Name: …………………………………………………   Adm No. ………………………

Class: ……………………………………………….   Date: …...

TEACHER.CO.KE OPENER EXAM – TERM 1 2022 233/1
CHEMISTRY
PAPER 1
FORM 4
TERM 1 EXAMS
**Time: 2 hours**

233/1

CHEMISTRY

FORM 4

INSTRUCTIONS TO THE CANDIDATES:-

- Write your **name** and admission **number** on the spaces provided.
- Answer *all* the questions in the spaces provided.
- Mathematical tables and electronic used calculators may be
- All working **MUST** be clearly shown where necessary.

Question	Maximum score	Candidate's score
1-30	80	

@TEACHER.CO.KE F4 CHEMISTRY PP1 2022

1. Matter exists in three states which can be related as shown in the diagram below.

Solid $\xrightarrow{\quad P \quad}$ Gas

Solid $\xleftarrow{R}$ Liquid $\xleftarrow{Q}$ Gas
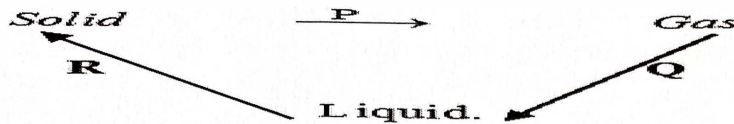
Name processes: **P**: ......Evaporation...... (1mk)

R: ......Condensation/freezing...... (1mk)

2. (a) Give **one** reason some of the laboratory apparatus are made of ceramics. **(1 mark)**

Because they do not react with laboratory chemicals.

(b) Name **two** apparatus that can be used to measure approximately 75 cm of dilute sulphuric (VI) acid. **(2 marks)**

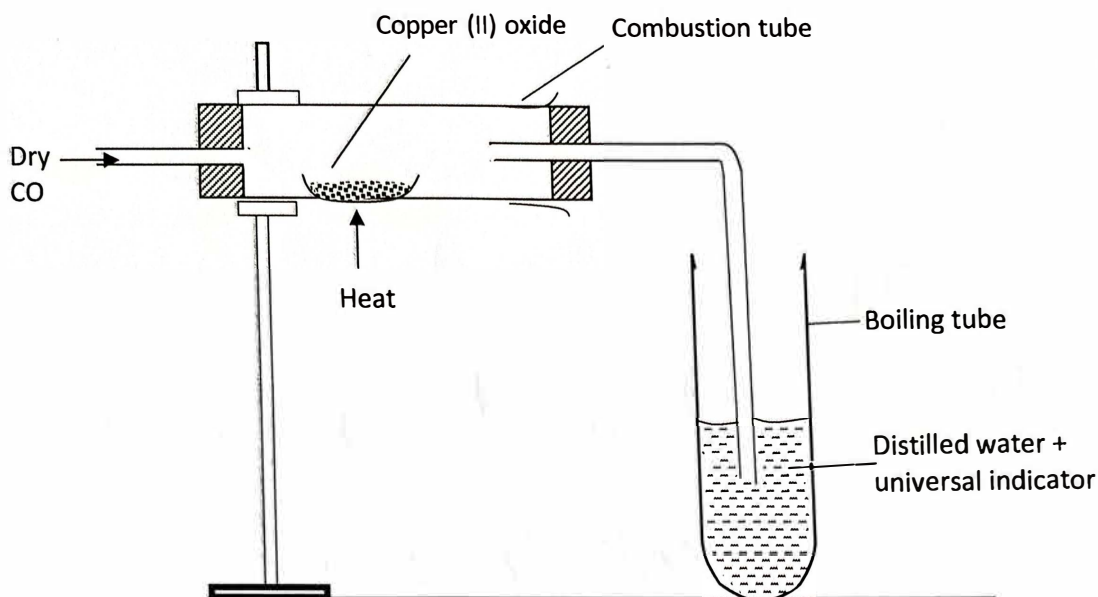- Measuring cylinder   - Burrette.
- Beaker

