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: oxidation reduction reactions

General Objectives:

On completion of this Section, students should:

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

Content:

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

- Reactions involving reduction and oxidation are known as redox reactions.
- Oxidation is defined as the loss of electrons, increase in oxidation number or gain an oxygen.
- Reduction is defined as a gain in electrons, decrease in oxidation number or loss of oxygen/gain of hydrogen.

- Oxidation number is the theoretical charge that an atom of an element would have if all the bonds between the atoms in the compound containing it where iron and the compound was composed entirely of ions.
- In any redox reaction there will always be a change in the oxidation number of two elements.
- An oxidizing agent is the reactant that brings about the oxidation of another reactant.
- A reducing agent is reactant that brings about the reduction of another reactant.
- There are distinctive color changes that accompany the oxidation or reduction of certain compounds and this allow them to be used when testing for the presence of oxidizing or reducing agents.
- Examples of these substances are potassium iodide and iron sulfate which are reducing agents and acidified potassium permanganate and acidified potassium dichromate which are oxidizing agent.

Learning Outcomes:

Upon completion of this section students should be able to:

1. Describe the action of common oxidizing and reducing substances in everyday activities.
2. Define oxidation and reduction in terms of electron transfer. Identify the reactant being oxidized and the reactant being reduced using electron transfer.
3. Define oxidation number.
4. Different term in the oxidation number of elements from formulae.
5. Define oxidation and reduction in terms of oxidation number.

6. Identify redox reactions using changes in oxidation number.
7. Identify reducing and oxidizing agent based on electron transfer.
8. Give examples of compounds which can act as both an oxidizing and reducing agent.
9. Describe tests to identify oxidizing and reducing agents.

Course Details

Date	Topics	Specific Objectives	1. Assignments	Resources
Week 1 October (5×40 mins)	Oxidation-Reduction Reactions	1. Investigate the action of common oxidizing and reducing substances in everyday activities. 2. Define oxidation and reduction. 3. Deduce oxidation number from formulae. 4. Identify oxidation and reduction reactions including reactions at electrodes. 5. Distinguish between oxidizing and reducing agents. 6. Perform test for oxidizing and reducing agents.	● Describe examples oxidation and reduction occurring in our daily lives. ● Calculate the oxidation numbers of an element in different compounds. ● Analyze equations and determine whether they are redox reactions or not. ● Conduct experiment to test for oxidizing and reducing agents.	

Unit topic: Electrochemistry

General Objectives:

On completion of this Section, students should:

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

Content:

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

- Electrochemical series of metals is a list of metals in order of how easily they lose their electrons.
- They higher the metal is in the electrochemical series the more easily it and ionizes and the stronger it's reducing powers.
- A metal can only displace a metal below it in the electrochemical series from a compound containing lower metal.
- Metals above hydrogen in the electrochemical series can displace hydrogen ions from an acid, forming hydrogen gas, however Metals below hydrogen will not displace hydrogen ions from an acid.
- The electrochemical series of non-metals is a list of nonmetals in order of how easily their atoms gain electrons.
- Conductors allow electricity to pass through while non-conductors do not.
- Electrolytes are compounds that form ions when molten or in aqueous solution.
- Electrolytes conduct electricity because they contain mobile ions.
- When electricity passes through an electrolyte the electrolyte decomposes.

- Metals conduct electricity because they contain mobile electrons. Strong electrolytes are fully organized they contain High concentration of ions.
- Weak electrolyte or partially ionized they contain a low concentration of ions.
- Pure water is a weak electrolyte due to the very low concentration of hydrogen and hydroxide ions present.
- Electrolysis is the chemical change that occurs when an electric current passes through an electrolyte.
- Electrodes are used during electrolysis to conduct electricity into and out of the electrolyte.
- The anode is the positive electrode, anions move towards the anode and lose electrons. Oxidation occurs at the anode.
- The cathode is the negative electrode, cations move towards the castle with an electrons. Reduction occurs at the cathode.
- Molten electrolytes contain one type of cation and one type of anion both are discharge during electrolysis.
- Aqueous electrolytes contains solute ions as well as hydrogen and hydroxide ions from the water. One of each type of ion will be discharged in preference to the other.

