The New Senior Secondary Curriculum for Sierra Leone

Subject syllabus for Chemistry

Subject Discipline: Sciences and Technologies

This subject syllabus is based on the National Curriculum Framework for Senior Secondary Education. It was prepared by national curriculum specialists and subject experts.

SSSC
Senior Secondary School Curriculum

Curriculum Elements for Chemistry – a core subject

Subject Description

Chemistry is the branch of science that deals with substances and their constituent particles; chemical processes and their representation; the chemical and physical properties of established, new and emerging materials/ substances; and methods of determining the purity, amount, presence, and in some cases, the preparation and isolation of materials/ substances.

Rationale for Inclusion of Chemistry in the Senior Secondary School Curriculum

It is important that Chemistry is given prominence in the new SSS curriculum as its study helps produce learners who are resourceful, resilient, scientifically literate, ethical, responsible, with strong environmental awareness, and therefore with the capacity to make good scientific and morally strong decisions. Learners will also be well informed, confident, ambitious, enterprising, and creative problem-solvers - capable of lifelong learning and with a desire to live healthy lives and take care of the environment

This Chemistry syllabus adopts a spiral approach in which learners are introduced to challenges that are appropriate for their age and complexities are developed gradually in subsequent years, giving them the opportunity to secure the appropriate prior learning needed for the understanding of more complex concepts and skills.

General Learning Outcomes (Broad Goals)

The study of chemistry as part of the Science and Technologies Discipline of the new SSS curriculum, offers learners the opportunity to:

1. acquire knowledge and understanding of the big ideas and concepts that underpin the details and complexities of both the natural phenomena and their day-to-day interactions and experiences of the material world,
2. recognise how and why chemistry and its application have such significant impact on our lives, both desirable and undesirable, as individuals and as a society,
3. appreciate the need for accurate use of scientific language, and to represent processes by using formulae and equations,
4. access the development, test and/ or use of modelling and models, especially to understand or represent microscopic and macroscopic entities and complex, very rapid or incredibly slow processes,
5. utilise their inquisitive nature and further develop an investigative mindset in evaluating claims, based on science, when used in the marketing and advertising of commodities and services,
6. grasp the importance of seeking rigorous and robust evidence, based on research, as the solid foundation for making decisions and drawing conclusions, and
7. develop their skills in assessing risks and recommending safety measures to be adopted in controlling identified associated hazards when carrying out or designing practical activities or laboratory investigations.

Structure and Content of the Senior Secondary School Chemistry Syllabus

	SSS 1	SSS 2	SSS 3
Term 1	**1. Atomic Structure and Properties** • The basic gross structure of the atom, including the relative properties of subatomic particles. • Atomic Number and Mass Number. • Electron arrangement using the KLM concept or electron octet rule. • Isotopes and Relative Atomic Mass based on the C-12 isotope. **2. The Periodic Table of Elements** • The development of the Periodic Table • The Periodic Law. • The basis of groups and periods of elements. • Position of metals and nonmetals. **3. Chemical Bonding** • Definition and basis of chemical bonding. • The three types of bonding. • Representation of each type (common examples). **4. Matter** • The kinetic theory of matter. • The basis and explanation of basic physical processes such as	**1. Atomic Structure and Properties** • The history of the Bohr's model of the atom. • Electron arrangement using spdf notations/ orbital concept, of simple elements (not transition metals). • Shapes of the s and p atomic orbitals. • Definition and discussion of atomic properties such as Ionisation energy, atomic radius, electron affinity and electronegativity. • The principles of the Mass Spectrometer. • Relative isotopic mass and relative atomic mass. • Calculating Relative Atomic Mass for elements, including that of diatomic elements, from mass spectrum data. **2. Periodicity** • Trends and patterns along Period 2 and down groups of atomic properties such as 1st Ionisation energy, atomic radius, and electronegativity. **3. Chemical Bonding, Structure& Properties** • Definition of structure of a substance.	**1. Atomic Structure and Properties** • The Electron arrangement of transition metal atoms and ions. **2. Periodicity** • Trends and patterns along period 3 and down groups of physical and chemical properties such as structure of substances, state at room temperature, boiling point and melting point, reactivity, and acid=base property of their oxides. **3. Chemical Bonding, Structure& Properties** • Polarisation. • Shapes of molecules. • Intermolecular forces and physical properties of simple molecules **4. Practical Investigations** • Qualitative analysis of ions. • Volumetric analysis: acid-base and redox reactions. **5. Mixtures and Separation Techniques** • Improving the purity of laboratory prepared substances.

	evaporation, diffusion, expansion, boiling, melting and solubility. • Heating and cooling curves of substances. **5. Working Scientifically (Doing Science)** • Compare experiments and investigations. • Designing an investigation. • Collecting and processing data. • Conclusions and evaluations. **6. Mixtures and Separation Techniques** • Definition and examples of mixtures. • Types of mixtures with examples • The basis of separation methods for mixtures • Separation methods for different mixtures.	• Stating and describing different types of structure associated with the three bond types. • Accounting for the physical properties of each of the different types. **4. Matter** • Gases **5. Scientific Research, Ideas & Evidence** • The scientific process. • How theories evolve. • Science & decision-making process • Conducting a literature search/ survey • Citing and referencing the literature. **6. Mixtures and Separation Techniques** • Alloys. • Obtaining pure samples of substances in the laboratory.	
Term 2	**7. Pure Substances and Chemical reactions** • Definition of the two types of pure substances. • Types of elements – metals/non-metals & Diatomic non-metals. • Types of compounds - acids, bases, and salts. • Working out their chemical formula.	**7. Pure Substances and Chemical reactions** • Metals and the reactivity series. • Extraction of Metals. • Electrolysis. • Redox reactions and half equations. • Neutralisation and preparation of salts. • Writing ionic equations.	**6. Pure Substances and Chemical reactions** • Strong and weak acids. • Bronsted-Lowry theory. • Oxidation Number and IUPAC Nomenclature. • Redox reactions and redox equations.

