CHEM365: Fundamentals of Biochemistry

This Class Meets Online via Zoom on Tuesday and Thursday: 12:30 – 1:45 pm, 3 units

Instructor: Professor John J. Love
Department of Chemistry & Biochemistry
Physical Office: CSL 339A (located inside Laboratory in CSL 339)
e-mail: jlove@sdsu.edu

Course time: 12:30-1:45 p.m., Tuesday and Thursday, Online via Zoom

Professor Love's Office hours: Wed. 1:00 -2:00 p.m. on Thurs. & 2:00-3:00 pm via Zoom. If necessary, send e-mail to Dr. Love to make an appointment for an alternative Zoom time.

Required Textbook: Fundamentals of Biochemistry Life at the Molecular Level by D. Voet, J.G. Voet and C.W. Pratt, 5th Edition, Wiley & Sons, Inc.

An e-book of the textbook can be accessed through a link on the left side of the course Canvas page. For more information about how this works please read the information provided on the SDSU Immediate Access website (https://www.shopaztecs.com/t-immediateaccess.aspx). You will be automatically enrolled in purchasing the electronic version of the textbook. If you do not want to pay for the electronic version (if you already have a physical textbook) you will need to 'opt out' by the SDSU and drop deadline (September 4th, by 7:59 PM)

Pseudo-clicker: Some form of in-class student response system will be devised, tested, and implemented by Dr. Love. This system will require student input during class.

Course attendance Policy: Students must attend all Zoom lectures held on Tuesday and Thursdays, and also view ny recorded Youtube lectures. Each lecture will have inserted Playposit questions that all students must answer. Correct answers to Playposit questions will be awarded points.

Syllabus is Subject to Change: This syllabus and schedule are subject to change in the event of extenuating circumstances. If you are absent from class, it is your responsibility to check on announcements made while you were absent.

Course Overview and Description: Chemistry 365: Fundamentals of Biochemistry is an important course that covers basic concepts of modern integrated biochemistry, cell and molecular biology. The structure, function, metabolism, and thermodynamic relationships of chemical entities in living systems will be fully described. The thermodynamic properties of biological macromolecules will initially be reviewed along with a review of the important role water plays in all living systems. Students will learn the different levels of macromolecular structure and the important interplay between structure and function. The macromolecules that will be explicitly described include DNA, RNA, proteins, carbohydrates, lipids as well as some of their derivatives. The lipids that make up the all-important cell membrane will be described and analyzed along with all the embedded biological macromolecules that enable the membrane to properly function. Finally, the catalytic mechanisms and kinetic properties of a number of important biological enzymes will be explicitly described and analyzed.

From the SDSU General Catalog

Prerequisites: Biology 203, 203L and Chemistry 232, 232L Chemistry 232, 232L. The structure, function, metabolism, and thermodynamic relationships of chemical entities in living systems.

Student Learning Outcomes:

1. Students will be able to fully describe and analyze the thermodynamic properties of biological macromolecules and the means by which these molecules function in living systems.
2. Students will be able to fully describe the role that water plays in all biochemical processes.
3. Students will be able to fully describe the structures and associated functions of biological macromolecules such as DNA, carbohydrates, lipids and proteins.
4. Students will be able to fully describe the methods used to purify biological macromolecules and explicitly analyze polyacrylamide gel electrophoresis results as well as column chromatography.
5. Students will be able to fully describe the catalytic mechanisms of a number of important biological enzymes.
6. Students will be able to understand, and potentially use, many of the fundamental tools used extensively in the field of molecular biology.

Required Textbook: Fundamentals of Biochemistry Life at the Molecular Level by D. Voet, J.G. Voet and C.W. Pratt, **5th Edition**, Wiley & Sons, Inc.

Course Requirements:

- **Course attendance Policy**: Students are expected to attend all Zoom lectures.

- **Grades:** Grades are based on the following: 1) three midterm exams, 2) approximately 12 on-line Canvas assignments (one per chapter), and 3) in-class responses. Exams and assignments that students fail to take will be assigned a grade of **zero**. The date of each exam is given below in this course schedule. The first two exams are given during class periods and the last exam is given during the final exam time slot. The due-date schedule for the on-line Canvas assignments are also listed in the class schedule as well as on Canvas.

- **Canvas Assignments:** Your online assignments **MUST** be completed through your SDSU Canvas account. The on-line Canvas assignments will all be very similar to the problems that are in the back of each chapter in your textbook. They will be similar but not exactly the same. It is suggested that you first work on and complete the questions at the end of each chapter. You will **NOT** hand these in. You must complete the on-line Canvas assignments by the assigned dates as they will not be available after the assigned due-date.

