CHEM162: Saving Our Planet with Sustainable Biochemistry

Course Syllabus

Close-up image of a Honeybee (*Apis mellifera*) collecting nectar from a violet-colored flower of an African Blue Basil plant.

Semester: Spring 2026
Class Days: Monday, Wednesday, and Friday
Class Location: COM 207
Attendance: Mandatory for every class

Class Number: 6726
Class Times: 11:00 AM to 11:50 AM
Course Modality: Face-to-face, Live Lectures
Platform: Canvas

Instructor: Prof. John Love
Email: jlove@sdsu.edu
Office location: CSL 339A (located inside the Love Laboratory in CSL 339)
Office hours: Wed. 12:00-1:00 p.m. and Fri for. 12:00-1:00 pm.

Syllabus is Subject to Change: This syllabus and schedule are definitely subject to change in the event of extenuating circumstances. If you are absent from class, it is absolutely your responsibility to check for Canvas announcements that are made during your absence.

Course Modality (how the course will be delivered)**:** Live, face-to-face lectures in COM 207.

Course Overview and Description (from the SDSU Catalog): Highly sustainable biochemical processes such as apiary science (beekeeping), edible insects, smart textiles, food production systems such as hydroponics, aquaponics, and humane poultry egg production from food waste. Upon global implementation, these processes may help save our planet. Concepts of general chemistry, organic chemistry, and biological chemistry will be described in order for students to fully understand sustainable biochemical processes. Additional concepts include chemical bonding, acidity, thermodynamics, carbohydrates, lipids, enzymes, proteins, and nucleic acids.

Required Textbook: The Basics of General, Organic, and Biological Chemistry from The Open Textbook Library (https://open.umn.edu/opentextbooks/textbooks/40)

Diversity, Equity, and Inclusion: In this course, we are absolutely committed to fostering a learning environment that values diversity, equity, and inclusion. We believe that the study of sustainable biochemistry significantly benefits from a wide range of perspectives, experiences, unique cultural backgrounds, and a variety of different voices.

- **Respect**: All members of this class are expected to treat one another with respect and kindness, recognizing the unique contributions that each individual brings to our collective understanding of biochemistry and sustainability.
- **Access**: We strive to ensure that course materials, discussions, and activities are accessible to all students, regardless of background, abilities, or personal circumstances. Please let me know if you feel there are barriers to your full participation so we can work together to address them.
- **Collaboration**: Science absolutely thrives on collaboration, and we encourage open dialogue and constructive feedback. By embracing diverse viewpoints, we can better tackle complex issues in sustainable biochemistry more effectively.
- **Responsibility**: Each of us has a role to play in creating a positive and inclusive classroom. Discrimination, harassment, or exclusion of any kind will not be tolerated.
- **Working Together:** Together, we will cultivate a learning space where everyone feels valued, supported, and inspired to contribute to the advancement of sustainable science.

Course attendance Policy: Students are absolutely expected to attend all scheduled lessons held from 11:00 AM until 11:50 AM on Mondays, Wednesdays, and Fridays.

Student Learning Outcomes:

1. Students will read definitions of and infer relationships between hypothesis, scientific law, scientific theory, causation and correlation, and experimental variables.
2. Students will fully describe, analyze, and recall the basic properties of chemical and biological molecules and the means by which these molecules function in living systems.
3. Students will read, recognize, and recall the organic classes of chemical groups commonly found in biological molecules, predict their reactivity, and explain the structure and function of biological systems from chemical and physical perspectives.
4. Students will analyze and describe the critical role that water, and buffers play in biochemical processes.
5. Students will analyze the history, global implementation, modern technologies, and current problems associated with Apiary Science (Beekeeping), and the global honey and commercial pollination industry.
6. Students will appraise and compare the historic use, nutritional profiles, and the sustainable culturing of edible insects.
7. Students will discuss, classify, and illustrate the toxic pollution associated with the textile industry and how sustainable production of protein fibers may alleviate textile pollution.
8. Student will identify and describe the fundamental science associated with sustainable gardening methods practiced by Master gardeners.
9. Students will analyze, illustrate, and point out connections between the different sustainable methods associated with Urban Agriculture such as hydroponics, aquaculture, and aquaponics.
10. Student will analyze and assess the validity of the process of sustainable poultry egg production and critique Black soldier fly larvae, raised on human food waste, as a viable feed for chickens.