	• Introduction to IUPAC nomenclature. • Understanding a chemical reaction process, including tell-tale signs. • Common types of chemical reactions. • Writing symbolic chemical reactions. **8. Quantitative Chemistry - Mole Concept** • Calculating relative molecular mass of compounds and diatomic elements. • Mole Concept and Avogadro Number of particles. • Number of moles of solids, gases, and solutions. **9. Rates of Reaction (Kinetics)** • Defining the rate of a reaction. • Measurable change of different types of reactions. • Graphical representation of reaction rate (rate curves). • Factors affecting rates of reaction. • Studying the rates of some common reactions. • Conduct an investigation into the effect of one of the factors on the speed of an appropriate chemical reaction.	**8. Quantitative Chemistry - Mole Concept** • Stoichiometry. • Mole concept applied to chemical reactions, both gravimetric and volumetric analysis. • Percentage yield. **9. Rates of Reaction (Kinetics)** • Collision theory and activation energy. • Maxwell-Boltzmann distributions. • The Maxwell-Boltzmann theory and the factors affecting rates of reaction. • Investigate the effect of one of the factors on the speed of an appropriate chemical reaction. **10. Energy Changes** • Standard Enthalpy of Formation, Combustion and Neutralization • Measuring enthalpy change. • Calculating enthalpy change of reactions. **11. Reversible Reactions and Equilibria** • Conditions for dynamic equilibrium. • Application of Le Chatelier's Principle to changes in temperature, pressure and concentration, as well as in the presence of a catalyst.	**7. Quantitative Chemistry - Mole Concept** • Mole concept applied to Redox reactions **8. Rates of Reaction (Kinetics)** • (See Reversible Reactions and Equilibria, below) **9. Energy Changes** • Hess's Law. • Bond Enthalpies. • Born Haber cycles. • Enthalpy of solution. **10. Reversible Reactions and Equilibria** • Industrial processes of relevance to Sierra Leone. **11. Group Chemistry** • Transition Metal Chemistry.

	10. Energy Changes • The two types of heat transfer – definition, representation, and examples • Representing heat transfer using energy level diagrams **11. Reversible Reactions and Equilibria** • Defining reversible reactions, and their representations. • Dynamic equilibrium. • Le Chatelier's Principle and its application to changes to the amounts of substances. **12. Group Chemistry** • The chemistry of Group 1 elements. • The chemistry of Group 0 elements.	**12. Group Chemistry** • The chemistry of Group 2 elements and some of their compounds. • The chemistry of Group 7 elements and some of their compounds.	
Term 3	**13. Organic Chemistry** • Definition of organic compounds, emphasising the two main parts of simple organic molecules. • Homologous series and functional groups of hydrocarbons. • Separation of crude oil. • Structure, naming, physical properties, and chemical reactions of alkanes.	**13. Organic Chemistry** • Isomerism. • Homologous series and functional groups of other key aliphatic organic groups. • The chemistry of selected non-hydrocarbon aliphatic organic groups. • Characteristic chemical reactions of alkenes, haloalkanes, primary alcohols, secondary alcohols, and carboxylic acids.	**12. Organic Chemistry** • The chemistry of Carboxylic acids and its derivatives. • The chemistry of amines. • Condensation polymerization. • The chemistry of amino acids. • Reaction pathways involving aliphatic organic compounds. • The reaction mechanisms for alkanes, alkenes and haloalkanes.

	• Structure, naming, physical properties, and chemical reactions of alkenes. **14. Intro: Modern Instrumental Techniques** • The basics of instrumental techniques. • Gas chromatography. • Colorimetry.	• An introduction to organic mechanisms. **14. Intro: Modern Instrumental Techniques** • Mass spectrometry as applied to simple organic compounds.	**13. Intro: Modern Instrumental Techniques** • IR spectrometry as applied to simple organic compounds.

Suggested Teaching and Learning Resources

Comprehensive Notes on Modern Chemistry for SHS, New Edition (2009), F.K. Sarpong, SARPS Series.
Essential Chemistry for SSS, 8th edition (2018), I. A. Odesina, Tonad Publishers Ltd.
New Chemistry for SHS First Edition (2014), J Dollar & S. Adjei., Aki-Ola Series.

Blackboard and chalk, or whiteboard and board pens.
Internet access, and use of relevant websites, YouTube videos, educational resources, etc.
Computer/ laptop/ tablet/ 3G+ mobile phone (and top-up for data)
PowerPoint presentations
Digital or overhead projectors.
Video clips, video cassettes, or DVDs.
Video or DVD player
Ethno pedagogical resources
Workbooks & revision guides
Flip charts
Topic-specific charts
Topic-specific models
All learners should be supplied with a copy of the Periodic Table
Fully equipped and functioning laboratory and computer laboratory
Science kits including the micro kits
Library

Alumni in the diaspora may offer or advise useful resources from other schools and education systems, e.g., UK GCSE and AS levels (to be used with due regard to copyright and intellectual property legislation).

