



ZIMBABWE

MINISTRY OF PRIMARY AND SECONDARY EDUCATION

O LEVEL CHEMISTRY SYLLABUS

FORMS 3 - 4

2015 - 2022

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1.0. PREAMBLE

1.1. Introduction

This two year syllabus is designed to put greater emphasis on the understanding, application of chemistry concepts and principles in an environmental friendly and sustainable manner. It makes learners identify and solve problems practically in a scientific manner. The Form 3 and 4 Chemistry syllabus is inclusively made to cater for all categories of learners in an increasingly technological world.

1.2. Rationale

Chemistry plays an important role in the technological development of any country since it is embedded in everyday life. The study of Chemistry enables learners to be creative and innovative in society, promoting the application of Chemistry in industrial processes for value addition, beneficiation of natural resources and harnessing of available opportunities for entrepreneurship.

The Chemistry syllabus enables learners to develop the following skills:

- Problem solving
- Critical thinking
- Decision making
- Conflict resolution
- Self-management
- Communication
- Psychomotor
- Leadership
- Enterprise
- Technology and innovation

1.3. Summary of Content

Form 3 and 4 Chemistry syllabus will cover theory and practical activities in the following areas: Physical Chemistry, Inorganic Chemistry, Organic Chemistry and Environmental Chemistry

1.4 Assumptions

It is assumed that learner:

- are familiar with laboratory apparatus
- are aware of laboratory safety precautions

- have successfully completed Form 1 and 2 Combined Science syllabus
- are computer literate and have a good mathematics background

1.5 Cross-Cutting Themes

The Chemistry learning area encompasses the cross cutting themes listed below:

- Inclusivity
- Life skills
- HIV/ AIDS
- Team work
- Food security
- Enterprise Education
- Environmental issues
- Safety and health issues
- Indigenous knowledge system
- Disaster and risk management

2.0 PRESENTATION OF THE SYLLABUS

The Form 3 and 4 Chemistry syllabus is a single document covering Forms 3 - 4.

3.0 AIMS

The syllabus aims are to:

- 3.1 appreciate the usefulness and limitations of the scientific methods
- 3.2 inculcate in learners the need for safety and protection of the environment.
- 3.3 create opportunities for learners to acquire research, experimental, practical, enterprising and technological skills.
- 3.4 enable learners to develop fundamental principles of Chemistry for application in life and as a basis for further studies in Chemistry and related disciplines.
- 3.5 stimulate in learners the desire to apply Chemistry for the benefit of society as guided by the principles of Unhu/Ubuntu/Vumunhu
- 3.6 promote awareness that the applications of Chemistry may be both beneficial and detrimental to the individual and the community.
- 3.7 develop, in learners the appreciation of the use of Chemistry in value creation, addition and beneficiation.

4.0 SYLLABUS OBJECTIVES

Learners should be able to:

- 4.1 follow instructions in practical work
- 4.2 make and record observations
- 4.3 use ICT to simulate Chemistry phenomena
- 4.4 apply safety measures in all practical work
- 4.5 present, analyse and interpret data to establish relationships
- 4.6 demonstrate knowledge of facts, laws, definitions and concepts in Chemistry
- 4.7 measure and express quantities to a given level of accuracy and precision
- 4.8 design a practical solution to a real life problem using knowledge of Chemistry

5.0 METHODOLOGY AND TIME ALLOCATION

5.1 Methodology

Some of the learner centred and multi-sensory methodologies used in the teaching and learning of Chemistry are suggested below. The principles of team work, concreteness, totality, stimulation and self-activity should guide the teachers as they employ the suggested methods:

- models
- site visits
- research
- seminars
- discovery
- simulations
- discussions
- demonstrations
- experimentation

5.2 Time Allocation

For adequate coverage of the syllabus, a time allocation of eight 35-minute periods per week are recommended. Double periods to accommodate practical work are recommended.

6.0 TOPICS

- Physical Chemistry:
 - Laboratory techniques
 - Matter
 - Atoms, Elements and Compounds
 - Chemical bonding

- The Mole concept
- Stoichiometry
- Acids, Bases and Salts
- Electrochemistry
- Chemical energetics
- Equilibria
- Reaction kinetics
- Inorganic Chemistry:
 - Periodic table
 - Metals
 - Non metals
- Organic Chemistry:
 - Fuels
 - Classification and naming of organic compounds
 - Hydrocarbons
 - Alcohols and carboxylic acids
 - Polymers
- Environmental Chemistry
 - Waste management
 - Pollution
 - Water purification
 - Herbs

7.0 SCOPE AND SEQUENCE CHART

FORM 3 AND FORM 4

TOPIC	FORM 3	FORM 4
7.1.0 PHYSICAL CHEMISTRY:		
7.1.1 Laboratory techniques	<ul style="list-style-type: none"> Measuring Instruments Separation techniques <ul style="list-style-type: none"> -Filtration -Distillation -Crystallisation -Paper and thin layer chromatography 	<ul style="list-style-type: none"> Volumetric analysis Separation techniques Qualitative analysis
7.1.2 Matter	<ul style="list-style-type: none"> States of matter 	<ul style="list-style-type: none"> Heating and cooling curves
2.1.3 Atoms, Elements and Compounds	<ul style="list-style-type: none"> Atomic structure Elements and compounds 	
7.1.4 Chemical bonding	<ul style="list-style-type: none"> Covalent bonding Ionic bonding Metallic bonding 	
7.1.5 The Mole concept	<ul style="list-style-type: none"> Mole concept 	<ul style="list-style-type: none"> Percentage compositions <ul style="list-style-type: none"> -Empirical and molecular formulae Molar gas volume
7.1.6 Stoichiometry	<ul style="list-style-type: none"> Chemical equations 	<ul style="list-style-type: none"> Percentage yield and purity
7.1.7 Acids, Bases and Salts	<ul style="list-style-type: none"> Properties of acids and bases Preparation of salts 	
7.1.8 Electrochemistry	<ul style="list-style-type: none"> Redox reactions Cells and batteries Electrolysis of acidified water 	<ul style="list-style-type: none"> Redox reactions Electrolytic purification of copper and aluminium
7.1.9 Chemical energetics	<ul style="list-style-type: none"> Endothermic and exothermic reactions Energy profile diagrams 	<ul style="list-style-type: none"> Enthalpy changes

7.0 SCOPE AND SEQUENCE CHART

FORM 3 AND FORM 4

7.1.10 Equilibria	<ul style="list-style-type: none"> Reversible reaction Dynamic Equilibria <ul style="list-style-type: none"> -Haber process -Contact process -Ostwald process 	<ul style="list-style-type: none"> Production of fertilisers
7.1.11 Reaction kinetics	<ul style="list-style-type: none"> Rates of reaction Factors affecting rates of reaction 	<ul style="list-style-type: none"> Industrial applications

