CHEM 251 – ORGANIC CHEMISTRY I | 4 CREDITS (3+3P)

SYLLABUS

CATALOG DESCRIPTION

Part one of the study of carbon compound chemistry covering: atomic and molecular orbitals; structure and reaction mechanisms of alkanes, alkenes, and alcohols; laboratory synthesis; gas chromatography; infrared, mass, and nuclear magnetic resonance spectroscopies. For pre-professional majors.

Prerequisites: CHEM 112 or CHEM 111 is recommended.

Semester Offered: Fall

Common Student Learning Outcomes

Upon successful completion of San Juan College programs and degrees, the student will demonstrate competency in…

BROAD AND SPECIALIZED LEARNING

Students will actively and independently acquire, apply, and adapt skills and knowledge with an awareness of global contexts.

CRITICAL THINKING

Students will think analytically and creatively to explore ideas, make connections, draw conclusions and solve problems.

CULTURAL AND CIVIC ENGAGEMENT

Students will act purposefully, reflectively, and ethically in diverse and complex environments.

EFFECTIVE COMMUNICATION

Students will exchange ideas and information with clarity in multiple contexts.

INFORMATION LITERACY

Students will be able to recognize when information is needed and have the ability to locate, evaluate, and use it effectively.

INTEGRATING TECHNOLOGIES

Students will demonstrate fluency in the application and use of technologies in multiple contexts.

Student work from this class may be randomly selected and used anonymously for assessment of course, program, and/or institutional learning outcomes. For more information, please refer to the Dean of the appropriate School.

Course Learning Outcomes

Upon successful completion of the course, the student will be able to…

1.1 Draw resonance structures and use them to predict stabilities of radicals and ions.
1.2 Identify nucleophiles and electrophiles, and predict Lewis acid-base reactions.
1.3 Predict hybridization and geometry of atoms in molecules.
1.4 Describe sigma and pi bonding in terms of orbital overlap.
1.5 Identify structural isomers and stereoisomers.
1.6 Predict boiling and melting points based on structure.
1.7 Predict acid - base behavior based on structure.

2.1 Name and draw alkanes.
2.2 Compare the energies of alkane conformations and predict the most stable conformations.
2.3 Explain the mechanism and energetics of the free-radical halogenation of alkanes.
2.4 Predict the products of the halogenation of an alkane.

3.1 Identify chiral centers and mirror planes of symmetry.
3.2 Define optical activity.
3.3 Use R and S nomenclature.
3.4 Draw Fisher projections and use them in identifying stereochemical properties.
3.5 Identify and classify diastereomers, enantiomers, meso compounds, and geometric isomers.

4.1 Predict the products of SN1, SN2, E1, and E2 reactions including stereochemistry.
4.2 Draw the mechanisms of SN1, SN2, E1, and E2 reactions including stereochemistry.

5.1 Name alkenes.
5.2 Predict relative stabilities of alkenes and cycloalkenes based on structure and stereochemistry.
5.3 Propose logical mechanisms for dehydrohalogenation, dehalogenation, and dehydration reactions.
5.4 Predict the products of additions, oxidations, reductions, and cleavages of alkenes, including regiochemistry and sterochemistry.
5.5 Use alkenes in devising single step and multistep synthesis.

6.1 Name alkynes.
6.2 Show the reaction and mechanism of how an alkyne is synthesized.
6.3 Identify an acetylenic hydrogen and discuss the unique chemistry of this hydrogen.
6.4 Predict the products of additions, oxidations, reductions, and cleavages of alkynes, including regiochemistry and sterochemistry.
6.5 Use alkynes in devising single step and multistep synthesis.

7.1 Show how to convert alkenes, alkyl halides, and carbonyl compounds to alcohols.
7.2 Predict alcohol products of hydration, hydroboration, and hydroxylation of alkenes.
7.3 Use retrosynthetic analysis to propose effective syntheses of compounds using alcohols.

8.1 Synthesize and investigate reactions of alkyl halides, alkenes, and alcohols in the laboratory.
8.2 Apply chemical and physical tests to identify organic compounds.
8.3 Identify key components and principles of operation of a gas chromatograph.
8.4 Use gas chromatography to separate and identify components of a mixture.
8.5 Describe how an infrared spectrophotometer works.
8.6 Given an IR spectrum, identify functional groups.
8.7 Describe how a mass spectrometer works.
8.8 Use the fragmentation pattern of a mass spectrum to determine structure.
8.9 Describe how a nuclear magnetic resonance spectrometer works.
8.10 Combine the chemical shifts, intervals, and spin-spin splitting patterns in the NMR spectrum with information from IR and MS to determine the structures of organic compounds.