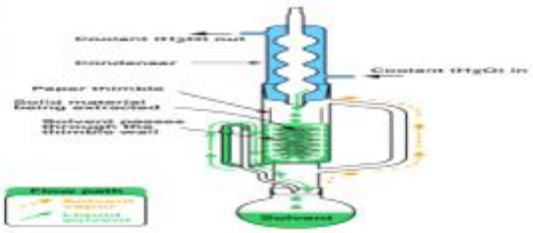
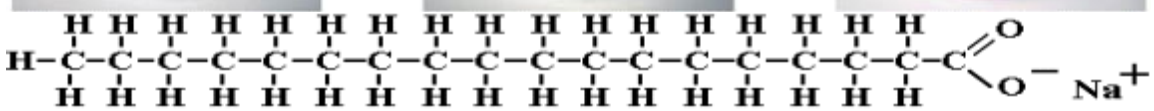
SIMPLIFYING CHEMISTRY



De'Chemist at work

Science 5124/2



S2 a typical soap, the salt **sodium stearate**

Grade 10 - 12

QUESTIONS AND ANSWERS

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Volume 1

K 25.0 Only

First published in 2017

Simplifying chemistry grade 10-12 volume one

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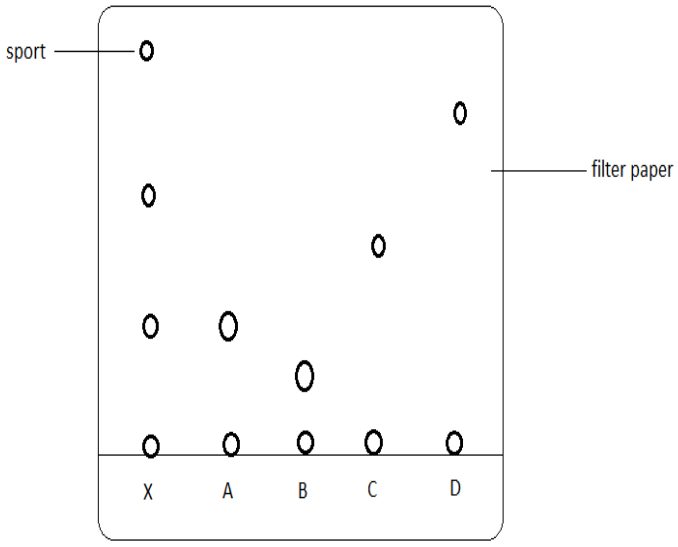
The Phamplet Simplifying Chemistry (volume one) covers all topics in the new 5124/2 Science syllabus for Senior Secondary Schools in Zambia. It contains parts 1,2 and 3 questions with their simplified answers at the end of the pamplet.

God Bless You!!!

PART ONE

1. Name a branch of chemistry that deals with the study of the physical principles that underline the structure of matter and chemical transformations.
   A. Analytical chemistry
   B. Biochemistry
   C. Organic chemistry
   D. Physical chemistry
2. Which of the following is the basic unit of matter?
   A. Compounds
   B. Atoms
   C. Mixtures
   D. Elements
3. What do we call a reaction where heat energy is given out from the system to the surrounding?
   A. Condensation reaction
   B. Decomposition reaction
   C. Exothermic reaction
   D. Endothermic reaction
4. Among the following factors, which one can affect the rate of diffusion?
   A. Pressure
   B. High pressure
   C. Low temperature
   D. Rate of reaction
5. What do we call a mixture where the components are not evenly distributed?
   A. Pure mixture
   B. Miscible mixture
   C. Homogeneous mixture
   D. Immiscible mixture

6. Name a clear liquid obtained after fractional distillation?
   A. Filtrate
   B. Distillate
   C. Fraction
   D. Residue
7. What term is used to describe a technique of vaporizing a liquid and then condensing the vapour?
   A. Simple distillation
   B. Chromatography
   C. Filtration
   D. Fractional distillation
8. Name a method which can be used to separate two homogeneous liquids.
   A. Filtration
   B. Floatation
   C. Simple distillation
   D. Fractional distillation
9. During chromatography, substance X separates into three sport as shown on the diagram below.



From the diagram, which substance can be considered to be contained in X?

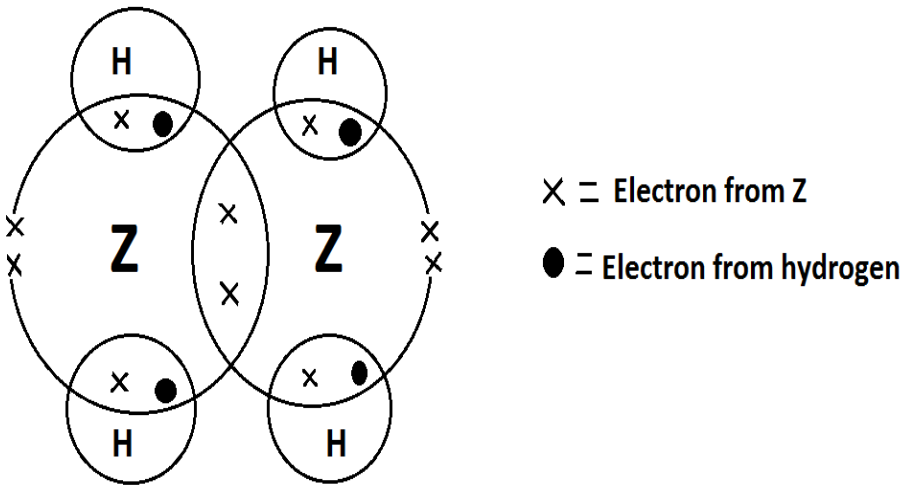
A B C D

10. Which of the following are the three sub-atomic particles of an atom?
    A. Protons, neutrons and shells
    B. Electrons,neutrons and protons
    C. Neutrons,orbits and electrons
    D. Protons, neutrons and nucleus
11. What is meant by mass number of an atom?
    A. Sum of electrons and protons
    B. Sum of electrons and neutrons
    C. Sum of nucleus and protons
    D. Sum of neutrons and protons
12. Which of the following is a use of radioactive isotopes in industries?
    A. Detecting flaws in welded joints.
    B. Checking the P^H of the soil and water.
    C. Manufacturing of enzymes.
    D. Making chemicals
13. What happens when sodium chloride melts?
    A. Covalent bonds in the giant lattice are broken.
    B. Electrons are released from atoms.
    C. Electrostatic forces of attraction between ions are overcome.
    D. Molecules are separated into ions.
14. What is the electronic configuration for magnesium-24?
    A. Mg (2, 12, 0)
    B. Mg (2, 8, 2)
    C. Mg (8, 2, 2)
    D. Mg (2, 2, 8)

15. Which of the following substances has typical properties of an ionic compound?

	Melting point	Boiling point	Solubility in water
A.	782	1600	soluble
B.	3727	4829	insoluble
C.	-21	105	soluble
D.	-39	-15	insoluble

16. A dot and cross diagram of a compound containing element **Z** with hydrogen is shown below



To which group does element **Z** belong?

A. 4
B. 5
C. 6
D. 2

17. Three elements **J**,**K** and **L** have consecutive, increasing atomic numbers. If element **J** is a noble gas, what could be the symbol for the ion of element **L** in its compound.

A. L^-
B. L^{2-}
C. L^+
D. L^{2+}

18. How many atoms are present in a molecule of propylethanoate,$CH_3CO_2(CH_2)_2CH_3$?

A. 16

B. 17

C. 14

D. 8

19. Iron (II) phosphate has the formula $Fe_3(PO_4)_2$. What is the valency of a phosphate ion?

A. 1

B. 2

C. 3

D. 4

20. Calcium ions ($\mathbf{Ca^{2+}}$) and nitrate ($\mathbf{NO3^-}$) ions combine to form the compound calcium nitrate. The chemical formula of the compound formed is.....

A. $Ca(NO_3)_2$

B. Ca_2NO_3

C. $CaNO_3$

D. $2CaNO_3$

21. The phosphate of praseodymium has the chemical formula $Pr_3(PO_4)_4$. The formula of its oxide is .....

A. Pr_2O_4

B. PrO_2

C. Pr_3O_4

D. Pr_3O_2

22. The relative formula mass of calcium hydrogen carbonate, $Ca(HCO_3)_2$ is.....

A. 102

B. 149

C. 162

D. 202

23. Magnesium burns in Oxygen according to the following equation.

$2Mg_{(s)} + O_{2\,(g)} \longrightarrow 2MgO_{(s)}$

If 2.4g of Magnesium burns completely, what will be the mass of magnesium oxide produced?

A. 3.2g

B. 4.0g

C. 4.6g

D. 40.6g

24. The reaction between magnesium and dilute hydrochloric acid may be represented by the ionic equation below.

$Mg + 2H^+ \longrightarrow Mg^{2+} + H_2$

Which one of the following statements describes the conversion of magnesium to magnesium ions? The change is.....

A. A reduction, because there has been a gain of electrons.

B. A reduction, because there has been a gain of electrons.

C. An oxidation, because there has been a gain of electrons.

D. An oxidation, because there has been a loss of electrons.

25. Which of the ionic equations represents the reaction between magnesium and aqueous copper (II) sulphate?

A. $Mg_{(s)} + Cu^{2+}_{(aq)} \longrightarrow Mg^{2+}_{(aq)} + Cu_{(s)}$

B. $Mg^{2+} + Cu_{(s)} \longrightarrow Mg_{(s)} + Cu^{2+}_{(aq)}$

C. $Mg^{2+} + SO_4^{2-}{}_{(aq)} \longrightarrow MgSO_{4(s)}$

D. $Mg(s) + SO_4^{2-}{}_{(aq)} \longrightarrow MgSO_{4(aq)}$

26. What is the ionic equation for the neutralisation reaction between sodium hydroxide and sulphuric acid?

A. $2Na^+_{(aq)} + SO_4^{2-}{}_{(aq)} \longrightarrow Na_2SO_{4(aq)}$

B. $Na^+_{(aq)} + OH^-_{(aq)} \longrightarrow NaOH_{(aq)}$

C. $2H^+_{(aq)} + 2OH^-_{(aq)} \longrightarrow 2H_2O_{(l)}$

D. $2H^+_{(aq)} + SO_4^{2-}{}_{(aq)} \longrightarrow H_2SO_{4(aq)}$

27. Solid **X** and dilute acid **Y** react dangerously and explosively at room temperature and reactions catches fire. Misozi wishes to carry out the reaction between **X** and **Y** safely in the laboratory. Which of the following are the best conditions.

A. Using a positive catalyst, lumps of **X** and concentrated **Y**.

B. Using **X** powder, very dilute **Y** and temperature 0^0C.

C. Using large lumps of **X**, very dilute **Y** and temperature of 0^0C.

D. Using powdered **X**, higher temperature and dilute **Y**.

28. According to the reactivity series, which of the following can take place?

A. $Mg + Zn^{2+} \longrightarrow Mg^{2+} + Zn$

B. $Cu + Zn^{2+} \longrightarrow Cu^{2+} + Zn$

C. $Fe + Zn^{2+} \longrightarrow Fe^{2+} + Zn$

D. $2Ag + Zn^{2+} \longrightarrow 2Ag^{+} + Zn$

29. Which of the following oxides dissolves in both acid and alkali?

A. ZnO

B. CuO

C. SiO

D. Fe_2O_3

30. Acids act alike because they all contain.....

A. sulphate ions

B. hydrogen ions

C. hydroxide ions

D. Cations

31. Dilute hydrochloric acid reacts faster with magnesium ribbon than ethanoic acid of the same concentration. Give a reason.