7.2.0 INORGANIC CHEMISTRY

7.2.1 Periodic table	<ul style="list-style-type: none"> Periodic trends Group trends 	<ul style="list-style-type: none"> Transition elements
7.2.2 Metals and non-metals	<ul style="list-style-type: none"> Properties of metals and non-metals Reactivity series Lime in agriculture and construction 	<ul style="list-style-type: none"> Composition of mineral ores Extraction of metals Processing of diamond and coal Liquefaction and fractional distillation of air

7.3.0 ORGANIC CHEMISTRY

7.3.1 Fuels	<ul style="list-style-type: none"> Types of fuels Production of fuels 	<ul style="list-style-type: none"> Fuel efficiency
7.3.2 Classification and Nomenclature of organic compounds	<ul style="list-style-type: none"> Homologous series <ul style="list-style-type: none"> - hydrocarbons - alcohols - carboxylic acids 	<ul style="list-style-type: none"> Isomerism
7.3.3 Hydrocarbons		<ul style="list-style-type: none"> Alkanes and alkenes
7.3.4 Alcohols		<ul style="list-style-type: none"> Fermentation Properties of ethanol
7.3.5 Carboxylic acids		<ul style="list-style-type: none"> Chemistry of carboxylic acids
7.3.6 Polymers		<ul style="list-style-type: none"> Synthetic polymers Natural polymers

7.4.0 ENVIRONMENTAL CHEMISTRY

7.4.1 Waste management	<ul style="list-style-type: none"> • Classification of waste • Effects of waste on the environment 	<ul style="list-style-type: none"> • Waste disposal methods
7.4.2 Pollution		<ul style="list-style-type: none"> • Sources of pollutants
7.4.3 Water purification	<ul style="list-style-type: none"> • quality of water from different sources 	<ul style="list-style-type: none"> • Purification of water
7.4.4 Herbs		<ul style="list-style-type: none"> • Herbs in health and agriculture

FORM 3 SYLLABUS

8.0 COMPETENCY MATRIX

8.1.0 PHYSICAL CHEMISTRY

8.1.1 LABORATORY TECHNIQUES

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.1.2 Measuring Instruments	<ul style="list-style-type: none"> identify suitable apparatus used in measurement of <ul style="list-style-type: none"> time temperature mass volume distance use measuring apparatus correctly 	<ul style="list-style-type: none"> Apparatus for measuring: <ul style="list-style-type: none"> thermometer balance, burettes, pipettes, measuring cylinders gas syringes stop watch Measurement of: <ul style="list-style-type: none"> time temperature mass volume 	<ul style="list-style-type: none"> Naming apparatus used in measurement of time, temperature, mass, volume, distance Taking measurements of temperature, mass, volume, distance, time 	<ul style="list-style-type: none"> Science Kit
8.1.3 Separation techniques	<ul style="list-style-type: none"> identify different methods of separating mixtures Suggest suitable separation techniques, given the nature of the mixture. 	<ul style="list-style-type: none"> Methods of separation such as: <ul style="list-style-type: none"> filtration distillation, crystallization, evaporation, paper and thin layer chromatography 	<ul style="list-style-type: none"> Discussing on methods of separating mixtures Making sand filters Experimenting on separating mixtures 	<ul style="list-style-type: none"> Cheese cloth Science Kit Thin layer chromatogram

8.2.0 MATTER

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Matter	<ul style="list-style-type: none"> state the three states of matter explain the states of matter using the kinetic theory. explain the inter-conversion of states in terms of energy and arrangement of particles describe and explain diffusion 	<ul style="list-style-type: none"> States of matter Kinetic theory Change of states of matter Diffusion of matter 	<ul style="list-style-type: none"> Discussing states of matter Experimenting on the changes of states of matter Drawing and describing arrangement of particles in solids, liquids and gases Demonstrating diffusion using perfume, ammonia and Hydrochloric acid, potassium permanganate NB: use of Bromine must be done in a fume cupboard since it is toxic	<ul style="list-style-type: none"> Ice Science Kit

8.3.0 ATOMS, ELEMENTS AND COMPOUNDS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWL- EDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURC- ES
8.3.1 Atomic Structure	<ul style="list-style-type: none"> describe the sub-atomic particles of an atom 	<ul style="list-style-type: none"> Atomic Structure <ul style="list-style-type: none"> - Protons - Electrons - Neutrons 	<ul style="list-style-type: none"> Drawing diagrams to illustrate structure of atoms 	<ul style="list-style-type: none"> Atomic models

8.3 ATOMS, ELEMENTS AND COMPOUNDS CONTD..

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.3.2 Elements	<ul style="list-style-type: none"> represent elements using chemical symbols use and interpret nuclide notation deduce the electronic configuration of an element from given data explain the concept of an isotope 	<ul style="list-style-type: none"> Elements Atomic Number Mass Number Nuclide notation Electronic configuration of the first 20 elements Isotopes 	<ul style="list-style-type: none"> Representing elements using chemical symbols and nuclide notation Calculating number of protons, electrons and neutrons from mass numbers and atomic numbers Drawing electronic structures of elements using dots and crosses 	<ul style="list-style-type: none"> periodic tables models of elements text books ICT tools Moulding clay/ plasticine
8.3.3 Chemical bonding	<ul style="list-style-type: none"> describe the formation of ionic bonds between metals and a non-metals describe the formation of a covalent bond deduce chemical formula of a compound from dot and cross diagrams Differentiate ionic from covalent compounds. describe metallic bonding as a lattice of positive ions in a 'sea of delocalised electrons' relate the physical properties of metals to metallic bonding 	<ul style="list-style-type: none"> Valence Theory Ionic bonding covalent bond Properties of ionic and covalent compounds metallic bonding refer to Properties of Metals 	<ul style="list-style-type: none"> Drawing dot and cross diagrams to show ionic and covalent bonding in the following: <ul style="list-style-type: none"> - NaCl, MgO, Al₂O₃, - H₂; Cl₂; O₂; HCl ;N₂; - H₂O; CH₄, CO₂, NH₃, Constructing models to represent compounds Experimenting on: <ul style="list-style-type: none"> - melting points - boiling points - electrical conductivity - solubility discussing metallic bonding simulations drawing metallic bond model 	<ul style="list-style-type: none"> Text books Molecular models Science kits Sodium chloride Candle wax Burner Circuit boards Water ICT tools and Braille/Jaws software Textbooks

8.4.0 THE MOLE CONCEPT

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.4.1 Mole Concept	<ul style="list-style-type: none"> describe the mole concept 	<ul style="list-style-type: none"> Mole Relative atomic mass Relative molecular mass Concentration of solutions molar mass 	<ul style="list-style-type: none"> Calculating: <ul style="list-style-type: none"> moles from mass mass from moles relative molecular masses concentration 	<ul style="list-style-type: none"> periodic table Balance Science kit

