# Chemistry for Health Sciences

**The University of Toledo**  
**College of Natural Sciences and Mathematics**  
**Department of Chemistry and Biochemistry**  
**CHEM1120–001, CRN 10747**

**Instructor:** Dr. Kristi Mock  
**Email:** kristi.mock@utoledo.edu  
**Office Hours:** MW 10-12:30, and by appointment  
**Office Location:** BO2086F  
**Office Phone:** 419-530-4080  
**Term:** Spring 2019  
**Lecture Location:** RH 1520  
**Lecture Day/Time:** MTWR 2:30-3:25 pm  
**Recitation Day/Time/Location:** N/A  
**Credit Hours:** 4

---

**COURSE/CATALOG DESCRIPTION**  
The study of chemistry for students majoring in nursing and other health-related fields. This course includes general, organic, and biochemical topics in condensed form. The impact of chemistry in health fields will be emphasized.

**COURSE OVERVIEW**  
CHEM 1120 is the second course in the Chemistry for Health Sciences series and builds upon the knowledge gained in CHEM1110. This course continues building a basic foundation in the principles of general chemistry, and then moves onto organic chemistry, and biological chemistry. CHEM 1120 is appropriate for non-chemistry majors who will require some knowledge of chemistry in their careers, but do not anticipate taking any further chemistry courses during their undergraduate career. This course is typically taken by nursing students, elementary education students, sports management students, and some science majors who do not want or need the more rigorous chemistry background that is provided by two or three years of chemistry courses. It is not appropriate for chemistry majors and may be too rigorous for non-science majors who are only interested in fulfilling their general education science core requirement. If you have any questions about course placement, please see me as soon as possible.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:
1. Explain how chemical processes work in the body.
2. Use chemical concepts to explain how chemistry is used in health care.
3. Demonstrate the ability to think critically and employ critical thinking skills.
4. Read and interpret graphs and data.
5. Demonstrate an understanding of the impact of science on society.

*General Education Courses:* This course is part of our institutional General Education Program and supports the general education outcomes for **Critical Thinking and Integrative Learning** and **Scientific and Quantitative Reasoning and Literacy.**

**PREREQUISITES AND COREQUISITES**
Students must have (a) received a high enough score on the Chemistry placement exam to gain admittance into this course, and received an ACT math score of 19 or higher, College Algebra Test score of 8 or higher, or completion of MATH 1200 with a grade of C or higher, or (b) completed CHEM 1110: Elementary Chemistry for Health Sciences with a grade of C or better.
REQUIRED TEXTS AND ANCILLARY MATERIALS


TECHNOLOGY REQUIREMENTS

Blackboard (https://blackboard.utdl.edu/webapps/login/) and Modified Mastering Chemistry (available through the Blackboard course) will be used on a regular basis in this course. Students need to have access to a properly functioning computer throughout the semester. Student computers need to be capable of running the latest versions of plug-ins, recent software and have the necessary tools to be kept free of viruses and spyware. Updated software is available from the Online Learning Download Center (https://www.utoledo.edu/dl/main/downloads.html).

For exams, students may use an approved calculator. Any calculator that is programmable, whether graphing or non-graphing, and any calculator based on a phone or other device that can receive or transmit data, are prohibited.

Students are required to have a web-enabled device (smartphone, laptop computer, iPod, or other device that connects to the internet will work) for use in all lecture classes. You may borrow a laptop from the library if necessary.

TEACHING STRATEGIES

Read the text before the lecture so you are familiar with concepts before hearing about them during the limited time of each class session. Attendance is required at all lectures; please arrive on time. We will be using Learning Catalytics (LC) as our in-class polling software. Questions asked in class through LC are for course points. You are responsible for all material, experiments, and problems covered in class. You will be provided with partial lecture outlines of the course material via Blackboard.

