Republic of Zambia

MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL TRAINING AND EARLY EDCATION

CHEMISTRY SYLLABUS

GRADES 10 – 12

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VISION

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

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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, analyse 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 in collaboration with Hiroshima University and UNICEF for rendering financial and technical support in the production of this syllabus.

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Director-Standard and Curriculum
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	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.1INTRODUCTION TO CHEMISTRY	10.1.1 Introduction to Chemistry	10.1.1.1 Describe Chemistry. 10.1.1.2 Classify the branches of chemistry	• The study of matter and their chemical changes • Branches such as: Analytical, Biochemistry, Inorganic, Physical and Organic	• ***Classifying*** of chemistry into its branches • ***Identifying*** different branches of chemistry	• ***Asking*** questions for more understanding • ***Awareness*** of chemistry branches
		10.1.1.3Explain 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.	• 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	• ***Differentiating*** chemistry from the other natural sciences	• ***Appreciating*** chemistry

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.2THE 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 10.2.1.3Classify the states of matter.	• Anything that has **mass** and occupies space • Atoms ,molecules ,ions • Kinetic theory: in terms of particle arrangement and movement. Solid, liquid, gas	• ***Classifying*** the basic units and states of matter	• ***Appreciating*** the basic units of matter and its existence in three states
		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	• Changes of states such as melting, freezing, boiling, condensation, sublimation in terms of kinetic theory • Changing states of matter, exothermic-release of heat during a reaction, endothermic-absorption of heat during a reaction, include heating and cooling curves	• ***Demonstrating*** the changes of states of matter • ***Inferring*** data on absorption and release of heat during changes of states of matter	• ***Applying*** changes of states of matter in everyday life

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	10.2.2 Diffusion	10.2.2.1Describe diffusion 10.2.2.2 Demonstrate diffusion in fluids 10.2.2.3Describe the factors that affect the rate of diffusion	• Movement of particles from region of higher concentration to region of lower concentration • Liquids and gases (Brownian motion) • Factors of diffusion E.g. molecular mass, temperature, concentration	• ***Demonstrating*** the movement of particles in fluids • ***Comparing*** movement of particles in fluids and factors affecting their speed of movement	• ***Appreciating*** diffusion • ***Asking*** more questions to learn more ***Fostering*** teamwork
10.3EXPERIMENTAL TECHNIQUES	10.3.1Measuring of quantities	10.3.1.1Demonstratehow different quantities are measured. 10.3.1.2 Identify different measuring apparatus used in chemistry. 10.3.1.3 Identify various measuring instrument and other apparatus used in chemistry	• Quantities such as time, temperature, mass and volume • Measuring apparatus such as stopwatch or stop clock, thermometers, balances, burettes, pipettes, volumetric flask, measuring cylinder, and gas syringes • Other apparatus: spatula, stands and clamp, test-tubes, burners, , glass rods, evaporating dish, funnel beaker, conical flask etc.	• ***Demonstrating*** accurate measurement of values of various quantities • ***Identifying*** different measuring apparatus	• ***Applying*** safety rules in use of apparatus

TOPIC	SUB TOPIC	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	• In terms of melting points and boiling points • Sharp melting for pure substance and melting over a range of temperatures for a mixture.	• ***Differentiating*** between melting points and boiling points • ***Demonstrating*** determination of purity of substances • ***Comparing*** pure and impure substances	• ***Appreciating*** purity of substances
		10.3.2.3 Explain the importance of purity of a substance	• Importance of purity in substances such as foodstuffs, medicines, drinks	• ***Communicating*** the importance of purity in substances	• ***Appreciating*** of the purity of substances

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	10.3.3Separating mixtures	10.3.3.1Distinguish between physical and chemical changes 10.3.3.2Demonstrate different methods of separating mixtures 10.3.3. Interpret simple paper chromatograms.	• In terms of mass changes, irreversibility/reversibility, chemical substance formed and energy involved. • Methods such as decantation, filtration, crystallisation, simple and fractional distillation, magnetism, chromatography, evaporation, sublimation, floatation, use of separating funnel and centrifugation • Uses such as R_f values and distances covered by components (restricted to paper chromatography)	• ***Analysing*** the components in the mixture • ***Identifying*** appropriate methods for separating different mixtures	• ***Applying*** separation techniques in everyday life

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.4ATOMS, ELEMENTS, COMPOUNDS AND MOLECULES	10.4.1Atomic structure and Periodic Table	10.4.1.1 Describe an atom and its structure. 10.4.1.2Describe the relative charges and approximate relative masses of protons, neutrons and electrons	• 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) • Charges as: +1,0,-1 Masses as: 1, 1, 1/1840	• ***Communicating*** atoms, elements molecules and compounds • ***Calculating*** relative atomic mass	• ***Awareness*** of the atomic structure
		10.4.1.3Describe the proton (atomic)number and nucleon(mass) number and nuclide notation	• As number of protons: Z, number of nucleons: A (protons + neutrons)and nuclide notation $^{A}_{Z}\mathrm{X}$	• ***Calculating*** relative atomic mass	• ***Asking*** more questions to learn more • ***Fostering*** teamwork

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.1.4 Describe an element 10.4.1.5 Identify elements using their chemical symbols 10.4.1.6Describe the basis of the Periodic Table	• As substance made up of same chemical atoms. • Symbols of the elements with atomic number 1 up to 20 and other common elements in the local environment • Group determined by valence electrons Period determined by number of shells	• ***Communicating*** elements and the periodic table	• ***Appreciating*** elements from the environment
		10.4.1.7Describe isotopes 10.4.1.8Calculate relative atomic mass of an element given the % abundances of isotopes and from mass spectrum.	• As atoms with same number of protons but different numbers of neutrons, including radioactive and non-radioactive isotopes • As sum of the products of the percentages and their mass numbers	• ***Calculating*** relative atomic mass of an element	• ***Asking*** more questions to learn more • ***Fostering*** teamwork

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.1.9Describe the use of radioactive isotopes 10.4.1.10 Demonstrate the build-up of electrons in shells	• Such as in medical treatment of cancer, industrial use as tracers • Electronic configuration of atoms (spdf configuration is **NOT** required)	• ***Communicating*** the uses of isotopes	• ***Awareness*** of the uses of isotopes
	10.4.2 Bonding	10.4.2.1 Describe a compound 10.4.2.2 Describe the formation of ions (radicals). 10.4.2.3Describe the formation of ionic (electrovalent) bonds.	• As substance formed from two or more elements chemically combined • Cations by electron loss, anions by electron gain. • 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	• ***Classifying*** ionic compounds and covalent compounds	• ***Appreciating*** the use of ionic compounds and covalent compounds