3. Draw the procedural set-ups that can be used to separate a mixture of sand and calcium chloride to obtain crystals of calcium chloride. **(3 marks)**
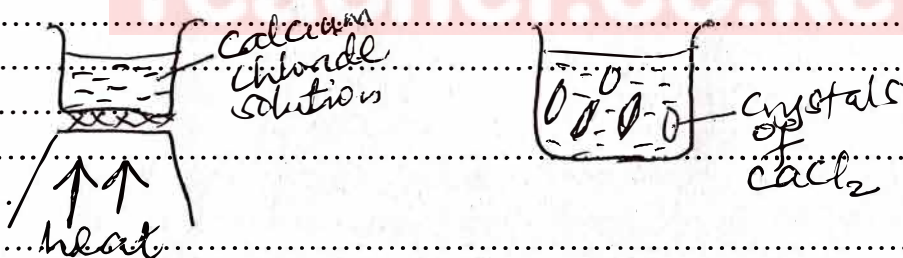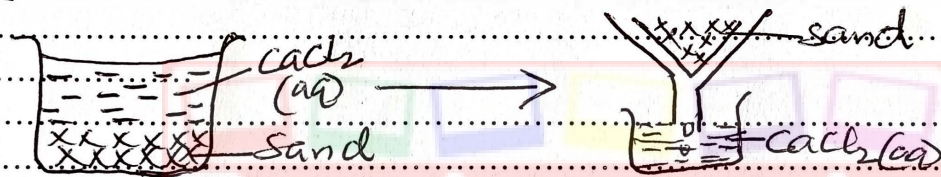
4. State **two** applications of chromatography. **(2 marks)**

- To identify banned substances in sports.
- To test for drug purity.
- To identify contaminants in food and drinks.
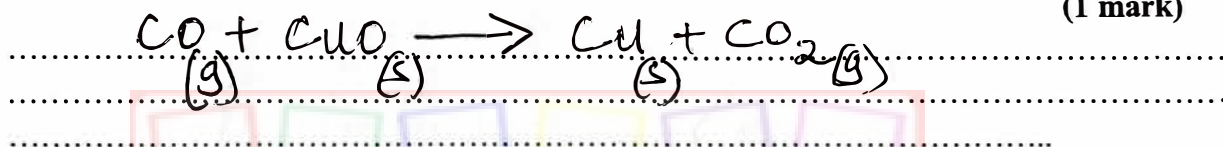- To identify harmful substances in cosmetics.

5.

Copper (II) oxide | Combustion tube
Dry CO
Heat
Boiling tube
Distilled water + universal indicator

The above set-up was used to determine the chemical properties of carbon (II) oxide.

(a) Write the chemical equation for the reaction taking place in the combustion tube. **(1 mark)**

$$CO_{(g)} + CuO_{(s)} \longrightarrow Cu_{(s)} + CO_{2(g)}$$

(b) State and explain the observation made in the boiling tube. **(2 marks)**

Colour of CuO changes from black to brown copper.

6.   A student placed some hydrogen peroxide in a test tube then added a small amount of Solutions can be classified as acids, bases or neutral. The table below shows solutions and their pH values

Solution	pH – values
K	1.5
L	7.0
M	14.0

(a) Select any pair that would react to form a solution of pH 7 *(1 Mark)*

K and M

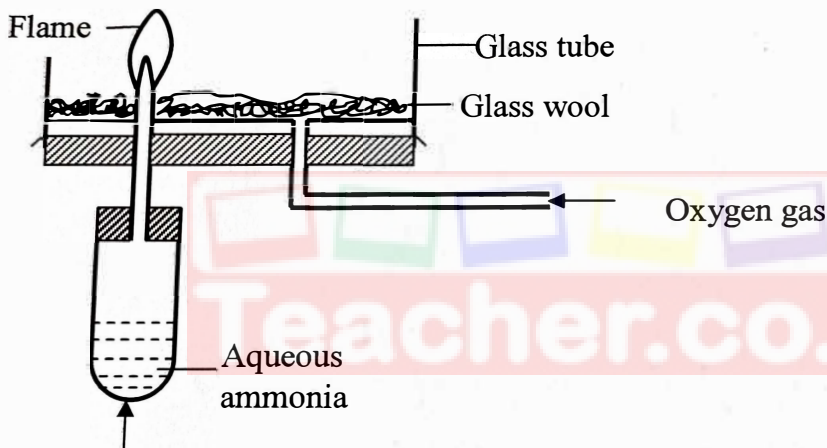(b) Identify two solutions that would react with aluminium hydroxide. Explain *(2 Marks)*

....
....

K and m because aluminium hydroxide is amphoteric hydroxide.