Teaching Syllabus

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
Atomic Structure and Properties • The basic gross structure of the atom, including the relative properties of subatomic particles. • Atomic Number and Mass Number. • Electron arrangement using the KLM concept or electron octet rule. • Isotopes and Relative Atomic Mass based on the C-12 isotope.	**Learners will be able to:** • use Bohr's nuclear model to describe atoms, • calculate the numbers of protons, neutrons and electrons in an atom or ion, given its atomic number and mass number, • relate the size and scale of the atom to objects in the physical world, • represent the electronic arrangements of the first twenty elements in both the diagrammatic and notation forms, • state that isotopes are different atoms of the same element containing different neutrons in their nuclei, • calculate the relative atomic mass of an element from the relative masses and abundance of its isotopes, and hence, • explain the why the relative atomic masses of some elements are not whole numbers.	• Teacher-led didactic approach aided by practice questions for individual and group work • Using models and props to illustrate number and types of subatomic particles in an atom. E.g., bottle caps/ ludo pieces - of three different colours; sheets with two or more concentric circles representing the nucleus and the electron shell(s) • Use of available PowerPoint slides with animations; use of relevant websites on the internet; use of video clips. Or various combinations of all. • Flipped classroom (whereby learners are are introduced to learning material before class and asked to make notes based on very clear expected outcomes. Classroom time is then used to deepen understanding through discussion with peers and problem-solving activities	**Learners may be asked independently, in pairs, or in groups to:** • State definitions of isotopes, the atom and give the number of the subatomic particles in a given atom/ isotope • Describe the atomic structure of an isotope from its nuclear symbol or position on the Periodic Table and mass number, (and vice versa). • Either justify the number of any, two or all of the subatomic particles present from a full symbol of an isotope/vice versa, or • Predict the position and hence name of element an isotope belongs to from a partial description of its atomic structure • Either draw or write the electronic configuration of elements from different groups and periods or • State/ describe/ justify the position of elements from their electronic configuration.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
		facilitated by teachers, e.g., using their notes subsequently to attempt a differentiated worksheet).	
The Periodic Table of Elements • The development of the Periodic Table • The Periodic Law. • The basis of groups and periods of elements. • Position of metals and nonmetals.	• describe the steps involved in the development of the periodic table, mentioning the work of Mendeleev and others, • describe that in the periodic table elements are arranged in order of increasing atomic number, in rows called periods, • describe that in the periodic table elements with similar properties are placed in the same vertical columns called groups, • explain the meaning of the atomic number of an element in terms of its position in the periodic table and the number of protons in the nucleus, • explain how the electron arrangement of an element is related to its position on the periodic table, • identify elements as metals or non-metals according to their position in the periodic table, explaining the division in terms of the atomic structure of the element.	• Teacher-led didactic approach aided by practice questions for individual and group work • Using models and props to illustrate number and types of subatomic particles in an atom. E.g., bottle caps/ ludo pieces - of three different colours; sheets with two or more concentric circles representing the nucleus and the electron shell(s) • Use of available PowerPoint slides with animations; use of relevant websites on the internet; use of video clips. Or various combinations of all. • Flipped classroom (whereby learners are are introduced to learning material before class and asked to make notes based on very clear expected outcomes. Classroom time is	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
		then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers, e.g., using their notes subsequently to attempt a differentiated worksheet).	
Chemical Bonding • Definition and basis of chemical bonding. • The three types of bonding. • Representation of each type (common examples).	• describe the octet rule, and its importance in chemical bonding of atoms, • explain chemical bonding in terms of electrostatic forces, and the transfer or sharing of the outer electrons, • work out the charge on the ions of metals and non-metals from the group number of the element (limited to the metals in Groups 1, 2 and 3, and non-metals in Groups 5, 6 and 7), • explain how ionic bonds are formed by the transfer of electrons between atoms to produce positive and negative ions, • draw dot and cross diagrams to represent ionic bonding, • explain how a covalent bond is formed when a pair of electrons is shared between two atoms, • draw dot and cross diagrams for simple molecules such as hydrogen, fluorine,	• Research using books, etc., or conduct a project on any aspect of the topic with the objective of teaching another pupil • Ask the Expert/ group work using the "Envoy" strategy.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
	oxygen, nitrogen, hydrogen fluoride, water, and methane (but not limited to these), • represent covalent bonds by using a line to represent a single bond, • explain that metallic bonds are formed when strong electrostatic forces of attraction exist between the positive metal ions and their delocalized outer electrons.		assessment, as applied at an appropriate point.
Matter • The kinetic theory of matter. • The basis and explanation of basic physical processes such as evaporation, diffusion, expansion, boiling, melting and solubility. • Heating and cooling curves of substances.	• a) describe the arrangement, movement, and relative energy of particles in each of the three states of matter – solid, liquid and gases, • explain the changes in arrangement, movement and energy of particles during the interconversions between the three states, • predict the physical state of a substance under specified conditions, given suitable data, • illustrate and interpret heating and cooling curves, including how boiling and melting points can be identified.	• Direct instruction by teacher • Hands on activities/ Practical activities • Animations/ video clips • Demonstrations/ use of models to aid understanding • Ask the Expert / group work using the "Envoy" strategy	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment,