COURSE EXPECTATIONS

1. Attendance is required for the lecture.
2. Read the textbook before the lecture, the schedule is listed on page 5 of the syllabus.
3. You are responsible for all material and problems covered in class.
4. Bring your web-enabled devise and a calculator to the every lecture. Each LC question is worth 0.5 points for a correct answer and 0.1 points for an incorrect answer.
5. Mastering Chemistry online homework assignments have to be completed before the deadline. A 25% per day late penalty is added for late assignments.
6. At a minimum answer the assigned Mastering Chemistry questions. There are many problems found throughout the book that should be worked if you are having difficulty with a certain concept.
7. If you need extra help, see your instructor during office hours or use email. You will not be graded or judged based on the questions that you ask! Seek help in the Chemistry Help Center (BO2043).

Additional resources are listed on page 4.

GRADING It is a very high priority to your instructor to ensure fairness and equity in all grading aspects of the course. There is nothing about this class that requires a certain number of students to get a certain grade. We don’t use a curve, so every one of you can achieve the grade that you are willing to earn!
Course Points The following is the distribution of possible points in the course:

- Midterm Exams – 3 @ 100 points each: 300 pts 38%
- Final Exam: 240 pts 30%
- Mastering Chemistry (online HW)*: 200 pts 25%
- Participation points*: 60 pts 8%

Total: 800 pts

* These categories will have extra points available to allow students a chance to reach the total points. However, points added to the total grade will not exceed total points for a category.

The grading scale for this class is:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Points</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100-90%</td>
<td></td>
</tr>
<tr>
<td>A-</td>
<td>89-87%</td>
<td></td>
</tr>
<tr>
<td>B+</td>
<td>86-84%</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>83-80%</td>
<td></td>
</tr>
<tr>
<td>C+</td>
<td>75-73%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>72-67%</td>
<td></td>
</tr>
<tr>
<td>D+</td>
<td>63-61%</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>60-57%</td>
<td></td>
</tr>
</tbody>
</table>

Drop, Withdrawal and Incomplete Grades Course drop and withdrawal procedures have been set by the University. Dropped courses do not appear on your transcript. The deadline for dropping is 1/28. You may withdraw from the course and receive a grade of W. The deadline for withdrawal is 3/29. W’s do not affect your GPA.

A course grade of Incomplete is given only to those who have completed all but a small percentage of course requirements for an acceptable reason.

All course points and grades will be frequently updated on blackboard including a midterm grade. Although this is not your final grade in the course, a midterm grade should be taken seriously with respect to how well you are doing in the course approximately halfway through the semester.

ACADEMIC POLICIES

Examinations Make-up exams will not be given. Excused absences will only be given based on conditions outlined below. If an excuse is acceptable, your missed exam score will be replaced with a score equal to the average of the other hour exams. The final exam cannot be excused. For all exams you must show a photo ID card. You may use a non-programmable calculator. You cannot use a programmable calculator or phone.

Exam Absence Policies: Students who will not be able to take an exam at the scheduled time due to an irresolvable conflict must provide written documentation to verify the conflict. This may occur for students on official university business. The exam will be given at another arranged time before the scheduled test date. Approval must be obtained in advance.

Students who unexpectedly miss an exam due to illness, car accident or similar extreme circumstance should inform their instructor ASAP. Documentation such as a physician’s note, an accident report, etc. is required and must be attached to an Absence Report Form (obtained from BO 2022). An email to the instructor and a telephone call within 24 hours is expected. In all other cases a missed exam will result in 0 on the exam.

Academic Dishonesty: Refer to the university’s policy on Academic Dishonesty in the university catalogue. Violation of this policy can result in a course grade of F with additional university sanctions
possible. You will be required to formally acknowledge the terms of our Academic Honesty Statement, by providing a statement through our Blackboard course page.

COMMUNICATION GUIDELINES As your instructor, I am here to help, and will do my best to respond to email within 24 to 48 hours. Students are expected to check their UT email account and blackboard frequently for important course information.

UNIVERSITY POLICIES
Policy Statement on Non-Discrimination on the basis of Disability (ADA):
The University is an equal opportunity educational institution. Please read The University’s Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.

ACADEMIC ACCOMMODATIONS
The University of Toledo is committed to providing equal opportunity and access to the educational experience through the provision of reasonable accommodations. For students who have an accommodations memo from Student Disability Services, it is essential that you correspond with me as soon as possible to discuss your disability-related accommodation needs for this course. For students not registered with Student Disability Services who would like information regarding eligibility for academic accommodations due to barriers associated with a potential disability, please contact the Student Disability Services Office.

