



Credit- Degree applicable
Effective Quarter: Fall 2017

I. Catalog Information

CHEM 30B Introduction to General, Organic and Biochemistry II 5 Unit(s)

(See general education pages for the requirement this course meets.)

Prerequisite: CHEM 1A, 25 or 30A.

Advisory: EWRT 211 and READ 211 (or LART 211), or ESL 272 and 273.

Four hours lecture, three hours laboratory (84 hours total per quarter).

This class is for students entering the allied health fields. The focus of the second part of Introduction to General, Organic, and Biochemistry is organic and biochemistry. The topics included in organic chemistry are: hydrocarbons, alcohols, thiols, ethers, carboxylic acids, esters, amines, and amides. Various physical and chemical properties of these organic substances will be studied along with nomenclature and structural features. The topics included in biochemistry are: carbohydrates, fatty acids and lipids, amino acids and proteins, nucleic acids and DNA. Various physical and chemical properties of these biological molecules will be studied. A brief introduction to metabolism will also be discussed.

Student Learning Outcome Statements (SLO)

Differentiate the general reactions of the principle organic functional groups.

Evaluate the major classes of biological compounds from a chemical perspective.

II. Course Objectives

- A. Examine the chemistry of simple organic molecules with an emphasis on structural features and nomenclature
- B. Examine the chemistry of unsaturated hydrocarbons: nomenclature, structure and reactivity
- C. Analyze and assess the properties of alcohols, thiols, ethers, aldehydes and ketones
- D. Analyze and assess the properties of carboxylic acids, esters, amines, and amides
- E. Examine the chemistry of carbohydrates
- F. Examine the chemistry of fatty acids, lipids, and the cell membrane
- G. Examine the chemistry of amino acids and proteins

- H. Examine the chemistry of nucleic acids and summarize the process of protein synthesis
- I. Inspect various metabolic pathways and relate them to energy production

III. Essential Student Materials

Chemistry department approved safety goggles

IV. Essential College Facilities

Classroom with chart of "Periodic table of elements"

V. Expanded Description: Content and Form

- A. Examine the chemistry of simple organic molecules with an emphasis on structural features and nomenclature
 - 1. Introduction to organic chemistry
 - 2. Alkanes
 - 3. Alkanes with substituents
 - 4. Properties of alkanes
 - 5. Introduction to functional groups
- B. Examine the chemistry of unsaturated hydrocarbons: nomenclature, structure and reactivity
 - 1. Alkenes and alkynes
 - 2. Cis-trans isomers
 - 3. Addition reactions
 - 4. Polymers of alkenes
 - 5. Aromatic compounds
- C. Analyze and assess the properties of alcohols, thiols, ethers, aldehydes and ketones
 - 1. Structural features and nomenclature
 - 2. Physical properties: Solubility, H-bonding and boiling points
 - 3. Reactions of alcohols and thiols: dehydration, oxidation, and reduction
 - 4. Benedict's test and Tollen's test for aldehydes and ketones
 - 5. Introduction to chiral molecules
- D. Analyze and assess the properties of carboxylic acids, esters, amines, and amides
 - 1. Structural features and nomenclature
 - 2. Physical properties: Solubility, H-bonding and boiling points
 - 3. Reactions of carboxylic acids: hydrolysis and neutralization
 - 4. Reactions of esters: hydrolysis and saponification
 - 5. Reactions of amines as a base

6. Reactions of amides: acid and base hydrolysis
- E. Examine the chemistry of carbohydrates**
1. Monosaccharides, aldoses, and ketoses
 2. Fischer projections of monosaccharides
 3. Haworth structures of monosaccharides
 4. Chemical properties of monosaccharides
 5. Disaccharides: lactose, maltose, and sucrose
 6. Polysaccharides: amylose, amylopectin, glycogen, and cellulose
 7. Stereochemistry of carbohydrates
 8. Discuss contributions from scientists in the field.
- F. Examine the chemistry of fatty acids, lipids, and the cell membrane**
1. Structural features of lipids and fatty acids
 2. Melting points of fatty acids
 3. Structural features of triacylglycerols
 4. Chemical properties of triacylglycerols
 5. Glycerophospholipids
 6. Steroids, cholesterol, and steroid hormones
 7. Cell membranes
- G. Examine the chemistry of amino acids and proteins**
1. Functions of proteins
 2. Structures of amino acids
 3. Amino acids as an acid and a base
 4. Formation of peptides
 5. Levels of protein structure
 6. Enzymes and enzyme action
 7. Factors affecting enzyme activity
 8. Enzyme cofactors
 9. Stereochemistry of amino acids
 10. Discuss contributions from scientists in the field.
- H. Examine the chemistry of nucleic acids and summarize the process of protein synthesis**
1. Nucleotides and nucleosides
 2. Primary structure of nucleic acids
 3. DNA double helix

4. RNA and the genetic code
 5. Protein synthesis
 6. Genetic mutations
 7. Discuss contributions from scientists in the field.
- I. Inspect various metabolic pathways and relate them to energy production
1. ATP as the energy currency
 2. Outline of glycolysis
 3. Outline of the citric acid cycle
 4. Overview of the electron transport chain
 5. Oxidative phosphorylation
 6. Oxidation of fatty acids
 7. Degradation of amino acids
 8. Provide a historical context for the discovery of various metabolic pathways.

