THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION AND VOCATIONAL TRAINING

CHEMISTRY SYLLABUS FOR ORDINARY SECONDARY EDUCATION FORM I - IV

2010

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION AND VOCATIONAL TRAINING

CHEMISTRY SYLLABUS

SYLLABUS FOR SECONDARY SCHOOLS

FORM I - IV

2010

1.0 INTRODUCTION

The New Chemistry syllabus for ordinary level secondary education is a revised version of the 1997 syllabus. The syllabus covers the first four years of secondary education i.e. Form I to Form IV, in Tanzania.

This revised syllabus has observed a paradigm shift from content to competence based curricula and gives room for the learner to build skills and competences in chemistry. It encourages the constructivist approaches whereby the learner participates actively in the construction and acquisition of knowledge.

The new syllabus incorporates changes in the ever involving scientific and technological fields. A salient feature of the new syllabus is the expanded inclusion of environmental issues. In addition, the syllabus intrinsically inculcates entrepreneurial skills in a learner.

Consistent with the country's training policy, the syllabus has taken into account the societal needs for Tanzanians. Views from educational stakeholders have also been incorporated.

2.0 AIMS AND OBJECTIVES OF EDUCATION IN TANZANIA

The general aims and objectives of education in Tanzania are:

(a) to guide and promote the development and improvement of the personalities of the citizens of Tanzania, their human resources and effective utilization of those resources in bringing about individual and national development;

(b) to promote the acquisition and appreciation of the culture, customs and traditions of the people of Tanzania;

(c) to promote the acquisition and appropriate use of literacy, social, scientific, vocational, technological, professional and other forms of knowledge, skills and attitudes for the development and improvement of the condition of man and society;

(d) to develop and promote self-confidence and an inquiring mind, and understand and respect for human dignity and human rights and readiness to work hard for personal self advancement and national development;

(e) to promote and expand the scope of acquisition, improvement and upgrading of mental, practical, productive and other skills needed to meet the changing needs of industry and the economy;

(f) to enable every citizen to understand and uphold the fundamentals of the National Constitution as well as the enshrined human and civic rights, obligations and responsibilities;

(g) to promote love for work, self and wage employment and improved performance in the production and service sectors;

3.0 AIMS AND OBJECTIVES OF SECONDARY EDUCATION

In Tanzania, secondary education refers to post primary formal education offered to the learners who successfully complete seven years of primary education and have met the requisite entry qualifications.

The aims and objectives of secondary education are to:

(i) consolidate and broaden the scope of baseline ideas, knowledge, skills and attitudes acquired and developed at the primary edueation level;

(ii) enhance the development and appreciation of national unity, identity and ethic, personal integrity, respect for human rights, cultural and moral values, customs, traditions and civic responsibilities and obligations;

(iii) promote linguistic ability and effective use of communication skills in Kiswahili and English;

(iv) provide opportunities for the acquisition of knowledge, skills, attitudes and understanding in prescribed or selected fields of study;

(v) prepare students for tertiary and higher education, vocational, technical and professional training;

(vi) inculcate a sense and ability for self-study, self-confidence and self-advancement in new frontiers of science and technology, academic and occupational knowledge and skills;

(vii) prepare the students to become responsible members of the society.

4.0 GENERAL OBJECTIVES

By the end of the four years course, the student should be able to:

a) design and perform experiments;

b) understand symbols, formulae and equations to communicate in Chemistry;

c) acquire Chemistry skills, knowledge and principles to solve daily life problems;

d) appreciate application of the scientific principles and knowledge in exploitation of natural resources with conservation of environment.

5.0 GENERAL COMPETENCES

By the end of the four years course, the student should have developed competences in:

a) developing knowledge in Chemistry by doing various activities and/or experiments;

b) applying chemical symbols, formulae and equations to communicate in Chemistry;

c) applying Chemistry knowledge skills and principles to solve daily life problem;

d) using science and technological skills in conserving and making sustainable use of the environment.

6.0 STRUCTURE AND ORGANIZATION OF THE SYLLABUS

This Chemistry syllabus has a slightly different structure compared to that of 1997. The following changes were added for improvement:

- General competences for the whole course.
- Competences for each level i.e. Form One to Form Four.
- Suggested areas for assessment.
- Number of periods per sub-topic.

6.1 Class Level Objectives

For each competence intended to be achieved, one or more objectives have been stated in order to achieve it. The general objectives for Form One to Form Four are stated in general terms to indicate the scope of content to be covered within each level.

6.2 Class Level Competences

Competences are skills, knowledge and attitudes attained by the learner after the learning process.

Competences have been stated for each class/level of chemistry course. The class level objectives are derived from the class level competences.

6.3 Topics

The topics have been derived from the class level competences and objectives. Most topics in the 1997 Chemistry syllabus have been retained. Important content from Cross-cutting Issues (CCI) has been integrated. Topics have been rearranged to attain a logical order, starting from the simple to the most difficult ones. Both block and spiral arrangements of topics have been used.

6.4 Sub – Topics

Topics have been divided into sub-topics. Each subtopic comprises of a portion of the content of the topic in question. The sub-topics have also been arranged to attain a logical order and facilitate learning.

6.5 Specific Objectives

Each sub-topic has one or more specific objectives. These specific objectives are the expected outcomes in classroom instruction. They also reflect the process to attain competences within the cognitive, affective and psychomotor domains.

6.6 Teaching and Learning Strategies

The column of teaching and learning strategies indicates what the teacher and students are expected to be doing in the process of teaching and learning. Students are encouraged to work in small groups for maximum participatory and cooperative learning. The teacher shall assume the role of a facilitator to promote, guide and help students' learning activities. The whole teaching and learning process should be participatory and interactive, where the student learns by doing a series of logical activities.

These suggested teaching and learning (T/L) strategies are not exhaustive. The teacher and students may use any other T/L strategies which suit the T/L environment and the available T/L resources to teach a particular topic.

6.7 Teaching and Learning Resources

In the teaching of Chemistry a variety of teaching – learning resources will be needed in quality and quantity. In case the commercial T//L resources are not available, the teacher should work with students to collect or improvise alternative resources available in their environment.

6.8 Assessment

For every specific instructional objective, there is/are some suggested questions or areas for assessment. Formative and summative assessment should be geared towards mastering all the competences and skills developed within the course.

6.9 Number of Periods

The numbers of periods have been allocated per subtopic. Three (3) Chemistry periods of 40 min. per week have been allocated for Forms One and Two; while four (4) periods are for Forms Three and Four. According to the Education Circular No. 9 of 2004, there are a total of 194 effective teaching days per year. Each sub-topic is allocated with appropriate number of periods for teaching/learning depending on the nature of content.

6.10 Instructional Time

This syllabus is to be covered in four academic years including two weeks reserved for mid-year and annual examinations in each year. Lost instructional time must always be compensated for.

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Ministry of Education and Vocational Training
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FORM I

CLASS OBJECTIVES

By the end of Form One Chemistry Course, the student should be able to:

i) explain the importance of Chemistry in daily life;
ii) carry out Chemistry activities safely and efficiently;
iii) use various laboratory apparatus;
iv) explain the nature and properties of matter;
v) separate various mixtures using variety of methods;
vi) differentiate physical from chemical changes of matter;
vii) use scientific procedures in carrying out investigations.

CLASS COMPETENCES

By the end of the Form One Chemistry Course, the student should have developed competences in:

a) using Chemistry skills and knowledge in daily life;
b) working safely in a Chemistry laboratory;
c) designing and carrying out simple Chemistry experiments;
d) applying the Scientific Procedure to carry out investigations in Chemistry;
e) using various Chemistry apparatus properly to perform different activities and experiments;
f) applying different methods to separate mixtures into pure components;
g) dealing with nature and properties of matter.

FORM I

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
1.0 INTRODUCTION TO CHEMISTRY 1.1 The Concept of Chemistry	The student should be able to: a) Explain the concept of Chemistry.	Teacher to guide students to discuss the meaning of Chemistry.	• Wall charts and pictures showing different Chemistry activities. • Wall pictures and charts showing industrial chemical processes.	Is the student able to explain the concept of Chemistry?	2
	b) Mention materials objects made by application of Chemistry.	i) Students to name the substances made by applying chemical methods. ii) Teacher to guide students to discuss how materials and objects are made by application of Chemistry e.g. soap, petrol, ethanol are made by chemical processes.	Detergents, soft drinks, fertilizers, medicines, plastics spirits, wines, tooth paste, shoe polish, table salt, cement, baking powder, yeast, fuel and cosmetics.	Is the student able to mention several material and objects made by the application of chemistry?	
1.2 The Importance of Chemistry in Life.	The student should be able to: a) Mention areas where Chemistry is applied.	The teacher to guide students to discuss how Chemistry is applied in industry and at home.	• Wall pictures of factories and chemical industries. • Pictures of a hospital and a pharmacy. • Picture of a domestic kitchen.	Is the student able to mention the areas where chemistry is applied?	2
	b) State the importance of Chemistry in daily life.	Teacher to guide students to discuss the importance of Chemistry in daily life by giving examples on the production of drugs and medicines, fertilizers, soaps and alcohol.	• Fertilizers • Insecticides • Soft drinks • Hard drinks • Soap and detergents • Drugs • Medicines	Is the student able to state the importance of chemistry in daily life?	
2.0 LABORATORY TECHNIQUES AND SAFETY 2.1 Rules and Safety Precautions in a Chemistry laboratory.	The student should be able to: a) State laboratory rules.	i) Students to prepare a list of ten safety rules in a Chemistry laboratory. ii) Teacher to guide students to discuss every laboratory rule and establish its importance.	• Chemistry Laboratory manuals. • Wall charts with written laboratory rules.	Is the student able to state at least ten chemistry laboratory rules?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	b) Explain the safety measures for a Chemistry laboratory.	Teacher to guide students to discuss the laboratory safety measures.	Wall charts showing safety measures for a chemistry laboratory. Pictures showing dangerous actions which have to be avoided.	Is the student able to mention and explain the safety measures needed to avoid accidents in a chemistry laboratory?	
2.2 First Aid and First Aid Kit	The student should be able to: a) Identify possible causes of accidents in a Chemistry laboratory.	Teacher and students to discuss activities which are likely to cause accidents in a Chemistry laboratory.	Wall charts and pictures showing possible laboratory accidents.	How many possible causes of accidents in a chemistry laboratory can the student be able to identify?	4
	b) name the items found in a First Aid Kit	Teacher to guide students to name every item found in a First Aid Kit.	First Aid Kit containing the all items: - A pair of scissors - Adhesive tapes - Cotton wool - Bandages - Iodine tincture, - Mild antibiotic - Petroleum jelly - Gentian violet solution - Razor blade - Soap	Is the student able to name all the items found in a First Aid Kit?	
	c) Demonstrate how each First Aid Kit item is used.	Teacher to guide students to simulate a mock use of each item in a First Aid Kit.	First Aid Kit	Is the student able to demonstrate the correct use of each item in the First Aid Kit?	
	d) Use the items in a First Aid Kit to provide First Aid to an accident victim.	Teacher to guide students on how to render First Aid in a real situation.	First Aid Kit containing all items: - A pair of scissors - Adhesive tapes - Cotton wool	Is the student able to provide First Aid correctly to a victim of accident?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
			- Bandages - Iodine tincture, - Mild antibiotic - Petroleum jelly - Gentian violet solution - Razor blade - Soap		
2.3 Basic Chemistry Laboratory Apparatus and their Uses	The student should be able to: a) List the apparatus used in a Chemistry laboratory.	i) Teacher to guide students to give names of different pieces of apparatus used in the Chemistry laboratory. ii) Teacher to summarize the names of pieces of apparatus used in the Chemistry laboratory.	• Apparatus for holding things in place. • Apparatus for taking measurements. • Apparatus for heating purposes. • Apparatus for doing chemical reactions.	Is the student able to list names of the apparatus used in a chemistry laboratory?	6
	b) Categorize Chemistry laboratory apparatus according to their uses.	Teacher to guide students to categorize laboratory apparatus into apparatus for holding things; taking measurements of mass, volume and temperature and heating purposes.	• Apparatus for holding things in place. • Apparatus for taking measurements. • Apparatus for heating purposes. • Apparatus for doing chemical reactions.	Is the student able to categorize chemistry apparatus according to their uses?	
	c) Use common Chemistry laboratory apparatus.	i) Students to discuss the uses of each Chemistry laboratory apparatus; ii) Teacher to guide students to practice the use of the apparatus for measuring: • Volumes of liquids; • Volumes of gases; • Masses of solids; • Temperature.	• Apparatus for holding things in place. • Apparatus for taking measurements. • Apparatus for heating purposes. • Apparatus for doing chemical reactions.	i) Is the student able to state the uses of each chemistry apparatus? ii) Is the student able to use common Chemistry apparatus to measure Volumes, Masses, and Temperature?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
2.4 Warning Signs	The student should be able to: a) Draw and label the basic chemical warning signs.	Teacher to guide students to draw simple diagrams of the following warning signs: • Toxic • Harmful • Irritant • Poison • Explosive • Corrosive • Oxidant.	• Oxidants e.g. $KMnO_4$, H_2O_2, • Irritants e.g. Conc H_2SO_4 • Explosive e.g. dynamite • Corrosive e.g. Cons, H_2SO_4, HNO_3, HCL. • Poison e.g. heavy metals.	Is the student able to draw and label the basic chemical warning signs?	6
	b) Explain the concept of warning signs.	Teacher to guide students to discuss the meaning of the different warming signs.	• Chemical containers labeled with warning signs. • Laboratory manuals containing warning signs. • Charts with drawings of warning signs. • Chemistry books containing warning signs.	Is the student able to explain the concept of warming signs?	
3.0 HEAT SOURCES AND FLAMES 3.1 Heat Sources	The student should be able to: a) Name different heat sources which can be used in a Chemistry laboratory.	Teacher and students to discuss how to use the following heat sources in a Chemistry laboratory: • Candle • Spirit burner • Kerosene burner • "Kibatari" • Charcoal burner.	• Candle • Spirit burner • Bunsen burner • Kerosene burner • Charcoal burner • Kibatari • Blow pipe.	Is the student able to identify different sources of heat for use in a Chemistry laboratory?	4
	b) Explain the functioning of a Bunsen burner.	Teacher and students to discuss how a Bunsen burner works.	• Bunsen burners • Gas source	Is the student able to explain how a Bunsen burner works?	
3.2 Types of Flames	The student should be able to: a) Produce luminous and non-luminous flames from	Teacher to guide students to use the different types of burners to produce luminous and non-luminous flames.	• Bunsen burner • Charcoal burner • Kerosene stove • Spirit burner • Kerosene fuel	Is the student able to produce luminous and non-luminous flame from different fuel burners?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	different fuel burners.				
	b) State the uses of the different types of flames.	Teacher to guide students to discuss how different flames are used to include: • Flames test of elements; • Production of light; • Production of heat.	• Bunsen burner • Charcoal burner • Kerosene stove • Spirit burner • Kerosene fuel	Is the student able to state the uses of both luminous and non-luminous flames?	
4.0 THE SCIENTIFIC PROCEDURE 4.1 Significance of the Scientific Procedure	The student should be able to: a) Explain the concept of Scientific Procedure.	The teacher to guide students in the discussion about the meaning of the Scientific Procedure.	• Wall chart showing the steps of the scientific procedure • Picture of a chemist working in a laboratory	Is the student able to explain the concept of scientific procedure?	2
	b) Explain the importance of the Scientific Procedure.	Teacher and students to discuss how the Scientific Procedure is used in carrying out systematic investigations.	• Wall chart showing the steps of the Scientific Procedure. • Picture of a chemist working in a laboratory	Is the student able to explain the importance of the Scientific Procedure?	
4.2 The Main Steps of the Scientific Procedure	The student should be able to describe each step of the Scientific Procedure.	Teacher and students to discuss the following steps of the Scientific Procedure: • Observation of a chemical phenomenon. • Statement of a problem. • Formulation of hypotheses. • Observation and collection of data. • Data analysis and interpretation. • Making inferences and conclusions.	• Wall chart showing the steps of the scientific procedure • Picture of a chemist working in a laboratory	Is the student able to describe each of the steps of the Scientific Procedure?	4
4.3 Application of the Scientific Procedure.	The student should be able to use the Scientific Procedure to carry out investigations in Chemistry.	1. Students to apply the Scientific Procedure to carry out a PROJECT on a Chemistry problem. 2. Teacher to supervise the students' projects.	• Pictures showing students working in groups to carry out a project on a Chemistry problem.	Is the student to apply Scientific Procedure to carry out a Chemistry investigation?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
5.0 MATTER 5.1 Concept of Matter	The student should be able to explain the concept of matter.	Teacher to guide students to discuss the meaning and definition of matter.	• Solids • Liquids • Gases.	Is the student able to explain the meaning of matter w ith examples?	2
5.2 States of Matter	The student should be able to: a) Describe the three states of matter.	Teacher to guide students to apply the kinetic nature of matter to explain the existence of matter in the three states; solid, liquid and gas.	• Maize grains • Bottle with lid • Bottle or jar with gas	Is the student able to describe each of the three states of matter?	6
	b) Change one state of matter to another.	Teacher to guide students to demonstrate the changes of matter from one state to another.	• Ice • Stove • Water • Kettle • Evaporating basin	Is the student able to change one state of matter to another?	
	c) Explain the importance of changing one state of matter to another.	Teacher and students to discuss the advantages of changing one states of matter to another for example • Distillation to form pure components of a mixture. • Evaporation of dry things. • Formation of ice in refrigerators. • Melting of metals to form alloys.	• Pictures of: - refrigerator; - petroleum refinery; - drying clothes - metallurgical factory	Is the student able to explain the importance of changing one state of matter to another?	
5.3 Physical and Chemical Changes	The student should be able to: a) Describe the characteristics of a physical change.	Teacher and students to discuss the meaning and characteristics of physical changes.	• Sugar • Table salt • Heat source • Kettle • Chalk • Pestle and mortar • Magnet	Is the student able to describe the characteristics of physical changes?	16
	b) Demonstrate physical changes of matter experimentally.	Teacher to guide students to carry out the experiments on physical changes to include: • melting of ice • boiling of water • condensation of steam	• Sugar • Table salt • Heat source • Kettle • Chalk	Is the student able to use different materials to demonstrate physical change?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
		• formation of ice • magnetization of iron • sublimation of solid iodine • grinding of chalk • dissolving sugar or salt in water • evaporation.	• Pestle and mortar • Magnet • Solid iodine • Water • Ice		
	c) Describe the characteristics of a chemical change.	Teacher and students to discuss the meaning and characteristics of a chemical changes e.g. - burning of paper - ripening of fruit - fermentation of materials etc.	• Sugar • Yeast • Fruits • Paper • Heat source • Magnesiun ribbon • Acids • Zinc metal • Calcium carbonate	Is the student able to describe the characteristics of a chemical change?	
	d) Demonstrate chemical changes of matter experimentally.	Teacher to guide students to carry out the following chemical changes: • decomposition of a solid carbonate. • burning of any fuel. • precipitation of an insoluble salt from a solution. • displacement of a weak metal by a strong metal.	• $Pb(NO_3)_2$ solution • $CuSO_4$ solution • Zn metal • Candle • $CaCO_3$ • Aluminium foil • Magnesium ribbon • Heat source • Acids	Is the student able to use different materials to demonstrate chemical change?	
5.4 Elements and Symbols	The student should be able to: a) Explain the concept of an element.	Teacher to guide students to discuss the meaning of an element as compared to other substances.	• Copper • Sodium • Periodic Table • Zinc • Aluminium • Iron • Sulphur • Hydrogen	Is the student able to explain with examples the meaning of an element?	6

