

# CHEM 1120 – General Chemistry II

## Syllabus

Instructor: Dr. Shawn M. Miller

## Spring Term, 2022

Email: shawn.miller@usu.edu

Office Hours: Monday/Wednesday

1:30 PM – 2:30 PM in Widtsoe 339 or by  
scheduled appointment

## Course Lecture Times & Locations:

Section (CRN)	Time	Day	Location
Lecture 001 (14085)	12:30 PM to 1:20 PM	M/W/F	Widtsoe Hall 007
	4:30 PM to 5:20 PM	R	Widtsoe Hall 007

## Prerequisite:

CHEM 1110

## Required Materials:

**Calculator:** A non-programmable scientific calculator is recommended for use in Lecture and on Exams. Programmable calculators are permitted during Exams only if their memory is cleared by the Testing Center. Other electronic devices, including phones, are not permitted during Exams.

**Online HW:** Achieve online homework system. Access is automatic upon paying of course fees, but you will need to create an account for the service. Follow the Achieve Enrollment instructions document on Canvas under the “Achieve Access” module.

## Optional Materials:

**Text:** Timberlake, K. *General, Organic, and Biological Chemistry: Structures of Life*, 6<sup>th</sup> ed.; Pearson Education, Inc. (ISBN: 978-0134730684) (earlier editions are fine)

**iclicker:** iclicker 2s are used during the Lecture period. iclickers must be registered by the beginning of class. To register an iclicker, use the link in the navigation sidebar on Canvas. Alternatively, the iClicker Student app can be used on personal smart devices.

## Supplementary Course Assistance:

**SI Information:** TBA (contact: TBA or Canvas)  
Session Times: TBA

**UTF Information:** River Mckinlay (contact: river.c.mckinlay@gmail.com or Canvas)  
Session Times: TBA

## **Course Overview**

CHEM 1120 is the second in a two-semester series of general chemistry courses that is targeted towards non-science major students that require a more rigorous chemistry curriculum than an introductory chemistry course and builds upon the lessons learned in CHEM 1110. Lectures are held four times a week and will include both presentation of content and practice problems. There will be assigned online Achieve homework sets for each chapter. There will be an online Post-Week Quiz on Canvas at the end of most weeks designed to help prepare students for the Exams. There will be three 90-minute Midterm Exams in addition to a 180-minute Final exam all of which will be proctored through Canvas via the Testing Center.

### **By the end of this course, you will be able to...**

- ...identify the chemical structures of organic functional groups.
- ...describe the common physical and chemical properties of organic molecules.
- ...predict the outcome of organic chemical reactions.
- ...draw organic and biochemical structures and chemical reaction equations.
- ...describe the common physical and chemical properties of biomolecules such as lipids, carbohydrates, proteins, and nucleic acids.
- ...explain the function of vitamins and enzymes in living systems.
- ...recall the location and function of metabolic pathways for the synthesis and degradation of biomolecules.

A detailed set of Learning Objectives for each chapter is located at the end of this syllabus.

### **You will prepare for and practice achieving these objectives by...**

- ...optionally reading the textbook prior to attending in-person lectures.
- ...attending and taking notes during lecture periods.
- ...answering clicker questions and solving problems during lecture periods.
- ...completing Achieve homework sets online.
- ...taking weekly graded online Canvas Post-week Quizzes.
- ...regularly reviewing your performance on the Post-week Quizzes.
- ...asking for help via Office Hours, Piazza, Canvas message, or e-mail.
- ...optionally attending UTF or SI sessions for problem solving and further assistance.

## **You will be assessed on how you have achieved these objectives using...**

- ...one Getting Started Quiz on Canvas.
- ...the aforementioned Achieve homework sets.
- ...the aforementioned Canvas Post-week Quizzes.
- ...three Midterm Exams.
- ...one Final Exam.

## **Course Communication**

**Piazza** is the recommended venue for asking academic questions about the course. Piazza is a free online system that can be accessed directly through Canvas designed for students to have access to rapid and efficient help from classmates, TAs, and the instructor simultaneously. **Piazza is not to be used to convey personal information.** Contact the instructor directly if you need to discuss personal information such as grades.

