THE REPUBLIC OF UGANDA
Ministry of Education and Sports

ADVANCED SECONDARY CURRICULUM

CHEMISTRY SYLLABUS

NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE

2025

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A product of the National Curriculum Development Centre for the Ministry of Education and Sports with support from the Government of Uganda

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ISBN: 978-9970-675-43-2

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FOREWORD

The Ministry of Education and Sports, through the National Curriculum Development Centre (NCDC), aligned the Advanced Level Curriculum with the competency-based Lower Secondary Curriculum (LSC) to ensure a smooth learner transition from lower secondary to advanced level. The two-year aligned Advanced Secondary Curriculum adopted learner-centered approaches, inquiry-based, and discovery methods. The learning outcomes give the learner hands-on experiences in real-life situations while being cognizant of different learner abilities and learning styles. The syllabus focuses on assessment for learning with emphasis on criterion-referenced assessment. It further provides learners with the opportunity to enhance the 21st-century skills and values that were acquired at the lower secondary level.

This Chemistry syllabus promotes the learners' application of scientific knowledge to what happens in their communities in terms of energy resources, conservation of the environment, communication and other areas of application. It promotes the acquisition of Higher-Order Thinking Skills (HOTS) such as inquiry, creativity and innovation, decision-making, critical thinking and problem-solving. It calls for learner-centred pedagogies with hands-on experience by the learners in real-life situations, while acknowledging different learner abilities and learning styles.

As the Minister responsible for Education, I endorse this syllabus as the official document for teaching and learning Chemistry at the Advanced Level of secondary education in Uganda.

Hon. Janet Kataaha Museveni
First Lady and Minister of Education & Sports

ACKNOWLEDGEMENTS

The National Curriculum Development Centre (NCDC) is indebted to the Government of Uganda for financing the alignment of the Advanced Level Curriculum to Lower Secondary Education in Uganda.

Our gratitude goes to the Ministry of Education and Sports for overseeing the adaptation of the curriculum, the Curriculum Task Force of the Ministry of Education and Sports for the oversight role and making timely decisions whenever necessary, and members of the public who made helpful contributions towards shaping this curriculum.

NCDC is also grateful to Members of Parliament, schools, universities, and other tertiary institutions, the writing panels, and professional bodies, for their input in the design and development of the Adapted A level curriculum. To all those who worked behind the scenes to finalise the adaptation process of this teaching syllabus, your efforts are invaluable.

NCDC takes responsibility for any shortcomings that might be identified in this publication and welcomes suggestions for effectively addressing the inadequacies. Such comments and suggestions may be communicated to NCDC through P. O Box 7002, Kampala, or Email: admin@ncdc.go.ug or on the Website: www.ncdc.go.ug

Dr Grace K. Baguma
Director National Curriculum Development Centre

1.0 INTRODUCTION

The Advanced Secondary Curriculum has been aligned with the Lower Secondary competency-based model for ease of progression of learners from the Lower to Advanced Secondary Level. The alignment is a result of the analysis of the Advanced Level Curriculum published in 2013, to determine whether the content is:

i) appropriate.
ii) high-pitched or overloaded.
iii) covered at lower secondary.
iv) obsolete.
v) repeated in different topics and redundant.

The results from the curriculum analysis revealed that there were overlaps of concepts with what was covered at the Lower Secondary, as well as concepts within different topics of the same subject. In addition, a number of syllabuses had content that is no longer necessary for today's contemporary society and the 21st century.

1.1 Changes in the Curriculum

The alignment of the A -Level Curriculum to that of the Lower Secondary led to changes in the pedagogies of learning from a knowledge- and objective-based, to an integrated and learner-centred competency-based approach. The adapted syllabus, therefore, is a result of rationalising, integrating, and merging content with overlaps and similar skills, dropping topics that had been studied at Lower Secondary, or are no longer critical and relevant for the current learning needs, while upgrading those that were of low competencies to match with the advanced level. The programme planner details the learning progression derived from the learning outcomes. The detailed syllabus section unfolds the learning experiences with corresponding assessment strategies.

This **Chemistry** syllabus is part of the Advanced Secondary Curriculum. The teacher is encouraged to read the whole syllabus before planning your teaching programme, since many topics have been merged, upgraded, or removed. While aligning this syllabus, efforts were made to ensure a smooth progression of concepts from the Lower Secondary Level, adapting topics and content with familiar features that are of value to the learner and society. In addition, the process of developing this syllabus document removed what was considered obsolete, high pitched as well as content overlaps and overloads.

1.2 Classroom-Based Assessment

This syllabus requires classroom learning to be experiential, through the suggested learning activities for the acquisition of the learning outcomes. This is the gist of a learner-centred and activity-based approach to learning, which emphasises the acquisition of required competencies. Formative assessment in **Chemistry** will focus on the acquisition of knowledge and skills, through performance of the learning activities.

The learning activities sprout from the learning outcomes, which are evidenced by acquiring and demonstrating the application of the desired skills, to show that learning has taken place. The sample assessment strategies have been provided to guide the teacher on classroom-based assessment. The teacher can develop more assessment strategies based on the same principles of observation, conversation, and product, for the acquisition of the desired knowledge, skills, values, and attitudes. (See detailed syllabus)

1.3 Learners with Special Educational Needs

The Advanced Secondary Curriculum is designed to empower all learners, including those with Special Educational Needs (SEN), to reach their full potential and contribute meaningfully to the nation. By incorporating inclusive strategies, the curriculum ensures equitable access to high-quality learning opportunities while maintaining high academic standards. It emphasises creating an inclusive learning environment that supports the diverse needs of learners with SEN, enabling them to succeed alongside their peers.

1.4 Generic Skills

Generic skills are embedded within all subjects and are essential for learning and workforce readiness. These skills enable learners to engage with the entire curriculum effectively and prepare them for lifelong learning. These skills equip learners with the ability to adapt to change and navigate life's challenges in the 21st century.

The key generic skills include:

1 Critical thinking and problem-solving

i) Planning and carrying out investigations
ii) Sorting and analysing information
iii) Identifying problems and proposing solutions
iv) Predicting outcomes and making reasoned decisions
v) Evaluating different solutions

2 Co-operation and Self-Directed Learning

i) Working effectively in diverse teams
ii) Interacting effectively with others
iii) Taking responsibility for own learning
iv) Working independently with persistence
v) Managing goals and time

3 Creativity and Innovation

i) Using imaginations to explore possibilities
ii) Working with others to generate ideas
iii) Suggesting and developing new solutions
iv) Experimenting with innovative alternatives
v) Looking for patterns and making generalisation

4 Communication

i) Listening attentively and with comprehension
ii) Talking confidently and explaining ideas/opinions clearly
iii) Reading accurately and fluently
iv) Writing and presenting information coherently
v) Using a range of media to communicate ideas

5 Mathematical Computation

i) Using numbers and measurements accurately
ii) Interpreting and interrogating mathematical data
iii) Using mathematics to justify and support decisions

6 Information and Communication Technology (ICT) Proficiency

i) Using technology to create, manipulate and process information
ii) Using technology to collaborate, communicate and refine work

7 Diversity and Multicultural Skills

i) Appreciate cultural diversity
ii) Respectfully responding to people of all cultures
iii) Respecting positive cultural practices
iv) Appreciating ethnicity as a cradle for creativity and innovation

1.5 Cross-cutting Issues

These are issues which young people need to learn about, and are not confined to a particular subject but are studied across subjects. They help learners to develop an understanding of the connections between the subjects and the complexities of life as a whole. They are:

i) Environmental awareness
ii) Health awareness
iii) Life skills
iv) Mixed abilities and involvement
v) Socio-economic challenges
vi) Citizenship and patriotism

These are a concern to all mankind irrespective of their areas of speciality. They are infused in the different learning outcomes of the different subjects.

1.6 Values

The curriculum is based on a clear set of values. These values underpin the whole curriculum and the work of schools. Learners need to base themselves on these values as citizens of Uganda. These values are derived from Uganda's National Ethical Values Policy (2013). They are:

i) Respect for humanity and environment
ii) Honesty, upholding and defending the truth at all times
iii) Justice and fairness in dealing with others
iv) Hard work for self-reliance
v) Integrity; moral uprightness and sound character
vi) Creativity and innovation
vii) Social responsibility
viii) Social harmony
ix) National unity
x) National consciousness and patriotism

These are not taught directly in lessons, nor are they assessed by pen and paper. However, they are incorporated in some learning outcomes and are developed as learners progress.

1.7 ICT Integration

The integration of ICTs into teaching and learning is strongly encouraged in this A-level adapted curriculum. ICT enhances the implementation of competency-based learning by fostering learner engagement, creativity, and lifelong learning. Teachers are encouraged to use technology to create interactive content, such as digital simulations and videos, to illustrate abstract or complex concepts effectively. Integrating ICT not only enhances the learning experience but also equips learners with essential digital skills for the 21st century.

ICT teachers should endeavour to assist other subject teachers in making the ICT integration process a reality. The table below shows a sample of suggested ICT tools that may be applied to given tasks.

Sample Task in the Syllabus	Suggested ICT Tool
Fieldwork	Use of cameras to take photos and record videos
Locate places on a map	Use digital maps such as Google Maps or an equivalent application.
Presentation in class	Use presentation applications or online presentation tools like Canva
Search for keywords and meanings	Use an online dictionary or search online
Make drawing/graphics	Use drawing tools like Draw.io or publishing software/Word processor
Roleplay, narrations	Use audio and video recordings
Demonstrations	Use audio/video recordings, models, simulations, or virtual labs
Analyse and present data	Use spreadsheet software or any other analytics tools
Group discussions	Mind mapping software
Search for extra reading materials	Download files from the Internet from academic Databases
Writing equations and formulae	Use equation editors like MathType
Carry out academic search/research	Use the Internet, AI models, and other academic applications like "Encarta", "Britannica", etc.
Collaborate with others across the world	Form learning networks with blogs, social media, emails, and videoconferencing tools like Zoom, MS Teams, Webex, Google Meet or any other networking application.

1.8 Projects

Project-based learning is an integral part of 21st century education. The syllabus incorporates several projects across various topics, which serve as illustrative examples. You are encouraged to develop more projects with your learners that can easily be linked to what is happening in your local environment. While doing this, make an effort to keep aligned with the learning outcomes of the topic you are teaching.

