

**City University of Hong Kong
Course Syllabus**

**offered by Department of Chemistry
with effect from Semester A 2022/23**

Part I Course Overview

Course Title:	Advanced Organic Chemistry
Course Code:	CHEM8131
Course Duration:	1 semester
Credit Units:	4 credits
Level:	R8
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: <i>(Course Code and Title)</i>	Nil
Precursors: <i>(Course Code and Title)</i>	Nil
Equivalent Courses: <i>(Course Code and Title)</i>	BCH8131 Advanced Organic Chemistry
Exclusive Courses: <i>(Course Code and Title)</i>	Nil

Part II Course Details

1. Abstract

This course aims to:

- introduce organic chemistry of aldol reactions and enolate anions;
- explain the structures and reactions of carbohydrates and lipids;
- introduce basic strategies of multi-step organic syntheses;
- explain conformational, steric, and stereoelectronic effects of organic molecules;
- critically evaluate organic reaction mechanisms;
- develop knowledge of nucleophilic substitution reaction.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs [#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	A2	A3
1.	Describe the concepts and basic principles of aldol reactions and enolate anions.		✓	✓	
2.	Describe the principles of chemistry in carbohydrates and lipids.		✓		
3.	Apply the strategies and principles in multi-step organic syntheses.		✓	✓	✓
4.	Compare and contrast conformational, steric, and stereoelectronic effects of organic molecules.		✓	✓	
5.	Apply various techniques in studying organic reaction mechanisms.		✓	✓	✓
6.	Explain various factors affecting nucleophilic substitution reactions.		✓	✓	
		100%			

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4	5	6	
Lectures and tutorials	Teaching and learning activities will be discovery-based relying primarily on lectures and tutorials explaining the concept of enolate, and principles of aldol reaction.	✓						
Lectures and tutorials	Teaching and learning will be discovery-based relying primarily on lectures and tutorials introducing structures and reactions of carbohydrates and lipids.		✓					
Lectures and tutorials	Teaching and learning will be discovery-based relying primarily on lectures and tutorials explaining basic strategies of multi-step organic syntheses.			✓				
Lectures and tutorials	Teaching and learning will be discovery-based relying primarily on lectures and tutorials examining conformational, steric, and stereoelectronic effects of organic molecules.				✓			
Lectures and tutorials	Teaching and learning will be discovery-based relying primarily on lectures and tutorials explaining basic concepts and principles of modern techniques used in studying organic reaction mechanisms.					✓		
Lectures and tutorials	Teaching and learning will be discovery-based relying primarily on lectures and tutorials introducing various factors affecting nucleophilic substitution reactions.						✓	

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4	5	6		
Continuous Assessment: <u>30%</u>								
Short Quizzes	✓	✓	✓	✓	✓	✓	30%	
Examination: <u>70%</u> (duration: 3 hours)								
							100%	

Starting from Semester A, 2015-16, students must satisfy the following minimum passing requirement for courses offered by CHEM:

“A minimum of 40% in both coursework and examination components.”

5. Assessment Rubrics

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Short Quizzes	Ability to explain chemical reaction/reactivity based on the knowledge of organic chemistry listed in section 3.	High	Significant	Basic	Not even reaching marginal levels
2. Examination	Ability to propose practical solutions/methods to new organic chemical transformation; ability to explain the mechanism of organic chemical reaction.	High	Significant	Basic	Not even reaching marginal levels

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Short Quizzes	Ability to explain chemical reaction/reactivity based on the knowledge of organic chemistry listed in section 3.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Examination	Ability to propose practical solutions/methods to new organic chemical transformation; ability to explain the mechanism of organic chemical reaction.	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information

1. Keyword Syllabus

- aldol reactions and enolate anions: keto and enol tautomers, crossed aldol reaction, cyclization via aldol condensation, Michael addition, Robinson annulation
- carbohydrates and lipids: mutarotation, monosaccharide, alditol, osazone, disaccharide, polysaccharide, reducing sugar vs non-reducing sugar, fatty acids and triacylglycerols, terpenes and terpenoids, steroids, prostaglandins, phospholipids and cell membranes, waxes
- multi-step organic syntheses: protective group, synthetic analysis and planning, retrosynthetic analysis, control of stereochemistry, convergent and linear synthesis
- conformational, steric, and stereoelectronic effects: steric strain, heteroatom, angle strain, conformational analysis, axial vs equatorial
- organic reaction mechanisms: kinetic vs thermodynamic control, substituent effect, isotope effect, solvent effect, catalysis
- nucleophilic substitution reaction: S_N1 vs S_N2 reaction, carbocations, nucleophilicity, leaving group effects, neighboring-group participation, rearrangement

2. Reading List

2.1 Compulsory Readings

1.	
2.	
3.	
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2.2 Additional Readings

1.	Organic Chemistry, T.W.G. Solomons (John Wiley and Sons, 7 th or 8 th edition)
2.	Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg
3.	
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