



## UNIVERSITI TEKNOLOGI MARA

### CHM207: ORGANIC CHEMISTRY

<b>Course Name (English)</b>	ORGANIC CHEMISTRY <b>APPROVED</b>
<b>Course Code</b>	CHM207
<b>MQF Credit</b>	3
<b>Course Description</b>	This course is an introduction to the principles of basic organic chemistry that covers nomenclatures, structures, isomers, bondings, reaction types and uses of organic compounds. Functional groups that are going to be discussed include alkanes, alkenes, aromatic compounds, alkyl halides, alcohols, aldehydes, ketones, carboxylic acids and amines.
<b>Transferable Skills</b>	Transferable skills of analyzing and expressing scientific ideas effectively.
<b>Teaching Methodologies</b>	Lectures, Demonstrations, Tutorial, Discussion, Journal/Article Critique
<b>CLO</b>	CLO1 Interpret the properties of organic compounds as well as its IUPAC name, chemical structure and isomerism. CLO2 Explain the properties of organic compounds as well as its IUPAC name, chemical structure, isomerism, reaction & mechanism. CLO3 Discuss the uses of organic compounds in commercial industrial applications. CLO4 Perform experiments independently as well as within a team based on given experiments.
<b>Pre-Requisite Courses</b>	No course recommendations
<b>Topics</b>	
<b>1. Introduction to Organic Chemistry</b> 1.1) Characteristic features of organic compounds: Hydrocarbons, functional groups, general reactions of organic compounds, structural formula, bonding hybridization theory, electronegativities and polarity. 1.2) Definition and examples of electrophiles and nucleophiles. 1.3) Isomerism: Structural isomerism, geometric isomerism and functional group isomerism.	
<b>2. Alkanes</b> 2.1) Nomenclature of alkanes. 2.2) Structural and physical properties. 2.3) Reactions of alkanes: Free radicals' substitution, Combustion. 2.4) Industrial source and uses of aliphatic hydrocarbon: Petroleum and natural gas, Petroleum refining: reforming and the importance of cracking.	
<b>3. Alkenes</b> 3.1) Nomenclature of alkenes. 3.2) Structures and physical properties of alkenes. 3.3) Reactions of alkenes (symmetric and asymmetric alkenes): Addition of hydrogen/hydrogenation, Addition of halogens/hydrohalogenation (in aqueous and organic medium), Addition of hydrogen halides, Addition of water and sulphuric acid/hydration (covering Markonikov 's rule and anti-Markonikov rule), Oxidation (combustion, epoxidation and hydroxylation to diols), Oxidation Cleavage of alkenes by ozonolysis, Polymerization. 3.4) Uses of alkenes.	
<b>4. Aromatic Compounds</b> 4.1) Nomenclature of aromatic compounds. 4.2) Structures and aromaticity, delocalisation of electrons, stability of benzene physical properties of benzene and toluene. 4.3) Reactions of benzene (electrophilic substitution reactions): Halogenation, Nitration, Sulfonation, Friedel-Crafts Alkylation and Acylation, Side-chain oxidation. 4.4) Effect of substituents on the reactivity and orientation of electrophilic aromatic substitution. 4.5) Uses of benzene and toluene.	

**5. Alkyl Halides**

- 5.1) Nomenclature of alkyl halides.  
5.2) Structures and physical properties of alkyl halides.  
5.3) Reactions of alkyl halides: Formation of alcohol, Formation of ether (Williamson synthesis), Formation of amino compounds, Formation of cyano compounds, Formation of alkanes (Wurtz reaction), Elimination reaction - dehydrohalogenation of alkyl halides to form alkenes, Nucleophilic substitution reactions (Reactions of alkyl halides with hydroxide and cyanide ions).  
5.4) Uses of alkyl halides.

**6. Hydroxyl Compounds**

- 6.1) Nomenclature of hydroxyl compounds.  
6.2) Structures, classification of alcohols, and physical properties of alcohol and phenol.  
6.3) Reactions of alcohol: Acidity, Reaction with sodium, Oxidation, Esterification, Halogenation and haloform reaction, Elimination reaction - dehydration to form alkenes, Formation of ether.  
6.4) Reactions of phenol: Reaction with sodium, Esterification, Halogenation of phenol, Nitration of phenol  
6.5) Uses of alcohols and phenol.

