

Students Learning Objectives: Chemistry Grade 12
Bilingual Syllabus (2010 – 2011)
Semester One

Student Learning Objectives: Organic Chemistry 1: Alcohols

By the end of this Unit students should be able to....

1. Recall the formation of ethanol by the fermentation of glucose using yeast.
2. Understand that the physical property such as boiling point is related to the hydrogen bonding between the alcohol molecules.
3. Demonstrate an understanding of the nomenclature and corresponding structural formulae of alcohols, and classify them as primary, secondary or tertiary.
4. Name the alcohols according to IUPAC rules.
5. Draw the structures of the different types of alcohols.
6. Describe the following chemistry of alcohols:
 - i. oxidation using acidified potassium dichromate(VI) solution on primary and secondary alcohols.
 - ii. reaction with sodium;
 - iii. reaction with carboxylic acids;
 - iv. nucleophilic substitution reactions to form haloalkanes;
 - v. dehydration reaction by heating the alcohol with concentrated sulfuric acid. (The mechanisms of the reactions are **not** required).
7. Discuss the manufacture of ethanol and its use as a fuel of the future.
8. Recall the use of ethane-1,2-diol as antifreeze.

Student Learning Objectives: Organic Chemistry 1: Aldehydes and Ketones

By the end of this Unit students should be able to....

1. State the general structures of aldehydes and ketones.
2. Give some examples of molecules that contain the aldehyde or ketone functional group.
3. Name the aldehydes and ketones according to IUPAC rules.
4. Draw the structures of the different types of aldehydes and ketones.
5. Describe the reactions of aldehydes and ketones:
 - i. oxidation with Tollens' reagent and Fehling's solution;
 - ii. iodine in the presence of alkali (iodoform reaction);
 - iii. reduction using hydrogen (nickel catalyst) or lithium tetrahydridoaluminate (in dry ether);
 - iv. nucleophilic addition of HCN in the presence of KCN. (The mechanisms of the reactions are **not** required).

Students learning Objectives: Chemistry Grade 12
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Semester One (cont.)

Student Learning Objectives: Organic Chemistry 1: Carboxylic Acids
By the end of this Unit students should be able to....

1. Give some examples of molecules that contain the carboxyl group.
2. Explain the physical properties of carboxylic acids in relation to their boiling points and solubility due to hydrogen bonding.
3. Name the carboxylic acids according to IUPAC rules.
4. Draw the structures of the different types of carboxylic acids
5. Describe the reactions of carboxylic acids:
 - i. reactions as acids with alkali to form salts;
 - ii. reduction with lithium tetrahydridoaluminate(III) in dry ether.
 - iii. esterification.
 - iv. halogenation.
6. Describe the acid hydrolysis of esters.
7. Describe the process of saponification including the reaction involved.
8. State the major commercial use of esters in flavourings and perfumes.

Student Learning Objectives: Organic Nitrogen Compounds
By the end of this Unit students should be able to....

1. Differentiate between the amine and amide functional groups.
2. Identify the functional groups in nitriles and amino acids.
3. Explain the basicity of amines.
4. Describe the phenomenon of optical isomerism in amino acids.
(**Note!**: The reactions of amines, amides and amino acids are not included).

Students learning Objectives: Chemistry Grade 12
Bilingual Syllabus (2010 – 2011)
Semester One (cont.)

Student Learning Objectives: Aromatic compounds

By the end of this Unit students should be able to....

1. Recall the structure and nature of the benzene ring as proposed by Kekulé and as suggested by X-ray diffraction studies.
2. Describe the electrophilic substitution reactions of benzene, limited to:
 - i. nitration (introduction of $-\text{NO}_2$ group);
 - ii. sulphonation (introduction of $-\text{SO}_3\text{H}$ group);
 - iii. halogenation;
 - iv. Friedel-Crafts reactions (introduction of a side-chain).
3. Describe addition reactions of benzene, limited to:
 - i. addition of hydrogen;
 - ii. addition of chlorine.
4. Describe the reactions of substituted benzene rings, like phenols and nitrobenzene.
5. Describe the reactions in side-chains, such as nucleophilic substitution and oxidation.
(Not the mechanisms of the reactions).