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.2.4 Describe the formation of covalent bonds 10.4.2.5 Describe the electronic arrangement in simple multiple covalent molecules	• 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 • Such as double bonds in O_2,C_2H_4andCO_2, Triple bond in $N_2$and C_2H_2	• ***Communicating*** the formation of covalent bonds • ***Inferring*** the arrangements of simple multiple covalent molecules • ***Demonstrating*** bond formation using models	• ***Asking*** more questions to learn more • ***Fostering*** teamwork
		10.4.2.6 Describe the uses of ionic and covalent compounds 10.4.2.7 Describe a molecule	• As refractory materials for ionic compounds (CaO) and polar and nonpolar solvents for covalent compounds. • As the smallest particle of an element or compound which exists independently.	• ***Communicating*** the uses of ionic and covalent compounds	• ***Asking*** more questions to learn more • ***Fostering*** teamwork • ***Appreciating*** ionic and covalent compounds

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.2.8 Describe valency and valence electrons. 10.4.2.9 Demonstrate how to deduce valency of an element.	• Valency as combining power of an atom or radical. Valence electrons as the number of electrons in the outer most shell. • From the formula of a compound, ionic charge, valence electrons.	• ***Demonstrating*** the deducing of valency	• ***Asking*** more questions to learn more • ***Fostering*** teamwork
		10.4.2.10 Formulate chemical formulae of compounds. 10.4.2.11 Identify the differences in properties of ionic and covalent compounds.	• Using valency and chemical symbols of elements, charges on ions, models, relative numbers of atoms present, diagrammatic representation • Differences such as volatility, electrical conductivity, density, melting point, boiling point and basic units.	• ***Formulating*** chemical formulae • ***Differentiating*** chemical formulae • ***Investigating*** properties of ionic and covalent compounds	• ***Asking*** more questions to learn more • ***Fostering*** teamwork • ***Appreciating*** ionic and covalent compounds

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.2.12Describe metallic bonding 10.4.2.13Describe the electrical and thermal conductivity of metals	• As lattice of positive ions in a 'sea' of delocalised electrons • Electrical and thermal:due to free electron movement/delocalised electrons	• ***Communicating*** metallic bonding and thermal conductivity	• ***Asking*** more questions to learn more
	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 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	• 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 (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.	• ***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	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	10.4.4 Chemical formulae and equations	10.4.4.1 Demonstrate how to construct word equations. 10.4.4.2 Formulate and balance chemical equations. 10.4.4.3 Construct net ionic equations from balanced chemical equations.	• Equation showing reactants and products separated by a full curled arrow (➔). • 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 – aqueous). • 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.	• ***Demonstrating*** construction of word equations • ***Formulating*** balanced chemical and ionic equations.	• ***Appreciating*** the conservation of matter.

GRADE 11	
General Outcomes: • 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	**Key Competences** • 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	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.5ACIDS, BASES AND SALTS	11.5.1Characteristic properties of acids and bases	11.5.1.1 Describe acids, bases or alkalis in terms of ions they contain or produce in aqueous solution. 11.5.1.2 Describe the meaning of weak, strong, dilute and concentrated acids and alkalis	• 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. • Strength as degree of ionisation, Concentration as the number of ions per volume of solution.	• ***Identifying*** acids and bases. • ***Investigating*** the acidity and alkalinity of substances in everyday life	• ***Applying*** the uses of acids and bases

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.5.1.3 Describe the P^H scale 11.5.1.4 Describe neutrality, acidity and alkalinity in terms of P^H value	• As scale ranging from 0 to 14 showing the degree of acidity and alkalinity. • The P^H values: 7 for neutrality, below 7 for acidity and above 7 for alkalinity	• ***Identifying*** acids and bases. • ***Investigating*** the acidity and alkalinity of substances in everyday life	• ***Applying*** the uses of acids and bases
		11.5.1.5 Determine the P^H value of a solution. 11.5.1.6 Demonstrate the characteristic properties of acids 11.5.1.7 Demonstrate the characteristic properties of bases 11.5.1.8 Illustrate the importance of acid-base reactions	• Using universal indicator: different colours at different P^H values, Using P^H meter: precise values • Such as reactions with metals, bases, carbonates/bicarbonates and effect on indicators. • Such as reactions with acids and ammonium salts, effect on indicators. • Such as in controlling the acidity in the soil, treatment of indigestion, brushing teeth with toothpaste.		

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.5.1.9 State the uses of acids and bases.	• Such as control of P^H in agriculture, making of soap, in car batteries	• ***Identifying*** acids and bases. • ***Investigating*** the acidity and alkalinity of substances in everyday life	• ***Applying*** the uses of acids and bases
	11.5.2Preparation of salts	11.5.2.1 Describe a salt 11.5.2.2Classify salts according to their nature and solubility in water 11.5.2.3 Demonstrate the preparation of an insoluble salt. 11.5.2.4Demonstrate the preparation soluble salts.	• 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. • As acid, basic and normal salts. Solubility rules of salts • Using precipitation method and separated by filtration. E.g. Barium sulphate, Silver chloride • By reaction of acids with bases, suitable metals and carbonates/ bicarbonates. Separated by crystallisation and filtration. E.g. Zinc sulphate, copper (II) sulphate	• ***Classifying*** of salts • ***Demonstrating*** the preparation of soluble and insoluble salts • ***Differentiating*** hydrated and anhydrous salts • ***Experimenting*** on preparation of salts	• ***Awareness*** of salts • ***Applying*** safety rules in preparation of salts

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.5.2.5 Demonstrate the preparation of ammonium, potassium and sodium salts. 11.5.2.6 Demonstrate the existence of hydrated salts and differentiate from anhydrous salts	• Using titration method (use of indicator for ease detection of end point) • Hydrated salts as salts containing water of crystallisation. Anhydrous salts as salts not containing water of crystallisation.	• ***Classifying*** of salts • ***Demonstrating*** the preparation of soluble and insoluble salts • ***Differentiating*** hydrated and anhydrous salts • ***Experimenting*** on preparation of salts	• ***Awareness*** of salts ***Applying*** safety rules in preparation of salts
		11.5.2.7 Describe the behaviour of salts with reference to the atmosphere.	• As hygroscopic, efflorescent, deliquescent.	• ***Classifying*** of salts • ***Demonstrating*** the preparation of soluble and insoluble salts • ***Differentiating*** hydrated and anhydrous salts ***Experimenting*** on the behaviour of salts	• ***Awareness*** of salts • ***Applying*** safety rules in preparation of salts