VI. Assignments

A. Reading

1. Required readings from the textbook in preparation for the scheduled lecture. This may include entire chapters or sections from the chapters covering topics included in this outline.
2. Required readings from the laboratory manual as a preparation for the scheduled experiment in order to provide students with familiarity about the specific laboratory protocols and related safety precautions necessary for successful completion of the experiment.

B. Writing

1. Homework assignments based on classroom discussion/lecture may include answering questions from end-of-chapter exercises or other sources as deemed appropriate by the instructor.
2. Periodic quizzes and mid-term examinations based on material discussed in lectures and/or reading assignments
3. Scientific paper discussing discoveries in one or more topics discussed.

C. Laboratory Assignments

- C. Pre-lab exercise: The pre-lab assignment for the scheduled laboratory experiment to be completed when beginning a new experiment. This assignment may be identical to that provided in the laboratory manual or substituted with other appropriate assignments determined by the instructor.
2. Report-sheet: Data obtained in laboratory exercises are to be entered in the assigned laboratory manual or a laboratory notebook. Necessary calculations required to obtain the final results from the experiment must be completed in the manual or the notebook as to be determined by the instructor.

VII. Methods of Instruction

Lecture and visual aids
Discussion of assigned reading
Discussion and problem solving performed in class
Quiz and examination review performed in class
Homework and extended projects
Laboratory experience which involve students in formal exercises of data collection and analysis
Laboratory discussion sessions and quizzes that evaluate the proceedings weekly laboratory exercises

VIII. Methods of Evaluating Objectives

- A. Homework assignments based on end-of-chapter problems from the primary text will be evaluated for completion to test comprehension of lectures.
- B. A minimum of three mid-term examinations in will be used to evaluate the ability of students to a) solve problems, b) outline various concepts covered in the lecture, and c) demonstrate an understanding of reading assignments. These will be evaluated for accuracy to assess student progress in achieving various learning outcomes.
- C. Periodic quizzes will be used to test the comprehension of topics covered during the lecture and will be evaluated for accuracy of responses.
- D. A comprehensive final examination in any chosen format (multiple choice questions or free response) will be based on all the course material covered during the entire quarter and evaluated for accuracy of responses.
- E. Pre-lab assignments will be evaluated for completeness and level of preparedness required for safe and timely execution of laboratory protocols and experiments.
- F. Report sheets and/or laboratory reports will be evaluated for successful completion of laboratory experiments as well as accuracy of data analysis and interpretation.
- G. A comprehensive laboratory examination will be used to evaluate the student understanding of the various concepts discussed in the different experiments performed during the course. Concepts evaluated will include: a) general laboratory protocol b) comprehension of data analysis and interpretation and c) critical thinking as it pertains to the scientific method.
- H. Evaluate scientific paper for critical thinking and originality

IX. Texts and Supporting References

- A. Examples of Primary Texts and References
 1. Timberlake, K.C., "An introduction to general, organic, and biological chemistry" 12th edition, Prentice Hall, 2014
 2. A custom laboratory manual for introduction to general, organic, and biochemistry: Timberlake, Pearson Custom Publishing, ISBN: 1-256-04207-2, 2011
- B. Examples of Supporting Texts and References
 1. None.

X. Lab Topics

- A. Laboratory Methodology

1. Maintaining a laboratory notebook
 2. Writing laboratory reports
- B. Chemical Safety**
1. Materials safety data sheets (MSDS)
 2. Chemical disposal
 - a. Separation of waste streams
 - b. Proper disposal methods
 - c. Environmental hazards of improper waste disposal
 3. Laboratory Environment
 - a. Maintaining laboratory cleanliness
 - b. Chemical labeling
 - c. Segregation of chemicals by hazard
 - d. Secondary containment
 4. Personal Safety
 - a. Safety goggles
 - b. Limiting chemical exposure
 - c. Safety showers
 - d. Eyewash stations
 - e. Proper use of the fire extinguishers
 5. Emergency Situations
 - a. Fires
 - b. Earthquakes
 - c. Evacuation procedures
- C. Physical Measurements**
1. Gravimetric Analysis
 - a. Taring
 - b. Mass by difference
 2. Boiling Points
- D. Laboratory Techniques**
1. Proper ignition of Bunsen burners
 2. Use of pipettes
- E. Chemical Analysis**
1. Reactions of hydrocarbons

2. Alcohols and phenols
3. Aldehydes and ketones
4. Tests for carbohydrates
5. Carboxylic acids & esters
6. Glycerophospholipids and steroids
7. Amines and amides
8. Synthesis of acetaminophen
9. Peptides and proteins