Learning Outcomes:

Upon completion of this section students should be able to:

1. Give the electrochemical series of the common metals.

2. Determine if a displacement reaction will occur between metals and their compounds based on their relative positions in the electrochemical series.
3. Determine if a metal will displace hydrogen from an acid based on its position in the electrochemical series.
4. Give the electrochemical series of some common nonmetals.
5. Determine if a displacement reaction will occur between certain non metals and their compounds based on their relative positions in the electrochemical series
6. Distinguish between a non conductor and a conductor.
7. Distinguish between a metallic and electrolytic conduction.
8. Distinguish between a strong electrolyte a weak electrolyte and a nonelectrolyte.
9. Give examples of strong electrolytes and weak electrolytes.
10. Define the term electrolysis anode cathode anion and cation. Identify ions present in an electrolyte.
11. Predict the electrode to which an ion will drift during electrolysis.
12. Discuss the electrolysis of molten electrolytes. Explain the term preferential discharge of ion.
13. Discuss the electrolysis of certain aqueous electrolytes.
14. Describe how electrolysis can be used to extract metals from their ores.
15. Describe how electrons can be used to purify Metals.
16. Describe the process of electroplating.
17. Describe the process of Anodizing.

18. The volume of a gas or the mass of a substance produced at an electrode during electrolysis is directly proportional to the quantity of electricity passing through the electrolytic cell .
19. The quantity of electricity is dependent on the rate of flow of electric charge, ie, the current, *I,* and the time, *t,* the current flows for. Q=I×t.
20. The Faraday constant is the size of the electric charge on one mole of electrons that is 96500 coulombs per mole.
21. Industrial uses of electrolysis includes the extraction of metals from their ores the purification of metals electroplating and anodizing

Course Details

Date	Topics	Specific Objectives	Assignments	Resources
Week 2-3 October (10×40 mins)	Electrochemistry	1. Conduct investigations reading to the classification of substances as conductors are non-conductors. 2. Distinguish between metallic and electrolytic conduction. 3. Classified electrolytes a strong or weak based on their conductivity. 4. Define electrolysis anode cation and anion. 5. Identify ions present in electrolytes. 6. Predict the electron to which an ion will drift.	● Perform Conductivity test on certain materials. ● Justify any predictions made how about electrodes to which ions will drift during electrolysis. ● Write equations to represent reactions occurring at the anode and the cathode. ● Discuss the electrolysis of molten, dilute and concentrated sodium chloride.	

		7. Predict chemical reactions making use of electrochemical series. 8. Discuss the electrolysis of certain substances. 9. Define the Faraday constant. 10. Calculate the masses and volumes of substances liberated during electrolysis. 11. Describe industrial applications of electrolysis.	● Perform calculations related to electrolysis. ● Select a metal product that is currently on the market when did Justified how electrolysis can increase the value or longevity of that product.	

Unit topic: Rates of reaction

General Objectives:

On completion of this Section, students should:

1. Understanding that the rate at which a chemical reaction proceeds is dependent on a number of physical factors.

Content:

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

- The rate of a reaction is a measured change in the concentration of a reactant or product with with time at a stated temperature.
- The Collision theory states that to react particles of the reactants must collide.
- Collisions must occur with the required activation energy and of the particles must be correctly orientated.
- An effective collision is one that results in the formation of the product.

- A rate curve shows a measured property plotted against time. All rate curves have the same basic shape.
- The rate of a reaction changes as the reaction proceeds. It is fastest at the beginning and the rate decreases with time until the reaction reaches completion when the limiting reagent is used up.
- Four main factors that the rate of a chemical reaction are affected by: concentration, temperature, surface area or particle size and the presence or absence of a catalyst.
- A catalyst is a substance which alters the rate of a chemical reaction without itself undergoing any permanent chemical change.
- Most catalysts if present speed up the rate of a reaction. A negative catalase if present slows down the rate of a reaction.