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.5.3 Types of oxides	11.5.3.1 Describe the 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	• ***Awareness*** of different types of oxides. • Applying acid-base reactions
	11.5.4 Identification of ions and gases (Qualitative analysis)	11.5.4.1 Demonstrate the 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 various reagents. Refer to Qualitative notes	• ***Observing*** and ***interpreting*** results of reactions of ions with different test reagents. • ***Analysing*** chemical composition of salts.	• ***Awareness*** about composition of salts

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.5.4.2 Demonstrate the identity of gases.	• Gases being ammonia, carbon dioxide, chlorine, hydrogen, oxygen and sulphur dioxide. Refer to Qualitative notes	• ***Identifying*** gases	• ***Appreciating*** different types of gases.
11.6THE MOLE CONCEPT	11.6.1 Relative masses	11.6.1.1 Describe Relative Atomic Mass and relative molecular mass. 11.6.1.2Calculate the relative formula mass of a compound	• RAM as relative mass of an element's isotopes as compared to carbon-12 RMM as relative mass of a molecule as compared to carbon-12 • As the sum of the relative atomic masses of all the atoms in the compound.	• ***Comparing*** the relative atomic masses and relative molecular masses ***Calculating*** relative molecular mass of compounds	• ***Appreciating*** the relative atomic masses and the relative molecular masses
	11.6.2 The mole	11.6.2.1 Describe a mole. 11.6.2.2 Determine the physical masses (m) of any substance using the molar mass (Mr) and the physical volume (v) of any gas at r.t.p and vice versa.	• As number or quantities of particles e.g. atoms, ions, molecules, electrons equivalent to 6.02 x 10^{23}(Avogadro's constant) • Apply $n = {}^{m}/_{Mr}$ and $n = {}^{v}/_{Vm}$ where n = number of moles	• ***Analysing*** chemical substances quantitatively	• ***Applying*** mole concept • ***Asking*** questions to learn more • ***Awareness*** of the mole concept ***Fostering*** team work

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.6.2.3Describe the relationship of Avogadro's law to reacting moles and volumes of gases at r.t.p and s.t.p. 11.6.2.4Determine the concentration of a solution and apply dilution law.	• As Molar gas volume (Vm) of any gas at rtp is 24dm^3 or 22.4 dm^3 at stp. • Concentration as mol/dm^3 / g/dm^3. The number of moles of solute before dilution is the same as after dilution, $M_1V_1 = M_2V_2$.	• ***Demonstrating*** acid-base titrations • ***Problem solving*** in mole concept	• ***Applying*** mole concept • ***Asking*** questions to learn more • ***Awareness*** of the mole concept • ***Fostering*** team work
		11.6.2.5Illustrate calculations involving stoichiometric reacting moles and volumes of gases and solutions.	• Using molar mass and molar volume of a gas using the mole concept. (Questions on gas laws and conversions of gaseous volumes to different temperatures and pressures will **not** be required). Proportional stoichiometric masses and the given quantities	• ***Problem solving*** in mole concept	• ***Applying*** mole concept • ***Asking*** questions to learn more • ***Awareness*** of the mole concept ***Fostering*** team work

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.6.2.6 Describe and calculate the percentage yield in a reaction and the percentage purity of a substance 11.6.2.7 Determine limiting reagent in a given reaction	• % yield as actual amount obtained divided by theoretical amount x 100% % purity as amount of substance divided by total amount of the mixture x 100% • Using proportional stoichiometric masses and the given quantities	• ***Problem solving*** in mole concept	• ***Applying*** mole concept • ***Asking*** questions to learn more • ***Awareness*** of the mole concept ***Fostering*** team work
		11.6.2.8 Demonstrate calculations involving different types of acid–base titration reactions.	• The different types of acid–base titration reactions: Using titration law	• ***Demonstrating*** acid-base titrations	• ***Applying*** mole concept • ***Asking*** questions to learn more • ***Awareness*** of the mole concept ***Fostering*** team work

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.7.1 Empirical and Molecular formulae	11.7.1.1 Calculate the percentage composition of elements in a compound. 11.7.1.2 Determine the empirical formulae of a compound given the molecular formula	• 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	• ***Appreciating*** chemical composition of substances • ***Applying*** chemical analysis • ***Fostering*** team work. • ***Asking*** more questions for better understanding.	• ***Appreciating*** chemical composition of substances • ***Applying*** chemical analysis • ***Fostering*** team work. • ***Asking*** more questions for better understanding.
		11.7.1.3 Determine the empirical and molecular formulae using percentage composition or masses.	• 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	• ***Appreciating*** chemical composition of substances • ***Applying*** chemical analysis • ***Fostering*** team work. • ***Asking*** more questions for better understanding.	• ***Appreciating*** chemical composition of substances • ***Applying*** chemical analysis • ***Fostering*** team work. • ***Asking*** more questions for better understanding.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.7 CHEMICAL REACTIONS	11.7.1 Rates of chemical reactions	11.7.1.1Describe rate of a chemical reaction. 11.7.1.2 Demonstrate the factors that affect the rates of chemical reactions 11.7.1.3 Interpret data on the rate of chemical reactions.	• As speed of a chemical reaction. • Factors such as temperature, concentration, surface area, catalyst, pressure, light. • Such as graphical representations for rate of chemical reactions.	• ***Demonstrating*** factors that control the rate of chemical reactions. • ***Comparing*** experimental results at different conditions	• ***Applying*** safety rules and the factors that affect the rate of chemical reactions. ***Awareness*** of slow and spontaneous reactions.
		11.7.1.4 Describe methods of controlling the rate of chemical reactions. 11.7.1.5 Describe the effect of a catalyst on the activation energy	• Made by either reducing or reducing the frequency of collisions between reacting particles such as explosions in flour mills/coal mines when ignited to surface area • Catalyst lowers the activation energy thus increasing the rate of a chemical reaction.	• ***Analysing*** and ***interpreting*** experimental results.	• ***Applying*** safety rules and the factors that affect the rate of chemical reactions. ***Awareness*** of slow and spontaneous reactions.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.7.2.Chemical equilibrium	11.7.2.1 Describe what chemical equilibrium is	• Chemical equilibrium: as when the rate of the forward reaction equalises with rate of the backward reaction and the concentrations of the substances remain constant. It occurs in reversible reactions.	• ***Communicating*** information in reversible reactions. • ***Classifying*** reactions as reversible and irreversible. • ***Comparing*** reversible reactions to irreversible reactions. • ***Inferring*** the direction of a reaction based on relevant data.	• ***Awareness*** of reversible reactions. • ***Applying*** and appreciating the optimum conditions of a reaction. • ***Asking*** more questions for better understanding.
		11.7.2.2 Describe the effect on the position of equilibrium of a reaction upon changing conditions.	• 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		
	11.7.3 Redox reactions	11.7.3.1 Describe what oxidation and reduction is	• Redox in terms of electron transfer, hydrogen/oxygen transfer, changes in oxidation state.	• ***Experimenting*** with redox reactions.	• Awareness of redox and non-redox reactions