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
			formative assessment, or summative assessment, as applied at an appropriate point.
Working Scientifically (Doing Science) • Compare experiments and investigations. • Designing an investigation. • Collecting and processing data. • Conclusions and evaluations.	• distinguish between a scientific experiment and a scientific investigation, • describe how a scientist's initial idea turns into a theory that is accepted by the wider scientific community, • describe the limitations of science, giving examples of questions that science can't answer, • identify and describe hazards in a procedure, describing ways of reducing and safely handling the risks, • know how to design a good experiment, including making sure good quality results are obtained, • identify and apply suitable ways of processing and displaying the data collected during the investigation.	• Direct instruction by teacher • Group work/ Think-Pair-Share • Animations/ video clips • Research – books / projectors • Demonstrations/ use of models to aid understanding	• State definitions of key terms. • Describe the concepts addressed. • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Mixtures and Separation Techniques • Definition and examples of mixtures.	• describe and give examples of different types of mixtures, • describe, explain, and give examples of specified processes of separation, including paper chromatography, distillation, and a combination of techniques,	• Group work/ Think-Pair-Share • Hands on activities/ Practical activities • Flipped classroom (whereby learners are are introduced to learning material before class and asked to make notes	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
• Types of mixtures with examples • The basis of separation methods for mixtures • Separation methods for different mixtures.	• suggest suitable separation techniques when given appropriate information, • describe how different forms of water – waste, ground, and sea water – can be made potable	based on very clear expected outcomes. Classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers, e.g., using their notes subsequently to attempt a differentiated worksheet). • Demonstrations/ use of models to aid understanding.	• Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Pure Substances and Chemical reactions • Definition of the two types of pure substances. • Types of elements – metals/non-metals & Diatomic non-metals.	• explain the differences between the use of 'pure' in chemistry compared with its everyday use, and the differences in chemistry between a pure substance and a mixture, • describe elements in terms of having the same types of atoms, giving examples of metals and non-metals, and their symbols, especially of the first twenty, with the help of the periodic table • define compounds in terms of the number of different atoms that are chemically bonded, identifying the *ide and *ate compounds,	• Direct instruction by teacher • Group work/ Think-Pair-Share • Animations/ video clips	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
• Types of compounds - acids, bases, and salts. • Working out their chemical formula. • Introduction to IUPAC nomenclature. • Understanding a chemical reaction process, including tell-tale signs. • Common types of chemical reactions. • Writing symbolic chemical reactions.	• work out the chemical formulae of compounds, both simple *ide compounds, and those involving radicals - the *ate compounds, • define and describe chemical reactions, including the tell-tale signs that they are occurring, • describe different types of reactions such as i) direct formation, ii) displacement and combustion, iii) neutralization and precipitation, iv) thermal decomposition, as illustrations of different combinations between elements and compounds, • write word equations for examples of the reactions described above, then write the symbolic equations and go on to balance them.		• Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Quantitative Chemistry - Mole Concept • Calculating relative molecular mass of compounds	• calculate relative formula mass using relative atomic masses, • state that one mole of particles of a substance is defined as the mass of "relative formula mass" in grams,	• Direct instruction by teacher • Group work/ Think-Pair-Share • Animations/ video clips • Demonstrations/ use of models to aid understanding.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
and diatomic elements. • Mole Concept and Avogadro Number of particles. • Number of moles of solids, gases, and solutions.	• state that one mole of particles of a substance is the Avogadro Constant number of particles 6 x 1023 particles. • calculate the number of moles (of particles) of any substance in a given mass of that substance, and vice versa • determine the empirical formula of a compound from relevant data provided, and subsequently deduce the molecular formula when its relative molecular formula is given, also • calculate the number of moles (of particles) of a gaseous substance when its molar volume is given, or when its volume is given under stated conditions of temperature and pressure from the ideal gas equation, • calculate the number of moles (of particles) of solute in a solution when the volume and concentration of the solution, are given		• Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Rates of Reaction (Kinetics) • Defining the rate of a reaction. • Measurable change of different types of reactions. • Graphical representation of	• state the expression for calculating the mean rate of a reaction in terms of the size of measurable change involving the amount of product formed or reactants used up, • draw and interpret graphs of mass, volume, or concentration of reactant used up, or product formed, against time, • describe the collision theory, as well as the activation energy theory,	• Direct instruction by teacher. • Group work/ Think-Pair-Share • Hands on activities/ Practical activities. • Ask the Expert / group work using the "Envoy" strategy.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short,

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
reaction rate (rate curves). • Factors affecting rates of reaction. • Studying the rates of some common reactions. • Investigate the effect of one of the factors on the speed of an appropriate chemical reaction.	• state the factors which affect the rates of chemical reactions, • using collision theory, predict and explain the effects of changing conditions of concentration, pressure, and temperature on the rate of a reaction, • predict and explain the effects of changes in the size of pieces of a reacting solid (in terms of surface area to volume ratio) on the rate of a reaction, • use simple ideas of proportionality when using collision theory to explain the effect of a factor on the rate of a reaction, • identify catalysts in reactions from their effect on the rate of reaction and because they are not included in the chemical equation for the reaction, • explain catalytic action in terms of activation energy, • investigate the effects of changing conditions of a reaction on the rate of a reaction		structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Energy Changes • The two types of heat transfer – definition, representation, and examples	• describe an endothermic change of reaction as one in which heat energy is taken in, • describe an exothermic change of reaction as one in which heat energy is given out, • draw simple reaction profiles (energy level diagrams) for exothermic and endothermic reactions, showing the relative energies of	• Direct instruction by teacher • Hands on activities/ Practical activities • Animations/ video clips • Research using books, websites, etc.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
• Representing heat transfer using energy level diagrams	reactants and products, the activation energy, and the overall heat energy change, with a curved line to show the energy as the reaction proceeds, • use reaction profile to identify reactions as endothermic or exothermic.		• Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Reversible Reactions and Equilibria • Defining reversible reactions, and their representations. • Dynamic equilibrium. • Le Chatelier's Principle and its application to	• recall that some chemical reactions are reversible, • state and explain the symbol depicting a reversible reaction • explain what is meant by dynamic equilibrium, • recall that the direction of some reversible reactions can be altered by changing the reaction conditions, • state Le Chatelier's Principle • make qualitative predictions about the effect of changes, on systems at equilibrium when	• Direct instruction by teacher • Group work/ Think-Pair-Share • Hands on activities/ Practical activities • Ask the Expert / group work using the "Envoy" strategy.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
changes to the amounts of substances.	given appropriate information, using Le Chatelier's Principle		• Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Group Chemistry • The chemistry of Group 1 elements. • The chemistry of Group 0 elements.	• state the elements of Group 1, and its special group name, • explain why some elements are classified as Group 1 elements, based on their electron arrangement or position on the periodic table, • state some of the physical properties of the members of this group • describe, with the aid of balanced equations, the reactions of the first three elements of this group with water and dilute samples of common laboratory acids, • describe the pattern in reactivity for the reactions in d) above, explain the pattern in terms of electronic arrangement, and go on to predict the reactivity of other alkali metals,	• Direct instruction by teacher • Group work/ Think-Pair-Share • Ask the Expert / group work using the "Envoy" strategy. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
	• State the elements of group 0, and its special group name, • explain why some elements are classified as Group 0 elements, based on their electron arrangement or position on the periodic table, • state some of the physical properties of the members of this group, • explain why the noble gases are chemically inert compared with other elements, in terms of their electron arrangement, • describe the pattern in the physical properties of the first three noble gases, and go on to use this pattern predict the physical properties of other noble gases, • explain how the uses of noble gases depend on their chemical inertness and physical properties (such as low density).		• Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Organic Chemistry • Definition of organic compounds, emphasising the two main parts of simple organic molecules. • Homologous series and	• describe an organic compound as consisting of at least two parts – a functional group and the carbon-carbon backbone of stem, • describe organic compounds that have the same functional group as belonging to the same homologous series, and go on to state four homologous series, namely: alkanes, alkenes, alcohols, and carboxylic acids,	• Direct instruction by teacher. • Group work/ Think-Pair-Share. • Demonstrations/ use of models to aid understanding.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short,

