Introduction

This Chemistry Teaching Syllabus is meant to aid teachers handling Chemistry at Uganda Advanced Certificate of Education (UACE). It is designed to build on and also taken to include the Chemistry Syllabus at Uganda Certificate of Education (UCE). Knowledge beyond that required for U. C. E. is not expected unless specifically mentioned in topics in the U. A. C. E. syllabus. The syllabus is divided into three broad areas. Each unit is divided into several topics which are arranged in a sequence that presents terms, concepts and procedures which should be learned before those that build on, extend or apply the knowledge gained.

Purpose of the Teaching Syllabus

This teaching syllabus will enable teachers cover the syllabus content adequately up to appropriate depth at each level of study. The design of this syllabus is to emphasize the teaching approaches to be used for each sub-topic from among the general approaches given by the syllabus to achieve the general objectives of the syllabus. The periods allocated should also guide teachers to make effective plans so that they can complete the syllabus within the recommended period. The recommended methods must all be based on experiments and experimental-investigative approaches where students can participate individually or in groups.

Broad Aims of Education in Uganda

1. To promote understanding and appreciation of the value of national unity, patriotism and cultural heritage, with due consideration of internal relations and beneficial inter-dependence.
2. To inculcate moral, ethical and spiritual values in the individual and to develop self-discipline, integrity, tolerance and human fellowship.
3. To inculcate a sense of service, duty and leadership for participation in civic, social and national affairs through group activities in educational institutions and the community.
4. To promote scientific, technical and cultural knowledge, skills and attitudes needed to promote development.
5. To eradicate illiteracy and to equip the individual with basic skills and knowledge to exploit the environment for self-development as well as national development, for better health, nutrition and family life and the capability for continued learning.
6. To contribute to the building of an integrated, self-sustaining and independent national economy.

Aims and Objectives of Secondary Education in Uganda

1. Instilling and promoting national unity and an understanding of social and civic responsibilities.
2. Promoting an appreciation and understanding of the cultural heritage of Uganda including languages.
3. Imparting and promoting a sense of self-discipline, ethical and spiritual values, personal responsibility and initiative.
4. Enabling individuals to acquire and develop knowledge and an understanding of emerging needs of society and the economy.
5. Provide up-to-date and comprehensive knowledge in theoretical and practical aspects of innovative production, modern management methods in the field of commerce and industry and their application in the context of socio-economic development of Uganda.
6. Enabling individuals to develop basic scientific, technological, agricultural, and commercial skills required for self-development.
7. Enabling individuals to develop personal skills of problem-solving, information, gathering and interpretation, independent reading and writing, self improvement through learning and development of social, physical and leadership skills such as are obtained through games, sports, societies and clubs.
8. Laying the foundation for further education.
9. Enabling the individual to apply acquired skills in solving problems of the community.
10. Instilling positive attitudes towards productive work.

Aims of Teaching Chemistry

1. Enabling the learners to know
   (i) the basic principles and concepts of Chemistry
   (ii) how theories and models are used to explain concepts in Chemistry
   (iii) the resources available to facilitate discovery about unfamiliar principles and concepts in Chemistry
   (iv) the use of knowledge of the principles and concepts of Chemistry in everyday life situations.

2. Making the learners aware of the effects of scientific discoveries and knowledge on everyday life through some applications of Chemistry

3. Enabling learners to
   (i) develop an experimental attitude by performing experiments in schools
   (ii) familiarise themselves with scientific methods.
   (iii) develop the necessary skills to design and carry out practical investigations based on the knowledge of Chemistry.

4. Preparing the learners for further studies in Chemistry and related fields

5. Enabling the learners to appreciate the applicability of Chemistry in other disciplines

6. Enabling the learners to develop
   (i) an initiative for inventiveness
   (ii) skills for practical investigation and exploration
   (iii) capacity to design models and analytical schemes for use in problem solving schemes

General Objectives

The learners should be able to
1. Recognise problems that can be dealt with using methods, concepts, principles, models and theories of Chemistry
2. Recognise the use of, and manipulate apparatus and equipment common in a Chemistry laboratory
3. Design and carry out practical investigations and experiments, describe and explain the procedures used as well as their effectiveness and their limitations
4. Handle all practical work with the accuracy required to obtain the desired results
5. Define terms related to various concepts in Chemistry and explain their relationship to materials and phenomena in the environment
6. Discuss the use and effectiveness of theories or models in explaining physical phenomena as well as events in the laboratory and in the environment

Target

This teaching syllabus is aimed at enriching the teaching strategies employed by teachers of Chemistry in schools.

Scope and Depth

The syllabus has been divided into four broad units, namely
1. Physical Chemistry
2. Inorganic Chemistry
3. Organic Chemistry
4. Applied Chemistry

Teaching Sequence

SENIOR FIVE

Section	Topic	Number of Periods
1. Physical Chemistry (60periods) 2. Inorganic Chemistry (26 periods) 3. Organic Chemistry (60 periods) 4. Applied Chemistry	1.Matter	20
	2. Atomic Structure and Periodic Table	12
	3. Structure and Bonding	14
	4. Thermochemistry(Chemical Energetics (Thermochemistry)	14
	2.1 Oxidation numbers	8
	2.2 Comparative study of physical and chemical properties of elements within groups and periods	12
	2.3 Period 3 (third short Period). Manufacture of ammonia (NH_3), Nitric acid (HNO_3), sulphuric acid (H_2SO_4), fertilizers, cement production should be treated here as applied chemistry.	6
	3.1 Carbon skeleton and organic functional groups i.e. chains and rings. Homologous series, Isomerism.	10
	3.2 Functional reactions	8
	3.3 Homologous series properties (i.e. alkanes, alkenes, alkynes, benzene). NB: Oil refining, distillation and cracking should be treated straight under alkanes)	22
	3.4 Halogen compounds	10
	3.5 Alcohols (fermentation should be treated here as applied chemistry).	10
	4.1 Manufacture of ammonia (NH_3), Nitric acid (HNO_3), sulphuric acid (H_2SO_4), fertilizers, cement	14
		10
		8

SENOIR SIX

Section	Topic	Number of periods
5. Physical Chemistry (60 periods)	5.1 Physical and Chemical equilibria	30
	5.2 Chemical kinetics	10
	5.3 Electrochemistry	20
6. Inorganic Chemistry (60 periods)	6.1 The groups: II, IV and VII (groups I and VI can also qualitative treated). Electrolytic production of Cl, NaOH to be treated under group VII, and utilisation of natural salt deposits e.g. NaCl, NaOH, Na_2CO_3 to be treated here too.	40
	6.2 Transition series (i.e. first of d-block elements)	20
7. Organic Chemistry (60 periods)	7.1 Phenols	10
	7.2 Carbonyl compounds	8
	7.3 Carboxylic acids and derivatives (soap and detergent production to be treated here)	12
	7.4 Nitro-compounds (manufacture of dyes to be treated here)	20
	7.5 Polymers	10
8. Applied Chemistry(periods)	8.1 Soap and detergent production, manufacture of dyes, production of Chlorine, Sodium hydroxide.	

Practicals

The practical skills will be derived from any of the branches of chemistry. It will cover the following areas:

i) Introduction

ii) Acid-base titrations i.e.

- Strong acid-strong base titrations (revision of O-level practical of titration i.e. standardisation)
- Dilution factors (acid-base titration)

- Back titration
- Double indicators

iii) Redox titration
- Introduction: balancing redox equations
- Permanganate titrations
- Thiosulphate titrations
- Iodometry and idiometry

iv) Kinetics
v) Determination of partition coefficient
vi) Colligative properties
vii) Precipitation reactions
viii) Thermometric titrations
ix) Qualitative analysis
- Inorganic (identification of anions and cations)
- Organic (identification of functional groups and nature of organic compounds)

Time Allocation

The allocation of periods for each topic and for each term assumes that there will be nine (09) weeks of effective teaching available per term for two years except for the first term of senior five and the third term of senior six. It is also recommended that there will be six (6) periods, each of 40 minutes of teaching per week for Chemistry theory and three (3) periods of laboratory practical work on the school timetable.

How to Use the Syllabus

The Chemistry Teaching Syllabus is aimed at providing the teacher with guidance required to teach Chemistry at advanced level classes. It is not meant to substitute the creativity of the classroom teacher. The Chemistry Teaching Syllabus has the following features:

a) Learning Objectives(s)
This is a statement of the general learning outcome expected of a learner at the end of the topic.

b) Objectives
These clarify the content and scope. The teacher should use the competences to plan the teaching strategies suitable for the lesson. Competences also guide in evaluation at the end of the learning process.

c) Content

Items in the content column have been simply listed but should be handled together with the specific objectives and the notes on the topic.

d) Teaching/learning strategies

These provide the teacher with guidance, for example, of suitable methodology, experiments and strategies which the teacher may employ.

e) Notes

These further clarify the scope and depth.

f) Number of periods per topic

The number of periods suggested for each topic is only to be used as a guide to enable the teacher cover the work adequately.

Assessment

Continuous assessment

It is recommended that the teacher carries out continuous assessment basing on each topic. The questions in the assessment should reflect acquisition of the following testable competences:

a) **Knowledge**

(i)	Knowledge of terminology.
(ii)	Knowledge of specific facts.
(iii)	Familiarity with experiments suggested in the syllabus.
(iv)	Knowledge of common principles and generalization identified in the syllabus.

b) **Comprehension**

Ability to:

(i)	Explain standard phenomena from laws and models and to describe standard experiments met with before.
(ii)	Translate between various forms of information presentation.
(iii)	Use standard methods to solve familiar numerical types of problems.
(iv)	Draw conclusion from experiments of a straight forward type.

c) **Application and higher abilities**

Ability to:

(i) Analyse presented information
(ii) Synthesis ideas from presented analyses and otherwise.
(iii) Apply laws and generalizations already learnt to new situations.
(iv) Devise experiments to test hypotheses and statements of models
(v) Exercise evaluative judgment on suitability and results of scientific procedures.

d) **Practical abilities**

The written tests will demand knowledge of, and familiarity with experiments in Chemistry relevant at this level. The practical component of the examination will further test acquisition of the following abilities:

(i) Application of knowledge to practical situations.
(ii) Manipulation of the apparatus and performing experiments.
(iii) Making and recording observations accurately.
(iv) Presentation of data in an appropriate form.
(v) Drawing conclusions from observations made.
(vi) Assessing suitability of procedure, experiment and observations made in support of the conclusion.

Valuable mathematical skills to be acquired by learners in the study of chemistry

The expected mathematical skills to be acquired by the learners include:

- Graphical ability to translate to graphical form and interpret graphical representation of data.
- Ability to perform simple operation of differentiation and integration.
- Familiarise with logarithmic functions to base ten and to base ***e.***
- Ability to visualise in three dimensions
- An understanding of elementary aspects of mathematical errors (i.e. ±).

Summative assessment

Uganda National Examinations Board (UNEB) will administer a Chemistry (Principal Subject) examination at the end of the second year of study.

Examination Format

There will be **three** papers:

Paper 1 (2 ¾ hours)
The paper will consist of two sections: A and B. Seventeen questions will be set as follows:
Section A. 9 questions from any part of the syllabus
Section B. 8 questions from any part of the syllabus

Candidates will be required to attempt a total of fifteen questions including all questions in Section A (46 marks) and 6(54 marks) questions from Section B. candidates will be expected to write the answers in the spaces provided on the question paper.

Paper 2 (2 ½ hours)
The paper will consist of two sections: A and B. Eight questions will be set as follows:
Section A. Four questions from any part of the syllabus
Section B. Four questions from any part of the syllabus

Candidates will be required to attempt a total of five questions including three from Section A and not more than two from section B. Each question carries twenty marks. (Total: 100 marks)

Paper 3 (3 ¼ hours)
Three questions will be set. Candidates will be required to attempt the three questions.

N.B. SI units and SI nomenclature will be used in all question papers.