Prerequisites: There are no prerequisites for this course. It is preferred that students have previously taken a high school or university STEM-related course in areas such as biology, chemistry, or physics.

Exams and Grading Policy: Grades are based on the following: 1) three midterm exams and one final exam, 2) in-class responses to 'clicker' questions, and 3) PlayPosit questions embedded in assigned videos. The date of each exam is given below in the course schedule. The first three exams will be given during class periods, and the final exam will be given during the final exam time slot. All four midterm exams will be taken by all students in our classroom during the standard class times, except for the final exam which will be given during the finals time slot. For the three midterm exams and final exam, if a student fails to take an exam it will be assigned a grade of zero. In case of an illness or emergency, which may preclude a student from being able to take a scheduled exam, it is expected that the student will contact the instructor prior to the exam if possible. Makeup exams will be administered only upon consultation with the instructor.

Course Grade Distribution:

Exam 1	100 pts.	20% of course work
Exam 2	100 pts.	20% of course work
Exam 3	100 pts.	20% of course work
Exam 4	100 pts.	20% of course work
In-Class Participation (clicker) points and PlayPosit questions embedded in assigned videos	100 pts.	20% of course work
	500 pts	

The following grades are guaranteed for the percentages shown. It is possible that the percentages may be curved more favorably to lower values, but they will not be raised for a given letter grade.

points	percentage	letter grade
475 – 500	95.0 - 100%	A
450 – 475	90.0 - 95.0%	A-
433 - 450	86.6 - 90.0%	B+
416.5 - 433	83.3 - 86.6%	B
400 – 416.5	80.0 - 83.3%	B-
383 - 400	76.6 - 80.0%	C+
366.5 - 383	73.3 - 76.6%	C
350 – 366.5	70.0 - 73.3%	C-
300 - 350	60.0 - 70.0%	D
below 300	below 60.0%	F

Class Participation (Clicker Questions): You are required to purchase the i>clicker app (sometimes referred to as an iclicker or i<clicker app) for in-class participation. You are only permitted to use your cell phones for the use of the i>clicker app during class. Therefore, you must purchase the clicker app from the bookstore, and you are to use the cell phone clicker app during class.

A clicker is a response system (a phone app) that allows you to answer questions that are posed during lectures. It is anticipated that there will be between five to ten questions per lecture beginning with the second week of the semester. These questions are usually presented in multiple choice format, and students typically have about 30 seconds to 1 minute to respond using the clicker. 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. For you to receive this credit, you MUST register your clicker app for this class through a link in your SDSU Canvas course menu. In order to get clicker credit you must register your clicker with this course through the SDSU Canvas

system. This is different than registering the app with the clicker company (which is not necessary to receive credit for clicker points). You will use your clicker app during almost every lecture. All information pertaining to clickers can be found at the SDSU website (https://its.sdsu.edu/software/audience-response-system). Students who forget their clicker app, or if their clicker app malfunctions (*e.g.,* cellphone fails) will NOT receive any points for that particular class session. The means by which absences, malfunctions, or forgotten clickers are dealt with is described below.

During the semester a maximum of 100 final grade points can be earned from all clicker participation and PlayPosit questions embedded in assigned videos. During each class, each student receives one clicker point for participation per session (per class), and additional points for correct answers. At the end of the semester, a student's clicker points from each class are totaled and then increased by 10% to allow for absences, malfunctioning clickers, and all other possible problems. The clicker points and the PlayPosit questions embedded in assigned videos are then normalized to the maximum of 100 grade points. For example, if there are 200 clicker questions posed during classes throughout the entire semester, then there are 200 possible clicker question points. A student who earned 150 clicker points (after the 10% increase) will receive 75 grade points (out of a possible 100 total points).