**7. Carbonyl compounds (aldehydes and ketones)**

- 7.1) Nomenclature of carbonyl compounds.  
7.2) Structures and physical properties of aldehydes and ketones.  
7.3) Reactions of aldehydes and ketones: Oxidation with mild and strong oxidizing agents (reactions with bromine water, acidified  $\text{KMnO}_4$  and acidified  $\text{K}_2\text{Cr}_2\text{O}_7$ ), Laboratory tests with Tollens' reagent and Fehling's or Benedict solutions, Reduction to alcohols, Condensation reaction with 2,4-dinitrophenylhydrazine, Nucleophilic addition with hydrogen cyanide, Iodoform test (formation of haloform).  
7.4) The uses of carbonyl compounds (propanone, formaline and plastics).

**8. Carboxyl Compounds**

- 8.1) Nomenclature of carboxyl compounds.  
8.2) Structures and physical properties of carboxyl compounds.  
8.3) Reactions of carboxylic acids and benzoic acid: Acidity, Formation of salt, Formation of ester, Formation of acid chloride, Formation of acid anhydrides, Formation of amides, Reduction to alcohols.  
8.4) Uses of carboxylic acids.

**9. Amines**

- 9.1) Nomenclature of amines.  
9.2) Structures, classification and physical properties of amines.  
9.3) Reactions of amines and phenylamine: Basicity, Formation of salt, Reaction with nitrous acid, Formation of amide, Ring halogenation of phenylamine in aqueous and organic medium.  
9.4) Uses of amines in synthesis of dyes and nylon.

Assessment Breakdown	%
Continuous Assessment	100.00%

Details of Continuous Assessment	Assessment Type	Assessment Description	% of Total Mark	CLO
	Assignment	Related to topics in the syllabus. The topic will be arranged by the lecturers. Must be done individually. Students need to find/review/relate the articles which contains the topics of their syllabus.	25%	CLO3
	Practical	1. Lab preparation (title, the procedure by flowchart and diagram) by the student before starting doing their experiments. The data of experiments also must be recorded in the logbook. 2. Students must at least show the essential skills to conduct experiments in the laboratory. Students will be assessed by the skills when using glassware/apparatus, instruments and handling safety issues. 3. Lab reports must be submitted to be evaluated by the instructors.	25%	CLO4
	Test	Test 1: Written tests that are administered on paper. Content: Can be selected from Topic 1 - 4. Duration: 1 to 1.5 Hour	25%	CLO1
	Test	Test 2: Written tests that are administered on paper. Content: Can be selected from Topic 5 - 8. Duration: 1 to 1.5 Hour.	25%	CLO2

Reading List	Recommended Text	<ul style="list-style-type: none"> <li>• Paula Yurkanis Bruice 2017, <i>Organic Chemistry, Global Edition</i>, 8th Ed. Ed., Pearson Education Limited [ISBN: 9781292160344]</li> <li>• T.W. Graham Solomons, Craig B. Fryhle, <i>Organic Chemistry</i>, 10th Ed. Ed., John Wiley &amp; Sons Ltd [ISBN: 9780470524596]</li> <li>• John E. McMurry 2011, <i>Organic Chemistry</i>, 8th Ed. Ed., Brooks Cole [ISBN: 9780840054449]</li> <li>• Janice Gorzynski Smith, Smith Janice 2005, <i>Organic Chemistry</i>, McGraw-Hill Science, Engineering &amp; Mathematics [ISBN: 9780073101705]</li> <li>• Donald L. Pavia, Gary M. Lampman, George S. Kriz, Randall G. Engel 2011, <i>A Small Scale Approach to Organic Laboratory Techniques</i> 3rd Ed. Ed., Brooks Cole [ISBN: 978143904932]</li> </ul>
Article/Paper List	This Course does not have any article/paper resources	
Other References	This Course does not have any other resources	