INTRODUCTION

The study of Chemistry enables learners to comprehend how science is studied and practiced and become aware that results of scientific research can have both positive and negative effects on individuals, communities and the environment.
The General objectives for Grades 10 – 12 Chemistry:

1. **Acquire knowledge and understanding of the basic principles of Chemistry and how to apply such principles to familiar and unfamiliar circumstances.**
2. **Develop keen interest in Chemistry as a discipline and in science generally.**
3. **Acquire essential laboratory skills as well as those of critical thinking, observation, data collection, analysis, research and interpretation.**
4. **Develop the scientific attitude of problem solving, sense of curiosity, creativity and innovation.**

A learner-centered approach is emphasized in this curriculum. This is based on the firm belief that learning becomes more permanent, meaningful and exciting when learners themselves take ownership of the learning process. Instructors are therefore urged to contrive those classroom strategies that engage learners actively in the teaching and learning process.

SEMESTER: ONE

GRADE: 10
PERIOD: I
TOPIC 1: INTRODUCTION TO CHEMISTRY

LEARNING OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to apply the Scientific Method in Chemistry using relevant acquired skills to solve problems.	Upon completion of this topic, learners will: 1. Demonstrate knowledge about the origins and various stages in the development of chemistry 2. Express appreciation for the scientific method 3. Explain the word Chemistry and other related terminologies 4. Distinguish the systems of units of measurement 5. Solve simple conversion problems	1. **Development of Chemistry** a. Scientific method and its steps b. Contributors of Chemistry c. Branches of Chemistry 2. **Units of Measurement** a. System of Units b. Measurement - mass, length, time, Temperature, Volume c. Scientific notation and Scientific figure d. Precision and accuracy in measurement	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/Exercises:** a. Calculation and conversion of units b. Writing formula for IUPAC nomenclature of some simple compounds c. **Field trip** Trips outside of classroom to observe, demonstrate or practice the application of Scientific method 2. **Lab Sessions**: a. Discuss Safety & Safety Rules b. Recognizing/identifying safety & hazard signs	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/ Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999)	**EXPECTED COMPETENCIES** • Analytical skills • Research and problem-solving skills • Effective communication skills • Digital skills • Creativity and innovation skills **ASSESSMENT STRATEGIES to** *be used to check competencies* (Select relevant options): • Presentation • Written Assignment • Quiz • Identification of Lab Apparatus

	6. Discuss the origin of symbols of element 7. Apply the symbols to write the formula and the names of compounds 8. Apply the laboratory safety rules and 9. Identify apparatus in the Lab.	and standard deviation 3. **Chemical Symbols, Formulae and naming compounds** a. Origin of symbols b. Writing formula c. Types of formula d. Naming compounds 4. Apparatus and safety rules a. Drawing and naming apparatus b. Knowing the basic safety rules in the laboratory	c. Identify and Draw laboratory apparatus d. Outline the formats of Lab report e. Measuring different objects to determine-length, Volume, Time, mass, temperature, area.	• Laboratory equipped with at least the apparatus listed on minimum apparatus list. • Poster sheets. ➢ Rulers, tape rules, vernier calipers, micrometer. ➢ Stopwatches, balances, scales, thermometers. • Safety and hazard signs. Phones, Laptops/Desktops, Pen drive, Internet modem, Printers, Calculators, etc. **Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Lab Report • Class participation • Attendance • Test

SEMESTER: ONE

GRADE: 10
PERIOD: I
TOPIC II: MATTER AND ITS PROPERTIES

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to recognize the states of matter, explain changes and utilize the different laboratory techniques.	Upon completion of this topic, learners will: 1. Discuss the states of matter 2. Identify physical and chemical changes 3. Make use of separation techniques to purify impure substances and 4. Utilize various techniques to separate mixtures.	1. States of Matter and their Changes. 2. Properties and Changes of Matter. 3. Standard separation techniques for mixture a. Solid-solid, solid-liquid, liquid-liquid b. Boiling point for liquids and melting point for solids 4. Classification of mixtures	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignment/Exercise**: Identify the states of matter by observing materials in their environment. 2. **Lab Sessions:** a. Demonstrate experiment on chemical and Physical changes b. Apply the separation techniques for solid-solid, solid-liquid, liquid-liquid mixtures.	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) • Poster sheets & markers • Ice Blocks, Rocks, Water, Sand, Sugar, Salt, oxygen, water vapor etc.	**EXPECTED COMPETENCIES** • Analytical skills • Research and problem-solving skills • Effective communication skills • Digital skills • Creativity and innovation skills **ASSESSMENT STRATEGIES to** *be used to check competencies* (Select relevant options): • Presentation • Written Assignment • Quiz • Lab Report • Class participation

				• Phones, Laptops/Desktops, Pen drive, Internet modem, Printers, Calculators, etc. **Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Attendance • Test

SEMESTER: ONE

GRADE: 10
PERIOD: II
TOPIC 1 : ATOMIC STRUCTURE

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to interpret the key concepts, theories and principles relating to Atomic Structure, and the appropriate application of these principles.	Upon completion of this lesson, learners must be able to: 1. Discuss contributors to Atomic structures 2. Explain the arrangement of fundamental particles 3. Discuss the concept of Atomic Theories 4. Discuss atomic number and mass number and their relationship to isotopes 5. Discuss the four quantum numbers 6. Construct electronic configurations for atoms and	**1. History of Atomic structure** a. History of Atomic Chemistry b. Dalton's atomic theory c. Discovery of the electron and nucleus d. Rutherford's gold foil experiment e. Bohr's model of hydrogen **2. Fundamental particles** a. Arrangement of the particles in the atom	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. **1. Assignments/exercises**: a. J. J. Thompson's, Rutherford's and Geiger-Marsden experiments. Dalton's atomic theory. b. preparation of models of atoms using the Bohr atomic model c. Calculations of relative atomic mass using MS data. d. Preparation of models of atoms and simple molecules. e. Preparation of charts /drawings showing	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **B. Secondary Texts** *Edexcel IGCSE Chemistry* (Pearson, 2010) *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) Dry cell batteries, wires coins and other metallic objects, pencil, rubber and other nonmetallic objects	**EXPECTED COMPETENCIES** • Analytical skills • Research and problem-solving skills • Effective communication skills • Digital skills • Creativity and innovation skills **ASSESSMENT STRATEGIES to** *be used to check competencies* (Select relevant options): • Presentation • Written Assignment • Quiz • Lab Report • Class participation

	7. Explain the rules and principles for filling in electrons.	**3. Isotopes** a. Atomic number and mass number **4. Relative atomic mass** a. Calculate the mass number and relative abundance **5. Quantum numbers** – shapes, sizes orientation and spin **6. Electron configuration** Dot notation, orbital notation, orbital diagram, noble gas configuration, KLMNOPQ notation Orbital **7.** Rules and principles for filling in electrons.	shapes of s, p and d orbitals f. Write energy level electron configurations for the first 30 elements g. Electronic configuration of the first transition series. **2. Lab sessions:** a. Flame photometry b. Conductivity of metals and nonmetals	Burners, glass rods, $MgCl_2$, NaCl, KCl, $CuSO_4$ Burner, naphthalene, camphor balls, watch glasses, evaporating dishes. Diagram of mass spectrometer Filter paper, beakers, funnels, magnets, etc. Poster sheets, markers, Phones, Laptops/Desktops, Pen drive, Internet modem, Printers, Calculators, etc. **Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Attendance • Test