Learning Outcomes:

Upon completion of this section students should be able to:

1. Define what is meant by rate of reaction.
2. Explain how the rate of a reaction can be measured.
3. Explain the Collision theory for reaction.
4. Interpret rate curves for reactions.
5. Identify the factors which affect the rates of reaction.
6. Explain how different factors affect the rate of reaction.
7. Describe experiments to determine the effect of changing a factor on the rate of a reaction.

8. Interpret graphical representations of data obtained in studying rates of reaction.

Course Details

Date	Topics	Specific Objectives	1. Assignments	Resources
Week 4 Oct (5×40 mins)	Rates of reaction	1. Define the rate of a reaction. 2. Identify the factors which affect the rate of reaction. 3. Predict the effects of factors on rate of a reaction from given data. 4. Interpret graphical representation of data obtained in studying rates of reaction	● Explain how each factor affects the rate of a chemical reaction. ● Analyze graphical data unprotect the effect of factors on the rate of the chemical reaction. ● Conduct experiment to investigate the effect of the different factors on the rate of reaction.	

Unit topic: Energetics

General Objectives:

On completion of this Section, students should:

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

Content:

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

- Exothermic reactions produce heat energy causing the reaction mixture and its surroundings to get hotter. They transfer energy to their surroundings.
- Endothermic reactions absorb heat energy causing the reaction mixture and its surroundings to get colder. They absorb energy from their surroundings.
- When bonds are broken in reactants energy is absorbed. When you bonds are formed in products energy is released.
- In an exothermic reaction, the energy absorbed to break bonds is less than the energy released in form in newborns.
- In an endothermic reaction, the energy absorbed to break bonds is greater than the energy released in forming new bonds.
- The energy content of a substance is called enthalpy and is given by the symbol H.
- In an exothermic reaction the enthalpy change is less than 0. The enthalpy change is negative.
- In an endothermic reaction the enthalpy change is greater than zero. The enthalpy change is positive.
- The enthalpy change in a chemical reaction can be illustrated by an energy profile diagram.
- The activation energy is the minimum energy required for the reaction to occur.
- Catalyst reduces the amount of activation energy required for a reaction to occur by providing an alternative route for the reaction to proceed which requires less energy.
- The specific heat capacity of a substance enables us to determine enthalpy change from a change in temperature.

- The specific heat capacity is the quantity of heat required to raise the temperature of a unit mass of the substance by 1 degree Celsius or 1 Kelvin.
- The heat of reaction can be calculated from the masses of the substances reacting, the specific heat capacity of the substances and the change in temperature using the formula.
- The heat of neutralization is the heat change which occurs when one mole of water is produced in a reaction between an acid and alkali.
- The heat of solution is the heat change which occurs when one mole of solute dissolves in such a volume of solvent that further dilution by the solvent produces no further heat change.
- To calculate the heat of neutralization or heat of solution the assumption that 1 cm^3 of dilute aqueous solution has the mass of 1g, which is equivalent to the density of water and the specific heat capacity of the solution is the same as that of water. It is also assumed that there is negligible heat lost to or absorbed from the surroundings.

Learning Outcomes:

Upon completion of this section students should be able to:

1. Distinguish between an exothermic reaction and an endothermic reaction.
2. Give examples of exothermic reaction and endothermic reaction.
3. Explain exothermic and endothermic reactions based on bond breaking and bond forming.
4. Explain what is meant by enthalpy change.
5. Explain exothermic and endothermic reactions based on enthalpy change.

6. Draw energy profile diagram for exothermic and endothermic reactions.
7. Show the effect of adding a catalyst using energy profile diagrams.
8. Define the terms specific heat capacity, heat of neutralization and heat of solution.
9. Give the formula to calculate the heat change of a reaction.
10. Calculate the heat changes from experimental data.
11. Explain why the heat of neutralization for a reaction between a strong acid and a strong alkali is always the same.
12. Describe experiments to determine the heat of neutralization and heat of solution.
13. Give assumptions made when calculating the heat of neutralization and the heat of solution from experimental data.

