Republic of Zambia

MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL, TRAINING AND EARLY EDUCATION

CHEMISTRY SYLLABUS

GRADES 10 – 12

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CONTENTS

VISION

Quality, life-long education for all which is accessible, inclusive and relevant to individual, national and global needs and value systems.

PREFACE

The syllabus was produced as a result of the Curriculum review process carried out by the Ministry of Education, Science, Vocational Training and Early Education under the auspices of the Curriculum Development Centre (CDC). The curriculum reform process started way back in 1999 when the Ministry of Education commissioned five (5) curriculum studies which were conducted by the University of Zambia. These studies were followed by a review of the lower and middle basic and primary teacher education curriculum. In 2005 the upper basic education National survey was conducted and information from learners, parents, teachers, school managers, educational administrators, tertiary institutions traditional leader's civic leaders and various stakeholders in education was collected to help design a relevant curriculum.

The recommendations provided by various stakeholders during the Upper Basic Education National survey of 2005 and National symposium on curriculum held in June 2009 guided the review process.

The review was necessitated by the need to provide an education system that would not only incorporate latest social, economic, technological and political developments but also equip learners with vital knowledge, skills and values that are necessary to contribute to the attainment of Vision 2030.

The syllabus has been reviewed in line with the Outcome Based Education principles which seek to link education to real life experiences that give learners skills to access, criticize analyze and practically apply knowledge that help them gain life skills. Its competences and general outcomes are the expected outcomes to be attained by the leaners through the acquisition of knowledge, skills, techniques and values which are very important for the total development of the individual and the nation as a whole.

Effective implementation of Outcome Based Education requires that the following principles be observed: clarity of focus, Reflective designing, setting high expectations for all learners and appropriate opportunities.

It is my sincere hope that this Outcome Based syllabus will greatly improve the quality of education provided at Grade 8 and 9 as defined and recommended in various policy documents including Educating Our Future`1996 and the `Zambia Education Curriculum Framework `2013.

Chishimba Nkosha
Permanent Secretary
MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL, TRAINING AND EARLY EDUCATION.

Acknowledgements

The syllabus presented here is a result of broad-based consultation involving several stakeholders within and outside the education system.

Many individuals, institutions and organizations were consulted to gather their views on the existing syllabus and to accord them an opportunity to make suggestions for the new syllabus. The Ministry of Education wishes to express heartfelt gratitude to all those who participated for their valuable contributions, which resulted in the development of this syllabus.

The Curriculum Development Centre worked closely with other sister departments and institutions to create this document. We sincerely thank the Directorate of Teacher Education and Specialized Services, the Directorate of Planning and Information, the Directorate of Human Resource and Administration, the Directorate of Open and Distance Education ,the Examinations Council of Zambia, the University of Zambia, schools and other institutions too numerous to mention, for their steadfast support.

We pay special tribute to co-operating partners especially JICA and UNICEF for rendering financial technical support in the production of the syllabus.

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MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL TRAINING AND EARLY EDUCATION

INTRODUCTION

This syllabus is designed for Grades 10 – 12. It is intended for learners taking Chemistry at Senior Secondary School Level of education. It places less emphasis on factual material and greater emphasis on understanding and application of scientific concepts and principles. This has been done so that learners develop skills that will be of the value for a long time in an increasingly technological world and it is expected that these will be of relevance for a very long time.

GENERAL AIMS

These provide the educational purposes of following a Chemistry Course at this level of education and are listed in a suggested order of priority:
The General aims are to:

1. provide, through well designed studies of experimental and practical Chemistry, a worthwhile educational experience for all learners, whether or not they go on to study Chemistry beyond this level and, in particular, to enable them to acquire sufficient understanding and knowledge to:
    - 1.1 become confident citizens in a technological world, able to take or develop an informed interest in matters of scientific importance
    - 1.2 recognise the usefulness, and limitations, of scientific method and to appreciate its applicability in other disciplines and in everyday life;
    - 1.3 be suitably prepared for studies beyond Senior Secondary School level in Chemistry, in applied Sciences or in Science dependent vocational courses.
2. Stimulate learners, create and sustain their interest in the learning of Chemistry.

3. develop abilities and skills that:
   - 3.1 are relevant to the learning and practice of chemistry;
   - 3.2 are useful in everyday life;
   - 3.3 encourage efficient and safe practice;
   - 3.4 encourage effective communication.
4. develop attitudes relevant to Chemistry such as:
   - 4.1 concern for accuracy and precision;
   - 4.2 objectivity;
   - 4.3 integrity.
   - 4.4 appreciation
5. assist the development of the skills of:
   - 5.1 enquiry;
   - 5.2 initiative;
   - 5.3 inventiveness.
   - 5.4 Demonstration
   - 5.5 Analysis
   - 5.6 Stimulate interest in and care for the local and global environment.
6. promote an awareness that:
   - 6.1 scientific theories and methods have developed, and continue to do so as a result of co-operative activities of groups and individuals;
   - 6.2 the study and practice of Chemistry is subject to social economic, technological, ethnical and cultural influences and limitations;
   - 6.3 the applications of Chemistry may be both beneficial and detrimental to the individual, the community and the environment;
   - 6.4 Chemistry transcends national boundaries and that language of science correctly and rigorously applied, is universal.

MATHEMATICAL REQUIREMENTS

This syllabus offers a context in which mathematical skills and techniques may be applied in a relevant and more meaningful way. The study of Chemistry through this syllabus therefore strengthens the applications of Mathematics.

Candidates will be required to be competent in the following mathematical techniques:

1. add, subtract, multiply and divide.
2. use averages, fractions, percentages, ratios and reciprocals.
3. recognise and use standard notation.
4. use direct and inverse proportion.
5. use positive and negative indices.
6. plot graphs from given data.
7. interpret charts and graphs.
8. select suitable scales and axes for graphs.
9. make approximate evaluations of numerical expressions.
10. recognise and use the relationship between length, surface area and volume and their units on metric scales.
11. solve equations of the form x = yz for only one variable when the other two are known.
12. make accurate numerical work and handle calculations up to three (4) significa
13. comprehend and use symbols notation such as ≥ and ≤.

Assessment

Continuous assessment will be emphasised by using various methods of testing according to topics and themes at various levels. The examinations council of Zambia will prepare detailed procedures on how continuous assessment will be conducted by the teachers. The

examination council will also develop examination syllabus to provide teachers with guidelines on the objectives to be tested. The scheme of assessment will consists of school based assessment and final examination that will be conducted by the examinations of council of Zambia.

School based assessment will be in the form of tests. Tests will be in the form of diagnostic, aptitude, achievement, oral, practice attitude and performance, learners.

Assessment objectives

The following aspects of the aims will be assessed:

1. Knowledge with understanding
   The candidates should be able to demonstrate knowledge and understanding in relation to:-
   (a) Scientific phenomena, facts, concepts, theories and laws.
   (b) Scientific terminology, use of symbols, quantities and units.
   (c) Scientific apparatus and instruments and their safe operations.
   (d) Scientific quantities and their determination.
   (e) Scientific and technological applications with social, economic and environmental relevance.

Questions testing these outcomes will in most cases begin with the terms such as:
"describe, discuss, state, explain, name, outline or define".

2. Handling information and solving problems.
   The candidate should be able to:-
   (a) Locate, select, organise and present information from a variety of sources.
   (b) Translate information from one form to another.

(c) Manipulate numerical data.
(d) Identify patterns and draw inferences from information.
(e) Give reasonable explanations for patterns and relationships.
(f) Make predictions and hypotheses.
(g) solve problems

Questions testing these outcomes will often begin with the term such as "predict, calculate, or determine".

3. Experimental Skills and Investigating.
The candidate should be able to:-
(i) Follow instructions.
(ii) Use basic laboratory techniques, apparatus and materials.
(iii) Observe, measure and record.
(iv) Plan investigations.
(v) Interpret and evaluate observations and results.
(vi) Predicts trends.
(vii) Evaluate methods and suggest possible improvements.

TIME ALLOCATION

A minimum of six teaching periods of forty (40) minutes each per week. Preferably two (2) double periods to be taken in the Laboratory.

GRADE 10

General Outcomes:	Key competences
• Develop an understanding of Chemistry and its branches • Develop investigative skills about Chemistry • Demonstrate an understanding of the particulate nature of matter • Develop investigative skills about states of matter • Demonstrate an understanding of Experimental Techniques and its application in everyday life • Develop investigative skills in experimental techniques Demonstrate an understanding of atoms, elements, molecules and compounds. • Develop investigative skills about the nature of substances. • Demonstrate an understanding of the importance, production, use, and effect on the environment of common elements and simple compounds.	• Demonstrate the ability to measure time ,temperature, mass and volume • Show basic skills and knowledge in constructing balanced chemical equations with state symbols • Demonstrate investigative skills in experimental techniques

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.1 Introduction to Chemistry	10.1.1 Introduction to Chemistry	10.1.1.1 Describe Chemistry. 10.1.1.2 Classify the branches of chemistry 10.1.1.3 Explain the importance of chemistry. 10.1.1.4 Describe the challenges of chemical industrial activities 10.1.1.5Demonstrate an appreciation of safety in the laboratory.	• The study of matter and their chemical changes • Branches such as: Analytical, Biochemistry, Inorganic, Physical and Organic • Improved life through manufacture of soaps, detergents, plastic, sugar, cement, paper, medicines, food production and other life necessities • Production of undesired harmful by-products • Safety rules in the lab	• Identifying different branches of chemistry • Comparing Different branches of chemistry	• Awareness of chemistry branches • Appreciating chemistry and application/importance in everyday life. • Applying safety rules in the chemistry laboratory. • Participating actively in group activities

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.2 The Particulate nature of matter	10.2.1 Matter and the Kinetic theory	10.2.1.1 Describe matter 10.2.1.2 Classify the basic units of matter 10.2.1.3 Classify the states of matter. 10.2.1.4 Illustrate changes of states of matter. 10.2.1.5 Describe the absorption of heat and release of heat during changes of states of matter	• Anything that has **mass** and occupies space • Units of matter Atoms, molecules ,ions • Kinetic theory: in terms of particle arrangement and movement. Solid, liquid, gas • Changes of states such as melting, freezing, boiling, condensation, sublimation in terms of kinetic theory The absorption and release of heat during changes of states of matter : Changing states of matter, exothermic-release of heat during a reaction, endothermic-absorption of heat during a reaction, include heating and cooling curves	• Communicating information on the basic units and states of matter • Experiments with the changes of states of matter • Inferring data on the absorption and release of heat during changes of states of matter	• Appreciating the basic units of matter and its existence in three states • Applying changes of states of matter in everyday life • Cooperating in group work.

