instructor. The lab instructor has the authority to remove 5 points from your laboratory report for each expectation in the laboratory guidelines that is not followed by the student. Removal of points is by instructor discretion based on previous warning or the gravity of the infraction. **NO ONE WILL BE ALLOWED TO PUT YOU OR OTHERS AT RISK IN THE LAB.**
  - The grade of 100 possible points for each laboratory experiment is broken down as follows:
    - i. 20 points for showing up on time with the pre-lab assignment complete (in the lab manual), the canvas pre-lab quiz complete and an up to date MSDS notebook containing all required safety information. This is your ticket in the door and you will not begin an experiment without having met all of the requirements.
    - ii. 30 points for conducting the experiment, adhering to all safety and equipment

use rules, completing the experiment, cleaning up your lab station, and disposing of all waste, trash according to instructions given. All of these items must be complete before leaving lab.

- iii. 50 points for the report sheet you turn in. It must be complete, legible, and information must be properly presented and clearly explained when necessary. All work must be shown when necessary.
  - Missing a lab-
    - i. No more than 2 missed labs may be made up
    - ii. A make-up lab schedule will be posted. It is the student's responsibility to make arrangements to attend make up labs according to the schedule. No additional make up lab times will be available.
    - iii. **LAB DOES MEET THE FIRST WEEK OF CLASS. DO NOT MISS YOUR ORIENTATION**
  - Cell phones in lab- **NO CELL PHONES IN LAB!!!!** If you have a situation where you may need to take a call, then you will leave the phone at the instructor table to be answered by you when/if it rings. If you have your phone out or are using your phone without permission for any reason, you will lose all 30 points of your participation grade but are required to complete the experiment. This is a violation of safety rules and putting others or yourself at risk will not be tolerated.
4. **Unit Exams** – Three unit exams are given throughout the semester worth 100 points each. Each exam will be given at a Panola College testing center on the date set by the instructor. You need a pencil/pen and your calculator for each exam. All other materials will be provided. Absences on exam day are not excused for ANY reason other than approved Panola College activities. (There are none in the summer). Students with excused absences may take a make up exam similar to the one given at a time convenient to the instructor. For unexcused absences, **one unit exam may be made up at the end of the semester at a time designated by the instructor. The make up exam is comprehensive and all essay/problems.** I do not drop/replace any grades in this course.
- A tentative schedule for unit exams is as follows (see the lecture schedule for dates):

Unit I	Chapters 1, 2
Unit II	Chapters 3, 4, 5
Unit III	Chapters 6, 7
Unit IV	Chapters 8, 9, 10 (on the final)
5. **Final Exam** – is also comprehensive and will be administered according to the posted final exam schedule.
6. **Attendance** – is expected at all labs. Attendance in lecture and lab is required for course completion. Class attendance is monitored for lecture by lecture quizzes and other responses. However, this level of instruction includes expected personal responsibility that will not always be addressed. YOU are responsible for missed information. Attendance does affect your grade because you probably missed something you needed to learn how to do. See the handbook for rules concerning allowed absences.

**NO CELL PHONES-** Cell phones are not allowed to be used as calculators in class or lab.

### **Course Grade:**

The grade for this course will be based on...

1. Homework and lecture activities 20%
2. Labs 25%
3. Unit Exams 40%
4. Final Exam 15%

Letter grades are as follows:

A	90 - 100
B	80 - 89
C	70 - 79
D	60 - 69
F	Below 60

**Texts, Materials, and Supplies:**

1. *General, Organic, and Biological Chemistry 4th ed.* By Karen Timberlake.
2. Mastering Chemistry access code (homework registration necessary for online homework)
3. *Introduction to Chemistry in the Laboratory II.* Amy Calhoun
4. SCIENTIFIC CALCULATOR (no cell phones) (it does NOT need to be graphing)
5. OPTIONAL- *A Visual Analogy Guide to Chemistry.* Krieger

**Other:**

- For current texts and materials, use the following link to access bookstore listings: <http://www.panolacollegestore.com>
- For testing services, use the following link: <http://www.panola.edu/elearning/testing.html>
- If any student in this class has special classroom or testing needs because of a physical learning or emotional condition, please contact the ADA Student Coordinator in Support Services located in the Administration Building or go to <http://www.panola.edu/student-success/disability-support-services/> for more information.
- Withdrawing from a course is the student's responsibility. Students who do not attend class and who do not withdraw will receive the grade earned for the course.
- Student Handbook, *The Pathfinder*: <http://www.panola.edu/student-success/documents/pathfinder.pdf>