Course Number and Title: CHM 111 Introduction to Organic and Biochemistry

Campus Location:
Georgetown, Dover, Stanton, Wilmington

Effective Date:
2018-51

Prerequisite:
CHM 110, SSC 100 or concurrent

Co-Requisites:
None

Course Credits and Hours:
4.00 credits
3.00 lecture hours/week
2.00 lab hours/week

Course Description:
This course includes a study of organic compounds and reactions and a basic study of biochemical reactions involving carbohydrates, lipids, and proteins and their metabolism. Laboratory experiments are used to illustrate theory.

Required Text(s):
Obtain current textbook information by viewing the campus bookstore - https://www.dtcc.edu/bookstores online or visit a campus bookstore. Check your course schedule for the course number and section.

Additional Materials:
None

Schedule Type:
Classroom Course

Disclaimer:
None

Core Course Performance Objectives (CCPOs):

1. Relate chemical and physical concepts of general chemistry to organic and biochemistry. (CCC 1, 2, 6; PGC BIT 1, CHM 1)
2. Examine and recognize the structures; physical properties; and reactions of various alkanes, alkenes, alkynes, aromatics, and alkyl halides. (CCC 1, 2, 6; PGC BIT 1, CHM 1)
3. Compare the functional groups, physical properties, and reactions of alcohols and analogs, ethers, aldehydes, ketones, carboxylic acids, esters, amines and amides. (CCC 1, 2, 6; PGC BIT 1, CHM 1)
4. Examine the monomers and polymers of carbohydrates, lipids, proteins, and nucleic acids. (CCC 1, 2, 6; PGC BIT 1, CHM 1)
5. Describe biochemical energetics, including carbohydrate, lipid, and protein metabolic pathways. (CCC 1, 2, 6; PGC BIT 1, CHM 1)
6. Perform and analyze various laboratory activities related to chemistry. (CCC 1, 2, 3, 4, 5, 6; PGC BIT 2, 4, 5, 6, CHM 1, 2, 3, 6, 8, 9)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

Measurable Performance Objectives (MPOs):
Upon completion of this course, the student will:

1. Relate chemical and physical concepts of general chemistry to organic and biochemistry.
    1. Describe the nature of the carbon atom as it relates to its electron configuration.
    2. Draw electron-dot structures for carbon, hydrogen, nitrogen, oxygen, phosphorous, and sulfur.
    3. Draw Lewis structures for molecular compounds, polyatomic cations, and polyatomic anions.
    4. Draw line angle, structural, and condensed formulas for simple compounds.
    5. Define and distinguish the principal intermolecular forces, and discuss the significance of hydrogen bonding.
    6. Discuss acid/base chemistry and the ionization of common organic functional groups at physiological pH (the negative logarithm of hydrogen ion concentration).
    7. Define *organic chemistry*.
    8. Name and describe the special functional groups in organic chemistry.
    9. Discuss solubilities.
2. Examine and recognize the structures; physical properties; and reactions of various alkanes, alkenes, alkynes, aromatics, and alkyl halides.
    1. Draw and name the first ten members of the alkane series.

2. Draw and name various skeletal isomers of some members of the alkane series.
3. Draw and name important alkyl side chains.
4. Discuss reactions of alkanes.
5. Draw and name various cycloalkanes.
6. Draw and name some alkenes and alkynes.
7. Name and describe the various types of isomerism.
8. Draw the cis and trans geometric isomers where applicable.
9. State Markovniknov's rule, and predict the products of common addition reactions to alkenes and alkynes.
10. Draw and describe conjugated double bonds and some aromatic compounds.
11. Describe the nomenclature for classifying aromatic compounds.

