# COURSE OUTLINE: CSEC CHEMISTRY

**Assessment Weighting:**

**Classwork: 25%**

**Tests: 15%**

**Exam: 45%**

**Attendance: 5% (absent for 50% of classes = 0%)**

**Punctuality: 5% (late for more than 50% of classes = 0%)**

**Participation: 5% (participate in less than 50% of classes = 0%)**

# Unit topic: states of matter

## General Objectives:

On completion of this Section, students should:

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

## Content:

At the end of this unit students will have knowledge of the following:

- Evidence obtained from practical work involved in processes such as diffusion and osmosis.
- Use of salt or sugar to control garden pests as a preservative.
- The three states of matter can be distinguished based on the arrangement of their particles, energy of the particles, strength of the forces of attraction, as well as a physical properties and the characteristics of their physical States.

- Matter undergoes changes in their states namely freezing melting boiling evaporation sublimation condensation. These changes can be represented on heating or cooling curves.

## Learning Outcomes:

Upon completion of this section students should be able to:

1. Use evidence to support your explanation of the particle theory of matter.
2. Use examples to describe osmosis and diffusion.
3. Distinguish among the three states of matter based on their properties.
4. Explain changes occurring in matter at the particular level as the day change between the different states.
5. Use scientific language in their explanations.

# Course Details

| Date | Topics | Specific Objectives | 1. Assignments | Resources |
|---|---|---|---|---|
| Week 1 October (5×40 mins) | States of Matter | 1. Explain how evidence supports the particulate theory of matter.<br>2. Distinguish among the three states of matter. | ● Use everyday examples to explain the particulate theory of matter.<br>● Worksheet on properties of states of matter. | |

| | | | | |
|---|---|---|---|---|
| | | 3. Explain the changes between the three states of matter in terms of energy and arrangement of particles. | ● Analysis of heating and cooling curves.<br>● Experiment on the cooling curve of naphthalene | |

# Unit topic: Mixtures and separations

## General Objectives:

On completion of this Section, students should:

1. Understand that different types of mixtures can be separated based on the properties of their components.

## Content:

At the end of this unit students will have knowledge of the following:

- Matter exists all around us in the form of elements compounds molecules atoms.
- Compounds and molecules have fixed compositions and fix properties.
- Mixtures have variable composition and a variable properties. Types of mixtures are solutions suspensions and colloids.
- The components of a solution maybe solid in liquid, solid in solid, gas in liquid, liquid and liquid and a gas in gas.
- The solubility of substances are affected by the temperature.
- Mixtures are separated by physical methods. The separation method employed is determined by the properties of the substances such as particle size boiling point crystalline structure solubility and the solute mobility in a solvent.

- The extraction sucrose from sugarcane employees some of the separation techniques.

## Learning Outcomes:

Upon completion of this section students should be able to:

1. Define the terms elements, compounds, atoms and molecules.
2. Describe the properties of pure substances and mixtures.
3. Distinguish among Solutions suspensions and colloids using examples.
4. State the uses of the different types of solutions.
5. State the relationship between temperature and solubility of substances.
6. Identify the correct separation technique for various mixtures based on the properties of they components.
7. Describe the process by which sucrose is extracted from sugar cane.

# Course Details

| Date | Topics | Specific Objectives | Assignments | Resources |
|---|---|---|---|---|
| Week 2-3 October | Mixrures and | 1. Distinguish between pure substances and mixtures. | • Worksheets on pure substances and mixtures. | |

| | | | | |
|---|---|---|---|---|
| (10×40 mins) | Separation | 2. Distinguish among solutions, suspensions and colloids.<br>3. Identify different types of [1]solutions.<br>4. Investigate the effect of temperature on solubility of solids in water.<br>5. Apply suitable separation techniques based on differences in properties of the components of the mixture.<br>6. Describe the extraction of sucrose from sugarcane. | ● Analysis of solubility graph.<br>● Conduct an experiment on separation techniques.<br>● Construct a flow chart outlining the extraction of sucrose from sugarcane. (Include chemical equations where applicable.) | |

# Unit topic: atomic structure

## General Objectives:

On completion of this Section, students should:

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

## Content:

At the end of this unit students will have knowledge of the following:

- Atoms are made up of three basic particles known as protons neutrons and electrons. Protons and neutrons are located in the nucleus of the atom where electrons are arranged in shells orbiting the nucleus.
- The mass of an atom is influenced mainly by the number of protons and the number of neutrons.
- The relative atomic mass of an atom is calculated based on they carbon-12 isotope.

- The element notation on the periodic table tells the symbol of an atom, atom's mass number, atomic number, possible charges for the atom and the number of Isotopes it bears.
- Isotopes are atoms of the same element that have the same atomic number but different mass number due to a difference in the number of neutrons.
- Some Isotopes are found to be useful in processes such as carbon dating, radiotherapy, tracers, pacemakers and generation of energy.