1.9 The Aims of Secondary Education

The aims of secondary education in Uganda are to:

i) instil and promote national unity, an understanding of the social and civic responsibilities, strong love and care for others and respect for public property, as well as an appreciation of international relations and beneficial international cooperation
ii) promote an appreciation and understanding of the cultural heritage of Uganda including its languages
iii) impart and promote a sense of self-discipline, ethical and spiritual values, personal and collective responsibility and initiative
iv) enable individuals to acquire and develop knowledge and an understanding of emerging needs of society and the economy
v) provide up-to-date and comprehensive knowledge in theoretical and practical aspects of innovative production, modern management methods in the field of commerce and industry and their application in the context of the socio-economic development of Uganda
vi) enable individuals to develop basic scientific, technological, technical, agricultural and commercial skills required for self-employment
vii) enable individuals to develop personal skills of problem solving, information gathering and interpretation, independent reading and writing, self-improvement through learning and development of social, physical and leadership skills such as are obtained through games, sports, societies and clubs
viii) lay the foundation for further education
ix) enable the individual to apply acquired skills in solving problems of community, and to develop a strong sense of constructive and beneficial belonging to that community
x) instil positive attitudes towards productive work and strong respect for the dignity of labour and those who engage in productive labour activities
xi) develop a positive attitude towards learning as a lifelong process

1.10 Aims of the Advanced Secondary Curriculum

The aims of the A-Level Curriculum are to:

i) adopt a competency-based learning approach.
ii) develop holistic education for personal and national development based on clear shared values.
iii) develop key skills which are essential to work and life and promote life-long learning.
iv) adopt an integrated approach to learning that develops the ability of learners to apply what they have learned.
v) improve on assessments by incorporating school-based assessment into End of Cycle Assessment.
vi) emphasise the learner's participation through engagement with the community.
vii) prepare learners for further education

1.11 Rationale for Teaching Chemistry at Advanced Level

The Advanced Level Chemistry syllabus aims to enable learners to:

1. Enable learners to know:
   i) the basic principles and concepts in Chemistry.
   ii) how theories and models are used to explain concepts in Chemistry.
   iii) the resources available to facilitate the discovery of unfamiliar principles and concepts in Chemistry.
   iv) the use and knowledge of the principles and concepts of Chemistry in everyday life situations.
2. Make the learners aware of the effects of scientific discoveries and knowledge on everyday life through some applications of Chemistry.
3. Enable the learners to:
   i) develop an experimental attitude by performing experiments in schools.
   ii) familiarise themselves with scientific methods.
   iii) develop the necessary skills to design and carry out practical investigations based on the knowledge of Chemistry.
4. Prepare the learners for further studies in Chemistry and related fields.
5. Enable the learners to appreciate the applicability of Chemistry in other disciplines.
6. Enable the learners to develop:
   i) an initiative for inventiveness.
   ii) skills for practical investigation and exploration.
   iii) capacity to design models and analytical schemes for use in problem-solving schemes.

1.12 Subject Overview

The areas of study have been reorganised within the syllabus to come up with the adapted version. The subject areas of study are theoretical understanding, practical skills, and real-world applications.

1. Theoretical Understanding

Chemistry theory provides the foundation for understanding the behaviour of matter at the atomic, molecular, and macroscopic levels. Key areas include:

i) Atomic structure and bonding, which explain the interactions and properties of substances.
ii) Thermodynamics and kinetics, which elucidate energy changes and reaction speeds.
iii) Organic chemistry, focusing on the structure, reactivity, and applications of carbon-based compounds.

This theoretical component builds critical analytical skills, enabling students to predict chemical behaviours, solve problems, and understand complex processes in both pure and applied chemistry.

2. Practical Skills and Laboratory Work

Practical work is at the heart of Advanced Level Chemistry, emphasising hands-on experimentation and scientific inquiry. Students learn to:

i) Design and conduct experiments safely and systematically.
ii) Measure and analyse data accurately.
iii) Use laboratory equipment effectively, from titrations and calorimetry to spectroscopic techniques.

Practical activities reinforce theoretical concepts by offering real-time observations and tangible results. They also develop critical thinking and troubleshooting skills essential for scientific and industrial research.

3. Real-World Applications

The syllabus bridges the gap between classroom chemistry and its applications in the real world. Students explore how chemistry is pivotal in:

i) **Healthcare:** Developing pharmaceuticals, diagnostic tools, and medical devices.
ii) **Energy:** Advancing renewable energy sources, batteries, and fuel technologies.
iii) **Environment:** Managing pollution, recycling, and sustainable chemical practices.
iv) **Industry:** Improving manufacturing processes, from materials development to food chemistry.

By connecting chemistry to real-world scenarios, students gain an appreciation of the subject's relevance and its role in addressing global challenges.

1.13 Time Allocation

The learners shall be engaged for nine (9) periods per week from Senior Five to Senior Six.

1.14 Suggested Approaches to Teaching Chemistry

The suggested approaches enhance learning and empower teachers to support the learners as they prepare for assessments. This will necessitate teachers to work alongside the learners to guide, direct, support, and supervise them as they progress through the research process. These approaches include:

i) Inquiry-based learning: The learners are encouraged to investigate through research aided by ICT tools and solve problems through a series of questions and scenarios enhancing critical thinking, communication, and research skills.

ii) Experiential learning: The learners actively participate in hands-on experiences during research, and learn through reflecting upon what they are doing, which leads to the development of reflective skills.

iii) **Problem- and project-based learning:** The learners find solutions to problems through their experience in research and projects. This leads to the development of critical thinking, social, and research skills.

iv) **Case-based learning:** The learners refer to real-world scenarios to discuss and analyse them, to develop critical thinking, as well as analytical and research skills.

v) **Discovery learning:** The learners construct their own knowledge through active participation, exploration, and inquiry, which encourages them to critically think, ask questions, and hypothesise through research.

1.15 Programme Planner

Class/Term	Topic	Sub-topic		Periods
Senior Five Term 1	1. Moles and Equations	1.1	Masses of atoms and molecules, accurate relative atomic masses	09
		1.2	Amount of substance, mole calculations	12
		1.3	Chemical formulae and chemical equations	09
		1.4	Solutions and concentration, calculations involving gas volumes	21
	2. Atomic and Electronic Structure	2.1	Electron configurations of atoms and ions	12
		2.2	Radioactivity and its applications	15
	3. Bonding and Structure	3.1	Formation of ionic and metallic bonds	12
		3.2	Covalent bonds and molecular structures	18
Total				**108**

Class/ Term	Topic	Sub-topic		Periods
Senior Five Term 2	4. Periodicity I	4.1	The Periodic Table	06
		4.2	Variation in trends of properties across periods and the diagonal relationships	18
		4.3	Trends in properties of Group 2 elements	09
	5. Thermochemistry	5.1	Enthalpy changes and energy profiles	15
		5.2	Types of enthalpy changes and Hess's law	15
		5.3	Born-Haber cycles and lattice energy	15
	6. Organic Chemistry I	6.1	Introduction to organic compounds	15
		6.2	Alkanes, alkenes, alkynes	15
Total				**108**

Class/ Term	Topic	Sub-topic		Periods
Senior Five Term 3		6.3	Halogen compounds (Alkyl halides)	12
		6.4	Benzene and methyl benzene	15
	7. Equilibria I	7.1	The concept of chemical equilibrium	18
		7.2	Equilibria and the chemical industry	15
		7.3	Ionic equilibrium, hydrolysis of salts and buffer solutions	30
		7.4	Solubility equilibria	18
Total				**108**

Class/Term	Topic	Sub-Topic		Periods
Senior Six Term 1	8. Equilibria II	8.1	Physical equilibria	27
		8.2	Colligative properties	18
	9. Organic Chemistry II	9.1	Alcohols and phenols	24
		9.2	Carbonyl compounds (aldehydes and ketones)	24
		9.3	Carboxylic acids and derivatives	15
Total				**108**

Class/ Term	Topic	Sub-topic		Periods
Senior Six Term 2	10. Electrochemistry	10.1	Redox reactions and oxidation numbers	18
		10.2	Electrochemical cells and applications	21
		10.3	Electrolysis and Faraday's laws	15
	11. Periodicity II	11.1	Trends in chemical properties of Group 14 elements and their compounds	15
		11.2	Trends in properties of Group 17 elements and their compounds	15
		11.3	The d-block transition elements	24
Total				**108**

Class/ Term	Topic	Sub-Topic		Periods
Senior Six Term 3	12. Organic Chemistry III	12.1	Amines	18
		12.2	Polymers and polymerisation	18
	13. Reaction Kinetics	13.1	Rate equations and orders of reaction	18
		13.2	Factors affecting rates of reactions	18
Total				**72**

1.16 Note to Users

Each topic has a competency, which is a broad statement that brings out what the learner is expected to do at the end of the topic. The competency is broken down into learning outcomes, for which suggested learning activities and sample assessment strategies are developed, as represented in the three columns below.

Learning outcomes	Suggested learning activities	Sample assessment strategy
A statement of the knowledge, understanding, skills, generic skills, values, and attitudes expected to be learnt by the end of the topic. Hence each learning outcome is coded with some of these as **k, u, s, gs and v/a** for emphasis to the teacher on what to consider during the lesson.	The sort of hands-on and minds-on engagements, which enable the learner to achieve the learning outcome, including the generic skills and values. They are designed to enable learners to Discover, Explain, Apply and Analyse (**DEAA**) as they participate in knowledge construction.	Opportunities for assessment within the learning process, that is, during and after the lesson. Teachers can also devise other means of assessment that are in line with the activities.

The learning activities and assessment strategies in the syllabus are "suggested" and "samples", respectively, and not exhaustive. The teacher is encouraged to develop more learning activities and assessment strategies that are based on the learning outcomes. In addition, the teacher is free to customise the suggested learning activities to make them suitable for their respective learning environments and for learners with Special Educational Needs (SEN).

2.0 DETAILED SYLLABUS

SENIOR FIVE TERM 1

TOPIC 1: Moles and Equations

Duration: 51 Periods

Competency: The learner analyses stoichiometric relationships, evaluates experimental methods, and synthesises solutions to complex chemical problems.

SUB-TOPIC 1.1: Masses of Atoms and Molecules, Accurate Relative Atomic Masses

Duration: 09 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategy**
a) evaluate the relationship between atomic masses and isotopic abundances in calculating accurate relative atomic masses. (u, s)	a) In groups, learners discuss atomic masses, isotopes, and relative atomic masses. Use real examples from the Periodic Table.	a) Observe the learners' group discussion session to assess their levels of interaction, confidence, and respect for one another's opinions. b) Ask learners to find their level of understanding of the relationship between the atomic masses and isotopic masses of an element. c) Review learners' written responses to assess their coherence in explaining how to obtain relative atomic mass from isotopic masses.
b) synthesise methods to determine accurate relative atomic mass using given isotopic data. (u, s)	a) As a whole class, learners watch a video on the working of a mass spectrometer or individually, search for information about the working of the spectrometer and its application in daily life, discuss their findings in groups, and make presentations. b) In groups, learners carry out activities to interpret isotopic data such as isotope masses and relative abundance and use it to calculate relative atomic masses.	a) Observe learners' level of attention and participation in group discussions and presentations. b) Engage the learners in discussions to assess their comprehension of the working of the mass spectrometer and interpretation of data. c) Evaluate learners' written calculations for accuracy when determining relative atomic masses from isotopic masses.