A. Because hydrochloric acid produces more hydrogen ions than ethanoic acid

B. Because hydrochloric acid produces more chloride ions than ethanoic acid

C. Because hydrochloric acid produces more hydroxide ions than ethanoic acid

D. Because hydrochloric acid has a P^H value close to 14

32. Name the process that can be used to prepare the salt silver chloride in a school laboratory.

A. Titration

B. Decomposition

C. Precipitation

D. Crystallization

33. Which of the following shows a neutralisation reaction?

A. Acid + metal oxide $\longrightarrow$ salt + alkali

B. Acid + metal hydroxide $\longrightarrow$ salt + water

C. Acid + metal hydroxide $\longrightarrow$ alkali + water

D. Acid + metal carbonate $\longrightarrow$ salt + carbon monoxide

34. In order to prepare an insoluble salt, you must mix a solution that contains its positive ions with another one containing.....

A. its negative ions

B. hydrogen ions

C. hydroxide ions

D. insoluble substance

35. How many oxygen atoms are in 1.6g of sulphur trioxide, SO_3?

A. 3

B. 4.8

C. 1.2×10^{22}

D. 9.6×10^{23}

36. What is the mass of 4.21×10^{24} atoms of carbon dioxide?

A. 3.1×10^{48}g

B. 6.99g

C. 307.7g

D. 44g/mol

37. What mass of calcium metal reacts completely with 9.0g of water according to the equation below?

$Ca_{(s)} + 2H_2O_{(l)} \longrightarrow Ca(OH)_{2(aq)} + H_{2(g)}$

A. 10g

B. 20g

C. 5.0g

D. 40g

38. Methane burns completely in oxygen according to the equation below:

$CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(g)}$

If 0.2 mole of methane is burned completely, which volume of carbon dioxide measured at r.t.p is formed?

A. $0.2dm^3$

B. $0.6dm^3$

C. $2.4dm^3$

D. $4.8dm^3$

39. Calcium carbonate is decomposed by heating according to the equation below:

$CaCO_3 \longrightarrow CaO + CO_2$

What is the percentage yield of CaO in the reaction if 12.5g of $CaCO_3$ is heated to give 3.5g of CaO?

A. 7%

B. 14%

C. 50%

D. 56%

40. Which one of the following is likely to be the molecular formula of a hydrocarbon containing 85.7% carbon and 14.3% hydrogen by mass?

A. C_2H_4

B. C_3H_8

C. C_5H_{12}

D. C_6H_{12}

41. How many elements are in **period 6** of the Periodic Table?

A. 8

B. 10

C. 18

D. 32

42. In which of the following are halogens correctly arranged as solid, liquid of gas?

	Chlorine	**Iodine**	**Bromine**
A.	Gas	solid	liquid
B.	Gas	liquid	solid
C.	Liquid	gas	solid
D.	Solid	gas	liquid

43. The diagram below shows part of the Periodic Table of elements. T represents an element in the Period Table but it is not the actual symbols of the element.

																Ne
Na																Ar
	Ca							T				Zn			Br	

Which of the following statements is true about T?

A. T forms covalent compounds with bromine
B. T is in period 2 of the Periodic Table
C. T has a high density and high melting point.
D. T is likely to be a gas at r.t.p

44. On the Periodic Table, an element with one less electron than does a neighbouring inert gas can.....

A. not be a halogen
B. not exist in the liquid and gaseous form
C. not react with elements in group 1
D. react with elements in group 1

45. An excess of iron fillings is added to a solution containing a mixture of the ions **Mg^{2+}, Ca^{2+}, Cu^{2+} and Ag^{+}**. Which two metals will **not** be displaced from the solution?

A. Calcium and copper.
B. Calcium and magnesium.
C. Copper and silver.
D. Magnesium and silver.

46. Experiments are carried out to arrange metals, **X**, **Y** and **Z** in order of decreasing reactivity. The table shows the results.

Experiment	**X**	**Y**	**Z**
Does the metal liberate hydrogen from dilute hydrochloric acid?	yes	no	yes
Is the metal oxide reduced by heating with carbon?	yes	yes	no

What is the order of reactivity of the metals?

	Most reactive → least reactive		
A	X	Z	Y
B	Y	X	Z
C	Z	X	Y
D	Z	Y	X

47. Desalination is the removal of sodium chloride from sea water.

Which method is used in the laboratory to desalinate sea water?

A. Chromatography
B. Crystalisation
C. Distillation
D. Filtration

48. When a nitrate of a metal **X** is strongly heated, it produces a black powder, a reddish brown gas and a colourless gas. Identify metal **X**?

A. Copper
B. Lead
C. Mercury
D. Silver

49. Most metals are extracted from metal ores. Which one of the following is **not** a metal ore of iron?

A. Bauxite

B. Haematite

C. Magnetite

D. Pyrite

50. When crude oil is separated using fractional distillation which substance has the lowest boiling point?

A. Lubricating oil

B. Bitumen

C. Paraffin (kerosene)

D. Petrol (gasoline)

51. Which one of the following is a condensation polymer?

A. Polystyrene

B. Protein

C. PVC

D. Polypropene

52. When butene undergoes an addition reaction with steam the organic compound formed will have the formula.....

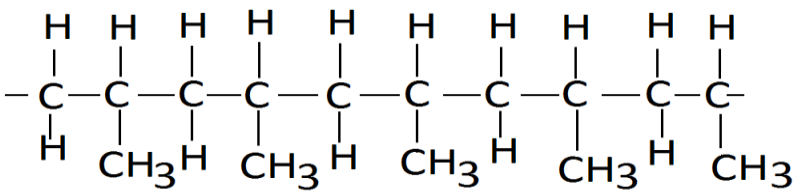
A. C_4H_{10}

B. $C_4H_{10}OH$

C. C_4H_9OH

D. C_4H_7COOH

53. A polymer has the structure shown below:



What is the molecular formula of the monomer?

A. C_2H_4

B. C_2H_6

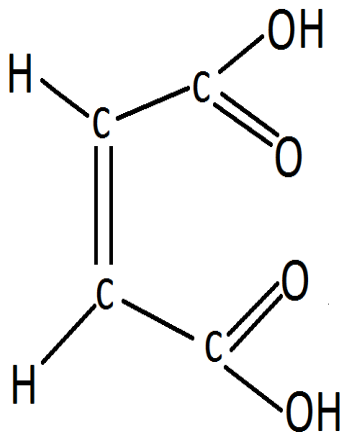
C. C_3H_6

D. C_3H_8

54.

A compound, **X**, has the molecular structure as shown:

How can **X** be described?



A. Both as an alkane and as an acid.

B. Both as an alkene and as an acid.

C. Both as an alkane and as an acid.

D. Both as an alkene and as an alcohol.

55. What is the formula of the ester formed when ethanoic acid reacts with propanol?

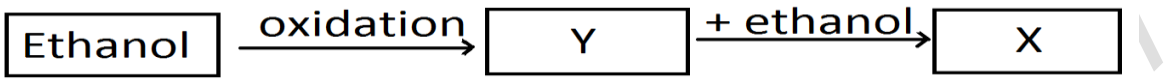
A. $CH_3CO_2(CH_2)_2CH_3$

B. $CH_3CO_2CH_3$

C. $CH_3CH_2COOCH_2CH_3$

D. $CH_3COOCH_2CH_3$

56. A compound , X, has a molecular formula $C_4H_8O_2$ and can be prepared by the reactions shown:



What is the condensed structural formula of X?

A. $HCO_2(CH_2)_2CH_3$
B. $CH_3CO2CH_2CH_3$
C. $CH_3CH_2CO_2CH_3$
D. $CH_3(CH_2)_2CO_2H$

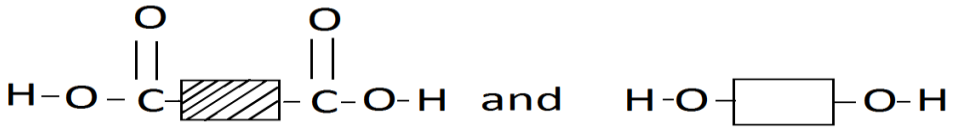
57. Which of the following processes involves formation of small molecules from large molecules?

A. Formation of starch from glucose.
B. Hydrogenation of ethene.
C. Fermentation of sugar
D. Polymerisation of ethene.

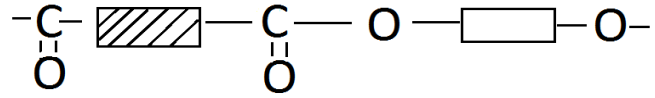
58. Which of the following pair of compounds contain glycosidic bonds?

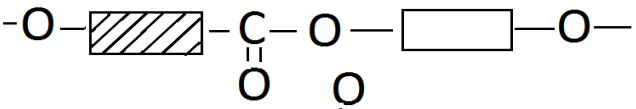
A. Cellulose and Starch
B. Cellulose and Fats
C. Cellulose and Proteins
D. Starch and Nylon

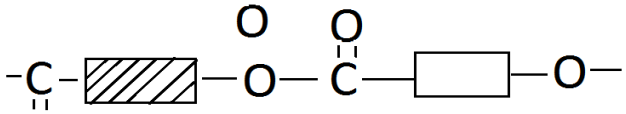
59. Terylene (polyester) is made by the condensation polymerisation of the two monomers:

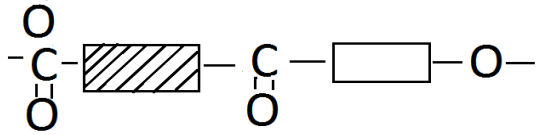


What is the simplest repeat unit of the polymer?

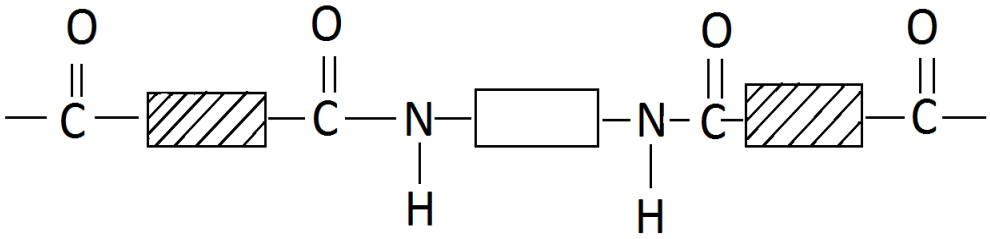
A 

B 

C 

D 

60. Study the structure of an organic compound below.



Which natural and artificial macro molecules are represented by the bond linkages?

	Natural	**Artificial**
A.	Starch	Nylon
B.	Fats	Terylene
C.	Proteins	Nylon
D.	Carbohydrates	Polythene

PART TWO

1. The table below shows some apparatus used in the laboratory in the laboratory when performing chemistry experiments.

Separating funnel	Beaker	Gas jar
Burette	Spatula	Laboratory thermometer
Desicator	Bunsen burner	Bee-hive shelf
Evaporating dish	Pipette	Tripod stand

Choose from the table the apparatus:

a) Used for measuring a fixed volume of a liquid.