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.7.3.2 Describe what redox reactions is. 11.7.3.3 Identify oxidizing and reducing agents in a reaction. 11.7.3.4 Demonstrate how to determine the oxidation number of an element with variable valency in a compound/ion. 11.7.3.5 Deduce a redox reaction using oxidation numbers. 11.7.3.6 Describe what non-redox reaction is	• Oxidizing agent as a reactant that gains electrons and/or reduces oxidation state • 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.	• ***Observing*** colour changes. • ***Comparing*** oxidizing and reducing agents • ***Classifying*** redox and non-redox reactions • ***Planning*** an experiment to show the effects of an oxidizing and reducing agent	• ***Applying*** redox reactions • ***Appreciating*** redox reactions. • Participating actively in group activities • ***Applying*** safety rules when experimenting
		11.7.3.7 Identify the characteristics of oxidizing and reducing agents	• 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 permanganate as oxidizing agents and observe colour changes only. **NB:**No equations involving potassium dichromate and potassium permanganate will be required.	• ***Predicting*** the oxidation number of an element • ***Predicting*** a reaction as being redox or non-redox.	• ***Applying*** redox reactions • ***Appreciating*** redox reactions. • Participating actively in group activities • ***Applying*** safety rules when experimenting

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.7.4 Energetics of reactions	11.7.4.1Describe what endothermic and exothermic reactions are 11.7.4.2 Determine a reaction which is endothermic or exothermic.	• 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.	• ***Experimenting*** with endothermic and exothermic reactions. • ***Classifying*** reactions as endothermic and exothermic.	• ***Applying*** endothermic and exothermic reactions • ***Applying*** safety rules during experiment
		11.7.4.3 Describe endothermic and exothermic reactions in relation to bonds. 11.7.4.4 Identify activation energy for a catalysed and uncatalysed reaction on an energy level diagram 11.7.4.5 Explain the advantages and disadvantages of energy sources (fuels). 11.7.4.6 Describe the effects of the use of fuels on the environment	• Endothermic as bond breaking and exothermic as bond formation. • As in energy level representations: lower for catalysed and higher for 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).	• ***Classifying*** reactions as endothermic and exothermic. • ***Investigating*** the effects of fuels on the environment	• ***Applying*** endothermic and exothermic reactions • ***Applying*** safety rules during experiment • ***Applying*** information on energies of reactions in everyday life.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.7.4.7 Describe the use of silver halide in photography 11.7.4.8 Describe respiration and photosynthesis in terms of energy changes	• 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 of light producing glucose and oxygen.	• ***Planning*** an investigation to show that respiration and photosynthesis involve energy changes. • ***Communicating*** use of halides in photography	• ***Applying*** safety rules during experiment • ***Applying*** information on energies of reactions in everyday life.
		11.7.4.9 Describe use of radioactive isotope in relation to energy changes. 11.7.4.10 Explain batteries as convenient source of electrical energy.	• The use of radioactive isotope: As a source of nuclear energy. • The convenient source of electrical energy: such as batteries as they are potable.	• ***Investigating*** the effects of fuels on the environment • ***Investigating*** to show that batteries are a source of electrical energy.	• ***Applying*** information on energies of reactions in everyday life.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.8THE PERIODIC TABLE	11.8.1Groups and Periods	11.8.1.1Describe the Period Table 11.8.1.2 Identify vertical columns and horizontal rows. 11.8.1.3 Demonstrate how to use the Periodic Table to classify elements	• As a tool for classifying elements. • Vertical columns as Groups and horizontal rows as Periods • As metallic and non-metallic	• ***Identifying*** of vertical columns and horizontal rows of the periodic table. • ***Classifying*** elements as metallic and non-metals	• ***Appreciating*** the Periodic Table • ***Applying*** the classification of elements
	11.8.2 Groups and Periodic trends	11.8.2.1 Describe trends in various Groups given information about the elements 11.8.2.2 Describe the physical and chemical properties of elements in Group I, II, VII and VIII. 11.8.2.3 Describe the importance of halogens	• As chemical relativity of group I, II, and VII, elements • Properties 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. • Such as fluoride in toothpaste, chlorine in water treatment, antiseptic, bromide in photographic film	• ***Identifying*** characteristics of representative elements from Groups. • ***Classifying*** elements according to their Groups and Periods	• ***Awareness*** of elements and their positions on the Periodic Table • ***Appreciating*** positioning of elements on the Periodic Table • ***Appreciating*** the uses of elements on the Periodic Table

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.8.2.4Describe the harmful effects of halides. 11.8.2.5Describe the use of the noble gases in providing an inert atmosphere	• Such as drugs, pesticides, CFCs in ozone layer depletion (CFCs) • The significance of their non-reactivity in providing an inert atmosphere. Such as argon in electrical lamps, helium in balloons	• ***Communicating*** harmful effects of halides and uses of noble gases	• ***Awareness*** of harmfulness of halides • ***Appreciating o***f uses of noble gases
	11.8.3 Transition metals	11.8.3.1 Describe transition metals. 11.8.3.2 Describe general properties of transition metals. 11.8.3.3 Describe the uses of transition metals	• As a block elements between Group II and Group III of the Periodic Table • As variable valencies, high densities, high melting points, form coloured compounds, catalysts. **Note**: Electronic configuration of transition metals will **not** be required • Uses such as catalysts, alloys, engineering materials NB: Heavy metals are no longer used to make paint for health reasons	• ***Investigating*** the physical and chemical properties of transition elements. • ***Identifying*** transition metals	• ***Appreciating*** transition metals