SUB-TOPIC 1.2: Amount of Substance, Mole Calculations

Duration: 12 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) analyse the concept of the mole as a fundamental unit of measurement for chemical substances and perform complex mole calculations in chemical reactions. (u, s)	a) In groups, learners use prior knowledge to discuss Avogadro's number and the mole concept using visuals to illustrate these ideas. b) In pairs, learners will complete worksheets with tasks involving the calculation of moles in chemical reactions.	a) Check learners' confidence and collaboration in the group discussion. b) Engage learners in a discussion to assess their reasoning about strategies used in calculations. c) Assess the accuracy of calculations.
b) formulate strategies for calculating moles in compounds and reactions. (u, s)	a) In pairs, learners use a problem-based approach to solve multi-step mole calculation exercises in different contexts (emphasise correct units).	a) Check learners' participation activities involving solving problems on the mole concept. b) Probe learners to assess their reasoning regarding the methodology in solving problems on mole concepts. c) Evaluate learners' accuracy and the coherence of written responses.

SUB-TOPIC 1.3: Chemical Formulae and Chemical Equations **Duration:** 09 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) construct balanced chemical equations for given reactions, including synthesis, decomposition, and combustion reactions. (u, s)	a) In pairs, learners use prior knowledge to practice and demonstrate balancing equations with correct formulae and state symbols.	a) Monitor learners' level of involvement in completing tasks on writing balanced equations. b) Question learners to evaluate their reasoning in writing balanced equations. c) Review the accuracy of the balanced equations and the correctness of formulae.
b) critically examine the relationships between empirical and molecular formulae in representing compounds. (u, s)	a) In groups, learners perform experiments to determine the empirical formula of magnesium oxide. b) In groups, learners use worksheets to determine empirical and molecular formulae through a series of problem sets and contextual applications.	a) Evaluate learners' ability to organise, plan and manipulate apparatus during laboratory activities. b) Probe learners' reasoning to assess the level of understanding of the relationship between empirical and molecular formulae. c) Assess learners' solutions to problems on formulae for accuracy.

SUB-TOPIC 1.4: Solutions and Concentration, Calculations Involving Gas Volumes

Duration: 21 Periods

Learning Outcome *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
apply the principles of concentration and gas laws to accurately calculate molarity and gas volumes in various solutions and reactions. (u, s)	a) Individually, learners search for information on the preparation of standard solutions and their use in calculations, discuss their findings in their groups, and make reports. b) In groups, learners carry out experiments to prepare solutions of different molarities and use them to standardise other solutions. c) In groups, learners use worksheets to carry out calculations involving Gay-Lussac's and Avogadro's laws to determine amounts of substances.	a) Monitor learners as they make presentations, checking the accuracy of their submissions. b) Ask learners to explain gas law principles and molarity to assess their understanding of the concept. c) Evaluate learners' written solutions to calculations for consistency and accuracy.

TOPIC 2: Atomic and Electronic Structure

Duration: 27 Periods

Competency: The learner deduces electronic configurations, evaluates their implications for chemical properties and bonding, and synthesises models to predict atomic behaviour in various contexts.

SUB-TOPIC 2.1: Electron Configurations of Atoms and Ions

Duration: 12 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
apply the Aufbau principle, Pauli exclusion principle, and Hund's rule to write electronic configurations of atoms and ions and use them to predict reactivity. (u, s)	a) Individually, learners use the Internet, demonstration videos, or suitable textbooks to search for information on principles of writing electronic configurations, discuss their findings in groups, and write electronic configurations of atoms and ions. b) In groups, learners use visual aids such as energy level diagrams to illustrate principles of writing electronic configurations. c) In pairs, learners use a problem-based approach to carry out exercises involving writing configurations of selected atoms and ions and predicting reactivity.	a) Watch learners as they discuss to assess their confidence and respect for one another's opinion while determining electronic configurations. b) Engage learners in a discussion to assess their level of conceptualisation of the s, p, d and f principles of writing electronic configurations. c) Evaluate the written electronic configurations for the correct application of s, p, d and f principles.

SUB-TOPIC 2.2: Radioactivity and Its Applications

Duration: 15 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) examine the nature and types of radioactive decay and apply this knowledge to predict decay rates and half-lives in specific elements. (k, u, s)	a) In groups, learners search for information about radioactive decay, nuclear stability, decay rates, and half-life, discuss their findings, and carry out related calculations. b) In groups, learners use a problem-based approach to solve mathematical problems on radioactive decay and half-life.	a) Evaluate the level of participation in group discussions. b) Engage learners in discussions to assess how much they know about applications and effects. c) Assess the accuracy and coherence of written responses to problems on radioactive decay and half-life.
b) evaluate the principles of radioactivity in real-life applications, such as in medicine, industry, and environmental science and the associated health, environmental, and ethical implications of radioactive materials. (u, v/a)	a) Individually, learners search for information about applications and effects of radioactivity, discuss their findings in groups and make presentations. b) In groups, learners analyse case studies on applications of radioactivity in real life. c) Learners engage in a class debate to evaluate the ethical and related safety implications of radioactivity.	a) Monitor the level of involvement of learners in the group discussions and debate. b) Ask learners to explain the safety and ethical implications of radioactivity to assess their appreciation. c) Evaluate the reports of the learners and debate for the accuracy of facts and coherence.

TOPIC 3: Bonding and Structure

Duration: 30 Periods

Competency: The learner analyses the types of chemical bonds and molecular structures, and relates them to the properties and uses of substances in real-life contexts.

SUB-TOPIC 3.1: Formation of Ionic and Metallic Bonds

Duration: 12 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) justify the formation of ionic and metallic bonds based on electron transfer and electrostatic forces. (u, s)	a) In groups, learners use prior knowledge to design models illustrating electron transfer in ionic bonding and electron pooling in metallic bonding.	a) Check the level of planning, manipulation, creativity, accuracy, and participation in hands-on model building. b) Discuss with the learners to assess understanding of the relationship between properties, structure, and bond strength. c) Evaluate the accuracy, creativity, and clarity of the models.
b) evaluate the properties of ionic and metallic compounds in relation to bond strength and structural composition. (u)	a) Individually, learners search for information about the properties of ionic and metallic bonds, their relative strengths, and how they relate to their properties, discuss in their groups, and make presentations.	a) Monitor the learners' involvement and respect for one another's opinions in the discussion groups. b) Check the learners' understanding of the relationship between properties of substances and bond strength by asking probing questions. c) Assess the learners' written reports for accuracy and coherence.

SUB-TOPIC 3.2: Covalent Bonds and Molecular Structures **Duration:** 18 Periods

Learning Outcomes *The learner should be able to:*	Suggested Learning Activities	Sample Assessment Strategies
a) analyse the formation of covalent bonds including dative covalency and explain molecular structures by applying VSEPR theory to predict molecular shapes and bond angles. (u, s)	a) Individually, learners search for information about covalent bonding, dative covalency, and the principles of VSEPR theory, discuss their findings in groups, and make presentations. b) In groups, learners predict, draw shapes of molecules and ions, and build 3D molecular models based on VSEPR theory.	a) Observe the learners' discussion about covalent bonding to assess the level of interaction and how confidently they present their ideas. b) Probe the learners to justify how they applied VSEPR theory to draw and design molecular shapes and models. c) Evaluate learners' drawn models and structures for accuracy.
b) analyse the polarity of molecules based on molecular structure and electron distribution. (u)	a) Individually, learners search for information about the bond and molecular polarity in relation to differences in electronegativity with emphasis on hydrogen bonding and Van der Waal's forces, discuss their findings in their groups, and make reports. b) In pairs, learners use problem-based methods to carry out exercises involving different molecular structures and their properties and make reports.	a) Monitor the learners as they discuss molecular and bond polarity to assess their level of confidence and clarity of facts. b) Probe the learners to assess their understanding of the difference between bond and molecular polarity. c) Evaluate the reports for accuracy and coherence.

SENIOR FIVE TERM 2

TOPIC 4: Periodicity 1

Duration: 33 Periods

Topic competency: The learner analyses the trends and periodic properties of elements, to explain and predict the reactivity and properties of elements in the Periodic Table.

SUB-TOPIC 4.1: The Periodic Table

Duration: 06 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) evaluate how the Periodic Table is organised based on atomic number and properties, recognising its historical significance. (u, s)	a) Learners watch a video or search for information on the historical development of the Periodic Table (from Mendeleev's design to Mosely's atomic concept), discuss its organisation, and write group reports. b) In groups, learners use samples of the modern Periodic Table to explore, discuss its organisation and respond to specific tasks such as identifying similarities in blocks, groups and periods (use the IUPAC form with 18 groups).	a) Observe the learners' level of engagement in group discussions. b) Ask the learners to articulate the historical reasons for certain arrangements in the Periodic Table to clear any misconceptions. c) Evaluate written reports of the learners for coherence and accuracy.
b) analyse the position of elements to predict their chemical behaviour, considering periodic trends. (u, s, v/a)	a) In groups, the learners use an inquiry-based approach to predict trends in properties such as reactivity based on element positions and make reports. b) Learners engage in problem-solving tasks where they predict the reactivity of unknown elements based on the position of elements in the Periodic Table.	a) Observe the learners to assess their reasoning skills and teamwork during discussions. b) Engage the learners in one-on-one discussions to gauge their understanding of trends. c) Collect and review the learners' predictions on element behaviour for accuracy.