8.5 STOICHIOMETRY

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.5.1 Chemical Equations	<ul style="list-style-type: none"> Write balanced chemical equations Calculate quantities of products given the quantities of reactants and vice versa Determine limiting reagents from given data 	<ul style="list-style-type: none"> Balancing chemical equations Masses and volumes of reactants and products Limiting reagents 	<ul style="list-style-type: none"> Writing balanced chemical equations Experimenting with neutralisation, precipitation and decomposition reactions Calculating quantities from given data 	<ul style="list-style-type: none"> Science kits

8.6 ACIDS, BASES AND SALTS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.6.1 Properties of Acids and Bases	<ul style="list-style-type: none"> Identify properties of acids and bases classify oxides as acidic, basic or amphoteric 	<ul style="list-style-type: none"> Acids, bases, pH scale, acid-base indicators Calcium oxide, sodium oxide, aluminium oxide, sulphur trioxide, carbon dioxide, nitrogen dioxide 	<ul style="list-style-type: none"> Experimenting to identify acidic and basic substances Describing properties of acids and bases 	<ul style="list-style-type: none"> Science kit ICT tools acid-base indicators vinegar lemons toothpaste ash household detergents
8.6.2 Preparation of salts	<ul style="list-style-type: none"> describe the methods of preparing salts 	<ul style="list-style-type: none"> methods of preparing salts <ul style="list-style-type: none"> - neutralisation - displacement - precipitation 	<ul style="list-style-type: none"> preparing salts by reacting acids with alkalis, carbonates, metals, metal oxides preparing salts by precipitation and displacement reactions 	<ul style="list-style-type: none"> Science kits ICT tools and Braille/ Jaws software

8.7 ELECTROCHEMISTRY

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.7.1 Redox reactions	<ul style="list-style-type: none"> define oxidation and reduction in terms of electron transfer and changes in oxidation number identify oxidising and reducing agents 	<ul style="list-style-type: none"> Redox reactions 	<ul style="list-style-type: none"> Discussing redox reactions Observing redox reactions Describing redox reactions 	<ul style="list-style-type: none"> Science kits CT tools and Braille/Jaws software
8.7.2 Cells and batteries	<ul style="list-style-type: none"> identify the composition of a simple cell describe the electrode reactions in a simple cell describe the composition and maintenance of a lead-acid batteries 	<ul style="list-style-type: none"> Cells Batteries - Electrolyte - Electrodes 	<ul style="list-style-type: none"> Describing the composition of a simple cell Constructing of Zinc/Copper cell Examining a car battery 	<ul style="list-style-type: none"> Science kits Lemon/dilute acids Torch bilbs Car battery
8.7.3 Electrolysis of acidified water	<ul style="list-style-type: none"> describe the electrolysis of acidified water identify the products of electrolysis of water and their uses deduce the formula of water from the ratio of volumes of products 	<ul style="list-style-type: none"> Electrolysis of acidified water Uses of hydrogen and oxygen Formula for water 	<ul style="list-style-type: none"> Constructing electrolytic cell Discussing electrode reactions Testing for hydrogen and oxygen gases Calculating volume ratios of gases 	<ul style="list-style-type: none"> Science kit

8.8 CHEMICAL ENERGETICS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.8.1 Endothermic and Exothermic reactions	<ul style="list-style-type: none"> describe endothermic and exothermic reactions in terms of bond formation and bond breaking differentiate between endothermic and exothermic reactions 	<ul style="list-style-type: none"> Endothermic and exothermic reactions 	<ul style="list-style-type: none"> Burning of fuels e.g. ethanol, sugar, saw dust, mealie-meal Dissolving washing powders in water Reacting acids and bases Dissolving ammonium nitrate/fertiliser, sodium hydroxide, potassium iodide, copper (II) sulphate plus zinc powder in water N.B. sodium hydroxide is corrosive, so must be handled with care 	<ul style="list-style-type: none"> Washing powder Science kit Sugar Saw dust Mealie-meal
8.8.2 Energy profile diagrams	<ul style="list-style-type: none"> draw energy profile diagrams to represent endothermic and exothermic reactions interpret energy profile diagrams 	<ul style="list-style-type: none"> Energy profile diagrams 	<ul style="list-style-type: none"> Drawing energy profile diagrams Analysing energy profile diagrams 	<ul style="list-style-type: none"> ICT Tools and Braille/Jaws software

8.9 EQUILIBRIA

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.9.1 Reversible reactions	<ul style="list-style-type: none"> explain the term reversible reaction use the reversible sign in equations (\rightleftharpoons) analyse reversible reactions predict the effect of change of conditions of reversible reactions at equilibrium 	<ul style="list-style-type: none"> Reversible reactions 	<ul style="list-style-type: none"> Dipping litmus paper in acid and in base Experimenting on the chromate (VI)/dichromate (VI) conversions in dilute acids and bases 	<ul style="list-style-type: none"> Science kit
8.9.2 Dynamic equilibrium	<ul style="list-style-type: none"> explain the term dynamic equilibrium 	<ul style="list-style-type: none"> dynamic equilibrium 	<ul style="list-style-type: none"> Experimenting on the sublimation of iodine in a sealed tube 	<ul style="list-style-type: none"> Iodine Sealed tube Water bath
8.9.3 Haber process	<ul style="list-style-type: none"> describe the production of raw materials for the Haber process (nitrogen and hydrogen) explain the conditions for the Haber process state the uses of ammonia observe safety during site visits describe environmental impacts of ammonia production 	<ul style="list-style-type: none"> Haber process (refer to electrolysis of water, liquefaction and fractional distillation of air) Uses of ammonia Safety Impacts of ammonia production on the environment 	<ul style="list-style-type: none"> Discussing the production of ammonia Visiting sites e.g. Sable Chemicals Making models of the Haber process plant Discussing the uses of ammonia Discussing possible hazards of ammonia production Discussing environmental impacts of ammonia production 	<ul style="list-style-type: none"> Flow charts Models Protective clothing Chart with danger warning signs Ammonium nitrate fertiliser Household detergents