Detailed Teaching Syllabus for Advanced Level Chemistry

SECTION A: PHYSICAL CHEMISTRY

SENIOR FIVE **TERM I**

TOPIC 1: MATTER (Atoms, Molecules, Ions)

General Learning Objectives: By the end of this topic the learner should be able to appreciate the particulate nature of matter and use the knowledge in qualitative and quantitative applications.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
06	**1.1: Atoms, molecules and Ions**	The learner should be able to: • Explain concept of matter. • Identify sub-atomic particles • Describe properties of sub-atomic particles. • Explain the fundamental particles of the atom. • Write isotopic notation	▶ **The structure of atom** • What is matter? • Atoms, molecules and ions as building blocks of matter ▶ **Sub-atomic Particles and Isotopic Notation** • Fundamental particles of the atom: electron, proton and neutron • The nucleus • Proton number (Z), nucleon number (A) • Isotopes • Isotopic notation • Ions and ion formation	• Discussions • Teacher demonstrations • Use of models • Computer Simulations of the structure of atoms.	• Discuss diffusion, Brownian motion at this point. • Proton numbers and nucleon (Mass) numbers are always whole numbers because they represent the number of protons in the nucleus of the atom, and number of neutrons and protons • Atomic mass of an isotope is not a whole number, with exception of carbon-12.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
02		The learner should be able to: - • Use proper nomenclature, assign correct and unambiguous name to every chemical compound.	▶ **IUPAC nomenclature for cations, anions and salts** • Naming monatomic ions – cations, anions • Naming ionic compounds – made of two elements (binary), stock system (systemic name), common nomenclature system, the selection of correct Roman numeral, writing the formula of an ionic compound.	• Use models • Discussions • Brainstorming	
04		• Describe the essential parts and operation of the modern Mass Spectrometer. • State the uses of the mass spectrometer. • Interpret the mass spectrum obtained from the results of a mass spectrometer analysis. • Demonstrate the ability to correctly the data obtained from the mass spectrometer in calculations.	▶ **Mass spectrometer and atomic mass** • The essential components of a modern mass spectrometer • Operation of the mass spectrometer • The relative abundance • The use of mass spectrum • Average atomic mass $= \frac{\sum f_i m_i}{\sum f_i}$ • Relative atomic mass $A_r = \frac{average\ mass\ of\ atom}{\frac{1}{12} \times mass\ of\ atom\ {}^{12}C}$ • Relative Molecular Mass (M_r) $= \frac{mass\ of\ one\ the\ compound\ molecule\ of}{\frac{1}{12} \times mass\ of\ one\ atom\ {}^{12}C}$	• Model of Mass Spectrometer • Computer Simulation of the operations of mass spectrometer. • Discussions • Study trips	• The modern mass spectrometer only detects positively charged ions. • Relative atomic mass has no units. • In calculations involving proportions of the isotopes, they must all make up 100% or 1.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
02	**1.2: Mole Concept**	The learner should be able to: • Explain the mole as a unit of measurement using Avogadro constant • Calculate molar masses of elements and compounds. • Apply the conversion factors in calculations	▶ **The Mole Concept and Avogadro constant** • What the mole is Avogadro constant • Moles atoms of elements in one of a compound • Molar mass of elements • Molar mass of compounds • Calculating numbers of atom, moles and mass by using conversion factors.	• Teacher guided discussion • Brain storming	• To be treated as a review of O, level work. • Calculations to be done based on first principles
04	**1.3: Measurement of Concentration and introduction to volumetric analysis**	The learner should be able to: • Use apparatus appropriately • Select appropriate apparatus • Abide by the laboratory safety rules when handling chemicals and apparatus • Explain the concept of concentration in terms of amount of the substance (solid or liquid) dissolved in a solvent. • Interpret v/v; w/w percentages. • Differentiate between molality and molarity. • Carry out calculations involving concentration.	▶ **Handling of apparatus and chemicals** • Techniques of handling apparatus and chemicals ▶ **Concentration** • Explain the concept of concentration. • Percentage by mass, %w/w $= \frac{\text{mass of solute (g)}}{\text{mass of solution (g)}} \times 100\%$ • Percentage by volume, %V/V $= \frac{\text{volume of solute (mL)}}{\text{volume of solution (mL)}} \times 100\%$ • Molarity, M ($molL^{-1}$ or $moldm^{-3}$) $= \frac{\text{moles of solute (mol)}}{\text{volume of solution (dm}^3\text{)}} \times 100\%$	• Teacher guided discussion • Brain storming • Class exercises • Practicals	• Mass of solute + mass of solvent = mass of solution • Stock solutions of common laboratory reagents or chemicals, e.g. H_2SO_4, HCl, NH_3 solution can be used. • volume of solvent + volume of solute ≈ Volume of solution.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• Prepare standard solutions from stock solutions.	• Preparation of standard solutions from stock solutions		
		• Explain the common terms used in volumetric analysis • Carry out acid-base titration	▶ **Volumetric analysis** • Concept of volumetric analysis • Acid-base titrations	• Teacher guided discussion • Brain storming • Class exercises • Practicals	
02	**1.4: Percentage composition by mass**	The learner should be able to: • Determine the percentage composition by mass of each element in a compound	▶ Percentage by mass of a particular element $= \frac{n \times \text{molar mass of element}}{\text{molar mass of compound}} \times 100\%$ n = number of atoms of element in the formula	• Class exercise	• Set questions on percentage composition of compounds by mass.
02	**1.5: Empirical formula and molecular formula**	The learner should be able to: • Explain concept of empirical formula and molecular formulae • Carry out calculations on empirical and molecular formulae. • Carry out experiment to determine empirical formula	▶ Empirical formula as the simplest formula that expresses the ratio in which each element is present in a given compound. • Determination of empirical formula. ▶ Molecular Formula as one the shows the number and kind of each element present in one molecule of the compound. Determining the Molecular Formula.	• Discussion • Demonstration	• Reduction of copper (II) oxide by ethanol vapour or butane gas could be used
	1.6: Oxidation–Reduction (Redox) Reactions)	The learner should be able to: • Explain concept of redox reactions	▶ Oxidation number (Oxidation state) • What oxidation state is • Rules for assigning oxidation number	• Discussions • Models • Demonstrations	• The characteristics include; change in oxidation number,

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• State the rules for assigning oxidation states. • Use correct nomenclature to name polyatomic ions and compounds • Explain the characteristics of oxidation and reduction reactions. • Write balanced redox equations.	• Naming of polyatomic ions and compounds. • The characteristics of Oxidation – Reduction Reactions ▶ Balancing redox Equations • In acidic medium • In alkaline medium		electron transfer and some time colour change • The teacher to put into account the different media(acidic, alkaline, neutral)
02	**Stoichiometry: Quantitative Relation in Reactions**	The learner should be able to: • Demonstrate knowledge of Stoichiometry by applying it in calculations. • Explain concept of limiting and excess reactants. • Calculate percentage yields from chemical reactions. • Experimentally demonstrate the concept of limiting and excess reactant • Explain the Avogadro's law • Apply the Avogadro' law in calculations • Explain Gay-Lussac's law	• What Stoichiometry is • Relating moles of reactants to moles of products • Limiting reactant – as that reactant which is completely used up in a chemical reaction and limits the quantities of products formed. • Excess reactant – as that reactant which remains after a chemical reaction • Percentage yield $= \left(\frac{actual\ yield}{theoretical\ yield}\right) \times 100$ • Avogadro's $V \propto n\ (n = number\ of\ moles\ of\ a\ gas)$ $V = ken$ • Gay- Lussac's law	• Teacher guided discussion • Brain storming • Class exercises • Practicals	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
02	**Redox Titrations**	Learners should be able to: • Differentiate between primary and secondary standard • Prepare standard solutions • Carry out redox titrations • Carry out calculations from first principles.	▶ Standard solution • Primary and secondary standard • Preparation of standard solutions of permanganate, thiosulphate solutions etc. • Standardise solutions • Carrying out different types of redox titrations.	• Class practical • Discussion	
02	**Physical states of matter**	Learners should be able to: • Explain the properties of different states of matter. • Describe the differences between the various states of matter in terms particle arrangement, forces of attraction and movement	▶ States of matter: Solid, Liquid and Gas. • Interconversion of the physical states • Comparison of physical properties between solids, liquids and gases. Kinetic theory of matter	• Discussion • Models • Computer simulations	
04	**Gas**	Learners should be able to: • Explain the gaseous state in terms of kinetic theory of matter. • Carry out calculations involving gaseous volumes, pressure and temperature. • Explain the concepts of different gas laws.	▶ General properties of gas • Ideal gas • Gas pressure • Pressure (P) = $\frac{\text{force}}{\text{area}}$ ▶ Gas laws: • Boyle's $V \propto \frac{1}{P}$ (at constant T and n) PV = k (where ***k*** is a constant)	• Discussion • Class exercises • Computer simulation	• Students to be reminded of the pressure expression in terms of force and area

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• Demonstrate knowledge of ideal gas behaviour using graphs • Derive the relationship between Charles's and Boyle's law(PV=nRT) • Explain mole fraction	• Charles's $V \propto T$ (at constant P and n) $\frac{V}{T} = \text{Constant}$ • Combined gas laws and ideal gas laws $\frac{PV}{T} = \text{Constant}$ • Ideal Gas Law $V \propto \frac{nT}{P}$ **PV = *n*RT** (where R is the molar gas constant) • Graham's law of gaseous diffusion. $\text{rate of difusion} \propto \frac{1}{\sqrt{\text{density}}}$ • Mole fraction, *x* $x = \frac{n_i}{n_{total}}$ • Dalton's Law of Partial Pressure $P_{Total} = P_1 + P_2 + P_3 + \ldots + P_n$	• Discussion • Class exercises • Computer simulation	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• Explain the molecular behaviour of gases in terms of the kinetic theory (qualitative treatment only required) • Use graphs to show deviation from ideal behaviour • Differentiate between ideal and real gases. • Explain the conditions under which real gases can behave like ideal gases.	▶ The molecular behaviour of gases • Kinetic molecular theory of gases • Relationship of the gas laws to Kinetic Molecular Theory of Gases • Maxwell-Boltzmann distribution ▶ Real Gases – Deviation From Ideality • What real gas is • Real gas behaviour under different conditions of temperature and pressure. • Correction of real gas behaviour by using van der Waals equation: $\left(P + \frac{n^2 a}{V^2}\right)(V - nb) = nRT$	• Discussions • Class exercises • Computer simulation	
02	**Liquid**	Learners should be able to: • Explain the liquid state in terms of kinetic theory of matter.	▶ Properties of Liquid • Compressibility • Viscosity • Surface tension • Diffusion • Vaporisation and condensation • Boiling ▶ Vapour Pressure • Intermolecular forces affecting Vapour Pressure. • Temperature affecting Vapour Pressure	• Discussions • Brainstorming • Computer simulations of the liquid state.	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
02	**Solid**	Learners should be able to: • Explain the solid state in terms of kinetic theory of matter. • Describe the changes in solid phase. • Describe the structures of different types of solids	▶ Phase changes in solids • Melting point • Freezing point • Sublimation • Deposition ▶ Types of solids • Giant Ionic solids (e.g. sodium chloride, caesium chloride, Zinc blend) • Giant covalent solids (e.g. diamond, graphite, silicon and fullerene. • Molecular covalent solids (e.g. iodine, I_2 and Phosphorus, P_4). • Giant metallic solids (e.g. iron, copper, titanium).	• Brainstorming • Discussions • Models • Computer simulations	• Learners are not expected to draw the structure of fullerene