When you post a question on Piazza, the instructor, the UTF, the SI, and your fellow students can all answer the question making it more likely for you to receive a rapid response compared to emailing one person and hoping they read it soon. Maybe someone will have already asked the question you were going to ask and got it answered! You have the option of posting anonymously to each other, but the instructor will always be able to see your identity. **Enrollment in Piazza is mandatory, and five points are assigned to Piazza enrollment.** Usage during the semester is optional. Enroll in the course by clicking on the “Piazza” link in the sidebar on Canvas and following the instructions there.

Due to changes in how Piazza licenses its product, this term a “contribution-supported” license is used to keep the service free. Piazza will prompt users provide a financial contribution if they find the experience valuable. **Students are under no obligation to provide monetary support to Piazza and may use the service for free throughout the course by ignoring the donation prompts.**

Students are always welcome to message the instructor directly with questions. Canvas messages are preferred, but email is fine as well. When using email, please include the course name in the message and a full name and A-Number in the message body. The course instructor teaches several courses each term and cannot answer questions if they do not know what course the questions correspond to. The instructor will attempt to respond to messages in a timely manner, but the instructor has responsibilities outside of the course that may prevent the instructor from doing so and asks student to exercise patience after sending your message.

The instructor holds in-person Office Hours based on the schedule on the first page of this syllabus. Office Hours do not require reservations so just come in and ask questions! Separate appointments may be possible upon request. Regular Office Hours will first be held during Week 2 of the semester.

Course announcements are made using the Canvas Announcements system. You are expected to keep up to date on all Canvas Announcements and are responsible for any information in the Announcements. “But I did not know” is not an acceptable excuse for being unaware of information in course Announcements.

## **Getting started in the course**

Read the course syllabus. Once that is done, the first assessment is a “Getting Started” quiz administered through Canvas that covers course policy as discussed in the course syllabus. This Quiz is due at 11:59 PM on the Friday of Week 1 of the term. The Getting Started quiz is graded immediately upon completion and may be attempted an unlimited number of times. Correct answers will not be shown upon completion of the Getting Started Quiz, but students will be able to view their responses. If multiple attempts are made, the **highest** score is accepted. **If no score is present the “Grades” section of Canvas, no attempt was submitted.** The Getting Started Quiz score cannot be dropped and cannot be made-up.

USU welcomes students with disabilities. If you have, or suspect you may have, a physical, mental health, or learning disability that may require accommodations in this course, please contact the Disability Resource Center (DRC) as early in the semester as possible (University Inn #101, 435-797-2444, [drc@usu.edu](mailto:drc@usu.edu)). All disability related accommodations must be approved by the DRC. Once approved, the DRC will coordinate with faculty to provide accommodations.

## **Lectures**

If students have access to the optional textbook, it can be helpful to read the textbook, as outlined in the schedule at the end of this syllabus, prior to lecture. Taking notes while reading the textbook can help create a foundation that can be built upon with lecture discussions. PDF copies of blank lecture PowerPoint slides will be available on Canvas that can be printed ahead of each lecture if you wish. Each lecture will be recorded and available on Canvas for viewing at your pleasure.

## **iClicker Questions**

iClicker questions will be asked through the Lecture period and will be used as a way to assess class understanding of topics by providing immediate feedback to both the instructor and you. These questions must be answered individually, but students may consult their notes and discuss the questions with one another. It is the student’s responsibility to register their iClicker either through the iClicker service on Canvas or at [iclicker.com](http://iclicker.com) and to remember to bring their iClicker, in working order, to class each day. Alternatively, the iClicker Student app can be used on personal smart devices. iClicker performance will be recorded starting with the second lecture period.

Students may earn up to 10 points extra credit via iClicker questions. 5 of those points are allocated to participating in iClicker questions and the remaining 5 points are allocated to answering iClicker questions correctly. The amount of extra credit awarded will be based on the percentage of iClicker questions answered by each student based on 90% of the total number of questions asked and the percentage of correct answers to iClicker questions based on 90% of the total number of questions asked.