7.9 EQUILIBRIA CONTD..

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RE-SOURCES
Contact process	<ul style="list-style-type: none"> identify sources of raw materials for the contact process explain the conditions for the contact process describe the contact process state the uses of sulphuric acid describe environmental impacts of sulphuric acid production 	<ul style="list-style-type: none"> Sources of raw materials (refer to production of copper, iron and coal) Contact process Uses of sulphuric acid Impacts of sulphuric acid production on the environment 	<ul style="list-style-type: none"> Discussing the production of sulphuric acid Visiting sites e.g. Zimphos Making models of the plant Discussing the uses of sulphuric acid Discussing possible hazards of sulphuric acid production Discussing environmental impacts of sulphuric acid production 	<ul style="list-style-type: none"> Flow charts Models Protective clothing Chart with danger warning signs Ammonium sulphate fertiliser Household detergents
Ostwald process	<ul style="list-style-type: none"> identify sources of raw materials for the Ostwald process explain the conditions for the Ostwald process describe the Ostwald process state the uses of nitric acid describe environmental impacts of nitric acid production 	<ul style="list-style-type: none"> Sources of raw materials (refer to Haber process) Ostwald process Uses of nitric acid Impacts of nitric acid production on the environment 	<ul style="list-style-type: none"> Discussing the production of nitric acid Visiting sites e.g. Sable Chemicals Making models of the plant Discussing the uses of nitric acid Discussing possible hazards of nitric acid production Discussing environmental impacts of nitric acid production 	<ul style="list-style-type: none"> Flow charts Models Protective clothing Charts with danger warning signs Ammonium nitrate fertiliser Pictures of explosives Resource persons

8.10 REACTION KINETICS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.10.0 Rate of reactions	<ul style="list-style-type: none"> describe methods of measuring reaction rates deduce from graphs the rate of reaction calculate reaction rates from given information 	<ul style="list-style-type: none"> Rate of reactions such as changes in volume, mass, colour with time 	<ul style="list-style-type: none"> Measuring rate of reactions e.g. using magnesium and hydrochloric acid, sodium thiosulphate and hydrochloric acid/ sulphuric acid 	<ul style="list-style-type: none"> Science kit ICT tools and Braille/ Jaws software
8.10.2 Factors affecting rate of reactions	<ul style="list-style-type: none"> describe factors affecting rate of reactions 	<ul style="list-style-type: none"> Factors affecting rate of reactions <ul style="list-style-type: none"> - Temperature - Concentration - Surface area - Catalyst - Pressure - Stirring 	<ul style="list-style-type: none"> Experimenting on factors affecting rate of reaction 	<ul style="list-style-type: none"> Science kit potato/ liver

8.11.0 INORGANIC CHEMISTRY**8.11.1 PERIODIC TABLE**

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT (Attitudes, Skills and Knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.11.2 Periodic trends	<ul style="list-style-type: none"> describe the change from metallic to non-metallic character across a period explain the relationship between number of electron shells and the period 	<ul style="list-style-type: none"> Periodic trends (refer to electronic configuration) 	<ul style="list-style-type: none"> Analysing the periodic table Making a model of the periodic table 	<ul style="list-style-type: none"> Periodic tables

8.11.1 PERIODIC TABLE CONTD..

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT (Attitudes, Skills and Knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.11.3 Group trends (group II and VII)	<ul style="list-style-type: none"> describe the relationship between group number and number of valence electrons describe the reactions of magnesium, calcium and barium with oxygen and water describe the trends in the physical and chemical properties of group (VII) elements 	<ul style="list-style-type: none"> Group trends (refer to electronic configuration) Reactivity of group (II) elements Trends in physical properties of group (VII) elements <ul style="list-style-type: none"> Colour Physical state Volatility 	<ul style="list-style-type: none"> Analysing the periodic table Experimenting on reaction of calcium and magnesium ribbon with cold water Discussing/simulating the reactions of group (II) elements Discussing/simulating the reactions of group (VII) elements <p>NB: Experiments involving pure bromine should be done in a fume cupboard since it is poisonous</p>	<ul style="list-style-type: none"> Periodic tables Science kit ICT tools and Braille/Jaws software

8.12.0 METALS AND NON- METALS

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT (Attitudes, Skills and Knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.12.1 Physical properties of metals and non-metals	<ul style="list-style-type: none"> compare the physical properties of metals and non-metals Explain the differences in the physical properties of metals and non-metals 	<ul style="list-style-type: none"> Physical properties <ul style="list-style-type: none"> Malleability Ductility Conductivity (thermal and electrical) Melting and boiling points Density Lustre 	<ul style="list-style-type: none"> Collecting and classifying materials as metals or non-metals Comparing the physical properties of metals and non-metals 	<ul style="list-style-type: none"> Samples of metals and non-metals

8.12.0 METALS AND NON - METALS CONTD..

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT (Attitudes, Skills and Knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.12.2 Reactivity series	<ul style="list-style-type: none"> demonstrate practically the reactivity of metals arrange elements in order of reactivity use the reactivity series to explain electroplating, electrolytic cells and metal extraction 	<ul style="list-style-type: none"> Reactivity series Displacement reactions (refer to electrochemistry and metal extraction) 	<ul style="list-style-type: none"> Listing of elements in order of reactivity Experimenting on reactions of metals with water and dilute acids Reacting zinc and copper (II) sulphate solution Comparing the voltages of different combinations of elements in a simple cell <p>NB: potassium, sodium and calcium should be used in very small quantities and never to be used with acids</p>	<ul style="list-style-type: none"> Science kit
Lime in agriculture and construction	<ul style="list-style-type: none"> describe the production of calcium oxide (lime) from calcium carbonate (lime-stone) explain the use of calcium oxide in agriculture and construction 	<ul style="list-style-type: none"> Lime in Agriculture and construction 	<ul style="list-style-type: none"> Demonstrating Lime as a base Reacting lime with dilute acids 	<ul style="list-style-type: none"> Science kit

8.13.0 ORGANIC CHEMISTRY**8.13.1 FUELS**

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT (Attitudes, Skills and Knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.13.2 Types of fuels	<ul style="list-style-type: none"> classify fuels according to their physical states 	<ul style="list-style-type: none"> Classification of fuels - Solid fuels 	<ul style="list-style-type: none"> Discussing the Classification of fuels 	<ul style="list-style-type: none"> Wood Charcoal Ethanol

8.13 FUELS CONTD..

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT (Attitudes, Skills and Knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.13.2 Types of fuels		<ul style="list-style-type: none"> - Liquid fuels - Gaseous fuels 		<ul style="list-style-type: none"> • Diesel • Petrol • Biogas • Coal • Coke • Biodiesel
8.13.3 Production of fuels	<ul style="list-style-type: none"> • describe the process of fermentation • outline the fractional distillation of crude oil • describe the destructive distillation of coal and wood • describe the production of biodiesel from Jatropha oil 	<ul style="list-style-type: none"> • Fermentation • Fractional distillation of petroleum • Destructive distillation of coal and wood • Biodiesel production 	<ul style="list-style-type: none"> • Experimenting on production of fuels by: <ul style="list-style-type: none"> - fermentation of carbohydrates - destructive distillation of coal/ wood • Visiting sites e.g. Green Fuels, Mutoko Jatropha plant 	<ul style="list-style-type: none"> • Models of biogas • Digester • Science kit • ICT Tools/ Braille/Jaws software