	10.2.2 Diffusion	10.2.2.1Describe diffusion 10.2.2.2 Demonstrate diffusion in fluids 10.2.2.3 Describe the factors that affect the rate of diffusion	• Movement of particles from region of higher concentration to region of lower concentration • Diffusion in fluids: Liquids and gases (Brownian motion) • The factors that affect the rate of diffusion: e.g. molecular mass, temperature, concentration	• Investigating the movement of particles in fluids • Comparing movement of particles in liquids, gases and factors affecting their speed of movement • Observing the spreading of particles in fluids.	• Appreciating diffusion • Asking more questions for better understanding • Fostering teamwork • Applying the different concepts in daily life.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.3 Experimental Techniques	10.3.1 Measuring of quantities	10.3.1.1 Demonstrate how different quantities are measured	• Measuring time, temperature, mass and volume	• Recording accurately measurement of values of various quantities	• Applying safety rules in use of apparatus
		10.3.1.2 Identify different measuring apparatus used in chemistry.	• Measuring apparatus such as stopwatch or stop clock, thermometers, balances, burettes, pipettes, volumetric flask, measuring cylinder, and gas syringes	• Identifying different measuring apparatus	• Fostering teamwork
		10.3.1.3 Identify various measuring instrument and other apparatus used in chemistry	• Other apparatus: spatula, stands and clamp, test-tubes, burners, , glass rods, evaporating dish, funnel beaker, conical flask etc.		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	10.3.2 Criteria of purity	10.3.2.1Describe the differences between a pure substance and a mixture. 10.3.2.2Demonstrate how to determine the purity of a substance 10.3.2.3 Explain the importance of purity of a substance	• Differences between a substance and a mixture: In terms of melting points and boiling points • Determining the purity of a substance: Sharp melting for pure substance and melting over a range of temperatures for a mixture. • Importance of purity in substances such as food stuffs ,medicines, drinks	• Investigating the purity of substances • Comparing pure and impure substances • Recording data and plotting graphs.	• Appreciating purity of substances • Applying the knowledge of purity in every day life. • Participating actively in class activities
	10.3.3 Separating mixtures	10.3.3.1Distinguish between physical and chemical changes 10.3.3.2Demonstrate different methods	• Differences between physical and chemical changes In terms of mass changes, irreversibility/reversibility, chemical substance formed and energy involved. • Methods of separating mixtures: such as	• Comparing components in the mixture • Planning an investigation to compare physical and chemical changes	• Applying separation techniques in everyday life • Cooperating in group work.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		of separating mixtures 10.3.3. Interpret simple paper chromatograms.	decantation, filtration, crystallisation, simple and fractional distillation, magnetism, chromatography, evaporation, sublimation, floatation, use of separating funnel and centrifugation • Simple paper chromatograms: Uses such as R_f values and distances covered by components (restricted to paper chromatography)	• Experimenting with different techniques. • Collecting data from paper chromatograms.	

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.4 Atoms, elements, compounds and molecules	10.4.1 Atomic structure and Periodic Table	10.4.1.1 Describe an atom and its structure.	• An atom as the smallest particle of an element which takes part in a chemical reaction. Structure: use Bohr model (nucleus at the centre surrounded by electron shells) • Relative charges and ~~relative~~ masses of protons, neutrons and electrons: Charges as: +1,0,-1 Masses as: 1, 1, 1/1840	• Communicating information on atoms, elements molecules and compounds • Calculating relative atomic mass • Comparing chemical symbols of elements.	• Awareness of the atomic structure • Participating actively in class activities. • Asking more questions for better understanding.
		10.4.1.2 Describe the relative charges and approximate relative masses of protons, neutrons and electrons			
		10.4.1.3 Describe the proton (atomic)number and nucleon(mass) number and nuclide notation	• The proton (atomic) number: As number of protons: Z, Nucleon (mass) as number of nucleons: A (protons + neutrons)and nuclide notation $^{A}_{Z}\mathrm{X}$ • What an element is: As Element substance made up of same	• Predicting names of element from symbols. • Interpreting data using the periodic table. • Communicating the use of isotopes	• Respect for other peoples

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
			chemical atoms	everyday life.	ideas in a group Appreciating the medical and industrial use of isotopes.
		10.4.1.4 Describe what an element is	• Symbols of the elements with atomic number 1 up to 20 and other common elements in the local environment	• Formulating a model for the building of electrons in shells.	
		10.4.1.5 Identify elements using their chemical symbols	• Periodic Table: Group determined by valence electrons, Period determined by number of shells		
		10.4.1.6 Describe the basis of the Periodic Table	• Isotopes : As atoms with same number of protons but different numbers of neutrons, including radioactive and non-radioactive isotopes		
		10.4.1.7 Describe what isotopes are	• Atomic mass of an element : As sum of the products of the percentages and their mass numbers		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.1.8 Calculate relative atomic mass of an element given the % abundances of isotopes and from mass spectrum. 10.4.1.9 Describe the use of radioactive isotopes 10.4.1.10 Demonstrate the build-up of electrons in shells	• Use of radioactive isotopes: Such as in medical treatment of cancer, industrial use as tracers • Electronic configuration of atoms (spdf configuration is **NOT** required)		
	10.4.2 Bonding	10.4.2.1 Describe what a compound is	• A compound: As a substance formed from two or more elements chemically combined • Formation of ions (radicals): Cations by	• Classifying compounds into covalent ionic compounds • Formulating chemical formulae of compounds	• Appreciating the use of ionic and covalent compounds • Asking more questions for better

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.2.2 Describe the formation of ions (radicals). 10.4.2.3Describe the formation of ionic (electrovalent) bonds. 10.4.2.4 Describe the formation of covalent bonds	electron loss, anions by electron gain. • Formation of ionic bonds: Electrovalent bonding as loss and gain of electrons between metallic and non-metallic atoms. Ionic bonds as electrostatic force between cations and anions. Such as NaCl, $CaCl_2$ and MgO • The formation of covalent bonds Covalent bonding as sharing of electrons between non-metallic atoms. Covalent bonds as shared pairs of electrons. Such as H_2, Cl_2,H_2O, NH_3, CH_4, HCl, C_2H_6 • Electronic arrangement in simple multiple covalent molecules: such as double bonds in O_2,C_2H_4 andCO_2, Triple bond in N_2 and C_2H_2	correctly • Communicating information on ionic and covalent compounds. • Predicting that substances are ionic or covalent based on elements. • Formulating models of ionic and covalent compounds. • Communicating information on properties of ionic and covalent compounds. • Predicating the chemical formula	understanding • Participating actively in class activities • Applying the concept of valency number in formulating formulae of compounds.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.2.5 Describe the electronic arrangement in simple multiple covalent molecules. 10.4.2.6 Describe the uses of ionic and covalent compounds 10.4.2.7 Describe what a molecule is	• Uses of ionic and covalent compounds: As refractory materials for ionic compounds (CaO) and polar and non polar solvents for covalent compounds. • Molecule as the smallest particle of an element or compound which exists independently. • Valency as combining power of an atom or radical. Valence electrons as the number of electrons in the outer most shell. • How to deduce valency of an element from the formula of a compound, ionic charge, valence	of compounds given relevant data. • Investigating thermal and electrical conductivity of metals.	

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.2.8 Describe what valency and valence electrons are 10.4.2.9 Demonstrate how to deduce valency of an element. 10.4.2.10 Formulate chemical formulae of compounds. 10.4.2.11Identify the	electrons. • Chemical formulae of compounds: Using valency and chemical symbols of elements, charges on ions, models, relative numbers of atoms present, diagrammatic representation. • Differences in properties of ionic and covalent compounds: such as volatility, electrical conductivity, density, melting point, boiling point and basic units • Metallic bonding: As lattice of positive ions in a 'sea' of delocalised electrons • Electrical/thermal conductivity of metals:		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		differences in properties of ionic and covalent compounds. 10.4.2.12 Describe metallic bonding 10.4.2.13 Describe the electrical/thermal conductivity of metals	Due to free electron movement/delocalised electrons		
	10.4.3 Macromolecules	10.4.3.1 Describe the giant covalent structures of graphite and diamond 10.4.3.2 Describe the uses of graphite and diamond in relation to their structures	• Graphite as giant structures of carbon atoms arranged in hexagonal layers while diamond as a giant structure of carbon atoms arranged tetrahedrally. • Uses of graphite as a lubricant, pencil leads, electrodes and uses of diamond in cutting, jewellery • Macromolecular structure of silicon (IV) oxide	• Comparing the structures and uses of graphite, diamond and silicon dioxide. • Comparing the properties of diamond and silicon dioxide.	• Awareness of macromolecules . • Appreciating the structures and uses of macromolecules • Cooperating in group work.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.3.3 Describe the macromolecular structure of silicon (IV) oxide(silicon dioxide) 10.4.3.4 Identify the similarities in properties between diamond and silicon dioxide	(silicon dioxide): As oxygen atoms bonded to silicon atoms tetrahedrally despite the formula being SiO_2. • Similarities in properties between diamond and silicon dioxide: such as atoms held together by covalent bonds tetrahedrally.		
	10.4.4 Chemical formulae and equations	10.4.4.1 Demonstrate how to construct word equations. 10.4.4.2 Formulate balanced chemical equations.	• Word Equations: showing reactants and products separated by a full curled arrow (➔). • The rules of chemical equation: Number of atoms of each element being equal on both sides of the equation. Balancing can be done by inspection. Equations may include state symbols (s-solid, l – liquid, g – gas, aq –	• Communicating information on construction and balancing of chemical equations • Formulating balanced chemical equations based on the rules • Constructing ionic equations	• Asking more questions for better understanding • Applying information on construction of word equation and balanced chemical equations • Participating

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.4.3 Construct net ionic equations from balanced chemical equations.	aqueous). • Net ionic equation: Only ionic aqueous reactants/products must be broken down into their respective ions then cancel out spectator ions to come up with net ionic equation.		actively in group work.

