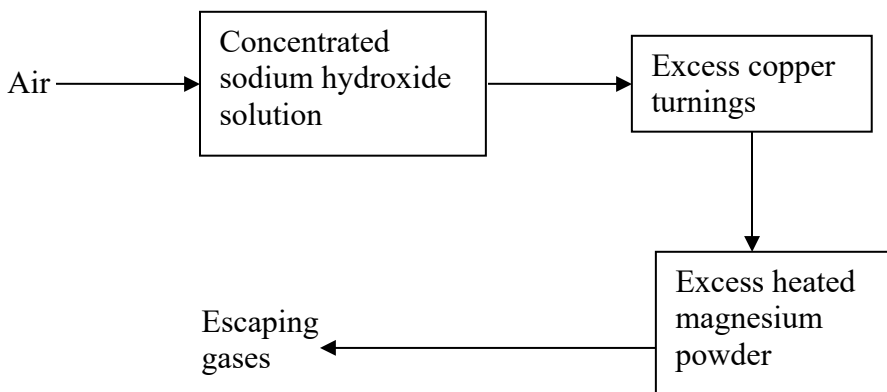


KAPSABET HIGH SCHOOL

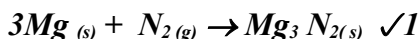
1. Explain why very little Carbon (IV) oxide gas is evolved when dilute sulphuric (VI) acid is added to lead (II) carbonate. (2 marks)

Insoluble Lead (II) sulphate is formed preventing any further reaction. ✓ 1

2. Air was passed through several reagents as shown below:



- (a) Write an equation for the reaction which takes place in the chamber containing magnesium powder. (1 mark)



- (b) Name **one** gas which escapes from the chamber containing magnesium powder. Give a reason for your answer. (2 marks)

Argon ✓ 1
- It is inert ✓ 1

3. (a) Hydrogen can reduce copper (II) Oxide but not aluminium oxide. Explain. (1 mark)

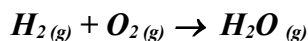
Hydrogen is above Cu^{√½} and below Al in the reactivity series^{√½} of elements.

- (b) When water reacts with potassium metal, the hydrogen produced ignites explosively on the surface of water.

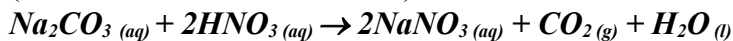
- (i) What causes this ignition? (1 mark)

The reaction is too exothermic that a lot of heat is produced causing ignition of hydrogen in presence of oxygen.

- (ii) Write an equation to show how this ignition occurs. (1 mark)



4. In an experiment an unknown mass of anhydrous sodium carbonate was dissolved in water and the solution made up to 250 cm³. 25cm³ of this solution neutralized 20 cm³ of 0.25 M nitric acid. Calculate the mass of unknown sodium carbonate used. (3 marks)
(Na = 23.0, C = 12.0, O = 16.0)



$$\text{Mole ratio } Na_2CO_3:HNO_3 = 1:2$$

$$\text{Moles of } HNO_3 \text{ in } 20 \text{ cm}^3 = 20/1000 \times 0.25 = 0.005 \text{ moles}$$

$$\text{Moles of } Na_2CO_3 \text{ in } 25 \text{ cm}^3 = \frac{1}{2} \text{ of } 0.005 = 0.0025 \text{ moles}$$

$$\text{If } 25 \text{ cm}^3 = 0.0025 \text{ moles}$$

$$\text{in } 250 \text{ cm}^3 = ?$$

$$\frac{250 \times 0.0025}{25} = 0.025 \text{ moles}$$

$$25$$

$$\text{RFM of } Na_2CO_3 = 106$$

$$1 \text{ mole of } Na_2CO_3 = 106 \text{ g}$$

$$0.025 \text{ moles} = ?$$

$$\frac{0.025 \times 106}{1} = 2.65 \text{ g of } Na_2CO_3$$

$$1$$

5. Carbon and silicon belong to the same group of the periodic table, yet Carbon (IV) oxide is a gas while silicon (IV) oxide is a solid with a high melting point. Explain this difference (2 marks)

Silicon (IV) Oxide has giant atomic structure with strong covalent bonds holding the atom together. These require a lot of energy to break, hence it has high melting point.

