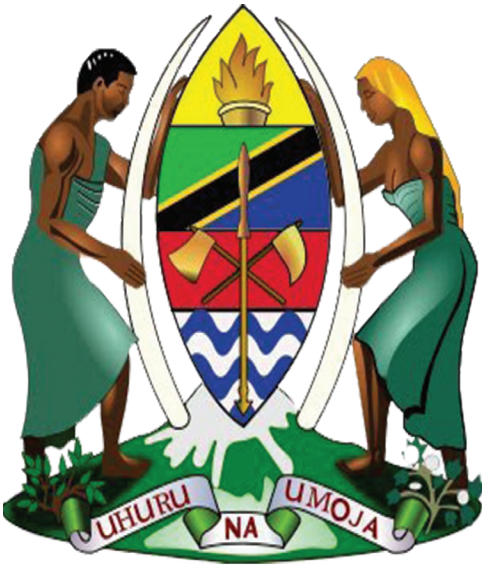
THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY



CHEMISTRY SYLLABUS FOR SECONDARY EDUCATION

FORM I – IV

THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

CHEMISTRY SYLLABUS FOR SECONDARY EDUCATION

FORM I – IV

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1.0 Introduction

This syllabus is a revised version which has been prepared to replace that of 1997 which has phased out. The revision process focused on change in paradigm from that of content based to competence based curriculum. Moreover, the revision was inevitable due to the fact that the1997 syllabus did not sufficiently consider the current social, cultural, global, technological, subject biases and cross cutting issues taking place worldwide but particularly in Tanzanian Society.

In addition, the revision has also taken into consideration the requirements for the Secondary Education Development Plan (SEDP). This syllabus has been introduced for implementation from January 2007.

2.0 Aims and Objectives of Education in Tanzania

The general aims and objectives of education in Tanzania are to:

a) 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) promote the acquisition and appreciation of the culture, customs and traditions of the peoples of Tanzania;

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

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

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

h) ciples of national ethic and integrity, national and international cooperation, peace and justice through the study, understanding and adherence to provisions of the national constitution and other international basic charters.

i) enable a rational use, management and conservation of the environment.

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:

a) consolidate and broaden the scope of baseline ideas, knowledge, skills and attitudes acquired and developed at the primary education level;
b) enhance further development and appreciation of national unity, identity and ethic, personal integrity, respect for and readiness to work, human rights, cultural and moral values, customs, traditions and civic responsibilities and obligations;
c) promote the development of competency in linguistic ability and effective use of communication skills in Kiswahili and at least one foreign language;
d) provide opportunities for the acquisition of knowledge, skills, attitudes and understanding in prescribed or selected fields of study;
e) prepare students for tertiary and higher education, vocational, technical and professional training;
f) 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;
g) prepare the students to join the world of work.

4.0 General Subject Competences

By the end of the four years course, the student should have ability to:

a) develop knowledge in Chemistry by doing various activities and experiments;
b) apply chemical symbols, formulae and equations to communicate in Chemistry;
c) apply Chemistry knowledge skills and principles to solve daily life problems;
d) using science and technological skills in conserving and making sustainable use of the environment.

5.0 General Subject 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 the application of scientific principles and knowledge in exploitation of natural resources with conservation of 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:

a) General competences for the whole course.
b) Competences for each level i.e. Form One to Form Four.
c) Suggested areas for assessment.
d) 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 during 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

Number of periods is an estimated time to be used to teach a given topic/sub-topic. Each period is 40 minutes. The numbers of periods have been taken into account the time needed to adequately cover the sub-topic. Some topics need more time than others depending on the nature and weight of the topic. The teacher is advised to make maximum use of time allocated in classroom instruction. Lost instructional time should always be compensated for.

DECLARATION

Ordinary level secondary education is a four year course which has been designed to prepare students for the advanced level or other tertiary education. A student will be recognized as a form four graduate when he/she successfully completes and passes secondary education examinations conducted by the National Examination Council of Tanzania.

*This document is hereby declared as the **Syllabus of Chemistry** subject for ordinary secondary education course.*

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FORM ONE

CLASS LEVEL COMPETENCES

Student should have the ability to:

1. use Chemistry skills and knowledge in daily life;
2. work safely in a Chemistry laboratory;
3. design and carrying out simple Chemistry experiments;
4. apply the Scientific Procedure to carry out investigations in Chemistry;
5. use various Chemistry apparatus properly to perform different activities and experiments;
6. apply different methods to separate mixtures into pure components; and
7. deal with nature and properties of matter.

CLASS LEVEL OBJECTIVES

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

a) explain the importance of Chemistry in daily life;
b) carry out Chemistry activities safely and efficiently;
c) use various laboratory apparatus;
d) explain the nature and properties of matter;
e) separate various mixtures using variety of methods;
f) differentiate physical from chemical changes of matter; and
g) use scientific procedures in carrying out investigations.

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.0 INTRODUCTION TO CHEMISTRY 1.1 The Concept of Chemistry	A student should be able to: a) explain the concept of Chemistry.	i) A teacher to guide students to brainstorm the meaning of Chemistry. ii) Students in groups 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 and objects made by application of Chemistry.	i) The 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. ii) Students to name the substances made by applying Chemistry.	Detergents, soft drinks, fertilizers, medicines, plastics, spirits, wines, toothpaste, shoe polish, table salt, cement, baking powder, yeast, fuel and cosmetics	Is the student able to mention material and objects made by the application of Chemistry?	
1.2 The Importance of Chemistry in Life	A student should be able to: a) mention areas where Chemistry is applied.	i) 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	Is the student able to mention areas where Chemistry is applied?	2

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students in groups to discuss how Chemistry is applied in industry and at home.	• Picture of a domestic kitchen		
	b) state the importance of Chemistry in daily life.	i) The 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. ii) Students in groups to discuss and state the importance of Chemistry in daily life.	• Fertilizers • Insecticides • Soft drinks • Alcohols • 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	A student should be able to: a) state laboratory rules.	i) The teacher to guide students to discuss every laboratory rule and establish its importance. ii) Students to prepare a list of ten safety rules in a Chemistry laboratory.	• Chemistry Laboratory manuals • Wall charts with written laboratory rules •	Is the student able to state chemistry laboratory rules?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) explain the safety measures for a Chemistry laboratory.	i) The teacher to guide students to role play the laboratory safety measures. ii) Students in groups to role play the safety measures for a Chemistry laboratory.	• Wall charts showing safety measures for a Chemistry laboratory • Pictures showing dangerous actions which have to be avoided	Is the student able to explain the safety measures needed to avoid accidents in a Chemistry laboratory?	
2.2 First Aid and First Aid Kit	A student should be able to: a) identify possible causes of accidents in a Chemistry laboratory.	i) The teacher to guide students to brainstorm activities which are likely to cause accidents in a Chemistry laboratory. ii) Students in groups to discuss activities which are likely to cause accidents in a Chemistry laboratory.	Wall charts and pictures showing possible laboratory accidents	Is the student able to identify the possible causes of accidents in a Chemistry laboratory?	4
	b) name the items found in a First Aid Kit.	i) The teacher to guide students through questions and answers to name every item found in a First Aid Kit.	• First Aid Kit containing all the items like: • a pair of scissors • adhesive tapes • cotton wool	Is the student able to name the items found in a First Aid Kit?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students to name all items found in a First Aid Kit.	• bandages • iodine tincture • mild antibiotic • petroleum jelly • gentian violet solution • razor blade • soap		
	c) explain how each First Aid Kit item is used.	i) The teacher to guide students through questions and answers to explain the use of each item in a First Aid Kit. ii) Students to explain the uses of each item of First Aid Kit.	First Aid Kit	Is the student able to explain the 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.	i) The teacher to demonstrate on how to render First Aid in a real situation. ii) Student to imitate on how to render First Aid in a real situation.	• First Aid Kit containing all items: • A pair of scissors • Adhesive tapes • Cotton wool • Bandages • Iodine tincture • Mild antibiotic • Petroleum jelly	Is the student able to provide First Aid correctly to a victim of accident?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
			• Gentian violet (GV) solution • Razor blade • Soap		
2.3 Basic Chemistry laboratory apparatus and their uses	A student should be able to: a) list the apparatus used in a Chemistry laboratory.	i) The teacher to guide students through questions and answers to give names of different pieces of apparatus used in the Chemistry laboratory. ii) Students to name apparatus used in the Chemistry laboratory.	• Apparatus for holding things in place • Apparatus for taking measurements • Apparatus for heating purposes • Apparatus for carrying out 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.	i) The teacher to guide students to categorize laboratory 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 carrying out chemical reactions	Is the student able to categorize Chemistry apparatus according to their uses?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students to categorize the apparatus used in Chemistry laboratory into apparatus for holding things; taking measurement of mass, volume and temperature and heating purposes.			
	c) state the use of common Chemistry laboratory apparatus.	i) Students to discuss the uses of each Chemistry laboratory apparatus. ii) The teacher to guide students to practice the use of the apparatus for measuring: • volumes of liquids. • volumes of gases. • masses of solids. • temperature. iii) Students to practice on the use of the apparatus for measuring.	• Apparatus for holding things in place • Apparatus for taking measurements • Apparatus for heating purposes • Apparatus for carrying out chemical reactions	Is the student able to state the uses of each Chemistry apparatus?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
2.4 Warning Signs	A student should be able to: a) explain the concept of warning signs.	i) The teacher to guide students to discuss the meaning of different warning signs. ii) Student to explain the concept of warning sign.	• Chemical containers labelled 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 warning signs?	6
	b) draw and label the basic chemical warning signs.	i) The teacher to guide students to draw simple diagrams of the following warming signs: • toxic, • harmful, • irritant, • poison, • explosive, • corrosive, and • oxidant. ii) Student to draw warning sign.	• Oxidants e.g. $KMnO_4$, H_2O_2, • Irritants e.g. • conc. H_2SO_4 • Explosive e.g. dynamite • Corrosive e.g. Conc. H_2SO_4, HNO_3, HCl. • Poison e.g. heavy metals	Is the student able to draw and label the basic Chemical warning signs?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.0 HEAT SOURCES AND FLAMES 3.1 Heat Sources	A student should be able to: a) name different heat sources which can be used in a Chemistry laboratory.	i) The teacher to guide students through think pair share to discuss how to use the following heat sources in a Chemistry laboratory: • Candle, • Spirit burner, • Kerosene burner, • "Kibatari", and • Charcoal burner. ii) Students in pairs to name different heat sources which can be used in Chemistry laboratory.	• Candle • Spirit burner • Bunsen burner • Kerosene burner • Charcoal burner • "Kibatari" • Blow pipe	Is the student able to name different sources of heat for use in a Chemistry laboratory?	4
	b) explain the functions of a Bunsen burner.	i) The teacher to guide students to discuss how a Bunsen burner works. ii) Student in groups to discuss the function of a Bunsen burner.	• Bunsen burners • Gas source	Is the student able to explain how a Bunsen burner functions?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.2 Types of Flames	A student should be able to: a) produce luminous and non-luminous flames from different fuel burners.	i) The teacher to demonstrate on how to use different types of burners to produce luminous and non-luminous flames. ii) Students to practice the uses of 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 flames from different fuel burners?	4
	b) state the uses of different types of flames.	i) The teacher to guide students to discuss how different flames are used, including: • flame tests of elements; • production of light; and • production of heat. ii) Students in groups to state the uses of different types of flames.	• 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?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
4.0 THE SCIENTIFIC PROCEDURE 4.1 Significance of the Scientific Procedure	A student should be able to: a) explain the concept of scientific procedure.	i) A teacher to guide students to discuss the meaning of the scientific procedure. ii) Student in group to discuss the concept of scientific procedure.	Wall chart showing the steps of the scientific procedure.	Is the student able to explain the concept of scientific procedure?	2
	b) explain the importance of the Scientific Procedure.	i) The teacher to guide students to discuss how the Scientific Procedure is used in carrying out systematic investigations. ii) Student in groups to discuss the importance of scientific procedure.	Wall chart showing the steps of the Scientific Procedure.	Is the student able to explain the importance of the Scientific Procedure?	
4.2 The Main Steps of the Scientific Procedure	A student should be able to describe each step of the scientific procedure.	i) The teacher to guide students to discuss the following steps of the Scientific Procedure: • Observation of a chemical phenomenon, • Statement of a problem,	Wall chart showing the steps of the scientific procedure	Is the student able to describe each of the steps of the Scientific Procedure?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		• Formulation of hypotheses, • Observation and collection of data, • Data analysis and interpretation, and • Making inferences and conclusions. ii) Students in groups to discuss the steps of the scientific procedure.			
4.3 Application of the Scientific Procedure.	A student should be able to use the scientific procedure to carry out investigations in Chemistry.	i) The teacher to supervise students' projects. ii) Students to apply the scientific procedure to carry out a project on a Chemistry problem.	Pictures showing scientists carrying out scientific projects	Is the student able to apply scientific procedure to carry out a Chemistry investigation?	4
5.0 MATTER 5.1 Concept of Matter	A student should be able to explain the concept of matter.	i) A teacher to guide students through questions and answers to discuss the meaning of matter. ii) Students to explain the meaning of matter.	• Solids • Liquids • Gases	Is the student able to explain with examples the meaning of matter?	2