GRADE 11

General Outcomes:	Key Competences
• Demonstrate an understanding of acids, bases and salts. • Develop investigative skills about acids, bases and salt. • Demonstrate an understanding of the importance, production, use, and effect on the environment of acids, bases and salts. • Demonstrate an understanding of the Mole Concept • Develop investigative skills about quantitative analysis. • Demonstrate an understanding of chemical reactions and energy changes • Develop investigative skills about various types of reactions. • Demonstrate an understanding of the Periodic Table • Develop investigative skills about the Periodic Table.	• Demonstrate the skills and knowledge in relating number of valence electrons to the Group number and the number of shells to the Period. • Demonstrate skills in classifying salts according to their solubility. • Demonstrate ability to classify oxides as acidic, basic, neutral and amphoteric. • Demonstrate ability to use tests in identifying aqueous cations, anions and gases. • Demonstrate basic skills and knowledge in calculating stoichiometric reacting moles. • Show ability to identify factors that affect rates of chemical reactions.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.1 Acids, Bases and Salts	11.1.1 Characteristic properties of acids and bases	11.1.1.1 Describe acids, bases or alkalis in terms of ions they contain or produce in aqueous solution. 11.1.1.2 Describe the meaning of weak, strong, dilute and concentrated acids and alkalis 11.1.1.3 Describe the pH scale 11.1.1.4 Describe neutrality, acidity and alkalinity in terms of pH value	• **Acid** as compound that produces hydrogen ions as the only positively charged ions in aqueous solutions, **Base** generally as an oxide or hydroxide of a metal including ammonium hydroxide **Alkalis** as soluble bases that produce hydroxide ions in aqueous solution as the only negatively charged ions. • The meaning of weak, strong, dilute and concentrated acids and alkalis: Strength as degree of ionisation, Concentration as the number of ions per volume of solution • pH: As a scale ranging from 0 to 14 showing the degree of acidity and alkalinity. • pH values: 7 for	• Investigating acids and bases • Comparing the characteristics of acids and bases • Investigating the acidity and alkalinity of substances in everyday life • Communicating information on PH Scale and its volumes • Experimenting with acids and bases and predicting the results of the reactions • Recording data accurately on PH values.	• Appreciating acids and bases • Applying the uses of acids and bases in everyday life • Cooperating in group activities • Appreciating the pH scale values in everyday life • Applying safety rules when experimenting with acids and bases • Caring for the environments during experiments.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.1.1.5 Determine the pH value of a solution.	neutrality, below 7 for acidity and above 7 for alkalinity • How to determine the pH value of a solution: Using universal indicator: different colours at different pH values, Using pH meter: precise values		
		11.1.1.6 Demonstrate the characteristic properties of acids 11.1.1.7 Demonstrate the characteristic properties of bases	• Characteristic properties of acids and bases: Acids such as reactions with metals, bases, carbonates/bicarbonates and effect on indicators. Bases such as reactions with acids and ammonium salts, effect on indicators.		
		11.1.1.8 Illustrate the importance of acid-base reactions	• Importance of acid-base reactions: Such as in controlling the acidity in the soil,		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.1.1.9 State the uses of acids and bases.	treatment of indigestion, brushing teeth with toothpaste. • Uses of acids and bases Such as control of pH in agriculture, making of soap, in car batteries		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.1.2 Preparation of salts	11.1.2.1 Describe what a salt is 11.1.2.2 Classify salts. 11.1.2.3 Demonstrate the preparation of an insoluble salt. 11.1.2.4 Demonstrate the preparation soluble salts.	• A salt: As a compound formed when the hydrogen ions of an acid are fully or partially replaced by a metal or ammonium ions. Or a compound made of positive metallic/ammonium ions and any negative ion of an acid. • Classification of salts according to their nature and solubility in water: As acid, basic and normal salts. Solubility rules of salts • Preparation of an insoluble salt: Using precipitation method and separated by filtration. E.g. Barium sulphate, Silver chloride • Preparation soluble salts: By reaction of acids with bases, suitable metals and carbonates/ bicarbonates. Separated by crystallisation and filtration. E.g. Zinc sulphate, copper (II)	• Classifying of salts according to their nature and solubility in water • Experimenting the preparation of soluble and insoluble salts • Differentiating hydrated and anhydrous salts • Inferring data on the solubility of salts • Recording data accurately	• Awareness of salts • Applying safety rules in preparation of salts • Participating actively in group work • Appreciating the use of salts in everyday use.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.1.3 Types of oxides	11.1.3.1 Describe the various types of oxides.	• Various types of oxides: Acidic oxides as oxides with acidic properties such as SO_2 and CO_2. Basic oxides as oxides with basic properties such as CaO and MgO. Neutral oxides as oxides with neither acidic nor basic properties such as CO, H_2O. Amphoteric oxides as oxides with both acidic and basic properties ZnO, Al_2O_3 and PbO.	• Classifying different types of oxides. • Predicting names of Oxides from given data. • Recording data accurately.	• Awareness of different types of oxides. • Applying acid-base reactions • Cooperating in group activities.
	11.1.4 Identification of ions and gases (Qualitative analysis)	11.1.4.1 Demonstrate the identity of aqueous cations and anion.	• Identity of aqueous cations and anion: Cations being aluminum, ammonium, calcium, copper (II), iron (II), iron (III), and zinc using aqueous sodium hydroxide and aqueous ammonia. Anions being carbonate, chloride, iodide, nitrate and sulphate using	• Observing and interpreting results of reactions of ions with different test reagents • Communicating information on chemical composition of Salts • Inferring data on	• Awareness about composition of salts • Appreciating different types of gases. • Applying safety rules during experiments. • Cooperating in group work

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
			various reagents. Refer to Qualitative notes. • The identity of gases: ammonia, carbon dioxide, chlorine, hydrogen, oxygen and sulphur dioxide. **Refer** to Qualitative notes	cations and anions • Investing the identity of gases	
		11.1.4.2 Demonstrate the identity of gases.			

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.2 The mole concept	11.2.1 Relative masses	11.2.1.1 Describe what Relative Atomic Mass and relative molecular mass is.	• Relative Atomic Mass (RAM) as relative mass of an element's isotopes as compared to carbon-12 Relative Molecular Mass (RMM) as relative mass of a molecule as compared to carbon-12	• Comparing the relative atomic masses of elements • Calculating relative molecular mass of compounds • Calculating relative formula mass of a compound	• Appreciating the relative atomic masses and the relative molecular masses • Participating actively in class activities.
		11.2.1.2 Calculate the relative formula mass of a compound	• The relative formula mass of a compound: As the sum of the relative atomic masses of all the atoms in the compound		
	11.2.2 The mole	11.2.2.1 Describe what a mole is	• The mole: as number or quantities of particles e.g. atoms, ions, molecules, electrons equivalent to 6.02×10^{23}(Avogadro's constant)	• Communicating information on the mole concept • Experimenting with chemical substances quantitatively • Experimenting with acid-base titrations • Calculating	• Applying mole concept • Asking more questions for better understanding • Awareness of the mole concept • Fostering team work • Applying safety rules when experimenting.
		11.2.2.2 Determine the physical masses (m) of any substance using the molar mass (Mr) and the physical volume (v) of any	• Physical masses (m) of any substance: Applying $n = {}^{m}/_{Mr}$ and $n = {}^{v}/_{Vm}$ where n = number of moles		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		gas at r.t.p and vice versa. 11.2.2.3 Describe the relationship of Avogadro's law to reacting moles and volumes of gases at r.t.p and s.t.p. 11.2.2.4 Determine the concentration of a solution in applying dilution law. 11.2.2.5 Illustrate calculations involving stoichiometric reacting moles and volumes of gases and	• Relationship of Avogadro's law to reacting moles and volumes of gases: As Molar gas volume (Vm) of any gas at rtp is 24dm^3 or 22.4 dm^3 at stp. • Concentration of a solution: as mol/dm^3 and/or g/dm^3. The number of moles of solute before dilution is the same as after dilution, $M_1V_1 = M_2V_2$ • Using molar mass and molar volume of a gas using the mole concept. (Questions on gas laws and conversions of	problems involving mole concept • Recording data accurately • Entering data using the dilution law • Calculating problems involving the mole and volumes of gases and solutions • Investigating limiting reagents in a reaction • Communicating information on percentage yields and percentage purity.	• Applying knowledge of mole concept in everyday life. • Applying the dilution law in calculations involving concentrations of solutions