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	b) Assign names and symbols to chemical elements.	i) Students to assign names and symbols to: • Mono-atomic elements e.g. Al, K, Na, Cu, Pb, etc • Polyatomic elements e.g. O_2, N_2, S_8, P_4, Cl_2 • Special elements (K, Na, Fe, Ag, Au, Hg, Pb, Sn, Sb, Cu) which carry Latin names. ii) Teacher and students to discuss the choice of alphabetical letters and their combinations to form the symbols of elements.	• Copper • Sodium • Periodic Table • Zinc • Aluminium • Iron • Sulphur • Hydrogen	Is the student able to assign names and symbols to different elements?	
	c) Differentiate elements from other substances.	Teacher to guide students on how to use the Periodic Table to differentiate metal elements from non-metal elements.	• Copper • Sodium • Periodic Table • Zinc • Aluminium • Iron • Sulphur • Hydrogen	Is the student able to differentiate metal elements from non-metal elements?	
5.5 Compounds and Mixtures	The student should be able to: a) Explain the concept of compounds and mixtures.	Teacher and students to discuss the differences between compounds and mixtures by referring to their characteristic properties.	• Iron filings • Powdered sulphur • Magnet • Heat source • Cruscible and lid • FeS • HCl solution	Is the student explains the meaning and give examples of compounds and mixtures?	12
	b) Prepare a binary compound.	Teacher to lead students to prepare a binary compound such as iron (II) sulphide (FeS) from a mixture of solid iron filings and powdered sulphur by heating.	• Iron filings • Powdered sulphur • Magnet • Heat source • Cruscible and lid • FeS	Is the student able to prepare a binary compound using iron filings and powdered sulphur?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
			• HCl solution		
	c) Compare the properties of a compound with those of its constituent elements.	Teacher and students to discuss the properties of a compound in comparison to the properties of its constitute elements.	• Iron filings • Powdered sulphur • Magnet • Heat source • Cruscible and lid • FeS • HCl solution	Is the student able to compare the properties a compound with those of its constituents?	
	d) Explain the concept of a mixture.	Teacher to guide students to discuss the meaning of mixtures and give examples.	• Iron filings • Powdered sulphur • Magnet • Heat source • Cruscible and lid • FeS • HCl solution	Is the student able to explain the meaning and give examples of mixtures?	
	e) Classify mixtures into solutions, suspensions and emulsions.	Teacher and students to discuss the properties of solutions, suspensions and emulsions.	• Milk • Clay soil • Water • Margarine • Ethanol • Chalk powder	Is the student able to classify mixtures into solutions, suspensions and emulsions?	
5.6 Separation of Mixtures	The student should be able to: a) Describe the different methods of separating mixtures.	Teacher and students to discuss the procedures for carrying out the following separation processes: • decantation • filtration • evaporation • simple distillation • fractional distillation • sublimation • chromatography • layer separation • solvent extraction	• Coloured flowers • Kerosene • Water • Black ink • Table salt • Ethanol • Iodine crystals • Sugar • Clay soil • Ether or toluene • Filter paper • Heat source • Funnel	Is the student able to explain common methods of separating mixtures?	16

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	b) Explain the significance of separating different mixtures.	Teacher to guide students to discuss the importance of obtaining separate components of a mixture e.g. distilleries, breweries, refinery of petroleum, separation of cooking oil, metal extraction.	• Wall charts • Pictures of distilleries, • Breweries • Petroleum refinery • Metal extraction factory	Is the student able to explain the importance of separating different mixtures in real life situations?	
	c) Separate the components of different mixtures using different methods.	Teacher to guide students to demonstrate the separation of different mixtures by applying different separation methods.	• Iron fillings • Sulphur powder • Winnower • Magnet.	Is the student able to carry out experiments to separate different mixtures using a variety of methods?	
6.0 AIR, COMBUSTION, RUSTING AND FIRE FIGHTING 6.1 Composition of Air	The student should be able to: a) Name the gases present in air and their proportions.	Teacher and students to discuss the proportions of different gases in air.	• Wall chart showing the composition of air.	Is the student able to name the gases present in air and their proportions?	2
	b) Demonstrate the presence of different gases in air.	Teacher to facilitate students to demonstrate the presence of the following gases in air: • carbon dioxide • oxygen.	• Lime water • Phosphorus • Bell jar • Water • Trough • Candle	Is the student able to carry out an experiment to demonstrate the presence of oxygen in air?	
	c) Determine the percentage of oxygen in air experimentally.	Teacher to facilitate students to carry out an experiment to determine the percentage of oxygen in air.	• Lime water • Phosphorus • Bell jar • Water • Trough • Candle	Is the student able to determine the percentage proportion of oxygen in air?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
6.2 Combustion	The student should be able to: a) Explain the concept of combustion.	Teacher and students to discuss the meaning and significance of combustion in real life.	• Pieces of paper • Candle • Charcoal • Kerosene • Spirit	Is the student able to explain the meaning of combustion?	4
	b) Demonstrate the combustion of different substances in air and analyse the products.	Teacher to guide students to determine the products of complete combustion of the following substances in air: • kerosene • paper • charcoal • candle • spirit •	• Pieces of paper • Candle • Charcoal • Kerosene • Spirit	Is the student able to burn different substances in air and analyse the products?	
	c) Describe the application of combustion in real life.	Teacher and students to discuss the application of combustion in real life for example: • automobile engines • burners to get heat and light.	• Wall chart • Pictures of: - automobile engines - kerosene burner - candle.	Is the student describing the application of combustion in real life?	
6.3 Fire Fighting	The student should be able to: a) Classify types of fires according to their causes.	Teacher and students to discuss the fires caused by: • petroleum products • electricity • wood and charcoal • paper.	• Kerosene • Spirit • Paper • Charcoal • Match- box	Is the student able to classify types of fires according to their source?	8
	b) Identify different types of fire extinguishers used to extinguish different types of fire.	Teacher and students to discuss the reasons why specific types of fires should be extinguished by specific types of fire extinguishers.	• Sand bucket • Heavy asbestos blanket • Soda-acid fire extinguisher • Foam fire extinguisher • Water hose.	Is the student able to identify the right fire extinguisher for a particular type of fire?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	c) State the components needed to start a fire.	Teacher and students to discuss the parts played by fuel and oxygen in a fire.	• Sample of oxygen gas • Fuels: - Kerosene - Spirit - Charcoal - Candle	Is the student able to state the components which must be present for a fire to start?	
	d) Classify fire extinguishers according to the chemicals they contain.	Teacher and students to discuss the classification of fire extinguishers into: • soda-acid type • foam type • water type • sand type • blanket type	• Asbestos blanket • Soda-acid fire extinguisher • Foam fire extinguisher • Sound bucket • Water hose	Is the student able to state the chemicals present in different types of fire extinguishers?	
	e) Extinguish small fires using the right types of fire extinguishers.	i) Teacher to guide students to prepare a small fire carefully e.g. burning a small paper or a candle, and extinguish it. ii) Students to prepare a small fire extinguisher of the soda-acid type and use to extinguish a small fire.	• Candle • Bunsen burner • Spirit burner • Charcoal • Paper	Is the student able to extinguish a small fire efficiently using the right type of fire extinguisher?	
6.4 Rusting	The student should be able to: a) Explain the concept of rusting.	Teacher and students to discuss the meaning of rusting and its economic importance.	• Iron fillings • Steel wool • Water • Cotton wool • Grease • Petroleum jelly • Heat source • Magnesium ribbon • HCl solution	Is the student able to explain the meaning and give examples of rusting?	6

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	b) Demonstrate the conditions necessary for iron to rust.	Teacher to guide students to design an experiment to demonstrate the conditions necessary for iron to rust.	• Steel wool • Water • Cotton wool • Petroleum jelly • Oil • Heat source	Is the student able to carry out experiments to demonstrate the conditions necessary for iron to rust?	
	c) Describe different methods of preventing iron from rusting.	i) Students to carry out experiments on different methods of preventing iron from rusting. ii) Teacher to guide students to summarize and discuss the experimental findings.	• Steel wool • Water • Cotton wool • Petroleum jelly • Oil • Heat source	Is the student able to describe the different methods of preventing iron from rusting?	

FORM II

CLASS OBJECTIVES

By the end of Form Two course, the student should be able to:

a) explain preparation and properties of simple gases;
b) treat, purify and use water while conserving the environment.
c) recognize the importance of efficiency and sustainability in using fuels;
d) promote the use of fuels with environmental consideration;
e) explain the structure of an atom and periodic trend.

CLASS COMPETENCES:

By the end of the Form Two course, the student should have developed competences in:-

a) preparing and testing properties of simple gases in the laboratory;
b) treating and purifying water with environmental consideration;
c) using fuels efficiently and sustainability with environmental consideration;
d) applying periodicity to explain characteristics of elements.

TOPICS/SUB-TOPIC	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
1.0 OXYGEN 1.1 Preparation and Properties of Oxygen	The student should be able to: a) Prepare a sample of oxygen gas in the laboratory.	i) The teacher to guide students on the preparation of oxygen from hydrogen peroxide. ii) Students to carry out an experiment to prepare oxygen from hydrogen peroxide or heating potassium chlorate.	• Hydrogen peroxide, potassium chlorate, manganese (IV) oxide, flat bottomed flask, Beehive shell, delivery tubes, troughs, gas jar, water, thistle funnel	Is the student able to prepare and collect a sample of oxygen gas in the laboratory?	4
	b) Perform simple experiments to demonstrate properties of oxygen gas.	i) Teacher to guide students to carry out the characteristic test for oxygen gas. ii) Students to burn metals and some non-metals in oxygen.	• Freshly prepared O_2, phosphorus, litmus paper, candle. • Combustion spoon, magnesium ribbon, carbon, sulphur, calcium granules, wooden splint.	Can the student perform simple experiments on physical and chemical properties of oxygen gas?	
	c) Explain properties of oxygen	i) The teacher to lead a discussion on the physical and chemical properties of oxygen. ii) Students in groups to discuss the risks of using $KMnO_4$ and HgO to prepare oxygen in the laboratory.	• Potassium permanganate.	Is the student able to explain the properties of oxygen?	
1.2 Uses of Oxygen	The student should be able to: a) List uses of oxygen in daily life.	Teacher to guide students in groups to list the uses of oxygen in daily life e.g. living organisms, metallurgy, welding, mountaineering, hospital, tent and ocean diving.	• Wall charts/flip charts/pictures showing uses of oxygen in the mentioned process.	Is the student able to list the uses of oxygen in daily life?	2
	b) Relate some uses of oxygen to its properties.	Teacher to guide a discussion on relationship between uses and properties of oxygen.	• Wall charts, showing some uses and properties of oxygen.	Is the student able to relate some uses of oxygen to its properties?	

TOPICS/SUB-TOPIC	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
2.0 HYDROGEN 2.1 Preparation and properties of Hydrogen	The student should be able to: a) Explain the preparation of hydrogen gas in a laboratory	The teacher to demonstrate on the preparation of a small sample of hydrogen using zinc and dilute hydrochloric acid.	• Zinc granules, dil. HCl, troughs, thistle funnels, delivery tubes, gas jars, beehive shall, flat bottomed flask, test-tube.	Explain the preparation of a sample of hydrogen gas in a laboratory?	4
	b) Explain properties of hydrogen.	i) The teacher and students to demonstrate an experiment on 'pop' sound test for H_2 gas. ii) The teacher and students to carry out an experiment on reduction of CuO using hydrogen gas. iii) The teacher to guide a discussion on the physical and chemical properties of hydrogen gas.	• Zinc granules, dil. HCl, wooden splints, test-tube CuO, lead oxide, litmus paper, cobalt chloride paper, combustion tubes source of heat, anhydrous, calcium chloride. • Wall chart showing physical and some chemical properties of hydrogen.	Is the student able to explain properties of hydrogen?	
2.2 Uses of Hydrogen	The student should be able to: a) State uses of hydrogen gas in daily life.	i) The teacher to lead discussion on the uses of hydrogen industrially to manufacture margarine and ammonia. ii) Students in groups to discuss the uses of hydrogen in daily life.	• Wall chart, flip chart, pictures showing production of ammonium fertilizers, margarine.	Is the student able to state uses of H_2 gas in daily life?	2
	b) Relate uses of hydrogen to its properties.	The teacher to guide discussion in groups the uses of hydrogen gas in relation to its properties.	• Wall chart, showing use of hydrogen into its properties.	Is the student able to relate some uses of hydrogen to its properties?	
3.0 WATER 3.1 Occurrence and Nature of Water	The student should be able to: a) Describe the occurrence and nature of water.	Teacher and students to discuss the occurrence and nature of water.	• Wall chart showing occurrence of water.	Is the student able to describe the occurrence and nature of water?	2

TOPICS/SUB-TOPIC	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	b) Describe the water cycle	i) Students in groups to discuss and present the concept of water cycle. ii) Teacher to guide students to draw water cycle and discuss it.	• Wall chart and picture displaying water cycle.	Is the student able to describe water cycle?	
	c) Relate water cycle to environmental conservation.	Teacher to lead students in a discussion on the relationship between water cycle and environmental conservation.	• Wall chart and picture displaying water cycle.	Is the student able to relate water cycle to environmental conservation?	
3.2 Properties of Water	The student should be able to: a) Perform simple experiments on physical and chemical properties of water.	i) The teacher to demonstrate an experiment on boiling and melting points of water. ii) Students to carry out an experiment to determine boiling and melting points of water; iii) Student to test for water using cobalt chloride paper and anhydrous copper (II) sulphate. iv) Teacher to guide students to carry out reaction between water and some metals.	• Thermometer, cobalt chloride paper, anhydrous copper sulphate, water, sodium, calcium, magnesium and potassium, litmus paper.	Can the student able to perform simple experiments on physical and chemical properties of water?	2
	b) Explain properties of water.	Teacher to facilitate discussion on physical and chemical properties of water.	• Wall charts showing physical and chemical properties	Is the student able to explain the properties of water?	
3.3 Treatment and Purification of Water	The student should be able to: a) Perform processes of domestic water treatment and purification.	i) The teacher to lead students on the discussion of different methods of treating and purifying water at home. ii) Students to purify water after boiling by filtering using a clean piece of cloth. iii) Students to prepare a simple water filter using sand, charcoal and gravel and use it for filter water.	• Water, clean piece of cloth, sand, charcoal, gravel, filter paper, boiling vessel (sufurias), "water guard", pellets/tables.	Is the student able to demonstrate the process of domestic water treatment and purification?	4

TOPICS/SUB-TOPIC	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	b) Describe the processes of urban water treatment.	i) Teacher and students to visit large scale water treatment plant. ii) Students to write report on visit. iii) Teacher and student to discuss the different chemicals used to treat large scale water.	• Water treatment plant	Is the student able to describe the processes of urban water treatment?	
	c) Explain the importance of water treatment and purification.	i) Students to discuss the importance of water treatment in daily life. ii) The teacher to summarize the discussion and draw a simple flow chart for large scale water treatment.	• Wall charts showing large scale • Water treatment plant.	Is the student able to explain the importance of water treatment and purification?	
3.4 Uses of Water	The student should be able to: a) State uses of water.	i) Student to discuss the various uses of water in daily life. ii) Teacher to summarize the discussion through question and answers.	• Wall charts showing uses of water.	Can the student able to state uses of water in daily life?	2
	b) Compare the solubility of different substances in water and organic solvent.	i) Teacher to guide students to dissolve different substances in water. ii) Students to list substances which dissolve in water.	• Table salt, sugar, toothpaste, sand, iron fillings, water, kerosene, detergent soap.	Can the student able to compare the solubility of different substances in water and organic solvents?	
4.0 FUELS AND ENERGY 4.1 Fuel Sources	The student should be able to: a) Identify different sources of fuels.	i) Teacher to lead students in small groups to discuss different sources of fuels found in Tanzania.	• Kerosene, fire wood, charcoal, petrol, heating gas, diesel.	Is the student able to identify different sources of fuels?	4
	b) Describe methods of obtaining fuels from locally available materials.	i) Students in small groups to discuss the procedures of making charcoal. ii) Teacher to summarize the process of making charcoal in small scale.	• Wall charts showing process of charcoal making in small scale.	Can the student able to describe methods of obtaining fuels from locally available materials?	