Carbon (IV) Oxide has simple molecular structure with weak Van Der Waals forces holding the molecules together which require little energy to break, hence is a gas at room temperature and pressure.

6. An ion of oxygen is larger than oxygen atom. Explain. (2marks)

The oxide ions has 2 extra electrons that causes greater electron repulsion than in oxygen atom

7. (a) What is meant by the term solubility of salts? (1 mark)

This is the maximum mass of a salt that will dissolve in 100 g of water at a given temperature

- (b) Calculate the solubility of a salt given that 15 g of the salt can saturate 25 cm³ of water. (1 mark)

$$15 \text{ g dissolve in } 25 \text{ cm}^3 \text{ water}$$

$$x \text{ g dissolve in } \frac{(15 \times 100)}{25}^{\sqrt{1/2}} = 60 \text{ g/100g water}^{\sqrt{1/2}}$$

8. (a) State the Graham's law. (1 mark)

Grahams law states;

Under the same conditions of pressure and temperature, the rate of diffusion of a gas is inversely proportional to the square root of its density. ✓

- (b) A 100 cm³ of Carbon (IV) oxide gas diffused through a porous partition in 30 seconds. How long would it take 150 cm³ of Nitrogen (IV) oxide to diffuse through the same partition under the same conditions? (C = 12.0, N = 14.0, O = 16.0) (2 marks)

$$\underline{\text{Time CO}_2} = \sqrt{M\text{CO}_2}$$

$$\underline{\text{Time NO}_2} = \sqrt{M\text{NO}_2}$$

Where 100 cm³ of CO₂ takes 30 seconds

$$\therefore 150 \text{ cm}^3 \text{ of CO}_2 \text{ takes } \frac{30}{100} \times 150 = 45 \text{ seconds}^{\sqrt{1/2}}$$

$$\frac{45}{T\text{NO}_2} = \frac{\sqrt{44}}{\sqrt{46}}$$

$$\frac{45}{T\text{NO}_2} = 0.975$$

$$T\text{NO}_2 = \frac{45}{0.975}$$

$$T\text{NO}_2 = \frac{45}{0.975} = 46 \text{ sec}^{\sqrt{1/2}}$$

$$0.97$$

OR

$$\underline{R\text{CO}_2} = \sqrt{M\text{NO}_2}$$

$$R\text{NO}_2 = \sqrt{M\text{CO}_2}$$

$$\text{But } R\text{CO}_2 = \frac{100 \text{ cm}^3}{30 \text{ s}} = 3.33 \text{ cm}^3 \text{ per sec}^{\sqrt{1/2}}$$

$$\frac{3.33}{R\text{NO}_2} = \frac{\sqrt{46}}{\sqrt{44}}^{\sqrt{1/2}} = 1.0225$$

$$R\text{NO}_2 = \frac{3.33}{1.0225}$$

$$R\text{NO}_2 = \frac{3.33}{1.0225}$$

$$1.0225$$

$$= 3.26 \text{ cm}^3 \text{ per second}$$

$$\underline{\text{Time for No}} = \frac{150 \text{ cm}^3}{3.26 \text{ cm sec}^{-1}}$$

$$= 46 \text{ sec}^{\sqrt{1/2}}$$

9. Given this reaction; $\text{RNH}_2 + \text{H}_2\text{O} \rightleftharpoons \text{RNH}_3^+ + \text{OH}^-$
Identify the acid in the forward reaction. Explain. (2 marks)

The acid is water H_2O : Reason H_2O has donated a proton (H^+) to RNH_2

10. The table below shows three isotopes of element neon. Study it and answer the questions that follow;

Mass number of Isotope	Percentage abundance (%)
20	90.9
21	0.3
22	8.8

a) What are isotopes (1mk)

Atoms of the same element with different mass numbers.

