Students Learning Objectives: Chemistry Grade 11
Bilingual Syllabus (2009 – 2010)
Semester One

Student Learning Objectives: <u>Atoms and electrons</u>
By the end of this Unit students should be able to….

1. Give a brief description of the different models of the atom.
2. Recall the definition of ionization enthalpies of gaseous atoms and that they are endothermic processes.
3. Recall that the evidence for electron shells (energy levels) and sub-shells developed from:
   i An understanding of atomic spectra;
   ii An understanding of the successive ionization enthalpies of an atom.
4. Describe the shapes of electron density plots (or structures) for *s* and *p* orbitals.
5. Write the electronic configuration of isolated atoms of different elements using both *s,p*- and electrons-in-boxes notations (according to the filling subshells rules).
6. Demonstrate a basic understanding of lasers and luminescence.

Student Learning Objectives: <u>Atoms and the nucleus</u>
By the end of this Unit students should be able to….

1. Recall the discovery of the main atoms components in terms of electrons, protons and neutrons.
2. Understand the relationships between the numbers of protons and neutrons in an atom and its atomic number, mass number, relative isotopic mass and the existence of isotopes
3. Demonstrate a basic understanding of the principles applied in a smoke alarm and a nuclear reactor.
4. Calculate the relative atomic mass of an element.

Student Learning Objectives: <u>Calculations using the mole</u>
By the end of this Unit students should be able to…

1. Balance formula-equations by inspection.
2. Define the Avogadro constant and the mole.
3. Calculate the number of moles in atoms, molecules and compounds.
4. Use balanced chemical equations to deduce reacting masses.
5. Understand the concept of the molar volume of a gas and apply this to simple calculations.
6. Deduce reacting gas volumes from chemical equations.
7. Demonstrate an understanding of the ideal gas equation and perform calculations using the ideal gas equation.
8. Use solution concentration data expressed in $mol.dm^{-3}$ in acid/base titrations calculations.
9. Calculate the empirical formula of compounds.
10. Deduce the molecular formula of compound used in a given experiment.
11. Determine salinity and pH using the concentrations of chloride ion and hydrogen ions.

Student Learning Objectives: <u>Ionic compounds</u>
By the end of this Unit students should be able to….

1. Describe the formation of ions in terms of electron loss or gain.
2. Draw electron configuration diagrams of cations and anions using dots or crosses.
3. Explain ionic bonding.
4. Use ionic charges to work out the formulae of ionic compounds.
5. Describe ionic crystals as giant lattices of ions.
6. Explain the properties of ionic compounds in terms of ionic bonds.
7. Describe the uses of some ionic compounds (sodium chloride, fluoride and magnesium oxide).

Student Learning Objectives: <u>Covalent compounds</u>
By the end of this Unit students should be able to….

1. Describe how the covalent bonding is formed.
2. Draw electron configuration diagrams for molecules containing single, double and dative (or coordinate) covalent bonds using dotes and crosses.
3. Predict the shapes of different covalent bonded molecules in terms of electron pair repulsion theory.
4. Discuss the different structures formed by carbon atoms, including graphite, diamond, fullerenes and carbon nanotubes, and the applications of these.
5. Recall the properties of giant covalent substances.
6. Interpret the nature of intermolecular forces (Van der Waals – polar molecules – permanent dipole –instantaneous dipole – intermediate forces and hydrogen forces).
7. Relate the boiling points of materials to the types of intermolecular force present.
8. Explain the meaning of the term electronegativity.
9. Explain bond polarity in bonds and molecules in terms of electronegativity differences.
10. Distinguish between polar bonds and polar molecules.
11. Predict if molecule is likely to be polar or non polar.
12. Explain the polarity of ionic and covalent bonding in terms of electronegativety differences.

Student Learning Objectives: <u>Enthalpy change</u>
By the end of this Unit students should be able to….