SEMESTER: ONE

GRADE: 10
PERIOD: III
TOPIC 1 : THE PERIODIC TABLE/PERIODIC CHEMISTRY

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to demonstrate knowledge of the Periodic Table and discuss basic properties of the elements	Upon completion of this topic, learners will: 1. Discuss the history and development of the periodic table 2. Identify that elements are placed on the periodic table due to similar properties 3. Identify the main blocks, groups and the periods of the periodic table 4. Discuss the chemical and Physical properties of	1. **History & Origin of The Periodic Law** 2. **Structure of the Periodic Table** a. Group and Period b. Metals, Nonmetal and metalloids 3. **Trends in Periodic Properties** a. Electronegativity b. Ionization energy c. Electron affinity d. Atomic radius e. Metallic character f. Ionic to covalent bonding in compounds g. Nonmetallic character h. Lattice energy	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/exercises:** a. Draw each group [Alkali metals, Alkaline earth metal, transitional metals (lanthanide and actinide series), boron family, carbon family, Nitrogen family, Oxygen Family, Halogen and Noble Gases in the periodic table. b. Plot a graph of atomic number of the second period elements vs. ionic radius and another graph of atomic number vs. ionic radius of main group elements. Then use these graphs to	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999)	**EEXPECTED COMPETENCIES** • Analytical skills • Research and problem-solving skills • Effective communication skills • Digital skills • Creativity and innovation skills **ASSESSMENT STRATEGIES to** *be used to check competencies* (Select relevant options): • Presentation • Written Assignment

	the groups and 5. Discuss the periodic trends.	4. **Main group elements:** physical properties and chemical reactivities of the elements (helium, lithium, beryllium, boron, carbon, nitrogen, oxygen, and fluorine). 5. **Period three compounds:** a. Comparison of physical and chemical properties of (hydrides, oxides, hydroxides and chlorides) compounds b. Thermal stability of CO_3^{2-}, NO_3^- of Li, Na, K, Mg and Ca 6. Period four metals (K, Ca) 7. Group Seven elements-the halogens (f, Cl, Br, and I)	explain the variation of ionic radius along a series and within a group of the periodic table. c. Make a list of all first transition elements and identify those elements which form colored compounds, those which may serve as catalysts and those which have magnetic properties. 2. **Lab sessions**: a. Investigate the pattern of arrangement of elements on the periodic table. b. Compare the relative reactivity of elements of main groups (helium, lithium, beryllium, boron, carbon, nitrogen, oxygen, and fluorine). c. Experiment to compare thermal stability of $Na_2CO_3/Li_2CO_3/CuCO_3$	• Burettes, pipettes, beakers • Periodic table, Poster sheets, markers graph paper • Strips of some metals including Na, K, Li, Mg and Ca, Water, Phones, Laptops/Desktops, Pen drive, Internet modem, Printers, Calculators etc **Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Quiz • Lab Report • Class participation • Attendance • Test

		8. **Elements of the 1st transition series**- physical states, metallic and magnetic properties, variable oxidation states, formation of colored compounds catalytic abilities, etc.			

SEMESTER: TWO

GRADE: 10
PERIOD: IV
TOPIC 1 : CHEMICAL BONDING

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to analyze the different types of chemical bonding, properties and their molecular shapes	Upon completion of this topic, learners will: 1. Distinguish the different types of chemical bonding 2. Discuss hybridization of atomic orbitals 3. Demonstrate the types of bonding of molecules by using the Lewis Structure 4. Discuss electronegativity relative to the concept of bond polarity 5. Discuss the molecular geometry	1. **Bonding Types** – Ionic Bonding: Factors influencing formation, properties of ionic compounds 2. **Discuss hybridization of atomic orbitals** (sp^3, sp^2, sp hybridization). a. **Covalent Bonding:** a. Factors influencing its formation, properties of covalent/ molecular compounds b. Bond Polarity c. Simple molecules and their shapes	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. **1. Assignments/exercises**: a. Draw electron dot & orbital diagrams to illustrate ionic bond formation involving different compounds b. Apply the octet rule to draw basic Lewis structure for compounds c. Calculating electro-negativity difference/ % ionic character and using the result to predict bond polarity	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) Phones, Laptops/Desktops, Pen drive, Internet modem,	**EXPECTED COMPETENCIES** • Analytical skills • Organizational skills • Creativity and innovation skills • Research and problem-solving skills • Effective communication skills • Digital skills **ASSESSMENT STRATEGIES** **to** *be used to check competencies* (Select relevant options): • Presentation • Written assignment

	6. Distinguish between inter-atomic bonding and intermolecular bonding and 7. Explain coordinate covalent (dative) bond.	3. **Discuss the molecular geometry**. 4. **Metallic Bonding:** Factors influencing its formation, properties of metals 5. **Intermolecular bonding** –van der Waal's forces, Intermolecular forces in covalent compounds and hydrogen bonding 6. **Coordinate bonding;** a. Comparison of all bond types	d. Draw the shapes of various molecules predicted by the hybridization theory and the Valence Shared Electron Pair Repulsion (VSEPR) theory e. List all the characteristics of metals that enable them to form metallic bonds f. Deducing the relative boiling points of various substances based on their structures. g. Make a chart to compare ionic covalent and metallic bond in terms of structure, heat and electrical conductivities, boiling & melting points, solubility in water and non-polar solvents and hardness.	Printers, Calculators, etc. Poster sheets, markers Sugar, NaCl, $NaHCO_3$, I_2, water, 2propanol (isopropyl alcohol). Polar solvents such as alcohol (ethanol), water; Non-polar solvents such as diethyl ether; NaCl, kerosene Naphthalene, graphite, iodine, camphor balls, Ethanol, Water, Ether, Ethanol, Diethyl ether, thermometer, simple distillation equipment **Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Quiz • Lab report • Fairs • Create models to show single, double, & triple bonds • Class participation • Attendance • Test

			7. **Lab sessions:** a. Physical properties of ionic and covalent solids b. Apply different models to illustrate single bond, double bond and triple bond c. Investigate the polarity of some solvents d. Investigate the effects of heat, electricity & some solvents on covalent compounds e. Comparison of the boiling points of two liquids to show how hydrogen bonding affects boiling point		

SEMESTER: TWO

GRADE: 10
PERIOD: V
TOPIC 1 : ATOMS, MOLECULES, IONS AND STOICHIOMETRY

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to identify the fundamental chemical laws, the percentage of elements in compounds, and discuss the mole concept; also discuss formulas, chemical reactions and the techniques in balancing chemical reactions.	Upon completion of this topic, learners will: 1. Distinguish the fundamental chemical laws 2. Distinguish atoms, molecules and ions 3. Discuss the mole concept 4. Determine the percent of elements in compounds 5. Determine the formula of a compound 6. Discuss the kinds and types	1. **Fundamental Chemical Laws:** a. law of conservation of mass b. law of definite proportion c. law of multiple proportion 2. **Molecules and Ions** 3. **The Mole concepts** a. Mole-Mole b. Mole-Mass c. Mass-Mass d. Mole-atom, particle, molecule 4. **Percentage Composition** 5. **Determination of the formula of a compound**: Molar Mass, Empirical and Molecular Formulae	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/exercises**: a. Presentation on the fundamental chemical laws b. Calculations of percentage composition 2. **Lab Sessions:** a. Demonstrate a lab to prove the fundamental chemical laws. b. Demonstrate the mole concept and	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/ Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for* (Sedco/Pearson, 1999) Poster, sheets, markers, Burner, Crucible tongs	**EXPECTED COMPETENCIES** • Analytical skills • Research and problem-solving skills • Creativity and innovation skills • Effective communication skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES** **to** *be used to check competencies* (Select relevant options):

	of chemical reactions 7. Analyze the techniques in balancing chemical reactions and 8. Determine the limiting reagent/reactant of a chemical reaction.	6. **Kinds of chemical reactions** (Reversible and irreversible reactions) 7. **Types of chemical reactions** a. Composition/Combination reactions b. Single replacement reactions c. Double replacement/metathesis reactions d. Decomposition reactions e. Combustion reactions f. Oxidation-Reduction reactions, etc. 8. **Writing and balancing chemical reactions** 9. **Limiting Reagents/Reactants**	related calculations c. Demonstrate understanding of atomic mass d. Demonstrate types of chemical reactions e. Demonstrate lab for limiting reactant	Micro spatula, Test tubes, Test tube holder, Test tube rag, Sand paper Fine evaporating dish, Safety goggles Lab apron/coat, Wood splints Copper wire, Zinc, Magnesium ribbon Hydrochloric acid, Copper carbonate Analytical balance, Filter paper, Beaker tongs, Hot plate/burner, Wash bottle Wash glasses, Beakers, Shield vials Unknown solid mixture, 0.2 M potassium chromate, 0.1 M silver nitrate Glass rod, Rubber policeman, Funnel Labelling tape, Distill water, Phones, Laptops/Desktops, Pen drive, Internet modem, Printers, Calculators, etc. **Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com	• Presentation • Written assignment • Quiz • Lab report • Class participation • Attendance • Test