Copyright Notice
The materials in the course website are only for the use of students enrolled in this course for purposes associated with this course, and may not be retained or further disseminated.

STUDENT SUPPORT SERVICES
Course scheduling assistance: Chemistry Department Secretary, Ms. Samples, is in Room BO 2022, telephone 419-530-2698. If you have further questions or if you need assistance, please talk to her. She takes care of all scheduling changes.

Supplemental Instruction is a student assistance program offered through First Year Experience support. Advanced students provide several structured study sessions on the material each week. Your participation is optional – though very strongly encouraged.

Chemistry Help Center, Room BO 2043, is where the teaching assistants hold their office hours so it is a great place to receive assistance. It is generally open all day Monday through Friday & evenings Monday through Thursday. A schedule will be posted early in the term. No appointment is necessary.

Tutoring support for all UT students is available through the Learning Enhancement Center located in the Carlson Library.

Instructor Office Hours are times when you can stop by my office (no appointment needed) with questions about the course material, grades, and any concerns with the course. My office hour times and location are listed at the top of the syllabus (page 1). If you have a scheduling conflict with all of the listed times and want to meet with me email me so we can schedule a different time to meet.

COURSE SCHEDULE The following table (page 5) will give you a general idea of our pace throughout the course. Exams will occur on the dates indicated below. Material covered on each exam will be dependent on the pace of the class and will be specified in lecture prior to each exam. Each chapter listed is consistent with the specific learning outcomes listed on pages 6-8 of the syllabus.
## CHEM 1120 – Chemistry for Health Sciences
University of Toledo

**TENTATIVE Course Schedule – Spring 2019**

<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Chapter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 14-20</td>
<td>Introduction 6.6-6.9 Ionic and Molecular Compounds</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Jan 21-27</td>
<td>9. Solutions</td>
<td>1/21 is MLK Holiday. Classes are cancelled. Last day to Drop via the web is Mon 1/28</td>
</tr>
<tr>
<td>3</td>
<td>Jan 28-Feb 3</td>
<td>10. Reaction Rates and Chemical Equilibrium</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Feb 4-10</td>
<td>11. Acids and Bases</td>
<td>Midterm Exam 1, Mon 2/4, Chapters 1-10</td>
</tr>
<tr>
<td>5</td>
<td>Feb 11-17</td>
<td>12. Intro to Organic Chemistry: Hydrocarbons</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Feb 18-24</td>
<td>13. Alcohols, Phenols, Thiols, and Ethers</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Feb 25-Mar 3</td>
<td>14. Aldehydes, Ketones, and Chiral Molecules</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Mar 4-10</td>
<td>SPRING BREAK!!!</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Mar 11-17</td>
<td>15. Carbohydrates</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Mar 18-24</td>
<td>16. Carboxylic Acids and Esters 17. Lipids</td>
<td>Midterm Exam 2, Mon 3/18, Chapters 11-15 and a review of exam 1</td>
</tr>
<tr>
<td>11</td>
<td>Mar 25-31</td>
<td>18. Amines and Amides</td>
<td>Note: Friday 3/29 is the last day to withdraw from the class</td>
</tr>
<tr>
<td>12</td>
<td>Apr 1-7</td>
<td>19: Amino Acids and Proteins 20. Enzymes and Vitamins</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Apr 8-14</td>
<td>21. Nucleic Acids and Protein Synthesis</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Apr 15-21</td>
<td>22. Metabolic Pathways for Carbohydrates 23. Metabolism and Energy Production</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Apr 22-28</td>
<td>24. Metabolic Pathways for Lipids and Amino Acids</td>
<td>Midterm Exam 3, Mon 4/22, Chapters 16-23 and a review of exams 1 and 2</td>
</tr>
<tr>
<td>Finals Week</td>
<td>Apr 29-May 3</td>
<td>The Final Exam will be comprehensive; including chapters 1-24 from your book.</td>
<td><em><strong>Final Exam</strong></em> Monday, 4/29/19, 2:45 – 4:45 pm YOU MUST TAKE THE FINAL EXAM AT THIS TIME!</td>
</tr>
</tbody>
</table>
SPECIFIC LEARNING OUTCOMES