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
5.2 States of Matter	A student should be able to: a) describe the three states of matter.	i) The 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. ii) Student in groups to describe the three states of matter.	• 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.	i) The teacher to demonstrate the changes of matter from one state to another. ii) Students to perform experiments on the change 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.	i) The teacher to guide students to discuss the advantages of changing one state of matter to another, for example:	• Pictures of: • refrigerator • petroleum refinery plant; and • metallurgical factory • Drying clothes	Is the student able to explain the importance of changing one state of matter to another?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		• distillation to form pure components of a mixture, • evaporation of dry things, • formation of ice in refrigerators, and • melting of metals to form alloys. ii) Students in groups to discuss the advantages of changing one state of matter to another.			
5.3 Physical and Chemical Changes	A student should be able to: a) describe the characteristics of a physical change.	i) The teacher to guide students to discuss the meaning and characteristics of physical changes. ii) Students in groups to discuss the characteristics of a physical change.	• Sugar • Table salt • Heat source • Kettle • Chalk • Pestle and mortar • Magnet	Is the student able to describe the characteristics of physical changes?	16

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) demonstrate physical changes of matter experimentally.	i) The teacher to demonstrate on how to carry out the experiments on physical changes, including: • melting of ice, • boiling of water, • condensation of steam, • formation of ice, • magnetization of iron, • sublimation of solid iodine, • grinding of chalk, • dissolving sugar or salt in water, and • evaporation. ii) Students to perform experiments on physical change.	• Sugar • Table salt • Heat source • Kettle • Chalk • Pestle and mortar • Magnet • Solid iodine • Water • Ice	Is the student able to demonstrate physical change experimentally?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) describe the characteristics of a chemical change.	i) The teacher to guide students to discuss the meaning and characteristics of a chemical changes e.g. • burning of paper, • ripening of fruit, and • fermentation of materials. ii) Students in groups to discuss the meaning and characteristics of a chemical change.	• Sugar • Yeast • Fruits • Paper • Heat source • Magnesium ribbon • Acids • Zinc metal • Calcium carbonate	Is the student able to describe the characteristics of a chemical change?	
	d) demonstrate experimentally the chemical changes of matter.	i) The 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, and	• $Pb(NO_3)_2$ solution • $CuSO_4$ solution • Zn metal • Candle • $CaCO_3$ • Aluminium foil • Magnesium ribbon • Heat source • Acids	Is the student able to demonstrate chemical change experimentally?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		• displacement of a weak metal by a strong metal. ii) Students to practice on the following chemical changes • decomposition of a solid carbonate, • burning of any fuel, • precipitation of an insoluble salt from a solution, and • displacement of a weak metal by a strong metal.			
5.4 Elements and Symbols	A student should be able to: a) explain the concept of an element.	i) The teacher to guide students to brainstorm on the meaning of an element as compared to other substances. ii) Students to discuss the concept of an element.	• 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 AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) assign names and symbols to chemical elements.	i) The teacher to guide students to discuss the choice of alphabetical letters and their combinations to form the symbols of elements. ii) Students to assign names and symbols to: • mono-atomic elements e.g. Al, K, Na, Cu and Pb, and • elements that carry Latin names e. g. K, Na, Fe, Ag, Au, Hg, Pb, Sn, Sb and Cu.	• 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.	i) The teacher to guide students on how to use a 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?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students to use the Periodic Table to differentiate metal elements from non-metal elements.			
5.5 Compounds and Mixtures	A student should be able to: a) explain the concept of compounds and mixtures.	i) The teacher to guide students to discuss the differences between compounds and mixtures by referring to their characteristic properties. ii) Students in groups to discuss the meaning of compound and mixture.	• Iron filings • Powdered sulphur • Magnet • Heat source • Crucible and lid • FeS • HCl solution	Is the student able to explains the meaning and give examples of compounds and mixtures?	12
	b) prepare a binary compound.	i) The teacher to lead students to prepare binary compounds such as iron(II) sulphide(FeS) from a mixture of solid iron filings and powdered sulphur by heating. ii) Students to prepare binary compounds.	• Iron filings • Powdered sulphur • Magnet • Heat source • Crucible and lid • FeS • HCl solution	Is the student able to prepare a binary compound?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) compare the properties of a compound with those of its constituent elements.	i) The teacher to guide students to discuss the properties of a compound in comparison to the properties of its constituent elements. ii) Students in groups to compare the properties of a compound with those of its constituent elements.	• Iron filings • Powdered sulphur • Magnet • Heat source • Crucible 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.	i) The teacher to guide students to brainstorm the meaning of mixtures and give examples. ii) Students in pairs or individually to explain the meaning of mixture. iii) Students in groups to distinguish between a mixture and a compound.	• Iron filings • Powdered sulphur • Magnet • Heat source • Crucible and lid • FeS • HCl solution	Is the student able to explain the meaning and give examples of mixtures?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	e) classify mixtures into solutions, suspensions and emulsions.	i) The teacher to guide students to discuss the properties of solutions, suspensions and emulsions. ii) Students to perform experiments to classify the mixture into solution, suspensions and emulations.	• 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	A student should be able to: a) describe the different methods of separating mixtures.	i) The teacher to guide students to discuss the procedure for carrying out the following separation processes: • decantation • filtration, • evaporation, • simple distillation, • fractional distillation, • sublimation, • chromatography, • layer separation, and • 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 describe common methods of separating mixtures?	16

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students in groups to discuss the procedures for separation of mixture.			
	b) explain the significance of separating different mixtures.	i) The 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, and metal extraction. ii) Students in groups to discuss the importance of separating components of mixtures.	• Wall charts • Pictures of: • distilleries • breweries • petroleum refinery plant • metal extraction factory	Is the student able to explain the importance of separating different mixtures?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) separate the components of different mixtures using different methods.	i) The teacher to demonstrate the separation of different mixtures by applying different separation methods. ii) Students to perform experiments on separation of mixtures of different solutions using different methods.	• Iron filings • Sulphur powder • Winnower • Magnet	Is the student able to separate different mixtures using a variety of methods?	
6.0 AIR, COMBUSTION, RUSTING AND FIRE FIGHTING 6.1 Composition of Air	A student should be able to: a) name the gases present in air and their proportions.	i) A teacher to guide students to do library search to find out information about the proportions of different gases in air. ii) Students to present the information on the composition of gases present in air.	Wall chart showing the composition of air	Is the student able to name the gases present in air and their proportions?	2

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) demonstrate the presence of different gases in air.	i) The teacher to facilitate students to perform experiments on the presence of the following gases in air: • carbon dioxide, and • oxygen. ii) Students to perform experiment to prove the presence of carbon dioxide and oxygen in air.	• Lime water • Phosphorus • Bell jar • Water • Trough • Candle	Is the student able to demonstrate the presence of oxygen in air?	
	c) determine experimentally the percentage of oxygen in air.	i) The teacher to facilitate students to carry out an experiment to determine the percentage of oxygen in air. ii) Students to perform experiments 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 AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
6.2 Combustion	A student should be able to: a) explain the concept of combustion.	i) The teacher to guide students to discuss the meaning and significance of combustion in real life. ii) Students in groups to discuss the meaning and importance 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.	i) The teacher to guide students to determine the products of complete combustion of the following substances in air: • kerosene, • paper, • charcoal, • candle, and • spirit. ii) students to perform experiments to determine the complete combustion of kerosene.	• Pieces of paper • Candle • Charcoal • Kerosene • Spirit	Is the student able to burn different substances in air and analyse the products?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii) The teacher to guide students to analyse products after combustion of substances. iv) Students in groups to analyse the products of combustion of a given substance.			
	c) describe the application of combustion in real life.	i) The teacher to guide students to discuss the application of combustion in real life for example: • automobile engines, and • burners to get heat and light. ii) Students in groups to discuss the application of combustion in real life.	• Wall chart • Pictures of: • automobile engines, • kerosene burner, and • candle	Is the student able to describe the application of combustion in real life?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
6.3 Fire Fighting	A student should be able to: a) classify the types of fire according to their causes.	i) The teacher to guide students to discuss the fires caused by: • petroleum products, • electricity, • wood and charcoal, and • paper. ii) Students in groups to discuss the fires coursed by different fuels.	• Kerosene • Spirit • Paper • Charcoal • Matchbox	Is the student able to classify the types of fire according to their causes?	8
	b) identify different types of fire extinguishers used to extinguish different types of fire.	i) The teacher to guide students to discuss the reasons why specific types of fire should be extinguished by specific types of fire extinguishers. ii) Students in groups to identify the different types of fire extinguishers for different types of fire.	• Sand bucket • Heavy asbestos blanket • Soda-acid fire extinguisher • Foam fire extinguisher • Water horse	Is the student able to identify different types of fire extinguishers used to extinguish different types of fire?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) state the components needed to start a fire.	i) The teacher to guide students to discuss the parts played by fuel and oxygen in a fire. ii) Students in groups to discuss the parts played by fuel and oxygen in fire.	• Sample of oxygen gas • Fuels: - Kerosene - Spirit - Charcoal - Candle, etc.	Is the student able to state the components necessary for fire to start?	
	d) classify fire extinguishers according to the chemicals they contain.	i) The teacher to guide students to discuss the classification of fire extinguishers into: • soda-acid type, • foam type, • water type, • sand type, and • blanket type. ii) Students in groups to discuss the classification of fire extinguishers.	• Asbestos blanket • Soda-acid fire extinguisher • Foam fire extinguisher • Sand bucket • Water hose	Is the student able to classify fire extinguishers according to the chemicals they contain?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	e) extinguish small fires using the right types of fire extinguishers.	i) The teacher to guide students to prepare a small fire carefully e.g. burning a paper or a candle, and extinguish it. ii) Students to prepare a fire extinguisher of the soda-acid type and use to extinguish a 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	A student should be able to: a) explain the concept of rusting.	i) The teacher to guide students to define the term rusting. ii) The teacher to guide students to explain the economic importance of rusting. iii) Students in groups to discuss the meaning and economic importance of rusting.	• Iron filings • Steel wool • Water • Cotton wool • Grease • Petroleum jelly • Heat source • Magnesium ribbon • HCl solution	Is the student able to explain the concept of rusting?	6