7. 9.12g of a gaseous compound contains 8g of silicon while the rest is hydrogen. Determine the empirical formula of the compound. (H = 1, Si = 28)   *(3 Marks)*
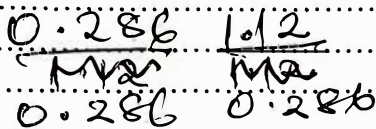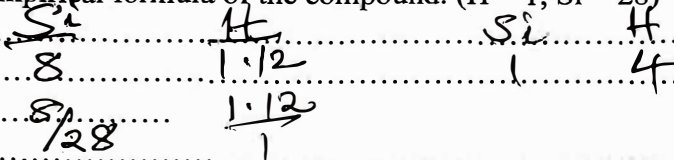
Si	H	Si	H
8	1.12	1	4
8/28	1.12		
	1		
0.286	1.12		
0.286	0.286		

SiH_4

8.   Study the set-up below and answer the questions that follow.

Flame — Glass tube — Glass wool — Oxygen gas — Aqueous ammonia — Gentle warming

(a) Why is aqueous ammonia warmed gently?   *(1 Mark)*

To produce ammonia vapours/gas.

(b) What is the colour of the flame?   *(1 Mark)*

green-yellow flame.

(c) Write the chemical equation for the reaction that takes place   *(1Mark)*

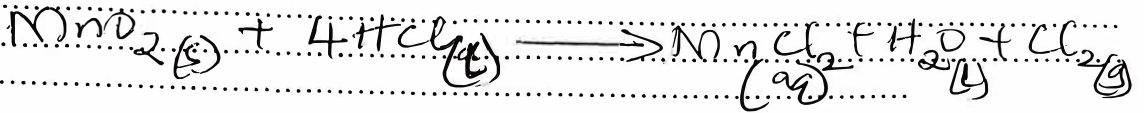$$4NH_{3(g)} + 3O_{2(g)} \longrightarrow 2N_{2(g)} + 6H_2O_{(g)}$$

9. (a) Chlorine can be prepared in the laboratory by using the following reagents and chemicals. Concentrated sulphuric (VI) acid, water, manganese (IV) oxide, concentrated hydrochloric acid.

(i)   State the role of concentrated sulphuric (VI) acid.   **(1 mark)**

Drying agent.

....

(ii)   Write the equation for formation of chlorine.   **(1 mark)**

$$MnO_{2(s)} + 4HCl_{(L)} \longrightarrow MnCl_{2(aq)} + H_2O_{(L)} + CC_{2(g)}$$

(iii)   What is the role of manganese (IV) oxide?   **(1 mark)**

Oxidising agent.

10.   (a)   State Boyle's law.   **(1 mark)**

The volume of a given mass of a gas is inversely proportional to its pressure at constant temperature.

(b)   A gas occupies 270cm^3 at a pressure of 660mmHg at 37^{0}C. What is the new volume if pressure is changed to 810 mmHg at 63^0 C?   **(2 marks)**

$V_1 = 270 \, cm^3$ $V_2 = ?$

$P_1 = 660 \, mmHg$ $P_1 = 810 \, mmHg$

$P_1 V_1 = P_2 V_2$

$270 \times 660 = 810 V_2$ $V_2 = 220 \, cm^3$

$$V_2 = \frac{270 \times 660}{810}$$

11.   An organic compound contains 24.24% carbon, 4.04% hydrogen and the rest chlorine. If its relative molecular mass is 99, what is its molecular formula?   **(3 marks)**
(C = 12, H = 1, Cl = 35.5)

C	H	Cl
$\frac{24.24}{12}$	$\frac{4.04}{1}$	$\frac{71.72}{35.5}$
$\frac{2.02}{2.02}$	$\frac{4.04}{2.02}$	$\frac{2.02}{2.02}$
1	2	1

E.F. CH_2Cl

$(CH_2Cl) \times n = 99$

$49.5n = 99$

$n = \frac{99}{49.5}$

$n = 2$

M.F. $C_2H_4Cl_2$

Page 5 of 1

©TEACHER.CO.KE F CHEMI5TRY PP1 2022

....

....

....