Student Learning Objectives: Polymers

By the end of this Unit students should be able to....

1. Demonstrate the mining of polymerisation with examples.
2. Distinguish between low density and high density poly(ethene) in terms of properties and structures.
3. Recall that some properties of plastics are related to their intermolecular bonding and distinguish between thermosets and thermoplastics.
4. Describe the characteristics of addition polymerisation. (Not the mechanism of addition polymerisation).
5. Describe the characteristics of condensation polymerisation in polyamides (Nylon) and polyesters (Terylene).
6. Recall the new developments in polymers such as Kevlar, Tencel, PET, Polyurethane, glue polymers, conducting polymers, alarming suits, flexible TV screens and smart polymers.
7. Describe the various types of biodegradable plastics.

The Practicals for Grade 12

Semester One

1. Investigating the reactions of alcohols, such as
 - (a) oxidation using acidified potassium dichromate(VI);
 - (b) reaction with sodium;
 - (c) reaction with carboxylic acids (esterification).
2. Testing for aldehydes using:
 - (a) Tollen's reagent (silver mirror test);
 - (b) Fehling's solution (red/orange precipitate).
3. Testing for ketones (with the methyl group) using an alkaline solution of iodine – iodoform reaction (yellow precipitate).
4. Making soap by boiling oils or fats with sodium hydroxide (hydrolysis of esters).
5. Investigating the reaction of phenol with bromine water.

End of Semester One

Students learning Objectives: Chemistry Grade 12
Bilingual Syllabus (2010 – 2011)
Semester Two

Student Learning Objectives: Equilibrium mixtures

By the end of this Unit students should be able to....

1. Differentiate between reversible and irreversible reactions.
2. Demonstrate an understanding of the terms “dynamic equilibrium” and “closed system”.
3. State Le Chatelier’s Principle and apply it to deduce qualitatively the effects of changes in concentration, pressure and temperature on the position of equilibrium.
4. Describe and explain the conditions used in the Haber process and the Contact process, as examples of the importance of an understanding of chemical equilibrium in the chemical industry.
5. Describe the making of nitric acid in industry.
6. Recall some of the important uses of nitric acid and sulfuric acid.

Student Learning Objectives: Equilibrium constants

By the end of this Unit students should be able to....

1. Deduce expressions for equilibrium constants in terms of concentrations, K_c , and equilibrium partial pressures, K_p , for homogeneous and heterogeneous systems.
2. Perform simple calculations on K_c and K_p and work out the units of the equilibrium constants.
3. Apply knowledge of the value of equilibrium constants to predict the extent to which a reaction takes place.
4. Calculate the value for the equilibrium constant for a reaction based on data from experiment.
5. Explain qualitatively and quantitatively the effects of changing concentration, pressure and temperature on K_c and K_p .
6. Describe the formation of nitrogen oxides by a lightning flash.

Students learning Objectives: Chemistry Grade 12
Bilingual Syllabus (2010 – 2011)
Semester Two (cont.)

Student Learning Objectives: Acid/Base Equilibria

By the end of this Unit students should be able to....

1. Recall the names of some common weak and strong acids and some properties of acids, including neutralization.
2. Demonstrate an understanding that a Brønsted-Lowry acid is a proton donor and a base a proton acceptor and that acid-base equilibria involve transfer of protons.
3. Demonstrate understanding of the Brønsted-Lowry theory of acid-base behaviour, and use it to identify conjugate acid-base pairs.
4. Calculate pH values and $[H^+]$ for strong and weak acids and strong bases.
5. Explain qualitatively the differences in behaviour between strong and weak acids and bases and the pH values of their aqueous solutions in terms of the extent of dissociation.
6. Explain the terms pH, K_a and K_w and use them in calculations.
7. Describe the changes in pH during acid-base titrations and draw titration curves using different combinations of strong and weak monobasic acids and bases.
8. Use data about indicators, together with titration curves, to select a suitable indicator.
9. Explain the action of buffer solutions and carry out calculations on the pH of buffer solutions, eg. making buffer solutions and comparing the effect of adding acid or alkali on the pH of the buffer.