**Chapter 9 Solutions**
- Identify the solute and solvent in a solution; describe the formation of a solution.
- Identify solutes as electrolytes or nonelectrolytes.
- Define solubility. Distinguish between an unsaturated and a saturated solution; identify a salt as soluble or insoluble.
- Calculate the concentration of a solute in a solution; use concentration to calculate the amount of solute or solution.
- Identify a mixture as a solution, a colloid, or a suspension. Describe how the number of particles in a solution affects the freezing point, boiling point, and osmotic pressure of a solution.
- Calculate the new concentration or volume of a diluted solution. Given the volume and concentration of a solution, calculate the amount of another reactant or product in a reaction.

**Chapter 10 Reaction Rates and Equilibrium**
- Use the concept of reversible reactions to explain chemical equilibrium.
- Calculate the equilibrium constant for a reversible reaction given the concentrations of reactants and products at equilibrium.
- Use an equilibrium constant to predict the extent of reaction and to calculate equilibrium concentrations.
- Use Le Chatelier's principle to describe the changes made in equilibrium concentrations when reaction conditions change.

**Chapter 11 Acids and Bases**
- Describe acids and bases.
- Identify conjugate acid-base pairs.
- Write equations for the dissociation of strong and weak acids; identify the direction of reaction.
- Write the expression for the dissociation constant of a weak acid or weak base.
- Use the water dissociation constant to calculate the $\left[H_3O^+\right]$ and $[OH^-]$ in an aqueous solution.
- Calculate pH from $\left[H_3O^+\right]$$;$ given the pH calculate $[H_2O^+]$ and $[OH^-]$ of a solution.
- Write the balanced equations for reactions of acids with metals, carbonates or bicarbonates, and bases.
- Calculate the molarity or volume of an acid or base solution from titration information.
- Describe the role of buffers in maintaining the pH of a solution; calculate the pH of a buffer.

**Chapter 12 Introduction to Organic Chemistry: Hydrocarbons**
- Write the IUPAC names and draw the condensed structural formulas for alkanes and cycloalkanes.
- Write the IUPAC names for alkanes with substituents and draw their condensed and line-angle structural formulas.
- Identify the properties of alkanes and write a balanced chemical equation for combustion.
- Identify structural formulas as alkenes, cycloalkenes, and alkynes, and write their IUPAC names.
- Draw the condensed and line-angle structural formulas and give the names for the cis-trans isomers of alkenes.
- Draw the condensed and line-angle structural formulas and give the names for the organic products of addition of alkenes. Draw a condensed structural formula for a polymer.
- Describe the bonding in benzene; name aromatic compounds, and draw their line-angle structural formulas.

**Chapter 13 Alcohols, Phenols, Thiols, and Ethers**
- Write the IUPAC and common names for alcohols, phenols, thiols, and ethers and draw their condensed and line-angle structural formulas.
- Describe the classification of alcohols.
- Place in increasing order alcohols, phenols, and ethers according to their boiling point and solubility trends.
- Write equations for the combustion, dehydration, and oxidation of alcohols and thiols.
Chapter 14 Aldehydes, Ketones, and Chiral Molecules
- Order molecules according to the trends of boiling point and solubility.
- Write equations for the combustion of alcohols.
- Identify compounds with a carbonyl group as aldehydes or ketones.
- Give the IUPAC and common names for aldehydes and ketones.
- Given a name draw the condensed structural formulas or skeletal formulas of aldehydes and ketones.
- Draw the condensed structural or skeletal formulas for the reactants and products in the oxidation or reduction of aldehydes and ketones.
- Draw the condensed structural formulas for the products of the addition of alcohols to aldehydes and ketones.
- Identify chiral and achiral carbon atoms in an organic molecule.

Chapter 15 Carbohydrates
- Classify a monosaccharide as an aldose or ketose, and indicate the number of carbon atoms.
- Identify a monosaccharide as the D or L stereoisomers.
- Draw and identify the Haworth structures of monosaccharides.
- Identify the products of oxidation or reduction of monosaccharides.
- Describe the monosaccharide units and glycosidic bonds in disaccharides.
- Describe the structural features of amylose, amylopectin, glycogen, and cellulose.