Topic 2: Atomic Structure and Periodic Table

General Learning Objectives: By the end of this topic learners should be able to appreciate the structure of an atom and its relationship to the periodic table.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
04	**2.1 Fundamental Particles of the atom and radioactivity**	Learners should be able to: • Explain the development of the modern theory of the atom • Describe the discovery of the fundamental particles of the atom.	• Modern theory of atom (John Dalton, J. J. Thomson, and Ernest Rutherford) should be discussed. • Fundamental particles of the atom (Protons, Electrons and neutrons) • Discoveries and properties of the fundamental particles.		
		• Explain the concept of radioactivity • State the different types of radiations. • Compare the characteristics of the different types of radiations • Carry out simple calculations involving half-lives of radioisotopes. • Balance nuclear reaction equations • Differentiate between	▶ Radioactivity: • Discovery • properties of radiations, • radioisotopes • binding energy • nuclear reactions • radioactive decay • half-life($t_{½}$) • Nuclear energy (discovery, fission, fusion, nuclear power) • Applications of radioactivity.	• Use Computer simulations to show types of radiations. • Use Models • Study tours	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		nuclear and chemical reactions • Mention factors that determine stability of a nucleus • Correctly demonstrate knowledge of radioactive decay using graphs			
20	**2.2 Electronic Structure of Atoms**	Learners should be able to: • Explain the concept of spectrum • Describe different types of spectra. • Explain what spectrum is. • Describe the various types of spectrum. • Describe and explain the hydrogen spectrum.	▶ Electromagnetic radiation • Electromagnetic radiation as **quanta** • Relationship between wavelength, λ, frequency, ν, and energy, E. • $E \propto \nu$ $E = h\nu$ where h = Plank's constant, 6.6256×10^{-34} Js and $E = \frac{hc}{\lambda}$ ▶ Atomic Spectra • What is Spectrum? • Types of spectra (emission and absorption) • Hydrogen Spectrum and Application of Rydberg Equation	• Computer simulations • Models • Guided discussions on proposed model of hydrogen atom to explain the behaviour of matter. • Class exercises	• The electron orbits the nucleus in a circle • The quantum number, n • When electron exists in a fixed energy level surrounding the nucleus. • When electron absorbs energy, it moves to a higher orbit. • Energy is released as the electron falls back to a lower orbit. $\Delta E = E_{f-} E_i$ $\Delta E = R_H \left(\frac{1}{n_i^2} - \frac{1}{n_f^2}\right)$

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
	Electronic Structure of Atoms cont…	• Explain the significance of the lines in the hydrogen spectrum • State the importance of convergence limit. • Explain Bohr's atomic postulates. • Discuss the weaknesses of Bohr's atomic model • Explain concept of ionisation energies using atomic spectra. • Relate the line series to the energy levels • Calculate ionisation energies • Explain the dual nature of the electron. • Explain concept of various quantum numbers.	• Energy level diagram for hydrogen atom • Convergent limit ▶ The Bohr's Model of the Hydrogen Atom • Bohr's Atomic Postulate • The weaknesses of Bohr's Atomic Model ▶ Ionisation Energy of Hydrogen • What ionisation energy is? • Calculations involving ionisation energies ▶ **Dual Nature of Electron** • de Broglie postulates • $E = mc^2$ • Heisenberg's Uncertainty Principle	• Models • Computer simulations • Discussions • Brainstorming on how the single electron of hydrogen atom behaves on excitation and why it does not jump out of its orbit. • Class exercises	• Rydberg equation is used to calculate the energy of one electron only. For one mole of electrons emitted, one should multiply the value by Avogadro constant, N_A.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
	Electronic Structure of Atoms cont…	At the end of the topic the Learners should be able to:- • Apply Hund's rule, Pauli's exclusion and Aufbau principle in the writing of electronic configuration • Write electronic configurations in terms of the energy levels, **spdf**.	▶ **Quantum Mechanic model** • Energy levels • Principal quantum number, *n.* • Azimuthal quantum number (angular momentum quantum number), *l* • Magnetic quantum number, *m* • Electron spin quantum number, *s* ▶Electronic Configuration of Atom • ***Spdf** notation* • Orbital diagram • The Aufbau Principle • Hund's rule • Pauli exclusion principle		
20	**2.3 The Periodic Table (PT)**	Learners should be able to: • Describe the historical development of P.T • Explain the unique position of, H, in the periodic table • Explain the basis on which the modern PT was constructed • Place the elements of PT into Groups, Periods and Blocks.	▶ Historical Development of the periodic table • Unique position of Hydrogen, H, in the Periodic Table ▶The Modern Periodic table • Periods and Groups • Classification of the elements: based on electronic configuration of elements as: *s, p, d* and *f* blocks • Classification into metals, metalloids and non-metals ▶ Periodicity of properties in the periodic table	• Guided discussions on development of the Periodic Table. • Models • Computer simulations • Project work	• Noble gas, Representative elements, Transition elements and Inner transition elements

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
	The Periodic Table (PT) Cont...	• Explain the relationship between effective nuclear charge, nuclear charge and shielding effect. • Explain the meanings of the terms ; Atomic radius, Ionic radius, Ionization energy • Describe the trends of the atomic properties across and down the PT • Explain the trends of the atomic properties down and across the PT Correctly demonstrate knowledge of graphical representation and interpretation of data on the atomic properties	▶ Atomic properties • Factors affecting atomic properties of elements (Z = nuclear charge S = shielding effect ,Effective Nuclear Charge $Z_{eff} = Z - S$) • Atomic Radius:- Across Period (from left to right) and Down a group • Ionic Radius • Ionisation Energy - Variation of ionisation Energy (across a Period and Down a group) - Anomalous Cases (Be, B, N, O) - Use of Successive Ionisation Energy to Deduce the Electronic Configuration of elements. • Electron Affinity, EA • Electro negativity • Electro positivity • Valency • Metallic Character • Melting and Boiling Points	• Guided discussions on development of the Periodic Table. • Models • Computer simulations • Project work	• Effective nuclear charge should be clearly distinguished from nuclear charge • Factors affecting the atomic properties should be discussed. • Diagonal relationship not to be treated in details here.

Topic 3: Structure and Bonding

Learning objectives: by the end of this topic the learners should be able to appreciate bonding and molecular structure and their relationship to the properties of substances.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
20	**3.1 Chemical Bonding**	Learners should be able to: - • Explain the concept of chemical bonding • Explain the importance of the Octet rule in formation of ions and stability of compounds • Explain the formation of ionic bond • Explain the properties of ionic compounds • Explain covalency in ionic compounds • Explain the concept of a covalent bond • Distinguish between the different types of covalent bonding • Explain the formation of Dative bond •	▶ Introduction to chemical bonding ▶ Lewis Dot Symbols ▶ The Octet Rule and Ions ▶ Ion Formation and Octet Rule ▶ Ionic bond formation • Properties of Ionic Compounds • Covalence in ionic compounds ▶ Covalent Bond formation • Properties of covalent compounds • Types of bonding.(normal, polar, dative) • Covalent bond strength • Dative (Coordinate) Bonding	• Models • Discussion • Class exercise • Brain storming • Computer simulations	• Ions which do not obey the octet rule should be noted e.g. Zinc (II) ions, Tin(II) ions • Refer to Fajan rules

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• Explain the factors that determine covalent bond strength • Compare properties of ionic and covalent compounds • Explain ionic character in polar covalent compounds • Explain the effect of intermolecular forces to the physical properties of the compound • Explain the concept of hydrogen bonding • Explain the effect of hydrogen bonding on physical properties of substances • Explain the concept of metallic bonding • Explain the properties of metals	▶ **Intermolecular Forces** • van der Waals Forces i) Dipole-dipole interaction ii) London/dispersion forces (Temporary dipole-dipole) ▶ **The Hydrogen bond** • What hydrogen bond is • Types of hydrogen bonding (intra- and inter-molecular hydrogen bonding) • Effects of hydrogen bonding on physical properties of substances: - Density of water, boiling points, Solubility, etc. ▶ Metallic Bonding • Properties of metal: - Ductility and malleability of metal, electrical Conductivity and Thermal conductivity	• Models • Discussion • Class exercise • Brain storming • Computer simulations • Models • Discussion • Class exercise • Brain storming • Computer	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
			• Strength of metallic bonds.		
		• Explain the factors affecting strength of metallic bonds			
		• Explain the VBT theory • Differentiate between Sigma and pi bonds	▶Valence Bond Theory • Introduction: what Valence bond theory is • Sigma (σ) bonds • pi (π) bonds	• Discussion • Class exercises	
		• Explain the concept of hybridization • Use hybridization to predict shapes of molecules	▶ hybridisation of Atomic Orbitals • hybrid orbitals • sp-hybridisation • sp^2-hybridisation • sp^3-hybridisation • geometry for different types of hybridisation	• Computer simulation	
		• Explain the formation of a double, triple bond • Explain double bond formation in benzene	▶ Hybridisation Involving Organic Compounds • Single bond • Double bond • Triple bond • Benzene molecule		
06	**3.2: Structure: Drawing Lewis Structures of Molecules and Polyatomic Ions**	• Explain the concept of Lewis structure • Draw Lewis structures of some molecules (ammonia, water, sulphur dioxide,	▶ Lewis structures • Steps in writing Lewis structure for more complex molecules ▶ Lewis Structures of Polyatomic Ions	• Discussion • Class exercises	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		carbon tetrachloride) • Apply the different rules in drawing Lewis structures of compounds • Explain the VSEPR theory • Draw molecules of compounds in three dimensions	▶ Exceptions to the Octet Rule • Incomplete octet • Expanded octet • Odd number electron ▶ Shapes of molecules and ions ▶ Formal charges = number of valence electrons in free atom-[number of non-bonding electrons + ½ number of bonding electrons] ▶ Resonance – as the situation in which two or more possible Lewis structures can be written. ▶ Valence Shell Electron Pair Repulsion (VSEPR) Theory. ▶ The Effect of Lone Pairs on Molecular Geometry • Lone pair – lone pair repulsion > lone pair-bonding pair repulsion > bonding pair-bonding pair repulsion. Molecular shapes that may result: - Bent (V-shaped), Trigonal pyramidal, Linear, Square pyramidal, square planar, triangular bi-pyramidal, Tetrahedral, octahedral.		• To use the VSEPR theory to predict molecular geometry, we apply the following procedure: - • Write the Lewis structure. • From the Lewis structure, find the total electron pairs (the total number of bonding pairs and lone pairs of electrons around the central atom). Double and triple bonds are treated as a single bond only.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
04	**3.3: Shapes of Molecules**	• Explain the concept of polar and non-polar molecules • Model molecules of simple covalent compounds	▶ Polar and Non-polar Molecules ▶ Modelling of simple covalent molecules	• Project work	• Identify the most stable arrangement by locating the electron domains corresponding with number of bonding pairs and lone pairs.

Topic 4: Thermochemistry (Chemical Energetics)

Learning Outcomes: By the end of the topic the learners should be able to appreciate energy changes that accompany chemical reactions

08	**4.1 Chemical Energy**	Learners should be able to: - • Explain the concepts of Thermo chemistry. • Explain the concept of heat content of a substance • Demonstrate correctly that heat changes can be measured. • Carry out simple calculations on enthalpy changes.	▶ Introduction • What Thermo chemistry is • What happens to bonds when chemical reactions take place ▶ Enthalpy, **H** • That every substance has some stored chemical energy. ▶ Enthalpy Change, **ΔH** • As the change in heat content measured at constant temperature and pressure, during a chemical reaction. • Enthalpy change is called Heat of reaction and is denoted as $\mathbf{\Delta H_{rxn}}$ $\Delta H_{rxn} = \sum H_{products} - \sum H_{reactants}$	• Discussion • Teacher Demonstration	• Absolute enthalpy is hard to measure. • You can use the reaction between fixed volumes of solutions of $AgNO_3$ and NaCl of known concentrations.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
			• Demonstrate of heat of reaction		
10	**4.2: Types of Heat of Reactions**	Learners should be able to: - • Explain concepts of exothermic and endothermic reactions. • Sketch energy diagrams for the types of reactions that take place. • Give characteristics of exothermic and endothermic reactions.	▶ Exothermic Reaction • Characteristics of exothermic reactions • Energy level diagram • Applications of exothermic reactions in everyday life. ▶ Endothermic Reactions • Characteristics of exothermic reactions • Energy level diagram • Applications of endothermic reactions in everyday life. ▶ Thermo chemical Equations	• Class practical • Discussion • Teacher demonstration • Project work	• Use several experimental examples to illustrate this: - Burning ethanol as fuel, burning metals (Magnesium), neutralisation reaction between and acid and a base, dilution of stock solutions, etc. • Dissolution of salts like (ammonium chloride, ammonium nitrate and ammonium sulphate), thermal decomposition of salts, change of state, reaction of $NaHCO_3$ or $KHCO_3$ with acid, etc should be carried out. (**Group or individual work is encouraged**).
02	**4.3: Calorimetry**	• Determine the heat capacity plastic cup calorimeter	▶ Heat Capacity and Calorimetry • Coffee-cup Calorimeter • Bomb calorimeter	• Class practical • Discussion • Teacher demonstration • Project work	•