SUB-TOPIC 4.2: Variation in Trends of Properties Across Periods and the Diagonal Relationships

Duration: 18 Periods

Learning Outcomes *The learner should be able to:*	Suggested Learning Activities	Sample Assessment Strategies
a) analyse the periodic physical and chemical properties in the Periodic Table, identifying patterns and exceptions. (u, s)	a) Individually, learners search for information about the periodic physical properties of elements in the Periodic Table (melting point, atomic radius, ionisation energy, electron affinity, electronegativity, electropositivity), discuss their findings in groups and make joint reports. b) Learners apply the jigsaw method by working in groups, with each group focusing on one trend and teaching it to the rest of the class. c) In groups, learners use data sets of periodic trends (ionisation energy, electron affinity, atomic radius, ionic radius, electronegativity) to analyse and graph this data to infer relationships and patterns, identifying exceptions.	a) Monitor participation in group discussions. b) Ask probing questions to evaluate understanding of trends and exceptions. c) Evaluate data interpretations and completed plotted graphs for comprehension of trends.
b) justify the variation in physical and chemical properties across period 3, incorporating diagonal relationships. (u, s v/a)	a) Learners individually search for information about the physical properties of period 3 elements (physical state, melting points, structure and bonding, metallic character), discuss their findings in groups and present reports. b) Learners apply problem-based learning to analyse sets of data relating to the physical properties of elements in period 3. c) In groups, learners conduct laboratory activities where they observe chemical properties (reactivity with water, dilute acids and alkali) of elements like	a) Observe the learners to assess the level of participation in group discussions and data analysis. b) Ask questions to assess understanding of physical and chemical properties of period 3 elements and their compounds. c) Assess group presentations and reports for accuracy and depth of understanding.

	sodium, magnesium, and aluminium and sulphur. Record observations, draw inferences and present their reports. d) Individually, learners search for information about the oxides (structure and bonding, melting points, reaction with dilute acids, alkalis and water) and chlorides (structure and bonding, melting points, reaction with dilute acids, alkalis and water) of period 3 elements, discuss their findings in groups and present reports. e) In groups, learners carry out test tube experiments to identify magnesium and aluminium ions. f) Individually, learners search for information about diagonal relationships between lithium and magnesium and also between beryllium and aluminium.	

SUB-TOPIC 4.3: Trends in Properties of Group 2 Elements

Duration: 9 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
investigate the reactivity and properties of Group 2 elements and their compounds in relation to their applications in industry. (s, v/a)	a) Individually, learners search for information about the physical properties (melting point, metallic radii and density) of Group 2 elements, discuss their findings in groups and make reports. b) In pairs, learners use problem-based learning to interpret data on the physical properties of Group 2 elements. c) In groups, learners carry out experiments to investigate the reactivity of Group 2 metals with air, water and dilute acids. d) In groups, learners carry out laboratory experiments to investigate solubility, effect of heat and action of dilute acids on compounds of Group 2 (hydroxides, sulphates, nitrates and carbonates). e) In pairs, learners carry out test tube experiments to identify ions in Group 2 compounds $(Ca^{2+}, Ba^{2+}, CO_3^{2-}, Cl^-, SO_4^{2-}, NO_3^-$ f) Individually, learners search for information on the applications of Group 2 elements and their compounds, discuss their findings in groups and make presentations. g) In groups, learners carry out projects to make different industrial products from Group 2 compounds.	a) Assess learners' skills in planning, manipulation of apparatus and safety management during experiments. b) Probe learners' opinions, methodology used in experiments and assess knowledge of linkages of the metals to industrial uses. c) Evaluate group presentations and reports for the accuracy, depth and coherence.

TOPIC 5: Thermochemistry

Duration: 45 Periods

Topic competency: The learner analyses and evaluates thermodynamic principles and processes to predict the spontaneity and feasibility of chemical reactions and processes.

SUB-TOPIC 5.1: Enthalpy Changes and Energy Profiles

Duration: 15 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) synthesise energy profiles for exothermic and endothermic reactions, explaining the concept of enthalpy change. (u, s)	a) In groups, learners use prior knowledge to discuss, draw and explain energy profiles for endothermic and exothermic reactions. b) In pairs, learners carry out experiments to demonstrate exothermic and endothermic reactions.	a) Monitor and assess the learners' planning, manipulation and safety management skills during experiments. b) Ask the learners to explain the differences between exothermic and endothermic reactions to check their knowledge of the concepts. c) Assess drawn energy profiles for correct depiction and explanations.
b) evaluates the role of activation energy in reaction mechanisms using energy profile diagrams. (u, v/a)	a) Individually, learners search for information about activation energy, discuss their findings in groups and make reports.	a) Monitor the learners' level of participation in group discussions. b) Assess the learners' understanding of activation energy by asking them key questions. c) Evaluate drawn diagrams for accurate representation of activation energy changes, reports for accuracy and coherence.

SUB-TOPIC 5.2: Types of Enthalpy Changes and Hess's Law **Duration:** 15 Periods

Learning Outcome *The learner should be able to:*	Suggested Learning Activities	Suggested Assessment Strategies
a) analyse different types of enthalpy changes and the conditions under which they occur, including their significance in thermochemical equations. (k, u)	a) Individually, learners search for information about enthalpy of reaction, formation, atomisation, bond energy, combustion, and neutralisation, with real-life examples, and discuss, in groups, their findings. b) Learners explore Hess's law by drawing simple energy cycle diagrams to deduce expected energy changes. c) In pairs, learners are engaged in problem-solving exercises using thermochemical equations.	a) Monitor the learners to assess the level of interaction and how they confidently express themselves in group discussions. b) Probe the learners to assess their understanding of the different types of enthalpies of reaction. c) Assess the accuracy of learners' responses to the problem-solving exercises.
b) apply Hess's law to calculate unknown enthalpy changes using energy cycles and enthalpy data. (s)	a) In pairs, learners engage in exercises where they apply Hess's law by using energy cycle diagrams, and thermochemical equations to solve given tasks. b) Individually, learners practise constructing energy cycle diagrams to apply Hess's law.	a) Observe the learners to assess their level of engagement and participation in solving problems. b) Assess the learners' ability to justify the use of energy cycle diagrams and thermochemical equations by asking key questions. c) Assess the learners' responses to the tasks for accuracy.

SUB-TOPIC 5.3: Born-Haber Cycles and Lattice Energy **Duration:** 15 Periods

Learning Outcomes *The learner should be able to:*	Suggested Learning Activities	Suggested Assessment Strategies
a) analyse the concept of lattice energy, its role in the formation of ionic compounds, and describe the steps involved in constructing Born-Haber cycles. (k, u, s)	a) Individually, learners search for information on the concept of lattice energy, factors affecting lattice energy, its role in the formation of ionic compounds, and how it can be calculated using the Born-Haber cycle, discuss their findings in groups, and make a report. b) In pairs, learners engage in practice exercises involving the calculation of lattice enthalpies.	a) Monitor the learners to assess the levels of participation in group discussions about Born-Haber cycles involving lattice energies. b) Ask the learners to explain the concept of lattice energy and the steps in Born-Haber cycles to assess their understanding. c) Evaluate the learners' reports for skill of drawing Born-Haber cycles and the correctness of responses to practice exercises.
b) apply Born-Haber cycles to solve problems involving the calculation of lattice energies and related thermodynamic quantities. (s)	a) In pairs, learners engage in problem-solving exercises involving the relationship between lattice energy, hydration energy, and enthalpy of solution. b) In groups, learners use case studies to analyse sets of data on lattice energy to predict the stability of ionic compounds.	a) Check the learners' level of engagement in finding solutions to tasks in exercises. b) Ask the learners to explain the methodology used in solving problems in the exercises. c) Evaluate the learners' written responses to tasks for accuracy.

TOPIC 6: Organic Chemistry I

Duration: 57 Periods

Topic competency: The learner analyses the structures, functional groups, and reactivity of organic compounds, and applies knowledge of organic reactions and organic reaction mechanisms to synthesise organic molecules.

SUB-TOPIC 6.1: Introduction to Organic Compounds

Duration: 15 Periods

Learning Outcomes *The learner should be able to:*	Suggested Learning Activities	Suggested Assessment Strategies
a) apply principles of organic chemistry to understand the classification and general characteristics of organic compounds, including functional groups, homologous series, and the concept of isomerism. (k, u)	a) Individually, learners search for information about the unique nature of carbon in organic compounds, such as how single, double, and triple bonds are formed, and engage in a teacher-led discussion. b) In groups, learners use molecular models to demonstrate functional groups and homologous series (C_nH_{2n+2}, C_nH_{2n}, C_nH_{2n-2}). c) In groups, learners use models to illustrate different types of isomers and create models of isomers for a given molecular formula and display their work. d) In groups, learners engage in a teacher-guided discussion to explain the different properties of isomers.	a) Monitor the learners' confidence, accuracy of facts, and involvement during the teacher-led discussion about the unique nature of carbon. b) Discuss with the learners to assess justification for the choice of materials used in making the models. c) Assess the accuracy of responses to practice exercises involving drawing and naming simple organic compounds.
b) use IUPAC nomenclature to name different organic compounds. (u, s)	a) In pairs, learners practise naming and drawing organic molecules following IUPAC rules. b) In groups, learners analyse molecular structures to identify functional groups. c) Individually, learners carry out problem-solving exercises involving structure prediction based on functional groups.	a) Observe the process of drawing and naming organic compounds to assess learners' interaction and participation. b) Question the learners to assess their knowledge of using IUPAC in naming organic compounds. c) Assess the correctness of responses to written exercises requiring the use of IUPAC nomenclature.

SUB-TOPIC 6.2: Alkanes, Alkenes and Alkynes

Duration: 15 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Suggested Assessment Strategies**
a) apply principles of organic chemistry to differentiate between alkanes, alkenes, and alkynes, and explain their physical properties based on molecular structure. (k, u)	a) Individually, learners search for information about the physical properties of alkanes, alkenes, and alkynes, discuss their findings in groups, and make reports. b) In groups, learners use molecular models to demonstrate bonding and structure in hydrocarbons. c) In groups, learners carry out laboratory experiments to observe the physical properties of the various functional groups of hydrocarbons (e.g. solubility, melting point).	a) Observe the learners during laboratory experiments to assess the planning, manipulation of apparatus and safety management skills. b) Probe the learners to assess their skills in interpreting results from experiments on functional groups of hydrocarbons. c) Assess the learners' reports from experiments and discussions for accuracy and coherence.
b) predict the reactivity and reaction mechanisms of alkanes, alkenes, and alkynes. (s)	a) Individually, learners search for information about the reactivity and reaction mechanisms of alkanes (UV-catalysed chlorination), alkenes (hydrogen, hydrogen halides, acidified water, halogens), polymerisation and oxidation using potassium manganate (VII), discuss their findings in their groups and make reports. (NB: Addition reactions of alkenes are similar to those of alkynes). b) In pairs, learners carry out test tube reactions to	a) Observe the learners' discussions on reactivity and mechanisms of hydrocarbons to assess interaction and confidence in presentation. b) Discuss with the learners to assess their understanding of the principle of writing addition reaction mechanisms. c) Evaluate written reports and mechanisms of reactions of hydrocarbons for accuracy and coherence.

Learning Outcomes *The learner should be able to:*	Suggested Learning Activities	Suggested Assessment Strategies
	identify the double bond in alkenes using bromine water and potassium manganate (VII). c) In pairs, learners practise the writing of reactions and their mechanisms using worksheets. d) In groups, learners use case studies to explore the different applications of alkenes and alkynes in everyday life and make reports.	