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		solutions.	gaseous volumes to different temperatures and pressures will **not** be required). Proportional stoichiometric masses and the given quantities		
		11.2.2.6 Calculate the percentage yield in a reaction and the percentage purity of a substance	• The percentage (%) yield as actual amount obtained divided by theoretical amount x 100% Percentage(%) purity as amount of substance divided by total amount of the mixture x 100%		
		11.2.2.7 Determine limiting reagent in a given reaction	• Limiting reagent: Using proportional stoichiometric masses and the given quantities		
		11.2.2.8 Demonstrate calculations involving different types of acid–base titration reactions.	• The different types of acid–base titration reactions: Using titration law		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.2.3 Empirical and Molecular formulae	11.2.3.1 Calculate the percentage composition of elements in a compound. 11.2.3.2 Determine the empirical formulae of a compound given the molecular formula 11.2.3.3 Determine the empirical and molecular formulae using percentage composition or masses.	• Percentage composition of elements in a compound: As relative mass of element divided by relative formula mass of compound x 100% • The empirical formulae by using atom ratios • Empirical formula: By calculating the number of moles of each component then converts to the simplest mole ratios to get empirical formula. Molecular formulae as a multiple of empirical formula given the relative molecular mass. $M.F = (E.F)_n$, where n = RMM/REM	• Communicating information on chemical substances • Comparing empirical and chemical formula • Calculating problems involving the molecular formula.	• Appreciating chemical composition of substances • Applying chemical analysis • Fostering team work. • Asking mole questions for better understanding.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.3 Chemical reactions and energy changes	11.3.1 Rates of chemical reactions	11.3.1.1 Describe rate of a chemical reaction. 11.3.1.2 Demonstrate the factors that affect the rates of chemical reactions 11.3.1.3 Describe methods of controlling the rate of chemical reactions. 11.3.1.4 Describe the effect of a catalyst on the activation energy	• Rate of a chemical reaction: As speed of a chemical reaction. • Factors such as temperature, concentration, surface area, catalyst, pressure, light • Methods of controlling the rate of chemical reactions: either reducing or reducing the frequency of collisions between reacting particles such as explosions in flour mills/coal mines when ignited to surface area • Effect of a catalyst on the activation energy: Catalyst lowers the activation energy thus increasing the rate of a chemical reaction.	• Investigating factors that control the rate of chemical reactions. • Comparing experimental results at different conditions • Recording and interpreting experimental results. • Communicating information on rates of chemical reactions. • Interpreting data on the rate of chemical reactions.	• Applying safety rules and the factors that affect the rate of chemical reactions. • Awareness of slow and spontaneous reactions. • Fostering team work.
	11.3.2. Chemical equilibrium	11.3.2.1 Describe what chemical equilibrium is	• Chemical equilibrium: as when the rate of the forward reaction equalises with rate of the backward	• Communicating information in reversible reactions. • Classifying	• Awareness of reversible reactions. • Applying and

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
			reaction and the concentrations of the substances remain constant. It occurs in reversible reactions. • As changes in temperature, pressure, concentration. Apply Le Chartelier's Principle (candidates may **not** be required to state the principle) **NB:**Catalysts have no effect on the position of equilibrium	reactions as reversible and irreversible. • Comparing reversible reactions to irreversible reactions. • Inferring the direction of a reaction based on relevant data.	appreciating the optimum conditions of a reaction. • Asking more questions for better understanding.
		11.3.2.2 Describe the effect on the position of equilibrium of a reaction upon changing conditions.			
	11.3.3 Redox reactions	11.3.3.1 Describe what oxidation and reduction is 11.3.3.2 Describe what redox reactions is.	• Redox in terms of electron transfer, hydrogen/oxygen transfer, changes in oxidation state. • Redox reactions: As those involving both oxidation and reduction • Oxidizing agent as a reactant that gains electrons and/or reduces oxidation state	• Experimenting with redox reactions. • Observing colour changes. • Comparing oxidizing and reducing agents • Classifying redox	• Awareness of redox and non-redox reactions • Applying redox reactions • Appreciating redox reactions. • Participating actively in group activities

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.3.3.3 Identify oxidizing and reducing agents in a reaction. 11.3.3.4 Demonstrate how to determine the oxidation number of an element with variable valency in a compound/ion. 11.3.3.5 Deduce a redox reaction using oxidation numbers. 11.3.3.6 Describe what non-redox reaction is 11.3.3.7 Identify the characteristics of oxidizing and reducing agents	Reducing agent as a reactant that loses electrons and/or increases oxidation state Determining oxidation numbers using standard rules. • As changes in oxidation numbers of reactants and products • Non-redox reaction: As reaction in which there is neither oxidation nor reduction involved. • Oxidizing agents identified using potassium iodide solution as reducing agent in the presence of starch or starched potassium iodide paper. Reducing agents identified using acidified potassium dichromate or potassium	and non-redox reactions • Planning an experiment to show the effects of an oxidizing and reducing agent • Predicting the oxidation number of an element • Predicting a reaction as being redox or non-redox.	• Applying safety rules when experimenting

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	**SKILLS**	**VALUES**
			permanganate as oxidizing agents and observe colour changes only. **NB:**No equations involving potassium dichromate and potassium permanganate will be required.		
	11.3.4 Energetics of reactions	11.3.4.1Describe what endothermic and exothermic reactions are 11.3.4.2 Determine a reaction which is endothermic or exothermic. 11.3.4.3 Describe endothermic and exothermic reactions in relation to bonds. 11.3.4.4 Identify activation energy for a	• Types of Energetics of reactions: As energy in(endothermic) and energy out(exothermic) reactions • Identification of endothermic or exothermic reactions: Such as changes in enthalpy, energy level diagrams. Calculating ΔH using bond energies. • Endothermic as bond breaking and exothermic as bond formation. • As in energy level representations: lower for catalysed and higher for	• Experimenting with endothermic and exothermic reactions. • Classifying reactions as endothermic and exothermic. • Investigating the effects of fuels on the environment • Planning an investigation to show that respiration and photosynthesis involve energy changes. • Investigation to	• Awareness of the dangers associated with explosions due to exothermic reactions E.g. bombs • Applying endothermic and exothermic reactions • Applying safety moles which experiment • Applying

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		catalysed and uncatalysed reaction on an energy level diagram 11.3.4.5 Explain the advantages and disadvantages of energy sources (fuels). 11.3.4.6 Describe the effects of the use of fuels on the environment 11.3.4.7 Describe the use of silver halide in photography 11.3.4.8 Describe respiration and photosynthesis in terms of energy changes	uncatalysed. • Advantages and disadvantages of energy sources: Such as safety, cost of available reserves, renewable/non-renewable sources • Effects of the use of fuels on the environment: Such as pollution, greenhouse effect (global warming). • Use of silver halide in photography: As reduction of silver ions to metallic silver by absorption of light.(endothermic reaction) • Respiration as exothermic process between oxygen and glucose producing carbon dioxide and water Photosynthesis as endothermic process between water and carbon dioxide through absorption	show that batteries are a source of electrical energy. .	information on energies of reactions in everyday life. • Cooperating in class activities.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.3.4.9 Describe use of radioactive isotope in relation to energy changes. 11.3.4.10 Explain batteries as convenient source of electrical energy.	of light producing glucose and oxygen. • The use of radioactive isotope: As a source of nuclear energy. • The convenient source of electrical energy: such as batteries as they are potable.		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.4 The Periodic Table	11.4.1Groups and Periods	11.4.1.1Describe what the Periodic Table is 11.4.1.2 Identify vertical columns and horizontal rows. 11.4.1.3 Use the Periodic Table to classify elements	• Periodic table as a tool for classifying elements. • Structure of periodic table: Vertical columns as Groups and horizontal rows as Periods • Elements classification as	• Communicating information on the periodic table • Comparing groups and periods. • Classifying element s into metallic and	• Awareness of the periodic table. • Participating actively in group work.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
			metallic and non-metallic	non metallic. • Interpreting data on periodic table.	
	11.4.2 Groups and Periodic trends	11.4.2.1 Describe trends in various Groups given information about the elements	• Trends in various Groups in periodic table: As chemical relativity of group I, II, and VII, elements	• Investigating the characteristics of representative elements from Groups and effects of halides. • Classifying elements according to their Groups and Periods • Interpreting data on the periodic table about trends in groups • Investigating the effects of halides.	• Awareness of elements and their positions on the Periodic Table • Appreciating the uses of elements on the Periodic Table in everyday life. • Applying safety rules when experimenting.
		11.4.2.2 Describe the physical and chemical properties of elements in Group I,II, VII and VIII.	• Properties of elements in periodic table: such as solubility, effect of heat on compounds, melting points, boiling points and displacement reactions. For Group VII consider atomicity, colour changes, changes in physical states, for Group I including description as a collection of soft metals.		
		11.4.2.3 Describe the importance of	• Importance of		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		halogens	halogens: Such as fluoride in toothpaste,chlorine in water treatment, antiseptic, bromide in photographic film		
		11.4.2.4 Describe the harmful effects of halides.	• Harmful effects of halides: :such as drugs, pesticides, CFCs in ozone layer depletion (CFCs)		
		11.4.2.5 Use the noble gases in providing an inert atmosphere	• The significance of their non reactivity in providing an inert atmosphere. Such as argon in electrical lamps, helium in balloons.		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.4.3 Transition metals	11.4.3.1 Describe what transition metals are	• Transition metals as a block of elements between Group II and Group III of the Periodic Table	• Investigating the physical and chemical properties of transition elements.	• Appreciating transition metals and their uses
		11.4.3.2 Describe general properties of transition metals.	• Properties of transition metals: As variable valences, high densities, high melting points, form coloured compounds, catalysts.	• Identifying transition metals	• Applying safety rules when experimenting.
			Note: Electronic configuration of transition metals will **not** be required		
		11.4.3.3 Describe the uses of transition metals	• Uses of transition metals: such as catalysts, alloys, engineering materials NB:Heavy metals are no longer used to make paint for health reasons		