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
06	**4.4: Types of Enthalpy Changes**	Learners should be able to: - • Explain concepts of the different types of energy changes • Carry out experiments on enthalpy of combustion. • Predict the relative stability of compounds from enthalpy of formation • Correctly use data from experiments performed to carry out calculations • Explain the application of enthalpy of combustion in real life situation	▶ Standard enthalpy of Formation, ΔH_f° • Determination of enthalpy of formation • Calculating ΔH_{rxn} using heats of formation • Relative stability of compounds ▶ Standard Enthalpy of Combustion, ΔH_c° • The meaning of Heat of Combustion • Determination of ΔH_c° • Calculating heats of combustion • Heats of combustion of various Alcohols • The fuel values of various fuels • The Selection of Suitable Fuels for Specific Purposes: (**Consider: - Fuel value, effect on the surrounding and Cost per gram of fuel**) ▶ Standard Enthalpy of Neutralisation, ΔH_{neu}° • The meaning of Heat of Neutralisation.	• Class practical • Discussion • Teacher demonstration • Project work	• Standard states of temperature and pressure are 298K (25°C) and 1 atmosphere of pressure, respectively. • Always consider 1 mole of the compound in describing the standard enthalpy changes. • Investigating heat of combustion of alcohol (ethanol) can be carried out in small groups. • Guide the learners on the simple steps or guide lines to follow. • Encourage the learners to make a write up of their investigations. Experiments on Heats of neutralisation should be carried out in small groups or individually.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
	Types of Enthalpy Changes Cont...	Learners should be able to:- • Carry out experiments on enthalpy of neutralization • Correctly use data from experiments performed to carry out calculations • Explain the application of enthalpy of neutralization real life situation • Carry out experiments on enthalpy of precipitation • Correctly use data from experiments performed to carry out calculations • Explain the application of enthalpy of precipitation real life situation • Carry out experiments on enthalpy of displacement • Correctly use data from experiments performed to	• Experimental determination of ΔH°_{neu} • Determining the heat of neutralisation between strong acids and alkalis • Investigating the difference between heat of neutralisation between weak acid and strong acid with strong alkali. • Heat of neutralisation between a weak acid and a strong alkali. • Heat of neutralisation between a weak acid and a weak alkali. • Calculating heats of neutralisation. ▶ Heat of Precipitation • Concept of heat of precipitation • Determining the Heat of Precipitation • Calculations involving heats of Precipitation ▶ Heat of Displacement • Concept of heat of displacement • Determining the Heat of Displacement.	• Class practical • Class exercise • Discussion	• Class practical (in Groups or as individuals where there are few students) on heats of displacement. • Copper (II) sulphate solution. • Zinc powder/granules. • Thermometer.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
	Types of Enthalpy Changes Cont...	• carry out calculations • Explain the application of enthalpy of displacement real life situation	• Calculations involving heat of displacement		
		• Explain the meaning of the terms; enthalpy of atomization, ionization, electron affinity, lattice energy, enthalpy of sublimation • Carry out experiments on enthalpy of solution • Correctly use data from experiments performed to carry out calculations • Explain the application of enthalpy of solution real life situation • Carry out experiments on enthalpy of hydration • Correctly use data from experiments performed to carry out calculations • Explain the application of enthalpy of hydration real life situation	▶ Standard Enthalpy of Atomisation ▶ Ionisation Energy, IE ▶ Electron Affinity, EA ▶ Lattice Energy, ▶ Enthalpy of Sublimation, ▶ The Standard Enthalpy of Solution ▶ The Standard Enthalpy of Hydration	• Teacher demonstration • Class practical • Discussion	
		• Explain Hess's law of constant heat summation	▶ Hess's Law • Concept of Hess's law		• H_2O, NaOH, HCl can be

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• Demonstrate Hess's law using an experiment. • To construct enthalpy cycles • Apply Hess's law in calculations involving two or more of the reactants are involved.	• Experimental justification of Hess's law. • Construction of Enthalpy cycles. • Calculations involving Hess's law	•	used to demonstrate Hess's law
06		• Explain relevance of the Born Haber cycle. • Explain terms as used in Born-Haber Cycle. • Correctly construct a Born-Haber cycle for ionic compounds or salts. • Identify the type of energy changes involved in the various stages of cycle. • Carry out calculations involving Born-Haber cycles.	▶ Born-Haber Cycle • Experimental justification • Construction of Born-Haber cycle • Simple calculations using Born-Haber cycle	• Discussions • Class exercises	• A Born-Harber cycle is used for ionic compounds only while a thermochemical (energy) cycle is for any other compound. • Usually l ΔH_c^θ can be used in the construction of enthalpy cycles and calculations • ΔH_c^θ Value is subtracted due to the direction of arrow indicating the combustion. • If the route follows the direction of the reaction, do not change the enthalpy sign. If the route goes against the direction of the reaction reverse the enthalpy change. •

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
10		Learner should be to: • Explain bond energy • Differentiate between bond energy and average bond energy • Relate the energy change for reaction to bonds broken and bonds formed. • Carry out calculations involving average bond energies. • Use bond energies to explain differences in physical properties of compound (e.g. melting points, physical states of compounds some giant atomic).	▶ Average Bond Energies (Enthalpies) • What it is • Relationship between Energy change and the Formation and Breaking of Bonds. • Calculations involving average bond energies • Importance of bond energies in relation to physical properties of substances ▶ Appreciating the Existence of Various Energy Sources. • Various Sources of Energy (renewable and non-renewable) • Technology for Harnessing various energy Sources (Nuclear energy, Hydroelectric energy, Geothermal energy, Wind Power, Biomass (biogas and diesel) and energy from tides.	• Class exercises • Computer simulations. • e-learning • discussions • Discussion • Field trips • e-learning	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		•	• The Advantages and Disadvantages in Using Various Energy Sources. • Choosing an energy source	•	•

SENIOR SIX TERM I

Topic 5: Physical Equilibria

General Learning Objectives: By the end of this topic learners should be able to appreciate the concept of interconversion of phases due to changes in the physical conditions and its applications.

06	**5.1: Systems, Phases and Components** **5.1.1:Component System (Types of component systems)**	*Learner should be to:* • *Explain concept of phases, components and systems* • *Mention different types of component systems* • *Give* examples of one-component system. • *E*xplain the cooling curves for pure substances • Explain the term phase diagram. • Draw phase diagrams for a one component system. • Explain what the different regions of a phase diagram represent.	▶ Introduction • System • Phase • Component ▶ **One-Component system** • Examples of One-Component systems (e.g. water, sulphur and Carbon dioxide) • Cooling curves for pure substances • Phase diagrams (water, carbon dioxide and sulphur) • Interpretation of phase changes from a phase diagram (melting point, triple point, influences of temperature and pressure on the phases).	• Discussion • Field trips • e-learning class exercises	•

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
10		Learners should be able to:- • Give examples of two-component system. • Explain the different types of two-component systems. • Identify the different types of two-component systems.	▶ **Two-Component System** • **Types of two-component systems (liquid mixture):** Miscible (ethanol + water), partially miscible (ether + water) and Immiscible (oil + water).		
	5.1.2: Types of Solutions	• State Raoult's law • Explain what ideal solution is. • Give characteristics and examples of ideal solutions. • Draw vapour-composition diagrams for ideal and real solutions. • Interpret the vapour pressure-composition diagrams • Carry out calculations on Raoult's law. • Explain what real solution is. •	▶ **Raoult's Law ($P_{i=} x_i P_i^o$)** ▶ **Ideal Solutions** • Characteristics and examples of ideal solutions. • Vapour Pressure-Composition diagrams • Boiling point –composition diagrams • Calculations involving Raoult's law. ▶ **Two-Component System: Non-Ideal (Real) Solutions.** • Non-Ideal solutions • Characteristics and examples.	• Discussion • Field trips • e-learning • class exercises	•

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
04		• Give characteristics and examples of real solutions. • Draw vapour-composition diagrams for real solutions. • Differentiate between negative and positive deviation from Raoult's law. • Explain what is meant by the terms Azeotropic mixtures and azeotropes. • Differentiate between ideal and real solutions • Explain what distillation is • Explain the process of fractional distillation. • Apply the knowledge of phase diagrams to explain the process of fractional	• Vapour pressure - composition diagrams. ▶ **Negative Deviation from Raoult's law: -** • Its characteristics vapour pressure-composition diagrams. • Maximum Boiling – Point composition diagram (Negative deviation from Raoult's law) - Azeotropic mixture and Azeotropes. ▶ **Positive Deviation from Raoult's law: -** • Its characteristics vapour pressure-composition diagrams. • Minimum Boiling – Point composition diagram (Positive deviation from Raoult's law) – Azeotropic Mixture and Azeotropes. ▶ **Distillation of a Binary liquid Mixture** • What distillation is • Fractional distillation (e.g. production of alcohol from fermented liquids i.e. waragi) • Distillation of an Ideal solution		•

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		distillation of ideal and non-ideal solutions. • Describe the process of various methods of separation of components of azeotropes. • Explain the total vapour of immiscible liquid mixture in terms of the vapour of the components. • Calculate the composition of the vapour above a mixture of two immiscible liquids. • Calculate the composition of the distillate. • Describe the process of purification of liquid mixture by using steam distillation. • State industrial application of steam distillation	• Distillation of a Non-ideal solution • Separation of components of azeotropes. ▶ Immiscible liquids • Vapour pressure of a system of two immiscible liquids. • Composition of the vapour phase. • Steam distillation (calculations involving steam distillation). • Industrial application of steam distillation	• Discussion • e-learning • class exercises	•
		• Explain the concept of distribution law • Experimentally determine KD • Carry out Calculations involving distribution law. • Explain the application in: - chromatography, solvent extraction and	▶ Distribution Law (Partition Coefficients) • What it is • Experimental determination of KD • Calculation involving KD • Application of partition coefficients (solvent extraction,	• Discussion • Field trips • e-learning • class exercises • class practical	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		Ion exchange. • Sketch cooling curves of pure substances • Explain the cooling curves for pure substances • Draw phase diagrams for mixtures • Explain the phase diagrams for mixtures. • Explain concept/behaviour of eutectic mixtures. • Compare the behaviour of eutectic mixture and a pure compound. Give examples of substances which form eutectic mixtures.	Paper chromatography, column chromatography, ion exchange). ▶ Solid – liquid Equilibria • Cooling curves for pure substances • Cooling curves for mixtures • Phase diagram for mixtures • Eutectic mixtures •	•	• • Consider simple eutectics • Alloys e.g. solder (tin + lead), brass (copper + zinc), bronze (copper + tin), • Consider the Solid – liquid phase diagrams.
10	**5.2: Colligative Properties**	• Explain the concept of Colligative properties and give examples • Explain lowering of vapour pressure • Derive a relationship for vapour pressure lowering • Carry out calculations involving lowering of vapour pressure • Draw graph of vapour pressure lowering	▶ Colligative properties • Concept of Colligative properties • Examples of Colligative properties ▶ Vapour Pressure Lowering • Why does a solute influence the vapour pressure of water(liquid) • Vapour pressure lowering, $\Delta P = P_A - P_A^0$ • Graphical representation of vapour lowering	• Class exercises • Discussion • Experimentation	• Calculations should be done using first principles. • Use 18 g of glucose and dissolve in 1 kg of water in a saucepan. Then determine at what temperature the water will boil. • You can repeat the above experiment with a salt that is 100%