Chapter 16 Carboxylic Acids and Esters
- Given a name draw the condensed structural formulas or skeletal formulas of carboxylic acids and esters.
- Write the IUPAC and common names for carboxylic acids and esters and draw the condensed or line-angle formula.
- Order molecules according to the trends of boiling point and solubility.

Chapter 17 Lipids
- Describe the classes of lipids.
- Identify a fatty acid as saturated or unsaturated.
- Draw the condensed structural formula for a wax or triacylglycerol produced by the reaction of a fatty acid and an alcohol or glycerol.
- Describe the composition and function of the lipid bilayer in cell membranes.
- Describe the structure of glycerophospholipids, including cephalin and sphingomyelin.
- Describe the structures of steroids.
- Draw the condensed structural formula for the product of a triacylglycerol that undergoes hydrogenation, hydrolysis, or saponification.

Chapter 18 Amines and Amides
- Name amines using common and IUPAC names.
- Draw the condensed structural formulas given the names.
- Classify amines as primary (1), secondary (2), or tertiary (3).
- Write the amide products for amidation.
- Name amides using common and IUPAC names.
- Describe the boiling points and solubility of amines.
- Write equations for the ionization and neutralization of amines.
- Describe the role of amines as neurotransmitters.
- Write equations for the hydrolysis of amides.

Chapter 19 Amino Acids and Proteins
- Draw the zwitterion for an amino acid at its isoelectric point, and its ionized structure at pH values above or below its isoelectric point.
- Describe the primary and secondary structures of a protein.
- Describe the tertiary and quaternary structures of a protein.
Given two amino acids draw the dipeptide bond that forms between them.

Describe the hydrolysis and denaturation of proteins.

Describe a peptide bond.

**Chapter 20 Enzymes and Vitamins**
- Classify enzymes and give their names
- Describe the effect of temperature, pH, concentration of enzyme, and concentration of substrate on enzyme activity.
- Describe competitive and noncompetitive inhibition, and reversible and irreversible inhibition.
- Describe enzymes and their role in enzyme-catalyzed reactions.
- Describe the role of zymogens, feedback control, covalent modification, and allosteric enzymes in regulating enzyme activity.

**Chapter 21 Nucleic Acids and Protein Synthesis**
- Describe the bases and ribose sugars that make up the nucleic acids DNA and RNA.
- Describe the double helix of DNA.
- Describe the process of DNA replication.
- Identify the different types of RNA.
- Describe the synthesis of mRNA.
- Use the genetic code to write the amino acid sequence for a segment of mRNA.
- Identify the types of change in DNA for a point mutation, a deletion mutation, and an insertion mutation.
- Describe the preparation and uses of recombinant DNA.
- Describe the methods by which a virus infects a cell.

**Chapter 22 Metabolic Pathways for Carbohydrates**
- Describe the components and functions of the coenzymes FAD, NAD+, and coenzyme A.
- Describe the structure of ATP and its role in catabolic and anabolic reactions.
- Describe how glucose is synthesized from noncarbohydrate molecules.
- Describe the conversion of glucose to pyruvate in glycolysis.
- Describe the oxidation of acetyl-CoA in the citric acid cycle.
- Describe the process of oxidative phosphorylation in ATP synthesis.
- Give the conditions for the conversion of pyruvate to lactate, ethonal, and acetyl coenzyme A.
- Describe three stages of metabolism.
- Describe the synthesis and breakdown of glycogen.

**Chapter 23 Metabolism and Energy Production**
- Describe the conversion of glucose to pyruvate in glycolysis.
- Describe how hydrogen and electrons are transferred during electron transport.
- Describe the oxidation of acetyl-CoA in the citric acid cycle.
- Account for the ATP produced by the complete oxidation of glucose.

**Chapter 24 Metabolic Pathways for Lipids and Amino Acids**
- Describe the sites and products obtained from the digestion of triacylglycerols.
- Describe the metabolic pathway of B-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 formation of urea from ammonium ion.
- Define ketosis and explain how your body can enter a state of ketosis.