SUBJECT: Chemistry

GRADE: 10

TERM: Christmas-Easter-Summer

Objectives: **Source CSEC chemistry syllabus pages 12-16 (**https://cxc.org/SiteAssets/syllabusses/CSEC/CSEC%20Chemistry%20Syllabus%20with%20Specimen%20Papers%20and%20Mark%20Scheme-Keys.pdf)

SECTION A - PRINCIPLES OF CHEMISTRY

Section A is designed as an introduction to fundamental chemical concepts and principles. A study of the particulate nature of matter, structure, bonding, chemical properties and physical properties of elements, compounds and mixtures is included as well as certain quantitative properties. Comprehension of these concepts and principles will help students appreciate the importance of chemistry as it relates to the environment and the daily activities of man.

GENERAL OBJECTIVES

On completion of this Section, students should:

1. Be aware that matter is made up of particles;

2. Understand that different types of mixtures can be separated based on the properties of the components;

3. Be familiar with the concept of the atom as the basic building block of matter;

4. Appreciate that matter can be classified based on physical or chemical properties;

5. Be aware of the different forces of attraction that exist between particles;

6. Understand the mole as the unit for comparison of amounts of matter;

7. Appreciate that properties of chemicals will affect their reactions;

8. Assess the impact of certain materials on living systems and the environment;

9. Be familiar with the composition of certain materials and develop the ability to make reasoned choices concerning their use;

10. Understand that the rate at which a chemical reaction proceeds is dependent on a number of physical factors;

11. Appreciate that energy changes occur during the course of a chemical reaction;

12. Appreciate the importance of chemistry to the environment.

CHRISTMAS TERM OCTOBER-DECEMBER

Topics: States of Matter, Separations and Mixtures

1. STATES OF MATTER

Specific Objectives

By the end of the topic students should be able to:

1.1 explain how evidence supports the particulate theory of matter; Evidence obtained from practical work involving processes, such as diffusion and osmosis.

1.2 distinguish among the three states of matter; Arrangement of particles, energy of particles, strength of forces of interaction. Consideration of physical characteristics of states. Example: Volume, density, compressibility.

1.3 explain the changes between the three states of matter in terms of energy and arrangement of particles. Consideration of freezing, melting, boiling, evaporation, sublimation, condensation; heating and cooling curves.

2. MIXTURES AND SEPARATIONS

Specific Objectives

By the end of the topic students should be able to:

2.1 distinguish between pure substances and mixtures; Elements, compounds, atoms, molecules, fixed composition, properties, variable composition, variable properties. Compare boiling point of pure water and sodium chloride solution.

2.2 distinguish among solutions, suspensions and colloids; Reference to particle sizes, passage of light, sedimentation. Filtration, use of lamp light to view particles.

2.3 identify different types of solutions; Types of solutions: solid in liquid, solid in solid, gas in liquid, liquid in liquid, gas in gas. Observe examples of each type of solution.

2.4 investigate the effect of temperature on solubility of solids in water; Examples showing that a decrease in solubility with increasing temperature will not be required. Determine the solubility of a solute in water, for example, potassium nitrate.

2.5 apply suitable separation techniques based on differences in properties of the components of mixtures; Properties to be included: particle size, boiling point, crystalline structure, solubility and solute mobility in solvent. Include line drawing to represent the separation process. Use of simple filtration, simple and fractional distillation, paper chromatography, and the separating funnel.

2.6 describe the extraction of sucrose from sugar cane. A simple treatment of the following crushing, precipitation, filtration, vacuum distillation, crystallisation, centrifugation.

EASTER TERM

Topics: Atomic Structure, Periods and Periodicity, Structure and bonding

3. ATOMIC STRUCTURE

Specific Objectives

By the end of the topic students should be able to:

3.1 describe with illustrations, the structure of atoms of atomic number 1 to 20; The atom as consisting of three basic particles: protons, neutrons and electrons arranged in shells. Make models.

3.2 state properties of electrons, protons and neutrons; Properties related to relative mass and relative charge only.

3.3 define atomic number and mass number

3.4 define relative atomic mass; Relative atomic mass based on carbon-12 isotope.

3.5 interpret notations of the form a c X b d a – mass number; b – atomic number; c - charge; d - number of items in the entity; X – symbol of atom.

3.6 define isotopy; Isotopes as atoms with the same number of protons and different number of neutrons.

3.7 list uses of radioactive isotopes. At least three uses of radioactive isotopes; for example, carbon dating, radiotherapy, tracers, pacemakers and energy generation.

4. PERIODIC TABLE AND PERIODICITY

Specific Objectives

By the end of the topic students should be able to:

4.1 explain the basis for the arrangement of elements in the periodic table; Mention historical development of the periodic table, for example, contributions from Mendeleev and Dobereiner. Classification based on atomic number, atomic structure. Arrangement in periods and groups.