SENIOR FIVE TERM 3

SUB-TOPIC 6.3: Halogen Compounds (Alkyl Halides)

Duration: 12 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) analyse the structure and properties of alkyl halides in terms of their reactivity with different reagents, identifying substitution and elimination reactions. (k, u, s)	a) Individually, learners search for information about the structure, nomenclature, and physical properties of alkyl halides, discuss their findings in groups, and make reports. b) Individually, learners search for information about the chemical properties of alkyl halides with different reagents (alkali, cyanide, ammonia, alcoholic alkali, reaction with metals), including synthesis, discuss their findings in their groups and make reports. c) In groups, learners create a visual map comparing substitution and elimination mechanisms, including key factors (e.g. reagents, solvents, temperature).	a) Monitor discussions of the learners about alkyl halides to assess learners' involvement and the ability to develop visual maps. b) Discuss with the learners to assess their understanding of the industrial impact and ethical considerations regarding products from alkyl halides. c) Assess the learners' reports on the physical and chemical properties of alkyl halides for accuracy of facts and coherence.
b) evaluate the uses and impacts of alkyl halides in industrial processes. (u, v/a)	a) In groups, learners analyse case studies involving the role of alkyl halides in industry, including environmental impacts, and discuss and make presentations.	a) Monitor discussions and presentations to assess participation, accuracy of facts, and respect for others. b) Discuss with the learners to assess their understanding of the role of the alkyl halides in industry. c) Evaluate the learners' reports for accuracy of facts about the role of alkyl halides and their impact on the environment.

SUB-TOPIC 6.4: Benzene and Methyl Benzene

Duration: 15 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) compare benzene and methyl benzene in terms of structure, stability, and reactivity in electrophilic substitution reactions. (k, u, s)	a) Individually, learners search for information about the structures of benzene, and methylbenzene in terms of their stability and reactivity. They discuss their findings in groups and make reports. b) In groups, learners discuss the difference between electrophilic substitution reactions involving benzene and methyl benzene, and make a report. c) In pairs, learners practice writing equations and mechanisms of electrophilic substitution reactions involving benzene and methylbenzene.	a) Monitor the learners' discussion to assess engagement and communication skills during discussions to understand the structures of benzene and methyl benzene. b) Engage the learners in discussions to assess their understanding of the difference between benzene and methyl benzene in terms of structure, stability and reactivity. c) Evaluate the accuracy of learners' reports, written equations, and mechanisms of reactions.
b) analyse the environmental and health impacts of benzene derivatives. (u, v/a)	a) In groups, learners analyse case studies involving the effects of benzene derivatives on health and the environment and discuss and present written reports.	a) Assess the learners' participation in a discussion involving analysing the health and environmental impact of benzene derivatives. b) Ask the learners to assess their knowledge of the impact of benzene derivatives on health and the environment. c) Assess the accuracy of the learners' reports about the effects of benzene derivatives on health and the environment.

TOPIC 7: Equilibria I

Duration: 81 Periods

Competency: The learner analyses principles of chemical equilibrium and applies them to explain and solve problems related to industrial processes, ionic equilibria, buffer systems, and solubility equilibria in various chemical and real-world contexts.

SUB-TOPIC 7.1: The Concept of Chemical Equilibrium

Duration: 18 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) evaluate the dynamic nature of chemical equilibrium and determination of equilibrium constants. (k, u, s)	a) Individually, learners' search for information about conditions for equilibrium, characteristics of the dynamic equilibrium, nature of chemical equilibrium systems, types of chemical equilibrium and equilibrium constants, discuss their findings in groups, and make presentations (derivation of the relationship between K_c and K_p not required). b) Learners carry out experiments to determine K_c involving the esterification of ethanol and ethanoic acid using concentrated sulphuric acid. c) In groups, learners use worksheets to discuss and solve mathematical problems about K_c and K_p.	a) Observe the learners to assess their planning, manipulation of apparatus, safety management skills and respect for one another during laboratory work. b) Discuss with the learners to assess their interpretation of observations from laboratory work. c) Evaluate written responses of the learners for accuracy of calculations of K_c and K_p.
b) predict how closed systems respond to stress, by applying Le Chatelier's principle. (u, s, v/a)	a) Individually, learners search for information about the different factors that affect chemical equilibria, discuss their findings in groups and make presentations. b) In groups, learners use digital simulation tools	a) Check the learners' skills of ICT proficiency in using digital software to explore equilibrium dynamics. b) Probe the learners to assess their methodology in completing worksheet tasks involving Le Chatelier's principle.

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
	such as PhET to explore equilibrium dynamics by modifying conditions and observing shifts. c) In pairs, learners use worksheets to practice solving problems involving Le Chatelier's principle and predict shifts.	c) Assess the correctness of the learners' reports on practising problems involving Le Chatelier's principle.

SUB-TOPIC 7.2: Equilibria and the Chemical Industry **Duration:** 15 Periods

Learning Outcome *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
evaluate how temperature, concentration, and pressure influence chemical equilibrium and propose methods to optimise reaction conditions in industrial applications. (u, v/a)	a) In groups, learners discuss real-life applications of equilibrium shifts, such as in industrial processes. b) In groups, learners analyse industrial applications of chemical equilibria, such as the Haber process and contact process where equilibrium control is essential.	a) Monitor the learners to assess their confidence in expression and interaction during discussions about real-life applications of chemical equilibria. b) Discuss with the learners to assess their understanding of the application of chemical equilibria in industry. c) Assess the learners' reports about the application of chemical equilibria for accuracy and coherence.

SUB-TOPIC 7.3: Ionic Equilibrium, Hydrolysis of Salts and Buffer Solutions

Duration: 30 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) apply the concepts of ionic equilibrium, including the dissociation of acids and bases, the pH scale, the hydrolysis of salts, and how buffer solutions maintain pH stability in chemical systems. (k, u, s)	a) Individually, learners search for information about theories of acids and bases, acid and base dissociation constants, and pH calculation, discuss their findings, and make reports. b) In pairs, learners apply problem-based learning to perform practice exercises to solve mathematical problems involving pH and dissociation constants. c) Individually, learners search for information about the hydrolysis of salts and hydrolysis constants (K_h), discuss their findings, and make reports. d) In pairs, learners apply problem-based learning to carry out practice exercises to solve mathematical problems involving hydrolysis constants. e) Individually, learners search for information about buffer solutions, their preparation, mode of action, and pH calculation, discuss their findings and make reports. f) In groups, learners perform laboratory experiments to prepare buffer solutions of a given (pH). g) In pairs, learners use worksheets to practise solving mathematical problems involving the (pH) of buffer solutions.	a) Observe the learners as they carry out laboratory experiments to assess their level of interaction within the group. b) Discuss with the learners to assess their understanding of theories of acids and bases. c) Assess written reports of the learners from discussion and practice exercises for accuracy and coherence.

b) evaluate the role of buffer solutions in biological and environmental systems, predicting their behaviour under acidic or basic conditions. (u, a/v)	a) Individually, learners search for information on the role of buffer solutions in biological and environmental systems, discuss their findings in groups, and make presentations.	a) Check the learners as they discuss to assess their level of participation and confidence in presenting during group discussions on applications of buffers. b) Discuss with the learners to assess their appreciation of the importance of buffer solutions. c) Evaluate reports of the learners about biological and environmental applications of buffer solutions for accuracy and coherence.

SUB-TOPIC 7.4: Solubility Equilibria

Duration: 18 Periods

Learning Outcomes *The learner should be able to:*	Suggested Learning Activities	Sample Assessment Strategies
a) investigate the factors affecting solubility equilibria, calculate solubility product (K_{sp}), and predict precipitation in different ionic solutions. (k, u, s)	a) Individually, learners search for information on solubility, solubility product, and prediction of precipitation, discuss their findings in groups, and make presentations. b) In groups, learners carry out experiments to determine solubility and solubility products of salts using salts such as calcium iodate and sodium oxalate. c) In groups, learners apply problem-based learning to solve mathematical problems involving solubility equilibria.	a) Monitor the learners as they perform experiments to assess planning, manipulation and safety management skills and also the level of participation. b) Engage in discussions with the learners to gauge the level of skills in the calculation of solubility products. c) Evaluate reports of the learners from experiments, discussion on solubility, solubility product and prediction of precipitation and exercises for accuracy and coherence.
b) apply the concept of solubility equilibria to real-life scenarios, such as water	a) In groups, learners study, analyse, and discuss case studies involving real-life applications of solubility in	a) Monitor the learners to assess their level of participation in group discussions involving real-

treatment and mineral formation. (s, v/a)	fields like geology and environmental science.	life applications of solubility. b) Engage in discussions with the learners to gauge their level of knowledge about the applications of solubility equilibria in real life. c) Evaluate reports of the learners and case study task solutions involving applications of solubility equilibria for accuracy.

SENIOR SIX TERM 1

TOPIC 8: Equilibria II

Duration: 45 Periods

Topic competency: The learner applies principles of physical equilibria and colligative properties to analyse and predict changes in physical systems, including phase transitions and effects of solute concentration on solution behaviour, in scientific and real-world contexts.

SUB-TOPIC 8.1: Physical Equilibria

Duration: 27 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) evaluate the principles of Raoult's law in ideal and non-ideal solutions, distinguishing their behaviours under varying conditions. (u, s, v/a)	a) Individually, learners search for information about two-component systems involving miscible liquids, Raoult's law, and non-ideal solutions, discuss their findings in groups, and prepare reports. b) In pairs, learners apply problem-based learning to solve problems using Raoult's law and its deviations and write reports. c) Learners analyse data by drawing vapor pressure/boiling point vs. mole fraction and interpreting the phase diagrams for ideal and non-ideal solutions. d) In groups, learners use digital simulations (e.g. PhET interactive simulations) to visualise molecular interactions in ideal and non-ideal solutions. e) In groups, learners discuss how the principle of separation of miscible liquids is applied in the distillation and separation of azeotropic mixtures.	a) Monitor the learners' level of engagement in group discussions about two component systems. b) Ask the learners to explain Raoult's law, deviations and its applications to gauge their level of knowledge about the concept. c) Assess reports about two component systems involving Raoult's law, drawings of pressure/boiling point vs. mole fraction and responses from set tasks for accuracy and coherence.
b) evaluate properties of two component systems involving immiscible liquid	a) Individually, learners search for information about the properties of immiscible liquids, steam distillation and	a) Observe the learners' planning, manipulation and safety management skills in carrying out experiments on

mixtures and their applications in real-life. (u, s, v/a)	solvent extraction, discuss their findings in groups and make reports. b) In pairs, learners use problem-based learning to solve mathematical problems on steam distillation (molecular mass determination and composition of distillate). c) In groups, learners carry out experiments to determine partition coefficients between immiscible liquid mixtures. d) In pairs, learners use problem-based learning to solve mathematical problems on partition coefficient and its application in solvent extraction.	partition coefficients between immiscible liquid mixtures. b) Probe the learners to justify the methodology used in dealing with mathematical problems on steam distillation. c) Evaluate the reports of the learners from research on steam distillation, experiments on partition coefficients, and related mathematical problems for accuracy and coherence.
c) analyse the behaviour of solid-liquid mixtures and their applications in industry. (u, s, v/a)	a) Individually, learners search for information about solid-liquid mixtures, phase diagrams for simple eutectic mixtures, and their applications, discuss their findings, and write reports. b) Learners work in pairs to construct phase diagrams for solid-liquid systems with simple eutectics and explain their features.	a) Take note of the learners' involvement in constructing phase diagrams. b) Discuss with the learners to gauge their understanding of the difference between eutectic mixtures and compounds. c) Assess the accuracy of reports from the discussion on phase diagrams for simple eutectic mixtures, and their applications and how representative the drawn phase diagrams on solid liquid systems are.