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• Explain graphs of vapour pressure lowering • Explain limitations of Colligative properties • Explain boiling point and boiling point elevation • Explain the relationship between vapour pressure and boiling point of a solution • Explain how the presence of a solute affects the boiling point of a solvent • Explain elevation of boiling point using vapour pressure-temperature graph • Describe an experiment that can be carried to determine molecular mass using boiling point elevation method • Carry out calculations involving boiling point elevation • Explain freezing point, and freezing point depression • Explain depression of freezing point using	• Calculations involving pressure vapour lowering. • Limitations of Colligative properties ▶ Boiling Point Elevation • How VP affects boiling point of liquids. • How the presence of a solute affects the boiling point of a solvent • Vapour pressure-temperature diagrams and boiling points. $\Delta T_b = T_{b(solution)} - P^0_{b(solvent)}$, and $\Delta T_{b=} K_b m$ Where *m* is the Molality of the solute in solution. • Experimental Determination of molecular mass using boiling point elevation method. • Calculations involving **molal boiling point elevation constant, K_b (ebullioscopic constant)** ▶ Freezing Point Depression • Vapour pressure – temperature diagrams and freezing points.	•	dissociated in water, e.g. NaCl.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		vapour pressure-temperature graphs • Experimentally determine molecular mass using freezing point depression method • Carry out calculations involving freezing point depression • Explain osmosis and osmotic pressure • Explain why osmotic pressure method is the most suitable method for determining molecular mass of large molecules e.g polymers • Carry out calculations involving osmotic pressure •	• Experimental Determination of molecular mass using freezing point depression. • $\Delta T_f = P^0_{f(solven)} - T_{f(solution)}$, and $\Delta T_f = K_f m$. Where *m* is the molality of the solute in solution. • Calculations involving **molal freezing point depression constant, K_f.** (**cryoscopic constant**) ▶ Osmotic Pressure, **π.** • What is osmosis and osmotic pressure • Suitability of using Osmotic pressure in determining molecular mass of large molecules e.g polymers • Methods of measuring osmotic pressure, **π.** • Osmotic pressure**, π, = *c*RT**, where, ***c,*** is the solute concentration and **R** = molar gas constant and **T** is the absolute temperature. • Calculations of molar masses from osmotic pressures.	•	• • Detailed experimental techniques on use of osmosis to determine molecular mass is not required • Camphor and naphthalene

Topic 6: Chemical Equilibria

General Learning Objectives: By the end of the topic the learners should be able to appreciate the concept of reversible reactions and its applications.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
06	**The concept of Chemical Equilibrium**	• Explain the concept of chemical equilibrium. • Distinguish between reversible and irreversible reactions • Explain dynamic Equilibrium • Differentiate between homogeneous and heterogeneous reversible systems • Apply the law of Mass Action in writing Equilibrium expressions • Carry out calculations involving use of K_c and K_p • Derive a general expression relating K_c and K_p	▶ Introduction • What equilibrium is • Irreversible and reversible reactions • Dynamic Equilibrium • Homogeneous and heterogeneous reversible systems. ▶ Equilibrium Constant, K_c and K_p • Law of Mass Action or Equilibrium Law, hence equilibrium constant *K.* • Expressions of equilibrium constants (for homogeneous aqueous solutions and gaseous systems; and heterogeneous systems). • Calculations involving K_c and K_p	• • Discussion • Class exercises • Experimentation	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
04		•	▶ The Equilibrium Constant for a Gas Phase Reaction: K_p vs K_c • Use of Ideal gas law to relate K_p and K_c PV = nRT $Kp = K_c(RT)^{\Delta n}$, where $\Delta n = (p + q) - (a + b)$ = change in number of moles of gases (product – reactant) • Calculations involving the relationships of K_p and K_c	• Discussion • Class exercises • Experimentation	
		• Compare Q and K_c to determine the direction of chemical reaction	▶ Interpretation of magnitude of Equilibrium Constant and the position of Equilibrium. • When K is large, small or nearly equal to one • Reaction Quotient, Q		
		• Explain Le Chatelier's principle • Apply Le Chatelier's principle in explaining the effects of various factors on the equilibrium of reversible chemical reaction • Experimentally	▶ Le' Chatelier's Principle and Factors Affecting Chemical Equilibrium. • Concept of Le' Chatelier's principle. • Factors affecting equilibrium • Effects of changes in Concentration or Partial Pressures of a reactant or Product: • Effects of Temperature: Effects of Pressure and Volume Changes		

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		determine Kc using Esterification reaction • Correctly apply the knowledge of chemical equilibria to justify conditions used in industrial processes.	• Effects of adding noble Gas: (At Constant Volume and Constant Pressure) • Effects of adding Catalyst • Experimental determination of Kc ▶ Industrial Application of Chemical Equilibrium • Haber process (manufacture of ammonia). • Contact Process (manufacture of sulphuric acid). • Ostwald process (manufacture of nitric acid)	•	

Topic 7: Ionic Equilibria

General Learning Objectives: By the end of this topic learners should be able to appreciate the behaviour of acids, bases and salts in aqueous solutions.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
08	**7.1: Acids, Bases and Salts**	• Explain the concepts of acid and bases according to various theories • Explain the concept of conjugate bases and conjugate acids	▶ Acids and Bases • Concepts of acids and bases Definitions of Acids Bases According to Arrhenius • According to Brønsted – Lowry • According to Lewis ▶ Conjugate Acid-base Pair • Conjugate base • Conjugate acid	• Discussion • Class exercises • Experimentation •	
		• Classify acids and bases on basis of their degree of ionisation •	▶ Classifying Strong Acids and Bases, Weak acids and bases • Strong acids • Strong bases • Weak acids • Weak bases		
		• Explain ionisation constants for weak acids and weak bases K_a and K_b • Derive a general	▶ Relative Strength of Brønsted – Lowry Acids and Bases • K_a and K_b as measures of strengths of acids and bases, respectively. • Expression of Acid dissociation constant, K_a		

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
04	**Acids, Bases and Salts Cont...**	• expression for K_a and K_b • Correctly apply knowledge about K_a and K_b in calculations • Explain auto ionisation(self ionisation) of water • Derive an expression of K_w • Explain the concept pH and pOH • Correctly apply knowledge pH and pOH and pK_w in calculation involving strong acids and bases • Explain the relationship between K_a and K_b for an acid-base conjugate pair • Derive expression of pH for weak acids and bases • Carry out calculation on pH for weak acids and bases	• Expression of Base dissociation constant, K_b • Calculations involving K_a and K_b ▶ The Autoionisation (Self Ionisation) of Water • Ionic product of water • $K_w = [H_3O^+][OH^-] = 10^{-14}$ ▶ The pH Scale (1 – 14) • Concept of pH • $pH = -\log_{10}[H_3O^+]$ • $pOH = -\log_{10}[OH^-]$ • $pK_w = -\log_{10}K_w$ • calculations involving pH ▶ The Relationship between Ka and K_b for an Acid-base Conjugate • Consider the acid-base conjugate pair of NH_4^+ and NH_3 • Derivation of the relationship, $\mathbf{K_a \times K_b = K_w}$ • Expression of pH for weak acids and bases ▶ pH calculations pH calculation for weak acid and weak base ▶ Salt Hydrolysis	• Discussion • Class exercises • Experimentation	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
02	**7.2: Hydrolysis of Salts**	• Explain what a salt is • Explain the concept of salt hydrolysis • Identify the various types of salts • Derive an expression of K_h • Correctly apply knowledge of K_h in calculations.	▶ Salt • What hydrolysis is • Hydrolysis constant K_h • Salt of strong Acid and Strong Base • Salt of Strong Acid and Weak Base • Salt of Weak Acid and Strong Base • Calculation involving K_h • pH of resultant solution	• Discussion • Class exercises • Experimentation	
04	**7.3: Buffer Solutions**	• Explain the concept of Buffer • Classify buffer and give examples of each type • Explain the action of a buffer • Describe the preparation of a buffer • Derive the Henderson-Hasselbalch equation • Carry out calculations of pH for buffers Explain application of buffers	• Concept of a buffer • Types of buffers: Acidic and Basic a basic • Action of an acidic buffer solution. • Action of a basic buffer solution. • Preparation of buffer solutions. • Henderson-Hasselbalch Equation $pH = pK_a + \log \frac{[\text{conjugate base}]}{[\text{weak acid}]}$ $pOH = pK_b + \log \frac{[\text{conjugate acid}]}{[\text{weak base}]}$ • Calculations involving buffer solutions • Application of buffers		

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
04	**7.4: Acid – base Titrations**	• Explain the concept of titration • Explain the action of an indicator • Explain the concept of pH range • Identify Ph range of different indicators • Choose suitable for use in acid base titrations • Sketch different types of pH-volume curves for acid-base titration • Interpretation of pH – volume curves for acid-base titrations • Calculate pH changes during acid-base titrations	• Titrations • Titrant • Titrand (analyte) • Equivalent point • End point ▶ Acid-Base Indicators • What an indicator is (HIn) • Examples of indicators • How an indicator works • pH ranges for indicators • choice of indicator ▶ Types of Acid-Base titrations • Strong Acid-Strong Base Titrations: (Examples NaOH and HCl titrations, Titration curves, Calculations). • Weak Acid-Strong base titrations: (Examples CH_3COOH and NaOH titrations, Titration curves, Calculations). • Strong Acid-Weak Base Titrations: (Examples: HCl and NH_3 solution; Titration Curves; Calculations). • Weak Acid-Weak Base Titrations: (example: CH_3COOH and NH_3 solution; titration curves).	• Class experiments • Discussions • Class exercises • Computer simulations	• The pH jumps up quite markedly after the equivalence point.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
04	**7.5: Solubility Equilibria**	• Explain the concept of solubility • Carry out an experiment to determine solubility of a salt • Explain the factors that affect solubility of a salt • Plot solubility curves for soluble salts • Interpret the solubility curves • Explain the applications of solubility curves • Carry out calculations for solubility • Explain the concept of dynamic equilibrium in a saturated salt solution • Explain the concept of solubility • Explain the factors that affect solubility of sparingly soluble salts	▶ **Solubility** ▶ **Soluble salts** ▶ **Molar Solubility** • Experimental determination of solubility of a salt • Factors affecting solubility • Solubility curves • Application of solubility curves (fractional crystallization) • Calculation of solubility ▶ **Soluble and Sparingly soluble salts** ▶ **Factors affecting solubility of sparingly soluble** ▶ **Solubility Product** • What solubility product is • Expressions for Solubility Product • Experimental determination of solubility product • Calculations involving solubility and Solubility Products. ▶ **Solubility Product and Precipitation** • When does precipitation take place? • Ionic product • Effective concentration	• Class experiments • Discussions • Class exercises • Computer simulations • Teacher demonstrations	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• Derive an expression for solubility product • Carry out an experiment to determine solubility product • Calculate K_{SP} • Carry out calculations involving solubility product • Explain the relationship between ionic product, Ksp and precipitation • Explain the applications of Ksp • Explain the concept of common ion effect • Explain the application of common ion effect	• Calculations involving solubility • Application of Ksp	•	• Include the effect of complexation on solubility of sparingly soluble salts

Topic 8: Chemical Kinetics

General Learning Objectives: By the end of this topic the learner should be able to appreciate that different reactions occur at different rates and explain why they do so.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
06	**8.1: Simple Rate Equations**	The learner should be able to: • Explain the concept of rate of reaction • Explain the law of mass action and its application • Explain order of a reaction and rate constant • Describe the experimental procedure to determine the orders of a reaction	▶ **Introduction** • Concept of chemical kinetics • Law of mass action • Simple rate equations • Definition of rate equations, Rate constant, Order of Reaction and Molecularity. • Relate kinetics to mechanism of reactions. • Mathematical derivation of zero, first and Second order rate equations. • Half-lives, $t_{½}$	• Discussions • Class experiments • Class exercises • Computer simulations • Field study	• Discontinuous e.g clock experiments • Continuous experiments should • Effect of Temperature: - (Energy barrier concept; Activation energy of Activated Complex). • Effect of Concentration:- (pressure and volume for gases) • Effect of Catalyst: (industrial processes such as Haber process, production of polymers, manufacture of HNO_3 acid, etc). • Effect of particle Size • Relationship between electrolysis and Avogadro constant.
	8.2: Factors Affecting Rates of Reactions	• Explain the relationship between orders and rates of reactions • Explain the concept of half-life Derive an expression for half-life of zero order, first order and second order reactions in terms of rate constant	▶ **Factors Affecting Rates of Reactions** • Theories of reaction (Collision theory, transition theory). • Effect of Temperature: - (Energy barrier concept; Activation energy of Activated Complex). • Effect of Concentration:- (pressure and volume for gases) ▶ Effect of Catalyst: (industrial production of polymers,	•	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• Apply the knowledge rate equations in sketching and interpreting graphs • Explain the concept of Molecularity of a reaction • Discuss the relationship between mechanism of a reaction and Molecularity • Explain the relationship between mechanism of a reaction and the rate of reaction • Explain theories of reaction • Use the theories of reaction to explain factors that affect rates of reaction • Give applications of the factors that affect rates of chemical reactions.	processes such as Haber process, manufacture of HNO_3 acid, etc). • Effect of particle Size • Calculations involving the given experiments • Molecularity and mechanism of reactions.		
		• Carry out designed experiments to generate kinetic data for determining order of reaction, rate of	▶ **Experiments** • 1^{st} Order • 2^{nd} Order • Calculations involving the given experiments	• Discussions • Class exercises • Class practicals	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		reaction and rate constants. Carry out calculation rates of reaction			

Topic 9: Electrochemistry

General Learning Objective: By end of the topic learners should be able to appreciate the effect of electric current on substances and ability of substances to generate electricity.

