



UNIVERSITI TEKNOLOGI MARA

CHM258: FUNDAMENTAL OF ORGANIC CHEMISTRY

Course Name (English)	FUNDAMENTAL OF ORGANIC CHEMISTRY APPROVED
Course Code	CHM258
MQF Credit	3
Course Description	This course is an introductory course on the structure and physical properties of hydrocarbons namely alkanes, alkenes, alkynes, aromatic compounds and alkyl halides. This course also covers the nomenclature, preparations, reactions, chemical tests and uses of organic compounds.
Transferable Skills	Knowledge Practical Skills Thinking and Scientific Skills
Teaching Methodologies	Lectures, Blended Learning, Lab Work, Tutorial, Collaborative Learning
CLO	CLO1 Apply the rules in organic chemistry towards nomenclature, structural and chemical reactions of selected organic compounds. CLO2 Perform (plan, conduct and analyze outcomes of) scientific investigations in areas of organic chemistry. CLO3 Outline the reaction mechanisms together with reagents and conditions for selected chemical reactions.
Pre-Requisite Courses	No course recommendations
Topics	
1. Introduction to Organic Chemistry 1.1) 1.1 Characteristic features of organic compounds 1.2) 1.1.1 Valence bond theory 1.3) 1.1.2 Chemical formula: Molecular formula, full structural formula, condensed structural formula and line angle formula 1.4) 1.2 Definition of common terms used in organic chemistry: hydrocarbon, isomers, electrophiles, nucleophiles, Lewis acids and Lewis bases. 1.5) 1.3 Isomerism 1.6) 1.3.1 Structural isomerism 1.7) 1.3.2 Geometrical isomerism 1.8) 1.3.3 Optical isomerism 1.9) 1.4 Homologous series: alkanes, alkenes, alkynes, cyclic hydrocarbons, aromatic compounds, amide, amine, aldehyde, alcohol, carboxylic acids, ester, ether, haloalkanes and ketone. 1.10) 1.5 Physical properties of organic compounds 1.11) 1.5.1 Solubility 1.12) 1.5.2 Boiling Point	
2. Alkanes and Cycloalkanes 2.1) 2.1 General formula, structure and nomenclature: IUPAC and common names 2.2) 2.2 Methods of preparation (alkanes): 2.3) 2.2.1 Hydrogenation of alkenes 2.4) 2.2.2 Reduction of alkyl halides 2.5) 2.2.3 Hydrolysis of Grignard reagent 2.6) 2.3 Reactions: 2.7) 2.3.1 Halogenation (discuss mechanism) 2.8) 2.3.2 Complete combustion 2.9) 2.3.3 Ring opening reactions: cyclopropane 2.10) 2.4 Baeyer Strain Theory for cycloalkanes (without calculation). 2.11) 2.5 Uses	

3. Alkenes and Cycloalkenes

- 3.1) 3.1 General formula, structure and nomenclature: IUPAC and common names
- 3.2) 3.2 Methods of preparation (alkenes):
- 3.3) 3.2.1 Dehydrohalogenation of alkyl halides
- 3.4) 3.2.2 Dehalogenation of dihalides
- 3.5) 3.2.3 Reduction of alkynes
- 3.6) 3.3 Reactions:
- 3.7) 3.3.1 Addition of symmetric reagents (H_2 and X_2)
- 3.8) 3.3.2 Addition of unsymmetrical reagents (HX and H_2O/H_2SO_4)
- 3.9) (Discuss Markovnikov and anti-Markovnikov rule.)
- 3.10) 3.3.3 Oxidation (Complete combustion, Ozonolysis, Hydroxylation $KMnO_4/H^+$ cold)
- 3.11) 3.3.4 Simple test of alkenes (Bromine Test and Baeyer's Test)
- 3.12) 3.4 Uses