SUB-TOPIC 8.2: Colligative Properties

Duration: 18 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
analyse colligative properties such as boiling point elevation and freezing point depression, and relate them to solute concentration in different solutions. (u, s)	a) Individually, learners search for information about the effect of adding non-volatile solutes to solvents on boiling point, freezing point, osmotic pressure, and vapour pressure, discuss their findings and make reports. b) In groups, learners carry out experiments to demonstrate the effect of adding non-volatile solute to a solvent on freezing point (using naphthalene or stearic acid), boiling point, and vapour pressure. c) In pairs, learners carry out exercises to calculate molecular mass and changes in boiling/freezing points with varied solute concentrations.	a) Evaluate the learners' collaboration and experimental design skills on the effect of adding non-volatile solute to a solvent on freezing point. b) Gauge the learners' level of appreciation of real-life applications of colligative properties by asking them probing questions. c) Assess the learners' reports about calculations about colligative properties and reports from discussions on different colligative properties for accuracy and coherence.

TOPIC 9: Organic Chemistry II

Duration: 63 Periods

Topic competency: The learner analyses reaction mechanisms, evaluates reaction pathways and conditions, and designs multi-step syntheses to achieve target compounds (considering alcohols, phenols, carbonyl compounds).

SUB-TOPIC 9.1: Alcohols and Phenols

Duration: 24 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) analyse the structure, nomenclature, physical and chemical properties of alcohols and phenols. (u, s)	a) Individually, learners search for information about the structure, nomenclature, preparation and physical properties of alcohols and phenols, discuss their findings in groups and make reports (preparation of phenols not required). b) Individually, learners search for information about the chemical properties of alcohols and phenols and their mechanisms, discuss their findings in groups and make reports. c) In pairs, learners use problem-based learning to carry out exercises on chemical reactions of alcohols and phenols and their mechanisms. d) In groups, learners perform test tube experiments on the identification and reactions of alcohols (include distinction between classes) and phenols and write reports.	a) Monitor the learners on skills of planning, design, manipulation of apparatus and also respect for one another during laboratory experiments on the identification and reactions of alcohols and phenols. b) Ask the learners to explain the observed reactivity differences between alcohols and phenols to assess their understanding. c) Assess completed reports from research on the structure, nomenclature, preparation and physical properties of alcohols and phenols and laboratory experiments for the accuracy and interpretation of data.
b) evaluate the applications of alcohols and phenols in real life. (u, v/a)	a) In groups, learners analyse case studies to evaluate the applications of alcohols and phenols in real life and make presentations.	a) Evaluate the learners' level of participation in the planning and execution of project work. b) Gauge the learners' understanding of the

	b) In groups, learners carry out projects to make useful products from alcohols and phenols.	project process by asking probing questions on reasons, choice of projects and methodology used. c) Assess completed reports of projects and responses from case study tasks for accuracy and coherence.

SUB-TOPIC 9.2: Carbonyl Compounds (Aldehydes and Ketones)

Duration: 24 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) analyse the structure, preparation and reactivity of aldehydes and ketones, identifying how functional groups affect chemical behaviour in different environments. (u, s)	a) Individually, learners search for information about the structure, nomenclature, preparation (by oxidation of alcohols) and physical properties of carbonyl compounds, discuss their findings in groups and make presentations. b) Individually, learners search for information about chemical properties of carbonyl compounds and their mechanisms, discuss their findings in groups and write reports. c) In pairs, learners use problem-based learning to carry out exercises on chemical reactions of carbonyl compounds and their mechanisms: i) Addition reactions ii) Condensation reactions (hydroxylamine and Brady's reagent) iii) Redox reactions iv) Reaction with iodine d) In groups, learners perform test tube experiments on	a) Track the learners' level of participation in discussions and laboratory work on identification and reactions of carbonyl compounds. b) Engage the learners in a discussion to gauge their knowledge of physical and chemical properties of carbonyl compounds. c) Assess laboratory reports for proper interpretation and explanations and also reports from discussions for accurate representation of facts on the chemical reactions of carbonyl compounds and their mechanisms.

	the identification and reactions of carbonyl compounds and write reports.	
b) evaluate the different applications of carbonyl compounds in real life. (u, v/a)	a) Learners work in groups to analyse case studies involving applications of carbonyl compounds in real life and present their findings. b) In groups, learners identify and carry out projects to produce products from carbonyl compounds and write reports.	a) Evaluate the level of the learners' engagement and interaction during project work on products from carbonyl compounds. b) Discuss with the learners to assess the choices made in identification and project pathway design. c) Evaluate the project reports on making products from carbonyl compounds, responses of tasks from case studies for accuracy and creativity.

SUB-TOPIC 9.3: Carboxylic Acids and Derivatives

Duration: 15 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) analyse the structure, nomenclature, preparation and properties of carboxylic acids and their derivatives (esters, acyl chlorides).	a) Individually, learners search for information about the structure, nomenclature, preparation (by hydrolysis of esters and oxidation) and properties of carboxylic acids and their derivatives, discuss their findings in groups and make reports. b) In groups, learners use the problem-solving approach to perform exercises on reactions of carboxylic acids and their derivatives and make reports. c) In pairs, learners carry out laboratory tests on the reactions of carboxylic acids and identification of the functional group in acids.	a) Monitor planning and manipulation of apparatus skills and also the level of participation while carrying out experiments on the reactions of carboxylic acids and the identification of the functional group. b) Engage the learners in a question-and-answer discussion about the acidity variations of different carboxylic acids. c) Assess laboratory reports on the reactions of carboxylic acids and reports from discussions for correctness of facts about carboxylic acids and their derivatives.
b) evaluate the different applications of carboxylic acids and their derivatives in real life. (u, v/a)	a) In groups, learners analyse case studies involving applications of carboxylic acids and their derivatives in real life and write reports.	a) Evaluate the level of engagement and interaction during project work on products from carboxylic acids and their derivatives.

	b) Learners work in groups to identify and carry out projects to make products from carboxylic acids and their derivatives and make reports.	b) Discuss with the learners to assess their choices made in identification and project pathway design. c) Evaluate the reports of projects and responses to tasks from case studies on the applications of carboxylic acids and their derivatives for accuracy and creativity.

SENIOR SIX TERM 2

TOPIC 10: Electrochemistry

Duration: 54 Periods

Topic competency: The learner analyses redox reactions, electrochemical processes and electrochemical cells, applies the principles of electrode potentials to predict reaction spontaneity and electrolysis outcomes.

SUB-TOPIC 10.1: Redox Reactions and Oxidation Numbers

Duration: 18 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) analyse the concept of redox reactions, including the identification of oxidation and reduction processes, and assign oxidation numbers to elements in compounds and ions. (k, u, s)	a) Individually, learners search for information about the concept of oxidation and reduction, finding oxidation numbers in binary compounds and ions, discuss their findings in groups and make reports. b) In pairs, learners use worksheets to solve problems involving the calculation of oxidation numbers for binary compounds and ions.	a) Monitor the level of the learners' engagement in group discussions on finding oxidation numbers. b) Ask the learners to explain key concepts about redox reactions to gauge their understanding. c) Assess the learners' reports on finding oxidation numbers in binary compounds and ions, for accuracy and coherence.
b) apply the rules for determining oxidation numbers to balance redox equations (in acidic and basic media) and predict the products of redox reactions in various chemical contexts, including redox titrations. (u, s)	a) In groups, learners engage in a teacher-guided discussion to write balanced redox equations and related quantitative calculations and share their findings. b) In pairs, learners use problem-based learning to perform exercises involving balancing redox equations and related calculations and write reports. In groups, learners carry out quantitative experiments on redox titration involving common redox reagents.	a) Observe the learners as they make presentations checking on the accuracy of facts; and also, the contributions of the team members to the presentations relating to writing balanced redox equations. b) Gauge the level of understanding by asking the learners to explain their choice of methodology during the practical activities on redox titrations. c) Evaluate the learners' reports from balancing

		redox equations and quantitative experiments for accuracy and coherence.
c) evaluate the importance of redox reactions in industrial and biological systems, explaining their impact on processes like respiration and corrosion. (u, s, v/a)	a) In groups, learners analyse case studies involving real-life applications of redox reactions and make presentations. b) Learners work in groups to identify and carry out projects involving redox reactions.	a) Monitor the learners' creativity, planning, and participation in project work involving redox reactions. b) Discuss with the learners to assess their choice of procedures used during project work on redox reactions. c) Assess the reports from projects and presentations from real-life applications of redox reactions for accuracy and creativity.

SUB-TOPIC 10.2: Electrochemical Cells and Applications **Duration:** 21 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) analyse the structure and functioning of electrochemical cells, including galvanic (voltaic) and electrolytic cells, and describe the role of electrodes, electrolytes, and the movement of ions in these cells. (u, s)	a) Individually, learners search for information about electrode potentials and electrochemical cells, discuss their findings and make presentations. b) In groups, learners design and construct a simple electrochemical cell using copper and zinc electrodes, measure voltage and explain the reactions at each electrode. c) In pairs, learners carry out exercises about redox potentials and reactions and write reports.	a) Evaluate the learners' presentations on electrode potentials and electrochemical cells for clarity and accuracy of facts. b) Engage the learners in discussions to assess their appreciation of real-life applications of electrode potentials. c) Evaluate constructed electrochemical copper and zinc cell for functionality and reports from redox reaction exercises for accuracy and coherence.
b) apply principles of electrochemistry to calculate cell potentials,	a) Learners engage in a guided class discussion about the significance of	a) Monitor the learners' participation in the discussion and

predict the feasibility of redox reactions, and evaluate the industrial applications of electrochemical cells, such as in batteries, electroplating, and corrosion prevention. (u, s, v/a)	electrochemical cells in batteries, renewable energy, and sustainable solutions. b) In groups, learners carry out projects involving real-life applications of electrode potentials.	engagement during project work. b) Discuss with the learners to assess their justification for the choice of projects and methodology. c) Evaluate presentations of the learners about electrode potentials and electrochemical cells for accuracy and creativity.