GRADE 12	
General Outcomes: • 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	**Key competences:** • 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	SUB TOPIC	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
	12.9.2 Electrolysis	12.9.2.1 Classify electrolytes and non-electrolytes 12.9.2.2 Describe what electrolysis is	• 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.	• ***Classifying*** electrolytes and non electrolytes • ***Formatting a hypothesis*** about the products at the electrodes during electrolysis.	• ***Asking*** more questions for better understanding • ***Awareness*** of the application of electrolysis in everyday life.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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 solutions.	• 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. 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.	• ***Classifying*** electrolytes and non electrolytes • ***Formatting a hypothesis*** about the products at the electrodes during electrolysis.	• ***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	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.9.2.5 Describe the industrial applications of electrolysis. 12.9.2.6 Calculate the quantity of electrolytic products.	• Applications of electrolysis: Such as extraction of aluminium from its oxide, copper refinery and electroplating. • The quantity of electrolytic products: Using Faradays laws	• ***Communicating*** the industrial application of electrolysis. • ***Calculating*** the quantities of electrolytic products.	• ***Awareness*** of the application of electrolysis in everyday life. • ***Applying*** safety rules when experimenting. ***Participating*** actively in group work.
	12.9.3 Simple cells (chemical cell)	12.9.3.1 Describe what a chemical cell is 12.9.3.2 Compare electrolytic cells and simple cells	• A chemical cell: Two different metals connected together and dipped in an electrolyte to produce electricity. • 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.	• ***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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.10 METALS	12.10.1 General properties of a metals	12.10.1.1 Describe diagrammatic representations of pure metals 12.10.1.2 Describe the physical properties of metal 12.10.1.3 Describe the chemical properties of metals	• Similar nuclei positive ions in a 'sea' of delocalised electrons. • Similar In terms of density, melting points, boiling points, appearance • All metals are electropositive as illustrated in the reaction with air, water / steam, dilute non- oxidizing acids, aqueous solutions of other metal ions.	• ***Identifying*** properties of metals.	• ***Appreciating*** metals
	12.10.2 Reactivity and Electro Chemical Series	12.10.2.1 Describe 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.	• ***Awareness*** of methods of extracting metals and dangers some metals pose.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.10.2.2. Explain the apparent non reactivity of aluminium. 12.10.2.3 Demonstrate an order of reactivity.	• Due to the presence of adhesive oxide/coat. Reactivity of aluminium due to adhesive coat • From a set of experimental results Such as reduction of oxides of metals by other metals.	• ***Demonstrating*** reactivity of aluminium and order of reactivity	• ***Appreciating*** of aluminium
		12.10.2.4 Describe the effects of heat on 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.	• ***Demonstrating*** effects of heat on salts	• ***Asking*** questions to learn more • ***Awareness*** of the heat on salts • ***Fostering*** team work

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.10.2.5 Describe the extraction of copper, iron 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.	• Chemical reduction. Chemical reducing agents being Carbon, carbon monoxide, and hydrogen. • Such as electrical wires, construction, aircraft parts. • Such as lead poisoning (brain damaging), sodium ions in raising high blood pressure, alzehermia by aluminium	• ***Comparing*** methods of extracting metals.	• ***Asking*** questions to learn more • ***Awareness*** of the importance of metals • ***Fostering*** team work
	12.10.3 Alloys	12.10.3.1Describe alloys. 12.10.3.2Describe diagrammatic representations of alloys.	• As mixture of two or metals/carbon such as steel, brass, bronze • Different nuclei positive ions in a 'sea' of delocalised electrons	• ***Identifying*** characteristics of alloys • ***Comparing*** structures of alloys and pure metals.	• ***Appreciating*** alloys.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.10.3.3 Explain the advantages of using alloys over pure metals. 12.10.3.4 Identify common uses of alloys	• Such as alloys exhibiting better properties compared to a pure metal (conductor, strength, weight ratio, hardness). • Such as cutlery, food packaging, aircraft.	• ***Identifying*** characteristics of alloys • ***Comparing*** structures of alloys and pure metals.	• ***Appreciating*** alloys.
	12.10.4 Corrosion	12.10.4.1 Describe corrosion 12.10.4.2 Relate corrosion to the reactivity of metals. 12.10.4.3 Describe different methods of preventing corrosion.	• As chemical wearing of metals resulting from attack by atmospheric oxygen in presence of moisture. • As more reactive metals easily corrode while less reactive metals do not easily corrode. • Such as sacrificial protection, painting, greasing/oiling, alloying and galvanising.	• ***Identifying*** corrosion. • ***Applying*** methods of reducing corrosion. • ***Relating*** sacrificial protection methods to reactivity series.	• ***Appreciating*** ways of minimizing corrosion.

TOPIC	SUB TOPIC	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.	• In terms of density, melting points, boiling points, oxidizing agent (electronegative elements)	• ***Identifying*** the physical and chemical properties of non-metals	• ***Appreciating*** 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 12.11.2.3 Describe industrial manufacture of 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. • In terms of colour, **o**dour, **d**ensity/"**w**eight", **s**olubility and chemical (effect on **l**itmus, **i**nflammability, combustion)(COWSLIPS) • By cracking, electrolysis of water (brine) and from natural gas	• ***Demonstrating*** laboratory preparation of hydrogen.	• ***Appreciating*** physical and chemical properties of hydrogen and its uses.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.2.4 Describe the uses of hydrogen.	• Such as reducing agent, fuel for rockets, manufacturing ammonia and margarine, balloons filler, welding.	• ***Communicating*** the uses of hydrogen	• ***Appreciating*** physical and chemical properties of hydrogen and its uses.
	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 chemical properties of oxygen. 12.11.3.3 Describe the industrial manufacture of oxygen.	• By catalytic decomposition of hydrogen peroxide and thermal catalytic decomposition of potassium chlorate, collected above water and re-lights the glowing splint • Such as colour, odour, solubility ,combustion • By fractional distillation of liquid air	• ***Demonstrating*** laboratory preparation of oxygen. • ***Observing*** the reaction. • ***Communicating*** the uses of oxygen	• ***Appreciating*** physical and chemical properties of oxygen and its uses.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.3.4 Describe the uses of hydrogen.	• Such as reducing agent, fuel for rockets, manufacturing ammonia and margarine, balloons filler, welding.	• ***Communicating*** the uses of hydrogen	• ***Appreciating*** physical and chemical properties of hydrogen and its uses.
	12.11.4. Oxygen	12.11.4.1 Demonstrate the laboratory preparation, collection and test for oxygen. 12.11.4.2 Describe the physical and chemical properties of oxygen. 12.11.4.3 Describe the industrial manufacture of oxygen.	• By catalytic decomposition of hydrogen peroxide and thermal catalytic decomposition of potassium chlorate, collected above water and re-lights the glowing splint • Such as colour, odour, solubility ,combustion • By fractional distillation of liquid air	• ***Demonstrating*** laboratory preparation of oxygen. • ***Observing*** the reaction. • ***Communicating*** the uses of oxygen	• ***Appreciating*** physical and chemical properties of oxygen and its uses.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.4.4 Describe the uses of oxygen in industry and in natural processes. 12.11.4.5Explain the importance of ozone layer and dangers of its depletion.	• Such as burning, welding, in blast furnace and respiration • It traps radiation, if depleted by CFCs causes skin cancer, respiratory diseases	• ***Communicating*** the uses of oxygen	• ***Appreciating*** uses of oxygen .
		12.11.4.6 Demonstrate the chemical test for water. 12.11.4.7 Describe the importance of water	• Using white anhydrous copper (II) sulphate which turns blue. • For laundry, drinking, as solvent.	• ***Demonstrating*** the chemical testing of water • ***Communicating*** the importance	• ***Appreciating*** importance of water