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
functional groups of hydrocarbons. • Separation of crude oil. • Structure, naming, physical properties, and chemical reactions of alkanes. • Structure, naming, physical properties, and chemical reactions of alkenes.	• describe and apply a set of rules in naming the first six members of each of the four homologous series given above, • describe and implement strategies for drawing displayed formulae to accurately represent the structure of the first six members of these four homologous series, • describe the chemical reaction of combustion in sufficient and insufficient oxygen with the aid of balanced equations, and in addition indicate implications for the earth's atmosphere, • describe the chemical reaction of cracking of long chain alkanes which results in the formation of alkenes, • describe the chemical addition reactions of alkenes with hydrogen, halogens, and hydrohalides, by balanced chemical equations involving displayed formulae, • describe the addition polymerization process with suitable displayed formulae, and also include the uses and environmental challenges posed by the following polymers – polythene, PVC, polystyrene and polytetrafluoto-ethene.		structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Intro: Modern Instrumental Techniques	• describe the common stages of any analytical process to include: sample preparation, creating conditions that enhance the property that is to be analysed, subjecting the sample to the analysis,	• Direct instruction by teacher. • Hands on activities/ Practical activities.	• State definitions of key terms. • Describe the concepts addressed.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
• The basics of instrumental techniques. • Gas chromatography. • Colorimetry.	recording and/ or displaying the results, analysing the results, and drawing appropriate conclusions, • describe the separating basis and technique used in a gas chromatography, the different stages and the processes occurring at each stage, and the methods of displaying and interpreting the results, • describe the separating basis and technique used in a colorimetry, the different stages and the processes occurring at each stage, and the methods of displaying and interpreting the results.	• Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers). • Ask the Expert / group work using the "Envoy" strategy.	• Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Atomic Structure and Properties • The history of the Bohr's model of the atom. • Electron arrangement using spdf	• explain the contributions made by scientists, starting with John Dalton, to the current acceptable model of the atom, • describe the electronic configuration of the first 30 elements using spdf notations, including the shapes of the s & p orbitals only,	• Direct instruction by teacher. • Demonstrations/ use of models to aid understanding, e.g., bottle caps/ ludo pieces of three different colours, sheets with two or more concentric circles	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
notations/ orbital concept, of simple elements (not transition metals). • Shapes of the s and p atomic orbitals. • Definition and discussion of atomic properties such as Ionisation energy, atomic radius, electron affinity and electronegativity. • The principles of the Mass Spectrometer. • Relative isotopic mass and relative atomic mass. • Calculating Relative Atomic Mass for elements, including that of diatomic	• define first ionization energy, electron affinity, atomic size, electronegativity, also write equations for the first and successive ionisation energies, and first electron affinity, • describe the process, stages, the spectrum involve in mass spectrometry • interpret simple mass spectra of elements and calculate relative atomic mass for mononuclear species.	representing the nucleus and the electron shell(s), • Research using books, websites, etc. • Animations/ video clips. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
elements, from mass spectrum data.			
Periodicity • Trends and patterns along Period 2 and down groups of atomic properties such as 1st Ionisation energy, atomic radius, and electronegativity.	• classify an element as s, p, d, or f block, according to its position in the Periodic Table as determined by its atomic number, • explain the trends in atomic radius and first ionization energy	• Direct instruction by teacher. • Animations/ video clips. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
Chemical Bonding, Structure& Properties • Definition of structure of a substance. • Stating and describing different types of structure associated with the three bond types. • Accounting for the physical properties of each of the different types.	• describe dative covalent bond as a shared pair of electrons in which both electrons come from one of the atoms of the bond, • discuss the basic factors that determine the nature and strength of ionic, covalent, and metallic bonds • describe structure to mean the arrangement of particles of the substance in three-dimensional space • describe, giving examples, the four types of giant structures – giant ionic, giant metallic giant covalent, and giant layered covalent, • describe giving examples, substances with a simple molecular structure • describe, explain, and predict the physical properties of substances with each of the types of structure given in the last two points above.	• Direct instruction by teacher. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Project work on any aspect of the topic with the objective of teaching another pupil.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Matter • Gases	• describe and conduct the laboratory preparation, including the principles of collection, of gases such as hydrogen, ammonia, and carbon dioxide,	• Direct instruction by teacher. • Role play • Group work/ Think-Pair-Share.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
	• describe the ideal gas equation, using it to calculate the number of moles of gases from relevant data on volume, temperature, and pressure, • describe the composition of solutions in general, • predict which solutes will form soluble or insoluble aqueous solutions, based on the nature of the solutes	• Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Scientific Research, Ideas & Evidence • The scientific process. • How theories evolve. • Science & decision-making process	• describe the processes of developing and testing theories or validating existing theories, collecting evidence, and ways of communicating results obtained, • develop their investigative and practical skills, as they describe and apply concepts such as types of variables, types of data (including constructing suitable tables of data), types of graphs and charts, drawing conclusions and evaluations,	• Direct instruction by teacher. • Role play • Field trips • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short,