Statement on Cheating and Plagiarism: Academic honesty, simply put - Don't cheat! If you cheat you will receive an F for the course and possibly be expelled from SDSU. Cheating is the actual or attempted practice of fraudulent or deceptive acts for the purpose of improving one's grade or obtaining course credit; such acts also include assisting another student to do so. Typically, such acts occur in relation to examinations. However, it is the intent of this definition that the term 'cheating' not be limited to examination situations only, but that it includes any and all actions by a student that are intended to gain an unearned academic advantage by fraudulent or deceptive means. Plagiarism is a specific form of cheating which consists of the misuse of the published and/or unpublished works of others by misrepresenting the material (i.e., their intellectual property) so used as one's own work. The penalty for cheating and plagiarism is an F for the course and possible expulsion from the University. For more information on the University's policy regarding cheating and plagiarism, refer to the Schedule of Courses ('Legal Notices on Cheating and Plagiarism') or the University Catalog ('Policies and Regulations'). You will need to learn the material in this course and, more importantly, develop the problem-solving skills required of this course to be prepared for upper division coursework and eventually a career.

Exams and grading: There will be 2 mid-term exams given in class and one final exam. The final is not comprehensive and will be given on-line via Canvas on Tuesday December 15th, 2020 from 10:30-12:30 p.m. Any absence from an exam, which is not excused **before** the exam will result in an automatic **zero** for that exam. If an online Canvas assignment is not completed by the assigned due-date that assignment will receive a zero (**NO** exceptions).

Exam 1	300 pts.	Chapter 1, 2, 3, 4
Exam 2	300 pts.	Chapter 5, 6, 7, 8
Exam 3 (final exam)	300 pts.	Chapter 9, 10, 11, 12
Online Canvas Assignments	100 pts.	~12 assignments
In-Class Participation (pseudo i>clicker) points	50 pts.	
	1050 pts. total	

The following grades are guaranteed for the percentages shown. It is possible that the percentages may be lowered, but they will not be raised for a given letter grade.

A	90%	D	60%
B	80%	F	below 60%
C	70%		

Online Canvas Assignments: Throughout the semester there will be approximately 12 online Canvas assignments (one for each chapter). Each Canvas assignment may contain between 5 to 25 questions and each question will be worth one point. At the end of the semester the assignment scores will be totaled and scaled to 100 points. For example, if there are a total of 150 Canvas assignment questions (worth one point each) throughout the semester and a student answered 120 questions correctly then they would receive 80 out of a possible 100 points for correct assignment answers (*i.e.,* 120/150 = 80%. 80% of 100 possible points = 80 points).

Class Participation (pseudo-clickers): For this semester you are **NOT** required to purchase an i>clicker remote for in-class participation. i>clicker is a response system (a remote) that allows you to answer questions that are posed during lives lectures. Dr. Love will devise and implement a system that is similar to clicker questions. It is anticipated that there will be between three to five questions per lecture beginning with the second to third week of the semester. These questions are usually presented in multiple choice format and students typically have about 1 minute to respond. The purpose of this exercise is to identify any misunderstandings with the material and encourage active learning. A small percentage of your total grade will derive from this form of in-class participation.

A maximum of 50 total grade points can be earned from pseudo-clicker participation. Each student receives one pseudo-clicker point by choosing the correct answer. At the end of the semester, a student's pseudo-clicker points are added and then increased by 10% to allow for absences, malfunctioning technology, and all other possible problems. The pseudo-clicker points are then normalized to the maximum of 50 grade points. For example, if there are 323 pseudo-clicker questions asked during the entire semester, there are 323 possible total pseudo-clicker question points. A student who earns 256 pseudo-clicker points (after the 10% increase) will receive 39.6 actual grade points. [Let's say you earned 233 pseudo-clicker points. 233 plus 10% of 233 is approximately 256. 256/323 x 50 possible points = 39.6 points total for pseudo-clicker participation].

Students with Disabilities: "**Americans with Disabilities Act (DA) Accommodation:** *The University is committed to providing reasonable academic accommodation to students with disabilities. The Student Disability Services Office provides university academic support services and specialized assistance to students with disabilities. Individuals with physical, perceptual, or learning disabilities as addressed by the Americans with Disabilities Act should contact Student Disability Services for information regarding accommodations. Please notify your instructor so that reasonable efforts can be made to accommodate you. If you expect accommodation through the*

Act, contact the Student Disability Services Office (http://go.sdsu.edu/student_affairs/sds/) at (619) 594-6473."

Religious Observances: "University Policy on Absence for Religious Observances includes the following statements: "By the end of the **second** week of classes, students should notify the instructors of affected courses of planned absences for religious observances. Instructors shall ***reasonably*** *accommodate students* ***who notify them in advance*** *of planned absences for religious observances." Please notify the instructor in a timely manner and a reasonable accommodation will be reached.*

(Class Schedule is on the following page)

In the Class Schedule table on the next page there are five columns - 1) Date, 2) Topic, 3) Required Reading, 4) Corresponding Textbook Assignment, and 5) Canvas Assignment Deadline. Columns 1-3 are self-explanatory. Column 4 provides a list of questions from the actual back-of-the-textbook-chapters. You are **not** required to hand in the answers to these questions. It is meant to simply provide you with a reference as to where the questions in the Canvas Assignments were derived from. Column 5 lists the due dates for the Canvas Assignments.