8.14.0 CLASSIFICATION AND NOMENCLATURE OF ORGANIC COMPOUNDS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.14.1 Homologous series	<ul style="list-style-type: none"> • define the term homologous series • name systematically organic compounds • classify organic compounds as hydrocarbons, alcohols and carboxylic acids up to six carbon atoms 	<ul style="list-style-type: none"> • homologous series <ul style="list-style-type: none"> - hydrocarbons - alcohols - carboxylic acids 	<ul style="list-style-type: none"> • Making molecular models up to six carbon atoms • Drawing structures of organic molecules up to six carbon atoms • Simulations of organic molecules 	<ul style="list-style-type: none"> • Plasticine • Molecular model kits • Models of organic molecules • ICT Tools/Braille Jaws software

8.15 ENVIRONMENTAL CHEMISTRY

8.15.1 WASTE MANAGEMENT

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.15.2 Classification of waste	<ul style="list-style-type: none"> identify solid, liquid and gaseous waste identify biodegradable and non-biodegradable waste identify the different sources of waste 	<ul style="list-style-type: none"> Classification of waste Household and industrial waste such as: <ul style="list-style-type: none"> Food left overs Waste gases gold processing oils from soap making tyre industries dust from cement industry Methods of controlling wastes 	<ul style="list-style-type: none"> Discussing and classifying waste material Discussing sources of waste material Visiting sites <ul style="list-style-type: none"> Burning of papers and an explanation on observable changes 	<ul style="list-style-type: none"> Refuse from shops and residential areas Industrial wastes Environmental policies and Acts Pictures and films Resource persons
8.15.3 Effect of waste on the environment	<ul style="list-style-type: none"> describe methods of identifying wastes from industries suggest ways of controlling waste describe the effects of waste on the environment 	<ul style="list-style-type: none"> Eutrophication Acid rain Global warming Health effects Ozone layer depletion 	<ul style="list-style-type: none"> Visiting sites Researching and discussing the effects Case studies 	<ul style="list-style-type: none"> Magazine articles Resource persons ICT tools and Braille/Jaws software

8.16.0 WATER PURIFICATION

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT (Attitudes, Skills and Knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.16.1 Composition of water from different sources	<ul style="list-style-type: none"> describe the composition of water from different sources 	<ul style="list-style-type: none"> Composition of water from different sources such as dam, borehole, river and 	<ul style="list-style-type: none"> Collecting water samples from different sources and analysing 	<ul style="list-style-type: none"> Water samples pH meter

8.16.0 WATER PURIFICATION CONTD..

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT (Attitudes, Skills and Knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	<ul style="list-style-type: none"> distinguish between hard and soft water describe the effects of hard water 	and rain <ul style="list-style-type: none"> hard and soft water effects of hard water on: boilers, electric jug, geysers, water pipes, solubility of soap 	following: colour, smell and pH <ul style="list-style-type: none"> testing for hardness of water using foam, boiling water and analysing the residue desalting using an acid / vinegar, lemon juice 	<ul style="list-style-type: none"> burners matches science kit heating elements soap

FORM 4 SYLLABUS

8.17.0 FORM 4 SYLLABUS

8.17.1 LABORATORY TECHNIQUES

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT (Attitudes, Skills and Knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.17.2 Volumetric Analysis	<ul style="list-style-type: none"> carry out titration experiments complete titration tables calculate moles and concentration from titres 	Acid-base titration <ul style="list-style-type: none"> Moles Concentration 	<ul style="list-style-type: none"> Assembling titration apparatus Carrying out experiments on acid -base titrations 	<ul style="list-style-type: none"> Science kit ICT Tools and Braille/jaws software

8.17.1 LABORATORY TECHNIQUES CONTD..

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT (Attitudes, Skills and Knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.17.2 Volumetric Analysis			<ul style="list-style-type: none"> Drawing titration tables Calculating moles and concentration 	
8.17.3 Separation Techniques	<ul style="list-style-type: none"> describe the principles of fractional and steam distillation describe the concepts of paper and thin layer chromatography 	<ul style="list-style-type: none"> Separation Techniques Fractional distillation Steam distillation Chromatography Rf values 	<ul style="list-style-type: none"> Separating ethanol from water Carrying out steam distillation to produce perfumes and flavours separating ink/chlorophyll pigments by paper and thin layer chromatography Calculating Rf values 	<ul style="list-style-type: none"> Fractional distillation apparatus Plant material Filter paper Ethanol Thin layer plate
Qualitative analysis	<ul style="list-style-type: none"> carry out tests to identify ions describe tests to identify gases 	<ul style="list-style-type: none"> Qualitative Analysis (Al³⁺, NH₄⁺, Mg²⁺, Pb²⁺, Cu²⁺, Fe²⁺, Fe³⁺, Cr³⁺, Zn²⁺, Cl⁻, I⁻, NO₃⁻, SO₄²⁻, CO₃²⁻) Tests for gases such as: ammonia; carbon dioxide; chlorine; hydrogen; oxygen and sulphur dioxide 	<ul style="list-style-type: none"> Carrying out experiments to identify cations and anions (refer to qualitative analysis table) Testing for : <ul style="list-style-type: none"> Oxygen Hydrogen Ammonia Carbon dioxide Sulphur dioxide 	<ul style="list-style-type: none"> Science Kit Delivery tube Lemon <p>N.B. Reagents must be 0.2 mol/dm³</p> <ul style="list-style-type: none"> Science kit

8.18.0 MATTER

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.18.1 Heating and cooling curves	<ul style="list-style-type: none"> interpret heating and cooling curves describe the effects of impurities on boiling and melting points 	<ul style="list-style-type: none"> Heating and cooling curves Melting and boiling points Effects of impurities on melting and boiling points 	<ul style="list-style-type: none"> Experimenting on heating and cooling of ice, stearic acid, wax and naphthalene. Drawing heating and cooling curves Interpreting heating and cooling curves 	<ul style="list-style-type: none"> Science kit ice

8.19.0 THE MOLE CONCEPT

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.19.1 Percentage composition	<ul style="list-style-type: none"> calculate percentage composition of elements in compounds and ores calculating empirical and molecular formulae 	<ul style="list-style-type: none"> Percentage composition (haematite, copper pyrite, fertilizers, bauxite, platinum group of metals (PGMs)) empirical and molecular formula 	<ul style="list-style-type: none"> Calculating percentage composition of given elements in given compounds and ores. Calculating empirical formula and molecular formula. 	<ul style="list-style-type: none"> Balances Text books Science kit Ore samples Resource people
8.19.2 Molar gas volume	<ul style="list-style-type: none"> explain the concept of molar gas volume use the molar gas volume concept in calculations. 	<ul style="list-style-type: none"> Molar gas volume 	<ul style="list-style-type: none"> Collecting and measuring gases produced from chemical reactions Calculating volumes of gases <p>N.B Use $24\text{dm}^3/\text{mole}$ as molar gas volume at rtp</p>	<ul style="list-style-type: none"> Science kit