				www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	

SEMESTER: TWO

GRADE: 10
PERIOD: VI
TOPIC I: OXIDATION-REDUCTION REACTIONS

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to Interpret oxidation-reduction reaction as well as balance simple redox equation.	Upon completion of this topic, learners will: 1. Discuss the terms oxidation and reduction 2. Discuss the difference between oxidizing and reducing agents 3. Apply the concept of calculating oxidation numbers and 4. Apply the rules for balancing redox reactions.	1. **Describe Oxidation and Reduction** 2. **Calculate Oxidation numbers.** 3. **Balancing simple redox equations including** acidic and basic solutions. a. Oxidized and Reduced b. Oxidizing agent and Reducing agent	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/exercises:** a. Determine oxidation states for elements in various species. b. Balancing simple redox equations in acidic and basic media 2. **Lab sessions**: a. Determining the mole ratio, and writing the balanced equation, for the reaction between aqueous	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/ Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) • Hydrated $CuSO_4$ crystals • Zn foil	**EXPECTED COMPETENCIES** • Effective communication skills • Analytical skills • Creativity and innovation skills • Research and problem-solving skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** *be used to check competencies* (Select relevant options): • Presentation • Written assignment • Quiz • Lab report • Class participation

			$CuSO_4$ and Zn metal. b. Experiment on "Testing for reducing agents and oxidizing agents".	• distilled water • beakers, balances, stirring rods, etc. Br_2, H_2O_2, Conc. HNO_3, $KmnO_4$, $K_2Cr_2O_7$, KI, $FeSO_4$, Cu turnings, $FeCl_3$, KIO_3, S, SO_2, test tubes HCl, Zn foil or granules, $KClO_3$ MnO_4, burner, NaCl, H_2SO_4, beakers, water bath, Phones, Laptops/Desktops, Calculators, Pen drive, Internet modem, Printers, etc. **Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Attendance • Test

SEMESTER: ONE

GRADE: 11
PERIOD: I
TOPIC 1: SOLUTION AND SOLUBILITY

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to elaborate the properties of solutions, simplify their mathematical skills as well as laboratory techniques. Learners are able to affirm a firm knowledge of solubility as well as demonstrate its practical applications.	Upon completion of this topic, Learners will: 1. Discuss the types of Solution 2. Distinguish between dilute and concentrated solutions 3. Analyze stock solution 4. Analyze various concentration units 5. Describe the colligative properties of solutions	**1. Solutions** a. Homogenous b. Heterogenous 2. **Types of solutions**: a. Saturated b. Unsaturated c. Supersaturated solutions 3. **Dilute and concentrated solutions** 4. **Solution concentration units** (molarity, molality, ppm normality, % w/w, %v/v, ppb) 5. **Colligative properties**: Vapor pressure, boiling point, freezing point, osmotic pressure; Colligative Properties of Electrolyte Solutions	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. **1. Assignments/ exercises**: a. Identify the solutes and solvents in common/household solution mixtures. b. Simple dilution calculations. c. Simple calculations involving solution concentration units. d. Simple calculations involving boiling point elevation, freeing point	**Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **Secondary Texts** *Edexcel IGCSE Chemistry* (Pearson, 2010) *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) Simple distillation apparatus, (flasks, stoppers, tubing, boiling chips, condensers, burners, etc.).	**EXPECTED COMPETENCIES:** • Effective communication skills • Creativity and innovation skills • Analytical skills • Research and problem-solving skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** *be used to check competencies* (Select relevant options): • Presentation • Written Assignment • Quiz

	6. Discuss colloids 7. Discuss factors affecting solubility 8. Discuss the general principles of solubility 9. Analyze the solubility curves 10. Discuss the solubility of ionic substances and 11. Apply the solubility table to determine the quantitative analysis of a solution.	**6. Colloids** **7. Factors affecting solubility** **8. General principles of solubility** a. Saturated solution as an equilibrium system b. Solubility expressed in concentration terms: $moldm^{-3}$ and gdm^{-3} c. Relationship between solubility and crystallization d. Crystallization/recrystallization as method of purification 9. **Solubility curves and their uses** (drawing and interpreting these curves) 10. **Solubility of ionic substances**	depression, lowering of vapor pressure and osmotic pressure. e. Perform some simple calculations involving Henry's law of solubility. f. Construct the solubility curve to analyze the various salts. g. Perform some simple calculations involving Henry's law of solubility. h. Construct the solubility curve to analyze the various salts. 2. **Lab sessions**: a. Separation of a solution mixture.	Stock solutions of Conc. H_2SO_4, Distilled water volumetric flasks, etc. Na_2CO_3, HCl, distilled water, burette, beakers, methyl orange indicator. Distilled water, granulated sugar, thermometer, boiling chips, thermometer, stopper, etc. Milk, Oil, Phones, Computers, Internet modem, Calculators Graph paper. Group 1A, ammonia, phosphate, sulfide, hydroxide, nitrate, chloride, bromide, iodide, AgCl, barium hydroxide, calcium hydroxide, barium sulfate, lead chloride, mercury (I) iodide, silver iodide, etc. Beaker, test tube, etc.	• Written • Lab Report • Class participation • Attendance • Test

		11. **Precipitation and quantitative analysis**	b. Dilution of concentrated solutions. c. Preparation of standard solutions (anhydrous: Na2CO3, (COOH)2, 2H2O/H2C2O4.2H2O. d. Simple experiment to demonstrate the elevation of boiling point by the addition of a nonelectrolyte solute to a pure solvent. e. Perform Lab to demonstrate the concept of colloids f. Generalizations about solubility of salts and their applications to quantitative analysis (Pb^{2+}, Ca^{2+}, Al^{3+}, Cu^{2+}, Fe^{2+}, Fe^{3+}, Cl-, Br-, I-, SO_4^{2-}, S^{2-}	**Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	

			and CO_3^{2-}, Zn^{2+}, NH_4^+, SO_3^{2-}. g. perform an experiment to demonstrate a precipitation concept. h. Perform Lab to demonstrate the concept of colloids i. Generalizations about solubility of salts and their applications to quantitative analysis (Pb^{2+}, Ca^{2+}, Al^{3+}, Cu^{2+}, Fe^{2+}, Fe^{3+}, Cl-, Br-, I-, SO_4^{2-}, S^{2-} and CO_3^{2-}, Zn^{2+}, NH_4^+, SO_3^{2-}. j. Perform an experiment to demonstrate a precipitation concept.		

SEMESTER: ONE

GRADE: 11
PERIOD: II
TOPIC I : KINETIC THEORY OF GASES

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to solve both composition and reaction stoichiometry problems	Upon completion of this topic, Learners will: 1. Describe the concept of pressure 2. Explain and apply Boyles, Charles', Gay-Lussac's, Avogadro's to observations of gas behavior 3. Perform calculations using the Ideal Gas Equation 4. Apply the concept of the gas laws to gas phase reactions and perform stoichiometric	1. **Pressure** a. Units of Pressure 2. **The Ideal Gas Laws** a. Boyle's Law b. Charles's Law c. Gay-Lussac's Law d. Avogadro's Law 3. **The Ideal Gas Equation** 4. **Gas Stoichiometry** a. Molar Mass of a Gas 5. **Dalton's Law of Partial Pressures** a. Collecting a Gas over Water 6. **The Kinetic Molecular Theory of Gases**	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. **1. Assignments/Exercises**: **a.** Perform calculations on gas laws and various stoichiometric problems. **b.** Calculate sample problems involving root mean square velocity as well as effusion and diffusion. **2. Lab sessions**: a. conduct an experiment to	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/ Supplementary Readings** • Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) • Simple distillation apparatus, (flasks, stoppers, tubing, boiling	**EXPECTED COMPETENCIES** • Research and problem-solving skills • Analytical skills • Creativity and innovation skills • Effective communication skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES** *be used to check competencies* (Select relevant options): • Presentation • Written Assignment • Quiz