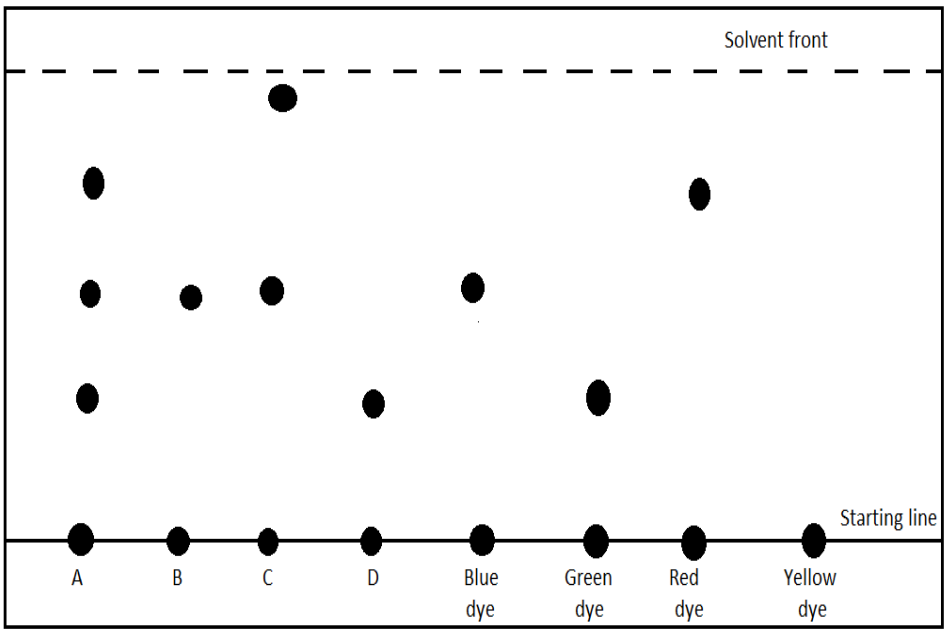
b) Used for drying substances or keeping them free from moisture.

c) Used for separating immiscible liquids.

d) Used as a source of heat.

e) Used to support a gas jar when collecting gases.

2. The diagram below shows a chromatogram obtained using solutions of three four dyes (blue, green red and yellow) and four other solutions (A, B, C and D):



a) Which of the solutions A, B, C or D contains the following:
   i. One dye only.
   ii. Three of the dyes.
   iii. A green and a red dye only.
   iv. A dye other than blue, green, red and yellow.

b) In preparing the chromatogram, the following instructions were given. Suggest a reason for each instruction:
   i. The starting line should be drawn in pencil rather than in ink.
   ii. Which solution (A, B, C or D) was the most soluble and give a reason to support your answer.
   iii. Among the colors in the chromatogram, which one was insoluble?
   iv. Write two applications of chromatography in your daily lives.

3. Copper **(II)** sulphate ($CuSO_4$) is a soluble salt prepared by using sulphuric acid as one of the starting materials.
   a) Define a salt.
   b) Name one other reagent which must be reacted with dilute sulphuric acid to form copper **(II)** sulphate.
   c) Construct a well balanced chemical equation for the reaction in **(b)** above with state symbols.
   d) Write a net ionic equation for the reaction in **(c)** above.
   e) Find the relative formula mass of copper **(II)** sulphate.
   f) Describe how your would obtain a dry sample of copper **(II)** sulphate from the reagents in **(b)** above.

4. The following label was obtained from a fruit juice. It lists the chemical contents of the fruit juice.

a) (i) Which one of these chemicals has a sour taste?

(ii) Would the pH of the fruit juice be below 7, equal to 7 or above 7?

b) Sodium benzoate is a preservative. Its chemical formula is C_6H_5COONa.

(i) How many different elements are combined together in sodium benzoate?

(ii) How many carbon atoms are there in each molecule of this compound?

(iii) What is the formula mass of sodium benzoate?

5. a. write the chemical formula for:

i. Zinc sulphide.

ii. Lead (II) nitrate.

iii. Ammonium Carbonate.

b. write a complete balanced chemical equations for the following reactions including state symbols:

i. potassium reacts with calcium nitrate solution

ii. Magnesium chloride solution reacts with sodium hydroxide solution

iii… heating sodium hydrogen carbonate

6. (a) Give three main ways by which rusting of iron metal can be prevented.
   (b) Give one similarity and one difference between rusting and respiration.
      (i) Similarity
      (ii) Difference

7. The increase in the number of vehicles and industrial activity in Zambian cities and towns has resulted in high levels of air pollution.
   a) State **two** air pollutants;
   b) Name the sources of the air pollutants stated in 4 (a) above
   c) What are the effects of the two air pollutants stated in 4 (a) above?

8. Part of the periodic table is shown below. Use it to answer the questions that follow.

H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar

   a. Give four reasons in terms of chemical properties to justify placing the elements Li and Na in the same group of the Periodic Table.
   b. Write down **one** chemical symbol in the above Periodic Table for an element which is a;
      (i) Metal in nature:
      (ii)Non-metal in nature:

9. Sodium sulphate can be produced by reacting ammonium sulphate and sodium hydroxide according to the following equation.

$$(NH_4)_2SO_4\ (aq) + NaOH\ (aq) \longrightarrow Na_2SO_4\ (aq) + NH_3\ (g) + H_2O\ (l)$$

(a) Balance the chemical reaction equation

$(NH_4)_2SO_4$ (aq) + NaOH (aq) ⟶ Na_2SO_4 (aq) + NH_3 (g) + H_2O $_{(l)}$

(b) Calculate the mass of ammonium sulphate that would react with sodium hydroxide to produce 17.64 kilogrammes of sodium sulphate.

(c) How could a student test for the presence of the ammonia gas produced in the reaction?

10. Study the table below that shows the properties of an alkali, an acid and salt solution.

a) Complete the table:

Solution	**Approximate P^{H}**	**Ions present**
i.	14.0	Na^+, OH^-
ii. Hydrochloric acid		
iii. Acetic acid		
iv. Sodium chloride	7	

b) Name two solutions from the table which, when mixed together, form a solution sodium chloride.

11. Potassium carbonate reacts with dilute sulphuric acid to form potassium sulphate, carbon dioxide gas and water.

i. Construct a balanced chemical equation, including state symbols for the reaction above.

ii. What is the identity test of the gas produced in the reaction above?

12. Write the complete ionic equations for the neutralisation reactions that take place in each case below:

a) $HCl_{(aq)} + KOH_{(aq)} \longrightarrow KCl_{(aq)} + H_2O_{(l)}$

b) $H_2SO_{4\,(aq)} + Li_2CO_{3(aq)} \longrightarrow Li_2SO_{4(aq)} + H_2O(l) + CO_{2(g)}$

c) $HNO_{3(aq)} + MgO_{(s)} \longrightarrow Mg(NO_3)_{2(aq)} + H2O_{(l)}$

13. a). Define

i. Proton number

ii. Mass number

b). An element contains atoms of an isotope that has mass number 35.5 and proton 17

I. Draw diagrams to show the electronic structures of an atom of this isotope.

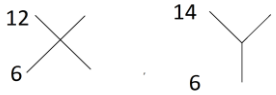
ii. Identify the this element by using the Periodic Table. Give the element's symbol and the number of the Group in which it appears.

iii. Decide whether the element is a metal or a non-metal, and explain how you made this decision.

14. a). An element Z forms an ion $^{60}_{27}Z^{3+}$ how many electrons, neurons and protons are there in this ion?

15.

b). Two nuclides are shown below:



Where X and Y are not the actual chemical symbols. Which term best describes the two nuclides

c). Give a reason as to why noble gases are considered to be stable?

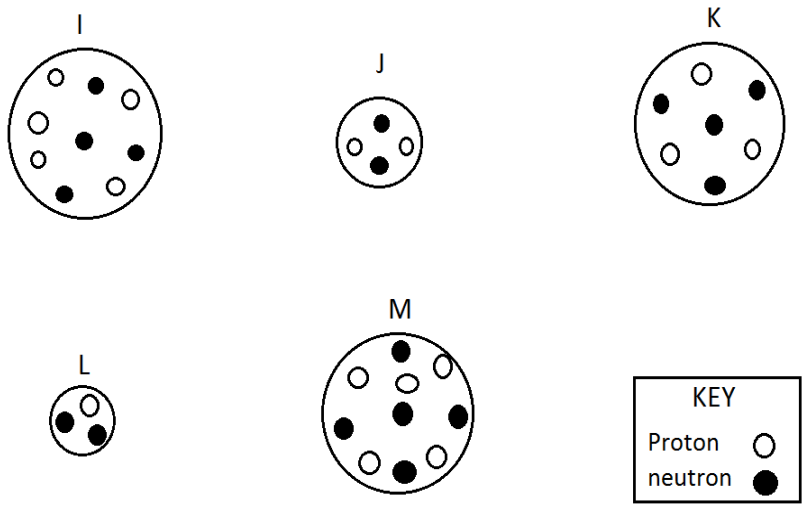
16. i. Define an ionic bond

ii. Calcium loses two electrons**(2e$^-$)** to form a positively charged cation. Write the ionic half reaction to explain this process.

iii. Give a reason as to why electrovalent compounds have high boiling points.

iv. Justify that the second shell of any atom of an element contains eight electrons **(8e$^-$)** as the maximum number.

17. Study the drawings below of nuclei of five different atoms, **I**, **J**, **K**, **L** and **M**.



Which of the atoms **I**, **J**, **K**, **L** and **M**.

a) are isotopes of the same lement?

b) has a nucleon number of three?

c) have one electron in their outermost electron shell?

d) is given by the symbol $^{7}_{3}Li$?

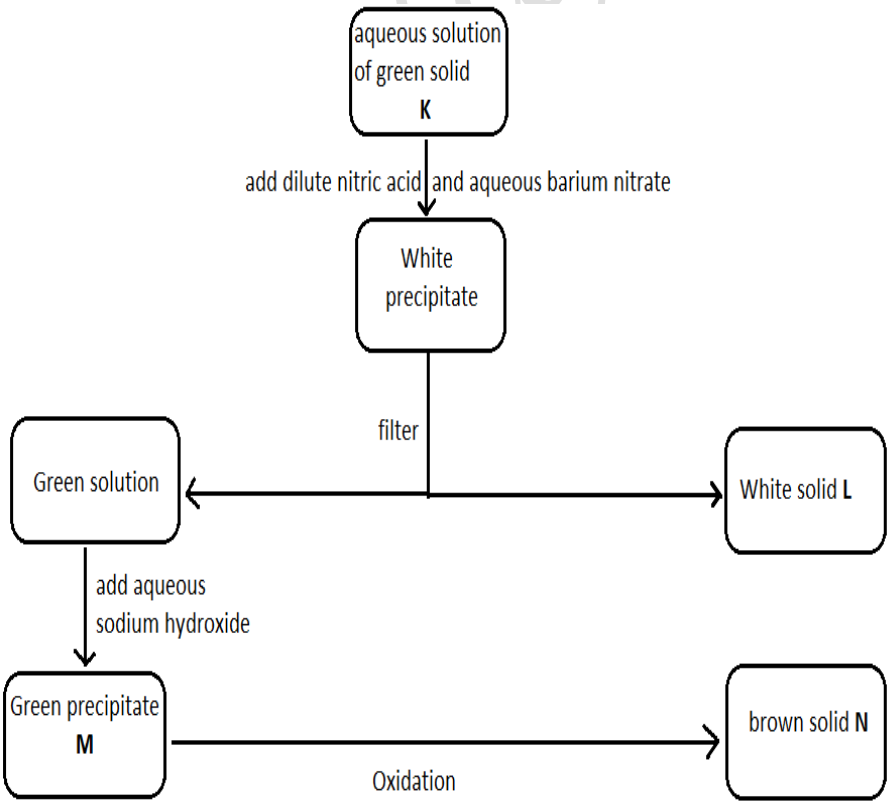
18. Sodium hydroxide solution is an alkali and dilute sulphuric acid is an acid.

a. i). Give two properties of alkalis and two properties of acids.

ii). What ions in alkalis and acids cause these properties.

b. Sulphuric acid can be neutralized by sodium hydroxide. Write a chemical equation and an ionic equation to represent this neutralisation.