3. Compare the functional groups, physical properties, and reactions of alcohols and analogs, ethers, aldehydes, ketones, carboxylic acids, esters, amines, and amides.
    1. Differentiate among primary, secondary, and tertiary alcohols.
    2. Name and draw various aliphatic alcohols and cycloalcohols.
    3. Name and draw some important polyhydric alcohols.
    4. Describe dehydration and oxidation reactions of alcohols.
    5. Draw and name some important thiols.
    6. Describe the interconversion between thiols and disulfides by redox reactions.
    7. Draw, name, and describe some important phenols.
    8. Discuss the acidity of phenols.
    9. Draw, name, and describe some important ethers.
    10. Draw and name some important aldehydes and ketones.
    11. Describe the redox behavior of aldehydes and ketones.
    12. Describe the formation of hemiacetals and hemiketals.
    13. Describe the formation of acetals and ketals and their hydrolysis.
    14. Draw and name some important organic acids.
    15. Discuss some important reactions of organic acids.
    16. Draw and name some important esters.
    17. Describe the formation of an ester.
    18. Describe hydrolysis and saponification reactions of esters.
    19. Draw and name various amines.
    20. Classify amines as primary, secondary, or tertiary.
    21. Describe aliphatic, heterocyclic, and aromatic amines.
    22. Draw and name some important heterocyclic amines, including pyrimidines and purines.
    23. Name, draw, and describe various amides and discuss their reactions.
4. Examine the monomers and polymers of carbohydrates, lipids, proteins, and nucleic acids.
    1. Examine optical activity and properties of enantiomers.
    2. Describe a monosaccharide, and identify it as being an aldose or a ketose.
    3. Discuss some common di-and polysaccharides.
    4. Describe the various types of glycosidic links in disaccharides and polysaccharides.
    5. Recognize various categories of lipids.
    6. Draw and name the components used in the formation of a triglycerides and phospholipids.
    7. Describe the nature of the cell membrane and how it relates to phospholipid structure.
    8. Discuss some important steroids.
    9. Draw the structure of a typical amino-acid.
    10. Describe the terms alpha amino acid and zwitterions.
    11. Identify some important amino acids, and categorize their side chains as nonpolar and polar; if polar, categorize as acidic, neutral, or basic.
    12. Describe the nature and structure of the peptide bond formed between amino acids.
    13. Classify the peptides by chain length.
    14. Classify proteins as either fibrous or globular.
    15. Describe various levels of protein structure.
    16. Name and describe some important enzymes.
    17. Discuss enzymatic reactions.
    18. Describe enzymatic mechanisms and their regulation.
    19. Describe a nucleic acid and differentiate deoxyribonucleic acid (DNA) from ribonucleic acid (RNA).
    20. Describe DNA replication.
    21. Discuss protein synthesis.
5. Describe biochemical energetics, including carbohydrate, lipid, and protein metabolic pathways.
    1. Define *metabolism,* and differentiate between catabolism and anabolism.
    2. Describe the use of adenosine-5'-triphosphate (ATP) in energy transfer.
    3. Describe the structure of a mitochondrion.
    4. Describe the common catabolic and anabolic pathways of carbohydrates, lipids, and proteins.
6. Perform and analyze various laboratory activities related to chemistry.
    1. Observe and adhere to accepted good laboratory practices for working safely in a laboratory.
    2. Safely and accurately follow written and oral experimental instructions to obtain valid qualitative and quantitative data.
    3. Make accurate observations of physical and chemical changes, and record those observations in written form.

4. Demonstrate the ability to work effectively with a laboratory partner or as part of a small group.
5. Use modeling to visualize various types of hydrocarbons.
6. Use chemical tests to identify and differentiate alkenes, alcohols, phenol, aldehydes, and ketones.
7. Perform experiments using carboxylic acids and alcohols to form esters.
8. Examine the properties of biochemical compounds.
9. Differentiate lipids, monosaccharides, proteins, and polysaccharides using chemical tests.

Evaluation Criteria/Policies:
Students must demonstrate proficiency on all CCPOs at a minimal 75 percent level to successfully complete the course. The grade will be determined using the Delaware Tech grading system:

92	–	100	=	A
83	–	91	=	B
75	–	82	=	C
0	–	74	=	F

Students should refer to the Student Handbook - https://www.dtcc.edu/handbook for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

Core Curriculum Competencies (CCCs are the competencies every graduate will develop):

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):

Biotechnology

1. Apply knowledge of the theories and principles of biology and biotechnology.
2. Employ good laboratory practices (GLP) and safety guidelines to conduct common laboratory operations.
3. Employ standard laboratory documentation practices for data management and laboratory notebooks.
4. Utilize chemical principles and apply mathematics in the preparation of laboratory solutions.
5. Analyze samples by common quantitative and qualitative techniques.
6. Perform separation techniques on biological samples and interpret results.
7. Perform laboratory techniques used in microbiology, immunology and biotechnology.
8. Apply mathematical concepts to the solution of problems.
9. Demonstrate professional behavior and communication skills.

Chemistry

1. Apply knowledge of the theories and principles of chemistry.
2. Follow safety procedures.
3. Perform basic laboratory operations and techniques.
4. Keep a laboratory notebook following standard laboratory practices and present data in an organized written format.
5. Prepare common laboratory solutions.
6. Prepare and purify samples using common techniques.
7. Communicate in a professional manner.
8. Analyze samples by common qualitative and quantitative techniques.
9. Use and maintain common laboratory instruments and equipment.
10. Apply mathematical concepts to the solution of scientific problems.

Disabilities Support Statement:
The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the disabilities services - https://www.dtcc.edu/disabilitysupport web page or visit the campus Advising Center.