TOPICS/SUB-TOPIC	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
4.2 Categories of Fuels	The student should be able to: a) Classify fuels according to their states.	i) Students to list fuels according to their states. ii) Teacher to summarize the classification of fuels according to their states.	• Heating gas, charcoal, fire wood, kerosene.	Can the student able to classify fuels according to their states?	4
	b) Classify fuels according to their efficiency.	i) The teacher to lead students to discuss the efficiency of different kinds of fuels. ii) The teacher to supervise students to burn different fuels and determine their calorific values.	• Kerosene, charcoal, piece of wood.	Can the student classify fuels according to efficiency?	
4.3 Uses of Fuel	The student should be able to: a) List uses of fuels.	i) Teacher to guide students in small groups to discuss different uses of fuels in daily life.	• Wall charts showing uses of fuels.	Is the student able to list uses of fuels?	4
	b) Assess the environmental effects on using charcoal and firewood as source of fuels.	i) The teacher to lead students to discuss the environmental effects of depending on fire-wood and charcoal as sources of fuel. ii) Students to mention the disadvantages of deforestation due to fuel production. iii) Students in small groups to discuss and present the contribution of vegetation to the balance of atmospheric gases. iv) Students in small groups to discuss and present the alternative to firewood and charcoal as sources of fuel.	• Wall charts showing disadvantages of deforestation; alternative sources of fuel.	Can the student able to assess the environmental effect of using charcoal and firewood as sources of fuel?	

TOPICS/SUB-TOPIC	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
4.4 Conservation of Energy	The student should be able to: a) Explain the law of conservation of energy.	i) The teacher to lead students to discuss the impossibility of destroying or creating energy. ii) Students in groups to discuss and present the law of conservation of energy and the teacher to clarify.	• Wall charts and pictures showing energy, energy change e.g. voltaic cell electric bell, bar magnets, iron filings, water, source of heat.	Is the student able to explain the law of conservation of energy?	4
	b) Carry out experiments on the conversion of energy from one form to another.	i) Students to perform experiments on conversion of energy from one form of energy into another e.g. chemical to electrieal, electrical to light. ii) The teacher to guide students to discuss the results obtained.	• Copper foil, sulphurie acid (I M), lamp bulb, beaker, magnesium ribbon, abrasive paper, iron filling, water, bar magnet, source of heat.	Can the student able to perform experiments on the conversion of energy from one form to another?	
4.5 Renewable Energy Biogas	The student should be able to: a) Explain the working mechanism of a biogas plant	The teacher to lead students to discuss the working mechanism of a biogas plant.	• Wall charts and pictures showing biogas plant.	can the student able to explain the working mechanism of biogas plant?	4
	b) Construct a model of biogas plant.	i) The teacher to assist students to construct a model of a biogas plant. ii) Student to construct a model of biogas plant. iii) Students under teachers supervision to construct a small biogas plant (outside class timetable).	• Biogas plans model, water, pipes, concrete, sewage, cow dung, animal/plant waste.	Can the student able to construct a simple biogas plant?	
	e) Explain the use of biogas in environmental conservation.	i) The teacher to guide students to discuss the applications of biogas in daily life. ii) Student to discuss use of biogas as an environmental friendly type fuel.	• Wall chart showing uses of biogas.	Is the student able to explain the use of biogas with environmental conservation?	

TOPICS/SUB-TOPIC	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
5.0 ATOMIC STRUCTURE 5.1 The atom	The student should be able to: a) Explain Dalton's contribution to atomic structure.	i) Students to divide a solid substance into fine indivisible particles. ii) The teacher to lead students to discuss Dalton's contribution to structure of an atom.	• Pieces of chalk, marble chips, pestle/mortar, paper.	Is the student able to explain the Daltons contribution to atomic structure?	2
	b) Explain the modern concept of Dalton's atomic structure.	i) The teacher to lead students to discuss the modern concept of Dalton's atomic structure. ii) Students to analyse the Dalton's atomic theory.	• Wall charts and pictures showing Daltons atomic structure • Modern periodic table	Is the student able to explain the modern concept of Daltons atomic structure?	
5.2 Sub-atomic particles	The student should be able to: a) Identify sub-atomic particles in an atom.	i) The teacher to guide students to identify the position of sub-atomic particles in an atom. ii) Students to identify the position of sub-atomic particles in an atom.	• Pictures, models or charts of an atom.	Is the student able to identify sub-atomic particles in an atom?	2
	b) Explain the properties of each particle in an atom.	i) The teacher to guide students to discuss the properties of each particle in an atom. ii) Students to explain the properties of each particle in an atom.	• Model of an atom.	Is the student able to explain the properties of each particle in an atom?	
5.3 Electronic arrangements	The student should be able to: a) Determine a maximum number of electrons in the shells.	i) The teacher to guide students to establish the maximum number of electrons in the shells. ii) Students to establish the maximum number of electrons in the shells.	• Atomic diagrams	Is the student able to establish the maximum number of electrons in a shell?	10
	b) Draw energy shell diagrams.	i) The teacher to guide students to draw energy shell diagrams of common atom. ii) The teacher to summarize energy shell diagrams.	• Atomic diagrams • Wall charts showing energy shell diagram	Is the student able to draw energy shell diagrams?	

TOPICS/SUB-TOPIC	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
5.4 Atomic number, mass number and isotopy.	The student should be able to: a) Relate atomic number with number of protons.	i) Teacher to guide students to discuss the relationship between the atomic number and number of protons ii) The student to role play to relating the atomic number and proton. iii)	• Models, charts and pictures showing the atomic number of elements playing cards	Is the student able to relate atomic number with number of protons?	10
	b) Calculate mass number of an atom from number of protons and neutrons.	The teacher to guide students on how to obtain mass number from number of protons and neutrons.	• Wall charts showing the number of protons and neutrons of elements.	Is the student able to obtain the mass number of an atom from number of protons and neutrons?	
	c) Explain the concept of isotopy.	i) Students to identify isotopes of some common elements. ii) The teacher to lead students to discuss the concept of isotopy.	• Wall charts showing isotopes of carbon, chlorine, oxygen and hydrogen.	Is the student able to explain the concept of isotopy?	
6.0 PERIODIC CLASSIFICATION 6.1 Periodicity	The student should be able to: Explain the concept of periodicity.	i) The teacher through questions and answers, to lead a discussion on the concept of periodicity. ii) Students in groups to explain the concept of periodicity.	• Wall charts displaying the modern periodic table.	Is the student able to explain the concept of periodicity?	1
6.2 General Trends	The student should be able to: a) Explain the change in properties of elements across the periods.	i) The teacher to guide students to discuss the change of properties across the periods. ii) Students to list down the changes in properties across the periods.	• Modern periodic table.	Is the student able to explain the changes in properties of elements across the periods?	10

TOPICS/SUB-TOPIC	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	b) Explain the change in properties of elements down the groups.	i) The teacher to guide students to discuss the change in properties down the group. ii) Student to list down the changes in properties down the group.	• Wall charts showing the modern periodic table.	Is the student able to explain the changes in properties of elements down the group?	
	c) Use electronic configurations to locate the positions of elements in the periodic table.	i) The teacher to guide students to write the electronic configuration of the first 10 elements. ii) Students to write the electronic configuration of the first 20 elements.	• Modern periodic table and atomic model.	Is the student able to use electronic configuration to locate the positions of elements in the periodic table.	
7.0 FORMULA BONDING AND NOMENCLATURE 7.1 Valence and chemical formulae	The student should be able to: The student should be able to: a) Explain the concept of valency.	i) The teacher to guide students to discuss on the concept of valency. ii) Students in groups to discuss the concept of valence in relation to periodic table, present and the teacher to clarify.	• Modern periodic table • Valence cards	Is the student able to explain the concept of valency?	12
	b) Write simple formulae of binary compounds.	i) The teacher to use questions and answers in writing simple formula of binary compounds. ii) Students to write simple formulae of binary compounds by exchange of valences.	• Valence cards • Styrofoam spheres • Periodic table	Is the student able to write simple formulae of binary compounds?	
	c) Explain the concept of empirical and molecular formulae.	i) The teacher to lead discussion on the concept of empirical and molecular formula. ii) Students in groups to discuss the concept of empirical and molecular formulae.	• Model depicting empirical and molecular formula. • Modern periodic table. • Wall charts showing empirical molecular formulae.	Is the student able to explain the concept of empirical and molecular formulae?	

TOPICS/SUB-TOPIC	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
		iii) Students to interpret the information given by the empirical and molecular formulae.			
	d) Calculate the empirical and molecular formulae.	i) Students to calculate the empirical and molecular formulae of various compounds. ii) The teacher to summarize the students' activities on empirical and molecular formulae.	• Modern periodic table • Wall charts showing molecular formular • Models illustrating empirical and molecular formulae. • Modern Periodic Table • Wall charts showing common radicals.	Is the student able to calculate the empirical and molecular formulae?	
7.2 Oxidation State	The student should be able to: a) Explain the concept of oxidation state.	i) The teacher to lead discussion on the concept of oxidation state. ii) Students in groups to discuss the concept of oxidation state and present. iii) The teacher to use questions and answers to summarize students activity.	• Wall charts showing oxidation states. • Modern periodic table • Wall charts showing common radicals.	Is the student able to explain the concept of oxidation state?	4
	b) Differentiate oxidation state and valence.	i) The teacher to provide activities on valence and oxidation states. ii) Students to perform the activities on valence and oxidation state. iii) The teacher to lead a discussion on students' activities.	• Periodic table • Wall charts showing Valence and Oxidation state.	Is the student able to differentiate Oxidation state from valence?	
7.3 Radicals	The student should be able to: a) Explain the concept of radicals.	i) The teacher to provide leading questions on names and formulae of radicals. ii) Students to practice writing and naming formulae of common radicals. iii) The teacher to guide students to summarize and conclude their work.	• Periodic table • Wall charts showing common radicals.	Is the student able to explain the concept of radicals?	4

TOPICS/SUB-TOPIC	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	b) Write chemical formulae of common compounds.	i) The teacher to illustrate writing of chemical formulae of common compounds. ii) Students to practice writing of chemical formulae of common compounds.	• Modern Periodic Table • Wall charts showing common radicals	Is the student able to write chemical formula of chemical compounds?	
7.4 Covalent bonding	The student should be able to: a) Explain the concept of covalent bonding.	i) The teacher to guide the discussion on the concept of covalent bonding. ii) Students in groups to draw electron diagrams to show covalent bonding in binary molecules.	• Modern periodic table • Wall charts showing covalent compounds.	Is the student able to explain the concept of covalent bonding?	8
	b) State the properties of covalent compounds.	i) The teacher to guide students to discuss the properties of covalent compounds. ii) Students in groups to perform experiments on covalent compounds.	• Sample of O_2 and H_2 • Kerosene, diesel • Water • Wall charts showing covalent compounds. • Bulb/ammeter, connecting wires, carbon electrodes, beakers.	Is the student able to state the properties of covalent compounds?	
7.5 Electrovalent bonding	The student should be able to: a) Explain the concept of electrovalent bonding.	i) The teacher to lead discussion on the concept of electrovalent bonding. ii) Students in groups to draw electron diagrams to show electrovalent bonding.	• Modern periodic table • Wall chart showing electrovalent compound.	Is the student able to explain the concept of electrovalent bonding?	8
	b) State properties of electrovalent compounds.	i) The teacher to guide students to discuss the properties of electrovalent compounds. ii) Students in groups to perform simple experiments on the ionic compounds.	• Table salt • Water • Potassium chloride • Wall charts showing ionic compounds. • Bulb, ammeter, connecting wires, carbon electrodes, beakers.	Is the student able to state properties of electrovalent compounds?	

FORM III

CLASS OBJECTIVES

By the end of form three Chemistry course, the student should be able to:-

a) promote knowledge on hardness of water;
b) establish accurate quantities of the reacting substances in various chemical reactions;
c) understand effects of electricity on chemical substances;
d) recognize appropriate methods of extraction of metals;
e) realize the consequences of environmental destruction;
f) realize Chemistry principles in industrial processes.

CLASS COMPETENCES

By the end of the form three Chemistry course, the student should have developed competences in:-

a) applying Chemistry principles in understanding industrial processes;
b) using technological skills in extraction of metals and conservation of environment;
c) solving problems of hardness of water in daily life;
d) using the concept of volumetric analysis in solving daily life problems;
e) using electrolysis to solve daily life problems.