12. A given mass of sodium nitrate was heated completely and 320 cm^3 of the gas was produced at s.t.p. Determine the mass of the sodium nitrate heated.
(Na = 23. N = 14, O = 16, molar gas volume = 22.4L)   **(3 marks)**

$$2NaNO_3 \xrightarrow{heat} 2NaNO_2 + O_2$$
$$\quad 2 \qquad\qquad\qquad 2 \qquad 1$$

moles of gas
1 mole = 22 400 cm^3
= 320 cm^3

$$\frac{320}{22400} = 0.0143$$

0.0143

$$0.0143 \times 2$$
$$= 0.0286 \text{ moles of } NaNO_3$$
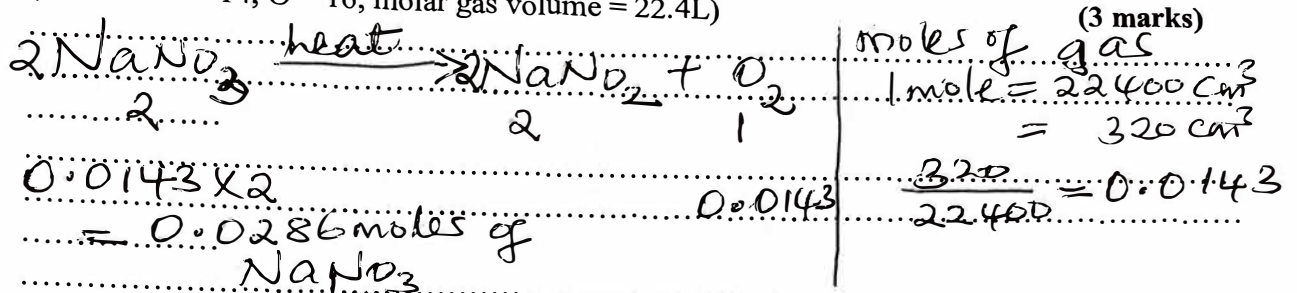
Mass of $NaNO_3 = 0.0286 \times 85$
$$= 2.431 \text{ g}$$

....

....

....

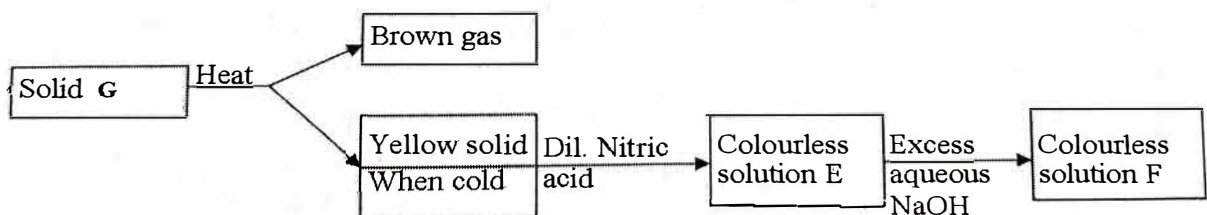...

....

13. (a) Give **one** advantage of using methyl orange over phenolphthalein as an indicator. **(1 mark)**

Methyl orange is used in neutralisation and reaction between carbonates and dil acids while phenolphthalein is used in neutralisation only.

(b) Three drops of litmus solution was added to 20 cm^3 of 2M hydrochloric acid in a beaker followed by 20 cm^3 of 2M ammonium hydroxide. State and explain the observation made. **(2 marks)**

The colour changes from colourless to pink to the neutralisation reaction (formation of (NH_4Cl)).

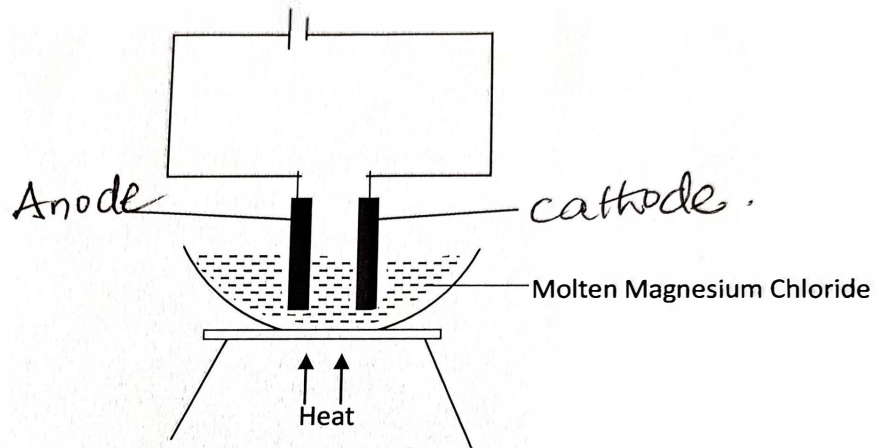14. Study the flow chart below and answer the questions that follow.

```
                          ┌───────────┐
                    ┌────→│ Brown gas │
                    │     └───────────┘
┌──────────┐  Heat  │
│ Solid G  │────────┤
└──────────┘        │   ┌────────────┐ Dil. Nitric ┌────────────┐ Excess    ┌────────────┐
                    └──→│ Yellow solid│    acid     │ Colourless │ aqueous   │ Colourless │
                        │ When cold  │─────────────│ solution E │──NaOH────→│ solution F │
                        └────────────┘             └────────────┘           └────────────┘
```

©TEACHER.CO.KE F4 CHEMISTRY PP1 2022

(a) *Identify* solid *G*......... Lead (II) Nitrate. .... (1mk)

....