b) Calculate the relative atomic mass of an atom of neon. (2mks)

$$\begin{aligned}
 RAM &= \left(\frac{20 \times 90.9}{100} \right) + \left(\frac{21 \times 0.3}{100} \right) + \left(\frac{22 \times 8.8}{100} \right) \\
 &= 18.18 + 0.063 + 1.93 \\
 &= 20.173
 \end{aligned}$$

11. A gas occupies 0.4dm^3 at 20°C and 1.0×10^3 Pascals what will be the temperature of the gas when the volume and pressure of the gas when the volume and pressure of the gas is 0.1dm^3 and 1.0×10^3 Pascals respectively. (3mks)

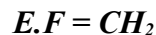
$$\begin{aligned}
 \frac{P_1 V_1}{T_1} &= \frac{P_2 V_2}{T_2} \\
 \frac{1.0 \times 10^3 \times 0.4}{293} &= \frac{1.0 \times 10^3 \times 0.1}{T_2} \\
 T_2 &= \frac{1.0 \times 10^3 \times 0.1 \times 293}{1.0 \times 10^3 \times 0.4} \\
 &= 73.25\text{k}
 \end{aligned}$$

12. (i) On complete combustion of a hydrocarbon 0.88g of carbon (iv) oxide and 0.36g of water were formed (i) calculate the molecular formula of the hydrocarbon given that relative molecular mass of the hydrocarbon is 70. (c = 12, H = 1, O = 16) (2mks)

$$\begin{array}{cc}
 CO_2 & H_2O \\
 \underline{0.88} & \underline{0.36} \\
 44 & 18
 \end{array}$$

$$\begin{array}{cc} 0.02 & 0.02 \\ \underline{0.02} & \underline{0.02} \\ 0.02 & 0.02 \\ 1 & 1 \end{array}$$

Mole ratio $CO_2 : H_2O = 1:1$



$$(CH_2)_n = 70$$

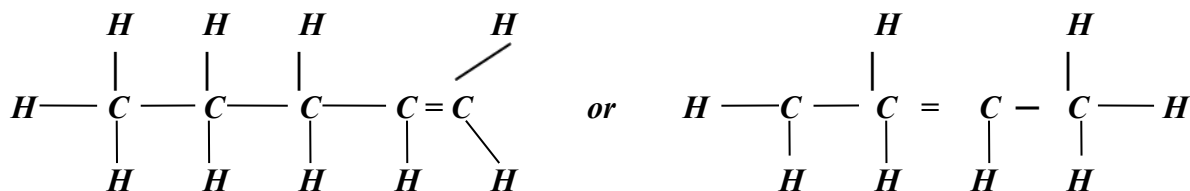
$$14n = 70$$

$$N = \frac{70}{14} = 5$$

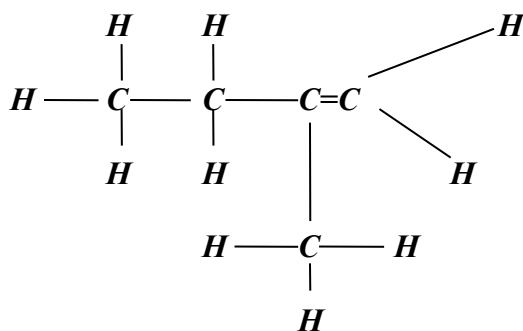
$$14$$

$$M.F = (CH_2)_5 = C_5H_{10}$$

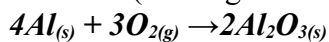
ii) Draw the structural formula of the hydrocarbon in (i) above (1mk)



Or



13. 0.28g of aluminium reacted completely with oxygen gas. Calculate the volume of oxygen used. (molar gas volume is $24000\text{cm}^3 \text{ Al} = 2.7$) (3mks)