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) demonstrate the conditions necessary for iron to rust.	i) The teacher to design an experiment to demonstrate the conditions necessary for iron to rust. ii) Students to perform experiments to demonstrate the conditions necessary for iron rusting.	• Steel wool • Water • Cotton wool • Petroleum jelly • Oil • Heat source	Is the student able 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) The teacher to guide students to 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 TWO

CLASS LEVEL COMPETENCES

Student should have the ability to:

1. prepare and test properties of simple gases in the laboratory;
2. treat and purify water with environmental consideration;
3. use fuels efficiently and sustainability with environmental consideration; and
4. apply periodicity to explain characteristics of elements.

CLASS LEVEL 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; and
e) explain the structure of an atom and periodic trend.

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.0 OXYGEN 1.1 Preparation and Properties of Oxygen	A student should be able to: a) prepare and collect a sample of oxygen gas in the laboratory.	i) A teacher to guide students on the preparation of oxygen from hydrogen peroxide or potassium chlorate. 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 shelf, delivery tubes, troughs, gas jar, water and 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) The 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 and candle • Combustion spoon, magnesium ribbon, carbon, sulphur, calcium granules and wooden splint	Is the student able to 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.	Potassium permanganate	Is the student able to explain the properties of oxygen?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students in groups to discuss the risks of using $KMnO_4$ and HgO to prepare oxygen in the laboratory.			
1.2 Uses of Oxygen	A student should be able to: a) list uses of oxygen in daily life.	i) The teacher to guide students in groups to list the uses of oxygen in daily life e.g. living organisms, metallurgy, welding, mountaineering, hospitals and ocean diving. ii) Students to discuss the uses of oxygen.	Wall charts/flip charts/ pictures showing uses of oxygen in daily life	Is the student able to list the uses of oxygen in daily life?	2
	b) relate some uses of oxygen to its properties.	i) The teacher to guide a discussion on relationship between uses and properties of oxygen. ii) Students to discuss the relationship of uses of oxygen to its properties.	Wall charts showing some uses and properties of oxygen	Is the student able to relate some uses of oxygen to its properties?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
2.0 HYDROGEN 2.1 Preparation and properties of Hydrogen	A student should be able to: a) explain the preparation of hydrogen gas in a laboratory.	i) A teacher to demonstrate on the preparation of hydrogen gas using zinc and dilute hydrochloric acid. ii) Students to perform experiment on the preparation of hydrogen gas.	Zinc granules, dil. HCl, troughs, thistle funnels, delivery tubes, gas jars, beehive shelf, and flat bottomed flask and test-tube	Is the student able to explain the preparation of hydrogen gas in the laboratory?	4
	b) explain properties of hydrogen.	i) The teacher to guide students to demonstrate an experiment on 'pop' sound test for ydrogen gas. ii) The teacher to guide students to carry out an experiment on reduction of CuO using hydrogen gas. iii) The teacher to lead a discussion on the physical and chemical properties of hydrogen gas.	• Zinc granules, dil. HCl, wooden splints, test-tube, CuO, lead oxide, litmus papers, cobalt chloride papers, combustion tubes, source of heat and anhydrous calcium chloride • Wall chart showing physical and chemical properties of hydrogen	Is the student able to explain properties of hydrogen?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iv) Students in groups to discuss the physical and chemical properties of hydrogen gas.			
2.2 Uses of Hydrogen	A 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 fertilizer and margarine	Is the student able to state uses of hydrogen gas in daily life?	2
	b) relate uses of hydrogen to its properties.	i) The teacher to lead discussion in groups on the uses of hydrogen gas in relation to its properties. ii) Students to discuss the relationship of uses of hydrogen and its properties.	Wall chart showing uses of hydrogen in relation to its properties	Is the student able to relate uses of hydrogen in relation to its properties?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.0 WATER 3.1 Occurrence and Nature of Water	A student should be able to: a) describe the occurrence and nature of water.	i) A teacher to guide students on library search to find information about the occurrence and nature of water. ii) Students to conduct library search to find information on the occurrence of water. iii) The teacher to guide student to present information on the occurrence of water. iv) 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
	b) describe the water cycle.	i) Students in groups to discuss and present the concept of water cycle. ii) The 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?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) relate water cycle to environmental conservation.	i) The teacher to lead students in a discussion on the relationship between water cycle and environmental conservation. ii) Students in groups to discuss 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	A 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 experiments to determine boiling and melting points of water. iii) Students to test for water using cobalt chloride paper and anhydrous copper(II) sulphate.	• Thermometer, cobalt chloride papers, anhydrous copper(II) sulphate, water, sodium, calcium, magnesium, potassium and litmus papers	Is the student able to perform simple experiments on physical and chemical properties of water?	2

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iv) The teacher to guide students to carry out reaction between water and metals.			
	b) explain properties of water.	i) The teacher to facilitate discussion on physical and chemical properties of water. ii) Students in groups to discuss the properties of water.	• Wall charts showing physical and chemical properties of water	Is the student able to explain the properties of water?	
3.3 Treatment and Purification of Water	A 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 simple water filter using sand, charcoal and gravel and use it to filter water.	• Water, clean piece of cloth, sand, charcoal, gravel, filter paper, boiling vessel and water guard pellets/ tablets •	Is the student able to perform the processes of domestic water treatment and purification?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) describe the processes of urban water treatment.	i) The teacher and students to visit large scale water treatment plant. ii) Students to write report on visit. iii) The teacher and students to discuss 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. iii) Students to 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?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.4 Uses of Water	A student should be able to: a) state uses of water.	i) The teacher through questions and answers to guide students to discuss various uses of water in daily life. ii) Students to discuss various uses of water in daily life.	Wall charts showing uses of water	Is the student able to state uses of water in daily life?	2
	b) compare the solubility of different substances in water and organic solvents.	i) The teacher to guide students to dissolve different substances in water and organic solvents. ii) Students to list substances which dissolve in water and organic solvents.	Table salt, sugar, toothpaste, sand, iron fillings, water, kerosene, detergent/soap	Is the student able to compare the solubility of different substances in water and organic solvents?	
4.0 FUELS AND ENERGY 4.1 Fuel Sources	A student should be able to: a) identify different sources of fuels.	i) A teacher to lead students in small groups to discuss different sources of fuels found in Tanzania. ii) Students to identify the sources of fuel.	Kerosene, firewood, charcoal, petrol, heating gas and diesel	Is the student able to identify different sources of fuels?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) describe methods of obtaining fuels from locally available materials.	a) Students in small groups to discuss the procedure for making charcoal. b) The teacher to summarize the process of making charcoal in small scale.	Wall charts showing process of charcoal making in small scale	Is the student able to describe methods of obtaining fuels from locally available materials?	
4.2 Categories of Fuels	A student should be able to: a) classify fuels according to their states.	i) Students to list fuels according to their states. ii) The teacher to summarize the classification of fuels according to their states.	Heating gas, charcoal, firewood, kerosene	Is 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 and pieces of wood	Is the student able to classify fuels according to their efficiency?	
4.3 Uses of Fuel	A student should be able to: a) list uses of fuels.	i) The teacher to guide students in small groups to discuss different uses of fuels in daily life. ii) Students to discuss the uses of fuels in daily life.	Wall charts showing uses of fuels	Is the student able to list uses of fuels?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) assess the environmental effects on using charcoal and firewood as source of fuel.	i) The teacher to lead students to discuss the environmental effects of depending on firewood 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 and pictures showing disadvantages of deforestation and alternative sources of fuel	Is the student able to assess the environmental effect of using charcoal and firewood as sources of fuel?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
4.4 Conservation of Energy	A 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 it.	Wall charts and pictures showing energy change e.g. voltaic cell, electric bell, bar magnets, iron filings, water and 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 to another e.g. chemical energy to electrical energy and electrical energy to light energy. ii) The teacher to guide students to discuss the results obtained.	Copper foil, sulphuric acid (1 M), lamp bulb, beaker, magnesium ribbon, abrasive paper, iron filings, water, bar magnet and source of heat	Is the student able to perform experiments on the conversion of energy from one form to another?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
4.5 Renewable Energy (Biogas)	A student should be able to: a) explain the working mechanism of a biogas plant.	i) The teacher to lead students to discuss the working mechanism of a biogas plant. ii) Students to explain the working mechanism of biogas plant.	Wall charts and pictures showing a biogas plant	Is the student able to explain the working mechanism of a biogas plant?	4
	b) construct a model of a biogas plant.	i) The teacher to assist students to construct a model of a biogas plant. ii) Students to construct a model of a biogas plant. iii) Students under teachers' supervision to construct a small biogas plant.	Biogas plant model, water, pipes, concrete, sewage, cow dung, animal/plant waste	Is the student able to construct a simple model of a biogas plant?	
	c) explain the use of biogas in environmental conservation.	i) The teacher to guide students to discuss the uses of biogas in daily life. ii) Students to discuss the uses of biogas as an environmental friendly type of fuel.	Wall chart showing uses of biogas	Is the student able to explain the uses of biogas in environmental conservation?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
5.0 ATOMIC STRUCTURE 5.1 The atom	A student should be able to: a) explain Dalton contribution to atomic structure.	i) Students to divide a solid substance into fine indivisible particles. ii) A teacher to lead students to discuss Dalton's contribution about the structure of an atom.	Pieces of chalk, marble chips, mortar and pestle, and paper	Is the student able to explain the Dalton contribution to atomic structure?	2
	b) explain the modern concept of Dalton's atomic structure.	i) Students to analyse the Dalton's Atomic Theory. ii) The teacher to lead students to discuss the modern concept of Dalton's atomic structure.	• Wall charts and pictures showing Daltons atomic structure • Modern Periodic Table	Is the student able to explain the modern concept of Dalton's atomic structure?	
5.2 Sub-atomic particles	A 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