Course Details

Date	Topics	Specific Objectives	1. Assignments	Resources
Week 5-6 Nov. (10×40 mins)	Energetics	1. Distinguish between exothermic and endothermic reactions. 2. Draw energy profile diagrams to illustrate endothermic and exothermic change. 3. Calculate energy changes from experiments or from experimental data.	● Explain exothermic and endothermic reactions based on bond breaking and bond formation. ● Draw energy profile diagrams to represent chemical reactions. ● Conduct experiments to determine the enthalpy of reaction off to reactants.	

Unit topic: Organic Chemistry

General Objectives:

On completion of this Section, students should:

1. Understand some of the processes involved in the formation of carbon compounds from natural sources.
2. Relate bonding properties of carbon to simple organic compounds.
3. Understand the patterns of reactions of various homologous series of carbon compounds.
4. Understand of the general pattern involved in the nature and formation of polymers.
5. Relate the properties of carbon compounds to their uses.

Content:

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

- Organic chemistry is the study of organic compounds.
- Organic compounds contain carbon.
- Most also contain hydrogen and many contain oxygen.
- A carbon atom can form four covalent bonds with other atoms.
- Carbon atoms have the ability to form single and double bonds with other carbon atoms. They can also form straight chains, branched chains and ring structures.
- Functional group is a particular atom or group of atoms or bond between carbon atoms within a molecule that determine the chemical properties of the compound.
- Organic compounds are classified into groups known as homologous series based on their functional groups.

- Members of a homologous series all possess the same functional group and it can be represented by the same general formula. Members of a homologous series are named based on the number of carbon atoms present and as a functional group present.
- Structural isomerism is the occurrence of two or more organic compounds with the same molecular formula but different structural formulas. These compounds are known as structural isomers. Each structural isomer has a specific name.
- Hydrocarbons are organic compounds composed of carbon and hydrogen atoms only.
- Natural gas on the petroleum are natural sources of hydrocarbons.
- Petroleum is a complex mixture of alkenes and a ring the hydrocarbons.
- Separation of petroleum into its components is done by fractional distillation at an oil refinery.
- The fractions obtained from the fractional distillation of petroleum are used as fuel in the manufacturer of petrochemicals, as lubricants and in surfacing roads.
- Large alkane molecules produced during fractional distillation of petroleum can be broken down into smaller, more useful by cracking. Thermal cracking uses high temperature and pressure to break the molecules down while catalytic cracking uses fairly high temperatures, low pressures and a catalyst to break the molecules down.
- Alkanes are saturated hydrocarbons with general formula CnH2n + 1.
- Alkanes with four or more carbon atoms display structural isomerism.
- Alkanes burn in air or oxygen with a clear blue flame in an exothermic reaction to produce carbon dioxide and water add Steam. Incomplete combustion reactions produce carbon monoxide and steam.
- Alkenes undergo substitution reactions with halogens in the presence of light.

- Substitution reactions takes place in stages hydrogen atom being replaced by one halogen atom at a time.
- Alkanes are mainly used as fuels and organic solvents.
- Biogas is a renewable source of methane.
- Alkenes are unsaturated hydrocarbons with the general formula cnh2n.
- Alkenes have the carbon to carbon double bond as their functional group.
- Alkenes with four or more carbon atoms display structural isomerism.
- The complete combustion of alkenes is an exothermic reaction which produces carbon dioxide and water as steam.
- Alkenes undergo addition reactions in which other atoms are added to the molecule.
- Alkenes change the color of bromine and potassium manganate solution colorless under standard laboratory conditions, whereas alkanes do not.
- Alkenes are used mainly as starting materials for the manufacture of a wide range of other chemicals because of their ability to undergo addition reactions.
- Alcohols have the general formula CnH2n+1OH.
- The functional group of alcohols is the hydroxyl group.
- Alcohols with three or more carbon atoms display structural isomerism.
- Alcohol molecules are polar. The smaller alcohols are completely soluble in water because of the polar nature nature of the molecules. Solubility decreases as the molecular size increases.
- Ethanol Burns in air or oxygen with a clean blue flame to form carbon dioxide and water in the form of steam the reaction is exothermic.
- Alcohols undergo many reactions.