Mole ratio 4:3

$$\text{No. of moles of Al} = \frac{0.28}{27}$$

$$= 0.01 \text{ moles}$$

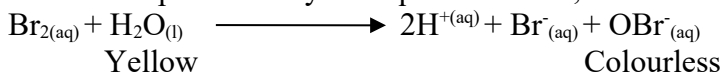
$$\text{No. of moles of Al} = \frac{0.28}{27}$$

$$= 0.01 \text{ moles}$$

$$\text{No. of oxygen} = 0.01 \times 3$$

$$\begin{aligned}
 &= 0.0075 \text{ moles} \\
 \text{Volume of oxygen gas} &= 0.0075 \times 24000 \\
 &= 180 \text{ cm}^3
 \end{aligned}$$

14. A solution of bromine in water is a chemical reaction in equilibrium. The reaction involved is represented by the equation below;



State and explain the observation made when concentrated sulphuric (IV) acid is added to the mixture at equilibrium. (2mks)

Yellow colour intensifies

Conc. H₂SO₄ is a dehydrating agent hence removes water from the system making the equilibrium to shift to the left.

15. Study the table below and answer the question that follow. The letters do not represent the actual symbols of the element.

Formula of ion	Electron configuration
W ²⁺	2
V ²⁻	2.8
X ³⁺	2.8
U ²⁺	2.8
Y ⁻	2.8.8

- a) Select elements found in;

i) the same group (1mk)

W and U

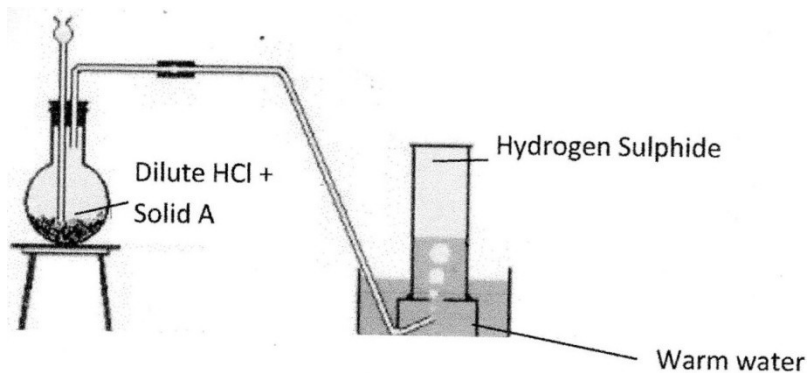
ii) period three (1mk)

Y X and U

- b) What is the family name given the group members to which element Y belongs (1mk)

Halogens

16. Study the diagram below and answer questions that follow



a) Identify solid A (1mk)

iron (ii)sulphide

b) Give a reason why warm water is used (1mk)

Hydrogen sulphide is less soluble in warm water

c) What observation would be made if hydrogen sulphide gas was bubbled into a solution of lead (II) nitrate. (1mk)

Black precipitate is formed

17. Study the table below and answer the questions that follow

Substance	A	B	C	D	E	F
Melting Point (°C)	801	113or 119	-39	5	-101	1356
Boiling Point (°C)	1410	445	457	54	-36	2860
Electrical solid	Poor	Poor	Good	Poor	Poor	Poor
Conducting Liquid	Good	Poor	Good	Poor	Poor	Poor

Identify with reasons the substances that

- i). Have a metallic structure (1mk)

C Good conductor of electricity in both solid and liquid state due to delocalized electrons

- ii). Have a molecular structure (1mk)

D or E

- Poor conductors of electricity in both solid /Liquid state***
- Have relatively low M.P and B.P due to molecular structure***

- iii). Suggest a reason why substance B has two melting points (1mk)

Exists as allotropes

18. Sodium Hydrogen carbonate was heated strongly in the laboratory by a student

- a) Write a balanced chemical equation for the above equation (1mk)