08	**9.1: Electrolysis**	The learner should be able to: • Identify the different modes of conduction in substances • Explain the different modes of conduction • Explain the concept of electrolysis • Explain the common terms used in electrolysis • Distinguish between weak and strong electrolytes and give examples • Explain the principles of selective discharge of ions • Apply the laws of	▶ Modes of conduction in substances ▶ Concept of electrolysis • Terms used in electrolysis (electrolytes, anode, cathode, discharge) • Weak and strong electrolytes • Principles of Electrolysis; - (Selective Discharge of Ions). • Laws of Electrolysis • Calculations on electrolysis • Applications of electrolysis: (extraction of metals e.g. Al, Na, etc, manufacture of NaOH and Cl_2, metal refining).	• Discussions • Class experiments • Class exercises • Computer simulations	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• electrolysis in calculations Identify applications of electrolysis in industry			
	9.2: Conductance and its Measurements	• Explain the concept of conductance • Explain the factors affecting conductivity of electrolytes • Explain conductance in weak and strong electrolytes • Differentiate between molar and specific conductance • Explain relationship between molar and specific conductance • Describe measurement of conductance • Apply Kholrausch's law in calculation of molar conductivity at infinite dilution of weak electrolytes • Apply the concept of conductance in	• Concept of conductance and terms used in conductance. • Factors affecting conductance of electrolytes • Conductance of weak and strong electrolytes • Types of conductance: - (Molar Conductance and Specific Conductance) • Measurement of Conductance • Kholrausch's law of Independent migration of ions and its application. • Application of conductance - Conductimetric Titrations: - (Strong acid-Strong base, Strong Acid-Weak Base, Weak Acid-Weak base). - Determination of solubility and solubility products - Determination of degree of ionization of weal electrolytes • Calculations involving electrolytic conductance.	• Discussions • Class experiments • Class exercises • Computer simulations	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		Conductimetric titrations, determination of solubility and solubility product, and degree of ionization			
	9.3: Electrochemical cells	• Explain the concept of electrode potential • Use electrochemical series to explain the absolute and relative electrode potential • Distinguish between absolute and relative electrode potential • Describe the structure and functioning of standard hydrogen electrode • Describe the measurement of standard electrode potential • Explain the term reduction potential • Apply reduction potentials to explain the metal / metal ion convention for cells • Construct an electrochemical cell	• Concept of Electrode Potentials • Electrochemical series • Absolute and relative electrode potential • Standard hydrogen electrode • Measurement of Electrode Potential of Metals against the Standard Hydrogen Electrode (SHE). • Reduction Potentials • Metal/Metal ion Convention for cells (LHS and RHS) • Construction of electrochemical cell • Cell notation • Calculation of cell e.m.f • Use of cell e.m.f to predict spontaneity of reactions • Gibb's Free Energy, ΔG, in relation to electrode potentials as a measure of spontaneity. • Construction of Daniel cell • Uses of Batteries. • Conversion of energy (Chemical to electrical).	• Discussions • Class experiments • Class exercises • Computer simulations	• American convention Differs for reduction potentials

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• Write the cell notation • Calculate the cell e.m.f and use the values to predict spontaneity of reactions • Give the Gibb's free energy expression • Use the Gibb's free energy expression to predict feasibility of reactions • Explain the functioning of a battery	•	•	

SECTION B: INORGANIC CHEMISTRY

SENIOR FIVE TERM I

Topic 10: 3rd Short Period of the Periodic Table
General learning objects: learners should be able to appreciate the behaviour of elements in the 3rd short period and their compounds

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
20	**Introduction**		• A brief introduction to the Periodic table		• This should be a brief introduction to the development of the periodic table. Newlands, Mendeleev and Moseley • The teacher can review the work on atomic structure and Periodic Table already covered in physical chemistry.
20	**Trends in atomic and physical properties of the elements**	Should be able to : • Identify elements in period 3 • State and explain the variations in physical properties	• Elements of 3rd Short period • Variation in physical properties in physical properties of elements - M.pts, B.pts, - ionization energy, - atomic and ionic radius - electronic structures, - electron affinity,		•

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
			- electronegativity, - electro – positivity, - electrode potential, • electrical conductivity	• Discussion • Group Practicals. • Class exercises • Laboratory experiments • Project work	•
	Chemical reactions of the elements	- Give equations for the reactions - State conditions for the reactions - State expected observations for each reaction Explain trends in reactivity of the elements	• Reactions of the elements with - Air - Water - Dilute acids (HCl, H_2S0_4) - Dilute Sodium hydroxide - With chlorine -		• Simple experiments on the reactions of the elements should be carried out where possible but care must be taken since some of the elements are very reactive.
	Compounds of the elements	• Explain the formation of compounds • Explain the physical and chemical properties of the compounds. • Describe the industrial process. • Explain the similarities and difference in physical and chemical properties	• (Formation, bonding and structure, volatility). - Oxides - Chlorides - hydrides • Chemical reactions of compounds with (H_2O, acid, alkali) • Oxo – acids of sulphur, phosphorus and chlorine (Should be treated) • Industrial processes (Haber process, Contact process, Manufacture of Cl_2, NaOH,		• Include oxides of sulphur and manufacture of sulphuric acid • Urea, Phosphates, Ammonium sulphate, Potassium nitrate, Ammonium nitrate • Oxo-acids of chlorine may be treated under group VII

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• between period 2 and period 3 elements • Explain the diagonal relationships between the 2nd short period and 3rd short period (Be and Al, Li and Mg) •	fertilizers, extraction of Aluminium) • Compare Period 3 with Period 2 • Details of chemistry of Al, Be covered •		• Diagonal relationship should be treated • Polarizing power and polarizability •

SENIOR SIX TERM I

Topic 11: The Chemistry of group II (Alkaline Earth Metals)
General learning objects: Learners should be able to appreciate the behaviour of group II elements and their compounds

12	**Trends in physical properties of the elements**	Learners should be able to: • Explain the trends in physical properties of the elements down the group	- M.pts, B.pts, - ionization energy, - atomic and ionic radius - electronic structures, - electron affinity, - electronegativity, - electro – positivity, - electrode potential, - electrical conductivity	• Discussion • Group Practicals. • Class exercises • Laboratory experiments • Project work	Comparison should be made with group I

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
	Chemical reactions of group II elements	• Explain the trends in chemical properties of the elements down the group • Compare the physical and chemical properties of group I and II element	• Chemical properties of the elements(reaction with H_2O, dil. Acids, air, Cl_2)		
	Compounds of Group II elements	• Explain the trend in variation of the physical and chemical properties of the compounds • Carry out test tube experiments to identify group II cations • Explain reactions of group II cations with their identifying reagents • State uses of common compounds of the group II elements • Describe the process of manufacture of cement • Compare strength of different building materials	• Compounds of the elements(oxides, hydroxides, chlorides, hydrides, sulphates CO_3^{2-} and HCO_3 - Solubility - Thermal stability - Structure and bonding - Reaction with acids(oxides, hydroxides) - Reaction with sodium hydroxide (oxides, hydroxides) • Qualitative analysis of group II cations • Making building materials out of locally available materials • Solubility of sulphates and hydroxides in relation to lattice and hydration energies		Test tube demonstration experiments for Mg^{2+}, Ba^{2+}, Ca^{2+} , using NaOH (aq), NH_4OH (aq) , Dilute H_2SO_4, Sodium hydrogen sulphate ethanoic acid, potassium chromate solution, ammonium chloride, ammonium oxalate

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
			• Uses of compounds of the elements (manufacture of cement) -	•	•

Topic 12: The Chemistry of group IV elements
General learning objects: Learners should be able to appreciate the behaviour of group IV elements and their compounds

08	**Trends in Physical properties**	Students should be able to :- • Explain the trends in physical properties of the elements down the group. • Explain the catenation of carbon	- - M.pts, B.pts, - electronic structures , - ionization energy - electropositivty - Transition from non – metal to metal down the group - Conductivity - Structure and bonding	• Discussion • Group Practicals. • Class exercises • Laboratory experiments	• Catenation of carbon (uniqueness of carbon) • Physical states of the oxides comparison between CO_2 and SiO_2 • Mention of lead poisoning in pumped water
	Chemical reactions of the elements	• Explain the trend in chemical properties • Explain trends in the variation of the stability in oxidation states	• Chemical properties - Reaction with: Air, dilute and concentrated acids, alkalis, chlorine, water, sulphur		
	Compounds of the elements	• Explain the trend in physical properties of the compounds • Explain the trend in chemical properties	. • Physical properties • Oxides, chlorides, hydrides (structure and bonding, M.P, B.P,) • Chemical properties of compounds		

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• Explain the inert pair effect • Describe the confirmatory test for Pb^{2+} • Explain reactions for qualitative analysis of Tin and Lead • Mention uses of Group IV elements • Explain the concept of green house effect •	(oxides, chlorides, hydrides) - Reaction with dilute acids - Reaction with alkalis - Redox properties of the oxides - Combustion of the hydrides • Hydrolysis of chlorides • Thermal stability of halides or hydrides. • Inert pair effects • Brief chemistry of Tin, and lead, • Uses of Group IV elements • Test tube experiment for lead (confirmatory test of Pb^{2+}) • Mention the green house effect of CO_2.	• Discussion • Group Practicals. • Class exercises • Laboratory experiments	

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SENIOR SIX TERM II

Topic 13: The Chemistry of group VII elements
General learning objects: Learners should be able to appreciate the behaviour of group VII elements and their compounds

20	**Trends in physical properties of the elements**	Students should be able to :- • Describe the general methods for preparing halogens • Explain the trends in the variation of physical properties down Group.	• General methods of preparing halogens • Variation in physical properties of the elements - M.pts, B.pts, - ionization energy, - atomic and ionic radius - electronic structures,		

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
			- electron affinity, - electronegativity, - electrode potential • structure and bonding		
	Chemical reactions of the elements	• Explain the trend in chemical properties of the elements. • Explain the chemical reactions with the identifying reagents	• chemical properties of the elements - Reaction with hydrogen, water, sodium hydroxide.	• Discussion • Group Practicals. • Class exercises • Laboratory experiments	
	Compounds of the elements	• write the chemical formulae of the hydrides • Describe the general methods of preparing hydrides • Explain in physical properties of the hydrides • Explain the trend in acid strength of the hydrides • Carry out test tube experiment to identify Cl-, Br- and I- • State the uses of the compounds. • Describe the extraction of sodium chloride from the natural deposits • State the uses of natural salt	• Compounds of the elements Hydrides, • Hydrogen Bonding (Its effect on physical properties of the hydrides) NB: Little emphasis on oxides except for their acidity. • Test tube experiments for CI, Br, and I • Uses of compounds (chlorates, chlorides) Occurrence, extraction and utilization of natural salt deposits be covered e.g. NaCl		

SENIOR SIX TERM III

Topic 15: The Chemistry of the d-block transition elements
General learning objects: Learners should be able to appreciate the behaviour of d-block transition elements and their compounds