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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	A 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 determine the maximum number of electrons in the shells.	Atomic diagrams	Is the student able to determine 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 atoms. ii) Students to draw energy shell diagrams of common atom.	• Atomic diagrams • Wall charts showing energy shell diagram	Is the student able to draw energy shell diagrams?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
5.4 Atomic number, mass number and isotope.	A student should be able to: a) relate atomic number with number of protons.	i) The teacher to guide students to discuss the relationship between the atomic number and number of protons. ii) Students to discuss the relationship between the atomic number and number of protons.	Models, charts and pictures showing the atomic number of elements	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.	i) The teacher to guide students on how to obtain mass number from number of protons and neutrons. ii) Students to practice 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 calculate mass number of an atom from number of protons and neutrons?	
	c) explain the concept of isotope.	i) Students to identify isotopes of some common elements. ii) The teacher to lead students to discuss the concept of isotope.	Wall charts showing isotopes of carbon, chlorine, oxygen and hydrogen	Is the student able to explain the concept of isotope?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
6.0 PERIODIC CLASSIFICATION 6.1 Periodicity	A student should be able to: explain the concept of periodicity.	i) A 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	A student should be able to: a) explain the changes in properties of elements across the periods.	i) The teacher to guide students to discuss the changes of properties of elements across the periods. ii) Students to list down the changes in properties of elements across the periods.	Modern Periodic Table	Is the student able to explain the changes in properties of elements across the periods?	10
	b) explain the change in properties of elements down the groups.	i) The teacher to guide students to discuss the changes in the properties of elements down the group. ii) Students to list down the changes in properties of elements 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?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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 20 elements in the Periodic Table. ii) Students to write the electronic configuration of the first 20 elements in the Periodic Table.	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	A student should be able to: a) explain the concept of valence.	i) A teacher to guide students to discuss the concept of valence. 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 valence?	12
	b) write simple formulae of binary compounds.	i) The teacher to use questions and answers in writing simple formulae 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?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) explain the concept of empirical and molecular formulae.	i) The teacher to lead a discussion on the concept of empirical and molecular formulae. ii) Students in groups to discuss the concept of empirical and molecular formulae. iii) Students to interpret the information given by the empirical and molecular formulae.	• Model depicting empirical and molecular formulae. • Modern Periodic Table • Wall charts showing empirical and molecular formulae	Is the student able to explain the concept of 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 students' activities on empirical and molecular formulae.	• Modern Periodic Table • Wall charts showing molecular formulae • Models illustrating empirical and molecular formulae	Is the student able to calculate the empirical and molecular formulae?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
7.2 Oxidation State	A student should be able to: a) explain the concept of oxidation state.	i) The teacher to lead a discussion on the concept of oxidation state. ii) Students in groups to discuss and present the concept of oxidation state. iii) The teacher to use questions and answers to summarize students' activities.	• 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 states. iii) The teacher to lead a discussion on students' activities.	• Periodic Table • Wall charts showing valence and oxidation states	Is the student able to differentiate oxidation state from valence?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
7.3 Radicals	A 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
	b) write chemical formulae of common compounds.	i) The teacher to illustrate writing of chemical formulae of common compounds. ii) Students to practice in writing of chemical formulae of common compounds.	• Modern Periodic Table • Wall charts showing common radicals	Is the student able to write chemical formulae of common compounds?	
7.4 Covalent bonding	A student should be able to: a) explain the concept of covalent bonding.	i) The teacher to lead a discussion on the concept of covalent bonding.	• Modern Periodic Table • Wall charts showing covalent compounds	Is the student able to explain the concept of covalent bonding?	8

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students in groups to draw electron diagrams to show covalent bonding in binary molecules.			
	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 or 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	A student should be able to: a) explain the concept of electrovalent bonding.	i) The teacher to lead a 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 compounds	Is the student able to explain the concept of electrovalent bonding?	8

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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 or ammeter • Connecting wires • Carbon electrodes • Beakers	Is the student able to state properties of electrovalent compounds?	

FORM THREE

CLASS LEVEL COMPETENCES

Student should have the ability to:

1. apply Chemistry principles in understanding industrial processes;
2. use technological skills in extraction of metals and conservation of environment;
3. solve problems of hardness of water in daily life;
4. use the concept of volumetric analysis in solving daily life problems; and
5. use electrolysis to solve daily life problems.

CLASS LEVEL 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; and
f) realize Chemistry principles in industrial processes.

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.0 CHEMICAL EQUATIONS 1.1 Molecular Equations	A student should be able to: a) write word equations for given chemical reactions.	i) A 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 including 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(II) sulphate, chlorine gas, potassium iodide, magnesium ribbon, hydrochloric acid and lead nitrate	Is the student able to write the word equations for the given chemical reactions?	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 formulae of reaction equations	Is the student able to write formula equations using chemical symbols?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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?	
1.2 Ionic Equations	A 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
	b) write balanced ionic equations.	i) The teacher to guide students to discuss the major steps of writing balanced ionic equations.	Wall charts showing balanced ionic equations	Is the student able to write balanced ionic equations?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students to write ionic equations for liquid, gaseous and solid products.			
2.0 HARDNESS OF WATER 2.1 The Concept of Hardness of Water	A student should be able to: a) explain the concept of hardness of water.	i) A teacher to guide students to discuss the meaning of hardness of water. ii) Students to explain the meaning of hardiness of water.	Wall charts showing mineral substances which cause hardness of water	Is the student able to explain the concept of hardness of water?	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.	• Soft water • Hard water • Soap	Is the student able to distinguish hard water from soft water experimentally?	
2.2 Types of Hardness of Water	A 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.	• Sources of heat • Test tubes • 0.5 M Na_2SO_4 • 0.5 M $MgSO_4$ • 0.5 M NaCl • 0.5 M $CaCl_2$	Is the student able to identify types of hardness of water?	2

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students to discuss their findings.	• 0.5 M $CaSO_4$ • 0.5 M Mg $(HCO_3)_2$ • 0.5 M Mg Cl_2		
	b) state causes of permanent and temporary hardness of water.	i) Students to use soap and heat to identify temporary and permanent 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 • Heat source	Is the student able to state causes of permanent and temporary hardness of water?	
2.3 Treatment and Purification of Hard Water	A student should be able to: a) examine the 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.	• Heat sources • $Ca(OH)_2$ • $Ca(HCO_3)_2$ • $CaSO_4$ • Na_2CO_3 • Beakers	Is the student able to examine the process of hard water treatment and purification?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii) The teacher to lead students to discuss observations from the two experiments.			
	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 guide students to discuss the importance of hard water in daily life. ii) Students to discuss the importance of hard water.	Wall charts displaying importance 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	A student should be able to: a) investigate the natural sources of acids and bases.	i) A teacher to guide students to collect natural sources of acids and bases. ii) Students to perform experiments to identify acids and bases using indicators.	Citrus fruits, vinegar, sour milk, apples, wood ash, toothpaste, dry leaves, bicarbonate of soda, mineral acids, hydroxides and indicators	Is the student able to investigate natural sources of acids and bases?	8

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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 analyse the reactions of acids on various materials.	Zinc granules, magnesium ribbon, calcium metal, $MgCO_3$, CaO, NaOH, dil. HCl and dil. H_2SO_4	Is the student able to determine reactions of acids on various materials?	
	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 perform 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 and beakers	Is the student able to determine the reactions of alkalis with various materials?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	d) determine the reaction of bases with various substances.	i) The teacher to guide students to prepare the solution of potash (K_2CO_3). ii) The teacher to guide students to perform an experiment of neutralization reaction between K_2CO_3 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 (MO) indicator and Phenolphthalein (POP) indicator	Is the student able to determine the reaction of bases with various substances?	
	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 and pictures showing the application of neutralization property, and anti-acid tablets	Is the student able to apply the concept of neutralization of acid-base in daily life?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.2 Indicators	A student should be able to: a) describe the concept of an indicator.	i) The teacher to lead a 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 and sulphuric acid	Is the student able to describe the concept of an indicator?	4
	b) 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 and NaOH	Is the student able to extract indicators from locally available materials?	
	c) test the acidity and alkalinity of substances using indicators.	The teacher to guide students to test the acidity and alkalinity of different substances using commercial indicators as well as locally made indicators.	• Extracted indicator from coloured flowers/leaves • POP indicator • MO indicator	Is the student able to test the acidity and alkalinity using indicators?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.3 Salts	A student should be able to: a) investigate the natural source of salts.	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.	Wall charts, drawings and pictures showing salt mining and of industrial salt processing	Is the student able to investigate the natural sources of salts?	8
	b) analyse the solubility of different salts in water.	i) The teacher to guide students to perform experiments to determine soluble, partially soluble and insoluble salts. ii) The teacher to lead a discussion on basic criteria used in categorizing salts.	Salts of potassium and sodium, ammonium nitrate, hydrogen carbonate, magnesium carbonates, barium sulphate, lead(II) sulphate and silver chloride	Is the student able to analyse the solubility of different salts in water?	
	c) prepare salts in the laboratory.	i) The teacher to guide students to perform experiments on preparation of soluble salts by reacting metal oxides and carbonates with dilute acids.	Hydrochloric acid, limestone, baking powder, egg shells, safety goggles, calcium oxide, zinc oxide, magnesium and zinc metal	Is the student able to prepare salts in the laboratory?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students to discuss in groups the results of the reactions.			
	d) examine the effects of heat on salts.	i) The teacher to guide students to perform experiments by heating different kinds of salts. ii) Students in groups to discuss the meaning of deliquescence, efflorescence and hydroscopic. iii) Students to carry out an experiment of thermal decomposition of carbonates.	• Carbonates, sulphates and chlorides of Na, Fe and Cu • Hydroxides of K, Na and Ca • Hydrated salts of Na_2CO_3, $CaCl_2$ and $CuSO_4$	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 everyday life. ii) The teacher to lead discussion on important applications and uses of different types of salts.	• Wall charts and pictures on the uses of salts in daily life • Table salt, paints, fertilizers, washing soda, Plaster of Paris. Health salt and silver nitrate	Is the student able to explain the uses of different types of salts in everyday life?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
4.0 THE MOLE CONCEPT AND RELATED CALCULATIONS 4.1 The Mole as a Unit of Measurement.	A student should be able to: a) compare the mole with other units of measurements.	i) A 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 and a gross of chalk	Is the student able to 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. ii) Students to construct the molar volume box. iii) Students to use a weighing balance to measure the molar masses of Cu, C, Fe, CuO and $CaCO_3$ and put them in separate glass containers for comparison.	• Molar volume box, Cu, C, Fe, CuO, $CaCO_3$, pan balance and glass container • Wall charts showing pictures of different substances	Is the student able to measure molar quantities of different substances?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iv) The teacher to lead students to discuss the relationship between the Mole and the Avogadro's constant (L = 6.02×10^{23}) particles.			
4.2 Application of the Mole Concept	A 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 • Weighing balance • Fe, Cu, Mg and Al	Is the student able to convert known masses of substances to mole?	8