Grade 12

General Outcomes:	Key competences:
• Demonstrate an understanding of Electricity and chemistry • Develop investigative skills about conductivity • Demonstrate an understanding of metals • Develop investigative skills about some properties and uses of metals. • Demonstrate an understanding of Non- metals. • Develop investigative skills about some industrial uses of non-metals • Demonstrate an understanding of Organic Chemistry • Develop investigative skills about organic compounds	• Demonstrate ability to determine the reactivity series of metals • Demonstrate ability to prepare and test gases • Demonstrate ability to classify conductors,non-conductors,electrolytes and non-electrolytes • Show understanding of common pollutants of land , water ,and air • Demonstrate ability to identify organic compounds

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.9 Chemistry and Electricity	12.9.1.Conductors	12.9.1.1 Classify conductors and non-conductors	• Conductors being metals such as copper, aluminium, silver and Non-conductors being non-metals such as sulphur, phosphorus, except carbon in form of graphite.	• Classifying conductors and non-conductors. • Planning an experiment to investigate conductors and non conductors. • Experiment to conductors and non conductors.	• Appreciating conductivity of substances. • Participating in class work actively • Applying safety rules when experimenting

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.9.2 Electrolysis	12.9.2.1 Classify electrolytes and non-electrolytes 12.9.2.2 Describe what electrolysis is 12.9.2.3 Describe the products at the electrodes during electrolysis of molten binary ionic compounds. 12.9.2.4 Describe the products at the electrodes during electrolysis of aqueous ionic	• Difference between electrolytes and non-electrolytes : Electrolytes as ionic compounds and non-electrolytes as covalent compounds. • Electrolysis: As decomposition of electrolyte using electricity in an electrolytic cell. • Products by electrolysis of molten binary ionic compounds: metals at the cathode by reduction, non-metals at the anode by oxidation • Products by electrolysis of aqueous ionic solutions: Refer to selective discharge of ions given conditions.	• Classifying electrolytes and non electrolytes • Formatting a hypothesis about the products at the electrodes during electrolysis. • Communicating the industrial application of electrolysis. • Calculating the quantities of electrolytic products.	• Asking more questions for better understanding • Awareness of the application of electrolysis in everyday life. • Applying safety rules when experimenting. • Participating actively in group work.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		solutions. 12.9.2.5 Describe the industrial applications of electrolysis. 12.9.2.6 Calculate the quantity of electrolytic products.	Electrolytes should include molten lead (II) bromide, molten aluminium oxide, dilute sulphuric acid (acidified water), concentrated hydrochloric acid, concentrated aqueous sodium chloride (brine) using carbon electrodes, and aqueous copper (II) sulphate using carbon and copper electrodes. • Applications of electrolysis: Such as extraction of aluminium from its oxide, copper refinery and electroplating. • The quantity of electrolytic products: Using Faradays laws		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.9.3 Simple cells (chemical cell)	12.9.3.1 Describe what a chemical cell is	• A chemical cell: Two different metals connected together and dipped in an electrolyte to produce electricity.	• Comparing electrolytic and simple cells • Classifying the electrolytic cells and simple cells in the chart	• Awareness of the two types of cells. • Asking more questions for better understanding
		12.9.3.2 Compare electrolytic cells and simple cells	• Types of cells: Similarities such as oxidation at the anode and reduction at the cathode. Differences such as cathode being negative in electrolytic cell while positive in simple cell and vice versa for the anode. Simple cell **must** use two different electrodes while electrolytic cell can use any.		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.10 Metals	12.10.1 General properties of metals	12.10.1.1 Describe diagrammatic representations of pure metals	• The diagrammatic representations of pure metals: Similar nuclei positive ions in a 'sea' of delocalised electrons.	• Investigating the properties of metals. • Experimenting with different metals.	• Awareness of metals • Fostering team work.
		12.10.1.2 Describe the physical properties of metals.	• The physical properties of metals: in terms of density, melting points, boiling points, appearance		
		12.10.1.3 Describe the chemical properties of metals	• The chemical properties of metals: All metals are electropositive as illustrated in the reaction with air, water / steam, dilute non-oxidizing acids, aqueous solutions of other metal ions.		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.10.2 Reactivity and Electro Chemical Series	12.10.2.1 Describe the reactivity series of metals	• The reactivity series of metals: As arrangement of metals in the order of either their increasing or decreasing order of reactivity as being potassium, sodium, calcium, magnesium, aluminium, zinc, iron, lead, (hydrogen), copper and silver	• Comparing methods of extracting metals • Investigating the reactivity of metals • Predicting the position of a metal in the reactivity series • Communicating the uses of metals in everyday life • Investigating the harmful effects of some metals • Predicting the effects of heat on hydroxides, carbonates of nitrates of metals and ammonium compounds.	• Awareness of methods of extracting metals and dangers some metals pose. • Awareness of the use of metals in everyday life. • Caring for the environment to avoid harmful effects of some metals.
		12.10.2.2. Explain the apparent non reactivity of aluminium.	• Apparent non reactivity of aluminium: Due to the presence of adhesive oxide/coat. Reactivity of aluminium due to adhesive coat		
		12.10.2.3 Demonstrate an order of reactivity.	• An order of reactivity: from a set of experimental results Such as reduction of oxides of metals by other metals.		
		12.10.2.4 Describe the effects of heat	• Effects of heat on		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		on hydroxides, carbonates, nitrates of metals and ammonium compounds. 12.10.2.5 Describe the extraction of copper, iron, aluminium and zinc from their ores. 12.10.2.6 Describe the uses of copper, iron, zinc and aluminium 12.10.2.7 Explain the harmful effects of some metals.	hydroxides, carbonates, nitrates of metals and ammonium compounds: As related to the reactivity/stability of the metallic ion present in the compound. Compounds of more reactive metals difficulty to decompose while compounds of less reactive metals easily decompose. • Extraction of copper, iron, aluminium and zinc: Chemical and electrolytic reduction. Chemical reducing agents being Carbon, carbon monoxide, and hydrogen. • Uses of copper, iron, zinc and aluminium: Such as electrical wires, construction, aircraft parts.		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	**SKILLS**	**VALUES**
			• Harmful effects of metals: Such as lead poisoning (brain damaging), sodium ions in raising high blood pressure, alzehermia by aluminium		
	12.10.3 Alloys	12.10.3.1Describe what an alloy is 12.10.3.2 Describe diagrammatic representations of alloys. 12.10.3.3 Explain the advantages of using alloys over pure metals. 12.10.3.4 Identify common uses of alloys	• An alloy: As mixture of two or metals/carbon such as steel, brass, bronze • The diagrammatic representations of alloys: Different nuclei positive ions in a 'sea' of delocalised electrons • Advantages of using alloys: Such as alloys exhibiting better properties compared to a pure metal (conductor, strength, weight ratio, hardness) • Common uses of alloys: Such as cutlery, food packaging, aircraft.	• Investigating the characteristics of alloys • Comparing structures of alloys and pure metals. • Communicating of alloys in everyday life.	• Appreciating the use of alloys in everyday life. • Awareness of the use of alloys in everyday life. • Fostering team work.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.10.4 Corrosion	12.10.4.1 Describe what corrosion is 12.10.4.2 Relate corrosion to the reactivity of metals. 12.10.4.3 Describe the different methods of preventing corrosion.	• Corrosion: As chemical wearing of metals resulting from attack by atmospheric oxygen in presence of moisture. • The corrosion to the reactivity of metals: As more reactive metals easily corrode while less reactive metals do not easily corrode. • The methods of preventing corrosion: Such as sacrificial protection, painting, greasing/oiling, alloying and galvanising.	• Observing of metals. corrosion. • Relating sacrificial protection methods to reactivity series. • Communicating information in corrosion.	• Appreciating ways of minimizing corrosion. • Applying methods of reducing corrosion.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.11 Non Metals	12.11.1 General properties of non-metals.	12.11.1.1 Describe the physical and chemical properties of non-metals.	• The physical and chemical properties of non-metals: In terms of density, melting points, boiling points, oxidizing agent (electronegative elements)	• Investigating the physical and chemical properties of non-metals • Predicting melting and boiling points of non metals.	• Awareness of non-metals.
	12.11.2. Hydrogen	12.11.2.1. Demonstrate the laboratory preparation, collection and test for hydrogen. 12.11.2.2 Describe the physical and chemical properties of hydrogen	• Laboratory preparation, collection and test for hydrogen : By action of moderate reactive metals on water/steam and dilute acids and collect by upward delivery method, puts out a lighted splint with a 'pop' sound. • The physical and chemical properties of hydrogen: In terms of colour,**o**dour,**d**ensity/"**w**eight",**s**olubilityand chemical (effect on**l**itmus,**i**nflammability,**p**oisonous, **s**upport of combustion)(COWSLIPS)	• Experimenting the laboratory preparation of hydrogen. • Predicting the test for hydrogen gas. • Communicating the uses of hydrogen in everyday life.	• Appreciating the use of and hydrogen in everyday life. • Awareness of the test for hydrogen • Cooperating in group work..

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.2.4 Describe industrial manufacture of hydrogen. 12.11.2.6 Describe the uses of hydrogen.	• Manufacture of hydrogen: By cracking, electrolysis of water (brine) and from natural gas • Uses of hydrogen Such as reducing agent, fuel for rockets, manufacturing ammonia and margarine, balloons filler, welding		
	12.11.3. Oxygen	12.11.3.1 Demonstrate the laboratory preparation, collection and test for oxygen. 12.11.3.2 Describe the physical and	• Laboratory preparation, collection and test for oxygen By catalytic decomposition of hydrogen peroxide and thermal catalytic decomposition of potassium chlorate, collected above water and re-lights the glowing splint • The physical and chemical properties of oxygen: Such as colour,	• Experimenting the laboratory preparation and collection of oxygen • Observing the reactions during the preparation of oxygen • Predicting the test for oxygen • Communicating	• Appreciating physical and chemical properties of oxygen and its uses. • Applying safety rules when preparing oxygen in the laboratory. • Care for the environment when disposing waste products

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		chemical properties of oxygen. 12.11.3.3 Describe the industrial manufacture of oxygen 12.11.3.4 Describe the uses of oxygen in industry and in natural processes 12.11.3.6 Explain the importance of ozone layer and dangers of its depletion. 12.11.3.7 Demonstrate the chemical test for water	odour, solubility ,combustion • Manufacture of oxygen: By fractional distillation of liquid air • Uses of oxygen: Such as burning, welding, in blast furnace and respiration • Importance of ozone layer and dangers of its depletion: It traps radiation, if depleted by CFCs causes skin cancer, respiratory diseases • Chemical test for water: Using white anhydrous copper (II) sulphate which turns blue.	information about oxygen.	from the experiment. .