19. The diagram below shows some properties and reactions of several substances:



a) Identify

i. White solid **L**,

ii. Green preciitate **M**,

iii. Brown solid **N**,

iv. Green solid **K**,

b) Write an equation for any **one** of the reactions above.

20. Caesium, lithium,potasium and sodium are in Ground I of the Poriodic Table.

a) Place these metals in order of reactivity with water, most reactive metal first.

b) Name the chemical products of the reactions between lithium and water and between sodium and water.

c) i. What would you expect to see if small pieces of caesium were dropped onto water? How would the P^H of the resulting solution be different from the P^H of water?

ii. Write the full chemical equation for the of caesium with water. Include state symbols.

21. a). Give three properties of all acid solutions.

b). Calcium hydroxide, a base, will react with ammonium sulphate to liberate ammonia gas. The **unbalanced** chemical equation for this reaction is:

$$Ca(OH)_2 + (NH_4)_2SO_4 \longrightarrow CaSO_4 + NH_4 + H_2O$$

i. Copy and balance this chemical equation.

ii. Calculate the relative molecular mass of ammonium sulphate. Use this molecular mass to determine the mass and volume of ammonia, at room temperature and pressure, that will be produced when 264g of ammonium sulphate react with calcium hydroxide. **[R.AM: Ar: H,1; N, 14; O, 16; S,32]**

22. a). E is a hydrocarbon with the formula C_2H_6. **F** is a hydrocarbon with the formula C_2H_4.

i. Give the full structural formula of **E** and of **F**.

ii. How would you distinguish in the laboratory between **E** and **F**?

Chemical test.....

Result with **E**.....

Result with **F**.....

iii. Calculate the relative molecular mass of **E**.

[Relative atomic masses **Ar: H,1; C, 12**]

b). i. Explain why F can be polymerised but E cannot.

ii. Give the chemical structure of the polymer formed from F.

iii. Explain why pollution is caused by

1. Dumping polymers

2. Burning polymers

23. The structure in Fig.4.1 are of five organic compounds.

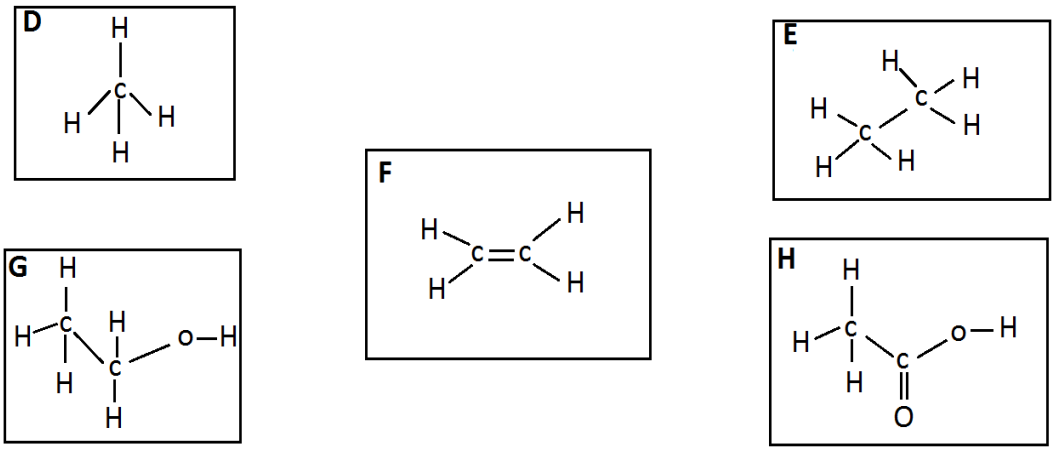


Fig. 4.1

Answer each of the following questions using letters **D, E, F, G or H.**

a) Which compound is ethane?

b) Which compound is unsaturated?

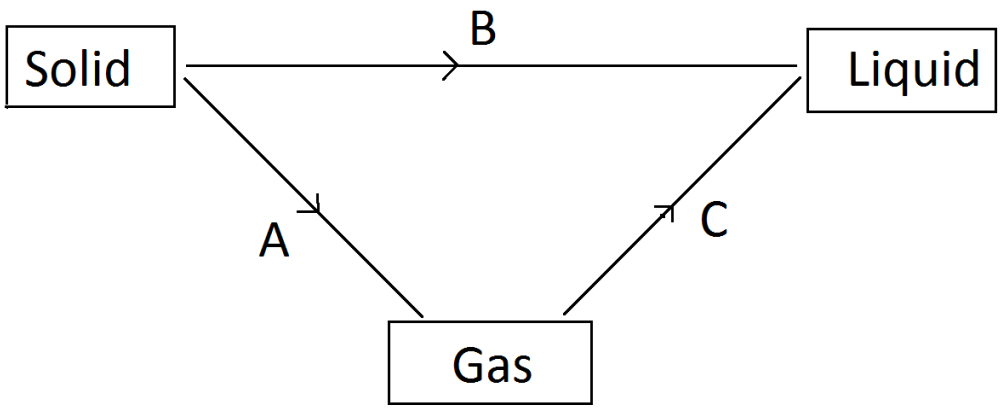
c) Which compound has the molecular formula C_2H_6O?

d) Which compound, when oxided, becomes compound **H**?

e) Which compound can be converted by the catalytic addition of steam into compound **G**?

PART THREE

1) Study the diagram answer the questions that follow



a) Name the processes represented by A, B and C

b) How is the change represented by letter A achieved?

c) What effect does process B have on the arrangement?

d) Explain the change in kinetic during the process C

2)

a. Mr Chulu enters class to teach Chemistry. The learners at the back of the class realize the smell of the perfume he is wearing.

i. Name the process that has taken place.

ii. Explain how these learners smelt the perfume.

b. Misozi dropped a crystal of potassium dichromate(**IV)** in a conical flask containing about 150cm3 of water. She then gently swirled the contents of the flask and left them to stand.

i. State what was observed and explain your observation.

ii. State any factor which affect the rate of diffusion.

iii. What do you learn from this experiment?

3) Chlorine has two isotopes, C*l*-35 and C*l*-37

a) Define the term isotopes.

b) State the number of neutrons in each of the following isotopes of chlorine.

i. Chlorine-35

ii. Chlorine-37

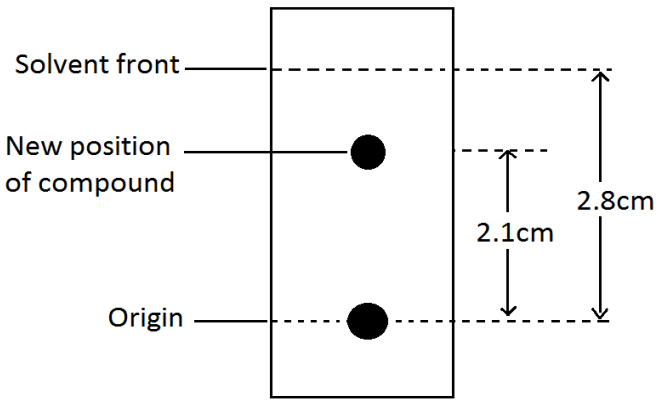
c) i. Draw the atomic structure of an atom of chlorine.

ii.Give the formula of a chloride ion.

d) Explain why the relative atomic mass of chloride on the Periodic Table is not a whole number.

4)

Study the diagram shown below:

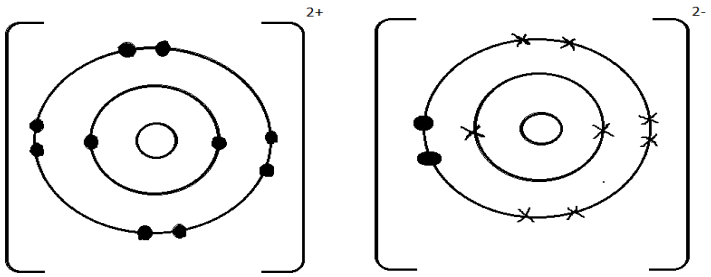


a) What is meant by the term **retention factor (R_f)**?

b) Calculate the **R_f value** of the compound in the chromatogram above?

c) Write any two applications of the separation technique shown above.

5) The figure below shows the structure of the compound



a) Name the compound shown.

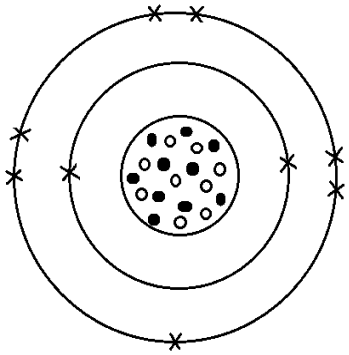
b) Write down the chemical formula of the compound.

c) What type of bonding is present in the compound?

d) State any two physical properties you would expect the compound to have.

6) a) what is meant by the proton number of an element?

b) The diagram below shows the structure of an atom of the element B.



i. Complete the table below about the three different sub-atomic particles present in an atom of element B.

Sub-atomic particle	Number of particle	Name of particle
×		
●		
○		

ii. In which Group of the Periodic Table is element B found?

iii. State the formula of an ion formed by element B.

c) Element B reacts with magnesium to form a compound. Construct a "dot and cross" diagram to show the bonding between element B and magnesium. (Show outer shells only).

7) A forensic chemist uses specific codes to identify chemical species. The chemist uses the Periodic Table and the positions of the elements to code the elements.

Example: Sodium is in Group 1, Period 3, so its code is (1:3) and hence Na*Cl* is coded (1:3) (7:3)

Complete the following table by filling in the blank spaces.

	CODE	**CHEMICAL FORMULA**	**CHEMICAL NAME**
a)	(2:4) (6:2)		
b)	$(1:3)_2$ (6:3) $(6:2)_4$	Na_2SO_4	
c)			Aluminium Nitrate

8) Magnesium reacts with hydrochloric acid to form magnesium chloride and hydrogen.

a) Write a balanced chemical equation, including state symbols, for the reaction of magnesium with dilute hydrochloric acid.

b) Calculate the mass of magnesium chloride formed when **6.0g** of magnesium react with an excess of dilute hydrochloric acid.

c) Silicon is a semiconductor that is used in computer chips and solar cells. It is made by the following reaction:

$SiCl_{4(l)} + 2Mg_{(s)} \longrightarrow Si_{(s)} + 2MgCl_{2(s)}$

If 225g of $SiCl_4$ and 225g of Mg is used to prepare the silicon, which reactant is the limiting reagent?

9) When copper(**II**) nitrate is heated strongly, it decomposes according to the equation below.

$2Cu(NO_3)_{2(s)} \longrightarrow 2CuO_{(s)} + 4NO_{2(g)} + O_{2(g)}$

9.4g of copper(**II**) nitrate were decomposed by heating. Calculate:

a) The mass of copper(**II**) oxide formed in the reaction.

b) The volume of nitrogen dioxide gas measured at **r.t.p** formed.

10) Write the correct chemical formula of the following compounds:

a) Ammonium carbonate

b) Aluminium phosphate

c) Calcium hydroxide

d) Lead(**IV**) oxide

11) Fertilizers often contain the compounds with the following formulae:

a) $(NH_4)_2HPO_4$ b) NH_4NO_3 c) KCl

i. Name the compounds with the formulae

a) $(NH_4)_2HPO_4$

b) NH_4NO_3

c) KCl

ii. Calculate the relative molecular mass (Mr) of $(NH_4)_2HPO_4$

iii. How many hydrogen atoms are present in the one molecule of $(NH_4)_2HPO_4$

iv. How many moles are there in 20g of aluminium sulphate $[Al_2(SO_4)_3]$

12) Complete the figure below by writing in the missing symbols and formula.