4.2 explain trends in Group II; Ease of ionisation, reactivity with oxygen, water, and dilute hydrochloric acid. Reactions of magnesium and calcium with water, air, and dilute hydrochloric acid.

4.3 explain trends in Group VII; Consideration of the following properties: physical state at room temperature, strength of oxidising power. Carry out simple displacement reactions with chlorine, bromine and iodine.

4.4 identify trends in period 3; Metallic to semi-metallic to non-metallic properties.

4.5 predict properties of unknown elements based on the position in periodic table. Plan and design an investigation of the position of element X in the periodic table.

SUMMER TERM

Topic: Structure and bonding and Acid, Bases and Salts

5. STRUCTURE AND BONDING

Specific Objectives

By the end of the topic students should be able to:

5.1 explain the formation of ionic and covalent bonds; Draw dot and cross diagrams to show ionic and covalent bonding.

5.2 predict the likelihood of an atom forming an ionic or a covalent bond based on atomic structure

5.3 write formulae to represent ions, molecules and formula units

5.4 explain metallic bonding; Arrangement of cations and mobile electrons

5.5 describe ionic crystals, simple molecular crystals and giant molecular crystals; Make diagrammatic representations of sodium chloride, graphite and diamond. Make models of sodium chloride, graphite and diamond.

5.6 distinguish between ionic and molecular solids; Use melting point, solubility in water and organic solvents, and conductivity. Investigate melting point and solubility of solids and conductivity of resulting solutions.

5.7 relate structure of sodium chloride, diamond and graphite to their properties and uses; Use melting point, solubility in water, conductivity, hardness and lubricating power.

5.8 explain the term allotropy. Reference to the allotropes of carbon – diamond and graphite.

7. ACIDS, BASES AND SALTS

Specific Objectives

By the end of the topic students should be able to:

1. Define acid, acid anhydride, base, alkali, salt, acidic, basic, amphoteric and neutral oxides; Consideration of proton donor or acceptor and replaceable hydrogen. Relate to basic and acidic oxides.

2. Relate acidity and alkalinity to the pH scale; pH scale - No formal definition of pH required. Carry out simple exercises with litmus paper and universal indicator. Biology - Digestion, blood, enzyme activity.

3. Discuss the strength of acids and alkalis on the basis of their completeness of ionisation; Degree of ionisation linked to strength and the pH of the solution. Use pH meter.

4. Investigate the reactions of nonoxidising acids; Reactions of acids with metals, carbonates, hydrogen carbonates, bases. Practicals to demonstrate reactions of acids. Demonstrate reactions with antacids, baking powder, fire extinguishers. Biology – Use of antacids.

5. List examples of acids in living systems; Vitamin C (ascorbic acid), methanoic acid (in ants), lactic acid (build-up in muscles). Neutralisation of Vitamin C with sodium hydrogen carbonate. Formula of Vitamin C not required. The treatment of ant stings, use of vinegar in food preservation due to low pH. Use of lime juice to remove rust stains. Plan, design and conduct an investigation to compare the vitamin C content of a named fruit juice before and after heating. Biology – Nutrition, respiration.

6. Investigate the reaction of bases with ammonium salts

7. Identify an appropriate method of salt preparation based on the solubility of the salt; A general knowledge of the solubility of sulfates, nitrates, chlorides, carbonates and bases. Uses of salts in everyday life. Prepare insoluble salts by precipitation; prepare soluble salts by

direct combination and by replacing hydrogen ions of an acid directly or indirectly by a metal or ammonium radical.

8. List the uses and dangers of salts; Refer to action of baking powder, calcium carbonate for the manufacture of cement. For food preservation: sodium chloride, sodium nitrite, sodium nitrate, sodium benzoate. For medical uses: plaster of Parris (calcium sulfate), Epsom salts (magnesium sulfate). Sodium nitrate is implicated in causing brain damage in infants and also suspected to be carcinogenic. Use of universal indicator, pH meter reaction with carbonates.

9. Distinguish between acid salts and normal salts; Basicity of acids.

10. Investigate neutralisation reactions using indicators and temperature changes; Use of colour change of indicators and temperature changes to determine neutralisation point. Refer to the action of toothpaste in neutralising acids in the mouth. For example, fluoride ions replacing hydroxide ions in the enamel of the tooth. Effect of adding lime to soil. Effect of adding lime and an ammonium fertiliser to soil at the same time.

11. Perform calculations using volumetric analysis data. (a) Number of moles reacting. (b) The mole ratio in which the reactants combine. (c) The molar concentration and mass concentration of reactants.