- Alcohols can be produced by fermentation of carbohydrates under anaerobic conditions in the presence of yeast.
- Alkanoic acids have the general formula CnH2n+1COOH.
- The functional group of the alkaline acid is the carboxyl group.
- Alkanoic acids are polar molecules. They are soluble in water.
- Ethanoic acid reacts with Metals, oxides, metal hydroxide and metal carbonate in the same way as inorganic acids.
- An ester is a compound formed when an organic acid reacts with an alcohol. The reaction is a condensation reaction known as Esther verification. It requires a catalyst of concentrated sulfuric acid and Heat.
- Esther's often have distinctive sweet fruity smells. Animal fats and vegetable oils are Esters of long-chain alkaloid acids and glycerol.
- A polymer is a macromolecule formed by linking together 50 or more small molecules, known as monomers, usually in chains.
- Polymers can be synthetic or natural.
- The reaction that results in the formation of a polymer is known as polymerization.
- The two types of polymerization are addition polymerization and condensation polymerization.
- Alkenes undergo addition polymerization to form alkenes.
- Esters, amides and saccharides undergo condensation polymerization to form polyesters, polyamide and polysaccharides respectively.

Learning Outcomes:

Upon completion of this section students should be able to:

1. Give examples of organic compounds.
2. Give the main compounds containing carbon.
3. Understand and illustrate that carbon can form single bonds, double bonds, unbranched chains, branched chains and ring structures.
4. Explain the term functional group.
5. Identify certain functional groups.
6. Represent organic compounds using molecular, fully displayed and condensed structural formulae.
7. Define the term homologous series.
8. List the general characteristics of a homologous series.
9. Write the general formula of a given homologous series.
10. Write the formula for members of a given homologous series.
11. Name straight chain members of the common homologous series.
12. Determine the homologous series to which a compound belongs from its name or formula.
13. Define structural isomer and structural isomerism.
14. Explain how structural isomers can be formed.
15. Name branched chain isomers.
16. Identify natural gas and petroleum as natural sources of hydrocarbons.
17. Describe the fractional distillation of petroleum.
18. List the main uses of the fractions of Jane from the fractional distillation of petroleum.

19. Describe thermal and catalytic cracking of alkanes.
20. Name the names and structural formula of branched find on branched alkanes up to six carbon atoms.
21. Relate the reactivity of alkanes to the presence of single bonds.
22. Describe the combustion reaction of alkanes.
23. Describe the substitution reactions of alkanes with a legend.
24. Explain why are alkanes undergo substitution reactions. Relate the uses of alkanes to their properties.
25. Describe the production of biogas.
26. Recognize alkanes by the presence of a carbon-carbon double bond.
27. Give the names and structure real formulae of unbranched alkenes up to six carbon atoms.
28. Relate the reactivity of alkenes to the presence of a carbon to carbon double bond.
29. Describe the combustion reaction of alkenes.
30. Explain why alkenes undergo addition reactions.
31. Describe addition reactions of alkenes with hydrogen, halogens, the hydrogen halides and water.
32. Describe reactions which can be used to distinguish between an alkane and an alkyne. Relate the uses of alkenes to their properties.
33. Identify alcohols by their hydroxyl (-OH) functional group.
34. Give the names and structural formula of unbranched alcohols with up to six carbon atoms.
35. Describe the reactions of ethanol.