Course Schedule:

Date	Topic	Required Reading	Corresponding Textbook Assignment	Canvas assignment # deadline
08/25/20	Introduction and Overview (Origins of Life)	Chap. 1, pages 1 - 11	**1:** 1 - 13	#1: 08/30/20
08/27	Thermodynamics: 1st & 2nd Laws	Chap. 1, pages 11 - 21	**1:** 1 - 13	
09/01	Gibbs Free Energy and ΔG in coupled reactions	Chap. 14.2, pages 446 - 456	**14:** 13 – 15, 17, 18	#1.4: 09/06/20
09/03	Properties of water; acids and bases	Chap. 2, pages 22 - 30	**2:** 1– 10, 12 – 21	#2: 09/13/20
09/08	Acids and bases (continued), buffers	Chap. 2, pages 30 - 39		
09/10	Acids and bases (continued), buffers			
09/15	Nucleotide and Nucleic Acid Structure	Chap. 3, pages 40 - 48	**3:** 1, 2, 7-10, 13-15, 17-20, 22, 25-27, 29	#3: 09/20/20
09/17	Genetic Information and Sequencing	Chap. 3, pages 48 - 58		
09/22	Manipulating DNA	Chap. 3, pages 62 - 75		
09/24	Amino Acids: acid-base properties; peptide bonds	Chap. 4, pages 76 - 92	**4:** 5-12,14, 16, 17, 24	#4: 09/27/20
09/29	Amino Acids (con't.)			
10/01	**First Examination**	**(Chapters 1-4, 14.2)**		
10/06	Peptides and proteins; protein isolation, purification by chromatographic methods	For Chapter 5 you are responsible for the following sections 1 Polypeptide Diversity 2 Protein Purification and Analysis You are also responsible for Mass Spectrometry and the table titled Specificities of Various Endopeptidases. You are not responsible for 3 Protein Sequencing 4 Protein Evolution	**5:** 1, 3-7, 9-14, 19, 20, 23-27 (come to office hours if you need help with any of these problems)	#5: 10/11/20
10/08	Protein Purification (cont.): electrophoresis, ultracentrifugation			
10/13	Protein secondary structure: α-helix, β-sheet, structural proteins: collagen, keratin, silk fibroin; tertiary structure	Chapter 6 you are responsible for all sections except for the Structural Bioinformatics section and	**6:** 1, 2, 4-16, 19-21, 23, 24	

		the section on the Quaternary Structure and Symmetry		#6: 10/18/20
10/15	Myoglobin and hemoglobin, Bohr effect, sickle cell and other abnormal hemoglobins.	For Chapter 7 you are responsible for the section on Oxygen Binding to Myoglobin and Hemoglobin and the section on Antibodies. You are not responsible for section on muscle contraction.	**7:** 5-8, 11-16, 23-29	#7: 10/25/20
10/20	Hemoglobin (continued), Antibody structure			
10/22	Carbohydrates: monosaccharides, reducing sugars (redox reactions), hemiacetal and acetal bonds, bonding, disaccharides and polysaccharides	Chap. 8, pages 217 - 240	**8:** 3, 4, 6, 11, 12, 14, 18, 19	#8: 11/01/20
10/27	carbohydrates (con't.)			
10/29	carbohydrates (con't.)			
11/03	**Second Examination**	**(Chapters 5, 6, 7, 8)**		
11/05	Lipids, triacylglycerol, steroid hormones, etc.	Chap. 9, pages 241 – 251 (but not the section titled: Vitamin D Regulates Ca^{2+} Metabolism)	**9:** 1-3, 6, 7, 11-15, 17, 18	#9: 11/08/20
11/10	Membranes	Chap. 9, pages 252 – 287		
11/12	Membrane Transport	Chap. 10, pages 288 – 295, 299-314	**10:** 5-11, 17, 22	#10: 11/15/20
11/17	Enzymatic Catalysis	Chap. 11, pages 315-354	**11:** 1-4, 6-8, 11-16, 19-21, 27-31	#11: 11/22/20
11/20	Enzymatic Catalysis (con't.)			
11/24	Enzymatic Catalysis (con't.)			
11/26	**Thanksgiving** – no class, have a happy and healthy holiday			
12/01	Enzymatic Catalysis (con't.)			
12/03	Enzyme Kinetics	Chap. 12, pages 355 -376	**12:** 1-4, 9-11, 15-17, 25	#12: 12/08/20
12/08	Enzyme Kinetics (con't.)			
12/10	Enzyme Kinetics (con't.)			
Final Exam Tuesday. 12/15/20 10:30 am - 12:30 pm	**Final Exam is NOT cumulative and covers Chapters 9 through 12.**	The final exam will be held on Tuesday December 15th, 2020 from 10:30 am – 12:30 pm Location: on-line Zoom		