4. Alkynes

- 4.1) 4.1 General formula, structure and nomenclature: IUPAC and common names
- 4.2) 4.2 Methods of preparation:
- 4.3) 4.2.1 Dehydrohalogenation of alkyl dihalides
- 4.4) 4.2.2 Alkylation of salt of terminal alkynes
- 4.5) 4.3 Reactions:
- 4.6) 4.3.1 Addition reactions (H_2 , X_2 , HX and H_2O , H_2SO_4 , $HgSO_4$).
- 4.7) 4.4 Uses

5. Aromatic Hydrocarbons

- 5.1) 5.1 Structure and nomenclature: IUPAC and common names
- 5.2) 5.2 Reaction and mechanism: Electrophilic aromatic substitution
- 5.3) 5.2.1 Halogenations
- 5.4) 5.2.2 Nitration
- 5.5) 5.2.3 Sulphonation
- 5.6) 5.2.4 Friedel-Crafts alkylation and acylation
- 5.7) 5.3 Effect of substituents on the reactivity and orientation
- 5.8) 5.3.1 Activating group: ortho-para directing effect
- 5.9) 5.3.2 Deactivating group: meta directing effect
- 5.10) 5.4 Reaction of side chain on arenes
- 5.11) 5.4.1 Substitution (halogenation)
- 5.12) 5.4.2 Oxidation (hot, concentrated $KMnO_4$, H^+)
- 5.13) 5.5 Uses

6. Alkyl Halides and Aryl Halides (RX and ArX)

- 6.1) 6.1 Nomenclature: IUPAC and common names
- 6.2) 6.2 Methods of preparation:
- 6.3) 6.2.1 Halogenation of alkanes
- 6.4) 6.2.2 Addition of HX to alkenes
- 6.5) 6.3 Reactions of alkyl halides:
- 6.6) 6.3.1 Substitution (mechanism, stereochemistry, rate of reaction, steric hindrance)
- 6.7) 6.4.1.1 SN_2 reaction
- 6.8) 6.4.1.2 SN_1 reaction
- 6.9) 6.3.2 Elimination (mechanism, rate of reaction)
- 6.10) 6.4.2.1 E_1 reaction
- 6.11) 6.4.2.2 E_2 reaction
- 6.12) 6.3.3 Reduction of alkyl halide
- 6.13) 6.3.4 Hydrolysis of Grignard reagent
- 6.14) 6.4 Uses

Assessment Breakdown	%
Continuous Assessment	60.00%
Final Assessment	40.00%

Details of Continuous Assessment	Assessment Type	Assessment Description	% of Total Mark	CLO
	Assignment	Written Assignment (2)	20%	CLO1
	Practical	Laboratory Report (3)	15%	CLO2
	Practical	Direct Observation	15%	CLO2
	Test	Written test (2)	10%	CLO3

Reading List	Recommended Text	<ul style="list-style-type: none"> John E. McMurry 2015, <i>Organic Chemistry</i>, 9th Ed., Brooks Cole [ISBN: 9781305638716]
	Reference Book Resources	<ul style="list-style-type: none"> L. G. Wade, Jan W. Simek 2016, <i>Organic Chemistry</i>, 9th Ed., Prentice Hall [ISBN: 9780321971371] Paula Yurkanis Bruice 2016, <i>Organic Chemistry</i>, Prentice Hall [ISBN: 9780134042282] Janice Smith 2016, <i>Organic Chemistry</i>, 5th Ed., McGraw-Hill Education [ISBN: 9780078021558] Donald L. Pavia, Gary M. Lampman, George S. Kriz, Randall G. Engel 2015, <i>A Small Scale Approach to Organic Laboratory Techniques</i>, Nelson Education [ISBN: 9781305253926] T. W. Graham Solomons, Craig B. Fryhle, Scott A. Snyder 2013, <i>Organic Chemistry</i>, 11th Ed., John Wiley & Sons [ISBN: 9781118323793]
Article/Paper List	This Course does not have any article/paper resources	
Other References	This Course does not have any other resources	