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.11.5 Nitrogen	12.11.5.1 Describe industrial manufacture of nitrogen. 12.11.5.2 Explain the characteristics and importance of Nitrogen as a gas.	• By fractional distillation of liquid air • As non- reactive insoluble gas hence used as refrigerant, food packaging. Manufacture of ammonia gas.	• ***Demonstrating*** laboratory preparation of ammonia. • ***Observing*** colour changes.	• ***Appreciating*** physical and chemical properties of nitrogen and ammonia and their uses.
		12.11.5.3 Demonstrate the preparation collection and test for ammonia in the laboratory 12.11.5.4 Describe the manufacture of ammonia.	• Action of a base on ammonium salt and collected by upward delivery method, turns damp red litmus paper blue. • Haber Process (Temperature, catalyst, pressure (Haber process).	• ***Demonstrating*** laboratory preparation of ammonia. • ***Observing*** colour changes.	• ***Appreciating*** physical and chemical properties of nitrogen and ammonia and their uses.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.5.5 Describe the physical and chemical properties of ammonia. 12.11.5.6 Describe the thermal dissociation of ammonium salts.	• In terms of **c**olour, **o**dour, **d**ensity/"**w**eight", **s**olubility and as reducing agent, a base/alkali, a complexing reagent. • Such as ammonium chloride, ammonium nitrate, ammonium carbonate.	• ***Demonstrating*** laboratory preparation of ammonia. • ***Observing*** colour changes.	• ***Appreciating*** physical and chemical properties of nitrogen and ammonia and their uses.
		12.11.5.7 Describe the uses ammonia 12.11.5.8 Describe the manufacture of nitric acid 12.11.5.9 Explain the importance of nitrogenous fertilizers 12.11.5.10 Describe the effects of nitrogenous fertilisers on the environment	• In manufacture of fertilisers, explosives, nitric acid • by Ostwald Process • Nitrogen for growth. Include Phosphorous for root development and potassium for seed formation (NPK). • Such as eutrophication and acidic soils		

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.11.6. Chlorine	12.11.6.1 Demonstrate the laboratory preparation, collection and test for chlorine gas. 12.11.6.2 Describe the physical and chemical properties of chlorine gas	• 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.	• ***Experimenting*** the laboratory preparation of chlorine. • ***Observing*** colour changes during the preparation of chloride. • ***Investigating*** the physical and chemical properties of chloride gas.	• ***Awareness*** of physical and chemical properties of chlorine and its uses. • ***Applying*** safety rules during experiments
		12.11.6.3 Describe the uses of chlorine. 12.11.6.4 Describe the industrial manufacture of chlorine.	• Uses of chlorine For sterilizing water, manufacture of PVC, HCl and in bleaching agents. • Manufacture of chlorine: By the electrolysis of brine ($NaCl_{(aq)}$)	• ***Communicating*** uses and industrial manufacture of chlorine	• ***Awareness*** of physical and chemical properties of chlorine and its uses.

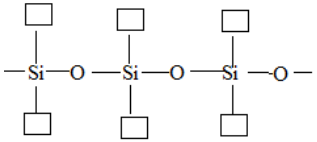
TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.6.5 Demonstrate the method for preparation, collection and test for hydrogen chloride gas 12.11.6. 6 Describe the physical and chemical properties of hydrogen chloride gas	• Preparation of hydrogen chloride: By action of concentrated sulphuric acid on solid metallic chlorides, collected by downward delivery method, react with ammonia to form white smoke. • In terms colour, odour, density, solubility and poisonous. Reactions with ammonia and water	• ***Experimenting*** the preparation of hydrogen chloride gas. • ***Investigating*** the physical and chemical properties of hydrogen chloride gas.	• ***Awareness*** of physical and chemical properties of hydrogen chloride and its uses. • ***Applying*** safety rules during experiments
		12.11.6. 7 Demonstrate the method for preparation of hydrochloric acid. 12.11.6.8 Describe the reactions of dilute hydrochloric acid.	• By dissolving hydrogen chloride gas in water • Such as reaction with alkalis, metals, carbonates, ammonia and silver nitrate.	• ***Experimenting*** the preparation of hydrogen acid and its reactions.	• ***Applying*** safety rules during experiments

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.11.7 Sulphur	12.11.7.1 Describe the formation of sulphur dioxide. 12.11.7.2 Demonstrate the laboratory preparation, collection and test for sulphur dioxide	• 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).	• ***Experimenting*** laboratory preparation of sulphur dioxide • ***Observing*** colour changes during the preparation of sulphuur dioxide •	• ***Awareness*** of the physical and chemical properties of sulphur dioxide and its uses. • ***Applying*** safety rules when experimenting
		12.11.7.3 Describe the physical and chemical properties of sulphur dioxide	• The physical and chemical properties of sulphur dioxide: In terms of colour, odour, density, 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).	• ***Communicating*** information on properties of sulphur dioxide and its everyday life. • ***Investigating*** properties of sulphur dioxide	• ***Awareness*** of the physical and chemical properties of sulphur dioxide and its uses. • ***Applying*** safety rules when experimenting

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.7.4 Describe the uses of sulphur dioxide 12.11.7.5 Describe the industrial manufacture of sulphuric acid. 12.11.7.6 Describe the uses of sulphuric acid.	• 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, fertilisers	• ***Investigating*** uses of sulphur dioxide • ***Communicating*** the industrial manufacture of sulphuric acid	• ***Awareness*** of the physical and chemical properties of sulphur dioxide and its uses. • ***Applying*** safety rules when experimenting
	12.11.8 Carbon and carbonates	12.11.8.1 Describe allotropes 12.11.8.2 Describe the physical properties of the allotropes of carbon.	• As different forms of an element existing in the same physical state. • In terms crystalline and non-crystalline allotropes of carbon.	• ***Investigating*** properties of allotropes of carbon	

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.8.3 Describe the 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.	• ***Demonstrating*** laboratory preparation of carbon dioxide. • ***Observing*** colour changes.	• ***Appreciating*** physical and chemical properties of carbon dioxide and limestone and their uses.
		12.11.8.4 Demonstrate the laboratory preparation, collection and the test for carbon dioxide.	• By reaction of dilute acids with carbonates or bicarbonates, collected by downward delivery method/ above water, forms white precipitate with limewater.		