(a) **Write** a balanced *chemical equation* between the yellow solid and dilute nitric acid.

(1mk)

$$PbO_{(S)} + 2HNO_{3(aq)} \longrightarrow Pb(NO_3)_{2(aq)} + H_2O_{(l)}$$
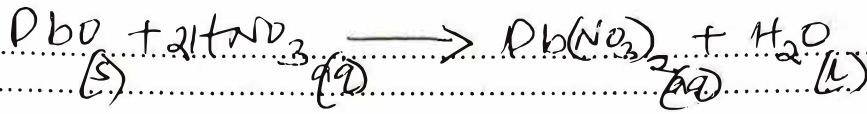
15. Study the diagram below and answer the questions that follow.

Anode   cathode.

— Molten Magnesium Chloride

Heat

(a) Define the term electrolysis. **(1 mark)**

Is the process of decomposing an electrolyte by passing an electric current through

(b) On the diagram, label the Anode and Cathode. **(2 marks)**

(c) Write the equation at the anode. **(1 mark)**

$$2Cl^-_{(l)} \longrightarrow Cl_{2(g)} + 2e^-$$
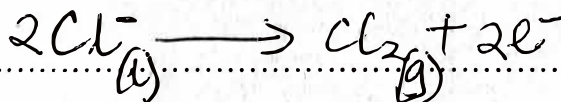
16. In order to find the proportion by volume of gases in air, a sample of air was passed through two wash bottles, the first containing sodium hydroxide solution and the second containing concentrated sulphuric (VI) acid. The remaining gas was then collected in a syringe.

(a) Why was the air passed through;

(i) sodium hydroxide solution? **(1 mark)**

To remove carbon (IV) oxide.

(ii) concentrated sulphuric (VI) acid? **(1 mark)**

To absorb water/remove water vapour vapour

(b) Name is the major gas collected in the syringe. **(1 mark)**

Nitrogen.

17. During the manufacture of sodium carbonate in the industry.

(a) Give the name of the process to manufacture sodium carbonate. **(1 mark)**

.... Solvay process.

(b)   Write the final equation to form sodium carbonate during the process.   **(1 mark)**

$$2NaHCO_{3(s)} \xrightarrow{heat} Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(l)}$$

(c)   Give **one** use of sodium carbonate.   **(1 mark)**
- Manufacture of glass
- Softening of water

18. Describe how to prepare crystal of magnesium sulphate starting with magnesium powder. **(3mks)**
- React ~~excess~~ Magnesium powder with dil sulphuric acid to obtain Magnesium sulphate
- Filter to obtain the filtrate
- Heat the filtrate to saturation and allow it to cool to obtain the crystals.
- Dry the crystals between two filter papers

19.   (a)   Complete the diagram below to show how dry sample of hydrogen gas is prepared in the laboratory.   **(2 marks)**