Compound	**Symbol of positive ion**	**Symbol of negative ion**	**Formula**
Sodium oxide			
Aluminium hydroxide			
Sodium hydrogen carbonate			
Potassium sulphate			
Copper(**II**) sulphite			

13) Barium sulphate ($BaSO_4$) is an insoluble salt which is prepared by precipitation.

Using ammonium sulphate as one of the reactants:

a) Briefly explain how you would obtain a fairly pure dry sample of the salt.

b) Name one salt that can be prepared by the reaction of metal a metal with a dilute acid.

c) Calcium chloride ($CaCl_2$) can be prepared by reacting calcium carbonate and dilute hydrochloric acid as shown in the equation below:

$CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$

Calculate the mass of calcium chloride produced by 150g of calcium carbonate.

14) **a)**. Copper does not react with sulphuric acid. To prepare Copper (**II**) sulphate salt, excess copper (**II**) oxide is reacted with dilute sulphuric acid.

i. In what ways is copper (**II**) oxide behaving when it reacts with dilute sulphuric acid?

ii. Explain why excess copper (**II**) oxide is added to dilute sulphuric acid.

iii. Write a balanced chemical equation with state symbols for the reaction of copper (**II**) oxide and dilute sulphuric acid.

iv. Describe how you would obtain anhydrous copper (**II**) sulphate crystals from a mixture of unreacted copper (**II**) oxide and a solution of copper (**II**) sulphate.

b). Silver chloride is an insoluble salt which is prepared by precipitation.

i). Describe briefly how you would prepare fairly pure dry precipitates of Silver chloride, and name the reagents.

ii). Write an ionic equation for this reaction.

15) Compound **R** is a pale green crystalline salt which readily dissolves in water.

a) An aqueous solution of **R** is acidified with dilute hydrochloric acid. On addition of aqueous barium chloride, a white precipitate is obtained.

i. What is the name of the white precipitate formed?

ii. From this observation what anion or negative ion must be present in solution **R**?

iii. Write an ionic equation for the formation of the white precipitate.

b) When aqueous sodium hydroxide is added to solution **R**, a green precipitate is obtained.

i. What is the name of the green precipitate?

ii. From this observation, what cation or positive ion is present in solution **R**?

iii. Write an ionic equation for the formation of the green precipitate.

c) Give the name and formula of compound **R**.

16) A lamp of marble chips was dropped in excess 0.1mol/dm3 hydrochloric acid and observed for sometime.

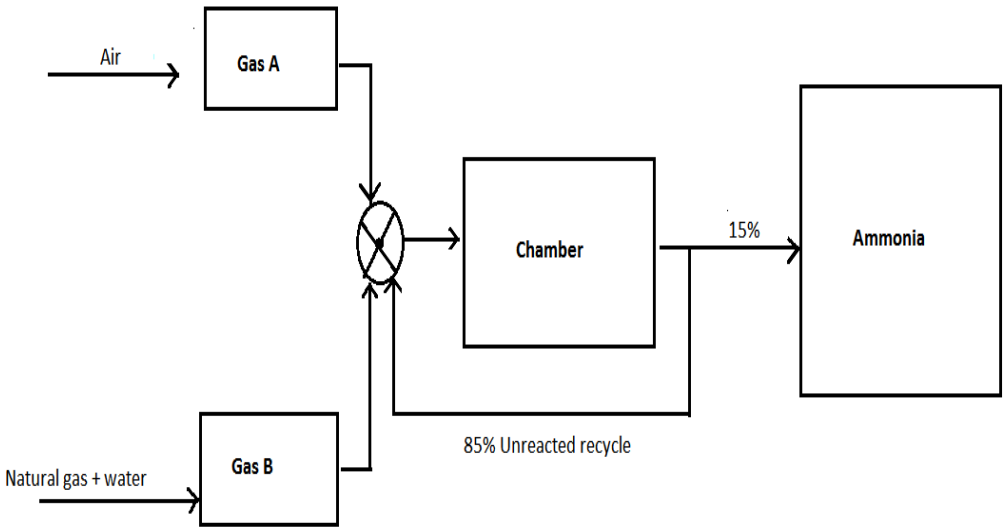
a) State what you would see.

b) Describe how the rate of reaction changed with time.

c) Explain why the reaction stopped after some time.

d) The reaction was rather slow. State two ways of speeding it up.

17) The flow chart shows the process used in an industrial preparation of ammonia



a) Name gas **A** and **B**.

b) What process is represented in the flow chart above?

c) Construct a balanced equation for the preparation of ammonia with state symbols.

d) State **two** (2) conditions required for the above preparation of ammonia.

e) How would you test to see if the gas collected above is ammonia?

18) The list below shows metals arranged in ascending order of reactivity:

Silver

Zinc

Aluminium

Sodium

Using metals from the list only, name:

a) a metal which can be displaced by copper.

b) a metal which reacts with cold water to produce an alkaline solution.

c) a metal which forms an amphoteric oxide when burnt.

d) a metal whose carbonate does not decompose when heated.

e) a metal which forms a stable oxide layer.

f) Write a balanced chemical equation for the reaction between sodium and water.

19) One of the main ore from which copper is extracted is copper pyrites(**$CuFeS_2$**).

a) Describe the chemical reactions involved in the extracted of copper from copper pyrites.

b) One use of copper is making electrical cables. State two properties of copper which makes it suitable for this use.

c) Name one other use of copper and state one property which make it suitable this use.

20) a). Zinc is extracted from its ore, Zinc blende. The Zinc blende is heated in air to form the oxide and an acidic gas. The Zinc oxide is then reduced to Zinc.

i. Name the acidic gas.

ii. What is the chemical name of zinc blende?

iii. Write down the chemical equations for the two processes involved in the extraction of zinc from zinc blende.

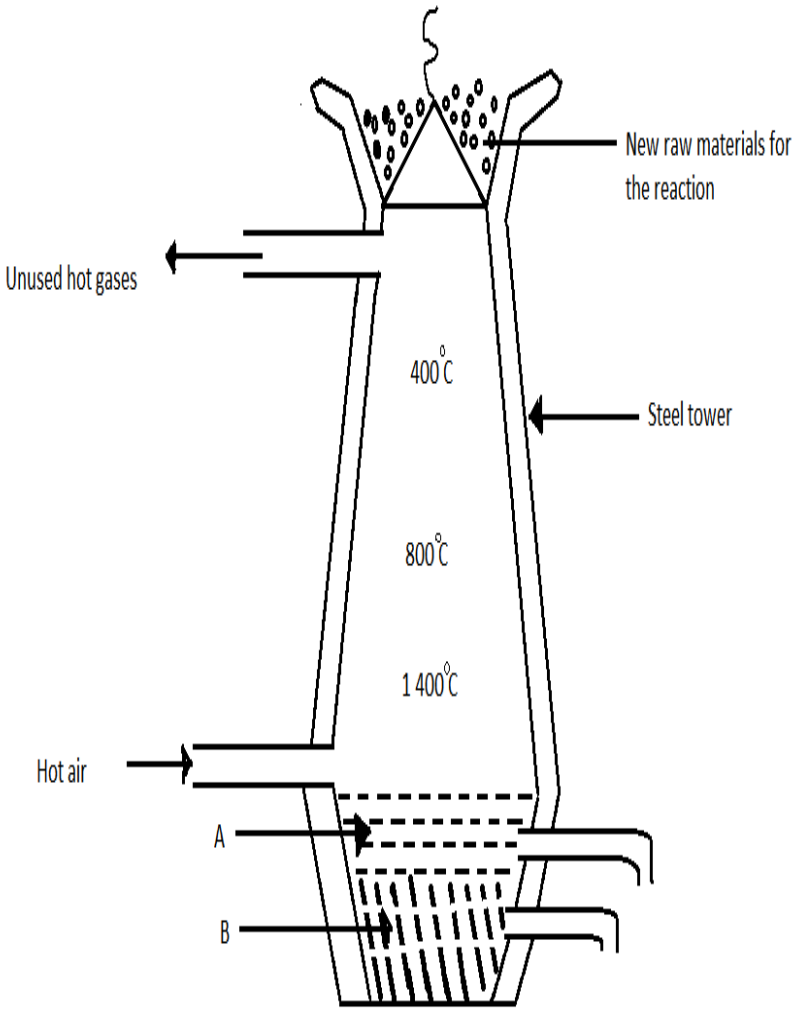
iv. Why it is not possible to reduce aluminium using carbon?

b). Important uses of zinc are galvanizing steel, making alloys and manufacturing dry cells.

i. Why is steel galvanized?

ii. Name an alloy containing zinc metal. State one physical property of the alloy.

21) Study the diagram below for the extraction of iron and answer the questions that follow:



a) What are the three raw materials added into the blast furnace from the top?

b) Write the first reaction equation for each of the three raw materials added into the blast furnace.

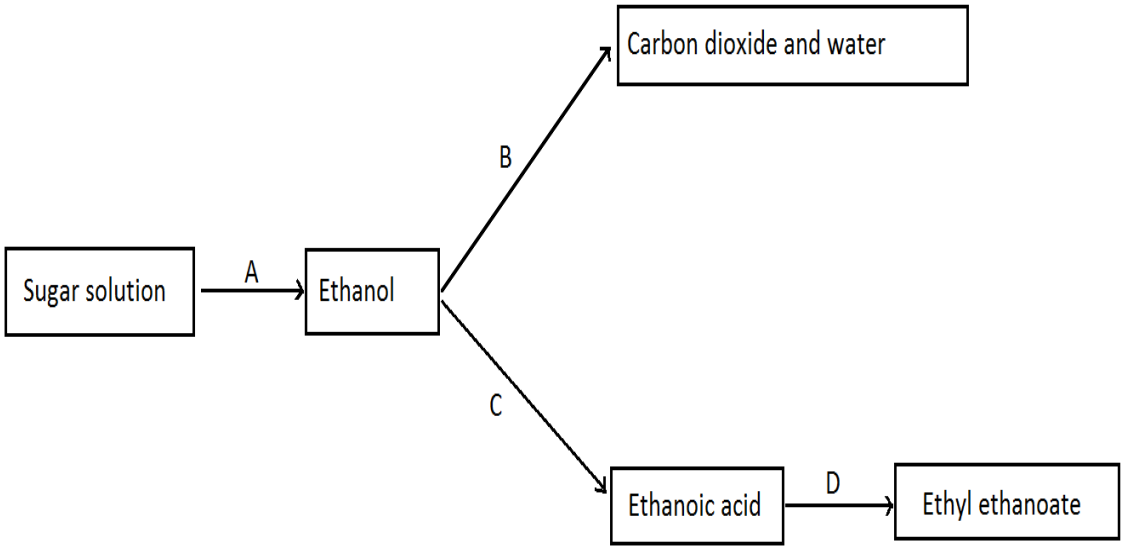
c) Give the identities of substance A and B.

d) Give three main ways by which rusting of iron metal can be prevented.

e) Give one similarity and one difference between rusting and respiration.

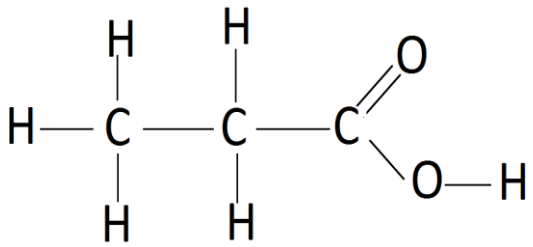
22) Chemical reactions sometimes have names. For example, the complete reaction of an acid with an alkali is called 'neutralisation'.