## **Achieve Online Homework**

There are 10 online homework sets administered through Achieve. Follow the Achieve registration instructions in the “Achieve Access Instructions” module. Each homework set is worth 10 points. These assignments are designed to provide additional practice to help students prepare for the quizzes and exams. The assignments will typically be due at 11:59 PM two days after the final lecture for the chapter is given. The homework sets involve a variety of interactive questions. Students may use their textbook, notes, and external help (such as other students), but students are encouraged

attempt the problems alone at first. Students can attempt each problem as many times as they wish, but 5% of the problem's credit will be deducted for each incorrect answer. The lowest Achieve homework score will be dropped at the end of the course.

### **Quizzes**

A Post-week Quiz is assigned following most weeks this term. The Quizzes will open at 2:00 PM each Friday and close at 11:59 PM the following Monday. Holidays and other events may affect open dates and due dates so check Canvas for specific dates. Individual Post-week Quizzes are worth 15 points. Students have 45 minutes to complete each Post-week Quiz. Students may use their textbook and notes but must work alone. Students should treat Post-week Quizzes as practice for the Exam in terms of both format and content and it is strongly recommended that students do not use external resources on their first Quiz attempt to more accurately gauge their understanding of the material. Students may take each Post-week Quiz twice to account for technical difficulties. The **highest** score is accepted. Discussion of Quiz details with other students while the Quiz is open is a violation of USU's academic integrity policy as detailed below. The lowest two Post-week Quiz score are dropped at the end of the course.

### **Examinations**

There will be three 90-minute midterm Exams, worth 100 points each, that will contain both an online component and a written paper component. The midterm Exams will be administered in the Testing Center according to the following schedule:

First Exam:	Wednesday, February 9 – Friday, February 11
Second Exam:	Thursday, March 3 – Saturday, March 5
Third Exam:	Wednesday, April 6 – Friday, April 8

These Examinations will contain a Canvas component with 25 questions worth 3 points each. Canvas question formats may include, but are not limited to, multiple choice, multiple answer, matching, short essay, and fill-in (dropdown or text). Exams will also contain a written component whose format will be announced prior to each Exam. Students must complete Exams alone. As Exams are open over multiple days, discussion of Exam details with other students while the Exam is open is a violation of USU's academic integrity policy as detailed below.

Make-up Exams for missed Exams may be granted upon petitioning the instructor only in the following situations: 1) documented and acceptable excuses for illness when verified by a doctor's note; 2) a family emergency when verified by a note from your academic advisor; 3) a regularly scheduled university-sanctioned conflict, such as a sports competition the student is participating in, but only when the instructor is notified well in advance of the conflict and verified with a note from the person in charge of the activity containing the specific reasons for the absence. Absences due to reasons not considered by the university to be excused absences, such as weddings, are not eligible for make-up Exams.

The only student materials permitted in the Testing Center are writing utensils, calculators (scientific preferred, graphing only if the Testing Center clears the memory), scratch paper, and Useful Information Sheets. The Testing Center will provide laptops and authorized auxiliary materials (Useful Information Sheets) as well as scratch paper upon request. Notes, textbooks, internet resources, etc. are not permitted during Exams. Reservations for the Testing Center are made

through their website at <http://testing.usu.edu/>. Students must bring a form of ID with them to Check-in for their Testing Center appointment.

A 180-minute cumulative Final Examination will be held in the Testing Center from Thursday, April 28 to Saturday, April 30.

### **Academic integrity**

All Utah State University academic integrity policies are strictly enforced. All students at Utah State University agree to be bound by the following Honor Pledge “I pledge, on my honor, to conduct myself with the foremost level of academic integrity.” See the following for further information: <https://studentconduct.usu.edu/studentcode/article5>. Students found guilty of academic misconduct on any assignment will, **at minimum, be given a zero for the assignment and have the full value of that assignment deducted from their final course grade**. Actions up to and including a failing grade for the course are options available to the instructor.