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.11.4 Nitrogen	12.11.4.1 Describe industrial manufacture of nitrogen. 12.11.4.2 Explain the characteristics and importance of Nitrogen as a gas. 12.11.4.3 Demonstrate the preparation collection and test for ammonia in the laboratory 12.11.4.4 Describe the manufacture of ammonia. 12.11.4.5 Describe the physical and	• Manufacture of nitrogen: By fractional distillation of liquid air • Characteristics and importance of Nitrogen : As non reactive insoluble gas hence used as refrigerant, food packaging. Manufacture of ammonia gas. • The preparation collection and test for ammonia: Action of a base on ammonium salt and collected by upward delivery method, turns damp red litmus paper blue. • Manufacture of ammonia: Haber Process (Temperature, catalyst, pressure (Haber process). • The physical and chemical properties of ammonia: In terms of **c**olour, **o**dour,	• Experimenting the laboratory preparation of ammonia • Observing colour changes during the preparation of ammonia • Communicating information on manufacture of ammonia • Using the model of haber process.	• Awareness of physical and chemical properties of nitrogen and ammonia and their uses • Care for the environment when disposing by experiment • Cooperating in group work • Caring for the environment when using fertisers. .

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		chemical properties of ammonia. 12.11.4.8 Describe the thermal dissociation of ammonium salts. 12.11.4.9 Describe the uses ammonia 12.11.4.10 Describe the manufacture of nitric acid 12.11.4.10 Explain the importance of nitrogenous	**d**ensity/"**w**eight", **s**olubility and as reducing agent, a base/alkali, a complexing reagent. • Thermal dissociation of ammonium salts: Such as ammonium chloride, ammonium nitrate, ammonium carbonate • The uses of ammonia: In manufacture of fertilizers, explosives, nitric acid • Manufacture of nitric acid: by Ostwald Process • Importance of nitrogenous fertilizers: Nitrogen for growth. Include Phosphorous for root development and potassium for seed formation (NPK)		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		fertilizers 12.11.4.11 Describe the effects of nitrogenous fertilizers on the environment	• Effects of nitrogenous fertilizers on the environment: Such as eutrophication and acidic soils		
	12.11.5. Chlorine	12.11.5.1 Demonstrate the laboratory preparation, collection and test for chlorine gas. 12.11.5.2 Describe the physical and chemical properties of chlorine gas 12.11.5.3 Describe the uses	• By action of hot concentrated Hydrochloric acid on manganese (IV) oxide, collected by downward delivery method, turns damp blue litmus paper red and then bleaches it • Physical and chemical properties of chlorine gas Such: as colour, odour, density, solubility, poisonous. Reactions with Iron, non-metals (H_2,S,O_2,P), sulphur dioxide, Iron(II)salts and halides. • Uses of chlorine For	• Experimenting the laboratory preparation of chlorine. • Observing colour changes during the preparation of chloride. • Experimenting the preparation of hydrogen chloride gas. • Investigating the physical and chemical properties of chloride gas. • Experimenting the preparation of hydrogen acid and its reactions.	• Awareness of physical and chemical properties of chlorine and its uses. • Applying safety rules during experiments • Caring for the environment when disposing by products of experiments. • Participating actively in group activities. .

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		of chlorine.	sterilizing water, manufacture of PVC, HCl and in bleaching agents.		
		12.11.5.4 Describe the industrial manufacture of chlorine.	• Manufacture of chlorine: By the electrolysis of brine ($NaCl_{(aq)}$)		
		12.11.5.5 Demonstrate the method for preparation, collection and test for hydrogen chloride gas	• Preparation of hydrogen chloride:By action of concentrated sulphuric acid on solid metallic chlorides, collected by downward delivery method, react with ammonia to form white smoke.		
		12.11.5. 6 Describe the physical and chemical properties of hydrogen chloride gas	• In terms colour, odour, density, solubility andpoisonous. Reactions with ammonia and water		
		12.11.5. 7 Demonstrate the	• By dissolving hydrogen chloride gas in water		

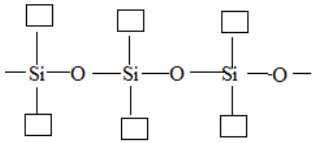
TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		method for preparation of hydrochloric acid. 12.11.5.8 Describe the reactions of dilute hydrochloric acid.	• Such as reaction with alkalis, metals, carbonates, ammonia and silver nitrate.		
	12.11.6 Sulphur	12.11.6.1 Describe the formation of sulphur dioxide. 12.11.6.2 Demonstrate the laboratory preparation, collection and test for sulphur dioxide 12.11.6.3 Describe the	• The formation of sulphur dioxide: By combustion of sulphur, fossil fuels • Laboratory preparation, collection and test for sulphur dioxide: By action of warm dilute acids on sulphites, collected by downward delivery, turns acidified potassium dichromate (VI) green/decolourises purple potassium manganate (VII). • The physical and chemical properties of sulphur dioxide: In terms of colour, odour, density,	• Experimenting laboratory preparation of sulphur dioxide • Observing colour changes during the preparation of sulphuur dioxide • Communicating information on properties of sulphur dioxide and its everyday life.	• Awareness of the physical and chemical properties of sulphur dioxide and its uses. • Applying safety rules when experimenting • Caring for the environment when disposing by products of an experiment. • Awareness of the use of sulphuric acid in everyday life.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		physical and chemical properties of sulphur dioxide	solubility, poisonous. Reaction with water, action on indicators and as a reducing agent E.g. turns acidified potassium dichromate (VI) green/decolourises purple potassium manganate (VII). • Uses of sulphur dioxide: As food preservative, bleaching wood pulp for paper making, manufacture of sulphuric acid • Manufacture of sulphuric acid: By Contact Process (catalyst, temperature) • Uses of sulphuric acid: Such as in explosives, as drying agent, making of soaps, fertilizers		.
		12.11.6.4 Describe the uses of sulphur dioxide			
		12.11.6.5 Describe the industrial manufacture of sulphuric acid.			
		12.11.6.6 Describe the			

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		uses of sulphuric acid.			
	12.11.7 Carbon and carbonates	12.11.7.1 Describe what allotropes are 12.11.7.2 Describe the physical properties of the allotropes of carbon. 12.11.7.3 Describe the formation and properties of carbon monoxide.	• Allotropes: As different forms of an element existing in the same physical state • The physical properties of the allotropes of carbon: In terms crystalline and non-crystalline allotropes of carbon • Formation and properties of carbon monoxide: By incomplete combustion of carbon and carbon compounds, reduction of carbon dioxide by carbon. In terms of colour, odour, density, solubility, poisonous. Reacts as reducing agent. • Laboratory preparation, collection and the test for carbon dioxide: By reaction	• Experimenting the laboratory preparation of carbon dioxide • Observing colour changes during the preparation of carbon dioxide • Communicating the uses of Carbon dioxide in everyday life. • Communicating information on the green house effects.	• Awareness of physical and chemical properties of carbon dioxide and limestone and their uses. • Awareness of Global warming • Appreciating the use of Carbon dioxide and lime in everyday life. • Caring for the environment when disposing by products of an experiment. • Cooperating in group activities. • .

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.7.4 Demonstrate the laboratory preparation, collection and the test for carbon dioxide. 12.11.7.4 Describe the physical and chemical properties of carbon dioxide. 12.11.7.5 Describe the uses of carbon dioxide.	of dilute acids with carbonates or bicarbonates, collected by downward delivery method/ above water, forms white precipitate with limewater • The physical and chemical properties of carbon dioxide: In terms of colour, odour, density, solubility. Reactions with limewater/alkalis, water and carbon • Uses of carbon dioxide: Such as in fire extinguishers, carbonated drinks, dry ice, baking, photosynthesis. • Manufacture of lime from limestone: By thermal dissociation of limestone • Uses of lime and slaked lime: Such as in neutralizing acidic soils,		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.7.6 Describe the manufacture of lime from limestone. 12.11.7.7 Describe the uses of lime and slaked lime. 12.11.7.8 Describe the uses of limestone. 12.11.7.9 Describe the green house effect	lime as a drying agent for ammonia. • Uses of limestone: Such as in manufacturing of lime, cement, glass, iron. • Green house effect: As global warming due to increase of carbon dioxide in the atmosphere		
	12.11.8 Silicon	12.11.8.1 Describe the properties of silicon. 12.11.8.2 Describe the use of silicon. 12.11.8.3 Describe what	• The properties of silicon: As a metalloid • Use of silicon: Used in semi-conductors Such as transistors, diodes and capacitors. • Silicones: As	• Communicating the properties of silicon and its uses • Comparing the fire resistance of macromolecules.	• Awareness of the use of silicon in everyday life. • Cooperating in group work.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		silicones are. 12.11.8.4 Compare the fire resistance of silicone plastics to carbon based macromolecules . 12.11.8.5 Describe the uses of silicon dioxide (sand)	macromolecules that exist as oils, waxes or plastics and their structures represented as:  • The nature of silicones: With reference to nature of combustion products, silicones produce silicon dioxide (sand) while organic based macromolecules produce carbon dioxide. • Uses of silicon dioxide: Such as in making glass, as fire extinguisher, in iron extraction.		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.12 Organic Chemistry	12.12.1 Saturated and unsaturated Hydrocarbons	12.12.1.1 Describe what an organic compound is 12.12.1.2 Describe what hydrocarbon is 12.12.1.3 Name the structures of the aliphatic alkanes up to five carbon atoms. 12.12.1.4 Demonstrate the structures of isomers and their names. 12.12.1.5 Describe what fractional distillation of petroleum (crude oil) is	• Organic compound: As a compound of carbon other than oxides and carbonates • Hydrocarbon: As a binary compound of carbon and hydrogen. • Structures of the aliphatic alkanes: Involve concept of catenation (Chain), use the general formula C_nH_{2n+2}, Named by IUPAC system, all should end with *ane*, • Structures of isomers: Use idea of branched(side chains) and unbranched butane and pentane and nomenclature follows IUPAC system • Fractional distillation of petroleum: As different fractions of crude oil collected at different boiling temperatures	• Comparing alkanes and alkenes • Comparing properties of alkanes and alkenes • Observing colour changes during the reactions of alkalis • Comparing different fractions of circle oil.	• Appreciating economic values of alkanes and alkenes. • Awareness of organic compounds. • Caring for the environment when using organics compounds. • Participating actively in group activities. • Awareness of the uses of alkalines and alkalies .