36. Explain the principles of the breathalyzer test.
37. Describe the fermentation process by which ethanol is produced from carbohydrates.
38. Describe the processes involved in winemaking and rum manufacturer.
39. Identify alkanoic acid by the presence of the carboxyl(-COOH) group.
40. Give the names and structural formula of unbranched alkanoic acid with up to six carbon atoms.
41. Describe the reactions of ethanoic acid.
42. Identify actors by the presence of the Ester functional group.
43. Describe how esters are formed.
44. Write the names and formulae of stuff.
45. Explain the hydrolysis of Esters.
46. Explain the saponification of fats and oils.
47. Distinguish between soapy and soapless detergent.
48. Define the term polymer.
49. Explain the process of addition polymerization.
50. Show all games are linked in the structure of a poly alkene.
51. Give examples of polyalkenes.
52. State the uses of different polyalkenes.
53. Explain the process of condensation polymerization.
54. Show how monomers are linked in the structure of a polyester, polyamide and a polysaccharide.
55. Give examples of polyesters, synthetic and natural polymers and polysaccharides.
56. State the uses of different condensation polymers.

57. Discuss the harmful effects of synthetic polymers on the environment.

Course Details

Date	Topics	Specific Objectives	Assignments	Resources
Week 7 Nov -Dec (5×40 mins)	Sources of Hydrocarbons	1. Identify natural gas and petroleum as natural sources of hydrocarbons. 2. List the main uses of at least three fractions obtained from the fractional distillation of petroleum. 3. Describe cracking of petroleum fractions.	● Write equations to show products formed during of cracking of large alkane molecules	
Week 8 Nov -Dec (5×40 mins	Organic chemistry -an introduction	1. Illustrate that the carbon atom can form single and double bonds, branched and unbranched chains and ring compounds. 2. Write the formula to represent simple organic compounds. 3. List the general characteristics of homologous series. 4. General and molecular formula for members of a given amount of a series. 5. Deduce the homologous series given the fully displayed and condensed formula of compounds. 6. Write fully displayed structures and names of branched and unbranched alkanes and unbranched alkenes, alcohols and alkanoic acids. 7. Define structural isomerism. 8. Write the full display the structures of isomers given their molecular formulae	● Draw structures off the 1st 10 compounds in each homologous series. Write the name, molecular formula condensed formula for each structure. ● Draw structures to illustrate structural isomerism and name them.	

Week 9-11 Nov -Dec (15×40 mins	Reactions of carbon compounds	1. Describe the reactions of alkanes and alkenes. 2. Relate the characteristic reactions of alkanes and alkenes to their structures. 3. Distinguish between alkanes and alkenes. 4. Relate the properties of hydrocarbons to their uses. 5. Identify alcohols, acids and esters by their functional groups. 6. Relate the properties of alcohols, acids and esters to their functional groups. 7. Describe the reaction of ethanol describe the fermentation process by which ethanol is produced from carbohydrates. 8. Describe the reactions of ethanoic acid. 9. Explain the hydrolysis of Esters including saponification. 10. Compare soapy and soapless detergents. 11. Define polymers. 12. Distinguish between addition and condensation reactions in the formation of polymers. 13. State at least one use of each type of polymer.	● Use any creative means to summarize the reactions of organic compound. (Must include general reaction and students own example.) ● Create a table complete with picture to summarize the uses of each organic compounds. ● Create story telling of how sugarcane became rum and was a bad example to grapes who became wine. ● Conduct an experiment, comparing soapy and soapless detergents. ● Create a cartoon illustrating polymerization of alkene, ester, amide or monosaccharide.	

Unit topic: Inorganic Chemistry

General Objectives:

On completion of this Section, students should:

1. Understand the features which characterize metals and nonmetals.
2. Understand the relationship between the methods of extraction of a metal and its reactivity.
3. Develop or determine an order of reactivity of the metals.
4. Be familiar with laboratory methods of preparation and collection of nonmetals and their compounds.
5. Appreciate the relationship between metals and nonmetals and their uses.
6. Understanding the characteristics by which specific metals, nonmetals and their ions can be identified
7. Appreciate that metals, nonmetals and their compounds impact the environment.
8. Appreciate that metals, nonmetals and their compounds impact the living systems.
9. Appreciate the impact that man's activities have on the environment and apply the knowledge of chemistry for the good of society.