8.20.0 STOICHIOMETRY

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.20.1 Percentage yield and purity	<ul style="list-style-type: none"> Calculate percentage purity and yield Explain the difference between actual and theoretical yield. 	<ul style="list-style-type: none"> Percentage yield <ul style="list-style-type: none"> actual yield, theoretical yield Percentage purity 	<ul style="list-style-type: none"> Experimenting on determining percentage yield and purity Thermal decomposition of calcium carbonate destructive distillation of coal and sawdust Calculating percentage yields and purity 	<ul style="list-style-type: none"> Science kit Wood, coal, sawdust

8.21.0 ELECTROCHEMISTRY

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.21.1 Redox equations	<ul style="list-style-type: none"> construct balanced redox equations 	<ul style="list-style-type: none"> redox equations e.g. displacement reactions 	<ul style="list-style-type: none"> Deducing electrode reactions Balancing redox equations Visiting sites <ul style="list-style-type: none"> Sable Chemicals, Chloride batteries 	<ul style="list-style-type: none"> ICT tools and Braille/Jaws software
8.21.2 Electrolytic purification of copper	<ul style="list-style-type: none"> describe the electrolytic cell on production of copper 	<ul style="list-style-type: none"> Electrolytic purification of copper uses of copper and by-products of the electrolytic process 	<ul style="list-style-type: none"> Assembling the electrolytic cell Analysing electroplating Discussing the uses of copper and by-products Visiting sites e.g. Empress mine, 	<ul style="list-style-type: none"> Science kit Resource persons ICT tools and Braille/Jaws software

8.22.0 CHEMICAL ENERGETICS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.22.1 Enthalpy changes	<ul style="list-style-type: none"> describe the concept of enthalpy change determine experimentally enthalpy change calculate enthalpy changes using the relationship, $q = mc \Delta T / VC\Delta T$ 	<ul style="list-style-type: none"> Enthalpy changes of: <ul style="list-style-type: none"> combustion neutralisation solution 	<ul style="list-style-type: none"> Carrying out experiments to determine enthalpy changes of combustion, neutralisation and solution Calculating enthalpy changes 	<ul style="list-style-type: none"> Science kit

8.23.0 EQUILIBRIA

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.23.1 Production of fertilisers	<ul style="list-style-type: none"> describe the manufacture of ammonium nitrate and ammonium sulphate fertilisers 	<ul style="list-style-type: none"> Production of fertilisers <ul style="list-style-type: none"> ammonium nitrate ammonium sulphate 	<ul style="list-style-type: none"> experimenting on production of fertilisers by neutralising ammonia with nitric acid/ sulphuric acid followed by crystallisation visiting sites e.g. Sable chemicals, ZimPhos 	<ul style="list-style-type: none"> science kit Resource persons
8.23.2 Industrial applications of reaction kinetics and equilibria	<ul style="list-style-type: none"> link reaction conditions to production costs for the Haber, and contact process analyse the cost of production in relation to the cost of product justify the conditions for Haber and contact processes 	<ul style="list-style-type: none"> Industrial Applications <ul style="list-style-type: none"> Effects of yields and costs Alternative sources of raw materials 	<ul style="list-style-type: none"> Analysing reaction conditions against productivity Visiting sites Analysing graphs showing relationships between conditions and yield 	<ul style="list-style-type: none"> Resource persons ICT tools and Braille/Jaws software Charts

8.24.0 INORGANIC CHEMISTRY

8.24.1 PERIODIC TABLE

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.24.2 Transition elements	<ul style="list-style-type: none"> describe the properties of transition elements explain the industrial and biological significance of transition elements 	<ul style="list-style-type: none"> Transition elements (copper, iron, manganese, cobalt, chromium, nickel, vanadium) Physical properties Industrial and biological significance of transition elements (catalysis, haemoglobin and alloys) 	<ul style="list-style-type: none"> Discussing properties of transition elements Experimenting to investigate the colours and catalytic properties of transition elements iron (II), iron (III), MnO_2, $\text{Cr}_2\text{O}_7^{2-}$, CrO_4^{2-} visiting sites 	<ul style="list-style-type: none"> Periodic table Salts metals Science kit Resource persons iron (II), iron (III), Cu^{2+}, MnO_4^-, MnO_2, Cr^{3+}, $\text{Cr}_2\text{O}_7^{2-}$, CrO_4^{2-}

8.25.0 METALS AND NON - METALS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.25.1 Composition of Mineral ores	<ul style="list-style-type: none"> describe the composition of mineral ores 	<ul style="list-style-type: none"> Composition of mineral ores of <ul style="list-style-type: none"> Iron Copper Platinum Lithium Nickel Gold 	<ul style="list-style-type: none"> Visiting sites e.g. Zimbabwe school of mines, Bikita minerals, platinum mines, Arcturus mine Analysing composition of samples of mineral ores 	<ul style="list-style-type: none"> Sample of mineral ores ICT tools and Braille/Jaws software Resource persons
8.25.2 Extraction of metals	<ul style="list-style-type: none"> describe the methods of processing minerals 	<ul style="list-style-type: none"> Methods of processing minerals Blast furnace Purification of copper, nickel, platinum, gold Value addition and beneficiation 	<ul style="list-style-type: none"> Discussing the methods of extracting minerals Discussing importance of value addition and beneficiation on mineral resources Visiting sites e.g. Zimbabwe School of Mines, Bikita minerals, 	<ul style="list-style-type: none"> Sample of mineral ores ICT tools and Braille/Jaws software Resource persons

8.25.0 METALS AND NON - METALS CONTD..

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT (Attitudes, Skills and Knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	<ul style="list-style-type: none"> explain the uses of metals and alloys in respect to their properties 	<ul style="list-style-type: none"> Uses of metals and alloys 	Platinum mines, Arcturus mine and other small scale mines <ul style="list-style-type: none"> Discussing the formation of alloys of copper, iron, aluminium Discussing uses of metals and alloys 	
8.25.3 Processing of diamond and coal	<ul style="list-style-type: none"> describe the processing of diamond and coal 	<ul style="list-style-type: none"> Processing of diamond and coal Destructive distillation of coal Coal gasification Value addition and beneficiation 	<ul style="list-style-type: none"> Discussing importance of value addition and beneficiation on mineral resources Visiting sites <ul style="list-style-type: none"> Hwange Zimchem 	<ul style="list-style-type: none"> ICT tools and Braille/Jaws software Coal Resource persons
8.25.4 Liquefaction and fractional distillation of air	<ul style="list-style-type: none"> describe the liquefaction and fractional distillation of air identify the uses of Oxygen, Nitrogen, Carbon dioxide and noble gases 	<ul style="list-style-type: none"> Composition of air Liquefaction and fractional distillation of air Uses of Oxygen, Nitrogen, Carbon dioxide and noble gases 	<ul style="list-style-type: none"> Discussing the composition, liquefaction and fractional distillation of air Visiting sites e.g. sable chemicals, BOC gases Simulating using ICT tools and Braille/Jaws software 	<ul style="list-style-type: none"> Flow charts ICT tools and Braille/Jaws software Resource persons

