UNIVERSITI TEKNOLOGI MARA

CHM412: ORGANIC CHEMISTRY FOR TECHNOLOGY

Course Name (English)	ORGANIC CHEMISTRY FOR TECHNOLOGY APPROVED
Course Code	CHM412
MQF Credit	3
Course Description	This course is an introduction to the structures and physical properties of hydrocarbons, aromatic compounds, alcohols, aldehydes and ketones, carboxylic acids, amines and their derivatives. It also includes nomenclature, preparations, chemical reactions, chemical tests as well as usage and importance of some organic compounds and their derivatives.
Transferable Skills	Knowledge in Specific Area -Content Practical Skills Thinking and Scientific Skills
Teaching Methodologies	Lectures, Blended Learning, Demonstrations, Tutorial, Discussion
CLO	CLO1 Name and draw organic compounds including hydrocarbons, alcohol, aldehydes, ketones, aromatic compounds, carboxylic acid, amines and derivatives using IUPAC nomenclature. CLO2 Explain the concepts of chemical bonding, physical properties and chemical reactivities of organic compounds. CLO3 Outline chemical reactions and the interconversions of functional groups. CLO4 Written reports on chemical reactions and obsevartions
Pre-Requisite Courses	No course recommendations

Topics
1. Introduction to Organic Chemistry 1.1) 3.1.1 Structure of carbon compounds 1.2) 3.1.2 The nature of chemical bonding: Covalent bonding 1.3) 3.1.3 Polar and nonpolar molecules 1.4) 3.1.4 Intermolecular forces 1.5) 3.1.5 Hybridization: sp3, sp2, sp 1.6) 3.1.6 Functional groups 1.7) 3.1.7 Empirical, molecular and structural formulae 1.8) 3.1.8 Homolytic and heterolytic breaking of covalent bond 1.9) 3.1.9 Homogenic and heterogenic formation of covalent bond 1.10) 3.1.10 Structural isomerism: chain, position, functional group 1.11) 3.1.11 Cis-trans isomerism
2. Hydrocarbon compounds 3.2.1 Alkane 2.1) 3.2.1.1 Structure and physical properties (boiling point and solubility) 2.2) 3.2.1.2 Nomenclature 2.3) 3.2.1.3 Preparation (hydrogenation of alkenes, hydrolysis of Grignard reagents) 2.4) 3.2.1.4 Alkane reactions (halogenation/free radical substitution, combustion) 2.5) 3.3.1.5 Sources and uses
3. Hydrocarbon compounds 3.2.2 Alkene 3.1) 3.2.2 Alkene 3.2) 3.2.2.1 Structure and physical properties 3.3) (boiling point and solubility) 3.4) 3.2.2.2 Nomenclature 3.5) 3.2.2.3 Preparation (dehydration of alcohols, 3.6) dehydrohalogenation of haloalkanes) 3.7) 3.3.2.4 Reactions 3.8) Addition (hydrogenation)

3.9) Electrophilic addition (addition of
3.10) hydrogen halides (HX), hydration,
3.11) halogenation in inert solvent (eg. CCl4),
3.12) halogenation in water, addition of conc.
3.13) H2SO4, Markovnikov's and anti-
3.14) Markovnikov's rule)
3.15) Oxidation (ozonolysis, diol hydroxylation (Baeyer test) and C=C bond cleavage with acidified KMnO4)

4. Hydrocarbon compounds 3.2.3 Aromatic compounds
4.1) 3.2.3.1 Resonance structure, benzene ring
4.2) stabilization and physical properties
4.3) 3.2.3.2 Nomenclature
4.4) 3.2.3.3 Oxidation of alkylbenzene
4.5) 3.2.3.4 Addition under certain conditions
4.6) (hydrogenation and chlorination)
4.7) 3.2.3.5 Electrophilic aromatic substitution
4.8) (halogenation, nitration, sulphonation,
4.9) Friedel-Crafts acylation and Friedel-
4.10) Crafts alkylation)
4.11) 3.2.3.6 Effects of substituents on the reactivity
4.12) and orientation (activating group: ortho-
4.13) para directing effect and deactivating
4.14) group: meta directing effect)
4.15) 3.2.3.7 Uses of aromatic compounds