## Learning Outcomes:

Upon completion of this section students should be able to:

1. Are internal structures of the first 20 atoms of the periodic table.
2. Summarize the properties of the summit subatomic particles.
3. Define the terms atomic number mass number and relative atomic mass.
4. Interprets element notation from the periodic table.
5. Explain what is meant by radioactive isotopes.
6. Describe applications of radioactive isotopes in industry.

# Course Details

| Date | Topics | Specific Objectives | Assignments | Resources |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Week 4 October (5×40 mins) | Atomic structure | 1. Describe with illustrations the structure of the atoms of atomic number 1 to 20.<br>2. State the properties of electrons protons and neutrons.<br>3. Define atomic number and mass number.<br>4. Define relative atomic mass.<br>5. Interpret notations of the form.<br>6. Define isotopy.<br>7. List the uses of radioactive isotopes. | ● Draw the structure of the first 20 elements of the periodic table and record the distribution of electrons in the atoms.<br>● Calculate the relative atomic mass of Select elements.<br>● Describe the application of radioactive isotopes in everyday life | |

# Unit topic: periodic table and periodicity

## General Objectives:

On completion of this Section, students should:

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

## Content:

At the end of this unit students will have knowledge of the following:

- T the periodic table was developed with the contributions of Mendeleev and over now. Classification was based on atomic number atomic structure. The periodic table was arranged in periods and groups.
- There are trends in the ease of ionization and reactivity of group 2 elements.
- Group 7 elements see a gradual change in their physical state at room temperature as the group is descended. There is also a decrease in the oxidizing power as the group is descended.

- As you go across the periodic table from Group 1 to group 8 there is a change in the metallic properties of the elements, as there is a progression from metallic to semi-metallic to non metallic properties of the elements.

## Learning Outcomes:

Upon completion of this section students should be able to:

1. Place elements in groups and periods based on their valence electrons and the number of shells occupied.
2. Compare the reactivity of group 2 Metals as the group is descended. State the trends and the reactivity of the group 2 metals.
3. State the trends in a group 7 elements.
4. Identify Trends in electropositivity and electronegativity in period3

# Course Details

| Date | Topics | Specific Objectives | Assignments | Resources |
|---|---|---|---|---|
| Week 5-6 Oct -Nov | Periodic table and Periodicity | 1. Explain the basis for the arrangement of the | ● Summarize the contributions of various scientists to the development of the periodic table. | |

| | | | | |
|---|---|---|---|---|
| (10×40 mins) | | elements in the periodic table.<br>2. Explain Trends in group 2.<br>3. Explain Trends in group 7.<br>4. Identify Trends in period 3.<br>5. Predict the properties of unknown elements based on the position in the periodic table | ● Carry out experiments on the reactions of calcium and magnesium.<br>● Plan and design an investigation to determine the position of an unknown element in the periodic table. | |

# Unit topic: Structure and bonding

## General Objectives:

On completion of this Section, students should:

1. Be aware of the forces of attraction that exists between particles.

## Content:

At the end of this unit students will have knowledge of the following:

- Atoms bond with each other to obtain a more stable electronic configuration.
- Atoms can lose gain or share valence electrons to attain a stable electronic configuration.
- There are three main types of chemical bonding: ionic, covalent and metallic.
- Chemical bond is a force of attraction between atoms that result from the redistribution of their electrons.

- Chemical compounds formed as a result of ionic or covalent bonding can be represented by chemical formulae.
- There are three main types of chemical formula of a molecular formulae structural formula and empirical formula.
- Valence number or valency is the number of bonds an atom can form with other atoms valence number can be used to write empirical formula of compounds composed of two different elements.
- Ionic bonding involves the transfer of electrons from metal atoms to nonmetal atoms forming ions.
- Metal atoms form positive ions called cations, a nonmetal atoms form negative ions called and ions.
- Ionic compounds have strong electrostatic forces of attraction between positive ions and negative ions known as ionic bonds which holds ions together in a crystal lattice.
- A crystal lattice is a three-dimensional regular arrangement of particles.
- Ionic compounds are represented using an empirical formula or formula unit both of which give the ratio of the ions present.
- Covalent bonding involves the sharing of electrons between nonmetal atoms to form molecules are shared the paired of electrons form a covalent bond.
- A molecule is a group of atoms which are bonded together strongly enough to behave as a single unit.
- In metals the valence electrons delocalized and they are able to move between the metal cations which remain diesel equalized elections are also known as mobile electrons.