### **Course Assessment**

After the first Exam, the instructor will solicit feedback through optional midterm evaluations on Canvas. The purpose of these surveys will be to determine student opinions of the course up to that point and ask for suggestions on what could be done to improve the course for the rest of the term and in subsequent terms. The instructor will know who completed the survey but will be unable to match survey responses to students. Each student who responds to the midterm evaluation will be granted a small quantity of extra credit points. At the end of the course, end-of-term IDEA evaluations administered through University will be sent to students via email. The instructor will know who completed the survey but will be unable to match survey responses to students. Each student who responds to the end-of-term evaluation will be granted a small quantity of extra credit points.

A Pre-test/Post-test approach is used to measure comprehension of important concepts. The Pre-test is administered online through Canvas. The Pre-test is comprised of 20 questions with a duration of 90 minutes. The questions of the Pre-test will reappear in the Final Exam, in some form, to assess teaching and learning progress during the semester. If weaknesses are observed in specific subject areas, teaching methods will be reevaluated. An all-or-nothing 10-point reward is given for completing the Pre-test. The Pre-test is due at 11:59 PM on the Friday of Week 1 of the term.

## **Grading**

The total score for each type of assignment in the below table represent totals after appropriate lowest scores have been dropped.

Getting Started Quiz	20	Percentage of Points Earned	Grade
Piazza Enrollment	5	93–100	A
Pre-Test	10	89–92	A-
Achieve Homework Sets	90	85–88	B+
Post-Week Quizzes	135	81–85	B
First Midterm Exam	100	78–81	B-
Second Midterm Exam	100	74–77	C+
Third Midterm Exam	100	70–73	C
Final Exam	200	66–69	C-
<hr/> Total Points	<hr/> 760	60–65	D+
		53–59	D
		<53	F

Letter grades are assigned by taking the total numerical score, rounding to the nearest whole number, finding the percentage of total points earned, and then assigning a letter grade according to the table above. A grade of 93 or higher is guarantee an “A”. The grade thresholds may be lowered depending on course performance but will never be increased. The administration of CHEM 1120, including the issuing of grades of Incomplete, will adhere to the outlines in the USU General Catalog

## Spring 2022 Schedule

Please look carefully at the following schedule for expected order of topics. Note that this schedule is approximate and may adjust depending on course pace.

**Purple text** denotes days set aside for taking Exams and lecture will not meet on those days. **Blue text** denotes holidays where lecture will not be held and study days with review sessions.