Course Schedule: In the following Class Schedule table there are three columns - 1) Date, 2) Chapter Topic, and 3) Subtopics. The class schedule listed below is currently a 'proposed' tentative schedule. As the class is always addressing novel biochemical and sustainable issues, the schedule is likely to change and be altered during this first semester of teaching the course. But the exam dates will not change.

Date	**Topic**	**Required Reading**
Wednesday 01/21/2026	Introduction and Overview	Chapter 1 What Is Chemistry? The Classification of Matter
Friday 01/23/2026	Introduction to Beekeeping (I) (Apiary Science)	Dr. Love PDF notes and supplied literature (Canvas)
Monday 01/26/2026	How do we measure chemistry and biochemistry? (I)	Chapter 1 Measurements The International System of Units Scientific Notation
Wednesday 01/28/2026	How do we measure chemistry and biochemistry? (II)	Chapter 1 Significant Figures Converting Units
Friday 01/30/2026	Introduction to Beekeeping (II) (Apiary Science - continued)	Dr. Love PDF notes and supplied literature (Canvas)
Monday 02/02/2026	Elements, Atoms, Molecules (I)	Chapter 2 The Elements Atomic Theory Atomic Masses The Periodic Table
Wednesday 02/04/2026	Elements, Atoms, Molecules (II)	Chapter 2 The Elements Atomic Theory Atomic Masses The Periodic Table

Friday 02/06/2026	Introduction to Beekeeping (III) (Apiary Science - continued)	Dr. Love PDF notes and supplied literature (Canvas)
Monday 02/09/2026	Ionic Bonding and Simple Ionic Compounds (I)	Chapter 3 Two Types of Bonding Ions Formulas for Ionic Compounds
Wednesday 02/11/2026	Ionic Bonding and Simple Ionic Compounds (II)	Chapter 3 Ionic Nomenclature Formula Mass
Friday 02/13/2026	Introduction to Beekeeping (IV) (Apiary Science - continued)	Dr. Love PDF notes and supplied literature (Canvas)
Monday 02/16/2026	**First Examination**	
Wednesday 02/18/2026	Covalent Bonding and Simple Molecular Compounds (I)	Chapter 4 Covalent Bonds Covalent Compounds: Formulas and Names Multiple Covalent Bonds
Friday 02/20/2026	Colony Collapse Disorder, *Varroa* destructor (*Varroa mite)* (I)	Dr. Love PDF notes and supplied literature (Canvas)
Monday 02/23/2026	Covalent Bonding and Simple Molecular Compounds (II)	Chapter 4 Characteristics of Covalent Bonds Characteristics of Molecules
Wednesday 02/25/2026	Covalent Bonding and Simple Molecular Compounds (III)	Chapter 4 Introduction to Organic Chemistry
Friday 02/27/2026	Composting and Anaerobic Digestion (I)	Dr. Love PDF notes and supplied literature (Canvas)
Monday 03/02/2026	Introduction to Chemical Reactions (I)	Chapter 5 The Law of Conservation of Matter Chemical Equations
Wednesday 03/04/2026	Introduction to Chemical Reactions (II)	Chapter 5 Quantitative Relationships Based on Chemical Equations Some Types of Chemical Reactions
Friday 03/06/2026	Composting and Anaerobic Digestion (II)	Dr. Love PDF notes and supplied literature (Canvas)
Monday 03/09/2026	Quantities in Chemical Reactions (I)	Chapter 6 The Mole Atomic and Molar Masses Mole-Mass Conversions
Wednesday 03/11/2026	Quantities in Chemical Reactions (II)	Chapter 6 Mole-Mole Relationships in Chemical Reactions Mole-Mass and Mass-Mass Problems
Friday 03/13/2026	Sustainable and Humane Poultry Egg Production	Food Waste to Rich Protein via Black Soldier Fly Larvae (Hermetia illucens → soil piranhas)
Monday 03/16/2026	**Second Examination**	
Wednesday 03/18/2026	Energy and Chemical Processes (I)	Chapter 7 Energy and Its Units Heat