	calculations using gas properties, masses, moles, limiting reagents and percent yield 5. Describe the relationship between partial pressure and the total pressure as described in Dalton's Law of partial pressure 6. Apply the ideas of Kinetic Molecular Theory to a variety of gas phenomena 7. Discuss the Root Mean Square Velocity as it relates to gas particles 8. Discuss effusion and diffusion in relation to Graham's Law 9. Explain the general	a. Pressure and Volume (Boyle's Law) b. Pressure and Temperature (Gay-Lussac's law) c. Volume and Temperature (Charles's Law) d. Volume and Number of Moles (Avogadro's Law) e. Mixture of Gases (Dalton's Law) f. Deriving the Ideal Gas Law g. The Meaning of Temperature 7. **Root Mean Square Velocity** 8. **Effusion and Diffusion**	interpret the concept of pressure b. Conduct an experiment to demonstrate the various gas laws. c. Perform an experiment with focus on the Kinetic Molecular Theory to explain the properties of an ideal gas d. Laboratory preparation of the following gases: H2, NH3, CO2, and to illustrate the principles of purification and collection of these gases. e. Preparation of standard solutions. f. Conduct an experiment to differentiate ideal gas from real gas.	chips, condensers, burners, etc.). • Plastic bottles, funnel, iron wool, plastic tubes, battery acid, balloons, sugar, yeast, baking soda, hydrochloric acid, vinegar, dry cell, hydrogen peroxide, water, etc. • Kerosene stove, battery acid, copper foil, glass tube, caustic soda, sulfuric acid, sodium hydroxide, delivery tube, nitrogen dioxide, etc • Stock solutions of Conc. H_2SO_4, Distilled water volumetric flasks, etc. • Na_2CO_3, HCl, distilled water, burette, beakers, methyl orange indicator. • Distilled water, granulated sugar, thermometer, boiling chips, thermometer, stopper, etc.	• Lab Report • Class participation • Attendance • Test

	principles of the hard sphere model and the van der Waal's Model of gas and 10. Discuss the concept of chemistry in the atmosphere.	9. **Real Gases** a. Characteristics of Several Real Gases 10. **Chemistry in the Atmosphere**	g. Conduct an experiment involving a chemical reaction to show the use of gases in the atmosphere.	Links: www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	

SEMESTER: ONE

GRADE: 11
PERIOD: III
TOPIC: ELECTROLYTES - ACID, BASES AND SALTS

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/ LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to Interpret knowledge of electrolytes – acid, bases, salts, as well as the ability to perform various acid-based titrations.	Upon completion of this topic, learners will: 1. Discuss electrolytes and non-electrolytes 2. Elaborate on Acids and Bases involving the Arrhenius and Bronsted-Lowry theories 3. Solve sample problems involving the concept of pH and pOH 4. Demonstrate calculations that analyze amounts of acid and base dissociated 5. Determine the effects of salt on	1. Electrolytes and Non-electrolytes. 2. Theories (Arrhenius & Bronsted-Lowry concept of acids-bases) and Properties of acids and bases. 3. pH and pOH calculations. 4. Percent dissociation 5. Acid-Base Properties of Salts a. Laboratory and industrial preparation of salt	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/exercises**: a. List several acids and bases. Then write chemical equations to show how they behave as electrolytes. b. Write an acid-base reaction explaining the concept of Arrhenius theories as well as write an acid-base reaction analyzing the concept of Bronsted-Lowry theories, identifying conjugate acid-base pair.	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) Khan Academy	**EXPECTED COMPETENCIES:** • Effective communication skills • Creativity and innovation skills • Analytical skills • Research and problem-solving skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** *be used to check competencies* (Select relevant options): • Presentation • Written Assignment • Quiz

	pH and pOH concentrations 6. Discuss the concept of Lewis acids and bases 7. Interpret the behavior of buffer solutions 8. Describe the behavior of certain salts towards hydrolysis and 9. Analyze the concentrations of acids and bases using titration	b. Chemicals from sodium chloride solution c. Hydrolysis of salts 6. Properties of Lewis Acids and Bases 7. Buffer solutions. 8. Acid-base titrations a. Acid-base indicators b. Acid-base titration	c. solve sample problems, analyzing the concept of Lewis acids and bases d. List five (5) different buffer solutions and classify them as either weak acid-salt buffer or weak base-salt buffer 2. **Lab sessions**: a. Experiment to demonstrate the conductivity of electrolytic solutions. b. measurement of pH of a solution using pH meter, calorimetric methods of universal indicators and also the significance of pH values in everyday life e.g. Acid rain, pH of soil, blood, urine. c. perform an experiment to analyze the percent of acid and base dissociated in a chemical reaction. d. Description of laboratory and	NaCl, granulated sugar, distilled water, dry cell or lead storage battery, electric wires, light bulbs sockets. Purple cabbage or hibiscus flower, isopropyl alcohol (2-propanol), burner, beaker, vinegar, citrus fruits, caustic solution, etc. pH meter, pH papers, buffer solutions of pH 4, 7 &10, distilled water acidic and basic solutions, etc. Phenolphthalein indicator, NaOH, HCl, burette, beakers, flasks, litmus paper, Internet, Phones, Computer, etc. Links: www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Written • Lab Report • Class participation • Attendance • Test

			industrial production of salt. e. Mining of impure sodium chloride and conversion into granulated and iodate salt f. Uses of sodium chloride, sodium hydroxide, chlorine gas and hydrogen gas. g. Explanation of how salt forms acidic, alkaline, and neutral aqueous solution h. Behavior of some salts e.g. NH4Cl, AlCl3, N2CO3, CH3COONa) in water as examples of equilibrium system i. Effects of charge density of some cations and anions on the hydrolysis of their aqueous solution e.g. group I, group II, group III, and the d-block elements.		

			j. Preparation of an indicator from local plants and its use to test acidity and basicity. k. Preparation of buffer solution and also calculation l. Acid-base titration experiment involving HCl, HNO_3, H_2SO_4 and NaOH, KOH, $Ca(OH)_2$, CO_3^{2-}, HCO_3^-. m. Titration involving weak acid VS strong base, strong acid VS weak base and strong acid VS strong base using the appropriate indicators and their applications in quantitative determination; eg concentrations, mole ratio, purity, water of crystallization and composition		

SEMESTER: TWO

GRADE: 11
PERIOD: IV
TOPIC I: ELECTROCHEMISTRY

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to demonstrate knowledge of the concepts and principles of Electrochemistry as well as its practical applications.	Upon completion of this topic, leaners will: 1. Explain the concept of balancing redox reaction 2. Discuss the electrochemical cell 3. Make use of the cell diagram 4. Apply the principle of electrolysis to distinguish electrochemical cell 5. Discuss the factors that influence the discharge of species 6. Simplify cell reactions for the	1. **Review of redox reactions/balancing of redox equations** a. Oxidation equations b. Reduction equations 2. **Electrochemical cells** – Standard Electrode Potential 3. **Cell Diagrams** (emf of cells) 4. **Principles of electrolysis** – comparison of electrolytic cell with electrochemical cell; 5. **Factors influencing discharge of species**	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/exercises:** a. Practice problems on balancing redox reactions b. Problem solving using standard electrode potentials c. Drawing diagrams of various electrochemical cells; simple calculations of emf of cells.	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/ Supplementary Readings** • Kobina Adu Lartson, *Practical Chemistry for*	**EXPECTED COMPETENCIES:** • Effective Communication skills • Analytical Skills • Creativity and innovation skills • Research and problem-solving skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** *be used to check competencies* (Select relevant options): • Presentation

	electrolysis of various species 7. State Faraday's first and second laws, solving sample problems 8. Discuss the various batteries, together with their applications and 9. Explain how electroplating materials can prevent rusting and corrosion.	a. **Electrolysis of common electrolytic cells** (molten NaCl & $PbBr_2$, dil. NaCl solution, conc. NaCl solution, $CuSO_4$ solution, dil. H_2SO_4, NaOH (using Pt or graphite and copper electrodes b. **Faraday's 1st and 2nd laws of electrolysis** 6. **Batteries** a. **Application of electrochemical cells** (Primary & secondary cells, Daniel cell, lead battery, dry cell, fuel cells – their use as generators of electrical energy from chemical reactions 7. **Corrosion of metals**	d. List the factors that influence the discharge of species from electrolytes; Identify the species and to be discharged from certain solutes. e. Sample problems on the writing of cell reactions for the electrolysis of various species, using as a guide, the factors that influence the discharge of species from electrolytes. f. Roasting of iron and its economic cost g. Solve sample problems to illustrate Faraday's laws of electrolysis h. Describe/explain how and why stainless steel is often used to make cooking and eating utensils.	(Sedco/Pearson, 1999) Dry cell batteries, wires, graphite rods, NaCl, distilled water, flasks, beakers, etc. • Beakers, graphite rods, NaCl crystals as salt bridge, etc. • Graphite rods, wires, source of electricity, distilled water, Dilute sodium NaCl solution, dilute sulfuric acid, etc. • Copper rods for electrodes, wires, source of electricity, aqueous copper(II) sulfate • Poster sheets Links: www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net	• Written Assignment • Quiz • Lab Report • Class participation • Attendance • Test