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.12.1.6 Describe the uses of the fractions of crude oil 12.12.1.7 Describe the chemical properties of alkanes. 12.12.1.8 Account for the apparent non reactivity of alkanes as compared to other organic compounds 12.12.1.9 Illustrate instauration in alkenes. 12.12.1.10 Name the structures of the alkenes up to 5 carbon atoms.	• Uses of the fractions of crude oil: Such as domestic fuel, road construction. NB: leaded fuel is no longer recommended due to harmful effects • Chemical properties of alkanes: Such as combustion, cracking, substitution, steam reforming • The apparent non reactivity of alkanes: Lack of a specific site of chemical attack (functional group) and they are saturated. • Instauration in alkenes: Using the concept of catenation and models. • Structures of the alkenes up to 5 carbon atoms: Use the concept of catenation and		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
			the general formula $C_nH_{2n.}$ Structures must contain one carbon to carbon double bond. Named using the IUPAC system all should end with- *ene*		
		12.12.1.11 Demonstrate the structures of isomers of alkenes.	• Structures of isomers of alkenes: Using the unbranched structures of butene and pentene (positional isomers)		
		12.12.1.12 Describe the chemical properties of alkenes.	• Chemical properties of alkenes: Such as combustion, addition reactions (hydrogenation, hydration, hydrohalogenation, halogenation, addition polymerisation)		
			• Differences and similarities		

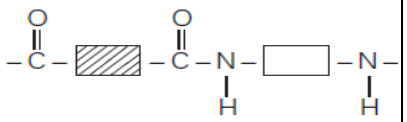
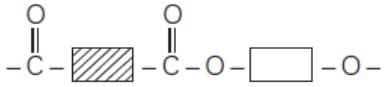
TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.12.1.13 Illustrate the differences and similarities between saturated and unsaturated Hydrocarbons 12.12.1.14 Describe the chemical tests for unsaturated hydrocarbons (alkenes) 12.12.1.15 Describe the uses of alkenes.	between saturated and unsaturated Hydrocarbons: Using structures and bromine solution to distinguish between saturated and unsaturated hydrocarbons • The chemical tests of hydrocarbons: As alkenes decolourise bromine solution rapidly. • Uses of alkenes: As in formation of polymers (Petrochemical industries)		
	12.12.2 Alcohols (Alkanols)	12.12.2.1 Describe the chemical composition of an alcohol. 12.12.2.2 Name structures of primary alcohols up to five	• Chemical composition of an alcohol: As an organic compound with a hydroxyl group with general formula $C_nH_{2n+1}OH$ • Structures of primary alcohols up to five carbon atoms: Using concept of catenation	• Identifying structures of alcohols. • Communicating isomerism in alcohols using models. • Predicting structures os alcohols based on the general formula. • Investigating the properties of alcohols.	• Appreciating the properties and economic uses of alcohols • Caring for the environment for the environment in the experiment when experimenting with alcohols.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		carbon atoms. 12.12.2.3 Demonstrate isomerism in alcohols 12.12.2.4 Describe the formation of alcohols. 12.12.2.5 Describe the chemical properties of alcohols 12.12.2.6 Describe the uses of alcohols	(Chain). Named following IUPAC nomenclature and all should end with- ***ol***). • Isomerism in alcohols: Using branched and unbranched and positional isomers of propanol, butanol and pentanol. • Formation of alcohols: By hydration of alkenes, hydrolysis of esters and fermentation for ethanol • Chemical properties of alcohols: Such as combustion,esterification ,dehydration and oxidation • Uses of alcohols: Such as fuel, antiseptic, organic solvent, alcoholic beverages.		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.12.3 Carboxylic acids (alkanoic acids)	12.12.3.1 Name structures of carboxylic acids up to five carbon atoms.	• Structures of carboxylic acids up to five carbon atoms: Using concept of catenation (Chain), organic compounds with a carboxylic group (COOH), general formula $C_nH_{2n+1}COOH$, all should end with- ***oic acid.***	• Inferring the structures of carboxylic acids • Investigating the chemical properties of carboxylic acids • Communicating the uses of Carboxylic acids in everyday life •	• Appreciating the properties and economic uses of carboxylic acids. • Applying safest rules when using Carboxylic acids. • Cooperating in group activities.
		12.12.3.2 Describe the formation of carboxylic acids	• Formation of carboxylic acids: By the oxidation of alcohols and hydrolysis of esters	• Predicting structures of Carboxylic acids based on general formula.	
		12.12.3.3 Demonstrate the chemical properties of carboxylic acids.	• Chemical properties of carboxylic acids: Such as reaction with bases, carbonates, metals and alcohols (esterification)		
		12.12.3.4 Describe the uses of carboxylic acids	• Uses of carboxylic acids: Such as formation of esters		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.12.4 Esters (Alkanoates)	12.12.4.1 Name the structures of esters up to five carbon atoms. 12.12.4.2 Describe the chemical properties of esters 12.12.4.3 Describe the uses of esters	• Structures of esters up to five carbon atoms: Using the concept of catenation (Chain), Organic compounds with an ester link and all should end with –***oate*.** • Chemical properties of esters: Such as combustion and hydrolysis • Uses of esters: Such as in perfumes, food flavourants because of having pleasant smell.	• Observing the structures and characteristic properties of esters • Communicating the chemical properties of esters	• Participating actively in class work. • Caring for the environment when using Esters in everyday life. • the properties and economic uses of esters.
	12.12.5 Homologous series	12.12.5.1 Describe what homologous series is	• Homologous series: As a collection of organic compounds belonging to the same family with the same general formula (consider alkanes, alkenes, alcohols, acids, esters). • The general characteristics of	• Classifying the different homologous series. • Communicating information on the homologous series.	• Awareness of homologous series. • Fostering team work.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.12.5.2 Describe the general characteristics of homologues (members).	homologues: Such as members of each homologous series have the same general formula and similar chemical properties. Physical properties (states, melting point, boiling point, density, solubility) of members show gradual changes as molecular mass changes. Adjacent members differ by CH_2 and have a general method of preparing members.		
	12.12.6 Macromolecules (Polymers)	12.12.6.1 Describe what macromolecules (polymers) are 12.12.6.2 Describe what synthetic macromolecules are.	• Macromolecules (polymers): As giant molecules formed by combination of many small molecules (monomers) • Synthetic macromolecules: As human made giant molecules (polymers).	• Classifying macromolecules • Identifying linkages in different macromolecules • Comparing the structure of nylon and teryline	• Awareness of polymers. • Appreciating economic use of polymers. • Caring for the environment when using macromolecules in everyday life. • Cooperating in

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.12.6.3 Describe the formation of polyalkenes. 12.12.6.4 Classify the types of plastics 12.12.6.5 Describe the formation of nylon and Terylene.	• Formation of polyalkenes: By addition polymerisation E.g. polyethene, polyvinylchloride, polypropene, polystyrene. • Types of plastics: As thermal plastics and non-thermal plastic • Formation of nylon and Terylene: By condensation polymerisation, Nylon: from a diamine and dioic acid structures represented as:  Terylene: from diol and dioic acid. Structures represented as:  • Different structure of	• Predicting the structure of different macromolecules based in the monomers they contain.	group work.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.12.6.6 Differentiate between the structure of Nylon and Terylene. 12.12.6.7 Describe typical uses of plastics and synthetic fibres. 12.12.6.8 Describe the biodegradability of synthetic fibres. 12.12.6.9 Describe what natural macromolecules are 12.12.6.10 Describe composition of carbohydrates 12.12.4.11 Identify linkages in starch, proteins and fats	Nylon and Terylene: Nylon as polyamide and Terylene as polyester. • Typical uses of plastics and synthetic fibres: Plastics used as in carrier bags, buckets, pipes Nylon and terylene as in clothing, tents, strings, ropes. • Biodegradability of synthetic fibres: As non-biodegradable (cannot be broken down by microorganisms) • Natural macromolecules: Such as Carbohydrates, proteins and fats (lipids) • Composition of carbohydrates: Carbohydrates contain carbon, hydrogen and oxygen in the form $C_xH_{2y}O_y$ where x is a multiple of six	• Comparing natural and man made macromolecules • Identifying of linkages in nature/macromolecules • Designing an experiment to investigate the hydrolysis of fats and its products.	• Caring for the environment when disposing by products of an experiment.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.12.4.12 Relate linkages in synthetic and natural polymers. 12.12.4.13 Describe hydrolysis of fats (saponification) 12.12.4.14 Identify the products of the hydrolysis of starch and proteins.	• linkages of starch, proteins and fats: In starch – glycosidic, Proteins – amide, fats – ester linkages • Linkages in synthetic and natural polymers: Such as difference and similarities between nylon and proteins. Terylene and fats. • Hydrolysis of fats (saponification): As formation of soaps and glycerine (glycerol) • Products of the hydrolysis of starch and proteins: Using chromatography to identify the amino acids from proteins, simple sugars from starch.		