SUB-TOPIC 10.3: Electrolysis and Faraday's Laws

Duration: 15 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
apply Faraday's laws to calculate the quantities of substances produced during electrolysis in various electrolytes. (k, u, s)	a) Learners engage in a class discussion to review prior knowledge about the concept of electrolysis. b) Individually, learners search for information about the process of electrolysis, Faraday's laws and how to calculate quantities of substances liberated at electrodes, discuss their findings and write reports. c) In pairs, learners use problem-based learning to perform exercises on Faraday's laws and calculate amounts of substances produced at electrodes.	a) Monitor the learners' participation during class discussions on prior knowledge of the process of electrolysis. b) Ask the learners to explain their understanding of Faraday's laws in practical contexts. c) Assess the learners' reports from discussion on the process of electrolysis, Faraday's laws and how to calculate quantities of substances for accuracy.

TOPIC 11: Periodicity II

Duration: 54 Periods

Topic competency: The learner analyses the trends in the physical and chemical properties of Group 14 elements, Group 17 elements and d-block elements and relates these trends to their applications in industrial and environmental contexts.

SUB-TOPIC 11.1: Trends in Properties of Group 14 Elements and their Compounds

Duration: 15 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) examine the general trends in physical properties, chemical reactivity, oxidation states, and bonding within Group 14 elements, with emphasis on their unique characteristics and variations down the group. (k, u, s)	a) Individually, learners search for information about properties of Group 14 elements such as melting point, metallic character, bond energy, structure and bonding, reaction with water, air and halogens, and discuss, in groups, their findings and make reports. b) In groups, learners carry out test tube experiments on the qualitative analysis of lead II compounds. c) In pairs, learners apply problem-based learning to carry out exercises about properties of Group 14 elements and write reports.	a) Observe the learners to assess their: i) interaction and collaboration during discussion. ii) practical skills of carrying out test experiments. b) Talk to the learners to assess their critical thinking ability in using problem-based information to carry out exercises about the properties of Group 14 elements. c) Evaluate the accuracy and coherence of the learners' reports.
b) analyse the properties of chlorides and oxides of Group 14 elements and use them to explain the stability of the different oxidation states. (u, s)	a) Individually, learners search for information about the physical properties (structure and bonding, melting points/boiling points) and chemical properties (thermal stability, reaction with water) of Group 14 chlorides, discuss their findings and write reports. b) In pairs, learners use worksheets to perform exercises on explaining trends and writing	a) Observe the learners to find out their level of involvement in discussions and skills of carrying out test tube experiments. b) Talk to the learners to assess their critical thinking ability in the use of worksheets to perform exercises on trends and on writing equations about chlorides of Group 14. c) Assess the learners' reports for accuracy and coherence.

	equations about chlorides of Group 14 elements. c) Individually, learners search for information about the physical properties (structure and bonding, melting points/boiling points) and chemical properties (bonding, thermal stability, reaction with water, acids and alkalis) of Group 14 oxides, discuss their findings and write reports. d) In pairs, learners use worksheets to perform exercises on explaining trends and writing equations about reactions of oxides of Group 14 elements. e) Learners carry out test tube experiments to identify Pb^{2+} and Sn^{2+} ions.	
c. evaluate the applications and limitations of Group 14 elements and compounds in technology and industry. (u, v/a)	a. Individually, learners search for information about applications and limitations of Group 14 elements and compounds in technology and industry, discuss their findings in groups and make reports. b. In groups, learners carry out projects about the application of Group 14 elements and their compounds in real life.	a. Monitor the learners as they discuss and carry out the projects to assess their involvement in discussion, project planning and execution. b. Discuss with the learners to assess their reasoning regarding the choice and methodology of projects. c. Assess the accuracy and coherence of the learners' reports.

SUB-TOPIC 11.2: Trends in Properties of Group 17 Elements and their Compounds

Duration: 15 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) examine the trends in electronegativity, boiling points, and reactivity of Group 17 elements and their compounds, relating them to their physical and chemical properties. (k, u, s)	a) Individually, learners search for information about the properties of Group 17 elements such as boiling point/melting point, atomic radius, colour, and electronegativity, discuss in their groups, and make reports. b) Learners work in pairs using worksheets to respond to tasks about the physical properties of Group 17 elements. c) Individually, learners search for information about the chemical reactions of halogens with: i) metals ii) hydrogen iii) alkalis (disproportionation) iv) water They discuss their findings in groups and make reports. d) Individually, learners search for information about the properties of compounds of Group 17 elements (hydrides and oxoacids) such as acidic strength, bond energy, and displacement reactions, discuss in groups and make reports. e) Learners work in pairs using worksheets to respond to tasks about the chemical properties of Group 17 elements.	a) Gauge the learners': i) level of involvement in group discussions. ii) skill of carrying out laboratory experiments. b) Engage the learners in discussions to find out their critical thinking ability in using worksheets to respond to tasks about the physical properties of Group 17 elements. c) Assess the learners' reports and worksheets for accuracy.

	f) Learners work in pairs to carry out test tube experiments to identify Cl^-, Br^-, and I^- ions and make reports.	
b) evaluate the impact of Group 17 elements in daily life and industry, particularly in disinfection and manufacturing, considering both advantages and environmental concerns. (u, s, v/a)	a) In groups, learners analyse case studies about the applications of Group 17 elements and their compounds in daily life, considering both advantages and environmental health concerns and make reports. b) In groups, learners carry out projects about the application of Group 17 elements and their compounds in real life.	a) Observe the learners to assess their interaction and collaboration during discussion. b) Talk to the learners to assess their critical thinking ability in analysing case studies about the applications of Group 17 elements and their compounds in daily life, considering both advantages and environmental health concerns. c) Assess the learners' reports for accuracy and coherence.

SUB-TOPIC 11.3: The d-Block Transition Elements

Duration: 24 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) Analyse the trends of the physical properties of the first series of the d-block elements (atomic radius, melting point, ionisation energy, density) across the period and compare them with s-block elements. (k, u, s)	a) Individually, learners search for information about the periodic physical properties of the transition elements, comparing them with s-block elements, discuss their findings in groups and write reports. b) Learners analyse case studies about the periodic physical properties of transition elements, interpret them and respond to given tasks.	a) Observe the learners to assess their: i) interaction and collaboration during discussion. ii) level of attentiveness in watching videos. iii) practical skills of carrying out test experiments. a) Talk to the learners to assess their critical thinking ability in analysing case studies

		about the periodic physical properties of transition elements and interpreting them. b) Assess the learners' reports for accuracy and coherence.
a) evaluate the properties of transition elements, explaining concepts like variable oxidation states, complex formation, coloured ions, magnetic properties and catalytic behaviour. (k, u, s)	a) Individually, learners search for information about the electronic structure, magnetic properties and catalytic properties of transition elements, discuss their findings in groups and make presentations. b) Individually, learners search for information about complex ion formation (shapes and isomerism not required) and the naming of complexes of transition elements, discuss their findings in groups and make reports. c) In groups, learners engage in a guided discussion with the teacher to practise the naming of complex ions. d) As a class, learners watch a video on variable oxidation states and coloured ions of transition elements and respond to set tasks. e) In pairs, learners perform test tube experiments to identify common transition metal ions such as: Fe^{2+}, Fe^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Cr^{3+}, Cu^{2+} *and* Zn^{2+} and make reports. f) In groups, learners use problem-based learning to solve problems involving redox reactions of transition metal ions.	a) Observe the learners to assess their: i) interaction and collaboration during discussion. ii) level of attentiveness in watching videos. iii) practical skills of carrying out test experiments. b) Converse with the learners to assess their: i) critical thinking in the use of problem-based information to solve tasks involving the redox reactions of transition elements. ii) ability to comprehend information presented in videos. c. Assess the learners' reports for accuracy and coherence.

b) critique the role of transition metals in industrial processes, medicine, and biological systems, assessing both their utility and environmental or health risks. (u, v/a)	a) Individually, learners search for information about the applications and risks involved in using transition elements, discuss their findings and write reports. b) In groups, learners carry out projects on the uses and environmental concerns of transition metals in various fields.	a) Check the learners' ability for planning and level of participation in project work. b) Discuss with the learners to assess their: i) understanding about the application and risks involved in the use of transition elements. ii) decisions during project work. c) Evaluate learners' reports for creativity and innovation.

SENIOR SIX TERM 3

TOPIC 12: Organic Chemistry III

Duration: 36 Periods

Topic competency: The learner analyses the chemical properties, industrial applications, and environmental impacts of amines and polymers, evaluates their social and ecological implications, and proposes innovations and sustainable solutions for addressing challenges in their use and disposal.

SUB-TOPIC 12.1: Amines

Duration: 18 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) analyse the structure, nomenclature, preparation and properties of amines in relation to their functional group. (k, u, s)	a) Individually, learners search for information about the structure, nomenclature, physical properties and reactions of amines, discuss their findings in groups and make reports. b) Learners work in groups to construct molecular models to demonstrate primary, secondary, and tertiary amine structures. c) In pairs, learners apply problem-based learning to perform exercises and fill worksheets on the nomenclature and properties of amines. d) Learners work in pairs to carry out test tube experiments involving the reactions of amines.	a) Watch the learners as they discuss, model the structures of molecules, and perform an exercise to assess their: i) collaboration spirit. ii) respect for one another's involvement. iii) skills to manipulate apparatus during experiment. b) Probe the learners to find out their perception about the chemical nature and use of amines in real life. c) Evaluate written experiment reports produced by learners for accuracy and consistency of procedure.
b) evaluate the industrial and biological significance of amines, and assess their roles in real life. (u, s, v/a)	a) In groups, learners examine case studies involving examples of amines in pharmaceuticals and dyes and discuss their functions. b) In groups, learners carry out projects involving the use of amines in daily life.	a) Assess the learners' commitment to collaborating and engaging in project activities, as well as presentation skills. b) Engage the learners in a discussion to assess their

		critical thinking in connection with: i) analysing case studies. ii) choosing projects. iii) planning and executing projects. iv) the depth of understanding and relevance of application. c) Evaluate the learners' presentations and reports for coherence and accuracy of facts.