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
1.0 CHEMICAL EQUATIONS 1.1 Molecular Equations	The student should be able to: a) Write word equations for given chemical reactions.	i) The teacher to assist students to discuss the rules of predicting reaction products. ii) The teacher to guide students to discuss the types of chemical reactions, to include: decomposition, displacement, combination/synthesis, precipitation and redox. iii) Students to write word equations for each types of chemical reaction mentioned.	• Wall charts showing rules of predicting reaction products. • Wall charts showing reaction equations, models, hard glass tube, source of heat, copper sulphate, chlorine gas, potassium iodide magnesium ribbon hydrochloric acid and lead nitrate.	- Is the student able to write the word equations for the given equations? - Is the student able to predict reaction products of a given word equation?	4
	b) Write formula equations using chemical symbols.	i) The teacher to lead students in the discussion of all the necessary steps needed in writing a formula equation. ii) Students to write formula equations using chemical symbols.	Wall charts showing formula of reaction equations.	Is the student write formula equation using chemical symbols?	
	c) Balance chemical equations.	i) The teacher to guide students to discuss with examples, all the necessary steps needed in balancing a chemical equation. ii) Students to identify the state symbols in an equation. iii) Students to balance chemical equations.	• Wall charts showing balanced reaction equations. • Wall charts showing state symbols in a chemical reaction. • Marker pens • Manila sheets	- Is the student able to balance chemical equations? - Is the student able to use state symbols in a chemical equation?	
1.2 Ionic Equations	The student should be able to: a) Differentiate between molecular equations and ionic equations.	i) The teacher to lead a discussion on the differences between molecular and ionic equations. ii) Students to write molecular and ionic equations.	Wall chart showing different molecular and ionic equations.	Is the student able to distinguish molecular equations from ionic equations?	2

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	b) Write balanced ionic equations	i) The teacher to guide students to discuss the major steps of writing balanced ionic equations. ii) Students to write ionic equations for equations, liquid, gaseous and solid products.	Wall charts showing balanced ionic equations.	Is the student able to write a balanced ionic equation?	
2.0 HARDNESS OF WATER 2.1 The Concept of Hardness of Water	The student should be able to: a) Explain the concept of hardness of water.	The teacher to guide students to discuss the meaning of hardness of water.	Wall charts showing mineral substances which cause hardness of water.	Is the student able to explain the concept of hardness of water in daily life situation?	2
	b) Differentiate soft from hard water.	i) The teacher to lead students to perform an experiment to distinguish hard water from soft water by washing with soap. ii) Students to draw conclusion from their observations.	• Water (soft) • Water (Hard) • Soap	Is the student able to distinguish hard water from soft water experimentally?	
2.2 Types of Hardness of Water	The student should be able to: a) Identify types of hardness of water.	i) The teacher to guide students to carry out an experiment to determine temporary and permanent hard water. ii) Students to discuss their findings.	• Sources of heat • Test tubes • 0.5M Na_2SO_4 • 0.5M $MgSO_4$ • 0.5M NaCl • 0.5M $CaCl_2$ • 0.5M $CaSO_4$ • 0.5M $Mg(HCO_3)_2$ • 0.5M $Mg Cl_2$	Is the student able to identify types of hardness of water?	2
	b) State causes of permanent and temporary hardness in water.	i) Students use soap and heat alone to identify temporary and permanently hard water. ii) Students to identify the ions which cause permanent and temporary hardness of water. iii) The teacher to lead a plenary discussion on students' work.	Wall charts showing mineral substances which cause temporary and permanent hard water.	Is the student able to state causes of permanent and temporary hardness in water?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
2.3 Treatment and Purification of Hard Water	The student should be able to: a) Examine process of hard water treatment and purification.	i) The teacher to guide students to perform experiment on removal of hardness by using $Ca(OH)_2$ and $Ca(HCO_3)_2$. ii) The teacher to guide students to carry out an experiment on removal of hardness by using $CaSO_4$ and Na_2CO_3. iii) The teacher to lead students to discuss observations from two above experiments.	• Heat sources • $Ca(OH)_2$ • $Ca(HCO_3)$ • $CaSO_4$ • Na_2CO_3 beakers	Is the student able to remove hardness in water?	4
	b) Describe the importance of hard water treatment and purification.	i) The teacher to guide students to discuss the importance of hard water treatment and purification. ii) Students in groups discuss the importance of hard water treatment and purification.	Wall charts showing the importance of hard water treatment and purification.	Is the student able to describe the importance of hard water treatment and purification?	
	c) State the importance of hard water in daily life.	i) The teacher to assist students to discuss the importance of hard water in daily life. ii) Students to discuss the importance of hard water.	Wall charts displaying importances of hard water.	Is the student able to state the importance of hard water in daily life?	
3.0 ACIDS, BASES AND SALTS 3.1 Acids and Bases	The student should be able to: a) Investigate the natural sources of acids and bases.	i) The teacher to guide students to collect natural sources of acids and bases. ii) Students to do an experiment to identify acids and bases using indicators.	Lemon, citrus fruits, vinegar, sour milk, apples, wood ash, oranges, tooth paste, dry leaves, bicarbonate of soda, mineral acids, hydroxides and indicator.	Is the student able to identify natural sources of acids and bases?	8
	b) Determine the reactions of acids with various materials.	i) The teacher to guide students to perform an experiment on the reactions of acid with metal, carbonates, oxides and hydroxides. ii) Students to analyze the reactions of acids on various materials.	Zinc granules, magnesium ribbon, calcium metal, $MgCO_3$, CaO, NaOH dil, HCl dil, H_2SO_4.	Is the student able to determine reactions of acids on various materials?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	c) Determine the reactions of alkalis with various materials.	i) The teacher to demonstrate the experiment on the reaction of alkalis with the different materials. ii) Students to do experiments on the reaction of alkalis with different substances. iii) Students and teacher to discuss the effects of strong alkalis on metals.	• NaOH, Zn granules, Mg ribbon, dil. H_2SO_4 dil. HCl, dil, HNO_3, beakers.	Is the student able to determine with various materials?	
	d) Determine the reactions of bases with various substances.	i) The teacher to guide students to prepare the clear solution of potash. ii) The teacher to guide student to perform an experiment of neutralization reaction between K_2CO_3 (Solution of Potash) and vinegar until the colour of indicator change. iii) The teacher to lead a plenary discussion on students' work.	Wood ash, vinegar, plastic syringe or dropper, beaker, potassium carbonate, methyl orange indicator (MO), Phenolphthalein (POP) indicator	-Is the student able to explain the neutralization reaction? -What examples can the student give on neutralization reaction?	
	e) Apply the concept of neutralization of acid-base in daily life.	i) The teacher to lead students to discuss applications of neutralization reaction in daily life. ii) Students to highlight the main application of acid-base neutralization.	Wall charts, pictures showing the application of neutralization property; anti acid tables.	Is the student able to mention application of acid-base neutralization?	
3.2 Indicators	The student should be able to: a) Extract an indicator from locally available materials.	i) The teacher to guide students to prepare the indicators from red, yellow or pink flowers/leaves. ii) Students to carry out an experiment to investigate which local flowers produce the most effective indicator.	• Coloured flowers • Coloured leaves. • Mortar and pestle, two pieces of clean clothes, beakers, ethanol, heat source, beakers, tripods stand, lemon juice, tomato juice, sour milk, vinegar, soft drinks kerosene, NaOH.	Is the student able to manage extraction of indicators from locally available materials?	4

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	b) Test the acidity and alkalinity of substances using indicators.	The teacher to guide the students to set the acidity and alkalinity of different substances using commercial indicators as well as that made from leaves and flowers.	• Extracted indicator from coloured flowers/leaves. • POP indicator • MO indicator	Is the student able to explain the acidity and alkalinity using indicators?	
	c) Describe the concept of an indicator.	i) The teacher to lead the discussion on the concept of an indicator. ii) Students in groups to discuss the concept of an indicator.	• Methyl orange • Litmus paper, sodium hydroxide, hydrochloric acid, sulphuric acid.	Is the student able to explain the meaning of indicators?	8
3.3 Salts	The student should be able to: a) Investigate the natural source of salts in daily life.	i) The teacher to lead students to brainstorm on the natural sources of salts through questions and answers. ii) Students to carry out group investigation on natural sources of salts in daily life.	Wall charts, drawings, pictures showing salt mining, pictures of industrial salt processing.	Is the student able to identify the natural sources of salts in daily life?	8
	b) Analyse the solubility of different salts in water.	i) Teacher to guide students to do experiments to establish soluble, partially soluble and insoluble salts. ii) The teacher to lead a discussion on basic criteria used in categorizing salts.	Salts of Potassium, Sodium, Ammonium nitrate, Hydrogen carbonate, Magnesium carbonates, Barium sulphate, Lead (II) sulphate, silver Chloride.	Is the student able to analyse the solubility of different salts?	
	c) Prepare salts in the laboratory.	i) The teacher to guide students to do experiments on preparation of soluble salts by reacting metal, oxides and carbonates with dilute acids. ii) Students to discuss in groups the results of the reactions.	Hydrochloric acid, limestone, baking powder, egg shells, safety goggles, calcium oxide, zinc oxide, magnesium, zinc metal.	Is the student able to prepare soluble salts?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	d) Examine the effects of heat on salts.	i) The teacher to guide the students to perform experiments on heating different kinds of salts. ii) Students in groups to discuss the meaning of deliquescence, iii) efflorescence and hydroscopy. iv) Students to carry out an experiment of thermal decomposition of carbonates.	• Carbonates, sulphates, chlorides of Na, Fe, Cu. • Hydroxides of K, Na, Ca. • Hydrated salts of Na2CO3, $CaCl_2$, and CuSO4.	Is the student able to examine the effects of heat on salts?	
	e) Explain the uses of different types of salts in everyday life.	i) Students to discuss the uses of salts in daily life. ii) The teacher to lead discussion on important applications and uses of different types of salts.	• Wall charts and pictures on the use of salts in daily life. • Table salt, painting, fertilizer, washing soda, Plaster of Paris. Health salt, Silver nitrate.	Is the student able to explain the uses of different types of salts in everyday life?	
4.0 THE MOLE CONCEPT AND RELATED CALCULATIONS 4.1 The Mole as a Unit of Measurement.	The student should be able to: a) Compare the mole with other units of measurements.	i) The teacher to guide students to discuss the mole as a unit for amount of substances. ii) Students in groups to compare the mole with other units of measurement e.g. 1 mole = 6.02×10^{23} particles 1 pair = 2 objects 1 Dozen = 12 objects 1 Gross = 144 objects	• Wall charts showing pictures and units of measurements. • A pair of shoes, a dozen of pencils, a gross of chalks.	Can the student compare mole with other units of measurements?	4
	b) Measure molar quantities of different substances.	i) The teacher to guide students to construct the molar volume box of 22.4 litres capacity using cardboard materials.	• Molar volume box, Cu, C, Fe, CuO, $CaCO_3$, pan balance, glass container. • Wall charts showing pictures of substances.	Can the student measure molar quantities of different substances?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
		ii) Students to construct the molar volume box. iii) Students to use a chemical balance to measure the molar masses of Cu, C, Fe, CuO and $CaCO_3$ and put them in separate glass containers for comparison. iv) The teacher to lead students to discuss the relationship between the Mole and the Avogadros constant (L = 6.02×10^{23}) particles.			
4.2 Application of the Mole Concept	The student should be able to: a) Convert known masses of elements, molecules or ions to moles.	i) The teacher to guide students to discuss the conversion of known masses of elements, molecules, or ions to moles. ii) Students to divide the masses of elements, molecules or ions by their molar masses so as to convert them to moles. iii) The teacher to summarize and conclude the work done by students.	• Periodic table • Pan balance • Fe, Cu, Mg, Al, Cu.	Can the student convert known masses of substances to mole?	8
	b) Convert known volumes of gases at S.T.P. to moles.	i) The teacher to guide students to discuss the conversion of known volumes of gases at S.T.P to moles. ii) Students in groups and then individuals to divide the gas volumes of elements or compounds by the molar volume so as to convert them to moles.	• Periodic table • Molar volume box • Wall charts showing reactions.	Is the student able to convert the volume of a gas at S.T.P to moles?	
	c) Change masses of solids or volumes of known gases to actual number of particles.	i) The teacher to lead students to discuss the conversion of masses of solids or volumes of known gases to actual number of particles.	• Wall charts showing the relationship between masses of solids or volumes of gases to actual number of particles.	How correctly can the student change masses of solids or volumes of known gases to actual number of particles?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
		ii) Students to apply the Avogadro's constant (L = 6.02×10^{23} particles $mole^{-1}$ to convert known masses of solid or volumes of gasses to actual numbers of particles.			
	d) Prepare molar solutions of various soluble substances.	i) The teacher to guide students to discuss the methods used to dissolve different substances in water. ii) Students in groups and then individually to prepare molar solutions by dissolving molar quantities of different substances in water to make molar solutions.	• Volumetric flasks, beakers, measuring cylinders, water, weighing balance • Soluble salts	Can the student able to prepare molar solutions of various soluble substances?	
	e) Perform calculations based on the mole concept.	The teacher to guide students to perform some calculations based on the mole concept and balanced equations in groups and then individually.	• Manila cards • Magic markers	Can the student able to perform calculations based on the mole concept?	
5.0 VOLUMETRIC ANALYSIS 5.1 Standard volumetric apparatus	The student should be able to: a) Explain the concept of volumetric analysis.	i) The teacher to demonstrate to students to brainstorm on how volumetric analysis is used to determine unknown volumes and concentration of solutions. ii) The teacher to lead a discussion on the significance of volumetric analysis.	• Solutions of different concentrations • Volumetric apparatus • Indicators	Is the student able to explain the meaning of volumetric analysis?	2
	b) Use volumetric apparatus.	i) The teacher to guide students on how to use volumetric analysis apparatus. ii) Students to use water in the practice of taking accurate measurements of liquid volumes using pipettes and burettes.	• Pipettes, burettes, conical flasks, beakers, white tiles, stands, water.	How accurately can the student identify and use apparatus in volumetric analysis work?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
		iii) The teacher to demonstrate to students on how to repair a leaking burette. iv) Students in groups to practice how to repair a leaking burette. v) The teacher to lead a plenary discussion on students' work.			
5.2 Standard Solutions	The student should be able to: a) Explain the steps for preparation of standard solutions of common acids.	i) The teacher to guide students to interpret the data on the labels of containers carrying commercial concentrated HCl, H_2SO_4 or HNO_3, acids. ii) The teacher to demonstrate to students how to carry out the dilution of commercial concentrated HCl, H_2SO_4 or HNO_3 to some required concentration e.g. 0.2M, 0.5M, 0.25M . iii) Students in groups to discuss the preparation of standard solutions of common acids.	• Commercial concentrated acids HCl, H_2SO_4 or HNO_3 • Volumetric flasks, measuring cylinder, beakers • Distilled water	How correctly can the student explain the preparation of a standard solution of a common acid?	8
	b) Prepare standard solutions of bases	i) The teacher to demonstrate to students the preparation of basic solutions. ii) Students in groups to measure accurately masses of solid bases (NaOH and Na_2CO_3). iii) Students to dissolve the measured bases in water to prepare the respective solution.	• Volumetric flasks • NaOH and Na_2CO_3. • Chemical balance • Beakers • Stirrer • Water • Funnel • Wash bottle	How accurately can the student prepare a standard solution of a base?	
	c) Carry out acid-base titration experiments.	i) The teacher to lead students to discuss the way of choosing the best indicator for a particular acid-base titration.	• Acid-base indicators. • Titration flasks • Burettes • Pipettes	-Is the student able to set up a titration experiment?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
		ii) Students to practice to perfection the accurate measurement of $25cm^3$ or $20cm^3$ of solution using a pipette. iii) Students to practice to perfection the titration process and reading volumes on a burette correct to two decimal places. iv) Students to record all titration data in a tabular form. v) The teacher to lead a discussion on accuracy and data recording.	• Measuring cylinders • Common mineral acids • Common bases	-Can the student handle properly the apparatus during titration? -Can the student take readings accurately during titration?	
5.3 Volumetric Calculations	The student should be able to: a) Standardize common mineral acids.	i) Teacher to guide students in groups and then individually to prepare standard solution of sodium carbonate. ii) Students in groups and then individually to use the standard sodium carbonate solution to standardize dilute hydrochloric acid. iii) The teacher to lead a discussion on students activities with emphasis on accuracy.	• Measuring cylinders • Titration flasks • Burettes • Pipettes • Dil HCl acid • Na_2CO_3 solution • Water	Is the student able to standardize common mineral acids?	6
	b) Find the relative atomic mass of unknown element in an acid or alkali.	i) Teacher to guide students to carry out the titration and work out the relative mass of the unknown element. ii) The teacher to guide students to work out the relative atomic mass of the unknown element.	• Acid or alkali • Chart of atomic masses • Flasks • Pipettes • Burettes • White tiles • Beakers	Can the student determine the relative atomic mass of unknown element practically?	
	c) Calculate the percentage purity of an acid or an alkali.	i) The teacher guide students in groups and individually in the titration experiment find out the percentage purity or impurity of an acid or an alkali.	• Impure acid or alkali • Chart of atomic masses • Pipettes • Burettes • Titration flasks	Is the student able to determine the percentage purity of an acid or base experimentally?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
		ii) Students in groups and individually to carry out an experiment to find out the percentage purity or impurity of an acid or an alkali. iii) The teacher to lead a discussion on students' activities with emphasis on accuracy.	• Beakers • White tiles		
	d) Find the number of molecules of water of crystallization of a substance.	i) Teacher to guide students to discuss ways of findings the number of molecules of water of crystallization of a substance. ii) Students to carry out the experiment set by the teacher. iii) Students to solve related problems using the experimental data obtained. iv) The teacher to lead a discussion on students activities.	• Salt containing water of crystaltization • Burettes • Pipettes • Titration flasks • White tiles	Can the student determine the number of molecule of water in a hydrated salt accurately?	
5.4 Application of Volumetric Analysis	The student should be able to: a) Explain the application of volumetric analysis in real life situations.	i) Students and the teacher to discuss the usefulness of volumetric analysis. ii) The students to list the application of volumetric analysis in daily life.	• Wall charts or pictures showing the places where volumetric analysis is applied e.g. industries, agriculture, hospitals.	-Can the student explain the application of volumetric analysis in daily life? -Can the student apply the knowledge of volumetric analysis in daily life?	2
	b) Compare industrial and laboratory skills of volumetric analysis.	i) The teacher to organize a study visit and provide guidelines to students. ii) The teacher and students to visit places where volumetric analysis is being applied. iii) Students in groups to discuss the findings from the study visit.	• Wall charts and pictures showing industrial volumetric skills and laboratory skills.	To what extent can the student compare industrial and laboratory skills of volumetric analysis?	