Chemistry Practical Syllabus

The following points should be considered during practical in chemistry:

(i) The student should have the knowledge of volumetric analysis in relation to one set of titrations.
The student is expected to comprehend acid-alkali titrations using ordinary methyl orange, screened methyl orange, phenolphthalein or any other suitable indicator. Other titrations using different reagents may be set as well e.g. redox titration.

(ii) Other experiments involving the determinations of quantity, temperature change and rates of reactions are necessary. Experiments of this nature will rely on the use of ordinary apparatus in the laboratory.

(iii) Experiments involving identification of an unknown substance or mixture could be set. A learner is expected to observe and investigate the expected outcome. This may comprise elementary chromatography and simple tests for oxidising and reducing agents. Detailed analysis is not necessary but a learner is expected to have the knowledge of the reactions of the cations with aqueous sodium hydroxide and aqueous ammonia which should include elementary cations like aluminium, ammonium, calcium, copper(II), iron (II), iron (III) and zinc.
A learner should also carry out the tests for the anions such as carbonate, chloride, iodide, nitrate and sulphate. Chemical tests for gases which should include ammonia, carbon dioxide, chlorine, hydrogen, oxygen and sulphur dioxide.
Organic substances and ions not mentioned above may be included in the practical sessions. A learner is expected to have sufficient knowledge in this area. Examination involving different salts with cations similar to the ones specified above may be set but candidates are expected to draw out their conclusions from the observations.
N.B. No note books, course books, information booklets and text books will be allowed in the practical examination.
A learner shall be expected to perform simple calculations as outlined by the chemistry syllabus. However non programmable calculators are allowed.

Practical techniques

Schools and students are reminded of the importance of accuracy in quantitative and qualitative exercises during the practical lessons.

(i) A learner is expected to read the burette accurately and to the nearest volume of $0.1cm^3$. At least 3 titrations should be done by a student to ensure a correct result and marks. Only values that fall within ±0.2 with respect to the supervisor's volume will score full marks.

(ii) A student is expected to take note of the temperature readings to the nearest 0.5^oC. Recommended thermometer range is -10^oC to 110^oC. The time should be recorded in seconds and the stop clock/stop watch will be the most convenient timing instrument.

(iii) Learner must show the ability to ignore certain values on the titration table and use only those that are consistent and compute the average of the consistent values. Consistent values must fall within 0.2 to one another.

- In case of qualitative exercises a learner should use around 1cm depth of a solution i.e. (about 2cm^3) in a test tube. Reagents should be added drop by drop and thoroughly mixing them, to ensure effective results for each test. The student should make sure that no further changes may occur if more reagents are added. A learner should take note of the stage at which the precipitate forms and also the colour changes. Furthermore the learner must take note of chemicals used to detect gases, if any, during the experiments. Observations must be recorded as stipulated in the qualitative notes. Equations are not required during practical.

Apparatus

The following apparatus should be stocked for teaching and examination purposes. Each learner should be provided with the necessary apparatus to conduct the experiments.

Bunsen burner
Test-tubes
Measuring cylinder calibrated 25cm^3 or 50cm^3.
Filter funnel.
Beaker (polystyrene, glass) volume of 250cm^3.
Conical flasks with volume of 250cm^3.
Burette with a volume of 50cm^3.
Pipettes with volumes of 25cm^3 or 20 cm^3
Pipette fillers.
Thermometers calibrated -10^oC to 110^oC at intervals of 1^oC.
Stop clocks/stop watches which record time in seconds.
Wash bottles.
Pyrex test tubes are essential for heating purposes with capacities 125mmx 16mm.
Boiling tubes i.e. of dimension 150mm x 25mm.

Stirring rods for stirring or mixing purposes.
Electronic balances /triple beam balances.

Reagents
The following standard reagents should be stocked among others. These are of paramount importance during practical.

Hydrochloric acid 1.0 mol/dm^3
Nitric acid 1.0 mol/dm^3
Sulphuric acid 0.5 mol/dm^3
Aqueous ammonia 1.0 mol/dm^3
Aqueous sodium hydroxide 1.0mol/dm^3
Lime water (a solution of calcium hydroxide)
Aqueous silver nitrate 0.05 mol/dm^3
Aqueous potassium dichromate (VI) 0.1 mol/dm^3
Aqueous potassium iodide 0.1 mol/dm^3
Aqueous lead (II) nitrate 0.2 mol/dm^3
Aqueous potassium permanganate (VII) approximate 0.02 mol/dm^3
Barium nitrate 0.2 mol/dm^3

In addition chemical substances such as aluminium foil, red litmus paper, blue litmus paper and universal indicators should be in stock.

QUALITATIVE ANALYSIS TESTS
Notes for use in qualitative analysis

Test for anions

Anions	**Test**	**Test result**
Carbonate (CO_3^{2-})	Add dilute acid	Effervescence occurs, carbon dioxide produced
Chloride (Cl^-) [in solution]	Acidify with dilute nitric acid , then add aqueous silver nitrate	White ppt.
Iodide (I^-)[in solution]	Acidify with dilute nitric acid , then add aqueous lead (II) nitrate	Yellow ppt.
Nitrate (NO_3^-)[in solution]	Add aqueous sodium hydroxide, then aluminum foil, warm carefully.	Ammonia produced
Sulphate (SO_4^{2-}) [in solution]	Acidify with dilute nitric acid, then add aqueous barium nitrate	White ppt.

Test for aqueous cations

Cations	**Effect of aqueous sodium hydroxide**	**Effect of aqueous ammonia**
Aluminium ions (Al^{3+})	White ppt.soluble in excess giving a colourless solution	White ppt., insoluble in excess

Ammonium ions (NH_4^+)	Ammonia produced on warming	-
Calcium ions (Ca^{2+})	White ppt., insoluble in excess	No change
Copper ions (Cu^{2+})	Light blue ppt., insoluble in excess	Light blue ppt., soluble in excess, giving a dark blue solution
Iron(II) ions (Fe^{2+})	Green ppt., insoluble in excess	Green ppt., insoluble in excess, turns reddish-brown on standing
Iron (III) ions (Fe^{3+})	Red-brown ppt., insoluble in excess	Red-brown ppt., insoluble in excess
Zinc ions (Zn^{2+})	White ppt.,soluble in excess giving a colourless solution	White ppt. soluble in excess giving a colourless solution.

Test for gases

Gas	**Test**	**Test result**
Ammonia	Introduce damp red litmus paper to the gas	Turns damp red litmus paper blue
Carbon dioxide	Bubble the gas through limewater	White precipitate formed
Chlorine (Cl_2)	Introduce damp blue litmus paper to the gas	Turns litmus paper red then bleaches it
Hydrogen (H_2)	Introduce a lighted splint into the gas	Puts out the lighted splint with a 'pop'sound
Oxygen (O_2)	Introduce a glowing splint into the gas	Glowing splint relighted
Sulphur dioxide (SO_2)	Bubble the gas through acidified potassium dichromate (VI)	Turns orange potassium dichromate green.

SCOPE and SEQUENCE

The following table shows the "Scope and Sequence" of Chemistry syllabus from G10 to G12.

Grade 10		Grade 11		Grade 12	
Unit 1 Introduction to Chemistry	**SUBTOPIC**	**Unit 5 Acids, Bases and Salts**	**SUBTOPIC**	**Unit 9 Chemistry and Electricity**	**SUBTOPIC**
	10.1.1 Introduction to Chemistry		11.5.1 Characteristic properties of acids and bases		12.9.1.Conductors
Unit 2 The Particulate nature of matter	10.2.1 Matter and the Kinetic theory		11.5.2 Preparation of salts		12.9.2 Electrolysis
	10.2.2 Diffusion		11.6.3 Types of oxides		12.9.3 Simple cells (chemical cell)
Unit 3 Experimental Techniques	10.3.1 Measuring of quantities		11.6.4 Identification of ions and gases (Qualitative analysis)	**Unit 10 Metals**	12.10.1 General properties of a metals
	10.3.2 Criteria of purity	**Unit 7 The mole concept**	11.6.1 Relative masses		12.10.2 Reactivity and Electro Chemical Series
	10.3.3 Separating mixtures		11.6.2 The mole		12.10.3 Alloys
Unit 4 Atoms, elements, compounds and molecules	10.4.1 Atomic structure and Periodic Table		11.6.3 Empirical and Molecular formulae		12.10.4 Corrosion
	10.4.2 Bonding	**Unit 7 Chemical reactions and energy changes**	11.7.1 Rates of chemical reactions	**Unit 11 Non Metals**	12.11.1 General properties of non-metals

	10.4.4 Macromolecules		11.7.2 Chemical equilibrium		12.11.2 Hydrogen
	10.4.5 Chemical formulae and equations		11.7.3 Redox reactions		12.11.3 Oxygen
			11.7.4 Energetic of reactions		12.11.4 Nitrogen
					12.11.5 Chlorine
		Unit 8 The Periodic Table	**11.8.1** Group and Periods		12.11.6 Sulphur
			11.8.2 Group and Periodic trends		12.11.7 Carbon and carbonates
			11.8.3 Transition metals		12.11.8 Silicon
				Unit 12 Organic Chemistry	12.12.1 Saturated and unsaturated Hydrocarbons
					12.12.2 Alcohols (Alkanols)
					12.12.3 Carboxylic acids (alkanoic acids
					12.12.4 Esters (Alkanoates)
					12.12.5 Homologous series
					12.12.6 Macromolecules (Polymers)