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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 individually 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. 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.	Wall charts showing the relationship between masses of solids or volumes of gases to actual number of particles	Is the student able to change masses of solids or volumes of known gases to actual number of particles?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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 and soluble salts	Is the student able to prepare molar solutions of various soluble substances?	
	e) perform calculations based on the mole concept.	i) The teacher to guide students to perform calculations based on the mole concept and balanced equations. ii) Student in groups and then individually students to perform some calculations based on the mole concept and balanced equations.	• Manila cards • Marker pens	Is the student able to perform calculations based on the mole concept?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
5.0 VOLUMETRIC ANALYSIS 5.1 Standard volumetric apparatus	A student should be able to: a) explain the concept of volumetric analysis.	i) A teacher to demonstrate to students 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. iii) The teacher to demonstrate to students on how to repair a leaking burette.	Pipettes, burettes, conical flasks, beakers, white tiles, retort stands and water	Is the student able to use volumetric analysis apparatus?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		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	A 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 on how to carry out the dilution of commercial concentrated HCl, H_2SO_4 or HNO_3 to some required concentration e.g. 0.2 M, 0.5 M and 0.25 M. iii) Students in groups to discuss the preparation of standard solutions of common acids.	• Commercial concentrated HCl, H_2SO_4 or HNO_3 • Volumetric flasks, measuring cylinder and beakers • Distilled water	Is the student able to explain the steps for preparation of standard solutions of common acids?	8

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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 solutions.	• Volumetric flasks • NaOH and Na_2CO_3 • Weighing balance • Beakers • Stirrer • Water • Funnel • Wash bottle	Is the student able to 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. ii) Students to practice the accurate measurement of 25 cm^3 or 20 cm^3 of solution using a pipette.	• Acid-base indicators • Titration flasks • Burettes • Pipettes • Measuring cylinders • Common mineral acids • Common bases	Is the student able to carry out acid-base titration?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		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.			
5.3 Volumetric Calculations	A student should be able to: a) standardize common mineral acids.	i) The 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.	• Measuring cylinders • Titration flasks • Burettes • Pipettes • Dil. HCl acid • Na_2CO_3 solution • Water	Is the student able to standardize common mineral acids?	6

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii) The teacher to lead a discussion on activities with emphasis on accuracy.			
	b) find the relative atomic mass of unknown element in an acid or alkali.	i) The teacher to guide students to carry out the titration and work out the relative atomic mass of the unknown element. ii) 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	Is the student able to determine the relative atomic mass of unknown element in an acid or alkali?	
	c) calculate the percentage purity of an acid or an alkali.	i) The teacher guide students in groups and then individually in the titration experiment to find out the percentage purity or impurity of an acid or an alkali. 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.	• Impure acid or alkali • Chart of atomic masses • Pipettes • Burettes • Titration flasks • Beakers • White tiles	Is the student able to determine the percentage purity of an acid or base?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii) The teacher to lead a discussion on students' activities with emphasis on accuracy.			
	d) find the number of molecules of water of crystallization of a substance.	i) The teacher to guide students to discuss ways of finding 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 crystallization • Burettes • Pipettes • Titration flasks • White tiles	Is the student able to find the number of molecule of water of crystallization of a substance?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
5.4 Application of Volumetric Analysis	A 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) Students to list the application of volumetric analysis in daily life.	Wall charts or pictures showing places where volumetric analysis is applied e.g. industries, agriculture and hospitals	Is the student able to explain the application 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. iv) Students to compare industrial and laboratory skills of volumetric analysis. v) The teacher to lead a discussion on the study visit.	Wall charts and pictures showing volumetric analysis laboratory activities	Is the student able to compare industrial and laboratory skills of volumetric analysis?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
6.0 IONIC THEORY AND ELECTROLYSIS 6.1 Ionic Theory	A student should be able to: a) distinguish electrolytes from non-electrolytes.	i) The teacher to guide students to discuss: • electrolytes, • non-electrolytes, and • 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 do 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.	• Common salt • Ethanol • Sugar • Lead bromide • Wax • Potassium iodide • Electric circuit	Is the student able to distinguish electrolytes from non-electrolytes?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		v) The teacher to lead students to discuss why a solid electrolyte would not conduct electricity but will do so in the molten and aqueous states.			
	b) categorize weak and strong electrolyte.	i) The teacher to demonstrate the experimental set up of electrolytic cell of different electrolytes in the molten and aqueous state. ii) The teacher to lead students to discuss the difference between the strength of an electrolyte and its concentration. iii) Students to give examples of strong and weak acids in relation to concentration.	• Strong acids • Weak acids • Concentrated acids	Is the student able to categorize weak and strong electrolyte?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
6.2 The Mechanism of Electrolysis	A 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	Is the student able to set up electrolytic cells of different electrolytes the molten and aqueous states accurately?	8
	b) explain ionic migrations during electrolysis and the preferential discharge of ions at the electrodes.	i) The teacher to guide students to discuss the migration of ions during electrolysis. ii) The teacher to set up an experiment on the movement of ions of electrolyte towards the electrode during electrolysis. iii) Students to discuss the reasons for ionic migration.	• Different types of electrolytes e.g. KI and $CuSO_4$ • Electric circuits • Wall charts and pictures showing mechanism of electrolysis	Is the student able to explain ionic migrations during electrolysis and the preferential discharge of ions at the electrodes?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iv) Students to write balanced equations for the reactions occurring at each electrode. v) The teacher to lead a discussion on students' work.			
	c) perform experiments to identify the products of electrolysis when different electrolytes are used.	i) The 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 electrodes during electrolysis. iii) Students to write balanced ionic equations at each electrode. iv) The teacher to lead a discussion on students' work.	• Sodium chloride • Copper(II) sulphate • Sodium hydroxide • Dilute sulphuric acid • Electrolytic cells • Dilute hydrochloric acid	Is the student able to perform an experiment to identify the products of electrolysis when different electrolytes are used?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	d) perform an experiment to identify the products of electrolysis when different electrodes are used.	i) The teacher to guide students to carry out experiments using different electrodes. ii) The teacher to guide students to discuss the products formed at the 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 perform an experiment to identify the products of electrolysis when different electrodes are used?	
6.3 Laws of Electrolysis	A student should be able to: a) carry out experiments to relate masses liberated and quantity of electricity passed.	i) The 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.	• Electrolytic cell • Electrolytes • Weighing balance	Is the student able to carry out an experiment to relate masses liberated and quantity of electricity passed?	6

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		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.			
	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. 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.	• Electrolytic cell • Electrolytes • Copper rods • Graph papers • Sand paper • 12 volts battery • Weighing balance	Is the student able to carry out an experiment to verify the Faraday's First Law of electrolysis?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) carry out experiments to verify Faraday's Second Law of electrolysis.	i) The 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 • Beakers	Is the student able to perform an experiment to verify Faraday's 2nd law of electrolysis?	
	d) relate the chemical equivalents of elements to the 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 calculations based on the 2nd Law.	Wall charts showing two voltammeters in series	Is the student able to relate chemical equivalents of elements to the quantity of electricity passed?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
6.4 Application of Electrolysis	A 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. iii) Students in groups to discuss the industrial purification of copper by electrolysis.	• Wall charts showing the purification process • Impure copper rod • Acidified copper(II) sulphate solution	Is the student able to outline the industrial purification of copper by electrolysis?	4
	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	Is the student able to carry out experiments on electroplating process of metallic materials?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
7.0 CHEMICAL KINETICS, EQUILIBRIUM AND ENERGETICS 7.1 The rate of chemical reactions	A student should be able to: a) compare the rates of chemical reactions.	i) A 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 favourable conditions.	• Manila sheets • Marker pens • Potassium iodide • Lead nitrate • Silver nitrate • Iron nails • Test tubes • Aqueous chlorides	Is the student able to compare the rates of 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.	• Zinc granule • Dilute HCl • Graph papers • Stop watches	Is the student able to perform an experiment to measure the rate of a chemical reactions?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		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.			
7.2 Factors Affecting the Rate of Chemical Reactions	A student should be able to: a) describe the effect of concentration on the rate of a reaction.	i) The 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	Is the student able to describe the effect of concentration on the rate of reaction?	16

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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	Is the student able to demonstrate the effect of temperature on the rate of a reaction?	
	c) show the effect of surface area of a solid on the rate of a reaction.	i) The 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 reacts with dilute hydrochloric acid.	• $CaCO_3$ blocks • Mortar and pestle • Stop watches • Syringe • Measuring cylinder	Is the student able to show the effect of surface area of a solid on the rate of a reaction?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		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.			
	d) demonstrate the effect of catalyst on the rate of a reaction.	i) The 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	Is the student able to demonstrate the effect of catalyst on the rate of reactions?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
7.3 Reversible and Irreversible Reactions	A 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 experiments on reversible and irreversible reactions.	• Heat source • Litmus papers • Test tubes • NH_4Cl • Ice	Is the student able to 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 make conclusions.	• NH_4Cl • Zinc metal • Dil. hydrochloric acid • Copper(II) sulphate crystals	Is the student able to describe the concept of reversible and irreversible reactions?	
7.4 Equilibrium Reaction	A 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.	• Bromine water • Sodium hydroxide • Flasks • Pipettes • Sulphuric acid	Is the student able to differentiate equilibrium reactions from simple reversible reactions?	6

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) The teacher and students to discuss examples of reversible and equilibrium reactions. 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.	• Potassium dichromate • Potassium chromate • Dilute hydrochloric acid		
	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).	• Wall charts showing the Haber process and Contact process. • Flow diagrams of Contact and Haber processes	Is the student able to describe the two industrial equilibrium reactions?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) The teacher to guide students to discuss Le Châtelier's Principle. iii) The teacher and students to discuss the Haber process, $3H_2 + N_2 \longrightarrow 2NH_3$ and the Contact process, $2SO_2 + O_2 \longrightarrow 2SO_2$ and make conclusion.			
7.5 Endothermic and Exothermic Reactions	A 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) The 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.	• Wall charts, pictures, diagrams and models showing energy changes during chemical reactions • H_2O • Conc. H_2SO_4 • NH_4Cl • Beakers	Is the student able to explain the concept of endothermic and exothermic reactions?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii) The teacher to lead a discussion on students' work.			
	b) draw energy level diagrams for exothermic and endothermic reactions.	i) The teacher to guide students to discuss the special features of energy level diagrams for exothermic and endothermic reactions. ii) Students to draw energy level diagrams for endothermic and exothermic reactions.	Wall charts and pictures showing the endothermic and exothermic reactions	Is the student able to draw energy level diagrams for exothermic and endothermic reactions?	
8.0 EXTRACTION OF METALS 8.1 Occurrence and Location of Metals in Tanzania	A student should be able to: a) identify locations of important metal ores in Tanzania.	i) A 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) The teacher to lead a discussion on types of ores in Tanzania.	Wall charts showing the map of Tanzania showing location of metal ores	Is the student able to identify locations of metal important ores found in Tanzania?	2