- The strong extra static force between the delocalized electrons on the positive cations formed the metallic bond which holds the metal atoms together.
- The properties of metals are due to the bonding within the metal lattice. Ionic crystals results from ionic bonding.
- They are composed of an ionic lattice in which the cations and anions are held together in a regular repeating three-dimensional arrangement by ionic bonds.
- Simple molecular crystals are composed of small molecules are arranged in a regular three-dimensional way to create a simple molecular lattice weak intermolecular forces between these molecules hold them together.
- Giant molecular crystals are composed of nonmetals bonded by covalent bond in a regular three-dimensional arrangement to form a giant molecular lattice known as a macromolecule diamond and graphite are examples of Jack molecular crystals.
- Allotropes are forms of the same element in which their atoms are bonded differently.

## Learning Outcomes:

Upon completion of this section students should be able to:

1. Explain why atoms form chemical bonds.
2. State how atoms form chemical bonds.
3. Name three types of chemical bonding.
4. Describe three types of chemical formula.
5. Explain the principles of ionic bonding.
6. Explain how metal atoms form cations and non-metal atoms form anions.
7. Name ionic compounds.

8. Describe the formation of ionic bonds.
9. Represent ionic bonding using shell diagrams.
10. Describe the formation of covalent bonds. Represent covalent bond in using cell diagrams.
11. Write formulas of covalent compounds.
12. Describe the formation of metallic bonds.
13. Relate the properties of metallic metals to the bonding in metals.
14. Describe the structure and give examples of ionic crystals.
15. Relate the properties of sodium chloride to its structure.
16. Describe the structure and give examples of simple molecular crystals.
17. Distinguish between ionic and simple molecular crystals.
18. Describe the structure and give examples of a giant giant molecular crystals.
19. Describe the structure of diamond and graphite.
20. Related the properties and uses of diamond and graphite to their structure.
21. Explain the term allotropy.

# Course Details

| Date | Topics | Specific Objectives | Assignments | Resources |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Week 7-10 Nov-Dec (20×40 mins) | Structure and bonding. | 1. Explain the formation of ionic and covalent bonds.<br>2. Predict the likelihood of an atom forming an ionic or covalent bond based on atomic structure.<br>3. Write formula to represent ions molecules and formula units.<br>4. Explain metallic bonding.<br>5. Describe ionic crystals, simple molecular crystals and a giant molecular crystals.<br>6. Distinguish between ionic and molecular solids.<br>7. Relate the structure of sodium chloride, diamond and graphite to their properties and uses.<br>8. Explain the term allotropy. | ● Draw diagrams to show the transfer of electrons during ionic bonding.<br>● Diagrams to show the sharing of electrons during covalent.<br>● Draw diagrams to represent metallic bonding.<br>● Investigate the properties of ionic crystals simple molecular compounds and a giant molecular crystals. | |

# Unit topic: Writing equations and Types of reactions

## General Objectives:

On completion of this Section, students should:

1. Appreciate that properties of chemicals will affect their reactions.

## Content:

At the end of this unit students will have knowledge of the following:

- Chemical equations are representations of chemical reactions using symbols and formulae.
- Reactions are shown at the left of an equation and products on the right.
- The state of each reactant and product is given after its formula using what is called a state symbol.
- In a balanced chemical equation there must be the same number of atoms of each element on both sides of the equation.
- Coefficients are numbers placed in front of the family.
- They are used when balancing equations.
- The formula must never be changed.
- There are solubility rules which can be used to determine the solubility of ionic compounds in water these are useful in determining the state symbols of ionic compounds.
- Ionic equation to show only the atoms or ions which actually take part in the reaction and as a result end up in a different situation from the one in which they started.
- Write an equation first but showing any ions are present in solution as an individual ion to determine which ions do not change in any way.
- There are seven main types of chemical reactions synthesis decomposition single displacement precipitation neutralization redox and reversible reactions.
- A synthesis reaction is any reaction in which two or more reactants combine to form a single product.
- A decomposition reaction is a reaction where a single reactant is broken down into two or more products.

- A single displacement reaction is any reaction between an element in its free state and a compound where the elements this place is another from its compound.
- Ionic precipitation reaction involves two compounds in aqueous solution reacting to produce a precipitate.

## Learning Outcomes:

Upon completion of this section students should be able to:

1. Write balanced chemical equations.
2. Predict whether a compound is soluble or insoluble in water.
3. Write balanced ionic equations.
4. Identify the seven main types of chemical reactions.
5. Give examples of the main types of chemical reactions.
6. Write balanced equation for the different types of chemical reactions.

# Course Details

| Date | Topics | Specific Objectives | Assignments | Resources |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Week 11-13 Dec-Jan (15×40 mins) | Writing equations and types of reaction. | 1. Translate word equations for chemical reactions into chemical equations.<br>2. Write balanced equations to represent chemical reactions.<br>3. Write net ionic equations for chemical reactions<br>4. Name the main types of reactions<br>5. Describe the main types of reactions.<br>6. Identify the type of reaction based on the chemical equation given. | ● Convert word equations to chemical equations.<br>● Write and balance chemical equations.<br>● Write net ionic equations for precipitation reactions.<br>● Identify the types of chemical reactions. | [1] |