Miami Dade College

Course Description

CHM2211 | Organic Chemistry 2 | 3.00 credits

In Organic Chemistry 2, students will learn about nomenclature, preparation reactions, and electronic and structural features of alcohols, ethers, phenols, aldehydes, ketones, carboxylic acids, acid anhydrides, amides, esters, and other organic compounds.

Course Competencies:

Competency 1: The student will demonstrate knowledge of the structure, composition, reactivity, and nomenclature of aromatic compounds by:

1. Applying the International Union of Pure and Applied Chemistry (IUPAC) rules to name and draw the structure of aromatic compounds.
2. Predicting whether a substance is expected to be aromatic, anti-aromatic or non-aromatic.
3. Predicting physical properties and reactivity of aromatic compounds.
4. Predicting the effect of electron-donating and electron-withdrawing groups on the acidity and PKA of aromatic acids, such as benzoic acids, phenols, and aniliniumions.
5. Constructing frost Circle Molecular Orbital (MO) diagrams to ascertain the stability of monocyclic conjugated systems.
6. Outlining the reaction mechanisms that illustrate the process by which electrophilic aromatic substitution reactions occur.
7. Illustrating typical reactions of aromatic compounds.
8. Constructing plausible synthetic sequences for the preparation and transformation of aromatic compounds from appropriate starting materials.

Competency 2: The student will demonstrate knowledge of how instrumental techniques such as Nuclear Magnetic Resonance (NMR) Spectroscopy, Infrared (IR) Spectroscopy, Ultraviolet-Visible (UV-Vis) Spectroscopy and Mass Spectrometry (MS) is used to characterize and provide molecular information about organic compounds by:

1. Applying the theory of UV-Vis spectroscopy, including electronic transitions and the effect of conjugation on wavelength and molar absorptivity, to characterize organic compounds using UV- Vis spectra.
2. Predicting IR spectra of organic compounds by considering vibrational motions, identifying functional groups, and the effects of conjugation and ring strain.
3. Outlining pulsed Fourier-transformproton-and carbon NMR spectroscopy, including the significance of the number of signals, chemical shift, integration, scalar coupling, the effects of chemical exchange and temperature, broadband decoupling, DEPT spectroscopy (Distortion less Enhancement by Polarization Transfer) and 2-D NMR.
4. Illustrating typical fragmentation patterns in mass spectrometry, including the information revealed by the molecular ion peak and the base peak.
5. Constructing plausible chemical structures by combining information from UV-Vis spectra, IR spectra, mass spectra, and NMR spectra.

Competency 3: The student will demonstrate knowledge of the structure, composition, and reactivity of organometallic reagents by:

1. Outlining the reaction mechanisms that illustrate how organometallic reagents can be transformed.
2. Illustrating typical reactions of organometallic reagents.
3. Constructing plausible synthetic sequences for the preparation and transformation of organometallic reagents from appropriate starting materials.

Competency 4: The student will demonstrate knowledge of the structure, composition, reactivity, and nomenclature of aldehydes and ketones by:

1. Applying the International Union of Pure and Applied Chemistry (IUPAC) rules to name and draw the structure of aldehydes and ketones.
2. Predicting physical properties and reactivity of aldehydes and ketones.
3. Drawing the "keto" and enol forms of aldehydes and ketones.

4. Outlining the mechanism that illustrates the interconversion between keto-enol tautomer.
5. Predicting which tautomeric form of aldehydes and ketones is predominant.
6. Outlining the reaction mechanisms that illustrate the process by which aldehydes and ketones can be prepared and transformed
7. Illustrating typical reactions of aldehydes and ketones
8. Constructing plausible synthetic sequences for the preparation and transformation of aldehydes and ketones from appropriate starting materials.

Competency 5: The student will demonstrate knowledge of the structure, composition, reactivity, and vocabulary of carboxylic acids and their derivatives (i.e., acyl chlorides, anhydrides, esters, amides, and nitriles) by:

1. Applying the International Union of Pure and Applied Chemistry (IUPAC) rules to name and draw the structure of carboxylic acids and their derivatives.
2. Predicting physical properties and reactivity of carboxylic acids and their derivatives.
3. Outlining the reaction mechanisms illustrating how carboxylic acids and their derivatives can be prepared and transformed.
4. Illustrating typical reactions of carboxylic acids and their derivatives.
5. Constructing plausible synthetic sequences for the preparation and transformation of carboxylic acids and their derivatives from appropriate starting materials.

Competency 6: The student will demonstrate knowledge of the structure, composition, and reactivity of compounds containing acidic hydrogens and active methylenes by:

1. Predicting the physical properties and reactivity of compounds containing α-acidic hydrogens and active methylenes.
2. Predicting the physical properties and reactivity of compounds containing α-acidic hydrogens and active methylenes.
3. Outlining the reaction mechanisms that illustrate how compounds containing α- acidic hydrogens and active methylenes can be prepared and transformed.
4. Illustrating typical reactions of compounds containing α-acidic hydrogens and active methylenes.
5. Constructing plausible synthetic sequences for the preparation and transformation of compounds containing α-acidic hydrogens and active methylenes from appropriate starting materials.

Competency 7: The student will demonstrate knowledge of the structure, composition, reactivity and nomenclature of amines by:

1. Applying the International Union of Pure and Applied Chemistry (IUPAC) rules to name and draw the structure of amines
2. Predicting physical properties and reactivity of amines.
3. Outlining the reaction mechanisms that illustrate the process by which amines can be prepared and transformed.
4. Illustrating typical reactions of amines.
5. Constructing plausible synthetic sequences for the preparation and transformation of amines from appropriate starting materials.

Competency 8: The student will demonstrate knowledge of the structure, composition, reactivity and nomenclature of phenols by:

1. Applying the International Union of Pure and Applied Chemistry (IUPAC) rules to name and draw the structure of phenols.
2. Predicting the physical properties and reactivity of phenols.
3. Outlining the reaction mechanisms that illustrate how phenols can be prepared and transformed.
4. Illustrating typical reactions of phenols.
5. Constructing plausible synthetic sequences for the preparation and transformation of phenols from appropriate starting materials

Competency 9: The student will demonstrate knowledge of the structure, composition, reactivity, and nomenclature of aryl halides by:

1. Applying the International Union of Pure and Applied Chemistry (IUPAC) rules to name and draw the structure of aryl halides.
2. Stating the differences and similarities between the types of reactions, their mechanisms, and reaction intermediates that alkyl and aryl halides undergo.
3. Predicting the physical properties and reactivity of aryl halides.
4. Outlining the reaction mechanisms illustrating how aryl halides can be prepared and transformed.
5. Illustrating typical reactions of aryl halides.
6. Constructing plausible synthetic sequences for the preparation and transformation of aryl halides from appropriate starting materials.

Competency 10: The student will demonstrate knowledge of the structure, composition, and reactivity α of unsaturated carbonyls by:

1. Predicting the physical properties and reactivity of α, β unsaturated carbonyls.
2. Outlining the reaction mechanisms that illustrate the process by which α, β-unsaturated carbonyls can be prepared and transformed.
3. Illustrating typical reactions of α, β unsaturated carbonyls.
4. Constructing plausible synthetic sequences for the preparation and transformation of α, β-unsaturated carbonyls from appropriate starting materials

Learning Outcomes

- Solve problems using critical and creative thinking and scientific reasoning
- Formulate strategies to locate, evaluate, and apply information
- Create strategies that can be used to fulfill personal, civic, and social responsibilities