Week	Day	Date	Lecture Day #	Topic	Chapter	Assignments Due
1	M	1/10	1	Course intro, CHEM 1110 review	13	
	W	1/12	2	CHEM 1110 review, chapter 13 introduction, alcohol nomenclature	13	
	R	1/13	3	ether/phenol/thiol fundamentals and nomenclature	13	
	F	1/14	4	intermolecular forces and their effects on physical properties	13	GS Quiz/Pre-test
2	M	1/17		<b>Martin Luther King, Jr. Day – No Lecture</b>		P-Quiz 1
	W	1/19	5	dehydration of alcohols	13	
	R	1/20	6	oxidation of alcohols, ether synthesis, thiol oxidation	13	
	F	1/21	7	aldehyde/ketone nomenclature and physical properties	14	
3	M	1/24	8	oxidation and reduction of carbonyls, creation of hemiacetals/acetals	14	P-Quiz 2
	W	1/26	9	chirality, Fischer projections	14	
	R	1/27	10	carbohydrate classification, carbohydrate chirality	15	
	F	1/28	11	Haworth projections, mutarotation	15	
4	M	1/31	12	chemical reactions of carbohydrates, linking monosaccharides	15	P-Quiz 3
	W	2/2	13	polysaccharides	15	
	R	2/3	14	carboxylic acid nomenclature and properties	16	
	F	2/4	15	ester synthesis, ester nomenclature	16	
5	M	2/7	16	physical properties of esters, hydrolysis of esters	16	P-Quiz 4
	W	2/9		<b>Study Day – Review Session</b>		
	R	2/10		<b>Exam 1 (Ch 14-16)</b>		
	F	2/11	17	triacylglycerols, phospholipids	17	
6	M	2/14	18	triacylglycerols, phospholipids	17	
	W	2/16	19	steroids, cell membranes	17	
	R	2/17	20	amines	18	
	F	2/18	21	amine reactivity	18	
7	M	2/21		<b>Presidents' Day – No Lecture</b>		P-Quiz 5
	W	2/23	22	alkaloids, neurotransmitters, amide physical properties and chemical reactions	18	
	R	2/24	23	amino acid fundamentals and charge states	19	
	F	2/25	24	peptide formation	19	
8	M	2/28	25	protein primary/secondary structure	19	P-Quiz 6
	W	3/2	26	protein tertiary/quaternary structure, stability	19	
	R	3/3		<b>Study Day – Review Session</b>		
	F	3/4		<b>Exam 2 (Ch 17-19)</b>		
9	M	3/7		<b>Spring Break - No Classes</b>		
	W	3/9				
	R	3/10				
	F	3/11				
10	M	3/14	27	enzyme function and enzyme classification	20	
	W	3/16	28	enzyme activity and regulation	20	
	R	3/17	29	enzyme regulation, vitamins	20	
	F	3/18	30	nucleic acids introduction, nucleotides	21	
11	M	3/21	31	nucleic acid drawing, DNA structure	21	P-Quiz 7
	W	3/23	32	DNA replication, RNA introduction, transcription	21	
	R	3/24	33	RNA translation, DNA mutations	21	
	F	3/25	34	genetic diseases, synthetic DNA, viruses	21	
12	M	3/28	35	metabolism intro, metabolism coenzymes	22	P-Quiz 8
	W	3/30	36	glycolysis introduction, glycolysis part 1	22	
	R	3/31	37	glycolysis part 2 and regulation, pentose phosphate	22	
	F	4/1	38	pyruvate metabolism, glycogenesis, glycogenolysis	22	
13	M	4/4	39	gluconeogenesis, Cori Cycle	22	P-Quiz 9
	W	4/6		<b>Study Day – Review Session</b>		
	R	4/7		<b>Exam 3 (Ch 20-22)</b>		
	F	4/8		<b>Day Off – No Lecture</b>		
14	M	4/11	40	citric acid cycle	23	
	W	4/13	41	citric acid cycle regulation, electron transport	23	
	R	4/14	42	oxidative phosphorylation	23	
	F	4/15	43	metabolism of fats, $\beta$ oxidation	24	
15	M	4/18	44	$\beta$ oxidation	24	P-Quiz 10
	W	4/20	45	ketogenesis, lipogenesis	24	
	R	4/21	46	amino acid degradation, urea cycle	24	
	F	4/22	47	energy from amino acids, amino acid synthesis	24	
16	M	4/25		<b>Study Day – Review Session</b>		P-Quiz 11
	W	4/27		<b>Interim Day – No Classe</b>		
		4/28-4/30		<b>Final Exam (cumulative)</b>		

## Chapter Learning Objectives

### **Chapter 13**

Name alcohols, phenols, ethers and thiols using the IUPAC system and common names.  
Describe the physical properties of alcohols, phenols, ethers and thiols.  
Write chemical equations for the dehydration of alcohols and predict the product distribution.  
Recognize the oxidation and reduction of alcohols and predict the products from oxidation of primary and secondary alcohols.  
Recognize the oxidation and reduction of thiols.

### **Chapter 14**

Identify compounds with aldehydes or ketones.  
Name aldehydes and ketones using the IUPAC system and common names.  
Describe the differences in physical properties of aldehydes or ketones as compared to alcohols, phenols, and ethers.  
Recognize the oxidation and reduction of aldehydes and ketones.  
Write chemical equations for the addition of alcohols to aldehydes and ketones.  
Recognize chiral objects, including molecules, and identify chiral and achiral carbons in molecules.

### **Chapter 15**

Recognize monosaccharide as aldoses and ketoses with respect to the number of carbon atoms.  
Draw the D- and L- configuration of glucose, galactose, and fructose.  
Draw and identify the cyclic structures of monosaccharides.  
Recognize the products from oxidation and reduction of monosaccharides.  
Recognize the monosaccharide units and linkages in oligosaccharides.  
Calculate acid/base titration curves and predict end-point conditions.  
Describe and apply  $K_{sp}$  values to determine solubility of inorganic solids.  
Describe the precipitation and separation of ions utilizing  $K_{sp}$  information.