Fig. 2.1 contains a series of chemical reactions. Give the names of these reactions.



a. Reaction **A**
b. Reaction **B**
c. Reaction **C**
d. Reaction **D**

23) The figure below shows the structural formula of an organic compound.



a) i. To which homologous series does this compound belong?
ii. Circle the functional group of the homologous series to which the compound belongs.

b) i. Name the organic product formed when methanol reacts with the organic compound above.

ii. To which homologous series does this new compound belong?

iii. State how the organic compound formed in **(b)(i)** above can be identified.

24) a). i. What is meant by the term **unsaturated** hydrocarbon?

ii. Name one unsaturated hydrocarbon and draw its structural formula.

iii. Name and write the chemical formula of the product formed when bromine and the named unsaturated hydrocarbon combine.

iv. Name one saturated hydrocarbon and draw its structural formula.

b). i. Which one of the two named hydrocarbons in **(a) (i)** and **(iv)** can be converted to a polymer?

ii. Name the polymer and draw its structure.

iii. State one environment disadvantage of the polymer named in **(b) (i)**.

25) Organic acids are a homologous series of compounds having the carboxylic group -COOH joined to an alkyl radical.

a) What is the general formula for organic acids?

b) Draw the structure of butanoic acid.

c) A reaction between an alcohol and an organic acid is described as esterification and this is similar to neutralisation.

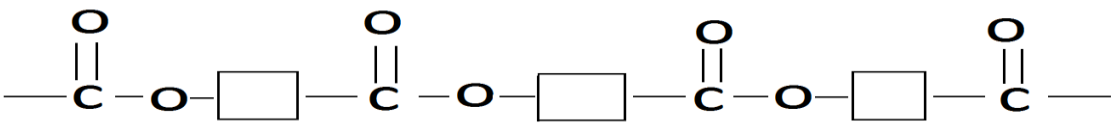
i. Ethylethanoate is an ester. Name two reagents used to prepare it.

ii. State two ways in which esterification is different from neutralisation.

iii. Write a balanced chemical equation for the esterification of ethylethanoate.

d) Calculate the mass of ethylethanoate formed from 15g of the organic acid.

26) Terylene is a condensation polymer. The structure of terylene is shown below.



i. What name is given to the linkage in the structure of terylene above.

ii. Name the natural macro-molecule that contains the same linkage as terylene.

iii. Draw and name the polymer formed when the following monomers are condensed. i.e $HOOC(CH_2)_6COOH$, $H_2N(CH_2)_6NH_2$

iv. What is the name of the linkage found in the drawn compound above in **(iii)**.

v. Draw the carbohydrate structure formula and label the cellulose linkage found in it.

ANSWERS

PART ONE

1	**D**	21	**B**	41	**D**
2	**B**	22	**C**	42	**A**
3	**C**	23	**B**	43	**C**
4	**B**	24	**D**	44	**D**
5	**D**	25	**A**	45	**B**
6	**B**	26	**C**	46	**A**
7	**A**	27	**D**	47	**C**
8	**D**	28	**A**	48	**B**
9	**A**	29	**A**	49	**A**
10	**B**	30	**B**	50	**D**
11	**D**	31	**A**	51	**B**
12	**A**	32	**C**	52	**C**
13	**D**	33	**B**	53	**C**
14	**B**	34	**A**	54	**B**
15	**A**	35	**C**	55	**A**
16	**C**	36	**A**	56	**B**
17	**D**	37	**A**	57	**D**
18	**B**	38	**D**	58	**B**
19	**C**	39	**C**	59	**A**
20	**A**	40	**A**	60	**C**

PART TWO

1. a). Pipette

   b). Desicator

   c). Seperating funnel

   d). Bunsen burner

   e). Bee-hive she

2. a) i. D

      ii. A

      iii. A

      iv. None of the above.

   b). i. To avoid ink interference with the solutions or avoid mixing ink and solutions.

      ii. Solution C, because it moved a longer distance as compared to solutions A, B and D

      iii. Yellow

      iv. i. To check the purity of foods and drinks when they are manufactured.

      ii. To find out whether drugs are pure and safe.

3. a). A salt is a compound formed when all hydrogen ions of an acid are replaced by metallic ions.

   b). Copper (II) Oxide

   c). $CuO_{(s)} + H_2SO_{4(aq)} \longrightarrow CuSO_{4(aq)} + H_2O_{(l)}$

   d). $CuO_{(s)} + 2H^+_{(aq)} \longrightarrow Cu^{2+}_{(aq)} + H_2O_{(l)}$

   e). $CuSO_4$

   Cu ; 64 + S ; 32 + O ; (16 X 4)

   96 + 64

   Therefore, relative formula mass is 160

f). - add CuO in a beaker of dilute H_2SO_4.

- Filter the mixture to remove excess CuO.

- Evaporate to concentrate filtrate.

4. a) i) Citric acid

ii) Below 7

b) i) 4 elements

ii) 7 carbon atoms

iii) 144 amu

5. a. i. ZnS

ii. $Pb(NO_3)_2$

iii. $(NH_4)_2CO_3$

b. i. $2K_{(s)} + Ca(NO_3)_{2(aq)} \longrightarrow 2KNO_{3(aq)} + Ca_{(s)}$

ii. $MgCl2_{(aq)} + 2NaOH_{(aq)} \longrightarrow Mg(OH)_2(aq) + NaCl_{(aq)}$

iii. $2NaHCO_{3(s)} \longrightarrow Na_2CO_{3(s)} + H_2O_{(g)} + CO_{2(g)}$

6. a) i) **Alloying**: alloying the iron so that it will be chemically resistant to corrosion.

ii) **Sacrificial protection**: Coating or galvanizing the iron with a material that will react with the corroding substances more readily than the iron does.

iii) **Coating the iron with an impermeable surface**: Coating the iron using grease, oil, paint so that air and water cannot reach it.

b) i) Similarity: - Both processes use up oxygen.

- Both processes liberate heat energy

(***any one of the two***)

ii) Difference: - Rusting is a slower process than respiration.

-Rusting occurs in metals (non-living things) while respiration occurs in living things.

7. a). i) sulphur dioxide

ii) Oxides of lead; carbon monoxide; oxides of nitrogen

b) i) Sulphur dioxide from car exhausts and emissions from industries

ii) Oxides of lead; carbon monoxide and oxides of nitrogen all from car exhaust

(***any two***)

c). Sulphur dioxide causes acid rain which corrodes buildings; causes respiratory disorders

Oxides of lead cause intellectual retardation in young children; causes respiratory disorders

Carbon monoxide causes respiratory problems leading to suffocation due to reduced oxygen transportation by blood.

Oxides of nitrogen cause breathing problems and lung damage.

(***any two***)

8. a. i). Both Li and Na ionize by loss of one valence electron.

ii). Both Li and Na have similar chemical reactions with dilute acids.

iii). Both Li and Na have similar chemical reactions with water.

iv). Both Li and Na form basic oxides which are soluble in water.

b) i) Li; Na; Be; Mg; Al (***any one***)

ii) F; Cl; S; O; P; N; C; B; Ar; Ne; He; (***any one***)

9. a). $(NH_4)_2SO_{4\,(aq)} + \mathbf{2}NaOH_{\,(aq)} \longrightarrow Na_2SO_{4\,(aq)} + \mathbf{2}NH_{3(g)} + 2H_2O_{(l)}$

b). $(NH_4)_2SO_{4(aq)} + \mathbf{2}NaOH_{(aq)} \longrightarrow Na_2SO_{4(aq)} + \mathbf{2}NH_{3(g)} + 2H_2O_{(l)}$

132Kg : 142Kg

X : 17.64Kg

X =16.40Kg

<u>Therefore, Mass of ammonium sulphate is 16.40Kg</u>

c) By introducing a damp red litmus paper to the mouth of the container collecting the gas; if the red litmus paper turns blue, then the gas is ammonia. If the red litmus paper remains red then the gas is not ammonia. [1mark for damp; and 1 mark for red litmus paper]

10. a).

Solution	Approximate P^H	Ions present
i. **Sodium hydroxide**	14.0	Na^+ , OH^-
ii. Hydrochloric acid	**1.0**	**H^+, Cl^-**
iii. Acetic acid	**3.5 - 4.5**	**H^+,CH_3COO^-**
iv. Sodium chloride	7	**Na^+, Cl^-**

b). Sodium hydroxide and hydrochloric acid

11. i). $K_2CO_{3(s)} + H_2SO_{4(aq)} \longrightarrow K_2SO_{4(aq)} + H_2O_{(l)} + CO_{2(g)}$

ii. Carbon dioxide gas turns lime water milky.

12.

a) $HCl_{(aq)} + KOH_{(aq)} \longrightarrow KCl_{(aq)} + H_2O_{(l)}$

$H^+_{(aq)} + Cl^-_{(aq)} + K^+_{(aq)} + OH^-_{(aq)} \longrightarrow K^+_{(aq)} + Cl^-_{(aq)} + H_2O_{(l)}$

$\mathbf{H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}}$

b) $H_2SO_{4(aq)} + Li_2CO_{3(aq)} \longrightarrow Li_2SO_{4(aq)} + H_2O_{(l)} + CO_{2(g)}$

$2H^+_{(aq)} + SO_4^{2-}{}_{(aq)} + Li^+_{(aq)} + CO_3^{2-}{}_{(aq)} \longrightarrow Li^+_{(aq)} + SO_4^{2-}{}_{(aq)} + H_2O_{(l)} + CO_{2(g)}$

$\mathbf{2H^+_{(aq)} + CO_3^{2-}{}_{(aq)} \longrightarrow H_2O_{(l)} + CO_{2(g)}}$

c) $HNO_{3(aq)} + 2MgO_{(s)} \longrightarrow Mg(NO_3)_{2(aq)} + H_2O_{(l)}$

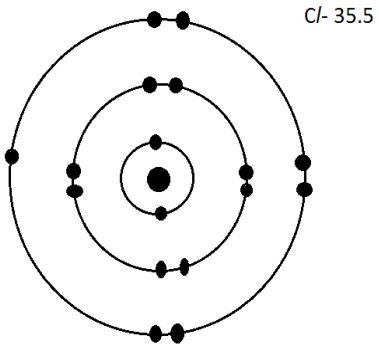
$2H^+_{(aq)} + NO_3^-{}_{(aq)} + 2MgO_{(s)} \longrightarrow Mg^{2+}_{(aq)} + NO_3^-{}_{(aq)} + H_2O_{(l)}$

$\mathbf{2H^+_{(aq)} + 2MgO_{(s)} \longrightarrow Mg^{2+}_{(aq)} + H_2O_{(l)}}$

13. a). i. Proton number is the number of protons in the central nucleus of an atom. It is also called atomic number.

ii. Mass number is the sum of protons and neutrons in the central nucleus of an atom . It is also called nucleon number.

b). i.



ii. Symbol C*l* and found in Group 7

iii. It is a non-metal because it gains an electron to attain stability **or** because it undergoes reduction to attain stability.

14. a). - 27 protons

-24 electrons because 3 electrons where lost to become Z^{3+}.

- 33 neutrons

b). Isotopes

c). Because noble gases have a full / complete electronic configuration in their outermost shell.

15. i. An ionic compound is one formed by complete transfer of electrons from an atom of a metal to an atom of a non-metal.

ii. $Ca \longrightarrow Ca^{2+} + 2e^-$

iii. Because of strong electro-static forces of attrations between cations and anions.

iv. Formula for finding maximum number of electrons is $2n^2$

$2n^2$

2×2^2

2×4

$8e^-$

Therefore, the second shell can accommodate 8 electrons.

