FORM ONE

1.0.0 INTRODUCTION TO CHEMISTRY (12 Lessons)

1.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) recall the topics related to chemistry taught at primary school level
b) explain what the study of chemistry is about
c) name and state the uses of common apparatus in the laboratory
d) describe a Bunsen burner and its flame
e) state laboratory safety rules.

1.2.0 Content

1.2.1 Review the following topics

- properties of matter
- states of matter
- mixtures and their separations
- conductors and non-conductors of electricity
- Mention of drugs (prescription, dosage and abuse)

1.2.2 Chemistry and the Society

- Definition of chemistry and its role in the society

1.2.3 Chemistry laboratory

- heating apparatus (Bunsen burner, spirit lamp, candle, gas or kerosene stove and electric heater)
- parts of a Bunsen burner and its flame
- measuring apparatus (volume, temperature, mass, time)
- other apparatus (glass ware, spatula, deflagrating spoon, crucible, wire gauze etc)
- laboratory safety rules.

2.0.0 SIMPLE CLASSIFICATION OF SUBSTANCES (32 Lessons)

2.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) carry out simple experiments to obtain pure substances from mixtures
b) state the criteria for identifying a pure substance
c) define and determine the melting point and boiling point of a substance
d) explain the three states of matter (solid, liquid, gas) in terms of a simplified form of the kinetic theory
e) state the effect of heat on a variety of substances
f) distinguish between permanent and non-permanent changes
g) define an element, a compound, an atom and a molecule
h) name and write the chemical symbols of common elements
i) recognize the constituents of matter from given examples
j) distinguish between mixtures and compounds
k) apply separation techniques to extract various substances from natural sources.

2.2.0 Content

2.2.1 Separation of Mixtures

- Filtration, evaporation and condensation
- Distillation (simple and fractional), chromatography, solvent extraction as a method of extracting oil from nut seeds, crystallization, separation by using separating

funnel, sublimation and decantation.
- Simple criteria for purity; melting point and boiling point.

2.2.2 Effect of heat on substances
- States of matter (solid, liquid, gases); The Kinetic theory
- Melting and boiling, condensation and evaporation of liquids in terms of kinetic theory
- Permanent and non-permanent changes (illustrate using iodine, wax, copper(II) sulphate crystals, potassium manganate(VII), zinc(II) oxide etc)

2.2.3 Constituents of matter
- Elements, atoms, molecules and compounds
- Names and symbols of common elements
- Simple word equations

2.2.4 Applications
- Fractional distillation of crude oil (e.g. Changamwe oil refinery) and liquid air, salt extraction e.g. Magadi Soda Company and Ngomeni; removal of stains from fabrics (dry cleaning); obtaining cream from milk.

2.3.0 Projects
- extraction of natural dyes, medicines and oils from plants
- construction and use of a fractionating column

3.0.0 ACIDS, BASES AND INDICATORS (16 Lessons)

3.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) prepare and use plant extracts as acid-base indicators
b) use indicators to identify acids and bases
c) state simple properties of acids and bases
d) name uses of acids and bases
e) state effects of acids on substances.

3.2.0 Content

3.2.1 Acid/Base indicators
- Plant - extracts as simple acid -base indicators
- Common acid-base indicators, universal indicator and pH scale
- Acidic, neutral and basic/alkaline solutions illustrated by the use of the following examples; water, aqueous solution/suspension; lemon juice, soap, wood ash, baking powder, anti-acid tablets and powders, toothpaste, sour milk, ammonia, ammonium sulphate, sodium chloride, sodium hydroxide, carbon(IV) oxide, sulphur(IV) oxide, sulphuric acid, hydrochloric acid, nitric acid, calcium hydroxide and magnesium oxide.