Content:

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

- T metals are elements whose atoms have a small number of valence electrons, usually one, two or three.
- Metals form positive cations in chemical reactions by losing their valence electrons the properties of metals can be explain by relating the structure of the metal lattice.

- Metals behave as reducing agents in reactions. Metals reacts with oxygen to form metal oxides.
- Soluble metal oxides I called alkalis. Potassium, sodium, calcium and magnesium react with water to the metal hydroxide and hydrogen.
- Other metals except copper react with steam to form the metal oxide and hydrogen gas.
- Reactive metals react with hydrochloric acid and sulfuric acid to form a salt and hydrogen.
- The nitrates of potassium and sodium decompose when heated to form the metal nitrite and oxygen. The nitrates of the other metals except silver decompose when heated to form the metal oxide nitrogen dioxide and oxygen. Silver nitrate decomposes when heated to form silver, nitrogen dioxide and oxygen.
- The carbonate and hydroxide of potassium and sodium are not decomposed when heated.
- Carbonates and hydroxides of other metals except silver decompose when heated to form the metal oxide water and carbon dioxide.
- It is possible to determine reactivity series of metals by looking at the strength of the reaction with oxygen, water and dilute acids, how easily their compounds are decomposed when heated.
- The more reactive the metal, the more stable its compounds.
- The very unreactive Metals occur in the Earth's crust in their free Elemental State, example silver and gold and can therefore be mined directly from the Earth.
- The extraction of a metal from its ore is a reduction process.
- Aluminum is extracted from its ore by the process of electrolysis.
- Iron is extracted from ore by reduction in a blast furnace.

- An alloy is a mixture of metals although sometimes and non-metal can be added.
- Alloys are often more useful than the pure metal because they are harder, stronger and more resistant to corrosion than the pure metal.
- Corrosion occurs when the surface of the metal gradually wears away due to its reaction with chemicals in the environment, mainly oxygen and moisture, and it to speed it up by the presence of certain Paula dance.
- When aluminum corrodes it forms a layer of aluminum oxide which is relatively unreactive and a deer's to the method below protecting it from further.
- When iron corrodes it form hydrated iron oxide, also known as rust, that flakes of overtime exposing fresh iron to oxygen and moisture which continues the rusting process.
- Metal ions play a vital role in the functioning of living organisms some of these are combined with organic compounds to form organometallic compounds.
- Macro minerals are needed by human body in amounts in excess of 100 mg per day example calcium, potassium, sodium and magnesium.
- Macro minerals are needed in small amounts by the human body for good health example iron and zinc. Magnesium is an important metal ion that is required by plants.
- Metals such as lead Mercury cadmium and arsenic are refer to as heavy metals and are harmful to organisms.
- Nonmetals are elements whose atoms usually have a large number of valence electrons, usually 5, six, seven or eight. In general nonmetals have low melting points and boiling points that do not conduct electricity and heat, are dull and weak and brittle in the solid state and have low densities. Many nonmetals are gases at room temperature.

- Nonmetals form negative ions in chemical reactions with metals by gaining electrons into their valence electron shell.
- All nonmetals behave as oxidizing agent when they react with metals oxygen can be prepared in the laboratory by the decomposition of hydrogen peroxide in the presence of Manganese oxide catalyst.
- Carbon dioxide can be prepared in the laboratory by reacting with an acid usually calcium carbonate and hydrochloric acid.
- Ammonia can be prepared in the laboratory by reacting an Alkali with an ammonia salt example calcium hydroxide and ammonium chloride.
- Calcium chloride, calcium oxide and concentrated sulfuric acid may be used to dry gases made in the laboratory
- Green chemistry is the utilization of a set of principles that reduce or eliminate use our generation of hazardous substances in the design, manufacture and application of chemical products and processes.

Learning Outcomes:

Upon completion of this section students should be able to:

1. Describe the physical properties of metals.
2. Relate the physical properties of metals to the bonding of metal atoms in the metal lattice.
3. Describe the reactions of various Metals with oxygen, water and dilute acids.
4. Name the products formed by these reactions.