		8. **Practical applications of electrolysis** – electroplating, smelting, etc.	i. Learners collect several materials available in their neighborhoods or communities that have been electroplated; also identify and collect various samples of corroded materials. 2. **Lab sessions:** a. Construction of an electrochemical cell b. Electrolysis of water and dilute NaCl solution c. Limit electrolytes to concentrated NaCl, (brine) CuSO4, dil. H2SO4, NaOH, KI, CaCl2. d. Electroplating of copper e. Perform an experiment to demonstrate electroplating by using dry cell,	www.funbrain.com www.researchgate.netacs.org	

			copper wire, iron nail, copper (II) sulfate soln., water and bottle/beaker f. perform an experiment on indicator of electrolysis by using phenolphthalein, water, salt, dry cell, speaker wire. g. Determine electrolysis in food and water using lemon, zinc plate, carbon rod, wire, galvanometer, light bulb, bottle, clothes pegs, water, table sugar. h. Electroplating, extraction of metals and purification		

SEMESTER: TWO

GRADE: 11
PERIOD: V

TOPIC 1: CHEMICAL ENERGETICS

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners able to perform comparative analysis, on the concept of energetics and interpret related energy level diagrams.	Upon completion of this topic, learners will: 1. Identify the systems and the surroundings in the chemical process 2. Identify the ways in which energy is transferred in the chemical process 3. Investigate the relationship between internal energy and enthalpy 4. Calculate change in enthalpy of a reaction using Hess' Law of heat 5. Calculate change in standard enthalpy of a reaction using	1. **Thermodynamics** a. Heat Energy b. Heat Capacity c. Changes of State d. Chemical Energy e. Law of conservation of energy f. Enthalpy changes g. Experimental data analysis 2. **Standard Enthalpy Change** a. Standard enthalpy of combustion b. Standard enthalpy of formation c. Enthalpy of reaction d. Enthalpy of neutralization e. Enthalpy of evaporation	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/exercises:** a. Simple calculations on heat of reaction b. Solve sample Hess' Law problems c. Plot simple energy vs. time. d. Identify several sources of fuels – solids, liquids and gases 2. **Lab session:** a. Demonstrate experiment to explain exothermic and endothermic processes.	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **B. Secondary Texts** • *Excel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/ Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson,1999) Graph paper Temperature bottles (3 plastic bottles, powdered soap, citric acid, spoon)	**EXPECTED COMPETENCIES** • Analytical skills • Research and problem-solving skills • Creativity and innovation skills • Effective communication skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** *be used to check competencies* (Select relevant options) • Presentation • Written Assignment • Quiz • Lab Report • 5Class participation

	tables of change in enthalpy of formation 6. Appreciate the origin of heat release in net bond breakage and 7. Discuss the concept of ionic systems.	3. **Hess' Law** a. Manipulation of chemical equations b. Energy cycles and diagrams c. Two and three step process calculations 4. **Bond Enthalpy** a. Bond dissociation enthalpy b. Bond enthalpy c. Limitations of bond enthalpies 5. **Ionic systems** a. Lattice enthalpy b. Born Haber cycles c. Enthalpy of solution d. Limitations of ionic model 6. **Fuels:** Gaseous, liquid and solid fuels as sources of energy	b. Use calorimeter to determine the heat capacity of the chemical reaction. c. Determining the heat of solution of: H_2SO_4, NaOH, $CuSO_4$	NaOH & $CuSO_4$ crystals Conc. H_2SO_4, Distilled water, volumetric flasks graduated cylinders balance. Thermometer, distilled water, sugar, NaCl. **Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Attendance • Test

SEMESTER: TWO

GRADE: 11
PERIOD: V
TOPIC 2: NUCLEAR CHEMISTRY

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to describe radioactivity, including its various applications.	Upon completion of this topic, learners will: 1. Describe radioactivity, including its historical development 2. Explain how nuclear reactions differ from chemical reactions 3. Describe the types and nature of radiations 4. Explain the role of half-life in the stability of the nucleus	1. Definition and history of radioactivity. 2. Difference between ordinary and nuclear reactions. 3. Types and nature of radiations. 4. Half-life as a measure of the stability of the nucleus. 5. Nuclear reactions – fission and fusion in nuclear reactors.	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. **1. Assignments/exercises:** a. Research on the key scientists in the development of nuclear chemistry. b. Write and balance simple nuclear equations. c. Identify and name various types of radiation. d. Simple calculations using half-life. e. Write fusion and fission reactions; Identify fission and fusion reactions. f. Explain how radioactivity is	**A. Primary Text** Michael C. Cox & John Sadler, Senior Secondary Guide for Liberia – Chemistry (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **B. Secondary Texts** Edexcel IGCSE Chemistry (Pearson, 2010) Edexcel Mastering Chemistry (Pearson, 2010) **C. Other Resources/Supplementary Readings** Kobina Adu Lartson, Practical Chemistry for SSS (Sedco/Pearson, 1999) KNO3, distilled water, HNO3. Acetone, ammonia solution, NH4Cl, separator funnel. Poster sheets.	**EXPECTED COMPETENCIES** • Effective communication skills • Analytical skills • Research and problem-solving skills • Creativity and innovation skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** be used to check competencies (Select relevant options): • Presentation • Written Assignment

	5. Distinguish between fusion and fission and 6. Explain the effects and applications of radioactivity.	**6.** Effects and application of radioactivity.	applicable in food preservation and pest control. **2. Lab session:** perform an experiment to facilitate learners understanding of radioactive dating and half-lives	**Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Quiz • Lab Report • Class participation • Attendance • Test

SEMESTER: TWO

GRADE: 11
PERIOD: VI
TOPIC I: CHEMICAL EQUILIBRIUM

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to discuss the general principles of equilibrium, including the mathematical relationships between Kp and Kc.	Upon completion of this topic, learners will: 1. Discuss the general principles of equilibrium 2. Explain the Le Chatelier's Principle as it relates to factors influencing equilibrium 3. Explain the nature of equilibrium constant, performing simple related calculations and 4. Demonstrate the	1. **General principles of Equilibrium** (Reversible reactions and law of mass action). 2. **Factors influencing equilibrium** (Le Chatelier's principle). 3. **The Equilibrium Constant**. 4. **Relationship between Kp & Kc**.	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. **1. Assignments/exercises:** a. Describe several reversible reactions in nature. b. Solve simple problems on equilibrium constant calculations. **2. Lab sessions:** a. Perform an experiment to demonstrate reversible and irreversible chemical reactions. b. Demonstrate an experiment by heating lead (II) nitrate and dinitrogen tetroxide to explain the variation of Kc/Kp c. Perform an experiment by using iron (III) chloride, potassium thiocyanate and	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) Copper (II) sulfate, spoon, heat source, water. Beaker, test tube, burner.	**EXPECTED COMPETENCIES** • Effective communication skills • Analytical skills • Research and problem-solving skills • Creativity and innovation skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** be used to check competencies (Select relevant options): • Presentation • Written Assignment

	mathematical relationship between Kp &Kc.		water to explain Le Chatelier's Principle	Links: www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Quiz • Lab Report • Class participation • Attendance • Test