### **Chapter 16**

Name carboxylic acids and esters using the IUPAC system and common names.  
Recognize the physical properties of carboxylic acids and esters.  
Write the equations for esterification and hydrolysis of esters.

### **Chapter 17**

Describe the classes of lipids.  
Write the structures of fatty acids and identify as saturated or unsaturated.  
Write the structural formula of a wax, fat or oil produced by the reaction of a fatty acid and an alcohol or glycerol.  
Draw the structure of products from hydrogenation, hydrolysis and oxidation of triacylglycerol.  
Describe the properties of glycerophospholipids.  
Describe the types of lipids that contain sphingosine.  
Describe the general structures of steroids.  
Describe the composition and function of the lipid bilayer in cell membranes

### **Chapter 18**

Name amines using the IUPAC system and common names.  
Differentiate primary, secondary, and tertiary amines.

Recognize the physical properties of amines.

Recognize heterocyclic amines.

Provide both IUPAC and common names for amides and write the equations for amidation from amines.

Write the equations for the hydrolysis of amides.

### **Chapter 19**

Draw the structure for an amino acid and be able to identify nonpolar and polar neutral, acidic, and basic amino acids.

Understand the acid/base properties of amino acids and be able to write the ionic forms of an amino acid at different pHs.

Understand the reactions involved in forming and hydrolyzing peptides.

Describe how to name simple peptides.

Understand different levels of protein structure, i.e., primary secondary, tertiary, and quaternary, and describe what the factors that influence structure.

### **Chapter 20**

Describe how enzymes function as biological catalysts, and name and classify them.

Describe the effect of temperature, pH, concentration of enzyme and concentration of substrate on enzyme activity.

Describe reversible and irreversible inhibition.

Describe the role of zymogens, feedback control and allosteric enzymes in regulating enzyme activity.

### **Chapter 21**

Describe the components that make up the nucleic acids.

Describe the primary structures of RNA and DNA.

Describe the double helix of DNA.

Describe the process of DNA replication.

Identify the different RNAs and describe the synthesis of mRNA.

Describe the function of codon in genetic code.

Describe the process of protein synthesis from mRNA.

Describe the correlation between altered DNA and the sequential mutation.

Describe the preparation and uses of recombinant DNA.

Describe the methods by which a virus infects a cell.

### **Chapter 22**

Describe three stages of metabolism.

Describe the role of catabolic and anabolic reactions.

Describe the components and functions of the coenzymes FAD, NAD<sup>+</sup> and coenzyme A.

Give the sites and products of digestion for carbohydrates.

Describe the conversion of glucose to pyruvate in glycolysis.

Give the conditions for the conversion of pyruvate to lactate, ethanol and acetyl coenzyme A.

Describe the breakdown and synthesis of glycogen.

Describe how glucose is synthesized from noncarbohydrate molecules.

### **Chapter 23**

Describe the oxidation of acetyl CoA in the citric acid cycle.

Describe the electron carriers involved in electron transport.

Describe the roles of electron carriers in electron transport.

Describe the process of oxidative phosphorylation in ATP synthesis.

Account the ATP produced by the complete oxidation of glucose.

### **Chapter 24**

Describe the sites and products obtained from digestion of triacylglycerols.

Describe the metabolic pathway of  $\beta$ -oxidation.

Calculate the total ATP produced by the complete oxidation of a fatty acid.

Describe the pathway of ketogenesis.

Describe the biosynthesis of fatty acids from acetyl CoA.

Describe the hydrolysis of dietary protein and absorption of amino acids.

Describe the reaction of transamination and oxidative deamination in the degradation of amino acids.

Describe the formation of urea from ammonium ion.

Describe where carbon atoms from amino acids enter the citric acid cycle or other pathway.

Illustrate how some nonessential amino acids are synthesized from intermediates in the citric acid cycle and other metabolic pathways.