Student Learning Objectives: Electrode potentials

By the end of this Unit students should be able to....

1. Demonstrate an understanding of the terms “oxidation”, “reduction” and “half-reactions” and use these to interpret reactions involving electron transfer.
2. Construct simple cells and predict the direction of electron flow.
3. Write a cell diagram as a shorthand way of representing a cell.
4. Recall the definition of standard electrode potential and standard hydrogen electrode and understand the need for a reference electrode.
5. Use the table of standard electrode potentials to:
 - i. identify the reducing and oxidising agents;
 - ii. calculate value of E_{cell} from standard electrode potential values under standard conditions.
6. Use E_{cell} to predict redox reactions.
7. Use electrode potentials to understand and explain corrosion of iron.
8. Explain the use of galvanising and sacrificial protection as means of preventing corrosion.

The Practicals for Grade 12

Semester Two

1. Investigating the factors affecting an equilibrium reaction.
2. Experimental determination of the equilibrium constant (K_c) by titrating ammonia solution with hydrochloric acid.
3. Performing an acid-base titration to find out the unknown concentration of a solution.
4. Determining the pH of common substances and then calculating their $[H^+]$.
5. Investigating the pH curves for different combinations of strong and weak acids against strong and weak alkalis, and choosing a suitable indicator.
6. Constructing and Investigating the different electrochemical cells using copper ,zinc , lead , Aluminum electrodes.

End of Semester Two

REFRANCE TEXT BOOKS

- 1-Advance Chemistry for You by Lawrie Ryan ,Nelson Thornes.UK
- 2- Organic Chemistry ,Paula Yurkanis Bruice,Prentice-Hall Inc.USA
- 3-Organic Chemistry , Princeton University, Maitland Jones , UK

Number of Periods for Each Topic

No.	The Topics	Suggested Number of Periods
1	Alcohols	10
2	Aldehydes & Ketones	7
3	Carboxylic Acids	7
4	Nitrogen Compounds	5
5	Aromatic Compounds	6
6	Polymers	5
	Total Classes for Semester One	40
No.		
1	Equilibrium mixtures	11
2	Equilibrium constants	8
3	Acid/Base Equilibria	13
4	Electrode potentials	10
	Total Classes for Semester Two	42

Grade 12

Semester 1

Subject: Chemistry

Chapter	Practical	Resources
1-Alcohols	1-Investigating the reactions of alcohols, such as: (a)-oxidation using acidified potassium dichromate(VI); (b)-reaction with sodium; (c)-reaction with carboxylic acids (esterification).	1- Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians . 2- www.practicalchemistry.org
2-Aldehydes	2- Testing for aldehydes using: (a)Tollen's reagent (silver mirror test); (b)Fehling's solution (red/orange precipitate).	1- Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians . 2-www.practicalchemistry.org
3-Ketones	3- Testing for ketones (with the methyl group) using an alkaline solution of iodine – iodoform reaction (yellow precipitate).	1-Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians.
4- Carboxylic Acids	4- Making soap by boiling oils or fats with sodium hydroxide (hydrolysis of esters).	1-Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians
5-Aromatic compounds	5-Investigating the reaction of phenol with bromine water.	1-Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians.

Grade 12**Semester 2****Subject: Chemistry**

Chapter	Practical	Resources
1- Equilibrium mixtures	1- Investigating the factors affecting an equilibrium reaction.	1-Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians 2-www.crocodile-clips.com
2- Equilibrium constants	2- Experimental determination of the equilibrium constant (K_c) by titrating ammonia solution with hydrochloric acid.	1-Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians 2-www.crocodile-clips.com 3- http://www.practicalchemistry.org/
3- Acid/Base Equilibria	3- Performing an acid-base titration to find out the unknown concentration of a solution	1-Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians 2-www.crocodile-clips.com
	4- Determining the pH of common substances and then calculating their $[H^+]$.	
	5- Investigating the pH curves for different combinations of strong and weak acids against strong and weak alkalis, and choosing a suitable indicator.	
4- Electrode potentials	6- Constructing and Investigating the different electrochemical cells using copper ,zinc , lead , Aluminum electrodes.	1-Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians 2-www.crocodile-clips.com