SEMESTER: TWO

GRADE: 11
PERIOD: VI
TOPIC II : CHEMICAL KINETICS

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to discuss the rate laws, as well as the concept of collision theory.	Upon completion of this topic, learners will: 1. Discuss the Rate Laws 2. Demonstrate the reaction mechanism 3. Discuss Activation Energy 4. Explain the concept of Collision Theory	1. Reaction Rates 2. Introduction to Rate Laws: a. Types of Rate Laws 3. Determining the Form of the Rate Law a. Method of Initial Rates 4. The Integrated Rate Law a. First-Order Rate Laws b. Half-Life of a First-Order Reaction c. Second-Order Rate Laws d. Second order Half-life	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/ exercises:** a. Describe the speed of certain natural reactions such explosions, food decay, rusting of iron, ripening of fruits etc. b. Explain why paper torn into pieces before being burned.	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* • 4 syringes, test tube racks, vinegar, baking soda, water, heat source • 3 bottles, 3 syringes, baking soda, vinegar, nail, super glue. • Old dry cell, hydrogen peroxide, 2 bottles, two balloons. (Pearson, 2010)	**EXPECTED COMPETENCIES** • Effective communication skills • Analytical skills • Research and problem-solving skills • Creativity and innovation skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** be used to check competencies (Select relevant options): • Presentation • Written Assignment • Quiz

		e. Zero-Order Rate Laws f. Zero-order Half Life g. Integrated Rate Laws for Reactions with More Than One Reactant 5. Reaction Mechanisms 6. Activation Energy 7. Collision theory	c. Deduce activation energy from energy profile diagrams or draw energy profile diagrams from data. 2. **Lab sessions:** a. Perform an experiment to illustrate the effect of temperature on reaction rate. b. Demonstrate an experiment to interpret the effect of concentration on reaction rate c. Effect of catalyst on reaction rate	**C. Other Resources/Supplementary Readings** • Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) • Thermometer • Beaker, cross, stirring rod, sodium thiosulfate solution, boiling test tube, ice, etc. • $KClO_3$, MnO_2, Burner, test tubes, crucibles, Beaker with cork, syringe, gas, stop clock, etc. **Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Lab Report • Class participation • Attendance • Test

SEMESTER: ONE

GRADE: 12
PERIOD: I
TOPIC 1: INTRODUCTION TO ORGANIC CHEMISTRY

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to discuss general characteristics, laboratory techniques, as well as writing and naming hydrocarbons.	Upon completion of this topic, learners will: 1. Discuss the general characteristics of organic compounds 2. Demonstrate practical knowledge about the separation and purification methods for organic compounds 3. Identify the various functional groups in organic compounds 4. Identify members of the homologous series	1. General characteristics of organic compounds: a. Classification of organic compounds (Straight Chain & Branched, Cyclic &Acyclic; Aromatic compounds) b. Separation & Purification (distillation, crystallization, chromatograph, etc.) of organic compounds c. Functional Groups & d. Homologous Series, e. Isomerism f. Chemical properties/reactions	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/exercises:** a. Solve problems on the determination of an organic compound from its structure Identifying and recognizing the functional groups present b. Classify and draw the structures of isomers c. Field trip to LPRC to see how the quality of petrol, using the concept of octane rating	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** • Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) Distillation apparatus, heating units, thermometer, melting point apparatus	**EXPECTED COMPETENCIES** • Effective communication skills • Analytical skills • Research and problem-solving skills • Creativity and innovation skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** be used to check competencies (Select relevant options): • Presentation • Written Assignment

.	5. Distinguish the classes of isomers 6. Discuss the general properties of hydrocarbons and 7. Discuss aromatic hydrocarbons.	2. **Hydrocarbons:** a. Alkanes: i. general formula, sources, uses, physical properties, nomenclature and chemical properties, reactions ii. Petroleum – composition, fractional distillation, cracking and reforming, iii. Petrochemicals, sources, uses, and as starting materials of organic synthesis, iv. Petrol quality (octane number, knocking) b. Alkenes – Sources, structure, uses, nomenclature, properties (physical and chemical), reactions. c. **Alkynes** – Sources, structure, nomenclature, physical properties, uses and reactions; 3. **Benzene** – Structure, physical properties, chemical properties, uses, reactions	2. **Lab session:** a. Production of carbon using table sugar b. Purification of anorganic compound by distillation and determination of its boiling point. c. Recrystallization of an organic solid. d. Paper chromatography e. Functional group tests f. Demonstrate an experiment using household oil to interpret the concept of cracking g. Laboratory preparation of alkanes, alkenes and alkynes as well as their laboratory tests. h. Laboratory test for benzene with acidified potassium permanganate	(capillary tube, rubber band, oil, etc. Organic compounds: Ethanol. Filter paper, scissors, ruler, wooden splint, ball-point pen, large boiling test tube, ethanol, cork, liquid bromine, carbon tetrachloride, a solution of an alkene, sulfuric acid, beaker, volumetric flask, stirring rod, etc. Links: www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Quiz • Lab Report • Class participation • Attendance • Test

SEMESTER: ONE

GRADE: 12
PERIOD: II
TOPIC I: INTRODUCTION TO ORGANIC CHEMISTRY (cont'd)

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to discuss hydrocarbon derivatives together with their preparation, testing, polymerization processes as well as basic concepts of biochemistry.	Upon completion of this topic, learners will: 1. Discuss hydrocarbon derivatives 2. Demonstrate techniques for the lab preparation and testing of hydrocarbon derivatives 3. Demonstrate practical knowledge about the production of soap 4. Distinguish between natural and synthetic organic materials	**1. Hydrocarbon derivatives** Sources, classification, nomenclature, physical and chemical properties (including laboratory tests characterization) of: **Alkanols (Alcohols)- sources, classification, nomenclature, structure, physical properties, chemical properties, uses;** **Alkanals (Aldehydes); Alkanones (Ketones); Ethers**; **Halocarbons (Alkyl Halides);** **Alkanoic (Carboxylic) Acids- sources, classification, nomenclature, structure, physical properties, and chemical**	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/exercises**: a. Practice problems on the classification, nomenclature, physical properties, preparation as well as reactions of these hydrocarbon derivatives. b. Practice problems on the writing of polymerization reactions involving some of these polymers. c. Field trip to plastic or rubber processing industry. d. Practice problems on the classification, structural drawing and	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/ Supplementary Readings** • Kobina Adu Lartson, *Practical*	**EXPECTED COMPETENCIES** • Effective communication skills • Analytical skills • Research and problem-solving skills • Creativity and innovation skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** be used to check competencies (Select relevant options):

	5. Discuss polymerization and polymers 6. Distinguish between plastics and resins and 7. Discuss proteins together with carbohydrates.	**properties, uses**; and **Alkyl Alkenoates (Esters).** **2. Natural Polymers**: definitions of polymerization, polymers, monomers, dimers, resines; Rubber. **Synthetic Polymers** (man-made polymers)– Classification and preparation based on the monomers and co-monomers; addition and condensation polymers; plastics and resins; important properties of polymers (thermoplastic and thermosetting polymers). **3. Introductory Biochemistry**: Amino acids (Di-functional nature). Proteins – synthesis from amino acids, hydrolysis, uses in living systems; Carbohydrates – classification, formulae, properties (including	reactions involving these bio-molecules 2. **Lab sessions:** **a.** Perform an experiment to demonstrate the preparation of hydrocarbon derivatives. **b.** Perform lab tests to identify the different hydrocarbon derivatives **c.** Perform an experiment to demonstrate the oxidation of alkanols using potassium permanganate, potassium dichromate and iodine. **d.** Perform an experiment to demonstrate the reaction of alkanoic acid with sodium hydroxide, sodium hydrogen carbonate, sodium carbonate, zinc, magnesium and ammonia. **e.** Lab test for alkanoic acid using sodium hydrogen carbonate and sodium carbonate. **f.** Test for fats and oils **g.** Reaction of alcohol and carboxylic acid	*Chemistry for SSS* (Sedco/Pearson, 1999) • Palm oil, NaOH solution, heating unit, etc. • Citric acid power, methylated spirit, battery acid, 5M sulfuric acid, tea spoon, colorless spirit, match box, soda cap, plastic, knife. • Aspirin tablets, NaOH, phenolphthalein indicator, weighing balance, heating unit, volumetric flask, beaker, pipette, burette, distilled water, etc. • Latex, ammonia solution, etc. Powdered starch, a piece of white tile, iodine solution, distilled water, beaker, heating unit, sulfuric acid solution, sodium hydroxide solution, Fehling's or Benedict's solution, boiled egg, Millon's reagent, copper(II) sulfate solution	• Presentation • Written Assignment • Quiz • Lab Report • Class participation • Attendance • Test

		reactions) and uses; Fats and oils as alkyl esters (sources, physical and chemical properties); General structure of fats and oils: palm oil, coconut oil.	**h.** Reaction of alcohol with oxygen **i.** Saponification of an ester to produce soap, including flavoring agent (plasticizers as solvent and in perfume). **j.** Demonstrate a lab to prepare soap. **k.** Composition of aspirin by back titration. **l.** Coagulation of latex. **m.** Investigating some properties of starch and proteins. **n.** Demonstrate a lab test for reducing sugars **o.** Demonstrate a lab test using ninhydrin reagent/biuret reagent/Millons reagent **p.** Perform an experiment to demonstrate a chemical test on plastics by heating. **q.** Perform an experiment to demonstrate test for protein	Soap preparation (Sunflower oil, caustic soda (sodium hydroxide), distilled water, salt, bottle, filter paper, Heat source, beaker **Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	