5. Write balanced chemical equations for the reactions of various metals with oxygen, water and dilute acid.
6. Describe the reactions of metal oxides hydroxides and carbonates with acids.
7. Describe the decomposition reactions of metal nitrates, carbonate and hydroxide.
8. Discuss the reactivity of metals.
9. Discuss the reactions between metals are metal compounds.
10. Explain the basis of the reactivity series of metals.
11. Deduce the order of reactivity of metals based on experimental results.
12. Explain how the position of a metal in the reactivity series determines its extraction method.
13. Describe the extraction of aluminum.
14. Describe the extraction of iron.
15. Describe the uses of aluminum, lead and iron.
16. Explain what an alloy is.
17. Explain why metal alloys are used often in place of the metals.
18. Relate the uses of aluminum, iron and Lead Alloys to their properties.
19. Explain what happens when metals corrode.
20. Give the conditions necessary for metals to corrode.
21. Explain the importance of metals and their compounds in living organisms.
22. Discuss the harmful effects of metals and their compounds on living organisms and the environment.
23. Division of physical properties of nonmetals.
24. State whether hydrogen, oxygen, nitrogen, chlorine, carbon and sulfur occur naturally.

25. Describe the reactions of nonmetals with oxygen and metals.
26. Explain the oxidizing and reducing the witches of non-metals.
27. Describe how oxygen, carbon dioxide and ammonia can be prepared in the laboratory.
28. Explain the uses of oxygen and carbon dioxide based on their properties.
29. Relate the methods of collecting the gases to their properties.
30. List uses of various nonmetals and their compounds.
31. Discuss the harmful effects of nonmetals and their compounds on living systems and the environment.
32. Define Green chemistry.
33. Outline the principles of green chemistry.

Course Details

Date	Topics	Specific Objectives	1. Assignments	Resources
Week 12-14 Jan (15×40 mins)	Metals and nonmetals	1. Describe the physical and chemical properties of metals. 2. Describe the reactions of metallic oxides, hydroxide, nitrates and carbonate. 3. Discuss the reactivity of metals. 4. Deduce the order of reactivity of metals based on experimental results or data supplied.	● Project on metals and nonmetals. ● Recreation of the electrolytic cell in the extraction of aluminum and the blast furnace in the	

		5. Describe the extraction of aluminum and iron. 6. Explain why metal alloys are often used in place of the metals. 7. Relate the properties of the metals aluminum, lead, iron and their allies to their uses. 8. Investigate the conditions necessary for the corrosion of metals. 9. Explain the importance of metals and their compounds on living systems and the environment. 10. Discuss the harmful effects of metals and their compounds to the living systems and the environment. 11. Describe the physical and chemical properties of nonmetals. 12. Describe the laboratory preparation of gases. 13. Explain the use of gases based on their properties. 14. List the uses of non-metals carbon, sulfur, phosphorus, chlorine, nitrogen, silicon and their compounds. 15. Discuss the harmful effects of nonmetal on living systems and the environment. 16. Relate to the unique properties of water to its function in living systems. 17. Discuss the consequences of solvent properties of water. 18. Describe the methods used in the treatment of water for domestic purposes. *19. Define green chemistry.* 20. *Outline the principles of green chemistry.*	reduction of iron. ● Experiment to identify anions, cations and guesses. ● Infomercial on the causes of rusting and methods of preventing. ● Creation and marketing of a new alloy to be used in there production of scam safe . ● Write a story based on the theme 'I Am water my life is bittersweet'. ● Analyse the day-to-day operations of a factory and discuss the processes and products involved, bearing the principles of green chemistry in mind.	

		21. Identify cations- Pb^{2+}, Al^{3+}, Ca^{2+}, Zn^{2+}, Fe^{2+}, Fe^{3+}, NH^{4+}, Cu^{2+} 22. Identify anions- $CO3^{2-}$, $SO4^{2-}$, $SO3^{2-}$, NO3-, Br-, I-, Cl- 23. Identifygases.- H2, O2, CO2, NH3, SO2, Cl2, NO2, H2O		