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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 earth's crust?	
8.2 Chemical Properties of Metals	A 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 showing the order of the tensile strength for some metals. e.g. Fe, Cu and Ca	Is the student able to differentiate the physical and chemical strengths of metals?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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. iii) The teacher and students to derive the meaning of reducing power of a metal.	• Periodic Table • Pb metal • Fe strips • $Mg(NO_3)_2$ • $ZnSO_4$ • $Pb(NO_3)_2$ • $CuSO_4$ • $AgNO_3$ • Magnesium ribbons	Is the student able to compare the reducing power of different metals?	
	c) describe the reactivity series of metals.	i) The teacher to lead a discussion on the reactivity of different metals e.g. K, Na, Ca, Mg, Al, Zn, Fe, Pb and Cu with water and steam. ii) Students to perform experiments on the reaction of metals e.g. Ca, Mg, Al, Zn, Fe, Pb and Cu, with water and steam.	• Al foil • Zn granules • Fe nails, • Cu foils • Water trough • Fe powder • Flasks • Gas jars • Combustion tubes • Source of heat	Is the student able to describe the reactivity series of metals?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		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 metal oxides on a charcoal block using blow pipe. v) Students to find out how dilute HCl or H_2SO_4 reacts with Zn, Fe and Cu.	• CuO • PbO • Charcoal blow pipe • dil HCl • dil. H_2SO_4 • Metals e.g. Mg, Cu, Fe and Ca		
8.3 Extraction of Metals by Electrolytic reduction	A 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 to guide 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	Is the student able to outline the criteria for the choice of best methods of extracting a metal from its ore?	4
	b) explain the extraction of sodium from its ore.	i) The 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 from its ore?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students to explain the extraction of sodium from its ore.			
8.4 Extraction of Metals by Chemical Reduction	A student should be able to describe the extraction of iron from its ore.	i) The teacher to guide students to discuss the extraction of iron in the blast furnace. ii) Students to write the important reaction equations taking place in the blast furnace.	Wall charts showing the extraction of iron in the blast furnace	Is the student able to explain the extraction of iron from its ore?	4
8.5 Environmental Consideration	A 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 and 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 and pictures showing environmental destructions caused by mining • Charts showing implications of environmental destruction	Is the student able to identify cases of environmental destruction caused by extraction of metals?	2

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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 intervention measures to rectify the environmental destruction?	
9.0 COMPOUNDS OF METALS 9.1 Oxides	A student should be able to: a) prepare oxides of some metals by direct and indirect methods.	i) A teacher to guide students to prepare metal oxides by heating 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 and carbonates • Wall charts and pictures showing these processes	Is the student able to prepare oxides of metals by direct and indirect methods?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) classify metal oxides.	i) The teacher to prepare guidelines to be used to classify metals oxides. ii) Students in groups to use guidelines/procedure provided by the teacher to test and put metal oxides into groups of soluble, insoluble, basic and amphoteric categories.	• Samples of oxides e.g. MgO, Al_2O_3, ZnO and PbO • Charts showing groups of metal oxides	Is the student able to 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 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 and litmus paper	Is the student able to demonstrate the reactions of metal oxides with water and dilute acids?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	d) explain the uses of metal oxides.	i) The 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. ii) Student in groups to explain the uses of metal oxides.	Oxides such as CaO, MgO and ZnO	Is the student able to explain the uses of metal oxides?	
9.2 Hydroxides	A 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 and KOH with aqueous solution of soluble salts e.g. $CuSO_4$, $Zn(NO_3)_2$ and $FeCl_3$.	• Calcium metal • Water • KOH • NaOH • $Zn(NO_3)_2$ • $CuSO_4$ • $FeCl_3$	Is the student able to prepare the hydroxides of some common metals by direct and indirect methods?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii) The teacher to guide students to discuss the results of the experiments above and make conclusion.			
	b) classify metal hydroxides.	i) The teacher to guide students to prepare and classify metal hydroxides. ii) Students to prepare, test and put metal hydroxides into groups of soluble, insoluble and amphoteric categories.	• Chlorides of Fe, Mg, Zn and Cu • NaOH • Test tubes • Beakers • $Cu(OH)_2$	Is the student able to classify metal hydroxides?	
	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 • Beakers	Is the student able to explain the chemical properties of the common metal hydroxides?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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, mortar and pestle, bleaching, softening water and in qualitative analysis. ii) Students in groups to discuss the uses of metal hydroxides in agriculture, bleaching, softening water and qualitative analysis.	• Calcium hydroxide • Water • Wall charts showing uses of metal hydroxides	Is the student able to describe uses of metal hydroxides?	
9.3 Carbonates and Hydrogen carbonates	A student should be able to: a) prepare metal carbonates and hydrogen carbonates by different methods.	i) The teacher to guide students on practical work to prepare metal carbonates and hydrogen carbonates by different methods. ii) Students to prepare soluble carbonates by passing carbon dioxide to an alkali.	• Any alkali e.g. NaOH and KOH • Carbon dioxide • Soluble hydroxide e.g. NaOH and carbonates of K and Na • Aqueous salt of Fe, Cu, Ca, Pb, Mg and Zn	Is the student able to prepare metal carbonates and hydrogen carbonates by different methods?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii) Students to prepare hydrogen carbonate by passing excess of carbon dioxide into lime water. iv) Students to precipitate insoluble carbonates by adding sodium carbonate solution to a solution of a salt of a heavy metal e.g. $CuSO_4$	• Charts showing different methods of preparing carbonates and hydrogen carbonates		
	b) classify metal carbonates.	i) The teacher to guide students to classify metal carbonates. ii) Students in groups to prepare a table of soluble and insoluble carbonates. iii) Students to present their findings in a panel for discussion.	A variety of soluble and insoluble carbonates	Is the student able to classify metal carbonates?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) analyse the chemical properties of metal carbonates.	i) Using guidelines/ procedure 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 • $NaHCO_3$ • $MgCO_3$	Is the student able to analyse the chemical properties of metal 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, manufacturing of glass, and in quantitative and qualitative analysis, and $NaHCO_3$ in baking and removal of grease. ii) Students to explain the uses of carbonates and hydrogen carbonates.	Wall charts and pictures showing the uses of carbonates and hydrogen carbonates	Is the student able to describe the uses of carbonates and hydrogen carbonates?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
9.4 Nitrates	A 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 carbonate, an oxide or an alkali in dilute nitric acid and record the results. iii) The teacher to guide students to discuss on the results.	• HNO_3 • Zn or Mg • An alkali • Carbonates • An oxide	Is the student able to prepare metal nitrates?	4
	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 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 filings • $FeSO_4$	Is the student able to explain the chemical properties of nitrates?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) explain the uses of metal nitrates.	i) The teacher to lead students to discuss the use of nitrates e.g. antiseptic, photography and fertilizers. ii) Students to explain the uses of metal nitrates	Wall charts showing the uses of metal nitrates	Is the student able to explain uses of metal nitrates?	
9.5 Chlorides	A student should be able to: a) prepare metal chlorides by direct and indirect methods.	i) The 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.	• $Pb(NO_3)_2$ • $Ag\ NO_3$ • 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 and Cu. • Evaporating dish.	Is the student able to prepare metal chlorides by direct and indirect methods?	4
	b) explain the chemical properties of metal chlorides.	i) The teacher to lead students to perform experiments to identify a chloride in a solid and a liquid mixture.	• Conc. H_2SO_4 • Litmus paper • $MgCl_2.\ 6H_2O$ • $Ag\ NO_3$ • NH_4Cl	Is the student able to explain the properties of metal chlorides?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students to perform experiments to identify a chloride in a solid and a liquid mixture. iii) Students to study the effect of heat on chlorides e.g. $MgCl_2.6H_2O$ and NH_4Cl.			
	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 metal chlorides using common materials collected.	Wall charts and pictures showing application of metal chlorides in daily life	Is the student able to explain the uses of metal chlorides?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
9.6 Sulphates	A student should be able to: a) prepare soluble and insoluble sulphates.	i) The teacher to lead students to prepare soluble and insoluble sulphates. ii) Students to dissolve a metal carbonate, hydroxide or oxide in dilute H_2SO_4 and isolate the crystals. iii) Students to prepare insoluble sulphates by adding sulphuric acid in aqueous lead or barium salts/compounds.	• CuO • $Zn(OH)_2$ • $ZnCO_3$ • Zinc metal • Dil. H_2SO_4 • $BaCl_2$ or $Ba(NO_3)_2$ • $Pb(NO_3)_2$	Is the student able to prepare soluble and insoluble sulphates?	4
	b) explain chemical properties of sulphates.	i) The teacher to guide students to perform experiment to identify a sulphate in an aqueous solution. ii) Students to perform experiments to identify a sulphate in an aqueous solution. iii) Students to study the effect of heat on sulphates e.g. $FeSO_4$ $Fe_2(SO_4)_3$ and $CuSO_4$.	• $BaCl_2$ • HCl • $CuSO_4.5H_2O$ • $Fe_2(SO_4)_3$ • $FeSO_4.7H_2O$	Is the student able to explain the chemical properties of sulphates?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) describe uses of sulphates.	i) The teacher to guide 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, alumni in dyes and leather industry. ii) Student in groups to discuss the uses sulphates	Wall charts and pictures showing the uses of sulphates in daily life	Is the student able to describe the uses of sulphates?	

FORM FOUR

CLASS LEVEL COMPETENCES

Student should have the ability to:

1. apply appropriate skills to conserve the environment;
2. investigate the properties of organic compounds and their applications in daily life;
3. determine the nature and properties of soil; and
4. analyse the effects of pollution and prevention.

CLASS LEVEL OBJECTIVES

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

a) analyse critically the properties of matter and their environmental effects;
b) show understanding of the 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; and
e) understand the effects of pollution and their remedial measures.