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
• Conducting a literature search/ survey • Citing and referencing the literature.	• explain the importance of ethical considerations when undertaking science investigations, • describe two major types of citations utlised in physical science literature, • conduct a literature survey on a chemistry-based topic that is of importance to the learner.	• Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc.	structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Mixtures and Separation Techniques • Alloys. • Obtaining pure samples of substances in the laboratory.	• describe the general composition and physical properties of alloys, giving examples and their uses, • describe and conduct the laboratory preparation and collection of copper sulphate crystals, • describe and explain the fractional distillation of air, • describe and explain the fractional distillation of crude oil	• Direct instruction by teacher. • Role play. • Field trips. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
		• Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Pure Substances and Chemical reactions • Metals and the reactivity series. • Extraction of Metals. • Electrolysis. • Redox reactions and half equations. • Neutralisation and preparation of salts. • Writing ionic equations.	• explain the reactivity series of metals in terms of the metal's readiness to form metal ions, by using their reactions with water, acids and salt solutions involving a different metal, • describe, with the aid of both balanced symbolic and ionic equations, the displacement reactions of metals discussed above, • use the reactivity series of metals to predict and describe three different methods of extracting metals from their ores, giving an example of each type, • discuss the pros and cons of using recycling as an alternative to extraction in meeting demands for some metals, • define oxidation and reduction reactions in terms of both the gain and loss of oxygen, and the gain and loss of electrons,	• Direct instruction by teacher. • Role play. • Field trips. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
	• describe, with the aid of half equations, the displacement reactions of metals discussed in the first point above, as redox reactions, • calculate the oxidation number of an element in both a compound and an ion, and determine which species is the reducing agent and which is the oxidizing agent, • state the IUPAC name of an ion or compound by making use of the oxidation number of the central element in a compound and ion • work out the chemical formula of a compound or ion when given the oxidation number of the central element • describe the electrolytic process of a molten binary ionic compound, applying the principles learnt to the extraction of aluminium, • describe the electrolytic process of an aqueous solution of a binary ionic compound, applying the principles learnt to the electrolysis of brine.	used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Quantitative Chemistry - Mole Concept • Stoichiometry. • Mole concept applied to chemical	• determine the mole ratio of different substances from balanced symbolic equations, • state the law of conservation of mass, and apply it to gravimetric calculations of several chemical reactions,	• Direct instruction by teacher. • Role play. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
reactions, both gravimetric and volumetric analysis. • Percentage yield.	• compare the effectiveness of different laboratory techniques of obtaining a substance in the lab by the same chemical reaction, by calculating the chemical yield of each technique, • describe the titration method (volumetric analysis) used to standardise (determine the concentration of) an acid or a base during an acid base reaction, • calculate the concentration of the oxidizing or reducing agent in a given redox reaction when provided the relevant data, by using the mole concept and balanced symbolic equation for the given reaction.	• Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Rates of Reaction (Kinetics) • Collision theory and activation energy. • Maxwell-Boltzmann distributions. • The Maxwell-Boltzmann theory and the	• draw and describe the Maxwell-Boltzmann distribution curves as it applies to the rate of a reaction generally, and of each of the factors of temperature, concentration, and presence of a catalyst, • investigate the effects of changing conditions of a reaction on the rate of a reaction.	• Direct instruction by teacher. • Role play. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short,

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
factors affecting rates of reaction. • Investigate the effect of one of the factors on the speed of an appropriate chemical reaction.		• Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Project work on any aspect of the topic with the objective of teaching another pupil. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Energy Changes • Standard Enthalpy of Formation, Combustion and Neutralization • Measuring enthalpy change. • Calculating enthalpy change of reactions.	• define and describe the standard enthalpies of formation, combustion, and neutralisation with the aid of balanced equations with state symbols • state the first law of thermodynamics, and apply it by calculating the enthalpy of reactions using temperature change of water or aqueous solutions, • describe lab procedure in measuring heat change of a reaction in aqueous solutions, and in burning fuels, • conduct an investigation.	• Direct instruction by teacher. • Role play. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
		• Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Reversible Reactions and Equilibria • Conditions for dynamic equilibrium. • Application of Le Chatelier's Principle to changes in temperature, pressure and concentration, as well as in the presence of a catalyst.	• state the conditions under which a dynamic equilibrium can be established, • state Le Chatelier's principle, • make qualitative predictions about the effect of changes, if any, in temperature, pressure, concentration, and the presence of a catalyst, on a system in equilibrium when given appropriate information, using Le Chatelier's principle, • conduct an investigation.	• Direct instruction by teacher. • Role play. • Field trips. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
		learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Group Chemistry • The chemistry of Group 2 elements and some of their compounds. • The chemistry of Group 7 elements and some of their compounds.	• state the elements of Group 2, and its special group name, • explain why some elements are classified as Group 2 elements, based on their electron arrangement or position on the periodic table, • compare some of the physical properties of the members of this group with those of group 1, highlighting any trends down the group, • describe, and account for any pattern in the solubility of the oxides, hydroxides, carbonates, and sulphates, down the group, • state and account for the uses of the compounds of some Group 2 members, • state the elements of Group 7 and its special group name, • explain why some elements are classified as Group 7 elements, based on their	• Direct instruction by teacher. • Role play. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment,

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
	electron arrangement or position on the periodic table, • state some of the physical properties of the members of this group, highlighting any trends, • describe the displacement reactions of the members with the aid of suitable balanced symbolic, ionic and half equations, • describe the trend in the reducing power of the halides in their reactions with sulphuric acid with the aid of suitable balanced symbolic, ionic and half equations, • describe the disproportionation reactions between chlorine and water and cold dilute aqueous sodium hydroxide with the aid of suitable balanced symbolic, ionic and half equations, • describe the uses of halogens and halides.	problem-solving activities facilitated by teachers).	formative assessment, or summative assessment, as applied at an appropriate point.
Organic Chemistry • Isomerism. • Homologous series and functional groups of other key aliphatic organic groups. • The chemistry of selected non-	• state and describe the meaning of the terms isomerism and structural isomerism, including how they are related, • draw the displayed formulae depicting chain, position and functional group isomerism, as different forms of structural isomerism, • draw the displayed formula to represent primary, secondary and tertiary haloalkanes and alcohols,	• Direct instruction by teacher. • Role play. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short,