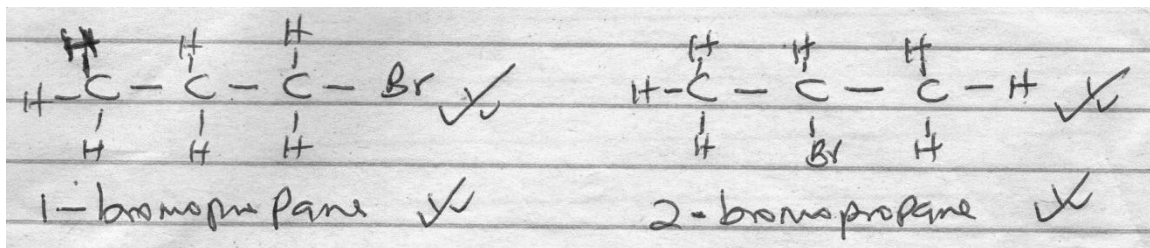


- b) Using an equation show how sodium carbonate is used to soften hard water (1mk)

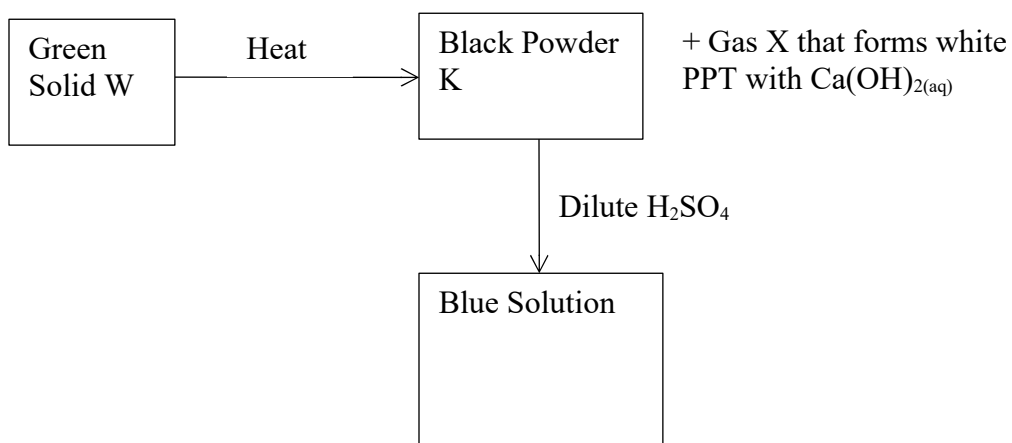


19. Draw the structural formula and name the possible isomers of organic compounds with the

following molecular formula $\text{C}_3\text{H}_7\text{Br}$. (2mks)



20. Study the chart below and answer the following questions



a) Name

i). Green solid W (1mk)

solid W-Copper (ii) Carbonate

ii). Black powder K (½ mk)

Powder K-Copper (ii) Oxide

iii). Gas X (½ mk)

Gas X-Carbonate (iv) Oxide

b) Write the equation for the complete decomposition of the green solid W identified above

(1mk)



(if heat is missing penalize fully)

21. The PH values of solutions K, L, M, N and P are as shown below.

Solution	K	L	M	N	P
PH Value	5	2	10	7	14

a) Which solution reacts with zinc carbonate most vigorously to liberate carbon (IV) oxide.

(1mk)

L

b) Given 2M hydrochloric acid and 2M ethanoic acid, which one is a stronger acid? Explain.

(1mk)

2M hydrochloride acid because it ionizes completely

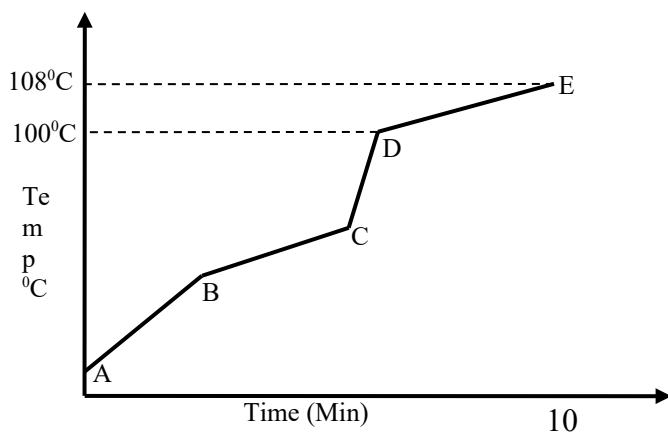
c) What is the purpose of the weak base in the toothpaste?