Dilute H₂SO₄

Zinc granules

H₂

©TEACHER.CO.KE F4 CHEMISTRY PP1 2022
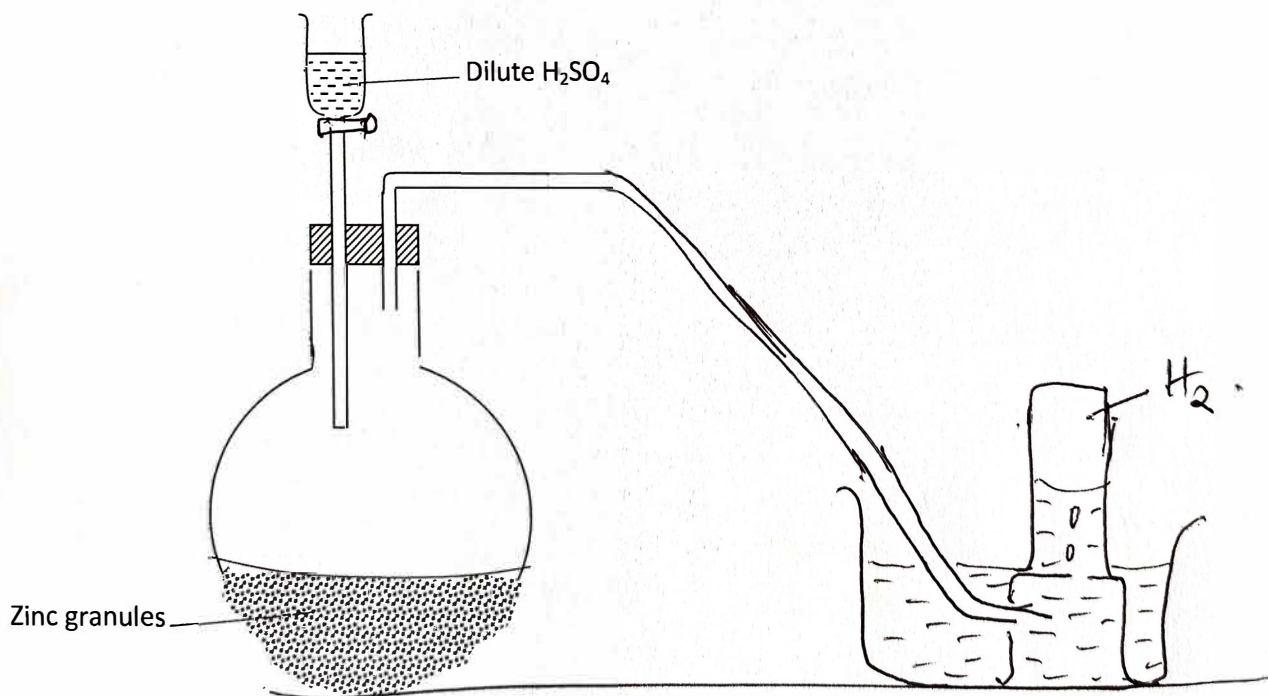
(b) Name the catalyst which could be used to increase the reaction rate of production of hydrogen gas in the set up drawn above. **(1 mark)**

Crystals of Copper (II) Sulphate.

20. An element consists of two isotopes with atomic masses 59 and 61 in the ratio of 3 : 2 respectively.

(a) What are isotopes? **(1 mark)**

are atoms with the same atomic number but different mass number.

(b) Calculate the relative atomic mass of the element. **(2 marks)**

$$\frac{59 \times 3 + 61 \times 2}{2 + 3}$$

$$\frac{177 + 122}{5}$$

$$\frac{299}{5}$$

$$= 59.8$$

21. An element: $^{24}_{12}R$

(a) To which chemical family does it belong? (2, 8, 2) **(1 mark)**

Alkaline Earth metal.

(b) Write the electron arrangement of the atom. **(1 mark)**

2.8.2

(c) Draw the structure of its ion **(1 mark)**
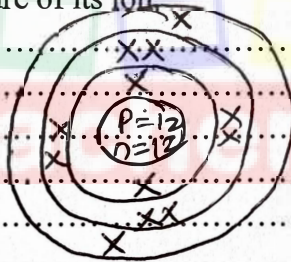
22. If 25cm³ of 0.1M H_2SO_4 solution neutralized a solution contain 1.06g of sodium carbonate in 250cm³ of solution, calculate the morality and volume of sodium carbonate solution. (Na = 23, O = 16, C = 12) **(3 Marks)**

$$Na_2CO_3 + H_2SO_4 \longrightarrow Na_2SO_3 + CO_2 + H_2O$$

Molarity of Na_2CO_3:

$$\frac{1.06 \times 4}{10.6} = \frac{4.24}{106}$$

$$= 0.04M$$

Moles of $H_2SO_4 \Rightarrow$

$$\frac{25 \times 0.1}{1000}$$

$$= 0.0025 \text{ moles}$$

$$Vol = \frac{0.0025 \times 1000}{0.04}$$

$$= 62.5 cm^3$$

23. 50cm³ of oxygen gas diffused through a porous plug in 80 seconds. How long will it take 100cm³ of sulphur (IV) oxide to diffuse through the same plug? (S = 32, o = 16)

(3 Marks)

$$\frac{O_2}{V \quad 50 cm^3} \quad \frac{SO_2}{100 cm^3} \qquad \frac{T_{SO_2}}{T_{O_2}} = \sqrt{\frac{Mm_{SO_2}}{Mm_{O_2}}}$$

	O_2	SO_2
V	$50 cm^3$	$100 cm^3$
T	80	?
T	$100 cm^3$	$100 cm^3$
	$160s$	?
Mm	32	64

$$T_{SO_2} = 160 \sqrt{\frac{64}{32}}$$

$$= 226.3 s.$$

24. (a) State the role of the following parts during fractional distillation of a mixture of water and ethanol

(i) Glass beads in the fractionating column **(1 Mark)**

To increase the surface area for condensation.