1. Define the term *enthalpy change*, ΔH.
2. Construct simple enthalpy level diagrams showing the enthalpy changes in exothermic and endothermic reactions.
3. Compare the sign of ΔH for exothermic and endothermic reactions.
4. Use experimental data to calculate energy transferred and the enthalpy change in a reaction for the following types :
   i. experiments in which substances are mixed in an insulated container and the temperature rise measured.
   ii. simple enthalpy of combustion experiments using an alcohol in a spirit burner.
5. Predict the sources of error and assumptions made in the experiments described in 4 above.
6. Define the standard enthalpy changes of reaction, formation, combustion and atomisation.
7. Recall Hess's law and apply it to calculate enthalpy changes of reaction from data provided.
8. Define the terms bond enthalpy and average bond enthalpy.
9. Calculate the approximate enthalpy changes using average bond enthalpy data.
10. Recall the reactions in fireworks, 'hand-warmers' and 'cold packs'.

Student Learning Objectives: <u>Kinetics – rates of reaction</u>
By the end of this Unit students should be able to….

1. Demonstrate an understanding of the term activation energy and kinetic stability.
2. State different ways of investigating rates of reaction experimentally.
3. Consider the relationship between the gradient of reaction rate graphs and rate of reaction.
4. Explain the change in rate of reaction based on the concept of collision theory.
5. Interpret the factors affecting rates of reaction including surface area, pressure, concentration, temperature and catalysis.
6. Relate, in a qualitative way, the changes in the Maxwell-Boltzmann distribution of molecular energies with changes of temperature and the addition of a catalyst.
7. Determine the effect of catalyst on rate of reaction in term of activation energy
8. Recall some of the industrial uses of catalysts.
9. Identify the properties, effect and uses of enzymes and the use of immobilized enzymes in industry.

<u>Practicals</u>

<u>Semester One</u>

1. Performing an acid-base titration to find out the unknown concentration of a solution.
2. Determining the formula of magnesium oxide by heating some magnesium ribbon in a crucible.
3. Determining the enthalpy of combustion of a liquid such as ethanol using a simple calorimeter.
4. Measuring the enthalpy change for reactions in solution by measuring the temperature change (reacting equivalent amounts of acidic and basic solutions)
5. Investigating the factors affecting reaction rate.

End of Semester One

Students learning Objectives: Chemistry Grade 11
Bilingual Syllabus (2009 – 2010)
Semester Two

Student Learning Objectives: <u>The Periodic Table</u>
By the end of this Unit students should be able to….

1. Recall the contributions of Döbereiner, Newlands and Mendeleev to our present understanding of the Periodic Table.
2. Recognize groups, periods and blocks in the Periodic Table.
3. Determine the position of an element using the electronic structures.
4. Explain trends in the following properties of the elements in Group 4 of the Periodic Table:
   i. metallic/non-metallic properties;
   ii. first ionization enthalpies.

11. Describe the" periodicity" for elements 1 to 36 in the periodic table from given data or graphs.

Student Learning Objectives: <u>Group 2 – Alkaline earth metals</u>
By the end of this Unit students should be able to….

1. Explain the trend in the first ionization enthalpy down group 2.
2. Recall some of the physical properties of group 2 elements.
3. Describe the reaction of the elements in group 2 with oxygen, water and acid and there products properties .
4. Write the chemical equations of the reactions mentioned above.
5. Identify the trends in solubility of the oxides and thermal stability of the nitrates and the carbonates of the elements in group 2.
6. Recall the medical uses of barium sulfate and calcium sulfate.

Student Learning Objectives: <u>Group 7 – Halogens</u>
By the end of this Unit students should be able to….

1. Recall the characteristic physical properties of the halogens.
2. Describe the following reactions of halogens including the chemical equations :
   i. oxidation reactions with metal elements;
   ii. displacement reactions.
3. Identify halide ions by precipitation with silver nitrate solution.
4. Determine the oxidation number of chlorine in various ions and compounds.
5. Recall the bleaching property of chlorine.

Students learning Objectives: Chemistry Grade 11
Bilingual Syllabus (2009 – 2010)
Semester Two (cont.)

Student Learning Objectives: <u>Organic Chemistry 1: Introduction</u>
By the end of this Unit students should be able to….

1. Identify the concepts of *functional group* and *homologous series*.
2. i. Name the organic compounds with given *functional group* according to IUPAC nomenclature.
   ii. Draw the structures formule of these compounds from their IUPAC nomenclature.
3. Distinguish between the three types of the structural isomerism.

Student Learning Objectives: <u>Organic Chemistry 1: The Alkanes</u>
By the end of this Unit students should be able to….