		Phase Changes
Friday 03/20/2026	Edible Insects as a Sustainable Protein Source	Crickets (*Acheta domesticus)* Mealworms (*Tenebrio molitor)*
Monday 03/23/2026	Energy and Chemical Processes (II)	Chapter 7 Bond Energies and Chemical Reactions The Energy of Biochemical Reactions
Wednesday 03/25/2026	Solids, Liquids, and Gases (I)	Chapter 8 Intermolecular Interactions Solids and Liquids
Friday 03/27/2026	Solids, Liquids, and Gases (II)	Chapter 8 Gases and Pressure Gas Laws
Monday 03/30/2026	Spring Break (no class)	
Wednesday 04/01/2026	Spring Break (no class)	
Friday 04/03/2026	Spring Break (no class)	
Monday 04/06/2026	Solids, Liquids, and Gases (III)	Chapter 8 Gases and Pressure Gas Laws (con't)
Wednesday 04/08/2026	Edible Insects as a Sustainable Protein Source	Super Worms *(Zophobas morio)* Oaxacan cuisine Chicatanas (flying ants) Chapulines (grasshoppers)
Friday 04/10/2026	**Third Examination**	
Monday 04/13/2026	Chemical Solutions (II)	Chapter 9 The Dissolution Process Properties of Solutions
Wednesday 04/15/2026	Acid and Base Chemistry (I)	Chapter 10 Arrhenius Definition of Acids and Bases Brønsted-Lowry Definition of Acids and Bases
Friday 04/17/2026	Urban Agriculture (I)	Dr. Love PDF notes and supplied literature (Canvas)
Monday 04/20/2026	Acid and Base Chemistry (II)	Chapter 10 Water: Both an Acid and a Base The Strengths of Acids and Bases
Wednesday 04/22/2026	Acid and Base Chemistry (III)	Chapter 10 Chemical Buffers Physiological Buffers
Friday 04/24/2026	Urban Agriculture (II)	Dr. Love PDF notes and supplied literature (Canvas)
Monday 04/27/2026	Organic Chemistry: Alkanes and Halogenated Hydrocarbons (I)	Chapter 12 Organic Chemistry Structures and Names of Alkanes Branched-Chain Alkanes Condensed Structural and Line-Angle Formulas

Wednesday 04/29/2026	Organic Chemistry: Alkanes and Halogenated Hydrocarbons (II)	Chapter 12 IUPAC Nomenclature Physical Properties of Alkanes Chemical Properties of Alkanes Halogenated Hydrocarbons Cycloalkanes
Friday 05/01/2026	Sustainable Textiles for Smart Clothing	Dr. Love PDF notes and supplied literature (Canvas)
Monday 05/04/2026	Unsaturated and Aromatic Hydrocarbons	Chapter 13 Alkenes: Structures and Names Cis-Trans Isomers (Geometric Isomers) Physical Properties of Alkenes Chemical Properties of Alkenes Polymers Alkynes Aromatic Compounds: Benzene Structure and Nomenclature of Aromatic Compounds
Wednesday 05/06/2026	Organic Compounds of Oxygen	Chapter 14 Organic Compounds with Functional Groups Alcohols: Nomenclature and Classification Physical Properties of Alcohols Reactions That Form Alcohols Reactions of Alcohols Glycols and Glycerol Phenols Ethers Aldehydes and Ketones: Structure Properties of Aldehydes and Ketones
Final Exam Monday 05/11/2026 10:30 am - 12:30 pm	**Fourth and Final Examination**	The final exam will be held on Monday, May 11th, 2026, from 10:30 am – 12:30 pm. The final exam will be held in COM 207.

General Education (GE) Foundation Course: This course is one of nine courses that you will take in General Education Foundations. Foundations courses cultivate skills in reading, writing, research, communication, computation, information literacy, and use of technology. They furthermore introduce you to basic concepts, theories and approaches in a variety of disciplines in order to provide the intellectual breadth necessary to help you integrate the more specialized knowledge gathered in your major area of study into a broader world picture.