(ii) Fractionating column **(1 Mark)**

Is to allow water vapour to condense into liquid and flow back into the flask.

(b) State any one application of fractional distillation **(1 Mark)**

- Distillation of crude oil
- Recycling of used oil
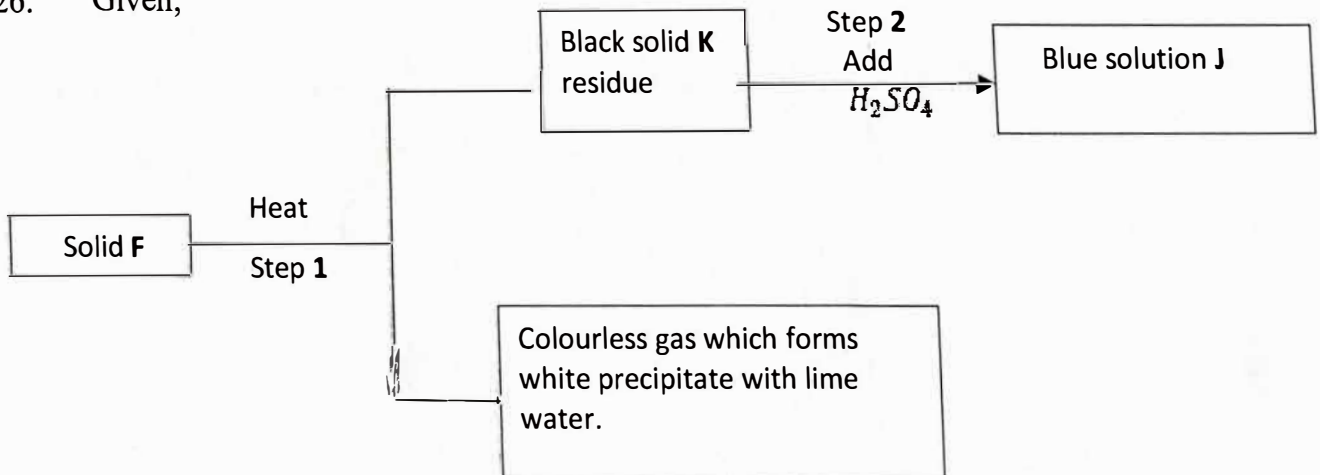- Fractional distillation of liquid air to manufacture nitrogen and oxygen.

25. (a) State what is observed when sodium hydroxide pellets are left in air overnight. **(1 mark)**

It melts up / absorbs water to form a solution.

(b) What name is given the process shown by the salt in (a) above? **(1 mark)**
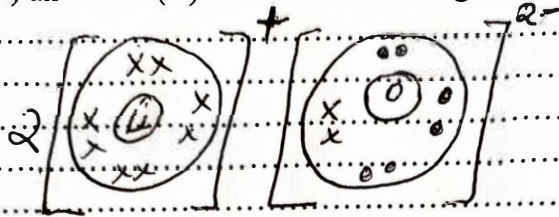
Deliquescence.

26. Given;

| Solid F | → Heat / Step 1 → | Black solid K residue | → Step 2 Add H_2SO_4 → | Blue solution J |

Colourless gas which forms white precipitate with lime water.

(a)   Identify;
Solid **F** - ....Copper (II) Carbonate........
(1 mark)
Solid **J** - ....Copper (II) Sulphate........
(1 mark)