(1mk)

To neutralize the acidic substance left by the bacteria after consuming the food

remains in the Mouth and on the teeth

22. Study the diagram shown below to answer the questions that follow. The curve shows the heating curve of water in the laboratory.



(i) At what temperature does the water boil? (1 Mark)

Between (100 and 108)0C. ✓1

(ii) Is the curve for a pure water or impure water? Give a reason for your answer (1 Mark)

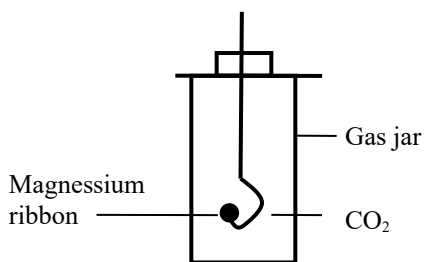
Impure water ✓ (½ Mark)

It boils over a temperature range ✓ (½ Mark)

(iii) Give the effect of impurities on the boiling point of water (1 Mark)

It raises the boiling point of the water. ✓1

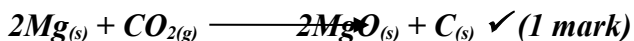
23. A student lowered burning magnesium in a gas jar of carbon (IV) oxide as shown in the diagram.



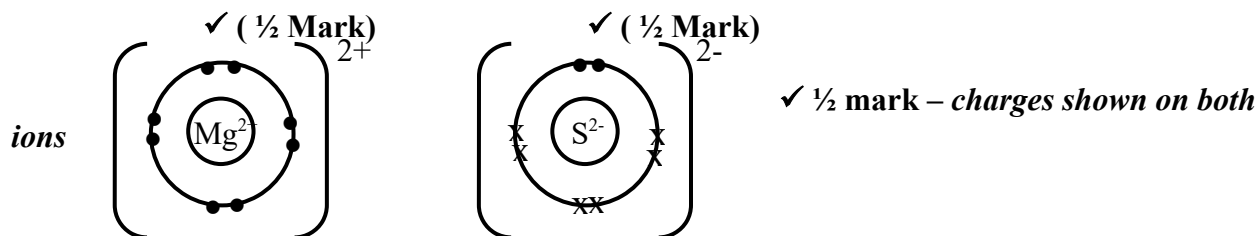
(a) State and explain the observation made in the gas jar (2 Marks)

The magnesium continue to burn ✓ (1 mark) in the gas jar producing a white solid i.e. magnesium oxide and black specs i.e. carbon. This is because the heat produced decomposes ✓ (1 mark) CO_{2(g)} to carbon and oxygen which supports the burning of magnesium.

(b) Write the equation of the reaction that takes place in the gas jar (1 Mark)



24. (a) Using a dot (•) and cross (x) to represent the outer most electrons, draw diagrams to show the bonding in magnesium sulphide. (1½ Marks)



(b) State the structure of the above compound. (½ Mark)

Giant ionic structure ✓ ½ mark

(c) Give two properties of substances with the above structure (1 Mark)

- Have high melting and boiling points ✓ ½ marks

- Conducts electricity in molten or aqueous state ✓ ½ mark

- Soluble in polar solvents like water ✓ ½ mark ***Any 2 for ½ m = 1m***

25. Given sodium carbonate solid, lead (II) nitrate solid and water, explain how you can obtain

a solid sample of Lead (II) carbonate. (3 Marks)