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.0 NON-METALS AND THEIR COMPOUNDS 1.1 General Chemical Properties of Non-Metals	A student should be able to: a) explain the oxidizing properties of non-metals.	i) A 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?	2
	b) describe the displacement of non-metals by other non-metals from their compounds.	i) The teacher to use gaseous chlorine to demonstrate the displacement of either bromine or iodine from their compounds in aqueous solutions. ii) The teacher to guide students to discuss the oxidizing properties of chlorine.	• Cl_2 • KI	Is the student able to describe the displacement of non-metals by other non-metals from their compounds?	
1.2 Chlorine	A 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.	• Coloured flowers • Dyes • Chlorine gas • SO_2 • H_2S • $FeCl_2$	Is the student able to describe the chemical properties of chlorine?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) The teacher to demonstrate the oxidizing properties of chlorine by passing into SO_2, H_2S and $FeCl_2$ solutions. iii) The teacher to guide students to write equations for the reactions. iv) The teacher to lead students to discuss the poisonous nature of chlorine.			
	b) explain the uses of chlorine.	i) The teacher to guide students to discuss uses of chlorine as a germicide, disinfectant, bleaching agent, water sterilizer, an ingredient in preparation of solvents and in plastic industry. ii) Students to explain the uses of chlorine	Wall charts and pictures showing the poisonous effects of chlorine and its uses	Is the student able to explain the uses of chlorine?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.3 Hydrogen Chloride	A 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 sodium chloride.	• NaCl • NH_4Cl • Conc. H_2SO_4	Is the student able to prepare HCl gas?	6
	b) explain the properties of hydrogen chloride gas.	i) The teacher to guide students to show how aqueous hydrogen chloride reacts with metals, oxides, hydroxides and carbonates. ii) Students to test the acidity and alkalinity of a pure dry sample of HCl gas using dry and wet litmus papers. iii) Students under teacher's guidance to show how HCl gas reacts with ammonia gas.	• H_2O • HCl gas • Litmus paper • Ammonia gas • Glass rod • Carbonates, oxides or hydroxides of Ca, Mg, Zn and Fe	Is the student able to explain the properties of hydrogen chloride gas?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iv) Students to test the solubility of HCl gas in water.			
	c) explain the uses of hydrogen chloride gas.	i) The teacher to guide students to discuss the uses of hydrogen chloride gas e.g. in qualitative and quantitative analysis. ii) Students in groups to discuss the uses of hydrogen chloride gas.	Wall charts showing the uses of HCl gas	Is the student able to explain the uses of hydrogen chloride gas?	
1.4 Sulphur	A student should be able to: a) describe the extraction of sulphur from its natural deposits.	i) The teacher to guide students to discuss the extraction of sulphur by the Frasch process. ii) Students in groups 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 its natural deposits?	10
	b) explain the properties of sulphur.	i) The teacher to guide students to discuss the oxidizing and reducing properties of sulphur.	• Sulphur • Copper or iron • Conc. H_2SO_4 • $K_2Cr_2O_7$	Is student able to explain the properties of sulphur?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students to discuss the oxidizing and reducing properties of sulphur.			
	c) explain the uses of sulphur.	i) The teacher to guide students to discuss the use of sulphur in rubber industry, manufacture of H_2SO_4, matches, gun powder, germicides, drugs and 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?	
1.5 Sulphur dioxide	A student should be able to: a) describe the properties of sulphur dioxide.	i) The teacher to guide students to discuss the properties of SO_2 i.e. acidic, reducing, bleaching and oxidizing properties. ii) 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 and PbO	Is the student able to describe the properties of sulphur dioxide?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) explain uses and hazards of sulphur dioxide	i) The teacher to guide students to discuss the uses and hazards of sulphur dioxide. ii) Students 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	A student should be able to: a) describe the contact process for the manufacture of sulphuric acid.	i) The teacher to guide students to use the Le Châtelier's Principle to discuss the Contact process of manufacturing sulphuric acid. ii) Students to discuss the use of Le Châtelier's Principle to discuss the Contact process of manufacturing sulphuric acid.	Wall charts and pictures showing the industrial manufacturing of sulphuric acid	Is the student able to describe the contact process for the manufacturing of sulphuric acid?	8

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) explain the uses of sulphuric acid.	i) The teacher to guide students to discuss the uses of sulphuric acid including the manufacturing of fertilizers, textiles, sulphates, and dye stuffs, in metallurgy, in accumulators, in the manufacturing 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?	
1.7 Nitrogen	A student should be able to: a) prepare a sample of nitrogen in the laboratory.	i) The teacher to guide students to prepare sample of nitrogen in the laboratory. ii) Students in groups using teacher's guidelines to prepare a sample of nitrogen gas in the laboratory.	• 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

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii) Students in groups to test the prepared nitrogen gas under the teacher's guidance.			
	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 manufacturing 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	A 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	Is the student able to prepare a sample of ammonia gas in the laboratory?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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 nitric acid. ii) Students in groups to discuss the uses of ammonia.	Wall charts and pictures on industrial preparation of fertilizers	Is the student able to explain the uses of ammonia?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.9 Carbon	A 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 name the forms in which carbon occurs?	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	Is the student able to describe the allotropic forms of carbon?	
1.10 Carbon dioxide	A 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.	• $CaCO_3$ • HCl • Delivery tubes • Flasks • Gas jars • Limestone	Is the student able to prepare a dry sample of carbon dioxide gas in the laboratory?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students to prepare carbon dioxide by adding dilute acids on marble or any carbonate.			
	b) analyse the properties of carbon dioxide.	i) The teacher to guide students to analyse the properties of carbon dioxide. ii) Students to test the physical properties of carbon dioxide. iii) Students to carry out the specific test for carbon dioxide with aqueous calcium hydroxide or barium hydroxide. iv) Students to find out how carbon dioxide reacts with NaOH, $Ca(OH)_2$, magnesium and water.	• Carbon dioxide • Lime water, $Ca(OH)_2$ • $Ba(OH)_2$ • $CaCO_3$ • Water • Magnesium	Is the student able to analyse the properties of carbon dioxide?	
	c) explain the uses of carbon dioxide.	Students in groups to discuss the uses of carbon dioxide (in fire extinguishers, in fizzy drinks, dry ice, beer and soda).	• Fire extinguishers • Fizzy drinks • Baking powder • Dry ice • Soda	Is the student able to explain the uses of carbon dioxide?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
2.0 ORGANIC CHEMISTRY 2.1 Introduction to organic chemistry	A student should be able to: a) distinguish organic from inorganic chemistry.	i) A 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	Is the student able to differentiate organic from inorganic chemistry?	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	Is the student able to explain the importance of organic chemistry in life?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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 petroleum and natural mines	Is the student able to trace the origins of organic compounds?	
	d) describe the fractional distillation of crude oil.	i) The 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	Is the student able to describe fractional distillation of crude oil?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
2.2 Hydrocarbons	A student should be able to: a) classify the three families of hydrocarbons.	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	Is the student able to classify 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 homologous series of alkanes, alkenes and alkynes.	Wall charts, pictures and models showing open and condensed structures of hydrocarbons	Is the student able to write the homologous series of the three families of hydrocarbons?	
	c) explain the concept of isomerism	The 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	Is the student able to explain the concept of isomerism?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	d) write structural formulae of all isomers of hydrocarbons up to five carbon atoms.	i) The teacher to guide students to discuss the structural formulae of the isomers of the lower hydrocarbons. ii) Students to write structures of all isomers of alkanes, alkenes and alkynes up to five carbon atoms.	• Manila sheets and magic markers • Wall charts, pictures and models showing structures of different isomers of lower hydrocarbons	Is the student able to write open structural formulae of all the isomers of hydrocarbons 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	Is the student able to name the isomers of hydrocarbons up to 5 carbon atoms?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	f) apply a general formula to identify the families of hydrocarbons.	i) Students to use the general formulae: 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, pictures and models of different hydrocarbons	Is the student able to apply the general formulae to identify families of hydrocarbons?	
2.3 Properties of hydrocarbons	A student should be able to: a) describe 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. ii) students to discuss physical properties of hydrocarbons to include: density, melting point, boiling point and states at room temperature.	Wall charts and models showing the physical properties of lower hydrocarbons	Is the student able to describe the physical properties of lower hydrocarbons?	8

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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	Is the student able to explain the concept of saturated and unsaturated hydrocarbons?	
	c) compare the chemical properties of lower alkanes, alkenes and alkynes.	i) Using appropriate reagents for example Bromine/ chlorine water and $KMnO_4$ solution, the teacher to demonstrate the saturation nature of alkanes and un-saturation nature of alkenes and alkynes. ii) The teacher and students to discuss how methane reacts with oxygen and chlorine.	• Bromine/ chlorine water • $KMnO_4$ solution • Wall charts showing the chemical properties of hydrocarbons	Is the student able to compare the chemical properties of lower alkane, alkenes and alkynes?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii) The teacher to lead a discussion on how ethane reacts with oxygen, halogens, hydrogen halides and sulphuric acid.			
2.4 Alcohols	A student should be able to: a) prepare ethanol in the laboratory.	i) The 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	Is the student able to prepare ethanol in the laboratory?	
	b) write the homology of alcohols up to five carbon atoms.	i) The teacher to lead a 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 • Marker pen • Models	Is the student able to write the homologous series of alcohols up to five carbon atoms?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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.	Wall charts and models showing open structures of alcohols	Is the student able to 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, • Pictures and models • Manila sheets • Marker pens	Is the student able to name isomers of alcohols up to five carbon atoms?	
	e) explain the properties of alcohols.	i) The teacher to guide students to find out how ethanol reacts with oxygen, sodium, ethanoic acid and concentrated sulphuric acid.	Wall charts showing the properties of alcohols	Is the student able to explain the properties of alcohols?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) students to find out how ethanol reacts with oxygen, sodium, ethanoic acid and concentrated sulphuric acid.			
	f) explain uses of alcohols.	i) The teacher to guide students to discuss different uses of alcohols. ii) Students to discuss different uses of alcohols.	Wall charts, pictures and real types of alcohols	Is the student able to explain different uses of alcohols?	
	g) explain the harmful effects of alcohols.	i) The 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.	• Wall charts and pictures showing alcohol addicts • Pictures showing different types of alcohols • Charts showing problems associated with alcohols	Is the student able to explain the harmful effects of alcohols?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		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) The teacher to invite a guest speaker to talk on the effects of alcohols and problems associated with alcoholism.			
2.5 Carboxylic Acids	A student should be able to: a) identify natural sources of organic acids.	i) The teacher to guide students to find out sources of organic acids like sour milk, citrus fruits and vinegar. ii) Students to demonstrate the acidic nature of natural substances.	• Milk • Citrus fruits • Vinegar	Is the student able to identify natural sources of organic acids?	5

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) explain the oxidation of ethanol to ethanoic acid.	i) The 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) The teacher to lead a discussion on the oxidation of ethanol to ethanoic acid.	• Local brews • Wine • Ethanoic acid • Litmus papers	Is the student able to explain the oxidation of ethanol to ethanoic acids?	
	c) write the structures of the homologues of carboxylic acids up to five carbon atoms.	i) The teacher to guide students to write the open and condensed structures of the carboxylic acid homologues using the general formula $C_nH_{2n+1}COOH$.	• Wall charts, pictures and models showing various structures of carboxylic acids • Manila sheets	Is the student able to write the structures of homologues of carboxylic acids up to five carbon atoms?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students to write the open and condensed structures of the carboxylic acid homologues using the general formula $C_nH_{2n+1}COOH$.			
	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	Is the student able to name 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	Is the student able to explain the properties of carboxylic acids?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	f) prepare soap from animal fats or vegetable oil.	i) The teacher to guide students to discuss the mechanism of soap formation. ii) Students to prepare soap by boiling a mixture of NaOH and oil, isolate the soap, dry it and use it in washing.	• Oil, fat, NaOH, manila sheets and marker pens • Wall charts and pictures showing industrial process of manufacturing soap	Is the student able to prepare soap from animal fat or vegetable oil?	
3.0 SOIL CHEMISTRY 3.1 Soil Formation	A student should be able to: a) describe soil formation.	i) A teacher to guide students to discuss the process of soil formation. ii) Students to discuss the process of soil formation.	• Soil sample • Chart showing flow diagram of soil formation	Is the student able to describe how soil is formed?	6
	b) Explain 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 acids as an example of how soil is formed.	• Soil samples of different types • Marble • Dilute acids	Is the student able to explain factors influencing soil formation?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.2 Soil Reaction	A 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 pH.	• pH meter • Samples of soil from different places • Soil pH kit	Is the student able to explain the concept of soil reaction?	8
	b) Measure the pH of a given soil sample.	i) The teacher to give guidelines to students on how to measure the pH of soil sample collected from the school garden using a soil pH kit. ii) Students to use a soil pH kit to measure the pH of a soil sample collected.	• Soil pH kit • Universal indicator • Soil sample	Is the student able to measure the pH 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, $MgCO_3$ and $Ca(OH)_2$.	• Wood ash • $MgCO_3$ • $Ca(OH)_2$ • Wall charts and pictures of liming materials	Is the student able to manage the soil pH by using different liming materials?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) Students under teacher's guidance to manage the soil pH by using different liming materials.			
3.3 Plant nutrients in the soil	A 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	Is the student able to categorize micro and macro plant nutrients?	4