Natural Sciences and Quantitative Reasoning (GE): This course is one of three Foundations courses that you will take in the area of Natural Sciences and Quantitative Reasoning. Upon completing Natural Science Foundations courses in physical sciences, life sciences, and a lab, you will be able to: 1) explain basic concepts and theories of the natural sciences; 2) use logic and scientific methods to analyze the natural world and solve problems; 3) argue from multiple perspectives about issues in natural science that have personal and global relevance; 4) use technology in laboratory and field situations to connect concepts and theories with real-world phenomena. Upon completing a Foundations course in Quantitative

Reasoning you will be able to: 1) apply appropriate computational skills and use basic mathematical concepts to analyze problems in natural and social sciences; and 2) use methods of quantitative reasoning to communicate answers to real-world problems.

Applied biochemical methods that students will appraise and master upon taking and completing this class include the following:

- Introduction to General Chemistry Principles
    - Elements, Atoms, Molecules
    - Forces within (intra) and between (inter) molecules
    - Acid/Base Chemistry
- Introduction to Organic Chemistry Principles Pertinent to Biochemistry
    - What is Organic Chemistry?
    - What's so great about carbon?
    - Covalent bonding
    - Hydrophobicity/Hydrophilicity
    - Hydrocarbons (Petroleum)
    - Petrochemical Industry (plastics from petroleum)
- Introduction to Important Biochemical Principles
    - The Central Role of H_2O
    - Four Major Categories of Biomolecules
    - Buffers in Living Systems
    - Metabolism, Catabolism
    - Photosynthesis
- Apiculture (Beekeeping)
    - History of Beekeeping
    - Honey Nutritional Profile, Production, and Harvesting
    - High Nectar and Pollen Producing Plants
    - Colony Collapse Disorder, *Varroa* destructor (*Varroa mite*)
- Edible Insects as a Sustainable (and Tasty!) Protein Source
    - Crickets (*Acheta domesticus)*
    - Mealworms (*Tenebrio molitor*)
    - Super Worms *(Zophobas morio)*
    - Oaxacan cuisine
        - Chicatanas (flying ants)
        - Chapulines (grasshoppers)
- Sustainable Textiles for Smart Clothing
    - Protein-based Fibers from Arachnids (Spiders) and Insects
        - Silk Textiles from Silkworms (*Bombyx mori*)
        - Spider Web Fibers → Stronger than Steel and Kevlar
        - Protein Design of Novel Fibers for Smart (Electric) Textiles
- Master Gardening
    - Organic Gardening
    - Soils Health (Microbial Community)
    - Plant Nutrients (Fertilizers)
    - Biochar (Terra Preta) Production

- Urban Agriculture:
    - Hydroponics: soil-less agriculture
    - Aquaculture: fish farming, crustaceans, aquatic plants, etc.
    - Aquaponics: combining aquaculture with hydroponics
- Sustainable and Humane Poultry Egg Production
    - Food Waste to Rich Protein via Black Soldier Fly Larvae (*Hermetia illucens* → soil piranhas)
- Master Composting
    - Composting with Worms (Vermicomposting)
    - Large Scale, Municipal Composting
    - Composting Human Food Waste with Black Soldier Fly Larvae (*Hermetia illucens)*

Email Policy: Students are provided with an SDSU Gmail account, and this SDSU email address will be used for all communications. Per University Senate policy, students are responsible for checking their official university email once per day during the academic term. For more information, please see Student Official Email Address Use Policy here. All communication regarding this course should occur through official SDSU email accounts.

Academic Honesty: The University adheres to a strict policy prohibiting cheating and plagiarism. Examples of academic dishonesty include but are not limited to:

- copying, in part or in whole, from another's test or other examination;
- obtaining copies of a test, an examination, or other course material without the permission of the instructor;
- collaborating with another or others in work to be presented without the permission of the instructor;
- falsifying records, laboratory work, or other course data;
- submitting work previously presented in another course, if contrary to the rules of the course;
- altering or interfering with grading procedures;
- assisting another student in any of the above;
- using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work);
- copying and pasting work from an online or offline source directly and calling it your own;
- using information you find from an online or offline source without giving the author credit;
- replacing words or phrases from another source and inserting your own words or phrases.