5. Hydroxyl compounds
5.1) 3.3.1 Alcohol
5.2) 3.3.1.1 Structure, classification and physical properties (boiling point, solubility, acidity and basicity)
5.3) 3.3.1.2 Nomenclature
5.4) 3.3.1.3 Preparation
5.5) hydration of alkenes
5.6) hydrolysis of haloalkanes
5.7) addition of Grignard reagents to
5.8) carbonyl compounds
5.9) 3.3.1.4 Reactions
5.10) reaction with sodium
5.11) esterification
5.12) dehydration to alkene and ether
5.13) reaction with hydrogen halide,
5.14) phosphorus halide and thionyl chloride)
5.15) oxidation
5.16) 3.3.1.5 Chemical tests to identify primary, secondary and tertiary alcohols
5.17) Lucas test
5.18) oxidation test
5.19) triiodomethane test
5.20) 3.3.1.6 Sources and uses of alcohols
5.21) 3.3.2 Phenol
5.22) 3.3.2.1 Structure and physical properties
5.23) 3.3.2.2 Reactions
5.24) with sodium and NaOH (acidity)
5.25) electrophilic substitution (nitration,
5.26) halogenation, sulphonation)
5.27) esterification
5.28) 3.3.2.3 Identification test with FeCl3(aq)
5.29) 3.3.2.4 Uses and importance of phenol

6. Carbonyl compounds
6.1) 3.4.1 Classes: Aldehydes and ketones
6.2) 3.4.2 Structure and physical properties (boiling point
6.3) and solubility)
6.4) 3.4.3 Nomenclature
6.5) 3.4.4 Preparation
6.6) oxidation of alcohols
6.7) ozonolysis of alkenes
6.8) Friedel-Crafts acylation
6.9) 3.4.5 Reactions
6.10) oxidation (Tollen's, Fehling's & Schiff's reagents)
6.11) reduction
6.12) nucleophilic addition (HCN, NaHSO3, water, alcohols, Grignard's reagents, ammonia)
6.13) 3.4.6 Haloform reaction
6.14) triiodomethane test

7. Carboxylic acids and derivatives 7.1) 3.5.1 Structure and physical properties (boiling point, Solubility and acidity) 7.2) 3.5.2 Nomenclature 7.3) 3.5.3 Preparation 7.4) oxidation of 1? alcohols, aldehye and alkylbenzene 7.5) 3.5.4 Reactions 7.6) with metals 7.7) neutralisation (with NaOH, NaHCO3, Na2CO3) 7.8) formation of acid chloride (reaction with PCl3,PCl5, SOCl2) 7.9) formation of acid anhydride (reaction with carboxylic acid, acid chloride) 7.10) formation of ester (reaction with alcohol) 7.11) formation of amide (reaction with ammonia, primary 7.12) and secondary amines) 7.13) reduction to alcohols 7.14) hydrolysis of carboxylic acid derivatives 7.15) 3.5.5 Interconversion reactions
8. Amines 8.1) 3.6.1 Structure, classification and physical properties 8.2) (boiling point, solubility and basicity) 8.3) 3.6.2 Nomenclature 8.4) 3.6.3 Reactions 8.5) with acids 8.6) acylation (with acid chloride, acid anhydride 8.7) and ester)

Assessment Breakdown	%
Continuous Assessment	60.00%
Final Assessment	40.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	nomenclature, drawing molecular structure and chemical reactions of hydrocarbons	10%	CLO1
Test	hydrocarbons, alkanes, alkenes, aromatics	10%	CLO2
Test	hydroxyl, aromatic , carbonyls	15%	CLO2
Test	carboxylic acids, carboxylic acids derivatives and amines	15%	CLO3
Written Report	laboratory reports	10%	CLO4

Reading List

Recommended Text

- **Textbook OrgT. W. Graham Solomons, Craig B. Fryhle, Scott A. Snyder 2013, *Organic Chemistry, 11th Edition*, 11th Edition Ed., John Wiley & Sons, Inc. [ISBN: 978-111813357]**
- **Tan Yin Toon & Sheila Shamuganathan 2014, *Chemistry for Matriculation Semester 2 Fourth Edition*, Fourth Edition Ed., 4-11, Oxfor Fajar University Press Malaysia [ISBN: 9789834714116]**

Reference Book Resources

- **L. G. Wade, Jr, 2006, *Organic Chemistry*, 6 Ed., , Pearson Prentice Hall [ISBN:]**
- **Francis A. Carey 1996, *Organic Chemistry*, 3 Ed., , Mc Graw-Hill, New York [ISBN:]**
- **John Mc Murray 1996, *Organic Chemistry*, 4 Ed., , Brooks/Cole, Pacific Grove, Cal., USA [ISBN:]**
- **Ralph J. Fessenden, Joan S. Fessenden 1997, *Organic Chemistry*, 5 Ed., , Brooks/Cole, Pacific Grove, Cal., USA**

Article/Paper List: This Course does not have any article/paper resources

Other References: This Course does not have any other resources