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		iv) Students to compare industrial and laboratory skills of volumetric analysis. v) The teacher to lead a discussion on the study visit.			
6.0 IONIC THEORY AND ELECTROLYSIS 6.1 Ionic Theory	The student should be able to: a) Distinguish electrolytes from non-electrolytes.	i) Teacher to guide students to discuss: • Electrolytes • Non electrolytes • Weak and strong electrolytes ii) Students in groups and then individually to perform experiments to distinguish electrolytes and non-electrolytes as well as weak and strong electrolytes. iii) The teacher to lead students to discuss why some substances conduct electricity while others not. iv) Students to pass electricity through different substances in the solid, molten and aqueous states to identify the conductors or electrolytes and non electrolytes. v) The teacher to lead students to discuss why a solid electrolyte would not conduct but will do so in the molten and aqueous states.	• Common salt • Ethanol • Sugar • Lead bromide • Wax • Potassium iodide • Electric circuit	Is the student able to distinguish electrolytes from non-electrolytes?	4
	b) Categorize weak and strong electtolyte.	i) Teacher to demonstrate the experimental set up of electrolytic cell of different electrolytes in the molten and aqueous slate. ii) The teacher to lead students to discuss the difference between the strength of an electrolyte and its concentration.	• Strong acids • Weak acids • Concentrated acids	Is the student able to differentiate concenttation and strength of electrolyte?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
		iii) Students to give examples of strong and weak acids in relation to concentration.			
6.2 The Mechanism of Electrolysis	The student should be able to: a) Set up electrolytic cells of different electrolytes in the molten and aqueous states.	i) Students in groups and then individually to set up an electric circuit which includes the electrolyte as a component part. ii) The teacher to guide students to set up the experiment. iii) The teacher to lead a discussion on setting electrolytic cells of different electrolytes in the molten and aqueous states.	• Electric circuit components • Electrolytes.	How accurately can the student set up electrolytic cells of different electrolytes?	8
	b) Explain ionic migrations during electrolysis and the preferential discharge of ions at the electrodes.	i) Teacher to guide students to discuss the migration of ions during electrolysis. ii) The teacher to set up an experiment on the movement of coloured ions of electrolyte towards the electrode during electrolysis. iii) Students to discuss the reasons for ionic migration. iv) Students to write balanced equations for the reactions occurring at each electrode. v) The teacher to lead a discussion on students' work.	• Different types of electrolytes • Electric circuits • Wall charts and pictures showing mechanism of electrolysis	- How accurately can the student explain the movement of ions during electrolysis? - Is the student able to explain the preferential discharge of ions during electrolysis?	
	c) Perform experiments to identify the products of electrolysis when different	i) Teacher to guide students in groups and then individually to carry out experiments using different electrolytes. ii) The teacher to guide students to discuss the products formed at the	• Sodium chloride • Copper (II) sulphate • Sodium hydroxide • Dilute sulphuric acid • Electrolytic cells • Hydrochloric acid	Can the student perform an experiment to identify the products of different electrolytes during	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	electrolytes are used.	electrodes during electrolysis. iii) Students to write balanced ionic equations at each electrode. iv) The teacher to lead a discussion on students' work.		electrolysis?	
	d) Perform an experiment to identify the products of electrolysis when different electrodes are used.	i) Teacher to guide students to carry out experiments using different electrodes. ii) The teacher to guide students to discuss the products formed at electrodes during electrolysis using inert and active electrodes. iii) Students to write a balanced ionic equation at each electrode. iv) The teacher to lead a discussion on students activities.	• Carbon rod • Copper rod • Sulphuric acid • Electrolytic cell • Copper (II) sulphate • Sodium chloride • Hydrochloric acid	Is the student able to identify experimentally the products of electrolysis when different electrodes are used?	
6.3 Laws of Electrolysis	The student should be able to: a) Carry out experiments to relate masses liberated and quantity of electricity passed.	i) Teacher to guide students to measure the mass of solid deposited on or eroded from an electrode by a specific current supplied for a specific time. ii) The teacher to guide students to discuss the relationship between mass liberated and quantity of electricity passed. iii) The teacher to use students responses to make clarifications and conclusion.	• Electrolytic cell • Electrolytes • Chemical balance	Can the student carry out an experiment to relate masses liberated and quantity of electricity passed?	6
	b) Carry out an experiment to verify Faraday's First Law of electrolysis	i) The teacher to guide students to perform experiments to verify Faraday's First Law of electrolysis. ii) Students to plot a graph of mass liberated against electricity passed.	• Electrolytic cell • Electrolytes • Copper rods • Graph papers • Sand paper • 12 volts battery	Can the student carry out an experiment to verify the Faraday's First Law of Electrolysis?	

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		iii) Students to relate the shape of the graph and the mathematical expression, m = Zit iv) The teacher to lead a discussion on students' activities.	• Chemical balance.		
	c) Carry out experiments to verify Faraday's Second Law of electrolysis.	i) Teacher to guide students to pass the same quantity of electricity through Copper (II) sulphate and Silver nitrate solutions and determine the masses liberated. ii) The teacher to guide students to discuss the relationship between masses liberated and chemical equivalents of copper and silver.	• Copper (II) sulphate • Silver nitrate • Carbon rods • Battery • Two small beakers	Can the student able to perform an experiment to verify Faraday's 2nd law of electrolysis?	
	d) Relate the chemical equivalents of elements and quantity of electricity passed.	i) The teacher to supervise students to discuss the mathematical interpretation of the Faraday's 2nd Law of electrolysis. ii) Students to work out some calculations based on the 2nd Law.	• Wall charts showing two voltammeters in series	Can student able to relate chemical equivalent of elements and the quantity of electricity passed?	
6.4 Application of Electrolysis	The student should be able to: a) Outline the industrial purification of copper by electrolysis.	i) The teacher to guide students to discuss the purification of copper by electrolysis. ii) The teacher to guide students to carry out an experiment to demonstrate the industrial purification of copper.	• Wall charts showing the purification process. • Impure copper rod • Acidified copper (II) sulphate solution.	Can the student able to outline the industrial purification of Copper by electrolysis?	4

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		iii) Students in groups to discuss the industrial purification of Copper by electrolysis.			
	b) Carry out an experiment on electroplating of metallic materials	i) The teacher to guide students to discuss the essential steps for electroplating an object. ii) Students to electroplate different metallic objects e.g. spoon, using an acidified copper (II) sulphate solution and a copper anode.	• Spoon • Copper rod • Copper (II) sulphate • Dilute sulphuric acid	Can the student carry out experiments on electroplating process of metallic materials?	
7.0 CHEMICAL KINETICS, EQUILIBRIUM AND ENERGETICS 7.1 The rate of chemical reactions	The student should be able to: a) Compare the rates of chemical reactions.	i) The teacher to guide students to discuss the concept of rapid and slow reactions. ii) Students to demonstrate a very rapid reaction by mixing KI with $Pb(NO_3)_2$ solutions and aqueous silver compound with any aqueous chloride iii) The teacher to guide students to carry out a slow reaction by allowing iron nails to rust under favorable conditions.	• Manila sheets • Magic marker • Potassium iodide • Lead nitrate • Silver nitrate • Iron nails • Test tubes	Is the student able to carry out experiments to show fast and slow chemical reactions?	4
	b) Perform experiments to measure the rates of chemical reactions.	i) The teacher to guide students to discuss the selection of the most convenient property of a reaction to measure, so as to determine the rate of that reaction. ii) Students to measure the rate of evolution of hydrogen when zinc is dissolved in dilute HCl acid. iii) The teacher to lead a discussion on students' work.	• Zinc granule • Dilute HCl • Graph papers • Stop watches	Can the student perform an experiment to measure the rate of a chemical reaction?	

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7.2 Factors Affecting the Rate of Chemical Reactions	The student should be able to: a) Describe the effect of concentration on the rate of a reaction.	i) Teacher to guide students to use dil. HCl and $Na_2S_2O_3$ to study the effect of concentration on the rate of precipitation of sulphur. ii) Students to tabulate the concentration rate data and plot a graph. iii) The teacher to guide students to study the special features of the graph and make conclusions.	• Beakers • Dilute HCl • $Na_2S_2O_3$ • White tiles • Stop watches • Graph papers	How well can the student describe the effect of concentration on the rate of reaction?	16
	b) Demonstrate the effect of temperature on the rate of a reaction.	i) Students in groups to use dilute HCl and $Na_2S_2O_3$ to study the effect of temperature on the rate of precipitation of sulphur. ii) Students to tabulate the temperature rate data and plot a graph. iii) The teacher to guide a discussion on the special features of the graph and make clarifications.	• Source of heat, • Thermometers • Dilute HCl • $Na_2S_2O_3$ • Stop watches	Can the student demonstrate the effect of temperature on rate of a reaction?	
	c) Show the effect of surface area of a solid on the rate of a reaction.	i) Teacher to instruct students to use blocks of $CaCO_3$ and its powder respectively to study the effect of particles size (surface area) on the rate of evaluation of carbon dioxide when reacted with dilute hydrochloric acid. ii) Students to tabulate the volume rate data and plot a graph. iii) The teacher to guide students to	• $CaCO_3$ blocks • Mortar and pestle • Stop watches • Syringe • Measuring cylinder	Can the student show the effect of surface area on rate of a reaction?	

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		discuss the special features of the graph and make conclusions.			
	d) Demonstrate the effect of catalyst on the rate of a reaction.	i) Teacher to guide students in groups and then individually to use solid MnO_2 to study the effect of the catalyst, on the rate of evolution of oxygen from H_2O_2. ii) Students to tabulate the volume-rate data and plot a graph. iii) The teacher to guide students to discuss the special features of the graph and make conclusions.	• H_2O_2 • MnO_2 • Stop watches • Syringe • Graph papers	Can the student show the effect of catalyst on rate of reactions?	
7.3 Reversible and Irreversible Reactions	The student should be able to: a) Compare reversible and irreversible reactions.	i) The teacher to guide students to discuss the concept of reversible and irreversible processes. ii) Students in groups to perform an experiment on reversible and irreversible reactions.	• Heat source • Litmus papers • Test tubes • NH_4Cl • Ice	Can the student compare reversible and irreversible reactions?	4
	b) Describe the concept of reversible and irreversible reactions.	i) The teacher to demonstrate at least one reversible and one irreversible reaction in the laboratory. ii) The teacher to guide students to discuss the results of the experiment obtained and makes conclusions.	• NH_4Cl • Zinc metal • Hydrochloric acid • Copper (II) sulphate crystals.	Can the student explain the concept of reversible and irreversible reactions?	
7.4 Equilibrium Reaction	The student should be able to: a) Differentiate equilibrium reactions from simple reversible reactions.	i) The teacher to guide students to discuss the differences and similarities between equilibrium reactions and reversible reactions. ii) Teacher and students to discuss examples of reversible and equilibrium reactions.	• Bromine water • Sodium hydroxide • Flasks • Pipettes • Sulphuric acid • Potassium dichromate • Potassium chromate • Dilute hydrochloric acid.	Can the student differentiate equilibrium reactions from simple reversible reactions?	6

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		iii) The teacher to demonstrate at least one equilibrium reaction which involves a colour change for example, $Cr_2O_7^{2-}$ and CrO_4^{2-} equilibrium. iv) Students to state more examples of equilibrium reactions e.g. ice, water and steam.			
	b) Describe two equilibrium reactions of industrial importance.	i) The teacher to guide students to discuss the factors affecting the position of equilibrium (pressure, temperature and concentration). ii) The teacher to guide students to discuss LeChateliers Principle. iii) The teacher and students to discuss the Haber process. $3H_2 + N_2 = 2NH_3$ and the Contact process $2SO_2 + O_2 = 2SO_3$ and make conclusion.	• Wall charts showing the Haber process and Contact process. • A picture of Sulphuric acid plant and Haber plant.	Is the student able to describe two equilibrium reactions of industrial importance?	
7.5 Endothermic and Exothermic Reactions	The student should be able to: a) Explain the concept of endothermic and exothermic reactions.	i) The teacher to guide students to discuss the concept of endothermic and exothermic reactions. ii) Teacher to guide students to perform experiments to demonstrate endothermic and exothermic reactions. e.g. dissolving NH_4Cl or conc. H_2SO_4 in water. iii) The teacher to lead a discussion on students' work.	• Wall charts, pictures, diagrams and models showing energy changes during chemical reactions. • H_2O • Conc. H_2SO_4 • NH_4Cl • Beakers	Can the student able to explain the concept of endothermic and exothermic reactions?	4
	b) Draw energy level diagrams for exothermic and endothermic	i) The teacher to guide students to discuss the special features of energy level diagrams for exothermic and endothermic reactions.	• Wall charts and pictures showing the endothermic and exothermic reactions.	Is the student able to draw energy level diagrams for exothermic and	

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	reactions	ii) Students to draw energy level diagrams for endothermic and exothermic reactions.		endothermic reactions?	
8.0 EXTRACTION OF METALS 8.1 Occurrence and Location of Metals in Tanzania	The student should be able to: a) Identify locations of important metal ores in Tanzania.	i) The teacher to guide students to discuss the distribution of metal ores in Tanzania and their types. ii) The teacher to guide students to make a collection of an assortment of mineral ores. iii) Teacher to lead a discussion on types of ores in Tanzania.	• Wall charts showing the map of Tanzania showing location of metal ores	Does the student know where important ores are found in Tanzania?	2
	b) Compare abundances of metals in the earth's crust.	i) The teacher to guide students to discuss abundances of metals in earth's crust. ii) Students in groups to compare the abundances of different metals in earth's crust.	• Wall chart showing the abundances of different metals.	Is the student able to compare the abundances of different metals in the earths crust?	
8.2 Chemical Properties of Metals	The student should be able to: a) Differentiate the physical and chemical strengths of metals.	i) The teacher to elaborate on that sodium and potassium are very weak physically, but they are among the strongest metals chemically. ii) The teacher and students to demonstrate the reactivity and tensile strength of Ca, Fe and Cu metals.	• Charts showing the reactivity series of metals and another order showing the order of the tensile strength for same metals. Fe, Cu and Ca metals.	Is the student able to differentiate the physical and chemical properties of metals?	4
	b) Compare the reducing power of different metals.	i) Students to write electronic configuration of the common metals to show the stability obtained after losing electrons. ii) The teacher to elaborate that some metals donate electrons more easily than others.	• Periodic Table • Charts • Pb metal • Fe strips • $Mg(NO_3)_2$ • $ZnSO_4$ • $Pb(NO_3)_2$	Is the student able to compare the reducing power of different metals?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
		iii) Teacher and students to derive the meaning of reducing power of a metal.	• $CuSO_4$ • $AgNO_3$ • Magnesium ribbons		
	c) Describe the reactivity series of metals.	i) Teacher to lead a discussion on the reactivity of different metals with water and steam to include K, Na, Ca, Mg, Al, Zn, Fe, Pb, Cu. ii) Students to perform experiments on the reaction of metals and water or steam: Ca, Mg, Al, Zn, Fe, Pb, Cu. iii) The teacher to guide students to predict the products and estimate the violence of a displacement reaction before doing it. iv) The teacher and students to reduce some metal oxides on a charcoal block using blow pipe. iv) Students to find out how dilute HCl or H_2SO_4 reacts with Zn, Fe, Cu.	• Al foil • Zn granules • Fe nails, • Cu foils • Water trough • Fe powder • Flasks • Gas jars • Combustion tubes • Source of heat • CuO • PbO • Charcoal blow pipe • dil HCl • dil. H_2SO_4 • Metals e.g. Mg, Cu, Fe, Ca.	-Is the student able to describe the reactivity series of metals? -Is the student able to establish the position of non-metals (C and H) on the reactivity series?	
8.3 Extraction of Metals by Electrolytic reduction	The student should be able to: a) Outline the criteria for the choice of the best methods of extracting a metal from its ore.	i) The teacher and students to discuss how the reactivity series is used to select the best method for extracting a metal from its ore. ii) Students to outline metals which can be extracted by electrolysis.	• Wall pictures, charts and model showing the reactivity series and different methods of extracting metals.	Can the student outline the criteria for the choice of a method of extraction of a metal from its ore?	4
	b) Explain the extraction of sodium from its ore.	Teacher to guide students to discuss the extraction of sodium metal by Down's Process.	• Wall charts showing the extraction of sodium metal from its ore.	Is the student able to explain the extraction of sodium by Down's process?	
8.4 Extraction of Metals by Chemical Reduction	The student should be able to: Describe the	i) The teacher to guide students to discuss the extraction of iron in the Blast Furnace.	• Wall charts showing the extraction of iron in the Blast furnace.	Can the student explain the extraction of iron from its ore?	4