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
	d-Block Transition Elements	Learners should be able to :- • Define transition elements • Distinguish between a transition element and d-block elements. • Explain the trend in physical properties of the elements • Compare the physical properties of the d-block and main block elements • Explain the general characteristics of the transition elements	▶ Concept of the transition elements (first series of the d-block) ▶ Physical properties - M.pts, B.pts, - ionization energy, - atomic and ionic radius - electronic structure - electrode potential - electro-positivity - conductivity ▶ General characteristics of d-block elements: • Variable oxidation states • Formation of interstitial Compounds • Catalytic activities e.g. Iron in Haber • Complex formation (H_2O, CI, NH_3, OH^-, CN^-, I ,ligands) • paramagnetism • Formation of coloured Compounds	• Discussion • Group Practicals. • Class exercises • Laboratory experiments • Practical demonstrations • Field trips	The trends of the physical properties to be compared to that of the main block elements Nomenclature of complex compounds Isomerism of complexes (hydrate and geometrical)

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
	Chemical properties of the elements and their compounds	• Explain the chemical properties of the elements • Describe the preparation of common oxides, hydroxides and chlorides. • Explain the amphoteric behaviour of Zn, Cr. • Identify oxo- anions of V, Cr, Mn • Draw and name the shapes of the common oxo-anions • Explain the redox behavior of the oxo-anions • Explain the importance of oxo anions in redox titrations • Carry out test tube experiments to identify d-block oxo-anions • Describe how Iron, Zinc and Copper are extracted from their ores • Explain how steel is formed from Iron • Carry out confirmatory tests on transition metal ions except Ti, Sc, V.	▶ Chemistry of each element • Chemical properties of the elements (reaction with H_2O, acids ,air , NaOH and oxidizing agents) • Compounds of the element - Oxides - Hydroxides - Oxo-anions (for V, Cr, Mn) - Chlorides - Oxo-salt • Identification of d-block oxo-anions • Amphoteric behaviour of the compound (oxides of Cr, Zn) ▶ Volumetric analysis : • permanganate • Dichromate (acidification with H_2SO_4) ▶ Extraction of Fe, Zn, Cu • Production of steel from pig Iron ▶ Test tube experiments for identifications of transition metal cations except Ti, Sc, V	• Discussion • Group Practicals. • Class exercises • Laboratory experiments • Practical demonstrations • Field trips	Test tube experiments of the reactions of the elements with acids and sodium hydroxide Emphasis on oxidation state changes in acidic, alkaline and neutral medium (to be related to E^{θ} and redox systems) Refer to redox titrations for reinforcement

SECTION C: ORGANIC CHEMISTRY

SENIOR FIVE TERM I

Topic 16: Introduction to organic chemistry
General objective: By the end of the topic the learner should be able to appreciate and apply the knowledge of carbon chemistry

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
06	**Introduction**	Learners should be able to; • Explain uniqueness of carbon • Explain the concept of hybridization with specific reference to carbon • Explain the various terms • Identify the various functional groups • Explain the type of organic reaction • Explain the different types of reaction mechanism •	• Carbon – skeleton (chains and rings) • Hybridization and multiple bond formation • Aliphatic and aromatic compounds • Homologous series • Isomerism • Functional groups and hydrocarbons • Types of reactions - Substitution - Addition - Elimination • Organic reaction mechanism. - Types of cleavage (bond polarity) - Inductive effect - Electrophiles, nucleophile • Free radical and ionic mechanism	•	• Sigma and pi-bond formation should be brought out • Use of models is highly recommended (Ball-stick models) • Hydrocarbon b as a compounds that don't contain functional groups other than hydrogen and carbon, be stated • Chain, position, functional group, cis- and trans- isomerism to be considered • Details of optical isomerism not required • At the introductory stage only formation of radicals and ions to be

Topic 17: Alkanes
General Objective: At the end of the topic learners' should be able to appreciate the nature, chemistry and uses of alkanes

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
04	**Introduction to alkanes and their physical properties**	• State general formula of alkanes. • State the occurrence of alkanes • Describe the process of separation of alkanes from oil • Describe the lab preparations of alkanes • Name alkanes using IUPAC system. • Explain the effect of combustion of fuels on the environment • Explain the physical properties of alkanes	• Introduction (occurrence, general formula, functional groups, nomenclature using IUPAC rules) • Isomerism • Isolation (Fractional distillation) • Lab. Preparation • Effect of combustion of fuels on the environment - Physical states, - Solubility, - Boiling point and melting point, - Density	• Field study • Discussion • Lab experiments • Class exercise	
	Chemical properties of alkanes and uses of Alkanes	• Explain chemical properties of alkanes including mechanisms of the reactions Explain uses of alkanes	- combustion, - chlorination, - cracking, - nitration - Uses	• Field study • Discussion • Lab experiments • Class exercise	•

TOPIC 18: Alkenes
General objective: Learners should be able to appreciate the nature, chemistry and uses of alkenes

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
06	**Introduction to alkenes and their Physical properties**	• State general formula of alkenes • State the occurrence of alkenes • Describe the process of preparation of alkenes by catalytic cracking of alkanes • Describe the lab preparations of alkenes from alcohols and alkyl halides • Name alkenes using IUPAC system. • Explain the physical properties of alkenes	• Introduction (occurrence, general formula, functional groups, nomenclature using IUPAC rules) • Isomerism • Preparation (lab and industrial cracking) • Physical properties of alkenes,(Solubility, B.P, M.P, Density).	• Discussion • Lab experiments Class exercise	Test tube experiments with bromine water and acidified / alkaline potassium manganate VII Emphasis should be made on Markonkov's rule for addition reaction with alkyl halides • Test for un saturation should be practically done
	Chemical properties of alkenes and uses of Alkenes	• Explain chemical properties of alkenes including mechanisms • of the reactions • Carry out test tube experiments to identify the functional group • Explain the chemical reactions for the identification of the functional group • Explain uses of alkenes	• Chemical properties of alkenes (combustion, hydration, halogenations, hydroxylation, hydrogenation, addition of hydrogen halides) • Practical identifications of the functional group • Uses of alkenes		

SENIOR FIVE TERM II

Topic 19: Alkynes
General objectives: learners should be able to appreciate the nature, chemistry and uses of alkynes.

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
04	**Introduction to alkynes and their Physical properties**	• State general formula of alkynes • Describe the lab preparations of alkynes from di-halo alkanes • Name alkynes using IUPAC system. • Explain the physical properties of alkynes	• Introduction (occurrence, general formula, functional groups, nomenclature using IUPAC rules) • Isomerism • Lab. Preparation • Physical properties - Physical states, - Solubility, - Boiling point and melting point, - Density	• Discussion • Laboratory experiments • Class exercise	• Alkynes comparison (acidified $KMnO_4$, Br_2, CuCl) i.e. gives red precipitate with terminal alkynes)
	Chemical properties of alkynes and uses of Alkynes	• Explain chemical properties of alkynes including mechanisms of the reactions (for halogen halides, bromine, H_2O / H^+ • Carry out test tube experiments to identify the functional group • Explain the chemical reactions for the identification of the functional group • Explain uses of alkynes	• Chemical reactions - combustion, - chlorination, - hydration, - reaction with ammoniacal silver nitrate and copper I chloride, - reaction with sodium in liq. ammonia - Practical identifications of the functional group • Uses		

Topic 20: Benzene and methyl benzene
General Objectives: Learners should be able to appreciate the nature, chemistry and uses of benzene and methyl benzene

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
10	**Introduction to Benzene and its Physical properties of Benzene**	• Draw the structure of benzene ring • Explain the stability of benzene ring. • Describe the preparation of benzene • Explain the physical properties of benzenes	• Structure (delocalization of pi electrons, resonance, bond angles and bond length) • Preparation(from ethyne, Bromo Benzene, decarboxylation of benzoic acid, reduction of phenol using Zinc dust • Physical properties - solubility, - Boiling point and melting points, - Density	• Discussion • Laboratory experiments • Class exercise	
		• Explain the chemical properties of benzene (include mechanisms , except combustion, hydrogenation) • State conditions required for the different reactions • Carry out test tube experiments to identify the functional group • Explain the chemical reactions for the identification of the functional group	• Chemical reactions: - With Bromine and chlorine, - alkylation - nitration - sulphonation - Acylation - Combustion - Hydrogenation in presence Raney Nickel •	• Discussion • Laboratory experiments • Class exercise	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
10	**Introduction to Methyl benzene** **Physical properties of methyl benzene**	• Draw the structure of methyl benzene • Identify the Para and ortho-, meta positions • State the groups that are ortho-, meta- and para-directing • Explain inductive effects of methyl group on the stability of the benzene ring • Explain the physical properties of methyl benzene • Compare the physical properties of methyl benzene with those of benzene •	• Structural and molecular formula • Preparation from benzene • Inductive orientation on benzene ring in relation to methyl group (Para and ortho position). • Examples of ortho-, meta- and para- directing groups • Physical properties of methyl benzene • Physical properties of methyl benzene and benzene compared	• Discussion • Laboratory experiments • Class exercise	
	Chemical properties of benzene	• Write the equations and mechanisms of the reactions involved (except oxidation and hydrogenation) • State conditions required for the different reactions • Explain the reactions that involve the ring and methyl groups.	• Reactions affecting the methyl group (i.e. X_2, Oxidation) • Reactions affecting the ring - Nitration - Sulphonation - Halogenation - Alkylation - Acylation - Hydrogenation		

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
10	**Introduction to Methyl benzene** **Physical properties of methyl benzene**	• Draw the structure of methyl benzene • Identify the Para and ortho-, meta positions • State the groups that are ortho-, meta- and para-directing • Explain inductive effects of methyl group on the stability of the benzene ring • Explain the physical properties of methyl benzene • Compare the physical properties of methyl benzene with those of benzene •	• Structural and molecular formula • Preparation from benzene • Inductive orientation on benzene ring in relation to methyl group (Para and ortho position). • Examples of ortho-, meta- and para- directing groups • Physical properties of methyl benzene • Physical properties of methyl benzene and benzene compared •	• Discussion • Laboratory experiments • Class exercise	
	Chemical properties of methyl benzene	• Write the equations and mechanisms of the reactions involved (except oxidation and hydrogenation) • State conditions required for the different reactions • Explain the reactions that involve the ring and methyl groups.	• Reactions affecting the methyl group (i.e. X_2, Oxidation) • Reactions affecting the ring - Nitration - Sulphonation - Halogenation - Alkylation - Acylation - Hydrogenation •		

Topic 21: Halogen compounds

General Objectives: Learners should be able to appreciate the nature, chemistry and uses of Halogen compounds

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
06	**Introduction to halogen compounds and their physical properties**	• Draw the structure of halogeno alkanes and halo benzene • Identify the Para and ortho-positions halo benzene • Explain inductive effects of halogen group on the stability of the benzene ring • Explain the physical properties of halogen compounds	• Structural and molecular formula • Preparation of halogen compounds • Inductive orientation on benzene ring in relation to halogen group (Para and ortho position). • Physical properties of halogen compounds - Solubility - Density - Melting point and boiling point	• Discussion • Laboratory experiments • Class exercise	Emphasis should be made to the learners about the competition between elimination and substitution.
	Chemical properties and uses of Halogen compounds	• Write the equations and mechanisms of the reactions involved (except reaction with metals and silver oxide) • Explain the difference between SN1 and SN2 and	▶ Reactions of halogeno alkanes • Substitution and elimination mechanisms for all reactions • Reactions with: •		

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• also E1 andE2 mechanisms • Draw energy diagrams for the mechanisms • State conditions required for the different reactions • Write the equations and mechanisms of the reactions involved (except oxidation and hydrogenation) Explain the reactivity of aryl halides in comparison with alkyl halides	- Alkalis - Concentrated ammonia - Silver salts and oxide - Cyanides - Metals(sodium and magnesium, include reactions of Grignard reagents) ▶ Reactions of aryl halides • Reactions affecting the ring - Nitration - Sulphonation - Halogens - Alkylation - Acylation - Hydrogenation • Compare reactivity of aryl halides with alkyl halides		

SENIOR FIVE TERM III

Topic 22: Alcohols and Phenols
General Objectives: Learners should be able to appreciate the nature, chemistry and uses of alcohols and phenols