16. a). atom **I** and atom **M**

b). atom **L**

c). atom **L**

d) atom **K**

17. a). i. **Properties of acids.**

- acids have a sour test.
- acids are corrosive (strong acids are dangerous and can burn the skin).

Properties of bases.

- alkalis have a bitter taste.
- alkalis have a soapy or slipery feel.

ii. In acid it H^+ ions and in alkalis OH^- ions

b). $2NaOH_{(aq)} + H_2SO_{4(aq)} \longrightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$

18. a). i. Barium sulphate, $BaSO_4$

ii. Iron**(II)**hydroxide, $Fe(OH)_2$

iii. Iron**(III)**hydroxide, $Fe(OH)_3$

iv. Iron**(II)**sulphate

b). $FeSO_{4\,(aq)} + Ba(NO_3)_{2(aq)} \longrightarrow Fe(NO_3)_{2(aq)} + BaSO_{4(s)}$

19. a). Caesium, potassium, sodium and lithium

b). Lithium hydroxide and hydrogen

Sodium hydroxide and hydrogen

c). i. A violent explosion occurs. A lot of heat is realesed. Colourless, odourless gas produced. Resulting solution has a P^H 14 instead of P^H 7 of water.

ii. $2Cs_{(s)} + 2H_2O_{(l)} \longrightarrow CsOH_{(aq)} + H_{2(g)}$

20. a). - acids have a sour taste.

- they have a P^H below 7.
- acids are corrosive.
- they blue litmus red.

b). i. $Ca(OH)_2 + (NH_4)_2SO_4 \longrightarrow CaSO_4 + 2NH_4 + 2H_2O$

ii. $(NH_4)_2SO_4$

N; (2 X 14) + H; (4 X 2) + S; 32 +O; (4 + 16)

Therefore, Mr of $(NH_4)_2SO_4$ is 132

$Ca(OH)_2 + (NH_4)_2SO_4 \longrightarrow CaSO_4 + 2NH_4 + 2H_2O$

Data for $(NH_4)_2SO_4$

Mr = 132g/mol

m = 264g

n = ?

$n = \frac{m}{Mr}$

$n = \frac{264g}{132g/mol}$

n = 2 mol of $(NH_4)_2SO_4$

Mole ratio

$Ca(OH)_2 + (NH_4)_2SO_4 \longrightarrow CaSO_4 + 2NH_4 + 2H_2O$

$(NH_4)_2SO_4 : NH_4$

1: 2

2: X

X = 4 mol of NH_4

Data for NH_4

n = 4 mol

$Vm = 24dm^3$

V = ?

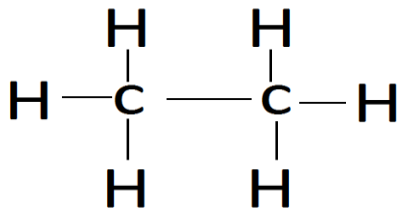
$V = n \times V_m$

V = 4 X 24

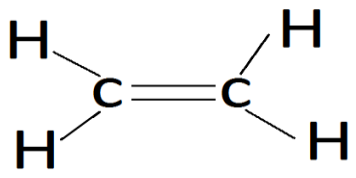
Therefore: V = 96 dm^3 of NH_4

21. a. i.

E



F



ii. Chemical test: Pass products of reaction into aqueous bromine

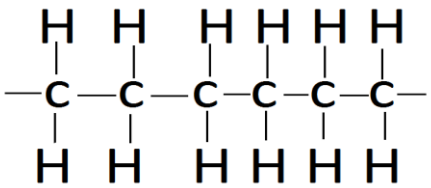
Result with alkaline: bromine remains brown in colour.

Result with alkene : bromine decolourised rapidly.

iii. Mr of C_2H_4 = 2(12) + 6(1) = 30

b. i. **F** is an unsaturated molecule. When one of its double covalent bonds is broken, more atoms can be added to the molecule. E is a saturated molecule and does not allow addition reaction to take place.

ii.



iii. 1. Polymers are generally non-biodegradable and accumulate in the environment.

2. Burning of polymers release toxic fumes. Example: burning of polyvinyl chloride produces toxic hydrogen chloride gas.

22. a. **E**

b. **F**

c. **G**

d. **G**

e. **F**

PART THREE

1. a). **A** is Sublimation

   B is Melting/ Fusion

   C is Condensation

   b). When a solid is heated, the molecules acquire more kinetic energy and overcome almost all the attractive forces between them. So they escape from their neighbours and go into a gaseous state (vapour is formed). Hence a solid changes to vapour.

   c). Particles in a solid have fixed positions, when they are heated they overcome some forces of attractions and move apart forming a liquid. Hence a solid changes to liquid.

2. a). i). Diffusion

   ii). Learners were able to smell the perfume quickly because of the fast movement of particles in a gas from a region of high concentration to a region of low concentration.

   b). i). The colour of the mixture changes to blue/black at the bottom (region of high concentration) to blue at the top (region of low concentration).

   ii). Temperature, concentration, size and nature of the molecule.

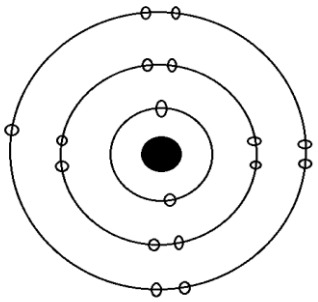
   iii). Diffusion also takes place in liquids.

3. a). Isotopes are atoms of the same element having the same number of protons but different number of neutrons.

   b). i). C*l*-15 has 18 neutrons

   ii). C*l*-37 has 20 neutrons

   c). i).



ii). Cl^-

d). Because chlorine exist as an isotope, therefore 35.5 is weighted value of the atomic mass values of the isotopes.

4. a). The retention factor is defined as the distance traveled by the compound divided by the distance traveled by the solvent front.

i.e R_f = distance traveled by the compound / distance traveled by the solvent

b). R_f value = distance traveled by the compound / distance traveled by the solvent

R_f value = $2.1 / 2.8$

Therefore the R_f value = 0.75

c). i. To check the purity of foods and drinks when they are manufactured.

ii. To find out whether drugs are pure and safe.

5. a). Magnesium oxide.

b). MgO.

c). Ionic/ electrovalent bonding.

d). i). Conduct electricity in molten or fused state.

ii). High melting/boiling points

iii). Produce ions in solution

6. a). Proton number is the number of protons in the nucleus of an atom.

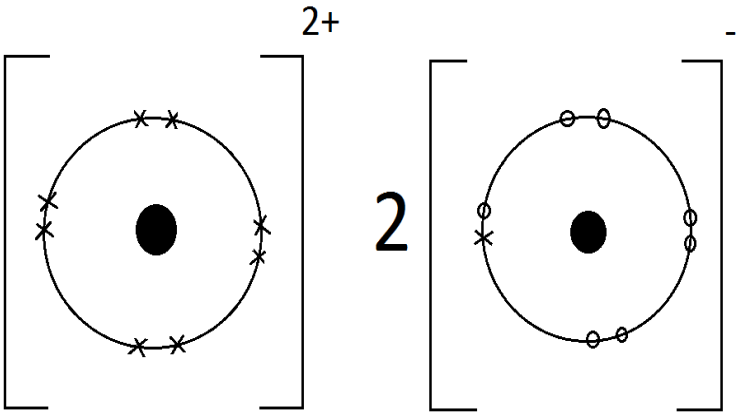
b). i).

Sub-atomic particle	Number of particle	Name of particle
X	9	Electrons
●	10	Neutrons
○	9	Protons

ii). Group VII

iii). F^-

c).



7.

	CODE	Chemical formula	Chemical name
a).	(2:4) (6:2)	CaO	Calcium oxide
b).	$(1:3)_2$ (6:3) $(6:2)_4$	Na_2SO_4	Sodium sulphate
c).	(3:3) $[(5:2)\ (6:2)_3]_3$	$Al(NO_3)_3$	Aluminium nitrate

8. a). $Mg(s) + 2HCl\ (aq) \longrightarrow MgCl_2(aq) + H_2(g)$

b). Data for Mg

m = 6.0g

Mr = 24g/mo

n = ?

n = m/Mr

$n = \frac{6.0g}{24gmol}$

n = 0.25mol of Mg

Mole ratio

Mg : $MgCl_2$

1 : 1

0.25 : x

X = 1 x 0.25

X = 0.25 moles of $MgCl_2$

Therefore ; m = n x Mr

m = 0.25 x 95

m = 23.75 g of $MgCl_2$

c). $SiCl_{4(l)} + 2Mg_{(s)} \longrightarrow Si_{(s)} + 2MgCl_{2(s)}$ **step 1 (given in the question)**

From the Periodic table:Mr($SiCl_4$) = 28 + (4 x 35.5) = 170g/mol ; Mr(Mg)=24g/mol

n($SiCl_4$)= m/Mr

= $225/170$

= 1.324 mol **step 2**

n(Mg) = m/M

= $225g/24g/mol$

= 9. 375 mol **Step 2**

RMR (from balanced equation); n($SiCl_4$) / n(Mg) = $1/2$ = **0.5** **Step 3**

AMR: n($SiCl_4$) / n(Mg) = $1.324/9.375$ = **0.141** **Step 4**

Therefore, $SiCl_4$ is the limiting reagent.

9. a). Data for $Cu(NO_3)_2$

m = 9.4 g

Mr = 188 g/mol

n = ?

n = $9.4g/188g/mol$

n = 0.05 moles of $Cu(NO_3)_2$

Mole ratio

$2Cu(NO_3)_{2(s)} \longrightarrow 2CuO_{(s)} + 4NO_{2(g)} + O_{2(g)}$

$2Cu(NO_3)_2$: 2CuO

2 : 2

0.05 : x

2x = 2 x 0.05

2x = 0.1

X = 0.05 moles of CuO

Therefore; mass = n x Mr

m = 0.05 x 80

m = 4 g of CuO.

b). **Mole ratio**

$2Cu(NO_3)_2 : 4NO_2$

2 : 4

0.05 : x

2x = 0.2

X = 0.1 moles of NO_2

Therefore; V = n x V_m

V = 0.1 x 24

V = 2.4 dm^3

10. a). Ammonium nitrate

NH_4^+ NO_3^-

NH_4NO_3

b). Aluminium Phosphate

Al^{3+} PO_4^{3-}

$AlPO_4$

c). Calcium hydroxide

Ca^{2+} OH^-

$Ca(OH)_2$

d). Lead (Iv) oxide

Pb^{4+} O^{2-}

PbO_2

11. i. a). Ammonium hydrogen phosphate

b). Ammonium nitrate

c). Potassium chloride

ii. Mr of $(NH_4)_2HPO_4$

= (14 X 2) + (4 X 2) + 1 + 31 + (16 X 4)

= 28 + 8 + 32 + 64

Therefore, the Mr of $(NH_4)_2HPO_4$ = 132.

iii. $n = \frac{m}{Mr}$

$= \frac{20g}{342g/mol}$

Therefore, [Al2(SO4)3] has 0.0585 or 0.1 moles.

12.

Compound	Symbol of positive ion	Symbol of negative ion	Formula
Sodium oxide	Na^+	O^{2-}	Na_2O
Aluminium hydroxide	Al^{3+}	OH^-	$Al(OH)_3$
Sodium hydrogen carbonate	Na^+	HCO_3^-	$NaHCO_3$
Potassium sulphate	K^+	SO_4^{2-}	K_2SO_4
Copper(**II**) sulphite	Cu^{2+}	SO_3^{2-}	$CuSO_3$

13. a). Pour a solution of ammonium sulphate into a beaker. Add to this, Barium chloride and stir. Filter off the supernatant liquid. The white insoluble precipitate (**Barium sulphate**) remains.

b). Zinc sulphate or Copper Chloride or Copper sulphate

c). Data for $CaCO_3$

m = 150g

Mr = 100g/mol

n = ?