Unauthorized recording or dissemination of virtual course instruction or materials by students, especially with the intent to disrupt normal university operations or facilitate academic dishonesty, is a violation of the Student Conduct Code. This includes posting of exam problems or questions to on-line platforms. Violators may be subject to discipline.

The California State University system requires instructors to report all instances of academic misconduct to the Center for Student Rights and Responsibilities. Academic dishonesty will result in disciplinary review by the University and may lead to probation, suspension, or expulsion. Instructors may also, at their discretion, penalize student grades on any assignment or assessment discovered to have been produced in an academically dishonest manner.
Classroom Conduct Standards and Netiquette:

SDSU students are expected to abide by the terms of the Student Conduct Code in classrooms and other instructional settings. Violation of these standards will result in referral to appropriate campus authorities. Prohibited conduct includes:

- Willful, material and substantial disruption or obstruction of a University-related activity, or any on-campus activity.
- Participating in an activity that substantially and materially disrupts the normal operations of the University or infringes on the rights of members of the University community.
- Unauthorized recording, dissemination, or publication (including on websites or social media) of lectures or other course materials.
- Conduct that threatens or endangers the health or safety of any person within or related to the University community, including
    1. physical abuse, threats, intimidation, or harassment.
    2. sexual misconduct.

Statement on Cheating and Plagiarism: 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.

Students with Disabilities: "**Americans with Disabilities Act (DA) Accommodation:** *The University is committed to providing reasonable academic accommodation to students with disabilities. If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Ability Success Center at (619) 594-6473. To avoid any delay in the receipt of your accommodations, you should contact Student Ability Success Center as soon as possible. Please note that accommodations are not retroactive, and that I cannot provide accommodations based upon disability until I have received an accommodation letter from Student Ability Success Center. Your cooperation is appreciated. (http://go.sdsu.edu/student_affairs/sds/) at (619) 594-6473*

Nondiscrimination Policy

- San Diego State University complies with the requirements of Title VI and Title VII of the Civil Rights Act of 1964, as well as other applicable federal and state laws prohibiting discrimination. No person shall, on the basis of race, color, or national origin be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination in any program of the California State University
- SDSU does not discriminate on the basis of disability in admission or access to, or treatment or employment in, its programs and activities. Students should direct inquiries concerning San Diego State University's compliance with all relevant disability laws to the Director of Student Disability Services (SDS), Calpulli Center, Room 3101, San Diego State University, San Diego, CA 92128 or call 619-594-6473 (TDD: 619-594-2929).

- SDSU does not discriminate on the basis of sex, gender, or sexual orientation in the educational programs or activities it conducts. More detail on SDSU's Nondiscrimination Policy can be found in the SDSU General Catalog, University Policies. Students should direct FERPA, Title IX, Discrimination, Harassment or any other protected categories inquiries and concerns to the office of Employee Relations and Compliance, phone number is 619-594-6464 and their website is http://oerc.sdsu.edu/

Land Acknowledgment: We stand upon a land that carries the footsteps of millennia of Kumeyaay people. They are a people whose traditional lifeways intertwine with a worldview of earth and sky in a community of living beings. This land is part of a relationship that has nourished, healed, protected and embraced the Kumeyaay people to the present day. It is part of a world view founded in the harmony of the cycles of the sky and balance in the forces of life. For the Kumeyaay, red and black represent the balance of those forces that provide for harmony within our bodies as well as the world around us. As students, faculty, staff and alumni of San Diego State University we acknowledge this legacy from the Kumeyaay. We promote this balance in life as we pursue our goals of knowledge and understanding. We find inspiration in the Kumeyaay spirit to open our minds and hearts. It is the legacy of the red and black. It is the land of the Kumeyaay. 'eyay e'haan My heart is good.