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.8.4 Describe the physical and chemical properties of carbon dioxide. 12.11.8.5 Describe the uses of carbon dioxide.	• In terms of colour, odour, density, solubility. Reactions with limewater/alkalis, water and carbon. • Such as in fire extinguishers, carbonated drinks, dry ice, baking, photosynthesis	• ***Demonstrating*** laboratory preparation of carbon dioxide. • ***Observing*** colour changes.	• ***Awareness*** of Global warming • ***Appreciating*** physical and chemical properties of carbon dioxide and limestone and their uses.
		12.11.8.6 Describe the manufacture of lime from limestone.	• By thermal dissociation of limestone		
		12.11.8.7 Describe the uses of lime and slaked lime.	• Such as in neutralizing acidic soils, lime as a drying agent for ammonia.		
		12.11.8.8 Describe the uses of limestone.	• Such as in manufacturing of lime, cement, glass, iron.		
		12.11.8.9 Describe the greenhouse effect	• As global warming due to increase of carbon dioxide in the atmosphere		

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.11.9 Silicon	12.11.9.1 Describe the properties of silicon. 12.11.9.2 Describe the use of silicon. 12.11.9.3 Describe what silicones are.	• The properties of silicon: As a metalloid • Use of silicon: Used in semi-conductors Such as transistors, diodes and capacitors. • Silicones: As macromolecules that exist as oils, waxes or plastics and their structures represented 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.
		12.11.9.4 Compare the fire resistance of silicone plastics to carbon based macromolecules	• The nature of silicones: With reference to nature of combustion products, silicones produce silicon dioxide (sand) while organic based macromolecules produce carbon dioxide.	• ***Comparing*** fire resistance of silicone to carbon based molecules	• ***Awareness*** of the use of silicon in everyday life. ***Cooperating*** in group work.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.9.5 Describe the uses of silicon dioxide (sand)	• Uses of silicon dioxide: Such as in making glass, as fire extinguisher, in iron extraction.	• ***Communicating*** the uses of silicon dioxide(sand)	• ***Awareness*** of the use of silicon in everyday life. • ***Cooperating*** in group work.
12.12 ORGANIC CHEMISTRY	12.12.1 Saturated and unsaturated Hydrocarbons	12.12.1.1 Describe an organic compound. 12.12.1.2 Describe hydrocarbon 12.12.1.3 Illustrate and name the structures of the aliphatic alkanes up to five carbon atoms.	• As a compound of carbon other than oxides and carbonates • As a binary compound of carbon and hydrogen. • Involve concept of catenation (Chain), use the general formula C_nH_{2n+2}, Named by IUPAC system, all should end with *ane*, Involve concept of catenation (Chain), use the general formula C_nH_{2n+2}, Named by IUPAC system, all should end with *ane*,	• ***Identifying*** alkanes and alkenes. • ***Comparing*** properties of alkanes and alkenes	• ***Appreciating*** economic values of alkanes and alkenes. • ***Awareness*** of organic compounds.

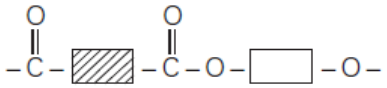
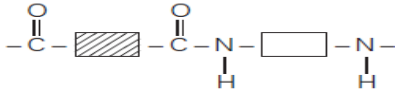
TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.12.1.4Demonstrate the structures of isomers and their names. 12.12.1.5 Describe fractional distillation of petroleum (crude oil) 12.12.1.6Describe the uses of the fractions of crude oil 12.12.1.7 Describe the chemical properties 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 unsaturation in alkenes.	• Use idea of branched (side chains) and unbranched butane and pentane and nomenclature follows IUPAC system. • As different fractions of crude oil collected at different boiling temperatures. • Such as domestic fuel, road construction. NB: leaded fuel is no longer recommended due to harmful effects • Such as combustion, cracking, substitution, steam reforming. • Lack of a specific site of chemical attack (functional group) and they are saturated. • Using the concept of catenation and models	• ***Identifying*** alkanes and alkenes. • ***Comparing*** properties of alkanes and alkenes • ***Observing*** colour changes.	• ***Appreciating*** economic values of alkanes and alkenes. • ***Awareness*** of organic compounds. • ***Identifying*** alkanes and alkenes. • ***Comparing*** properties of alkanes and alkenes • ***Observing*** colour changes.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.12.1.10 Describe and name the structures of the alkenes up to 5 carbon atoms. 12.12.1.11Demonstrate the structures of isomers of alkenes. 12.12.1.12 Describe the chemical properties of alkenes.	• Use the concept of catenation and 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.* • Using the unbranched structures of butene and pentene (positional isomers). • Such as combustion, addition reactions (hydrogenation, hydration, hydrohalogenation, halogenation, addition polymerisation).	• ***Identifying*** alkanes and alkenes. • ***Comparing*** properties of alkanes and alkenes • ***Observing*** colour changes.	• ***Appreciating*** economic values of alkanes and alkenes. • ***Awareness*** of organic compounds. •
		12.12.1.13 Illustrate the differences and similarities between saturated and unsaturated Hydrocarbons. 12.12.1.14Describe the chemical tests for unsaturated hydrocarbons (alkenes) 12.12.1.15 Describe the uses of alkenes.	• Using structures and bromine solution to distinguish between saturated and unsaturated hydrocarbons. • As alkenes decolourise bromine solution rapidly. • As in formation of polymers (Petrochemical industries)	• ***Identifying*** alkanes and alkenes. • ***Comparing*** properties of alkanes and alkenes • ***Observing*** colour changes	• ***Appreciating*** economic values of alkanes and alkenes. • ***Awareness*** of organic compounds.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.12.2 Alcohols (Alkanols)	12.12.2.1 Describe the chemical composition of an alcohol. 12.12.2.2 Describe and name structures of primary alcohols up to five carbon atoms.	• As an organic compound with a hydroxyl group with general formula $C_nH_{2n+1}OH$ • Using concept of catenation (Chain). Named following IUPAC nomenclature and all should end with- ***ol***).	• ***Identifying*** composition of alcohols ***Comparing*** structures of alcohols	• ***Appreciating*** economic values of alcohols. • ***Awareness*** of organic compounds.
		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 12.12.2.6Describe the uses of alcohols	• Using branched and unbranched and positional isomers of propanol, butanol and pentanol. • By hydration of alkenes, hydrolysis of esters and fermentation for ethanol. • Such as combustion, esterification, dehydration and oxidation • Uses such as fuel, antiseptic, organic solvent, alcoholic beverages	• ***Identifying*** uses of alcohols • ***Comparing*** properties of alcohols.	• ***Appreciating*** economic values of alcohols. • ***Awareness*** of organic compounds.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.12.3Carboxylic acids (alkanoic acids)	12.12.3.1 Describe and name structures of carboxylic acids up to five carbon atoms. 12.12.3.2 Describe the formation of carboxylic acids	• 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.*** • By the oxidation of alcohols and hydrolysis of esters	• ***Identifying*** structures of carboxylic acids.	• ***Appreciating*** the properties and economic uses of carboxylic acids.
		12.12.3.3 Demonstrate the chemical properties of carboxylic acids. 12.12.3.4Describe the uses of carboxylic acids	• Such as reaction with bases, carbonates, metals and alcohols (esterification). • Such as formation of esters.	• ***Demonstrating*** the chemical properties of carboxylic acids	• ***Appreciating*** the properties and economic uses of carboxylic acids.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.12.4 Esters (Alkanoates)	12.12.4.1 Describe and name the structures of esters up to five carbon atoms. 12.12.4.2 Describe the chemical properties of esters	• Using the concept of catenation (Chain), Organic compounds with an ester link  and all should end with –***oate*****.** • Such as combustion and hydrolysis.	• ***Identifying*** structures and characteristic properties of esters.	• ***Appreciating*** the properties and economic uses of esters.
		12.12.4.3Describe the uses of esters and relate the uses to properties.	• Such as in perfumes, food flavourants because of having pleasant smell.	• ***Describing*** the chemical properties of esters	***Appreciating*** the properties and economic uses of esters.
	12.12.5 Homologous series	12.12.5.1 Describe homologous series 12.12.5.2Describe the general characteristics of homologues (members).	• As a collection of organic compounds belonging to the same family with the same general formula (consider alkanes, alkenes, alcohols, acids, esters). • 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.	• ***Identifying*** different homologous series.	• ***Awareness*** of homologous series.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.12.6Macromolecules (Polymers)	12.12.6.1 Describe macromolecules (polymers) 12.12.6.2 Describe synthetic macromolecules. 12.12.6.3 Describe the formation of polyalkenes. 12.12.6.4 Classify plastics	• As giant molecules formed by combination of many small molecules (monomers). • As human made giant molecules (polymers). • By addition polymerisation E.g. polyethene, polyvinylchloride, polypropene, polystyrene. • As thermoplastics and Thermosets	• ***Classifying*** macromolecules • ***Identifying*** linkages in different macromolecules	• ***Awareness*** of polymers. • ***Appreciating*** economic use of polymers.
		12.12.6.5 Describe the formation of nylon and Terylene.	• By condensation polymerisation, Nylon: from a diamine and dioic acid structures represented as: **Terylene**  **Nylon** 	• ***Classifying*** macromolecules • ***Identifying*** linkages in different macromolecules	• ***Awareness*** of polymers. • ***Appreciating*** economic use of polymers.