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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	Is the student able to explain the functions of each of the primary macronutrient elements in plant growth?	
	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	Is the student able to prepare nutrient cultures in the laboratory?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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?	
3.4 Manures and fertilizers	A 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 manures.	i) The teacher to facilitate students to discuss the advantages and disadvantages of manures. ii) Students to apply compost and farmyard manures on different plant plots and observe the differences on plant growth.	• Compost manure • Farmyard manure • Wall charts and pictures showing the application of manures on a farm	Is the student able to explain advantages and disadvantages of manures?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) mention types of synthetic fertilizers used in Tanzania.	i) The teacher to lead students in groups to discuss the types of artificial fertilizers used in different parts of Tanzania. ii) Students in groups to discuss the types of artificial fertilizers used in different parts of Tanzania.	• Samples of industrial fertilizers e.g. NPK, MSP, DSP, TSP, Urea, CAN and SP • Wall charts and pictures of artificial fertilizers	Is the student able to mention types of synthetic fertilizers used in Tanzania?	
	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?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	e) describe 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 different methods of fertilizer application.	• Farm plot • Fertilizers • Wall charts and pictures showing the application of fertilizers	Is the student able to describe different methods of fertilizer application?	
	f) explain the advantages and disadvantages of artificial fertilizers as compared to 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 the advantages and disadvantages of artificial fertilizers as compared to manures?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.5 Soil fertility and productivity	A 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 infertile soil	Is the student able to explain the concept of soil fertility and productivity?	6
	b) differentiate soil fertility from soil productivity.	i) The teacher to lead student in groups to discuss the differences between soil fertility and soil productivity. ii) 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	Is the student able to differentiate soil fertility from soil productivity?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) explain the factors which determine fertility and productivity of the soil.	i) The teacher to guide students to discuss the 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 pH. ii) 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 pH.	• Areas with fertile soils and others with unfertile soils • Samples of fertile soil • Samples of unfertile soil	Is the student able to explain factors which determine fertility and productivity of soil?	
	d) explain the causes of loss in soil fertility.	i) The teacher to guide students to discuss causes of loss in soil fertility.	• A farm plot • A project outline	Is the student able to explain causes of loss of soil fertility?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) The teacher to assign projects to students to find the causes of loss of soil fertility.			
4.0 POLLUTION 4.1 Concept of Pollution	A student should be able to explain the concept of pollution.	i) A 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	Is the student able to explain the concept of pollution?	2
4.2 Terrestrial Pollution	A student should be able to: a) explain the concept of terrestrial pollution.	i) The teacher to lead a discussion on the meaning and examples of terrestrial pollution. ii) Students to discuss the meaning and example of terrestrial pollution.	Wall charts and pictures of terrestrial pollution	Is the student able to explain the concept of terrestrial pollution?	4
	b) identify human activities which cause terrestrial pollution.	i) The teacher to guide students to discuss how the environment is polluted by careless dumping of:	• Field visit to actual sites where solid wastes are found • Wall charts and pictures of areas with solid wastes and damps	Is the student able to identify human activities which cause terrestrial pollution?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		• Rotting garbage, • Non-biodegradable plastic bags and containers, • Bottles and other types of glassware, and • Toxic chemicals used in farms. 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) The teacher to organize visits to areas where urban solid wastes are dumped. ii) Students to discuss diseases and accidents likely to occur in a polluted environment.	Wall charts and pictures illustrating diseases and accidents likely to occur in a polluted environment	Is the student able to identify hazards caused by terrestrial pollution?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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	Is the student able to suggest methods of preventing terrestrial pollution?	
4.3 Aquatic Pollution	A student should be able to: a) explain the concept of aquatic pollution.	i) The teacher to guide students to discuss the meaning of aquatic pollution. ii) Students to discuss examples of aquatic pollutants.	Wall charts and pictures about aquatic pollution	Is the student able to explain the meaning of aquatic pollution?	4
	b) identify human activities which cause water pollution.	i) The teacher to organize field visits to factories and industries to study how they deal with their liquid effluents. ii) The teacher to guide students to identify cases where water pollution from industrial effluents has caused death to aquatic flora and fauna.	• 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 than industrial effluents	Is the student able to identify human activities which cause water pollution?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii) Students to discuss how to stop aquatic pollution.			
	c) identify the hazards which are caused by water pollution.	i) The teacher to guide students to identify and discuss the effect of fertilizers and other agrochemicals 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	Is the student able to 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	Is the student able to suggest ways of preventing water pollution?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
4.4 Aerial Pollution	A student should be able to: a) explain the concept of aerial pollution.	i) The teacher to guide students to discuss the meaning of aerial pollution and examples of aerial pollution in real life situations. ii) Students in groups to discuss the meaning of aerial pollution and give examples of aerial pollution in real life situations.	Wall charts and pictures describing aerial pollution	Is the student able to 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	Is the student able to identify activities which cause air pollution?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	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 the destruction of buildings and stone statues, and the formation of acid rain.	Pictures of: • stone statues • large buildings • destroyed forests • destroyed ponds	Is the student able to identify the hazards caused by aerial pollution?	
	d) suggest different methods of preventing aerial pollution.	i) The teacher and students to make a visit to factories which produce gaseous pollutants. ii) The teacher and students to discuss effective methods of curtailing the production of gaseous pollutants. iii) Students to discuss the different methods of preventing air pollution.	Pictures of factories emitting gases and smoke into the air	Is the student able to suggest effective methods of preventing aerial pollution?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	e) identify safety measures to protect industrial workers from gaseous pollution.	The 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	Is the student able to suggest effective measures of preventing factory workers from gaseous pollutants?	
4.5 Environmental Conservation	A student should be able to: a) explain the meaning of environmental conservation.	i) The teacher and students to discuss the meaning of environmental conservation. ii) Students to differentiate environmental conservation from environmental protection.	Pictures of: • an eroded land • conserved land • protected land	Is the student able to explain the meaning of environmental conservation?	4
	b) demonstrate right attitudes, values and behaviours towards environmental conservation.	The teacher to lead students to do the following activities: i) Planting flowers and trees, ii) Clean the environment, and iii) Other several activities to conserve the environment.	Pictures of students cleaning the environment	Is the student able to manifest acceptable attitudes, values and behaviours towards environmental conservation?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
4.6 Global Warming	A student should be able to: a) explain global warming, in terms of the 'green house' effect.	i) The teacher to guide students to discuss the meaning of: • global warming • greenhouse effect ii) 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 and greenhouse effect?	4
	b) describe how the major "greenhouse" gases are produced.	i) The teacher to guide students to discuss how the following greenhouse gases are produced in life: • CO_2 • NO_2 • CH_4 • SO_2 ii) Students to discuss how the different greenhouse gases are produced in life.	Pictures of factories which produce the greenhouse gases	Is the student able to describe how the major green house gases are produced?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) describe climatic conditions caused by global warming.	i) The teacher to guide 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 coastlines; • formation of hurricanes and typhoons; • expansion of deserts; and • flooding. ii) Students to discuss how the different climatic conditions can be caused by global warming.	Pictures of hurricanes, glaciers, deserts and floods	Is the student able to describe climatic conditions caused by global warming?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	d) suggest ways of preventing global warming.	i) The teacher to guide students to discuss how to stop the production of greenhouse gases which cause global warming. ii) Students to discuss how to stop the production of greenhouse gases which cause global warming.	Pictures of hurricanes, glaciers, deserts and floods	Is the student able to suggest ways of preventing global warming?	
4.7 Ozone Layer Depletion	A student should be able to: a) explain meaning of ozone layer and its importance to life on earth.	i) The teacher to guide students to discuss the meaning and significance of the ozone layer in relation to life on earth. ii) 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	Is the student able to explain the meaning of the ozone layer, and its importance to life on earth?	4
	b) identify chemical substances which deplete the ozone layer.	The teacher and students to discuss how aerosols and chlorofluorocarbons destroy the ozone layer.	Pictures of containers of aerosols	Is the student able to identify the substances which are capable of depleting the ozone layer?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) suggest methods of protecting the ozone layer.	The teacher and students to discuss the possible methods of protecting the ozone layer e.g. using alternative chemicals to aerosols.	Pictures and charts showing ozone layer depletion	Is the student able to suggest methods of protecting the ozone layer?	
5.0 QUALITATIVE ANALYSIS 5.1 The Concept of Qualitative Analysis	A student should be able to: a) explain the meaning of qualitative analysis.	i) The teacher and students to discuss the meaning of qualitative analysis. ii) 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.	i) The teacher to guide 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 pH of a soil sample.	Wall chart and pictures	Is the student able to explain the importance of qualitative analysis in real life?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) 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 pH of a soil sample.			
5.2 Qualitative Analysis Procedures	A student should be able to: a) use apparatus for qualitative analysis.	The teacher to guide students to practice the use of apparatus for qualitative analysis.	• Test tube rack • Centrifuge • Test-tube holder • Heat source • Small test tubes • Charcoal block • Platinum wire • Blow pipe • Filter paper • Filter funnel	Is the student able to use apparatus for qualitative analysis?	16

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
			• Wash bottle • Crucible and lid • Evaporating basin • Watch glass		
	b) carry out preliminary tests on an unknown sample.	i) The 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.	• Conc. H_2SO_4 • Dil. HCl • Litmus papers	Is the student able to carry out preliminary tests on an unknown sample?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii) 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.			
	c) prepare stock solutions from soluble and insoluble salts.	i) The teacher to lead students to prepare stock solutions using: • distilled water, • dilute hydrochloric acid, and • dil. HNO_3. ii) students to prepare stock solutions.	• 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?	

TOPICS/ SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	d) precipitate insoluble salts from their solutions.	i) The teacher to guide students to perform practical work to precipitate insoluble salts from their solutions. ii) Students to carry out experiments to precipitate Cu^{2+}, Fe^{2+}, Fe^{3+}, Ca^{2+}, Pb^{2+} and Zn^{2+} ions form their solutions.	• Dilute NaOH • Dilute ammonia solution • Potassium iodide • Potassium hexacynoferrate(II) • Potassium hexacynoferrate(III) • Lead nitrate • Concentrated ammonia solution	Is the student able to precipitate insoluble salts from their solutions?	
	e) confirm the cations and anions identified.	i) The teacher to guide students to perform practical work on confirmatory test to identify ion. ii) Students to carry out confirmatory tests on the identified ions.	• Nessler's 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 identified cations and anions?	