SEMESTER: ONE

GRADE: 12
PERIOD: III
TOPIC I: CHEMISTRY, INDUSTRY AND THE ENVIRONMENT

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to discuss the development of the chemical industry in Liberia as well as its effects on the environment and biotechnology concept.	Upon completion of this topic, learners will: 1. Discuss the historical development of industry 2. Explain the general characteristics as well as the classification of the chemical industry 3. Describe the raw materials of the chemical industries in Liberia 4. Discuss the difference between heavy and fine chemicals 5. Discuss the effects of industries on the	1. **Historical development of industry**; characteristics and classification of the chemical industry. 2. **Raw materials of the Chemical industries in Liberia**; Factors that determine sitting of chemical industries. 3. **Heavy and fine chemicals – distinction.** 3. **Effect of industries on the environment in Liberia.** 4. **Air, Water and Soil Pollution –** Sources, effects and control. 5. **Greenhouse effect, acid rain and depletion of the ozone layer**	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/exercises**: a. Describe the development of the chemical industry in Liberia, together with their characteristics. b. Classify the chemical industry in Liberia, giving raw materials of each sector. c. Field Trips to leading chemical industries in Liberia. d. Classify heavy and fine chemicals as they relate to the chemical industry in Liberia.	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/ Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS*	**EXPECTED COMPETENCIES** • Effective communication skills • Analytical skills • Research and problem-solving skills • Creativity and innovation skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** be used to check competencies (Select relevant options): • Presentation

	environment in Liberia 6. Discuss various types of environmental pollution 7. Distinguish between biodegradable and non-biodegradable pollutants and 8. Discuss the processing of food using biotechnology concept.	6. **Bio-degradable and non-biodegradable pollutants.** 7. **Biotechnology** – Food processing, fermentation (including production of bread, farina and palm wine and other alcoholic beverages, e.g. the local cane juice); food testing (using Ninhydrin, Xanthoproteic, Biuret and Millon's tests for proteins), drinks, mushrooms, brewing, medical products (e.g. hormone insulin drugs, antibiotics penicillin, chemicals e.g. ethanol and polymers, fuel e.g. biogas (methane), gasohol (ethanol gasoline) 8. **Biotechnology Services:** mining: extraction of metals by bioleaching, treatment of waste, enzyme technology	e. Discuss biodegradable and nonbiodegradable pollutants in your environment. f. Write an essay on one of the major environmental challenges facing Liberia. g. Write balanced chemical equations of the processes involved in alcoholic fermentation. h. Field Trips to waste management site (Wein Town, Paynesville, Liberia) 6. **Lab sessions** a. Perform an experiment to demonstrate the production of biogas. b. Demonstrate in an experiment the fermentation processes	(Sedco/Pearson, 1999) Vehicles, Cassava, distilled water, beaker, yeast, distillation apparatus, sulfuric acid solution, potassium dichromate solution, potassium permanganate solution, iodine solution, sodium hydroxide **Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Written Assignment • Quiz • Lab Report • Class participation • Attendance • Test

SEMESTER: ONE

GRADE: 12
PERIOD: III
TOPIC 2: CHEMISTRY OF SELECTED METALS AND THEIR COMPOUNDS

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to identify the properties and uses of metals as well as their compounds.	Upon completion of this topic, learners will: 1. Discuss the properties and uses of sodium, calcium, copper and their compounds and 2. Demonstrate the preparation of copper, sodium and calcium.	1. **Properties and uses of sodium and its compounds -** (Compounds limited to NaCl, NaOH, Na_2CO_3, $NaHCO_3$, NaNO3, NaClO3 and Na_2SO_4). 2. **Properties and uses of calcium and it compounds -** (Compounds limited to $CaCO_3$, CaO, $CaSO_4$, $CaCl_2$, and $Ca(OH)_2$ 3. **Reactivity of iron and aluminum with air, water, and acid** 4. **Properties and uses of copper and its compounds** CuSO4, CuO, and CuCl2	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/ exercises**: a. Describe common household sodium compounds including their chemical formulae and uses. b. Describe common household calcium compounds including their chemical formulae and uses 2. **Lab sessions**: Apply quantitative analysis to identify cations	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) • 5% solutions of cations from groups I – III. • Solutions of HCl, H_2S, $(NH_4)_2S$. Test tubes & holders, Test tube racks.	**EXPECTED COMPETENCIES** • Effective communication skills • Analytical skills • Research and problem-solving skills • Creativity and innovation skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** be used to check competencies (Select relevant options): • Presentation • Written Assignment • Quiz

				• Centrifuge, **Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Lab Report • Class participation • Attendance • Test

SEMESTER: TWO

GRADE: 12
PERIOD: IV
TOPIC 1: CHEMISTRY OF SELECTED METALS AND THEIR COMPOUNDS (cont'd)

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/ LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to gain greater insights as well as the ability to discuss extensively the different extraction methods and production activities.	Upon completion of this topic, learners will: 1. Describe the metallurgy, properties as well as uses of Al, Fe, Cu, Au and Sn 2. Discuss alloys including the common uses of brass, bronze, steel, and duralumin and 3. Analyze the production processes of cement and uses.	**1. Metallurgy**: a. Extraction of metals (Al and Fe, Au and Sn) – raw materials, processing, main product, by-products, recycling; uses of the metals; b. Alloys – common alloys of Cu, Al, Pb, and Fe c. Uses of alloys of Cu, Al, Pb, and Fe. **2. Cement and its uses** a. Processes involving production of cement b. Uses of cement c. Environmental impact of cement	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/exercises:** a. Identify some alloys in your surroundings and state their compositions. b. Identify some ores in Liberia, together with their constituent metals. c. Field trip to CEMENCO d. Field trip to any mining company. 2. **Lab sessions.** Perform experiments to demonstrate extraction of Al and Fe, Au and Sn from their ores, indicating the	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Principles (Anderson et All, 2017) **B. Secondary Texts** • *Edexcel IGCSE Chemistry* (Pearson, 2010) • *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** • Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) • 5% solutions of cations from groups I – III. • Solutions of HCl, H_2S, $(NH_4)_2S$. Test tubes & holders,Test tube racks,.	**EXPECTED COMPETENCIES** • Effective communication skills • Analytical skills • Research and problem-solving skills • Creativity and innovation skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** be used to check competencies (Select relevant options): • Presentation

			main products as well as by-products for each extraction process.	• Centrifuge,Distilled water, pH. **Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Written Assignment • Quiz • Lab Report • Class participation • Attendance • Test