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
10	**Introduction to alcohols and their properties**	• State general formula of alcohols • Describe the preparations of alcohols • Name alcohols using IUPAC system. • Explain the physical properties of alcohols	• Introduction (occurrence, general formula, functional groups, nomenclature using IUPAC rules and classification of monohydric alcohols) • Isomerism in alcohols • Preparations (fermentation, industrial by hydration of alkenes, hydrolysis of alkyl halides, use of Grignard reagent, reduction of carbonyl compounds and carboxylic acids, from primary amines. (Include mechanisms for hydration of alkenes and base hydrolysis of alkyl halides) • Physical properties - B.pts, M.pts, solubility, physical states	• Discussion • Laboratory experiments • Class exercise • Field study • Visits to rehabilitation centres	• Effect of hydrogen bonding on solubility b.pts) • Compare with phenol • TT experiment for - Luca's reagent - Esterification - Oxidation
	Chemical properties of alcohols	• Explain chemical properties of alcohols including mechanisms of the reactions (except oxidation, reaction	• Chemical properties - pH - Reaction with: H_2SO_4, or		

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• with phosphorus halides, sodium and thionyl chloride) • Carry out test to distinguish the different classes of alcohols • Explain uses of alcohols • Carry out test tube experiments to identify the functional group • Explain the chemical reactions for the identification of the functional group • Discuss the effects of alcohol abuse	- H_3PO_4, - HX, - sodium,, - PCl_3, PCl_5, $SOCl_2$, - Esterification - Oxidation • Test for alcohols • Practical identifications of the functional group • Uses of alcohols • Effect of abuse of alcohols •	•	
	Introduction to Phenol and its physical properties	• Write the formula of Phenol • Draw the structure of Phenol • Describe the different of preparing Phenol • Explain the physical properties of Phenol • Explain the inductive effect of OH group on the properties of phenol	• Introduction (general formula, functional groups) • Preparation - Lab. Preparation (from chlorobenzene, hydrolysis of diazonium salts, benzene sulphonic acid) - Industrial preparation (from petroleum oil, the Cumene process) • Physical properties - Appearance, - Melting and boiling points, - Solubility	• Discussion • Lab experiments • Class exercise • Field study • Visits to rehabilitation centres	- B r_2 T.T experiment water) - T.T experience neutral $FeCl_3$ -

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
	Chemical properties and uses of Alcohols	• Explain the chemical properties of Phenol • Compare the reactivity of OH group of phenol with those of aliphatic alcohols • Carry out confirmatory tests for phenol • Carry out test tube experiments to identify the functional group • Explain the chemical reactions for the identification of the functional group • Give uses of phenol	• Chemical reactions - pH - Reaction of –OH group (Na, acid chlorides, PCl_5 , Zinc dust, sodium hydroxide and Esterification) - Reactions of the benzene ring(hydrogenation, nitration, sulphonation, halogenations, alkylation, Acylation) - Chemical test for Phenol - Practical identifications of the functional group • Uses of phenol	•	• Mechanisms of the reactions of benzene ring to be left out • Compare the reactions of the OH group in Phenol with those of the aliphatic alcohols

SENIOR SIX TERM I

Topic 23: Carbonyl compounds

General Objectives: Learners should be able to appreciate the nature, chemistry and uses of carbonyl compounds

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
08	**Introduction to Carbonyl compounds and their physical properties**	• State general formulae of carbonyl compounds • Describe the preparations of carbonyl compounds • Name aldehydes and ketones using IUPAC system. • Explain the physical properties of carbonyl compounds • Compare the physical properties of aldehydes and ketones in relation to their structure • Compare the physical properties of carbonyl compounds and those of alcohols	• Introduction (general formula, functional groups, nomenclature using IUPAC rules) • Lab. Preparations - Oxidation of alcohols - Hydrolysis of dihalides • Physical properties - solubility, - physical states - boiling points and melting points	• Discussion • Laboratory experiments • Class exercise	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
	Chemical properties and uses of carbonyl compounds	• Explain the chemical • properties of carbonyl compounds giving mechanisms for the reactions (except oxidation, reduction) • Carry out tests to identify the carbonyl functional group • Carry out tests Distinguish between aldehydes and ketones • Carry out test tube experiments to identify the functional group • Explain the chemical reactions for the identification of the functional group • Give uses of carbonyl compounds •	• Chemical properties - Addition reactions ($NaHSO_3$, CN^-) - Reduction ($LiAlH_4$, $NaBH_4$, Na/ethanol, H_2/Ni) - Condensation reactions (hydrox-amines, hydrazine, phenyl hydrazine, 2,4-dinitrophenyl hydrazine (Brady's reagent) - Oxidation reactions ($Cr_2O_7^{2-}/H^+$, $KMnO_4/H^+$, I_2/OH^-) - Distinguishing reaction between aldehydes and ketones - Practical identifications of the functional groups • Uses of carbonyl compounds •	•	• TT reactions for general test using Brady's reagent • Distinguishing tests • with Fehling's reagent and Tollens reagent • Function group position identifying tests using Iodoform tests

Topic 24: Carboxylic acids
General Objectives: Learners should be able to appreciate the nature, chemistry and uses of carboxylic acids

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
06	**Introduction to Carboxylic acids and their physical properties**	• State general formula of alkanoic acids • Describe the preparations of alkanoic acids • Name alkanoic acids using IUPAC system. • Explain the physical properties of alkanoic acids • Compare the physical properties of carboxylic acids with those of alcohols and carbonyl compounds	• Introduction (general formula, functional group, nomenclature using IUPAC rules) • Lab. Preparations - Oxidation of primary alcohols, aldehydes - Use of Grignard reagent - Hydrolysis of nitriles, esters, acid amides • Physical properties, - Melting point and boiling point, - solubility, - physical state	• **Discussion** • **Lab experiments** • **Class exercise**	Comparison of acid strength with that of phenols
	Chemical properties and uses carboxylic acids	• Explain chemical properties of alkanoic acids including mechanisms of the reactions for Esterification • Explain uses of alkanoic acids • Discus the unique properties of methanoic acid • Carry out test tube experiments to identify the	• Chemical properties - Acidic behaviour (effect on litmus, metals, NaOH, carbonates / hydrogen carbonates) - Effect of substituent on acid strength - Esterification - Reaction with; PCl_5, Cl_2 - Reduction with $LiAlH_4$, H_2 - Decarboxylation	• Discussion • Laboratory experiments • Class exercise	Effect of hydrogen bonding on physical properties should be highlighted

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
	Soaps and soapless detergents	functional group • Explain the chemical reactions for the identification of the functional group • Give uses of alkanoic acid • Describe the preparation of: - Soaps - Soap less detergent • Explain the cleansing action of soap and soapless detergents • Explain the advantages and disadvantage • Explain the effect of soaps and soapless detergents on the environment	- Reaction with ammonia and ammonium salts - Unique properties of methanoic acid - Uses of organic acids • preparation of soap • Preparation of soap less detergents • Cleansing action of soap and soapless detergents • Advantages and disadvantages of soaps and detergents • Effect of soaps and detergents on the environment •	• Discussion • Laboratory experiments • Class exercise	Test tube reaction on confirmatory tests using sodium carbonate or hydrogen carbonate.

Topic 25: Esters

General Objectives: Learners should be able to appreciate the nature, chemistry and uses of esters

	Introduction to Esters and their physical properties	• State general formula of esters • Describe the preparations of esters • Name esters using IUPAC system.	• Introduction (occurrence, general formula, functional group, nomenclature using IUPAC rules) • Lab. Preparations (Esterification reaction	• **Discussion** • **Lab experiments** • **Class exercise**	

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• Explain the physical properties of esters	• Physical properties: - Smell, - solubility, - Melting points and boiling points,		
	Chemical properties and uses of Esters	• Explain chemical properties of esters including mechanisms of the reactions. • Explain the chemical reactions for the identification of the functional group • Explain uses of esters	• Chemical properties - Hydrolysis - Reduction - Ammonolysis • Uses of esters		

SENIOR SIX TERM II

Topic 26: Nitro compounds

General Objectives: Learners should be able to appreciate the nature, chemistry and uses of Nitro compounds

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
02	**Introduction to Nitro compounds and their Physical properties**	• State general formula of nitro compounds • Name nitro compounds using IUPAC system. • Describe the preparations of nitro compounds • Explain the physical properties of nitro compounds	• Introduction (general formula, functional group, nomenclature using IUPAC rules) • Lab. Preparations from alkyl halides, nitration of benzene • Physical properties - Solubility - Melting points and boiling points	• Discussion • Laboratory experiments • Class exercise	
	Chemical properties and uses of Nitro compounds	• Explain chemical properties of nitro compounds • Give uses of nitro compounds	• Chemical reactions; - Reduction, - Hydrolysis - Electrophilic substitution • Uses of nitro compounds		• Details of mechanisms not required

Topic 27: Amines
General Objectives: Learners should be able to appreciate the nature , chemistry and uses of amines

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
06	**Introduction to Amines and their physical properties**	• State general formula of amines • Name amines using IUPAC system. • Describe the preparations of amines • Explain the physical properties of amines • Explain the basic properties of amines	• Introduction (general formula, functional group, nomenclature using IUPAC rules) • Classification of ammines • Laboratory preparations; - Reduction of nitro compounds, nitriles, amides using $LiAlH_4$ - Reaction between alkyl halide and ammonia - Hofmann's degradation • Physical properties - Solubility, Melting points and boiling points	• Discussion • Laboratory experiments • Class exercise	• Comparison of basic properties with ammonia should be high lighted Relate solubility to hydrogen bonding
	Chemical properties and uses of Amines	• Explain chemical properties of amines (include mechanisms for alkylation) • Explain the effect of temperature on reaction with nitrous acid • Carry out test tube experiments to identify the functional group • Explain the chemical reactions for the identification of the functional group	• Chemical properties: - pH - the effect of substituent on basic strength - reaction with acids - Acylation, alkylation - Reaction with nitrous acids - Diazotization - Bromination , sulphonation, nitration, of aromatic amines • Practical identifications of the functional group • Uses amine		

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
		• State uses of amines • State the uses of dyes (social and economic aspects)	• Uses of dyes		

SENIOR SIX TERM III

Topic 28 : Polymers
General Objectives: Learners should be able to appreciate the nature , chemistry and uses of Polymers

06	**Introduction to polymers**	Should be able to: • Explain the process of polymerisation • Differentiate between addition and condensation polymerization. • Describe the structures of the different classes of polymers • Explain the different types of polymers •	• Concept of polymers and polymerisation. • Types of polymerization (addition and condensation) • Classes of polymers (natural and synthetic polymers) • Types of polymers - Rubbers, - fibres - plastics •		
	Rubber	• Describe the occurrence, structure, properties and vulcanisation of natural rubber • Describe the process of preparation of artificial rubber • Give the properties and uses of artificial rubber	• Rubber - Natural rubber(occurrence, structure , properties vulcanisation) - Synthetic rubber(preparation, structure and properties) - Uses •		

Periods	Sub-Topic	Specific Objectives	Content	Teaching and Learning Strategies	Notes
	Fibres	• Mention the occurrence of natural fibres and their uses • Explain the properties of natural fibres • Give examples of natural and artificial fibres • Explain the preparation of synthetic fibres • Explain the properties of artificial fibres • Give the uses of artificial fibres	• Fibres - Natural fibres(occurrence, examples and uses) - Examples: Starch, cotton, silk, proteins - Synthetic fibres(preparation, structure and uses) - Examples: Nylon and terylene, Propeno – nitrile fibre. •	• Discussion • Laboratory experiments • Class exercise Field study	• Many synthetic polymers can be moulded into required shapes and are useful as plastics for manufacture of a wide range of articles
	Plastics	• Explain the concept of plastics • Explain the differences between thermo setting and thermo softening plastics • Describe the process of preparation of selected plastics • Identify monomers and the related polymers of plastics • Construct a unit structural formula of a polymer from a monomer • Give uses of natural and synthetic polymers • Identify environmental effects of artificial polymers.	• Plastics - Thermo setting - Thermo plastics (thermo softening) - Structure - Preparation - Properties - Examples: PVC, polyethene, polypropene - Uses • Effects of plastics on the environment •		

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