Lecture Contact Hours: 48-54; Homework Hours: 96-108; Total Student Learning Hours: 144-162
Laboratory Contact Hours: 48-54; Homework Hours: 0; Total Student Learning Hours: 48-54

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

CHEMISTRY 116 – INTRODUCTORY ORGANIC AND BIOCHEMISTRY

3 hours lecture, 3 hours laboratory, 4 units

Catalog Description
Study of carbon compounds with an emphasis on their structure, properties and reactivity. Introduction to the structure of the major classes of biomolecules–carbohydrates, lipids and proteins–and their relationship to the major classes of organic compounds.

Prerequisite
"C" grade or higher or "Pass" in CHEM 115 or equivalent

Entrance Skills
Without the following skills, competencies and/or knowledge, students entering this course will be highly unlikely to succeed:
1) Understand the different classifications of matter: physical states, pure substances and mixtures, elements and compounds.
2) Understand and interpret the periodic table.
3) Classify matter into different structural units: atoms, molecules, ions, networks.
4) Differentiate between physical and chemical changes in matter.
5) Understand the structure of atoms and the nature of subatomic particles; determine the number of each type of subatomic particle present within a given atom.
6) Determine to which class–ionic or covalent–a compound belongs; write the formula for the compound and/or determine the name from the formula.
7) Predict the products of chemical reactions and write balanced chemical equations for specific types of reactions.
8) Understand and apply the mole concept.
9) Write Lewis dot structures; predict and draw the geometry of molecules and polyatomic ions with as many as four regions of electron density around the central atom.
10) Classify bonds into their various types: nonpolar, polar, and ionic.
11) Predict physical properties of substances such as solubility and boiling point based on their polarity.
12) Identify common acids and bases; explain their properties including differences between strong and weak.
13) Calculate pH and hydrogen ion concentration.
14) Identify what is being oxidized and reduced in reactions involving metals.

Course Content
1) IUPAC nomenclature of organic compounds: alkanes, alkenes, alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, amines, amides
2) Chemical bonding and geometry of organic molecules
3) Identification of organic functional groups
4) Structure-function relationships of organic functional groups
5) Basic organic reaction chemistry
6) Molecular asymmetry and stereochemistry of organic molecules
7) Identification of major types of biomolecules
8) Description of carbohydrate, lipid, and protein structure
9) Laboratory investigations of the properties and reactivity of the major classes of organic compounds

Course Objectives

Students will be able to:

1) Identify the functional group present in an organic compound and classify it into one of the major classes of organic compounds.
2) Write a systematic name for an organic compound given its structure.
3) Deduce the structures of the constitutional isomers corresponding to a given molecular formula.
4) Deduce and draw the structures of the stereoisomers corresponding to a given condensed structural formula.
5) Predict the physical properties of an organic compound.
6) Predict the products of organic chemical reactions.
7) Design a synthesis of an organic compound employing one or more organic chemical reactions.
8) Apply organic chemistry knowledge as a tool to measure biological functionality.
9) Identify the functional groups present in a biomolecule and classify it into one of the major classes of biomolecules.
10) Draw expanded structural formulas of the major classes of biomolecules.
11) Explain the relationship between the bonding and three dimensional structure of a biomolecule and its physical and chemical properties.
12) Predict the products of chemical reactions undergone by the major classes of biomolecules.
13) In the laboratory, observe and record physical and chemical properties of the major classes of organic compounds and biomolecules.
14) Analyze and evaluate observations acquired in the laboratory by applying the theoretical principles being studied.

Method of Evaluation

A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.

1) Exams that measure students' ability to explain and apply the basic chemical concepts. General question types are definition, short essay, and problem solving. Specific question types are classification schemes, prediction of physical and chemical properties, translation of structure to name and vice-versa, deduction of structures from molecular formulas, prediction of reaction products, and synthesis of molecules.
2) Laboratory activities that evaluate students' ability to observe the properties of a wide range of chemical substances, to apply competent observational skills, and to demonstrate proper collection and recording of data.
3) Written laboratory reports that measure students' ability to interpret and analyze both qualitative and quantitative data.

Special Materials Required of Student

Scientific calculator, safety glasses or goggles, laboratory notebook

Minimum Instructional Facilities

1) Lecture classroom with blackboard space, wall-sized periodic table, demonstration table with sink and gas jet
2) Laboratory facility
3) Access to computer network

Method of Instruction

1) Lectures are designed to explain basic concepts. Some concepts are introduced by presentation of data. Analysis and explanations of data are elicited from students by frequent and persistent questions. Applications to the real world are incorporated as much as possible.
2) Laboratories correlate with lectures and are designed to allow students to make observations of chemical phenomena. Students work in pairs for most experiments. Lab reports and class

discussion require students to explain their laboratory observations employing the concepts discussed in lectures.
3) The textbook is required reading and is essential to successful solution of homework problems, performance of laboratory experiments, and performance on exams.
4) Students are strongly encouraged to form study groups as well as seek help through peer tutoring and instructor office hours.

Out-of-Class Assignments
1) Reading and homework problems, as assigned
2) Lab reports
3) Specialized project involving selected topics in chemistry, as required; this project may require the use of research on the internet, at the library, or other resources

Texts and References
1) Required (representative examples):
   a. Timberlake, Karen. *An Introduction to General, Organic and Biological Chemistry*. 4th edition. Prentice Hall, 2013.
   b. Villarreal. *Chemistry 116 Supplementary Materials*. Cuyamaca College. (updated annually)
2) Supplemental: None

Exit Skills
Students having successfully completed this course exit with the following skills, competencies and/or knowledge:
1) Identify the common organic functional groups.
2) Assign IUPAC nomenclature and draw structural formulas for the following groups of organic compounds: alkanes, alkenes, alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, amines, amides.
3) Understand and diagram the three-dimensional aspects of organic molecules.
4) Describe the general physical properties of alkanes, alkenes, alcohols, ethers, aldehydes, ketones, carboxylic acids, amines, amides.
5) Predict reaction products given the reactants and reaction conditions for the following compounds: alkanes, alkenes, alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, amines, amides.
6) Distinguish the major classes of biomolecules by name and structure.
7) Perform basic laboratory investigations into the properties and reactivity of organic compounds.

Student Learning Outcomes
Upon successful completion of this course, students will be able to:
1) Identify the functional group present in an organic compound and classify it into one of the major classes of organic compounds.
2) Write a systematic name for an organic compound given its structure.
3) Deduce the structures of the constitutional isomers corresponding to a given molecular formula.
4) Deduce and draw the structures of the stereoisomers corresponding to a given structural formula.
5) Describe how properties of functional groups dictate the chemical and physical properties of organic compounds.
6) Identify the functional groups present in a biomolecule and classify it into one of the major classes of biomolecules.
7) Draw structural formulas of the major classes of biomolecules.
8) Describe the chemical and physical properties of a biomolecule.
9) In the laboratory, observe and record physical and chemical properties of the major classes of organic compounds and biomolecules.