3.2.2 Simple properties of acids and bases:
- Reaction of dilute acids with metals, metal oxides, hydroxides, carbonates and hydrogencarbonates
- Effects of acids on substances

3.2.3 Applications
- Uses of acids and bases

3.3.0 Projects
- Investigate various plant extracts and use them as acid/base indicators

4.0.0 AIR AND COMBUSTION (24 Lessons)

4.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state the percentage composition of air by volume
b) carry out simple experiments to show that oxygen is the active part of air
c) determine the percentage of oxygen in air using suitable methods
d) describe the combustion of specified elements in air and oxygen and name the products
e) explain how liquefied air can be separated into its components by fractional distillation
f) carry out experiments to investigate the conditions for rusting, and state the composition of rust
g) state methods of preventing rusting
h) prepare oxygen, investigate its properties and state its uses
i) arrange some elements in order of their reactivity with oxygen using experimental data
j) classify the products of burning elements in oxygen either as acidic or basic
k) state pollution effects due to burning of substances in air
l) state the uses of reactivity series.

4.2.0 Content

4.2.1 Composition of air

- Approximate percentage of nitrogen and oxygen in air by volume (mention of carbon dioxide and noble gases as other constituents of air)
- Quantitative determination of oxygen in air using copper, iron fillings and burning candle.
- Burning of substances in air; carbon, sulphur, phosphorus (CARE), sodium and copper
- Oxygen as an active part of air (mass changes involved)
- Fractional distillation of liquefied air
- Rusting: conditions, composition and prevention

4.2.2 Oxygen

- Laboratory preparation of oxygen using 20 volume by volume (v/v) hydrogen peroxide with manganese(IV) oxide or reaction of sodium peroxide with water (relate methods of collection to the properties of the gas)
- Properties; physical and chemical
- Combustion of elements in oxygen (metals and non-metals)
- competition for combined oxygen illustrated by the reaction of magnesium with carbon(IV) oxide, lead(II) oxide) and copper(II) oxide
- Mention atmospheric pollution due to burning in oxygen

4.2.3 Reactivity Series

- order of reactivity of elements from reaction with oxygen: potassium, sodium, calcium, magnesium, aluminium, carbon, zinc, iron, lead and copper.
  (It is not possible to establish full series practically)
- Uses: oxy -acetylene in welding; life support functions

4.2.4 Application

Extraction of metals (use the concept of reactivity series only)

4.3.0 Projects

Determination of oxygen in water from different sources. Investigate industrial processes of large scale oxygen production (e.g. the British Oxygen Company (BOC) Kenya Limited).

5.0.0 WATER AND HYDROGEN (20 Lessons)

5.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state sources of water
b) describe an experiment to show water is a product of burning organic matter
c) describe an experiment to show that water contains hydrogen
d) state the products of reactions of cold water and steam with different metals
e) list the order of reactivity of metals as obtained from metal-water reactions
f) prepare hydrogen, investigate its properties and state its uses.
g) define oxidation as oxygen gain and reduction as removal of oxygen
h) explain metal oxide reactions with hydrogen in terms of reduction and oxidation.

5.2.0 Content

5.2.1 Water

- Sources of water: Burning of organic matter e.g. burning candle in air (test for carbon(IV) oxide and water vapour using calcium hydroxide and cobalt chloride paper or anhydrous copper(II) sulphate respectively)
- Water as an oxide of hydrogen.
- Reaction of sodium, calcium, magnesium with cold water and reaction of magnesium, zinc, iron with steam.

5.2.2 Hydrogen

- Laboratory preparation of hydrogen by reacting a metal with a dilute acid. (relate methods of collection to properties of the gas). Test for hydrogen
- Properties; physical and chemical
- Oxidation and reduction (oxygen gain and removal only) e.g. in metal oxide - hydrogen reaction.
  (Caution: experiments involving the burning of hydrogen gas are explosive).
- Uses (manufacture of margarine, rocket fuels, ammonia, hydrochloric acid, Oxy-hydrogen flame for welding and weather balloons.

5.3.0 Project

- Identification of common pollutants of water from local sources and suggesting their control