SEMESTER: TWO

GRADE: 12
PERIOD: IV
TOPIC 2: CHEMISTRY OF SELECTED NON-METALS AND THEIR COMPOUNDS

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES/ LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ EVALUATION
Learners are able to discuss the occurrence, properties, preparation, reactions as well as the uses of non-metals and their compounds.	Upon completion of this topic, learners will: 1. Apply the laboratory methods of preparing as well as testing for carbon, nitrogen, oxygen, sulfur as well as their compounds 2. Discuss the uses of carbon, nitrogen, oxygen, and sulfur 3. Discuss the reactions of compounds of carbon, nitrogen, oxygen, and sulfur	**1. Carbon and its compounds:** carbon and its compounds, including Allotropes of carbon (also properties of amorphous, diamond & graphite), oxides of carbon (CO and CO_2 their sources, preparations, properties & uses). **2. Coal:** a. Types b. Destructive distillation of coal and uses of the products **3. Coke:** a. Gasification and uses b. Manufacture of synthetic gas and uses	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. **1. Assignments/exercises:** a. Learners are to do group (according to abilities, gender and learning styles) reports on carbon and its compounds, including Allotropes of carbon (also properties of diamond & graphite), oxides of carbon (CO and CO_2 their sources, preparations, properties & uses). b. learners are to prepare group presentations on the industrial	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Principles (Anderson et All, 2017) **B. Secondary Texts** *Edexcel IGCSE Chemistry* (Pearson, 2010) *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) Solutions of some anions such as	**EXPECTED COMPETENCIES** • Effective communication skills • Analytical skills • Research and problem-solving skills • Creativity and innovation skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** be used to check competencies (Select relevant options): • Presentation

	4. Describe the reactions as well as uses of binary compounds of oxygen as well as its acidic, basic and neutral oxides 5. Apply laboratory techniques to prepare and test for coal and coke 6. Discuss the halogens, their means of identification as well as their compounds and 7. Demonstrate laboratory methods in testing for softness and hardness of water. 8.	**4. Nitrogen**: nitrogen and its compounds; the industrial preparation and uses of nitrogen (from liquified air), its properties and uses as well as the properties and industrial preparation of ammonia and Nitric Acid (including the contact process), their reactions & uses as well as salts of trioxonitrate (V) salt/nitrates **5. Oxygen**: The Laboratory & industrial methods of preparation, properties and uses of oxygen, its binary compounds, including acidic, basic, amphoteric and neutral oxides. **6. Sulfur**: Allotropes, uses; and compounds of sulfur, including sulfides,	preparation and uses of nitrogen (from liquified air), its properties and uses as well as the properties and industrial preparation of ammonia and Nitric Acid (including the contact process), their reactions & uses as well as salts of trioxonitrate (V)/nitrates **2. Lab Sessions:** a. Demonstrate an experiment to prepare and test for carbon and its compounds. b. Perform an experiment to prepare and test for nitrogen and its compounds. c. Learners are to perform an experiment on the laboratory preparation and test for oxygen. d. Perform an experiment to prepare and test for sulfur and its compounds e. Perform an experiment to prepare and test for	MnO_4^-, CO_3^{2-}, $Cr_2O_7^{2-}$, Cl^-, I^-, etc., nitric, hydrochloric and acetic acid solutions, ammonia solution, distilled water. Crystals of $FeSO_4$, distilled water, $NaNO_3$, conc. H_2SO_4, test tubes, etc. NaI, NaBr, NaCl crystals, distilled water, beakers, flasks, etc. □ Chart of the Periodic Table, etc. Bleach, battery acid, color flowers, string or thread, bottle, caustic soda, delivery tubes, burner, copper wire, glass tube, ammonium sulfate, red litmus paper, match box, conc. Hydrochloric acid, heating vessel, syringe wood ash, dilute citric acid, lime water, straw, baking soda, vinegar, balloon, funnel, iron wool, plastic tube, card board, manila, deflagrating spoon, sulfur, bottle cap, jar, candle, sulfur power, copper wire, spoons, scissors, Erlenmeyer flask, Ph paper, eriochrome black T (EDT), 0.01M of EDTA, water testing kit.	• Written Assignment • Quiz • Lab Report • Class participation • Attendance • Test

		trioxosulfate (IV) acid c. (sulfurous acid – H_2SO_3) and its salts, as well as tetraoxosulfate (VI) acid/sulfuric acid – H_2SO_4, industrial preparation, reactions and uses. **7. The Halogens:** properties, methods of preparation, tests for the identification of the halogens, uses. **8. Chlorine**: Chlorine-Laboratory preparation, properties and reactions, uses of halogen compounds such as silver halide for photography and sodium oxo-chlorate (I)/sodium hypochlorite, $NaClO_3$ as bleaching agent. **9. The Noble Gases:** Properties and Uses. **10. Water and solution**	halogens and their compounds. f. Learners are to perform an experiment to demonstrate the laboratory preparation and test for chlorine. g. Perform an experiment to prepare and test for noble gases and their compounds. h. Demonstrate an experiment to test for softness and hardness water.	**Links:** www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	

		a. Compositions of water (soft and hard water)			

SEMESTER: TWO

GRADE: 12
PERIOD: V
TOPIC 1: REVIEW OF SOME FUNDAMENTAL TOPICS PREVIOUSLY TREATED (GRADES 10-12)

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are able to demonstrate ability to review topics in chemistry as well as the WASSCE past papers.	Upon completion of this revision exercise, learners will: 1. Learners demonstrate ability to review fundamental topics previously treated, including WASSCE past papers.	1. Units of Measurement. 2. The History and Importance of Chemistry. 3. Matter and its Properties. 4. The Atomic Structure. 5. The Periodic Table/Chemistry. 6. Chemical Bonding. 7. Chemical Reactions/Equations and Stoichiometry. 8. Oxidation-Reduction Reactions. 9. States of Matter. 10. Solutions – Solution Concentration Units and Solution Stoichiometry.	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. 1. **Assignments/exercises:** Related to the topics being treated /reviewed.	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Principles (Anderson et All, 2017) **B. Secondary Texts** *Edexcel IGCSE Chemistry* (Pearson, 2010) *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) Same as before	**EXPECTED COMPETENCIES** • Effective communication skills • Analytical skills • Research and problem-solving skills • Creativity and innovation skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** be used to check competencies (Select relevant options): • Presentation • Written Assignment

		11. Acids, Bases and Salts - Acid-Base (Volumetric) Titrations. 12. Solubility of Substances. 13. Energetics. 14. Nuclear Chemistry. 15. Chemical Equilibrium. 16. Reaction Rates. 17. Electrochemistry.		Links: www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Quiz • Lab Report • Class participation • Attendance • Test

SEMESTER: TWO

GRADE: 12
PERIOD: VI
TOPIC 1: REVIEW OF SOME FUNDAMENTAL TOPICS PREVIOUSLY TREATED (GRADES 10-12) – Cont'd.

OUTCOMES	OBJECTIVES	CONTENTS	ACTIVITIES /LAB WORK	MATERIALS/ RESOURCES	COMPETENCIES/ ASSESSMENT
Learners are to be able to demonstrate ability to correctly answer questions set in the WASSCE Chemistry examination.	Upon completion of this revision exercise, learners will: 1. Learners can utilize their skills to review topics in chemistry, including the WASSCE Chemistry papers.	1. **Introduction to Organic Chemistry:** a) General Characteristics of Organic Compounds; b) Classification of Organic Compounds; c) Homologous Series and Functional Groups; d) Hydrocarbons; e) Hydrocarbon Derivatives; f) Natural and Synthetic Organic Compounds. 2. **Chemistry, Industry and the Environment**	**Inclusive and Differentiated Learning** Individual seat works or work in mixed groups according to gender, abilities, learning styles, etc. **1. Assignments/exercises:** Learners are to carry out internet research and make group presentations on selected topics related to the topics being treated/reviewed.	**A. Primary Text** Michael C. Cox & John Sadler, *Senior Secondary Guide for Liberia – Chemistry* (Star Books/Pearson, 2011); CHEMISTRY: The Study of Change and Its Principles (Anderson et All, 2017) **B. Secondary Texts** *Edexcel IGCSE Chemistry* (Pearson, 2010) *Edexcel Mastering Chemistry* (Pearson, 2010) **C. Other Resources/Supplementary Readings** Kobina Adu Lartson, *Practical Chemistry for SSS* (Sedco/Pearson, 1999) Same as before	**EXPECTED COMPETENCIES** • Effective communication skills • Analytical skills • Research and problem-solving skills • Creativity and innovation skills • Digital skills • Organizational skills **ASSESSMENT STRATEGIES to** be used to check competencies (Select relevant options): • Presentation • Written Assignment

		3. **Chemistry of Selected Metals and their Compounds** 4. **Chemistry of Selected Nonmetals and their Compounds.**		Links: www.reviewgamezone.com www.khanacademy.com www.dictionary.com www.sciencegeek.net www.funbrain.com www.researchgate.netacs.org	• Quiz • Lab Report • Class participation • Attendance • Test