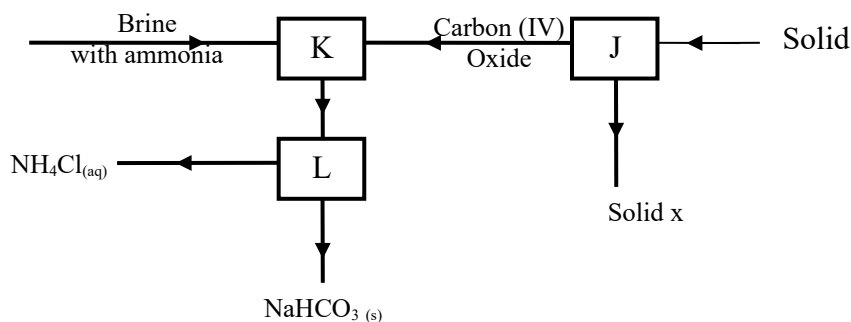
Put the sodium carbonate salt into water in a test tube and stir to form a solution of the salt ✓ ½. Put the Lead (II) nitrate in water in a test-tube too and stir to make a solution of the salt ✓ ½. React equal portions ½ of the two solutions in a boiling tube where

Lead (II) carbonate ½ is precipitated out at the bottom. Filter the mixture ✓ ½ to obtain

Lead (II) carbonate precipitate as residue. Wash it with distilled water and dry it between

two blotting ✓ ½ papers to obtain dry crystals of the salt.

26. The diagram below shows part of Solvay process.



(a) Name solid X (1 Mark)

Calcium oxide// Quick line ✓ 1 mark

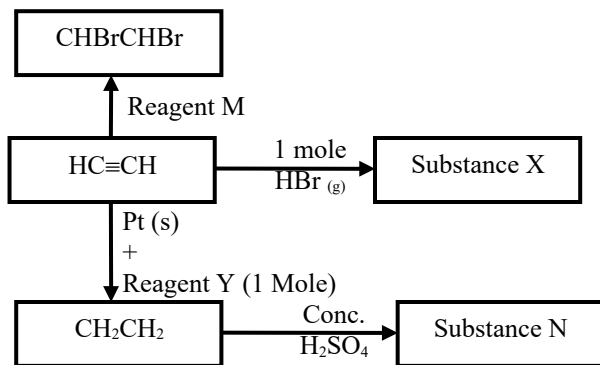
(b) State the process taking place in chamber L (1 Mark)

Filtration// Fractional crystallization/ crystallisation of NaHCO₃. ✓ 1

(c) State two uses of sodium carbonate (1 Mark)

- *Manufacture of glass*
- *Water softening*
- *Manufacture of NaOH*
- *Manufacture of laundry detergents*
- *Paper making process*
- *In textile*

27. The scheme below shows some reactions starting with ethyne. Study it and answer the questions that follow.

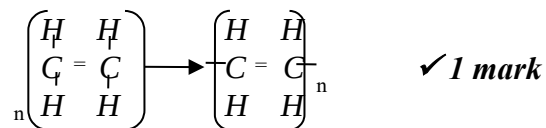


(a) name substance (i) X *Bromo ethene ✓ ½ mark* (½ Mark)

(ii) *N Ethyl hydrogen sulphate ✓ ½ mark* (½ Mark)

(b) Name reagent M – **Bromine gas** ✓ ½ mark (½ Mark)

(c) Ethene undergoes polymerization to form a polymer. Give an equation for the reaction and name the product. (1½ marks)



Polyethene ✓ ½ mark

28. A solution of hydrogen chloride gas in water conducts an electric current, while that of hydrogen chloride in methylbenzene does not conduct. Explain. (3 Marks)

A solution of HCl (aq) in water conducts because its ionic i.e. it contains H⁺ (aq) and Cl⁻ (aq)

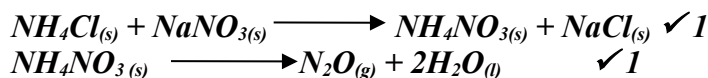
While a solution of HCl in methylbenzene is molecular and molecules do not conduct electricity.

29. A mixture of ammonium chloride and sodium nitrate was heated together in a round bottomed flask to produce gas x.

(i) Identify gas x (½ Mark)

Nitrogen (I) Oxide // N₂O_(g) ✓ ½

(ii) Write equations to show how gas x is formed. (2 marks)



(iii) Why would gas x not be collected over cold water? (½ mark)

The gas dissolves in cold water ✓ ½