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
hydrocarbon aliphatic organic groups. • Characteristic chemical reactions of alkenes, haloalkanes, primary alcohols, secondary alcohols, and carboxylic acids. • An introduction to organic mechanisms.	• draw the displayed formula of the functional groups for the carbonyls (aldehydes and ketones) and esters homologous series • describe and implement strategies for drawing displayed formulae to accurately represent the structure of the first six members of these three homologous series mentioned immediately above, • describe with the aid of balanced equations, preferably using displayed formulae, the key reactions of haloalkanes, alcohols and carboxylic acids, • define and demonstrate understanding of the following terms: mechanism, reactive intermediate species, nucleophile, electrophile, free radicals, heterolytic fission and hemolytic fission, single and double headed curly arrows, as applied to organic reactions, • state and justify the type of mechanism undertaken by alkanes, alkenes and haloalkanes.	• Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Intro: Modern Instrumental Techniques • Mass spectrometry as applied to simple	• demonstrate knowledge, understanding and application of mass spectra for identification, and fragmentation peaks.	• Direct instruction by teacher. • Role play. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
organic compounds.		• Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Atomic Structure and Properties • The Electron arrangement of transition metal atoms and ions.	• deduce the electronic configurations of atoms and ions of the d-block elements of Period 4, given their atomic number and charge (if any).	• Direct instruction by teacher. • Group work/ Think-Pair-Share. • Animations/ video clips. • Research using books, websites, etc. • Demonstrations/ use of models to aid understanding, e.g., bottle caps/ ludo pieces of three different colours,	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short,

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
		sheets with two or more concentric circles representing the nucleus and the electron shell(s), • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Periodicity • Trends and patterns along Period 3 and down groups of physical and chemical properties such as structure of substances, state at room temperature, boiling point and melting point, reactivity, and	• explain the trends in bond types, acid-base properties, structure, melting points, and thermal stability of oxides and other compounds.	• Direct instruction by teacher. • Research using books, websites, etc. • Group work/ Think-Pair-Share. • Animations/ video clips. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
acid-base property of their oxides.		problem-solving activities facilitated by teachers).	some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Chemical Bonding, Structure& Properties • Polarisation. • Shapes of molecules. • Intermolecular forces and physical properties of simple molecules	• define and demonstrate understanding of the terms: polarization, polarizing power of a cation and polarizability of an anion, as they apply to ionic bonds • state and apply Fajan's rules in accounting for the covalent properties displayed by some ionic compounds, • describe the polarity of a covalent bond based on the electronegativity difference between the atoms of the bond, • predict and draw the shapes of, and predict the bond angles in, simple polynuclear AXn molecules and ions, limited to species where n or coordination number is 2, 3, 4, 5, and 6, • state and describe the three intermolecular forces of induced dipole–dipole (Vander Waals or London forces), permanent	• Direct instruction by teacher. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
	dipole–dipole forces, and hydrogen bonding, • describe how molecules such as iodine, HCl, and water can interact by one or more of these three types of intermolecular forces, • predict the physical properties of simple molecules based on the type of intermolecular forces they have • describe and explain the trend in boiling points of the hydrides of Group 6 elements.	discussion with peers and problem-solving activities facilitated by teachers).	• Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Practical Investigations • Qualitative analysis of ions. • Volumetric analysis: acid-base and redox reactions.	• describe the principle, methodology, usefulness, and limitations of flame tests to identify metal ions such as lithium, sodium, potassium, barium, calcium, and copper, • use balanced ionic equations to describe tests using aqueous sodium hydroxide and ammonia solutions to identify the presence of cations such as aluminium, calcium, copper, iron (ii), iron (iii), and ammonium, • use balanced ionic equations to describe tests using suitable reagents to identify the presence of anions such as carbonates, the halides, sulphates, iron (ii), iron (iii), and ammonium, • use balanced ionic equations to describe tests using suitable reagents to test for the following gases: CO_2, H_2, O_2, and Cl_2,	• Direct instruction by teacher. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
	• identify ions in unknown salts using chemical tests only, • undertake a safe and rigorous redox titration procedure in the lab, collect and record useful data, process them and communicate the findings with the aid of relevant charts and graphs, and finally draw conclusions and evaluate the entire process.	understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Mixtures and Separation Techniques • Improving the purity of laboratory prepared substances.	• describe, demonstrate, and obtain salts that have gone through some process of purification both in the lab and by local small-scale industries, e.g., salt processing, • describe, demonstrate, and extract liquid compounds that have gone through some process of purification, both in the lab and by local small-scale industries such as those processing palm oil and ginger beer, • describe the different methods of purification that water from different sources can be subjected to by large-scale, small-scale, and home-based techniques, • describe and demonstrate how impure metal samples can be purified using electrolysis	• Direct instruction by teacher. • Role play. • Field trips. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
		understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Pure Substances and Chemical reactions • Strong and weak acids. • Bronsted-Lowry theory. • Oxidation Number and IUPAC Nomenclature. • Redox reactions and redox equations.	• explain the terms weak and strong acids, with respect to the degree of dissociation into ions, • explain differences between weak and dilute acid solutions, and strong and concentrated acid solutions, • demonstrate an understanding that Bronsted-Lowry acid is a proton donor, and Bronsted-Lowry base is a proton acceptor, • identify and predict Bronsted-Lowry conjugate acid-base pairs, • define and describe what is meant by the terms: oxidation number, redox reaction, and disproportionation, • use oxidation numbers to identify redox and disproportionation reactions, • write full balanced equations for redox reactions starting from ionic half equations.	• Direct instruction by teacher. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
Quantitative Chemistry - Mole Concept • Mole concept applied to redox reactions	• describe the titration method (volumetric analysis) used to standardise (determine the concentration) of an acid or a base during an acid base reaction, • calculate the concentration of the oxidizing or reducing agent in a given redox reaction, when provided with the relevant data, by using the mole concept and balanced symbolic equation for the given reaction	• Direct instruction by teacher. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Rates of Reaction (Kinetics)	• investigate the effect of changing one of the conditions of a reaction on the rate of a reaction	• Hands on activities/ Practical activities. • Animations/ video clips.	• State definitions of key terms. • Describe the concepts addressed.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
• (See Reversible Reactions and Equilibria)		• Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Energy Changes • Hess's Law. • Bond Enthalpies. • Born Haber cycles. • Enthalpy of solution.	• state Hess's Law and use it to calculate enthalpy of reaction, for those reactions which cannot be measured directly, based on appropriate data on standard enthalpy of formation or combustion of the relevant substances, • calculate mean bond energy from appropriate data,	• Direct instruction by teacher. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
	• use mean bond enthalpies and the displayed formulae of the substances involved to calculate the enthalpy change of a reaction, • define and represent by an equation with appropriate symbol, the terms – enthalpy of solution, enthalpy of hydration, and lattice energy, • use energy cycles or energy level diagrams to support the calculations involving enthalpy of solution, enthalpy of hydration, and lattice energy, • account for the relative values for the enthalpy of hydration of ions down a group or across a few groups of the periodic table, using the two factors of magnitude of ionic charge and ionic radius, • conduct an investigation to determine the enthalpy change of a reaction by Hess's Law.	• Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Reversible Reactions and Equilibria • Industrial processes of relevance to Sierra Leone.	• explain, using the Haber process as an example, how two important considerations in industrial reactions are i), the availability and cost of raw materials and energy supplies, and ii), the control of temperature, pressure and catalyst used to produce an acceptable yield in an acceptable time,	• Direct instruction by teacher. • Role play. • Field trips. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
	• describe how a heterogeneous catalyst works and highlight its advantages and disadvantages.	• Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Group Chemistry • Transition Metal Chemistry.	• state the elements of 3d block, and its special group name, • explain why some elements are classified as 3d block elements based on their electron arrangement or position on the periodic table, and why all of them are not regarded as transition metals, • state some of the physical properties of the members of this group, • state and explain the four key chemical characteristics of this block of elements – i.e., formation of complex ions, formation of	• Direct instruction by teacher. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
	coloured species, variable oxidation state, and can serve act as catalysts, • describe, with the aid of equations, the formation of complexes with monodentate and bidentate ligands, • name and draw the shapes with examples of octahedral, tetrahedral, and linear complexes, • describe how the three factors of i) type of transition metal, ii) the oxidation state, and iii) the type of ligand, all affect the colour of a complex ion, using V, Fe, Ni and Cu as examples.	• Flipped classroom (whereby learners are are introduced to learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.
Organic Chemistry • The chemistry of carboxylic acids and its derivatives. • The chemistry of amines. • Condensation polymerization. • The chemistry of amino acids. • Reaction pathways involving aliphatic organic compounds.	• describe, with the aid of balanced equations and the nature of the function group, the two classes of reactions carboxylic acids can undergo, i.e., i) acid-base reactions, and ii) nucleophilic addition elimination reactions, producing the relevant salt and derivative respectively, • explain carboxylic acids are weak acids, and represent this suitably as a reversible reaction result, • describe, with the aid of balanced equations and displayed structure of the organic reactants and products, the reaction between a carboxylic acid and an alkali such as sodium hydroxide, which results in the formation of the relevant metal carboxylate salt,	• Direct instruction by teacher. • Role play. • Field trips. • Group work/ Think-Pair-Share. • Hands on activities/ Practical activities. • Animations/ video clips. • Demonstrations/ use of models to aid understanding. • Ask the Expert / group work using the "Envoy" strategy. • Research using books, websites, etc. • Flipped classroom (whereby learners are are introduced to	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt some dedicated questions using the research notes made