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	extraction of iron from its ore.	ii) Students to write the important reaction equations taking place in the Blast furnace.			
8.5 Environmental Consideration	The student should be able to: a) Identify the environmental destruction caused by extraction of metals.	i) The teacher to guide students in a study visit ,to the following sites:- Quarries, mineral mines, coal mines. ii) The teacher to lead a discussion on the study visit to include the environmental destruction and their implication	• Land maps showing the location where mining processes is done. • Wall charts, pictures showing environmental destructions caused by mining. • Charts showing implications of environmental destruction.	Can the student identify cases of environmental destruction caused by extraction of metals?	2
	b) Suggest intervention measures to rectify the environmental destruction	i) The teacher and students to discuss the strategies of planting trees in the destroyed areas and filling the pits using solid wastes. ii) Students to plant grass, trees or surfacing the affected areas as their school project.	• Wall charts showing the environmental destructions. • Wall charts and pictures showing environmental reforming.	Is the student able to suggest measures to rectify the environmental destruction caused by metal extractions?	
9.0 COMPOUNDS OF METALS 9.1 Oxides	The student should be able to: a) Prepare oxides of some metals by direct and indirect methods.	i) Teacher to guide students to prepare metal oxides by heating elements calcium and magnesium in air; reacting copper with concentrated HNO_3 and heating the hydroxides and carbonates of magnesium, aluminium, zinc, iron, tin, lead and copper. ii) The teacher to guide students to discuss the results of the experiments in (i) above.	• Calcium, magnesium, copper, nitric acid, hydroxides, carbonates. • Wall charts showing pictures and drawings showing these processes.	Can the student prepare oxides of metals by direct and indirect methods?	4

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	b) Classify metal oxides	i) The students in groups to use guideline/procedures provided by the teacher to test and put metal oxides into groups of soluble, insoluble, basic and amphoteric categories.	• Wall charts and drawings of metal oxides. • Samples of oxides e.g. MgO, Al_2O_3, ZnO, PbO. • Charts showing groups of metal oxides	Can the student test and classify metal oxides?	
	c) Demonstrate the reactions of metal oxides with water and dilute acids.	i) Students to carry out experiments using guidelines/procedure provided by the teacher to find out the reactions of metal oxides with water and with acids. ii) The teacher to guide students to discuss the results of the experiments.	• Oxides of lead, aluminium, Zinc magnesium, calcium, copper and iron. • Dilute HCl, water, litmus paper.	How accurately can the student demonstrate the reactions of metal oxides with water and dilute acids?	
	d) Explain the uses of metal oxides.	Teacher to guide students in groups to discuss the uses of oxides e.g. CaO in preparing CaC_2, lining of furnaces, formation of slag, dry agent, manufacture of mortar, cement and plasters.	• Oxides such as CaO, MgO, ZnO.	Can the student explain the uses metal oxides?	
9.2 Hydroxides	The student should be able to: a) Prepare hydroxides of some metals by direct and indirect methods.	i) Students to prepare the hydroxide of calcium by adding the metal directly in water. ii) Students to prepare insoluble hydroxides by reacting the solutions of NaOH, KOH, with aqueous solution of soluble salts e.g. $CuSO_4$, $Zn(NO_3)_2$, $FeCl_3$. iii) The teacher to guide students to discuss the results of the experiments above and make conclusion.	• Calcium metal • Water • KOH • NaOH • $Zn(NO_3)_2$ • $CuSO_4$ • $FeCl_3$	Can the student prepare the hydroxides of some common metals by direct and indirect methods?	4
	b) Classify metal hydroxides	i) The teacher to guide students to prepare and classify metal hydroxides.	• Chlorides of Fe, Mg, Zn, Cu • NaOH • Test tube • Beakers	How accurately can the student test and classify metal hydroxides into soluble, insoluble and	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
		ii) Students to prepare test and put metal hydroxides into groups of soluble, insoluble and amphoteric categories.	• $Cu(OH)_2$	amphoteric categories?	
	c) Explain the chemical properties of metal hydroxides	i) Using the guidelines students to perform experiments on the chemical properties of some common metal hydroxides. ii) Students to discuss the chemical properties of hydroxides.	• $Cu(OH)_2$ • $Fe(OH)_2$ • NaOH • H_2SO_4 • Beaker	How accurately can the student explain the chemical properties of the common metal hydroxides?	
	d) Describe the uses of metal hydroxides	i) The teacher to guide students to discuss the uses of hydroxides e.g. $Ca(OH)_2$ in agriculture, builders, mortar and plaster, bleaching, softening water and in qualitative analysis. ii) Students in groups to discuss the uses of metal hydroxides in agriculture, builders, bleaching, softening water and qualitative analysis.	• Calcium hydroxide • Water • Wall charts showing uses of metal hydroxides	Can the student describe uses of metal hydroxides?	
9.3 Carbonates and Hydrogen carbonates	The student should be able to: a) Prepare metal carbonates and hydrogen carbonates by different methods.	i) Students to prepare soluble carbonates by passing carbon dioxide to an alkali. ii) Students to prepare a hydrogen carbonate by passing excess of carbon dioxide into lime water. iii) Students to precipitate insoluble carbonates by adding sodium carbonate solution to a solution of a salt of a heavy metal e.g. $CuSO_4$	• Any alkali e.g. NaOH and KOH • Carbon dioxide • Soluble hydroxide e.g. NaOH and carbonates of K, Na. • Aqueous salt of Fe,Cu, Ca, Pb, Mg and Zn.	Can the student prepare metal carbonates and hydrogen carbonates in the laboratory?	4

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
			• Charts showing different methods of preparing carbonates and hydrogen carbonates.		
	b) Classify metal carbonates	i) Students in groups to prepare a table of soluble and insoluble carbonates. ii) Students to present their findings in a panel for discussion.	• A variety of soluble and insoluble carbonates	Can the student classify the metal carbonates into soluble and insoluble categories?	
	c) Analyse the chemical properties of metal carbonates	i) Using guidelines/procedures students to carry out experiments to determine the chemical properties of metal carbonates. ii) The teacher to guide students to differentiate carbonates from hydrogen carbonates.	• $CuCO_3$ • $ZnCO_3$ • $PbCO_3$ • Na_2CO_3 • $NaHCO_3$ • $MgCO_3$	- Can the student explain the chemical properties of metal carbonates? - Can the student differentiate between carbonates and hydrogen carbonates?	
	d) Describe the uses of carbonates and hydrogen carbonates	i) The teacher to guide students to discuss the uses of carbonates and hydrogen carbonates e.g. Na_2CO_3 in the softening of water, manufacture of glass, and in quantitative and qualitative analysis, $NaHCO_3$ in baking and removal of grease.	• Wall charts and pictures showing the uses of carbonates and hydrogen carbonates.	Can the student explain the uses of metal carbonates and hydrogen carbonates in daily life?	
9.4 Nitrates	The student should be able to: a) Prepare metal nitrates.	i) The teacher to demonstrate on the preparation of metal nitrates. ii) Students to prepare metal nitrates by dissolving a metal, a carbonate, an oxide or an alkali in dilute nitric acid and record the results.	• HNO_3, Zn, Mg • An alkali • Carbonates • An oxide.	Can the student prepare metal nitrates by using different methods?	4

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
		iii) The teacher to guide students to discuss on the results obtained above.			
	b) Explain the chemical properties of metal nitrates.	i) Students in groups to carry out an experiment to identify a nitrate from unknown mixtures, in the solid and liquid form. ii) The teacher to lead the students to discuss on the results obtained in (i) above. iii) Students to heat the following nitrates in air and discuss the product: HNO_3, KNO_3, $Pb(NO_3)_2$ and $AgNO_3$.	• $Pb(NO_3)_2$, KNO_3 • $AgNO_3$ • NH_4NO_3 • NaOH • Conc. H_2SO_4 • Zinc granules • Copper sillings • $FeSO_4$	Can the student describe the chemical properties of nitrates of common metals?	
	c) Explain the uses of metal nitrates.	The teacher to lead students to discuss the use of nitrates e.g. antiseptic, photography and fertilizers.	• Wall charts showing the uses of metal nitrates.	Can the student explain uses of metal nitrates?	
9.5 Chlorides	The student should be able to: a) Prepare metal chlorides by direct and indirect methods.	i) Teacher to guide students to prepare insoluble chlorides by adding HCl in an aqueous salt of lead or silver. ii) The teacher to prepare $FeCl_3$, by passing chlorine directly over heated iron. iii) Students to prepare soluble chlorides by mixing dil. HCl with oxides, hydroxides, carbonates and metals.	• $Pb(NO_3)_2$, • $AgNO_3$, • Dil. HCl • Chlorine gas • Fe • Any alkali e.g. NaOH, KOH, NH_4OH and $Ca(OH)_2$ • Metallic oxides e.g. that of Mg, Zn, Fe, Pb, Cu • Evaporating dish.	Can the student prepare metal chlorides by direct and indirect methods?	4
	b) Explain the chemical properties of metal chlorides.	i) Students to perform experiments to identify a chloride in a solid and a liquid mixture. ii) Students to study the effect of heat on chlorides e.g. $MgCl_2.6H_2O$, NH_4Cl	• Conc. H_2SO_4 • Litmus paper • $MgCl_2.6H_2O$ • $AgNO_3$ • NH_4Cl	Can the student explain the properties of metal chlorides correctly?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	c) Explain the uses of metal chlorides	i) The teacher to guide students to discuss the uses of chlorides e.g. uses of NH_4Cl in the manufacture of dry batteries, common salt and $AlCl_3$ in petroleum industry. ii) Students in groups to collect some common materials made from metal chlorides. iii) Students in groups to discuss the uses of metals chlorides using common materials collected.	• Wall charts and pictures showing application of metal chlorides in daily life.	Can the student explain the uses of metal chlorides?	
9.6 Sulphates	The student should be able to: a) Prepare soluble and insoluble sulphates.	i) Students to dissolve a metal, a carbonate, a hydroxide or an oxide in dilute H_2SO_4 and isolate the crystals. ii) Students to prepare insoluble sulphates by adding sulphuric acid in aqueous lead or barium ions.	• CuO • $Zn(OH)_2$ • $ZnCO_3$ • Zinc metal • Dil. H_2SO_4 • $BaCl_2$ or $Ba(NO_3)_2$ • $Pb(NO_3)_2$	Can the student prepare soluble and insoluble sulphates in the laboratory?	4
	b) Explain chemical properties of sulphates	i) Students to perform experiments to identify a sulphate in an aqueous solution. ii) Students to study the effect of heat on sulphates e.g. $FeSO_4$ $Fe_2(SO_4)_3$, $CuSO_4$.	• $BaCl_2$ • HCl • $CuSO_4 . 5H_2O$ • $Fe_2(SO_4)_3$ • $FeSO_4 . 7H_2O$	Can the student explain the properties of metal sulphates correctly?	
	c) Describe uses of sulphates	The teacher and students to discuss the uses of sulphates e.g. $CuSO_4$ in plaster casts, $FeSO_4$ in manufacturing of ink, pigmentation and medicines, $BaSO_4$ as white pigment for paints, alumn in dyes and leather industry.	• Wall charts and pictures showing the uses of sulphates in daily life.	Can the student describe the uses of metal sulphates?	

FORM IV

CLASS OBJECTIVES

By the end of form four, the student should be able to:

a) analyse critically properties of matter and their environmental effects;
b) show understanding of sources of organic compounds, their properties and uses in daily life;
c) use scientific skills to investigate the nature and properties of soil;
d) use knowledge on conservation of soil for maximum utility;
e) understand effects of pollution and remedial measures.

CLASS COMPETENCES

By the end of Form Four Chemistry Course the student should have developed competences in:

a) applying appropriate skills to conserve the environment;
b) investigating the properties of organic compounds and their applications in daily life;
c) determining the nature and properties of soil;
d) analyzing effects of pollution and prevention.

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
1.0 NON-METALS AND THEIR COMPOUNDS 1.1 General Chemical Properties of Non-Metals	The student should be able to: a) Explain the oxidizing properties of non-metals	i) The teacher to guide students to discuss strong and weak oxidants as electron acceptors. ii) Students to write several equations to show how non-metals gain electrons.	• Wall charts and pictures showing some important oxidation reactions of non-metals • Periodic table	Is the student able to explain the oxidizing properties of non-metals as good electron acceptors?	2
	b) Describe the displacement of non-metals by another non-metal from a compound.	i) The teacher to use gaseous chlorine to demonstrate the displacement of either bromine or iodine from their compounds in aqueous solution. ii) The teacher to guide students to discuss the oxidizing properties of chlorine.	• Cl_2 • KI	Is the student able to explain the displacement of a non-metal by another non-metal from a compound?	
1.2 Chlorine	The student should be able to: a) Describe the chemical properties of chlorine	i) The teacher to demonstrate the use of chlorine to decolourize coloured flowers and dyes. ii) The teacher to demonstrate the oxidizing properties of chlorine by passing into SO_2, H_2S and $FeCl_2$ solutions. iii) Teacher to guide students to write equations for the reactions. iv) Teacher to lead students to discuss the poisonous nature of chlorine.	• Coloured flowers • Dyes • Chlorine gas • SO_2 • H_2S • $FeCl_2$	Is the student able to explain the chemical properties of chlorine?	4
	b) Explain the uses of chlorine	The teacher to guide students to discuss uses of chlorine as germicide, disinfectant, bleach, water sterilization, an ingredient in preparation of solvents and in plastic industry.	• Wall charts and pictures showing the poisonous effects of chlorine and its uses.	Is the student able to explain the uses of chlorine?	
1.3 Hydrogen Chloride	The student should be able to: a) Prepare a dry sample of hydrogen chloride gas.	i) The teacher to guide students to prepare HCl gas in the laboratory using Conc. H_2SO_4 and NaCl. ii) Students to prepare HCl gas using Conc. H_2SO_4 and a chloride.	• NaCl • NH4Cl • Conc. H_2SO_4 • HCl	Is the student able to prepare HCl gas?	6