SUB-TOPIC 12.2: Polymers and Polymerisation

Duration: 18 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) synthesise information on the types of polymerisation (addition and condensation), including the mechanisms involved in forming polymers from monomers, and distinguish between natural and synthetic polymers based on their structures and properties. (u, s)	a) As a class, learners watch a video about the process of addition and condensation, as well as polymerisation, and use the information to hold group discussions and perform related tasks. b) In groups, learners use the inquiry-based approach to compare the properties of different polymers created through each type of polymerisation. c) In pairs, learners perform exercises involving the formation, classification and properties of polymers.	a) Assess the learners' level of attention in watching the video and engagement in the discussions. b) Discuss with the learners to assess how they can predict and explain the properties of polymers based on polymerisation type. c) Review the learners' written reports for accuracy and coherence.
b) evaluate the environmental impact of polymers with emphasis on artificial polymers, proposing sustainable alternatives and analysing recycling techniques. (u, s, v/a)	a) As a class, learners engage in a debate on the pros and cons of synthetic polymers. b) In groups, learners carry out projects on polymers and sustainable alternatives to synthetic polymers.	a) Watch the learners' participation in: i) the debate for confidence and clarity of communication. ii) projects for reasoning skills during the debate.

		b) Discuss with the learners to assess their reasoning and critical thinking ability about polymers and sustainable alternatives to synthetic polymers. c) Evaluate the learners' project reports for feasibility and usefulness.

TOPIC 13: Reaction Kinetics

Duration: 36 Periods

Competency: The learner evaluates factors influencing reaction rates, and applies the principles of reaction, mechanisms and rate laws to predict the speed of chemical reactions under various conditions.

SUB-TOPIC 13.1: Rate Equations and Orders of Reaction

Duration: 18 Periods

Learning Outcome *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) deduce rate equations from experimental data, determine the order of reactions, and explain the significance of rate constants. (u, s, v/a)	b) Individually, learners search for information about key concepts in reaction kinetics such as rate of reaction, rate law, molecularity of reaction, and mechanisms of reaction, discuss in their groups and make reports. c) Learners engage in a teacher-guided discussion and use the kinetic data provided to determine the order of reaction, rate constant and half-life. d) Learners engage in guided discussions to analyse and interpret graphical data and use it to determine the order of reaction (first- and zero-order reactions), rate constant and half-life. (Derivations of integrated forms of orders of reaction are not required.) e) In pairs, learners design experiments to determine orders of reaction (iodination of propanone and decomposition of hydrogen peroxide) and make reports.	a) Assess the learners': i) level of co-operation with peers. ii) confidence and respect for one another's opinions during discussions. b) Converse with the learners to find out their reasoning in interpreting kinetic data. c) Evaluate the learners' written reports for accuracy and coherence.

SUB-TOPIC 13.2: Factors Affecting Rates of Reactions

Duration: 18 Periods

Learning Outcomes *The learner should be able to:*	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) evaluate how temperature, concentration, surface area, and catalysts affect reaction rates by applying collision theory to support conclusions. (u, s, v/a)	a) In groups, learners use prior knowledge to discuss the effect of different factors on reaction rates, linking them to the collision theory, and then write reports. b) In pairs, learners experimentally determine the activation energy of a redox reaction between ethanedioate ions and manganate (VII) ions in the acidic medium, and make reports.	a) Observe the learners to find out their: i) confidence and respect for one another's opinions during discussions. ii) skills in manipulating apparatus during laboratory experiments. b) Converse with the learners to find out their reasoning about how factors that affect the rate of reaction can be usefully applied in real-life contexts. c) Evaluate the learner's written reports for accuracy and coherence.
b) evaluate the influence of factors affecting reaction rates in industrial contexts, critically analysing how optimising reaction rates benefits production processes. (u, s, v/a)	a) In groups, learners analyse industrial case studies where reaction rate optimisation is crucial and role-play as industry chemists, presenting solutions.	a) Observe the learners to find out their level of engagement and analytical skills in case studies and role-play. b) Discuss with the learners to assess their objectiveness and critical thinking about the industrial relevance of reaction optimisation. c) Assess the learners' written case study analyses for thoroughness and application of concepts.

3.0 ASSESSMENT

3.1 Assessing Chemistry

This Advanced Secondary Curriculum sets new expectations for learning, with a shift from Objectives to Learning Outcomes that focus mainly on the application of knowledge and deeper learning that leads to the acquisition of skills. These Learning Outcomes require a different approach to assessment. The "Learning Outcomes" in the syllabi are set out in terms of Knowledge, Understanding, Skills, Values and Attitudes. This is what is referred to by the letters k, u, s v & a.

It is not possible to assess values and attitudes in the same way as knowledge, understanding, and skills because they are more personal and variable, and are long-term aspirations. This does not mean that values and attitudes are not important or cannot be assessed. They too can be assessed but not easily done through tests and examinations. Values and attitudes can be assessed over a period of time through observing and having interactions with the learner.

To assess knowledge and its application, understanding, and skills, we need to look for different things. Knowledge can be assessed to some extent through written tests, but the assessment of skills, application of what is learnt, and deeper understanding requires different approaches. Because of this, the role of the teacher in assessment becomes much more important. This section focuses on knowledge, understanding, and skills.

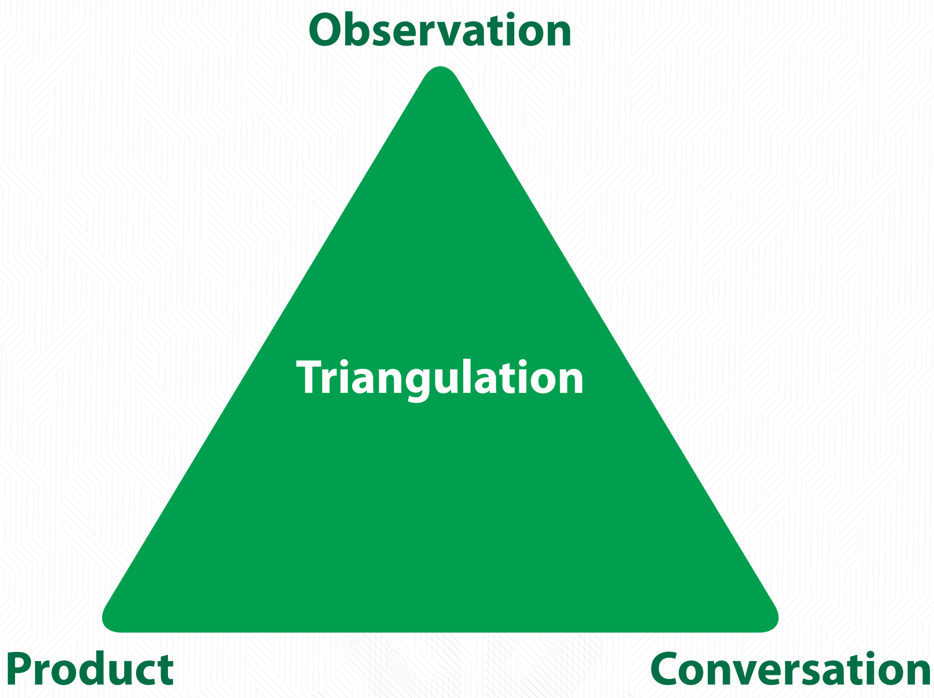
3.2 Formative Assessment

In this aligned curriculum, the teacher's assessment role is not only to write tests for learners, but to make professional judgements about learners' learning in the course of the normal teaching and learning process. The professional judgement is about how far the learner achieves the Learning Outcomes that are set out in this syllabus. To make these judgements, the teacher needs to look at how well the learners are performing in terms of each Learning Outcome.

The formative assessment opportunities occur in three forms. They can be done through:

1. **Observation** – watching learners working (good for assessing skills, values and attitudes);
2. **Conversation** – asking questions and talking to learners (good for assessing knowledge and understanding); and
3. **Product** – appraising the learner's work (writing, report, translation, calculation, presentation, map, diagram, model, drawing, painting etc). In this context, a "product" is seen as something physical and permanent that the teacher can keep and look at.

When all three are used, the information from any one can be checked against the other two forms of assessment opportunity (e.g. evidence from "observation" can be checked against evidence from "conversation" and "product"). This is often referred to as "triangulation".



3.3 Assessing Generic Skills

The generic skills have been built into the syllabuses and are part of the Learning Outcomes. It is, therefore, not necessary to assess them separately. It is the increasingly complex context of the subject content that provides progression in the generic skills, and so they are assessed as part of the subject Learning Outcomes. Assessing generic skills is done with the help of **an observation checklist and scoring rubric**.

3.4 Assessing Values/Attitudes

It is not possible to assess values and attitudes in the same way as knowledge, understanding and skills because they are more personal and variable and are long-term aspirations. This does not mean that attitudes are not important. It means that we must value things that we cannot easily assess through tests and examination. However, values and attitudes can be assessed over a long period of time through observing and interactions.

3.5 Assessment of Project-based Learning

Project-based learning is a teaching method in which learners or participants gain knowledge and skills by engaging for an extended period of time to investigate and respond to an authentic challenge. The task must have a driving question and it involves sustained inquiry.

Project-based learning is assessed using a rubric and an observation checklist.

3.6 Examinations

There will be only one school-based summative assessment at the end of the year. There will no longer be examinations or tests set at the beginning and end of every term. Instead, there will be a summing up of ongoing teacher assessments made in the context of learning through end-of-topic scenario-based tasks (Activities of Integration). The learners will also be subjected to the end of cycle assessment for certification.

3.7 Record-keeping

In competency-based learning, accurate and comprehensive record-keeping is crucial to track learners' progress and achievements. Therefore, the teacher and school **must keep accurate records about learners' achievement.**

Various assessment tools and strategies are employed to capture learners' demonstration of abilities and achievements, including observation checklists, rubrics, and scoring grids. These tools provide a holistic picture of learners' strengths, weaknesses, and areas for improvement.

The collected data and evidence from these assessments are correctly recorded and maintained in learners' files, portfolios and anecdotal notes.

Glossary of Key Terms

Term	Definition
competency curriculum	One in which learners develop the ability to apply their learning with confidence in a range of situations.
differentiation	The design or adaptation of learning experiences to suit an individual learner's needs, strengths, preferences, and abilities.
formative assessment	The process of judging a learner's performance, by interpreting the responses to tasks, to gauge progress and inform subsequent learning steps.
generic skills	Skills which are deployed in all subjects, and which enhance the learning of those subjects. These skills also equip young people for work and life.
inclusion	An approach to planning learning experiences which allows each student to feel confident, respected, safe and equipped to learn to his or her full potential.
learning outcome	A statement which specifies what the learner should know, understand, or be able to do within a particular aspect of a subject.
process skill	A capability acquired by following the programme of study in a particular Learning Area; enables a learner to apply the knowledge and understanding of the Learning Area.
sample assessment activity	An activity which allows a learner to show the extent to which s/he has achieved the Learning Outcomes. This is usually part of the normal teaching and learning process and not something extra at the end of a topic.
suggested learning activity	An aspect of the normal teaching and learning process that will enable a formative assessment to be made.

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ISBN 978-9970-675-43-2