8.26.0 ORGANIC CHEMISTRY

8.26.1 FUELS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.26.2 Fuel efficiency	<ul style="list-style-type: none"> determine, experimentally, the heating values of fuels explain why some fuels are more efficient than others 	<ul style="list-style-type: none"> Types of fuels Fuel efficiency 	<ul style="list-style-type: none"> Experimenting with fuels to determine their heating values Discussing the reasons why the fuels have different efficiency 	<ul style="list-style-type: none"> Fuels Thermometer Beaker Burners Science kit

8.27.0 CLASSIFICATION AND NOMENCLATURE OF ORGANIC COMPOUNDS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.27.1 Isomerism	<ul style="list-style-type: none"> describe the term isomerism identify structural isomers of alkanes draw the structures of the isomers 	<ul style="list-style-type: none"> structures of isomers of alkanes up to 6 carbon atoms 	<ul style="list-style-type: none"> discussing isomerism making models of isomers of alkanes simulating isomerism 	<ul style="list-style-type: none"> models ICT tools and Braille/Jaws software

8.28.0 HYDROCARBONS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.28.1 Alkanes and Alkenes	<ul style="list-style-type: none"> describe the manufacture of alkanes and alkenes distinguish between alkanes and alkenes describe the 	<ul style="list-style-type: none"> Cracking of long chain alkanes Combustion of alkanes and alkenes 	<ul style="list-style-type: none"> Making models of alkenes and alkanes Drawing structures of alkenes and alkanes Burning Experimenting with 	<ul style="list-style-type: none"> Hydrocarbon Burner Sand Cooking oil Bromine water Boiling tube

8.28.0 HYDROCARBONS CONTD..

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT (Attitudes, Skills and Knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	<ul style="list-style-type: none"> chemical properties of alkanes as exemplified by methane describe the chemical properties of alkenes as exemplified by ethene 	<ul style="list-style-type: none"> Reaction with chlorine in the presence of UV light and in darkness Reaction with bromine water Reaction of ethene with steam and hydrogen 	<ul style="list-style-type: none"> cooking oil to demonstrate cracking Hydrocarbons Discussing the production of margarine and ethanol 	<ul style="list-style-type: none"> Delivery tubes

8.29.0 ALCOHOLS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.29.1 Fermentation	<ul style="list-style-type: none"> describe the conditions necessary for the fermentation process describe the industrial production of ethanol by fermentation 	<ul style="list-style-type: none"> Conditions for fermentation Fermentation <ul style="list-style-type: none"> - ethanol - mahewu - Indigenous beer brewing 	<ul style="list-style-type: none"> Discussing conditions necessary for fermentation investigating the conditions necessary for fermentation visiting sites e.g. breweries, ethanol production plants 	<ul style="list-style-type: none"> Glucose Yeast Sugarcane Malt, hops, maize, barley, rapoko, sorghum
8.29.2 properties of ethanol	<ul style="list-style-type: none"> describe the properties of ethanol describe the uses and social effects of ethanol 	<ul style="list-style-type: none"> Solubility Boiling point Combustion Oxidation to carboxylic acids Dehydration of ethanol to ethene Uses of ethanol <ul style="list-style-type: none"> - Solvents - Fuels (blend petrol) - Perfumes - Alcoholic beverages Social effects 	<ul style="list-style-type: none"> Burning of ethanol Testing for ethanol using potassium dichromate Dehydrating ethanol using concentrated sulphuric acid Discussing the uses and social effects of using ethanol 	<ul style="list-style-type: none"> Science kit

8.30.0 CARBOXYLIC ACIDS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.30.1 Chemistry of carboxylic acids	<ul style="list-style-type: none"> describe the formation of ethanoic acid describe the chemical properties of carboxylic acids describe the uses of ethanoic acids describe the process of saponification 	<ul style="list-style-type: none"> Oxidation of ethanol (refer to alcohols) Properties of carboxylic acids <ul style="list-style-type: none"> Esterification Reaction with carbonates Uses of ethanoic acids <ul style="list-style-type: none"> Manufacture of perfumes Food preservation Flavouring Soap manufacturing Structure of soap molecule Glycerine/glycerol 	<ul style="list-style-type: none"> Experimenting on chemical properties of ethanoic acid Discussing the uses of ethanoic acids Making soap in the laboratory 	<ul style="list-style-type: none"> Science kit Perfume samples Vinegar Animal fat Sodium chloride Sodium hydroxide

8.31.0 POLYMERS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.31.1 Synthetic polymers	<ul style="list-style-type: none"> describe the formation of polythene describe the formation of nylon and terylene draw structures to represent synthetic polymers identify repeat units for polymers deduce the structure of the monomer from a given polymer and vice-versa 	<ul style="list-style-type: none"> Addition polymerisation Structures of: <ul style="list-style-type: none"> Polythene Condensation polymerisation Nylon Terylene Uses of synthetic polymers <p>N.B: Use block diagrams to represent condensation polymers</p>	<ul style="list-style-type: none"> Discussing polymerisation Identifying and naming linkages in synthetic polymers Drawing repeat units for polymers Drawing structures to represent monomers and polymers Discussing on the uses of synthetic polymers Visiting sites <ul style="list-style-type: none"> Saltrama plastics 	<ul style="list-style-type: none"> Models and images to represent structures of monomers ICT tools and Braille/Jaws software Samples of different polymers Resource persons

8.31.0 POLYMERS CONTD..

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	<ul style="list-style-type: none"> describe the uses of synthetic polymers 	<ul style="list-style-type: none"> Nylon Terylene Uses of synthetic polymers <p>N.B: Use block diagrams to represent condensation polymers</p>	<ul style="list-style-type: none"> Treger plastics 	
8.31.2 Natural Polymers	<ul style="list-style-type: none"> name the type of linkages in each of the polymers draw structures to represent natural polymers deduce structure of the monomer from a given polymer and vice-versa describe the hydrolysis of natural polymers 	<ul style="list-style-type: none"> Natural polymers Starch Proteins <ul style="list-style-type: none"> Hydrolysis of natural polymers 	<ul style="list-style-type: none"> Discussing structures of natural polymers Drawing structures of natural polymers Discussing hydrolysis of natural polymers Experimenting on acid hydrolysis of natural polymers 	<ul style="list-style-type: none"> Science kit