TOPIC/SUB-TOPICS	*SPECIFIC OBJECTIVES*	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	b) Explain the properties of hydrogen chloride gas.	i) Students to test the solubility of HCl gas in water. ii) Students to test the pH of a pure dry sample of HCl using dry and wet litmus papers. iii) Students under the teacher guidance to show how HCl gas reacts with gaseous ammonia. iv) The teacher to guide students to show how aqueous hydrogen chloride reacts with metals, oxides, hydroxides and carbonates.	• H_2O, HCl gas • PH scale • Litmus paper • Ammonia gas • Glass rod • Ca, Mg, Zn, Fe • $CaCO_3$ or any other carbonate, oxides, hydroxides	Is the student able to explain the properties of hydrogen chloride gas?	
	c) Explain the uses of hydrogen chloride	i) The teacher to guide students to discuss the uses of aqueous hydrogen chloride eg. in qualitative and quantitative analysis. ii) Students in groups to discuss the uses of hydrogen chloride gas.	• Wall charts showing the uses of HCl	Is the student able to explain the uses of hydrogen chloride?	
1.4 Sulphur	The student should be able to: a) Describe the extraction of sulphur from natural deposits.	The teacher to guide students to discuss the extraction of sulphur by the Frasch process.	• Wall charts and pictures showing the industrial extraction of sulphur?	Is the student able to explain the extraction of sulphur from natural deposits by the Frasch process?	10
	b) Explain the properties of sulphur.	The teacher and students to discuss the oxidizing and reducing properties of sulphur.	• Sulphur • Copper, iron • Conc. H_2SO_4 • $K_2Cr_2O_7$	Is student able to explain the properties of sulphur?	
	c) Explain the uses of sulphur.	i) The teacher to guide students to discuss the nse of sulphur in rubber industry, manufacture of H_2SO_4, matches, gun powder, germicide, drugs, fertilizers. ii) Students in groups to collect some common materials made from sulphur.	• Wall charts and pictures showing the uses of sulphur?	Is the student able to explain the uses of sulphur?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
1.5 Sulphur dioxide	The student should be able to: a) Describe the properties of sulphur dioxide	The teacher to guide students to discuss the properties of SO_2. i.e. acidic, reducing, bleaching and oxidizing properties.	• SO_2, NaOH , $KMnO_4$, $FeCl_3$, HNO_3, coloured flowers, H_2S, Mg, PbO.	Is the student able to explain the properties of sulphur dioxide?	4
	b) Explain uses and hazards of suphur dioxide	Teacher and student to discuss the uses and hazards of sulphur dioxide.	• Wall charts and pictures on uses and hazards of sulphur dioxide	Is the student able to explain uses and hazards of sulphur dioxide?	
1.6 Sulphuric acid	The student should be able to: a) Describe the Contact Process for the manufacture of sulphuric acid.	The teacher to guide students to use the Le Chatelier's principle to discuss the Contact Process of manufacture of sulphuric acid.	• Wall charts and pictures showing the industrial manufacture of sulphuric acid.	Is the student able to describe the Contact Process for the manufacture of sulphuric acid?	8
	b) Explain the properties of sulphuric acid	i) Students to carry out experiments on the reaction of dilute sulphuric acid with metals, oxides, hydroxides and carbonates. ii) The teacher to demonstrate how concentrated sulphuric acid reacts as a dehydrating agent and a drying agent. iii) The teacher to lead students to discuss the properties of sulphuric acid.	• Mg, MgO • NaOH • Conc. H_2SO_4 • Sugar • $CuSO_4.5H_2O$ • Carbon	Is the student able to explain the properties of sulphuric acid?	
	c) Explain the uses of sulphuric acid.	i) The teacher to guide students to discuss the uses of sulphuric acid including the manufacture of fertilizers, textiles, sulphates, and dyestuffs, in metallurgy, in accumulators in the manufacture of petrochemicals and pigments for paints. ii) Students in groups to discuss the uses of sulphuric acid.	• Fertilizers • Textiles • A sulphate accumulates • Wall charts and pictures showing the uses of sulphuric acid.	Is the student able to explain the uses of sulphuric acid?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
1.7 Nitrogen	The student should be able to: a) Prepare a sample of nitrogen in the laboratory.	i) Students in groups using teacher's guidelines to prepare a sample of nitrogen gas in the laboratory. ii) Students in groups to test the prepared nitrogen gas under the teacher's guidance.	• Gas jar • Copper turnings • Combustion tube • Flasks • Conc. KOH solution • Source of heat	Is the student able to prepare a sample of nitrogen in the laboratory?	4
	b) explain the uses of nitrogen	i) The teacher to guide students to discuss the uses of nitrogen for example in fertilizer and plastic industry in Haber process and the manufacture of nitric acid. ii) Students in groups to discuss the uses of nitrogen.	• Wall charts showing uses of nitrogen.	Is the student able to explain the uses of nitrogen?	
1.8 Ammonia	The student should be able to: a) Prepare a dry sample of ammonia gas in the laboratory.	i) The teacher to demonstrate the preparation of ammonia. ii) Using guidelines, students carry out experiments to prepare ammonia in the laboratory.	• $Ca(OH)_2$ • NH_4Cl • CaO • Litmus paper • Conc. HCl.	To what extent can the student prepare a sample of ammonia gas in the laboratory?	4
	b) Describe the properties of ammonia.	i) The teacher to guide students to discuss the chocking smell and extreme solubility of ammonia in water. ii) The teacher to guide students to react ammonia with HCl, CuO and Oxygen. iii) Students under teacher's guidance to demonstrate the properties of ammonia.	• HCl. • CaO • Oxygen • Ammonia • Litmus papers • Water	Is the student able to describe the properties of ammonia?	
	c) Explain the uses of ammonia	i) The teacher to guide students to discuss how ammonia is converted to fertilizers and to nitric acid. ii) Students in groups to discuss the uses of ammonia.	• Wall charts and pictures on industrial preparation of fertilizers.	Can the student explain the uses of ammonia?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
1.9 Carbon	The student should be able to: a) Name the forms in which carbon exists.	i) The teacher to guide students to discuss the presence of carbon in CO_2, carbonates, shells, diamond, graphite and coal. ii) Students under teacher's guidance to discuss the forms in which carbon appears.	• Egg shells • A carbonate • Pictures of diamond, coal and graphite.	Is the student able to explain the forms in which carbon occurs in nature?	4
	b) Describe the allotropic forms of carbon	i) The teacher to lead students to discuss the differences and similarities in the physical properties of carbon allotropes. ii) Students to discuss the uses of the carbon allotropes.	• Wall charts and pictures showing the allotropes of carbon.	Can the student describe the allotropic forms of carbon?	
1.10 Carbon dioxide	The student should be able to: a) Prepare a dry sample of carbon dioxide gas in the laboratory.	i) The teacher to guide students to prepare carbon dioxide in the laboratory. ii) Students to prepare carbon dioxide by adding dilute acids on marble or any carbonate.	• $CaCO_3$ • HCl • Delivery tubes • Flasks • Gas jars • Limestone	Is the student able to prepare a dry sample of carbon dioxide gas in the laboratory?	4
	b) Analyse the properties of carbon dioxide.	i) Students to test and observe the physical properties of carbon dioxide. ii) Students to carry out the specific test for carbon dioxide with aqueous calcium hydroxide or barium hydroxide. iii) Students to find out how carbon dioxide reacts with NaOH, $CaCO_3$, $Ca(OH)_2$; magnesium and water.	• Carbon dioxide • Lime water, $Ca(OH)_2$ • $Ba(OH)_2$ • $CaCO_3$ • Water • Magnesium	- Can the student explain the properties of carbon dioxide gas? - Can the student carry out the specific test for carbon dioxide gas?	
	c) Explain the uses of carbon dioxide.	i) Students in groups to discuss the uses of carbon dioxide (in fire extinguishers, in mineral water, in fizzy drinks, dry ice, beer and soda).	• Fire extinguishers • Fizzy drinks • Mineral water • Baking powder • Dry ice • Soda	Is the student able to explain the uses of carbon dioxide?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
2.0 ORGANIC CHEMISTRY 2.1 Introduction to organic chemistry	The student should be able to: a) Distinguish organic from inorganic chemistry.	i) The teacher to guide students to discuss the meaning of organic chemistry and compare organic and inorganic substances. ii) Students to suggest substances which are of organic and inorganic origin.	• Wall charts and pictures of organic compounds • Samples of organic compounds • Samples of inorganic compounds	- Can the students differentiate organic from inorganic chemistry? - To what extent can the student identify organic compounds?	4
	b) Explain the importance of organic chemistry in life.	i) The teacher to lead students to discuss the importance of organic chemistry in our lives and the nature as a whole. ii) Students to discuss the importance of organic compounds. iii) Students to describe various processes where organic compounds are put into use.	• Samples of organic compounds • Wall charts and pictures of organic compounds • Wall charts and pictures showing processes that involve organic compounds and their importance.	Can the student describe the importance of organic chemistry in life?	
	c) Explain the origin of organic compounds.	i) The teacher to guide students to relate organic compounds with prehistoric system (coal petroleum, natural gas) and present living system (plants and animals). ii) The teacher to lead students to discuss the ever increasing number of synthetic organic compounds and materials made in laboratories and factories.	• Synthetic organic compounds • Wall charts and pictures of coal petroleun and natural mines.	Can the student trace the origins of organic compounds from prehistoric systems to the present living systems?	
	d) Describe the fractional distillation of crude oil.	i) Teacher to guide students to discuss how crude oil is refined into different fractions. ii) Students to discuss the uses of the large fractions of crude oil.	• Wall picture showing fractional distillation of crude oil and fractions of the distillation.	- To what extent can the student describe industrial distillation of crude oil?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
2.2 Hydrocarbons	The student should be able to: a) Classify the three families of hydrocarbons: (alkanes, alkenes and alkynes).	i) The teacher to lead students to discuss the meaning of hydrocarbons. ii) The teacher to lead students to discuss the structure of hydrocarbons and classify them into three families i.e. alkanes, alkenes and alkynes.	• Wall picture showing classification of hydrocarbons. • Models of carbon and hydrogen atoms. • Models of lower hydrocarbons.	Can the student identify the three families of hydrocarbons?	10
	b) Write the homologous series of the three families of hydrocarbons.	The teacher to guide students to write the condensed and open structures of the first five members of the homologues series of alkanes, alkenes and alkynes.	• Wall charts and pictures showing open and condensed structures of hydrocarbons • Models.	Can the student write the homologous series of alkanes alkenes and alkynes up to five carbon atoms?	
	c) explain the concept of isomerism	Teacher to guide students to use models, open and condensed structures of alkanes alkenes and alkynes to discuss the concept of isomerism.	• Wall charts, picture and models illustrating isomerism	Can the student explain the concept of isomerism?	
	d) Write structural formulae of all isomers of hydrocarbons up to five carbon atoms.	i) Students to write structures of all isomers of alkanes, alkenes and alkynes up to five carbon atoms. ii) Teacher to guide students to discuss the structural formulae of the isomers of the lower hydrocarbons.	• Manila sheets and magic markers • Wall charts and pictures showing structures of different isomers of lower hydrocarbons • Models.	Can the student write open structural formulae of all the isomers of alkanes alkenes and alkynes up to five carbon atoms?	
	e) Name the isomers of hydrocarbons up to 5 carbon atoms.	i) The teacher to guide students to discuss the rules of naming isomers of hydrocarbons. ii) Students using the rules given to write the names of all the isomers of alkanes, alkenes and alkynes up to five carbons atoms.	• Wall charts showing the nomenclature of different isomers of alkanes alkenes and alkynes up to 5 carbon atoms • Models of different isomers. • Wall charts for rules of naming hydrocarbons.	Can the student name the isomers of hydrocarbons up to 5 carbon atoms?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	f) Apply a general formula to identify the families of hydrocarbons.	Students to use the general formulae: i) C_nH_{2n+2}, C_nH_{2n} and C_nH_{2n-2} to identify alkanes, alkenes and alkynes respectively. ii) Students to use the general formulae to write various molecular formulae of alkanes, alkenes and alkynes.	• Wall charts and pictures • Models.	Can the student use the general formulae to identify alkanes, alkenes and alkynes?	
2.3 Properties of hydrocarbons	The student should be able to: a) Explain the physical properties of lower hydrocarbons; alkanes, alkenes and alkynes.	i) The teacher to guide students to discuss physical properties of hydrocarbons to include: density, melting point, boiling point and state at room temperature.	• Wall charts showing the physical properties of lower hydrocarbons • Models.	Can the student describe the physical properties of lower alkanes, alkenes and alkynes?	8
	b) Explain the concept of saturated and unsaturated hydrocarbons.	i) Using models, pictures and charts, teacher to guide students to discuss the concept of saturation and unsaturation in hydrocarbons. ii) Students to prepare models and drawings illustrating saturated and unsaturated hydrocarbons.	Models and charts showing the saturated and unsaturated hydrocarbons.	Can the student explain the meaning of saturation in alkanes and unsaturation in alkenes and alkynes?	
	c) Compare the chemical properties of lower alkanes, alkenes and alkynes.	i) Using appropriate reagents for example Br_2/Cl_2 water, $KMnO_4$ solution, the teacher to demonstrate the saturation nature of alkanes and unsaturation nature of alkenes and alkynes. ii) The teacher and students discuss how methane reacts with oxygen and chlorine.	• Br_2Cl_2 water • $KMnO_4$ solution • Wall charts showing the chemical properties of hydrocarbons.	- Can the student compare the chemical properties of lower alkanes alkenes and alkynes?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
		iii) The teacher to lead a discussion on how ethane reacts with oxygen, hydrogen, halogens, hydrogen halides and sulphuric acid.		Can the student explain the difference in properties between saturated and unsaturated hydrocarbons?	
2.4 Alcohols	The student should be able to: a) Prepare ethanol in the laboratory	i) Teacher to lead discussion on the preparation of ethanol in the laboratory. ii) Students to prepare ethanol by fermentation of a mixture of yeast and sugar in the right temperature.	• Glucose or sugar • Water • Yeast.	-Can the student prepare ethanol in the laboratory?	
	b) Write the homology of alcohols up to five carbon atoms.	i) Teacher to lead discussion on the general formula $C_nH_{2n+1}OH$. ii) Students to write the structures of members of alcohol series using the general formula $C_nH_{2n+1}OH$ up to 5 carbon atoms.	• Large hard papers • Magic markers • Models.	Can the student write the homologous series of alcohols up to five carbon atoms?	
	c) Write the structures of all isomers of saturated alcohols up to five carbon atoms.	Students to practice the writing of open and condensed structures of the isomers of alcohols up to five carbon atoms.	• Models • Wall charts showing open structures of alcohols	Can the student write the structures of all isomers of alcohols up to five carbon atoms?	
	d) Name all the isomers of alcohols up to five carbon atoms.	i) The teacher to lead a discussion on systematic nomenclature of alcohols. ii) Students to use rules of systematic nomenclature to name all the isomers of alcohols up to five carbon atoms.	• Wall charts and pictures • Models • Large hard paper • Magic markers	Can the student name isomers of alcohols up to five carbon atoms?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	f) Describe the properties of alcohols.	Teacher to guide students to find out how ethanol reacts with: Oxygen, sodium metal, ethanoic acid and concentrated sulphuric acid.	Wall charts showing the properties of alcohols	Can the student explain the properties of alcohols?	
	g) Explain uses of alcohols.	Students to discuss different uses of alcohols	• Wall charts, pictures and real types of alcohols	Can the student explain different uses of alcohols?	
	h) Explain the harmful effects of alcohols.	i) Teacher to guide students to find out health problems associated with alcohol drinking such as alcoholism (alcohol addiction). ii) Students to dramatize on health problems associated with alcoholism. iii) Students to conduct plenary presentations on health problems associated with alcohol drinking. iv) Students to prepare wall charts and pictures showing alcohol addicts. v) Teacher to invite a guest speaker to talk on the effects of alcohols and problems associated with alcoholism.	• Wall charts and pictures showing alcohol addicts • Pictures showing different types of alcohols. • Charts showing problems associated with alcohols.	Can the student explain the harmful effects of alcohols?	
2.5 Carboxylic Acids	The student should be able to: a) Identify natural sources of organic acids.	i) Teacher to guide students to find out sources of organic acids like milk, citrus fruits and other fruits and vinegar. ii) Students to demonstrate the acidic nature of natural substances.	• Milk • Citrus fruits • Vinegar	Can the student identify natural sources of organic acids?	5
	b) Explain the oxidation of ethanol to ethanoic acid.	i) Teacher to guide students to find out what happens to different types of alcohols including local brews when exposed to air. ii) Students to allow atmospheric oxidation of wine to form ethanoic acid. iii) Teacher to lead a discussion on the oxidation of ethanol to ethanoic acid.	• Local brews • Wine • Ethanoic acid • Litmus papers	Can the student explain the oxidation of alcohols to acids?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	c) write the structures of the homologues of carboxylic acids up to five carbon atoms.	Students to write the open and condensed structures of the carboxylic acid, homologues, using the general formula $C_n H_{2n+1} COOH$.	• Wall charts and pictures showing various structures of carboxylic acids • Model • Manila sheets	Can the student write the structures of homologues of carboxylic acids up to five carbon atoms?	
	d) name the isomers of carboxylic acids up to five carbon atoms.	i) The teacher to lead a discussion on the principles of naming carboxylic acids. ii) Students to write open structures and systematic names of all isomers of carboxylic acids up to five carbon atoms.	• Wall charts showing open structures of carboxylic acids • Models of structures of carboxylic acids.	Can the student write the names of all the isomers of carboxylic acids up to five carbon atoms?	
	e) explain the properties of carboxylic acids	i) The teacher to lead students to discuss the reactions of ethanoic acid with ethanol and NaOH. ii) Students to carry out experiments to demonstrate the reaction of ethanoic acid with hydroxides and alcohols.	• NaOH • Na_2CO_3 • $NaHCO_3$ • Ethanoic acid • Ethanol	Can the student explain the properties of carboxylic acids?	
	f) Prepare soap from animal fats or vegetable oil.	i) Teacher to guide students to prepare soap by boiling a mixture of NaOH and oil, isolate the soap, dry it and use it in washing. ii) Teacher and students to discuss the mechanism of soap formation.	• Oil, fat, NaOH, manila sheets, magic markers • Wall charts and pictures showing industrial process of manufacturing soap.	Can the student prepare soap from animal fat or vegetable oil?	
3.0 SOIL CHEMISTRY 3.1 Soil Formation	The student should be able to: a) Describe soil formation.	The teacher to guide students to discuss the process soil formation.	• Soil sample • Chart showing flow diagram of soil formation	Can the student explain how soil is formed?	6
	b) Describe the factors influencing soil formation	i) The teacher and students to brainstorm on the chemical and climatic factors which influence soil formation. ii) Students to demonstrate the dissolution of marble in dilute acid as an example of how soil is formed.	• Soil samples of different types • Marble • Dilute acid	Can the student explain factors influencing soil formation?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
3.2 Soil Reaction	The student should be able to: a) Explain the concept of soil reaction.	i) The teacher to guide students to discuss the natural and artificial causes of soil acidity. ii) Students in groups to discuss the soil P^H.	• P^H meter • Samples of soil from different places • Soil P^H kit	How precisely can the student explain soil reaction, its causes and effects to plant growth?	8
	b) Measure the pH of a given soil sample.	i) The teacher to give guidelines to students on how to measure the P^H of soil sample collected from the school garden using a soil P^H kit. ii) Students to use a soil P^H kit to measure the P^H of a soil sample collected.	• Soil P^H kit • Universal indicator • Soil sample	Can the student measure the P^H of a soil sample?	
	c) Manage the soil pH by using different liming materials.	i) The teacher to assist students to choose liming materials among the following: CaO, wood ash, $MgCO_3$, $Ca(OH)_2$. ii) Students under teachers guidance to manage the soil P^H by using different liming materials.	• Wood ash • $MgCO_3$ • $Ca(OH)_2$. • Wall charts and pictures of liming materials	Can the student manage the soil P^H by using different liming materials?	
3.3 Plant nutrients in the soil	The student should be able to: a) Categorize the essential plant nutrients.	i) The teacher to guide students to consider the following list of elements as the essential nutrient elements of plants: C, H, O, N, P, K, S, Ca, Zn, Mo, Cl and Co. ii) Students to categorize macro elements as N, P, K, Ca, Mg, and S, while the rest of the essential elements remain as microelements.	• Wall charts showing the categories of soil nutrients.	Can the student categorize micro and macro plant nutrients?	4
	b) Explain the functions of each of the primary macronutrients in plant growth.	i) The teacher to guide students to discuss the functions of each of the primary macro nutrients (N, P and K) in plant growth. ii) Students to discuss the effects of the deficiency of each of the primary macronutrients.	• Different types of plants • Wall charts • Plants with nutrient deficiencies.	Can the student explain the functions of each of the primary macronutrient elements (N, P,K)?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	c) Prepare plant nutrient cultures in the laboratory.	i) The teacher to guide students to prepare complete nutrient cultures and grow plants in them. ii) The teacher to prepare nutrient cultures in which one nutrient is missing. iii) Students to discuss the effects of the missing elements to plant growth.	• Nutrient cultures • Wall charts and pictures showing the nutrient cultures • Pictures showing plants growing in different cultures.	Can the student prepare nutrient cultures in the laboratory?	
	d) Manage the loss of plant nutrients from the soil.	The teacher to assist students to discuss the prevention of nutrients loss from the soil when the following methods are applied: prevention of soil erosion, leaching, crop rotation and good harvesting practices.	• Nutrient cultures • A farm affected by soil erosion • Wall charts and pictures • Pictures showing overgrazing cattle.	-Is the student able to manage the loss of plant nutrients? -Can the student prevent practices which lead to soil erosion or atiy other soil damage?	
3.4 Manures and fertilizers	The student should be able to: a) Prepare heap and pit compost manure.	i) The teacher to guide students to prepare compost manures by different ways. ii) Students to prepare and use compost manure in the school garden.	• Pit compost manure • Vegetable leaves • Ash • Heap compost manures.	Is the student able to prepare heap and pit compost manure?	6
	b) Explain the advantages and disadvantages of natural manures.	i) The teacher to facilitate students to discuss the advantages and disadvantages of natural manures. ii) Students to apply compost and animal manures on different plant plots and observe the differences on plant growth.	• Pit manures • Animal manures • Wall charts and pictures showing the application of manures on a farm.	Is the student able to explain advantages and disadvantages of natural manures?	
	c) Mention types of synthetic fertilizers used in Tanzania.	Teacher to lead students in groups to discuss the types of artificial fertilizers used in different parts of Tanzania.	• Samples of fertilizers; NPK, MSP, DSP, TSP, Urea, CAN, super phosphate. • Wall charts and pictures of artificial fertilizers.	Can the student mention types of synthetic fertilizers used in Tanzania?	