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
• The reaction mechanisms for alkanes, alkenes and haloalkanes.	• describe, with the aid of balanced equations and displayed structure of the organic reactants and products, the reaction between a carboxylic acid and an alcohol resulting in the formation of an ester, indicating that it is a reversible reaction as well, • illustrate the basic nature of lipids (fats and oils) as tri-esters, and their use in the making of soaps, describing the process of making soap by a small-scale cottage industry, • describe amines as alkyl substituted ammonia, stating that they are weak bases, and represent this property suitably by a reversible reaction, • describe, with the aid of balanced equations and displayed structure of the organic reactants and product, the reaction between an amine and a strong mineral acid such as HCl which results in the formation of the relevant alkyl ammonium salt, • name and draw the displayed formulae of diols, dicarboxylic acids and amino acids, • describe, with the aid of a balanced equation and the displayed or structural formula of the product and/ or its monomer unit, the condensation polymerisation process that diols undergo with dicarboxylic acids in the formation of nylon, and that	learning material before class and classroom time is then used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers).	• Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
	amino acid molecules undergo with themselves in the formation of polypeptides in nature, • state, justify and outline the mechanism for the substitution reaction between an alkane and a halogen, • state, justify and outline the mechanism for the addition reaction between an alkene and a hydrohalogen, • describe the characteristic tests for alkenes, carbonyls and carboxylic acids, • construct a maximum of two step synthetic routes of organic compounds, stating the reagents and reaction conditions, starting from alkenes, haloalkanes, alcohols or carbonyls.		
Intro: Modern Instrumental Techniques • IR spectrometry as applied to simple organic compounds.	• describe how infrared spectra can provide information about the bonds in an organic molecule, • use data from infrared spectra to deduce functional groups present in organic compounds and to predict infrared absorptions given wave number data, caused by familiar functional groups.	• Animations/ video clips and data from the internet to illustrate the principles of interpreting the spectra in the process of identifying organic compounds. • Research using books, websites, etc.	• State definitions of key terms. • Describe the concepts addressed. • Either justify the application of the concepts addressed in given scenarios, or • Predict the impact of the concepts addressed in novel scenarios • Answer different types of questions, such as multiple choice, short, structured, long essay, and open ended. • Conduct research with the aid of clear prompts, and then attempt

Topic/ Theme/ Unit	Expected learning outcomes	Recommended teaching methods	Assessment of learning outcomes
			some dedicated questions using the research notes made • Use the revision strategy of Learn, Cover, Write, Check (LCWC) to aid quality of information retrieval. • Use any of these strategies for peer assessment, self-assessment, formative assessment, or summative assessment, as applied at an appropriate point.