8.32.0 ENVIRONMENTAL CHEMISTRY

8.32.1 WASTE MANAGEMENT

TOPIC	OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.32.2 Waste disposal methods	<ul style="list-style-type: none"> identify the waste disposal methods describe the advantages and disadvantages of each of the methods of waste disposal explain the concepts of re-using and recycling of waste 	<ul style="list-style-type: none"> Waste disposal methods: incineration, landfills, activated sludge re-using and recycling of wastes 	<ul style="list-style-type: none"> Describing each of the methods of waste disposal Visiting sites e.g. biodigesters, incinerators, landfills 	<ul style="list-style-type: none"> Incinerators Landfills Sewage treatment plants Composts Bio-digesters Resource persons

8.33.0 POLLUTION

TOPIC	OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.33.1 Sources of pollutants	<ul style="list-style-type: none"> list the sources of pollutants explain the effects of pollution describe methods of controlling pollution 	<ul style="list-style-type: none"> Sources of pollutants <ul style="list-style-type: none"> Industrial waste Exhaust fumes Domestic waste Effects of pollutants <ul style="list-style-type: none"> Acid rain Eutrophication Global warming Health hazards Ozone layer depletion Methods of controlling pollution <ul style="list-style-type: none"> Catalytic converters Recycling shakers 	<ul style="list-style-type: none"> Discussing sources of pollution Discussing effects of pollution Visiting sites Discussing methods of controlling pollution 	<ul style="list-style-type: none"> ICT tools and Braille/Jaws software Resource persons Catalytic converter

8.34.0 WATER PURIFICATION

SUB TOPIC	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.34.1 Water purification	<ul style="list-style-type: none"> describe the process of large scale water purification explain the role of aluminium sulphate and chlorine in the treatment of water 	<ul style="list-style-type: none"> Water purification <ul style="list-style-type: none"> Filtration Flocculation Sedimentation Chlorination role of aluminium sulphate and chlorine problems associated with water purification 	<ul style="list-style-type: none"> Experimenting on sedimentation and filtration Visiting sites e.g. <ul style="list-style-type: none"> Water works Discussing the roles of aluminium sulphate and chlorine 	<ul style="list-style-type: none"> Resource persons Models of Sand filters Water guard Aluminium sulphate Chloride tablets Potassium Chlorate (V)

8.35.0 HERBS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.35.1 Herbs	<ul style="list-style-type: none"> • describe the uses of herbs • describe advantages and disadvantages of using herbs 	<ul style="list-style-type: none"> • Uses of herbs <ul style="list-style-type: none"> - Health and agriculture • Advantages and disadvantages of herbs 	<ul style="list-style-type: none"> • Listing of herbs found in the local environment • Visiting herbal gardens • Discussing on the advantages and disadvantages of using herbs 	<ul style="list-style-type: none"> • Herbs • Resource persons

8.0 ASSESSMENT

8.1 ASSESSMENT OBJECTIVES

The scheme of assessment is grounded in the principle of inclusivity and equalisation of opportunities hence does not condone direct or indirect discrimination of learners.

Modifications of arrangements to accommodate candidates with special needs must be put in place in both continuous and summative assessments. These modifications must neither give these candidates an undue advantage over others nor compromise the standards being assessed.

NB: For further details on arrangements, accommodations and modifications refer to the assessment procedure booklet.

The three assessment objectives in 'O' Level Chemistry are:

- 1: Knowledge and understanding
- 2: Handling information and problem solving
- 3: Experimental skills, investigations and applications

1: Knowledge and understanding

Candidates should be able to demonstrate knowledge and understanding of:

- scientific quantities and their determination
- scientific phenomena, facts, laws, definitions, concepts, theories
- scientific vocabulary, terminology, conventions (including symbols, quantities and units)
- scientific instruments and apparatus, including techniques of operation and aspects of safety
- scientific and technological applications with their social, economic and environmental implications.

2: Handling information, problem solving, synthesis, analysis and evaluation

Using words or other written forms of presentation (e.g. symbolic, graphical and numerical), candidates should be able to:

- make predictions and hypotheses
- manipulate numerical and other data
- solve problems quantitatively and qualitatively.
- translate information from one form to another.
- use information to identify patterns, report trends and draw inferences.
- locate, select, organise and present information from a variety of sources.
- present reasoned explanations on phenomena, patterns and relationships.

3: Experimental skills, investigations and applications

Candidates should be able to:

- make and record observations and measurements
- interpret and evaluate experimental observations and data
- Use the knowledge of chemistry to solve everyday life challenges, acquire and enhance enterprising skills
- demonstrate correct use of techniques, apparatus, and materials (including following a sequence of instructions, where appropriate)
- plan investigations, evaluate methods and suggest possible improvements (including the selection of techniques, apparatus and materials).

8.2 SCHEME OF ASSESSMENT

The assessment scheme for Chemistry comprises of:

- a) Continuous assessment, and
- b) Summative assessment.

The final grade in Chemistry is 30% continuous assessment and 70% summative assessment.

The assessment shall be administered as follows:

Continuous Assessment/Profile

Summative assessment

- Paper 1: Multiple choice questions
- Paper 2: Structured theory questions
- Paper 3: Practical Examination

PAPER	Type of paper	Duration	Marks	Paper Weighting %
1	Multiple choice	1 hr	40	20
2	Theory	2 hrs	100	40

PAPER 1: THEORY: the paper consists of 40 compulsory multiple choice items of the direct choice type. A copy of the periodic table will be printed as part of this paper. Each question shall have 4 response items.

PAPER 2: THEORY. The paper has 2 sections, Section A and B.

Section A will carry 40 marks and will consist of five compulsory structured questions of 8 marks each.

Section B carries 60 marks and will consist of 5 structured questions. Each question will carry 15 marks. Candidates will be required to answer any 4 questions. A copy of the periodic table will be printed as part of this paper

PAPER 3: PRACTICAL TEST

This paper will consist of 2 compulsory questions each carrying 20 marks. Learners will be assessed as they carry out the practical examination.

8.3 SPECIFICATION GRID

SKILL	Paper 1	Paper 2	Paper 3
Knowledge and Understanding	15%	15%	
Handling of information and Problem solving	40%	50%	
Analysis, Synthesis and Evaluation	45%	45%	
Experimental, Investigative and application			100%
TOTAL	100%	100%	100%

CONTINUOUS ASSESSMENT

Level	Assessment Tasks	Frequency	Weighing
Form 3	<ul style="list-style-type: none"> • Practical test • Theory test • Project 	<ul style="list-style-type: none"> • 2 per term • 3 per term • 1 per year 	10%

This component will consist of standardised tests in Practical, Theory and Projects administered during the first 5 terms.