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	d) Explain the concept of fertilizer grades and analysis.	i) The teacher to guide a class discussion and make clarification on fertilizer grades and analysis as it appears on the labels of fertilizer bags. ii) Students in groups to discuss the fertilizer grades and analysis.	• Fertilizer bags.	Is the student able to explain fertilizer grades and analysis?	
	e) Identify methods of fertilizer application	i) The teacher to assist students to identify methods of fertilizer application including: broadcasting, top-dressing and side dressing. ii) Students to practice differetit methods of fertilizer application.	• Farm plot • Fertilizers • Wall charts and pictures showing the application of fertilizers.	Can the student describe different methods of fertilizer application?	
	f) Explain the advantages and disadvantages of artificial fertilizers as compared to natural manures.	i) The teacher to guide students to discuss the advantages and disadvantages of artificial fertilizers as compared to manures. ii) Students to apply manures and fertilizers to two different plant plots and observe the difference in plant growth.	• Plant plots • Fertilizers • Manures	Is the student able to explain advantages and disadvantages of artificial fertilizers as compares to manures?	
3.5 Soil fertility and productivity	The student should be able to: a) Explain the concept of soil fertility and soil productivity.	i) The teacher to guide students in groups to discuss the concept of soil fertility and productivity. ii) Students in groups to discuss the concept of soil fertility and soil productivity.	• A farm plot with fertile soil and the other with unfertile soil.	Is the student able to explain the fertility and productivity of soil?	6
	b) Differentiate soil fertility from soil productivity.	Students in groups to discuss the differences between soil fertility and soil productivity.	• Wall charts and pictures showing the difference between fertile and productive soils	Can the student differeutiate soil fertility from soil productivity?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	c) Explain the factors which determine fertility and productivity of the soil.	The teacher to guide students to discuss the following factors which determine fertility and productivity of the soil: mineral and organic matter content, drainage, water table, climate, soil depth, soil texture and structure and soil P^H.	• Areas with fertile soils and others with unfertile soils. • Samples of fertile soil. • Samples of unfertile soil.	Can the student explain factors which determine fertility and productivity of soil?	
	d) Explain the causes of loss in soil fertility.	i) Teacher to guide students to discuss causes of loss in soil fertility. ii) The teacher to assign projects to students to find the causes of loss of soil fertility.	• A farm plot • A project outline.	Is the student able to explain causes of loss of soil fertility.	
4.0 POLLUTION 4.1 Concept of Pollution	The student should be able to explain the concept of pollution.	i) Teacher to guide students to discuss the meaning of pollution. ii) Students to discuss and give examples of pollution in real life situations.	• Wall charts and pictures showing examples of pollution.	Can the student explain the concept of pollution?	2
4.2 Terrestrial Pollution	The student should be able to: a) Explain the concept of terrestrial pollution.	Teacher to lead a discussion on the meaning and examples of terrestrial pollution	• Wall charts and pictures of terrestrial pollution.	Can the student explain the meaning of terrestrial pollution?	4
	b) Identify human activities which cause terrestrial pollution.	i) Teacher to guide students to discuss how the environment is destroyed by careless dumping of: • Rotting garbage, • Non-biodegradable plastic bags and containers, • Bottles and other types of glassware • Toxic chemicals used in farms,	• Field visit to actual sites where solid wastes are found. • Wall charts and pictures of areas with solid wastes and damps.	Can the student identify human activities which cause terrestrial pollution?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
		ii) Students in groups to discuss activities which cause terrestrial pollution.	• Video tapes showing different activities causing terrestrial pollution.		
	c) Identify hazards caused by terrestrial pollution.	i) Students to discuss diseases and accidents likely to occur in a polluted environment. ii) The teacher to organize visits to areas where urban solid wastes are damped.	• Wall charts and pictures illustrating diseases and accidents likely to occur in a polluted environment.	Can the student identify hazards caused by terrestrial pollution?	
	d) Suggest different methods of preventing terrestrial pollution.	i) Students to suggest laws which should be enacted to curb terrestrial pollution. ii) The teacher to guide students to discuss the modern techniques of recycling solid materials.	• Wall charts and pictures showing different methods used to treat wastes in the environment.	Can the student suggest methods of preventing terrestrial pollution?	
4.3 Aquatic Pollution	The student should be able to: a) Explain the concept of aquatic pollution.	i) Teacher to guide students to discuss the meaning of aquatic pollution. ii) Students to discuss examples of aquatic pollution.	• Wall charts and pictures about aquatic pollution.	Can the student explain the meaning of aquatic pollution?	4
	b) Identify human activities which cause water pollution.	i) Teacher to organize field visits to factories and industries to study how they deal with their liquid effluents. ii) Teacher to guide students to identify cases where water pollution from industrial effluents has caused death to aquatic flora and fauna. iii) Students to discuss how to stop aquatic pollution.	• Pictures of factories and industries • Wall charts and pictures showing how industries cause water pollution • Wall charts, drawings and pictures showing other causes of water pollution other then industrial effluents.	Can the student identify human activities which cause water pollution?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	c) Identify the hazards which are caused by water pollution.	i) Teacher to guide students to identify and discuss the effect of fertilizers and other agroehemicals on nearby rivers or lakes. ii) Students to discuss the effects of dumping raw sewage into nearby waters iii) Students to discuss the effect of bathing or washing clothes in a stream or river.	• Wall charts and pictures showing effects of water pollution.	Can the student identify hazards caused by water pollution?	
	d) Suggest ways of preventing water pollution.	i) The teacher to guide students to suggest laws which should be enacted to curb water pollution. ii) Students to discuss how liquid effluent and sewage should be treated before emptying into waters.	• Wall charts and pictures showing ways used to treat wastes before emptying into waters.	Can the student suggest ways of preventing water pollution?	
4.4 Aerial Pollution	The student should be able to: a) Explain aerial pollution.	The teacher to guide students to discuss the meaning of aerial pollution and examples of aerial pollution in real life situations.	• Wall charts and pictures describing aerial pollution.	Can the student explain the meaning of aerial pollution?	4
	b) Identify human activities which cause aerial pollution.	i) The teacher to organize for students to visit factories and industries to study how they deal with their gaseous effluents. ii) The teacher to lead a discussion on industrial air pollutants e.g. heavy smoke, SO_2, NO_2, H_2S, NO_2 and CO_2.	• Wall charts and pictures of: - Factories, - Industries - Garages.	Can the student identify activities which cause air pollution?	
	c) Identify the hazards caused by aerial pollution.	i) Students to do group discussions on health hazards caused by air pollution (lung and skin diseases, eye problems etc). ii) The teacher to make clarifications and lead discussions on other hazards including: - destruction of buildings and stone statues. - formation of acid rain.	• Pictures of: - stone statues - large buildings - destroyed forests - destroyed ponds	Is the student able to explain the hazards caused by gaseous pollutants?	

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	d) Suggest different methods of preventing air pollution.	i) Teacher and students to make a visit to factories which produce gaseous pollutants. ii) Teacher and students to discuss effective methods of curtailing the production of gaseous pollutants.	• Pictures of factories emitting gases and smoke into their air.	Is the student able to suggest effective methods of preventing aerial pollution?	
	e) Identify safety measures to protect industrial workers from gaseous pollution.	Teacher and students to discuss laws which can be used to enforce protection of industrial workers from gaseous pollution while at work.	• Pictures of workers in a chemical factory.	Can the student suggest effective measures of preventing factory workers from gaseous pollutants?	
4.5 Environmental Conservation	The student should be able to: a) Explain the meaning of environmental conservation.	i) Teacher and students to discuss the meaning of environmental conservation. ii) Students to differentiate environmental conservation from environmental protection.	Pictures of • a destroyed land e.g. - gulley - burned forest - solid waste on land. • Conserved land • Protected land	Can the student explain the meaning of environmental conservation?	4
	b) Demonstrate right attitudes, values and behaviours towards environmental conservation.	Teacher to lead students to do the following activities: i) Planting flowers and trees, ii) Clean the environment. iii) Other several activities to conserve the environment.	• Pictures of students cleaning the environment.	To what extent does the student manifest acceptable attitudes, values and behaviours towards environmental conservation?	

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4.6 Global Warming	The student should be able to: a) Explain global warming, in terms of the 'green house' effect.	The teacher and students to discuss the meaning of: - global warming - greenhouse effect.	• Pictures to illustrate the greenhouse effect.	Is the student able to explain the meaning of - global warming - greenhouse effect	4
	b) Describe how the major "greenhouse" gases are produced.	Teacher and students to discuss how the following greenhouse gases are produced in life: -CO_2 -NO_2 -CH_4 -SO_2	• Pictures of factories which produce the greenhouse gases.	Can the student describe the processes of producing greenhouse gases?	
	c) Describe climatic conditions caused by global warming?	Teacher and students to discuss how the following climatic conditions can be caused by global warming: - melting of polar ice and mountain glaciers; - submerging of islands and costlines; - formation of hurricanes and typhoons; - expansion of deserts; - flooding.	• Pictures of hurricanes, glaciers, deserts floods.	Can the student describe climatic effects of the global warming?	
	d) Suggest ways of preventing global warming.	Teacher and students to discuss how to stop the production of greenhouse gases which cause global warming.	• Pictures of hurricanes, glaciers, deserts floods.	Is the student able to suggest ways of controlling global warming?	
4.7 Ozone Layer Destruction	The student should be able to: a) Explain ozone layer and its importance to life on earth.	Teacher and students to discuss the meaning and significance of the ozone layer in relation to life on earth.	• Wall charts showing the formation of a hole in the ozone layer.	Can the student explain the meaning of the ozone layer, and what happens when it is destroyed?	4

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
	b) Identify chemical substances which destroy the ozone layer.	Teacher and students to discuss how the following substances destroy the ozone layer: - aerosols - chlorofluorocarbons	• Pictures of containers of aerosols	Can the student identify the substances which are capable of destroying the ozone layer?	
	c) Suggest methods of protecting the ozone layer.	Teacher and students to discuss the possible methods of protecting the ozone layer, e.g. - using alternative chemicals to aerosols. - using alternative ozone-friendly refrigerants.	• Pictures and charts showing ozone layer destruction.	Can the student suggest alternative methods to replace aerosols and refrigerants?	
5.0 QUALITATIVE ANALYSIS 5.1 The Concept of Qualitative Analysis	The student should be able to: a) Explain the meaning of qualitative analysis.	Teacher and students to discuss the meaning of qualitative analysis.	• Qualitative analysis reagents • Apparatus for qualitative analysis. • Qualitative analysis sheets	Is the student able to explain the meaning of qualitative analysis?	4
	b) State the importance of qualitative analysis in real life.	Teacher and students to discuss the use of qualitative analysis in finding out: poisonous substances in the environment; ions present in a chemical substance; the nature of gases produced in a chemical reaction; the nature and identification of chemical substances, and the P^H of a soil sample.	• Wall chart • Picture of a student doing qualitative analysis experiments.	Can the student explain the importance of qualitative analysis in real life?	
5.2 Qualitative Analysis Procedures	The student should be able to: a) Use special apparatus for qualitative analysis.	Teacher to guide students to practice the use of special apparatus for qualitative analysis.	• Test tube rack • Centrifuge, low speed and high speed varieties • Test-tube holder • Heat source • Small test tubes • Charcoal block • Platinum wire • Blow pipe	Can the student carry out qualitative analysis using the specialized apparatus?	16

TOPIC/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING/LEARNING STRATEGIES	TEACHING/LEARNING RESOURCES	ASSESSMENT	PERIODS
			• Filter paper • Filter funnel • Wash bottle • Crucible and lid • Evaporating basin • Watch glass		
	b) Carry out preliminary tests on an unknown sample.	Teacher to guide students to carry out the following preliminary tests: direct observation on the colour and texture of a solid sample; effects of warming and strong heating of the solid sample; action of concentrated sulphuric acid on a solid sample; flame test, and action of dil. HCl.	• Coc. H_2SO_4 • Dil HCl • Litmus papers.	Is the student able to carry out preliminary tests on an unknown salt sample?	
	c) Prepare stock solutions from soluble and insoluble salts	Teacher to lead students to prepare stock solutions using: - distilled water - dilute hydrochloric acid - dil. HNO_3	• dilute HCl • Solid hydrogen carbonate • Solid carbonates • Solid sulphates • Solid chlorides • Solid nitrates • Ammonium compounds • Distilled water.	Is the student able to prepare stock solutions from soluble and insoluble salts?	
	d) Precipitate insoluble salts from their solutions	i) Students to carry out experiments to precipitate the following ions form their solutions: Cu^{2+} Fe^{2+} Fe^{3+} Ca^{2+} Pb^{2+} Zn^{2+}	• dilute NaOH • dilute ammonia solution • potassium iodide • Potassium hexacynoferrate (II) • Potassium hexacynoferrate (III) • Lead nitrate • Concentrated ammonia solution.	Can the student carry out experiments to identify soluble ions in solutions by precipitation?	

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	e) Confirm the cations and anions identified	Students to carry out confirmatory tests on the identified ions	• Nesslers reagent • NaOH • Dil. HCl • Ammonia solution • Potassium chromate • Potassium hexacyanoferrate (II) • Potassium hexacynoferrate (III) • Ammonium oxalate • $MgSO_4$ • Barium chloride.	Is the student able to confirm cations and anions in a sample salt?	