$n = {}^{m}\!/_{M}$

$n = {}^{150g}\!/_{100g/mol}$

n = 1.5 moles of $CaCO_3$

Mole ratio

$CaCO_{3(s)} + 2HCl_{(aq)} \longrightarrow CaCl_{2(aq)} + CO_2(g) + H_2O_{(l)}$

$CaCO_3 : CaCl_2$

1 : 1

1.5 : x

X = 1.5 moles of $CaCl_2$

Data for $CaCl_2$

n = 1.5 mol	m = n x Mr
Mr= 111g/mol	m = 1.5 x 111
m = ?	**m = 666.5 g of $CaCl_2$**

14. a). i. It is behaving like a base.

ii. Excess copper (II) oxide is added to completely react with an acid.

iii. $H_2SO_{4(aq)} + CuO_{(s)} \longrightarrow CuSO4_{(aq)} + H_2O_{(l)}$

iv. - Mix the two reagents in the beaker.

- Filter the mixture using a filter paper.
- Evaporate the filtrate to concentrate it.
- Cool the filtrate and rinse with distilled water.

b). i. - Mix silver nitrate solution and sodium chloride in a beaker.

- Filter off the precipitate on the filter paper.
- Cool the precipitate on the filter paper.

ii. $AgNO_{3(aq)} + HCl_{(aq)} \longrightarrow AgCl_{(s)} + HNO_{3(aq)}$

$Ag^+_{(aq)} + NO_3^-{}_{(aq)} + H^+_{(aq)} + Cl^-_{(aq)} \longrightarrow AgCl_{(s)} + H^+_{(aq)} + NO_3^-{}_{(aq)}$

$Ag^+_{(aq)} + Cl^-_{(aq)} \longrightarrow AgCl_{(s)}$

15. a). i. Barium sulphate precipitate

ii. Sulphate ion, SO_4^{2-}

iii. $Ba^{2+}{}_{(aq)} + SO_4^{2-}{}_{(aq)} \longrightarrow BaSO_{4(s)}$

b). i. Iron(II) hydroxide precipitate

ii. Fe^{2+}

iii. $Fe^{2+}_{(aq)} + 2OH^{-}{}_{(aq)} \longrightarrow Fe(OH)_{2(s)}$

c). Iron(II) sulphate, $FeSO_4$

16. a). Bubbles of a gas are produced.

b). The reaction becomes slow after sometimes and eventually stopped or the reaction was completed.

c). The reaction stopped after sometime because all the reactants were used up and their concentration(number of moles) decreases.

d). i. Surface area of reacting particles.

ii. Concentration

iii. Temperature

iv. Catalyst

v. Pressure

17. a). A is nitrogen

B is Hydrogen

b). Haber process

c). $N_{2(g)} + 3H_{2(g)} \longleftrightarrow 2NH_{3(g)}$

d). i. Iron as a catalyst

ii. High pressure and high temperatures

e). The gas produced must turn red litmus blue because ammonia is a base.

18. a). Silver

b). Sodium

c). Aluminium

d). Sodium

e). Zinc

f). $2Na_{(s)} + 2H_2O_{(l)} \longrightarrow 2NaOH_{(aq)} + H_{2(g)}$

19. a). - the concentrate ore is roasted in air in a furnace, producing copper (II) sulphide, iron (II) oxide and sulphur dioxide gas.

$2CuFeS_{2\,(s)} + 4O_{2(g)} \longrightarrow Cu_2S_{(l)} + 2FeO_{(l)} + 3SO_{2(g)}$

- Removal of iron (II) by heating it with Silicon dioxide to form iron (II) silicate.

$FeO_{(l)} + SiO_{2(s)} \longrightarrow FeSiO_{3(l)}$

- Reduction of Copper (I) sulphide

$Cu_2S_{(l)} + O_{2(g)} \longrightarrow 2Cu_{(s)} + SO_{2(g)}$

- Anodic reaction

$Cu_{(s)} \longrightarrow Cu^{2+} + 2e^{-}$

- Cathodic reaction

$Cu^{2+} + 2e^{-} \longrightarrow Cu_{(s)}$

b). - Conducting electricity

- Ductility

c). Making jeweries because copper is shine.

20. a). i. Sulphur dioxide

ii. Zinc sulphide

iii. - $2ZnS_{(s)} + 3O_{2(g)} \longrightarrow 2ZnO_{(g)} + 2SO_{2(g)}$

- $2ZnO_{(g)} + C_{(s)} \longrightarrow 2Zn_{(g)} + CO_{2(g)}$

iv. Because aluminium is a more reactive, therefore, it can only be extracted by electrolysis.

b). i. To protect a metal from further attack eg. From corrosion.

ii. Brass, it is shinny and strong.

21. a) i) iron ore (***accept*** Haematite or Magnetite)

ii) Limestone (***accept*** Calcium carbonate or marble chips)

iii) coke (***accept*** carbon)

b) i) $Fe_2O_{3(s)} + CO_{(g)} \longrightarrow Fe_{(l)} + CO_{2(g)}$

ii) $CaCO_{3(s)} \longrightarrow CaO_{(s)} + CO_{2(g)}$

iii) $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$

(***accept*** *equation without state symbols*)

c) A: Slag (***accept*** molten calcium silicate)

B: Pig iron or cast iron (***accept*** molten pig iron / cast iron)

22. a. Reaction A: **Fermentation**

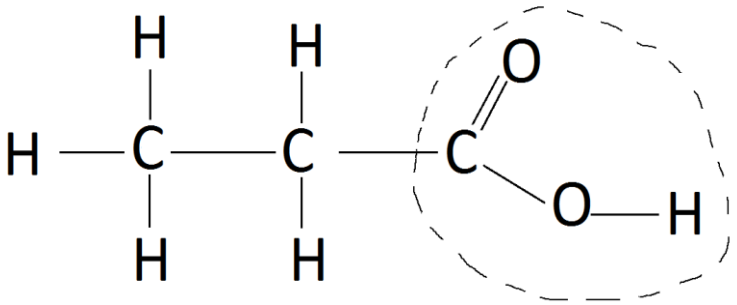
b. Reaction B: **Combustion**

c. Reaction C: **Oxidation**

d. Reaction D: **Esterification**

23. a). i. Carboxylic acid/ organic acids

ii.



b). i. Methylpropanoate

ii. Esters

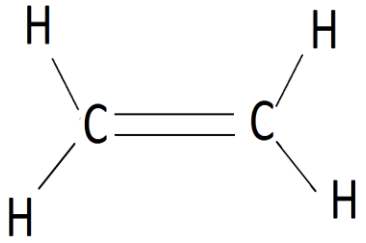
iii. - esters are slightly soluble in water.

- they burn with a bright flame

- they are volatile and colourless liquid with a characteristic pleasant odour .

24. a). i. Unsaturated hydrocarbons are those containing either a double or triple carbon-carbon bonds within the compound eg. All alkenes and alkynes are unsaturated hydrocarbons.

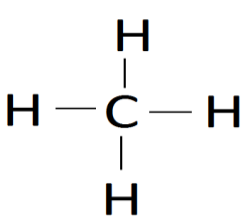
ii. Ethene

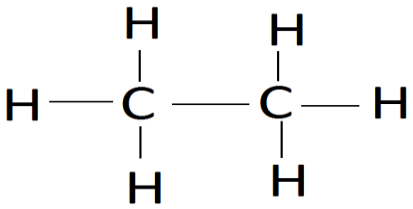


iii. - 1, 2-dibromoethane/ vinyl bromide/ ethylbromide

- CH_2BrCH_2Br

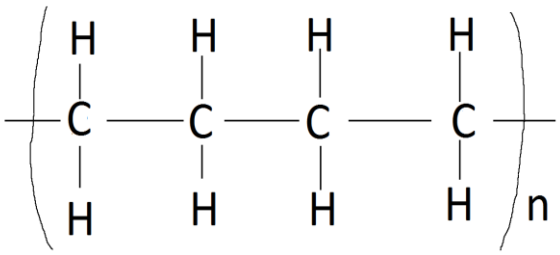
iv. Methane or Ethane or any other alkane





b). i. Ethene

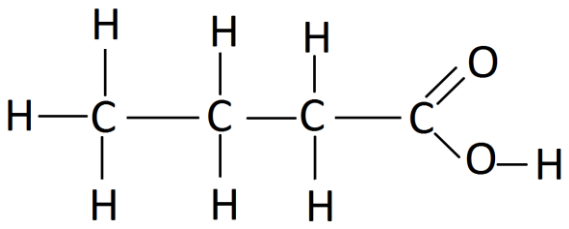
ii. Polyethene



iii. Polymers do not decompose, thereby polluting the environment.

25. a). $C_nH_{2n+1}COOH$

b).



c). i. - Ethanol

- Ethanoic acid

ii. - Esterification is a reversible reaction while neutralisation is not a reversible reaction.

- Under esterification, an acid donates -OH and an alcohol donates -OH while neutralisation is vice versa.

iii. $CH_3CH_2OH + CH_3COOH \longleftrightarrow CH_3COOCH_2CH_3 + H_2O$

d). Data for an organic acid (CH_3COOH)

m = 15g

Mr = 49 g/mol

n = ?

$n = \frac{n}{Mr}$

$n = \frac{15g}{49g/mol}$

n = 0.31 moles of CH_3COOH .

Mole ratio

$CH_3COOH : CH_3COOCH_2CH_3$

1 : 1

0.31 : x

X = 0.31 moles of $CH_3COOCH_2CH_3$

. Data for an organic acid ($CH_3COOCH_2CH_3$)

n = 0.31 mol

Mr = 77g/mol

m = ?

Therefore, m = n x Mr

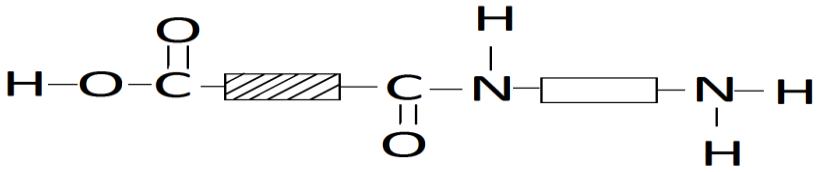
m = 0.31 x 77

m = 23. 9 g $CH_3COOCH_2CH_3$

26. i. Ester linkage.

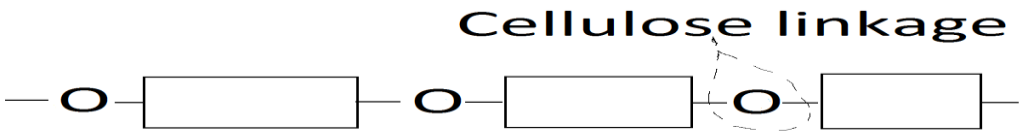
ii. Fats and lipids.

iii.



iv. Peptide or amide linkage.

v.



DATA SHEET

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	104 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mecury 80	204 Tl Thallium 81	207 Pb lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 +															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
+90-103 Actinoid series

Key: a / X / b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

Simplifying chemistry grade 10-12 volume one

The Pamphlet **Simplifying Chemistry (volume one)** covers all topics in the new **5124/2** Science syllabus for Senior Secondary Schools in Zambia. It contains parts 1,2 and 3 questions with their simplified answers at the end of the pamphlet.

God Bless You!!!

Simplifying Chemistry Volume one