TOPIC	SUB TOPIC	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.	• Terylene: from diol and dioic acid. Structures represented as: Nylon as polyamide and Terylene as polyester. • Plastics used as in carrier bags, buckets, pipes Nylon and terylene as in clothing, tents, strings, ropes.	• ***Classifying*** macromolecules • ***Identifying*** linkages in different macromolecules	• ***Awareness*** of polymers. • ***Appreciating*** economic use of polymers.
		12.12.6.8 Describe the biodegradability of synthetic fibres. 12.12.6.9Describe natural macromolecules	• As non-biodegradable (cannot be broken down by microorganisms) • Such as Carbohydrates, proteins and fats (lipids).	• ***Classifying*** macromolecules • ***Identifying*** linkages in different macromolecules	• ***Awareness*** of polymers. • ***Appreciating*** economic use of polymers.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.12.6.10Describe composition of carbohydrates 12.12.4.11 Identify linkages in starch, proteins and fats 12.12.4.12 Relate linkages in synthetic and natural polymers.	• Carbohydrates contain carbon, hydrogen and oxygen in the form $C_xH_{2y}O_y$ where x is a multiple of six. • In starch – glycosidic, Proteins – amide, fats – ester linkages • Such as difference and similarities between nylon and proteins. Terylene and fats.	• ***Classifying*** macromolecules • ***Identifying*** linkages in different macromolecules	• ***Awareness*** of polymers. • ***Appreciating*** economic use of polymers
		12.12.4.13 Describe hydrolysis of fats (saponification). 12.12.4.14Identify the products of the hydrolysis of starch and proteins.	• As formation of soaps and glycerine (glycerol). . • Using chromatography to identify the amino acids from proteins, simple sugars from starch.	• ***Classifying*** macromolecules • ***Identifying*** linkages in different macromolecules	• ***Awareness*** of polymers. • ***Appreciating*** economic use of polymers

CHEMISTRY PRACTICAL DATA

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 CHART

Topic	Grade 10		Grade 11		Grade 12
Introduction to Chemistry	**SUBTOPIC**	**Acids, Bases and Salts**	**SUBTOPIC**	**Chemistry and Electricity**	**SUBTOPIC**
	10.1.1 Introduction to Chemistry		11.5.1 Characteristic properties of acids and bases		12.9.1.Conductors
The Particulate nature of matter	10.2.1 Matter and the Kinetic theory		11.5.2 Preparation of salts	**Metals**	12.10.1 General properties of a metals
	10.2.2 Diffusion	**The mole concept**	11.6.3 Types of oxides		12.10.2 Reactivity and Electro Chemical Series
Experimental Techniques	10.3.1 Measuring of quantities		11.6.4 Identification of ions and gases (Qualitative analysis)		12.10.4 Corrosion
	10.3.2 Criteria of purity		11.6.1 Relative masses		12.10.5 Thermal stability of the compounds
	10.3.3Separatingmixtures		11.6.2 The mole	**Non Metals**	12.11.1 General properties of non-metals.
Atoms, elements, molecules and compounds	10.4.1Atomic structure and Periodic Table		11.6.3 Empirical and Molecular formulae		12.11.2. Hydrogen
	10.4.2 Bonding	**Chemical reactions and energy**	11.7.1 Rates of chemical reactions		12.11.3. Oxygen

Topic	Grade 10		Grade 11		Grade 12
		changes			
	10.4.4 Macromolecules		11.7.2. Chemical equilibrium		12.11.4 Nitrogen
	10.4.5 Chemical formulae and equations		11.7.3 Redox reactions		12.11.5. Chlorine
			11.7.4Energetics of reactions		12.11.6 Sulphur
		The Periodic Table	11.8.1 Group and the periodic trends		12.11.7 Carbon and carbonates
			11.8.2 Group properties	**Organic Chemistry**	12.12.1 Saturated and unsaturated Hydrocarbons