(b)   Write equation for step **1**.   **(1 mark)**

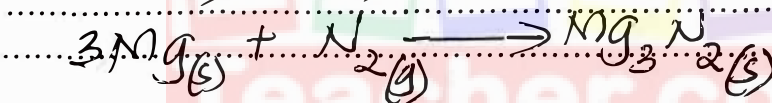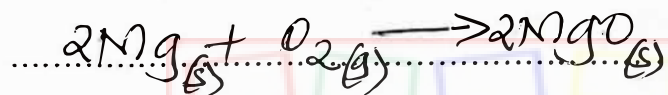$$CuCO_{3(s)} \xrightarrow{heat} CuO_{(s)} + CO_{2(g)}$$
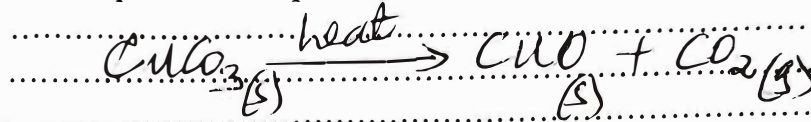
27. Use dot (•) and cross (**X**) to show the bonding in Lithium oxide.   **(2 mark)**
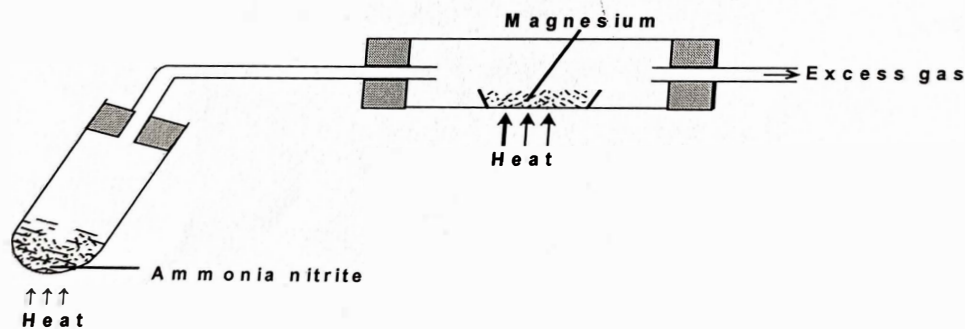

28. Excess magnesium ribbon was burnt in air to form a white solid mixture. Write two equations to show the formation of the white solid mixture.   **(2 marks)**

$$2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO_{(s)}$$
$$3Mg_{(s)} + N_{2(g)} \rightarrow Mg_3N_{2(s)}$$

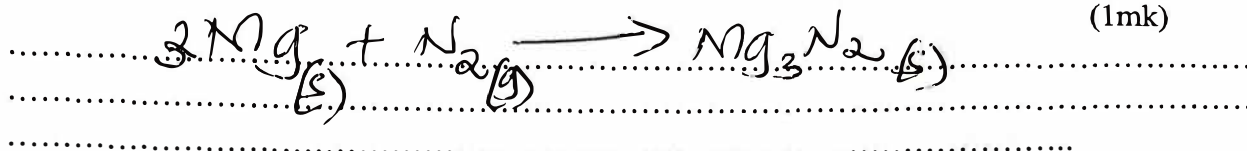29. The set-up below shows how gas A was prepared and reacted with heated magnesium

a) **Give** a reason why it is not advisable to heat magnesium before heating ammonium nitrite.   (1mk)

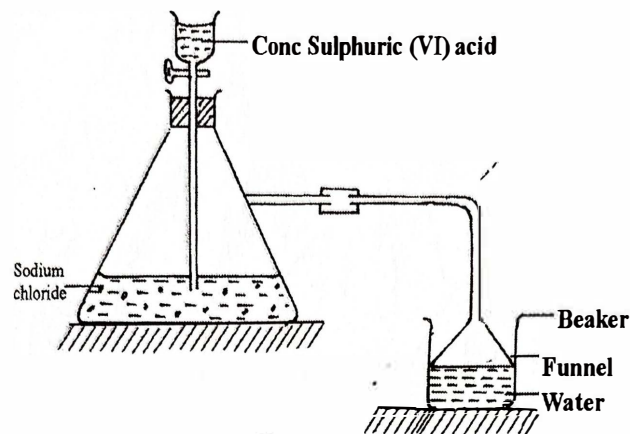Because it will be oxidised by oxygen in the combustion tube.

b) i) **Identify** gas A ....Nitrogen gas........ (1mk)

ii) **Write** a chemical equation for the reaction between gas **A** and magnesium

(1mk)

$$3Mg_{(s)} + N_{2(g)} \longrightarrow Mg_3N_{2(s)}$$

30. Study the set-up below and answer questions that follow.

i) Name the gas that is produced when concentrated sulphuric (VI) acid reacts with the sodium chloride **(1 mark)**

Hydrogen chloride gas.

ii) Why is it necessary to use a funnel in the beaker? **(1 mark)**

To increase the surface of absorption.

iii) How does the gas affect the P^H of the water in the beaker? **(1 mark)**

The pH reduces.