1. Interpret the general formula and the nature of c-c bond in alkanes.
2. Identify the source of alkanes and their physical properties.
3. Describe the combustion of alkanes and pollution problems related to it.
4. Write the equation substitution reactions of alkanes (mechanism of reaction not required).

Student Learning Objectives: <u>Organic Chemistry 1: The Alkenes</u>
By the end of this Unit students should be able to….

1. State the general formula of alkenes and understand that they are unsaturated hydrocarbons with a carbon-carbon double bond.
2. Describe the geometric/cis-trans isomerism and the nature of the substitution in in the isomers.
3. Recall the products of the combustion reaction of alkenes.
4. Describe the addition reactions of alkenes, limited to:
   i. the addition of halogens (bromine) .
   ii. the oxidation of the double bond by potassium manganate(VII) .
   iii. the addition of hydrogen with a nickel catalyst.
   iv. the addition of hydrogen halides.
   (mechanism of addition reaction is **not** required).
5. Describe the test for the presence of C = C using bromine water.
6. Predict the products of addition using Markovnikov's rule.

Student Learning Objectives: <u>Organic Chemistry 1: The Haloalkanes (Halogenalkanes)</u>
By the end of this Unit students should be able to….

1. State the general formula of haloalkanes and understand their nomenclature and corresponding structural formulae.
2. Interpret the reactivity of haloalkanes in terms of carbon-halogen bond strength.
3. Describe the nucleophilic substitution reactions, limited to treatment with:
   i. aqueous alkali, eg. NaOH(aq);
   ii. ethanolic (alcoholic) potassium cyanide;
   iii. ethanolic (alcoholic) ammonia.
   (mechanism of nucleophilic substitution is **not** required).
4. Describe the elimination reactions of haloalkanes using ethanolic (alcoholic) sodium hydroxide.
   (mechanism of elimination reactions is **not** required).
5. Discuss the uses of haloalkanes (CFC's) as refrigerants, flame retardants and aerosol propellants.

<u>Practicals</u>

<u>Semester Two</u>

1. Investigating the reactions of some Group 2 metals with oxygen, water and acids.
2. Identifying halide ions by precipitation reactions with silver nitrate solution.
3. Investigating the reactions of alkenes with bromine water and acidified potassium manganate(VII) solution.
4. Identifying the halogen in a haloalkane by adding the alkane to silver nitrate solution (acidified with dilute nitric acid) or by heating the haloalkane with aqueous sodium hydroxide solution, then adding aqueous silver nitrate.
5. Investigating nucleophilic substitution reactions of haloalkanes with ammonia.

End of Semester Two

Grade 11

Semester 1

Subject: Chemistry

Chapter	Practical	Resources
1-Calculations using the mole	1- Performing an acid-base titration to find out the unknown concentration of a solution.	Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians
2-Ionic compounds	2- Determining the formula of magnesium oxide by heating some magnesium ribbon in a crucible	http://www.practicalchemistry.org/
3-Entropy change	3- Determining the enthalpy of combustion of a liquid such as ethanol using a simple calorimeter.	Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians
	4- Measuring the enthalpy change for reactions in solution by measuring the temperature change (reacting equivalent amounts of acidic and basic solutions)	Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians
4- Kinetics – Rate of Reaction	5- Investigating the factors affecting reaction rate	http://www.practicalchemistry.org/

Grade 11

Semester 2

Subject: Chemistry

Chapter	Practical	Resources
1- Group 2 –Alkaline earth metals	1- Investigating the reactions of some Group 2 metals with oxygen, water and acids.	Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians
2-Group 7 – Halogens	2- Identifying halide ions by precipitation reactions with silver nitrate solution.	http://www.practicalchemistry.org/
3- Organic chemistry – Alkenes	3- Investigating the reactions of alkenes with bromine water and acidified potassium manganate(VII) solution.	Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians
4- Organic chemistry – Haloalkanes	4- Identifying the halogen in a haloalkane by adding the alkane to silver nitrate solution (acidified with dilute nitric acid) or by heating the haloalkane with aqueous sodium hydroxide solution, then adding aqueous silver nitrate.	Edexcel AS chemistry, implementation and assessment, guide for teacher and technicians
	6. 5- Investigating nucleophilic substitution reactions of haloalkanes with ammonia.	