

Name:

Adm No.

Class:

Date:

233/1

CHEMISTRY

PAPER 1

FORM III

END TERM 2 EXAMS

Time: 2 hours

233/1

CHEMISTRY

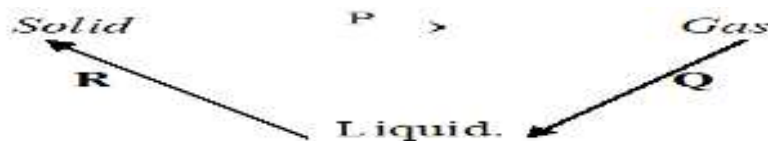
FORM III

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	

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



Name processes: **P:** *Sublimation* (1mk)

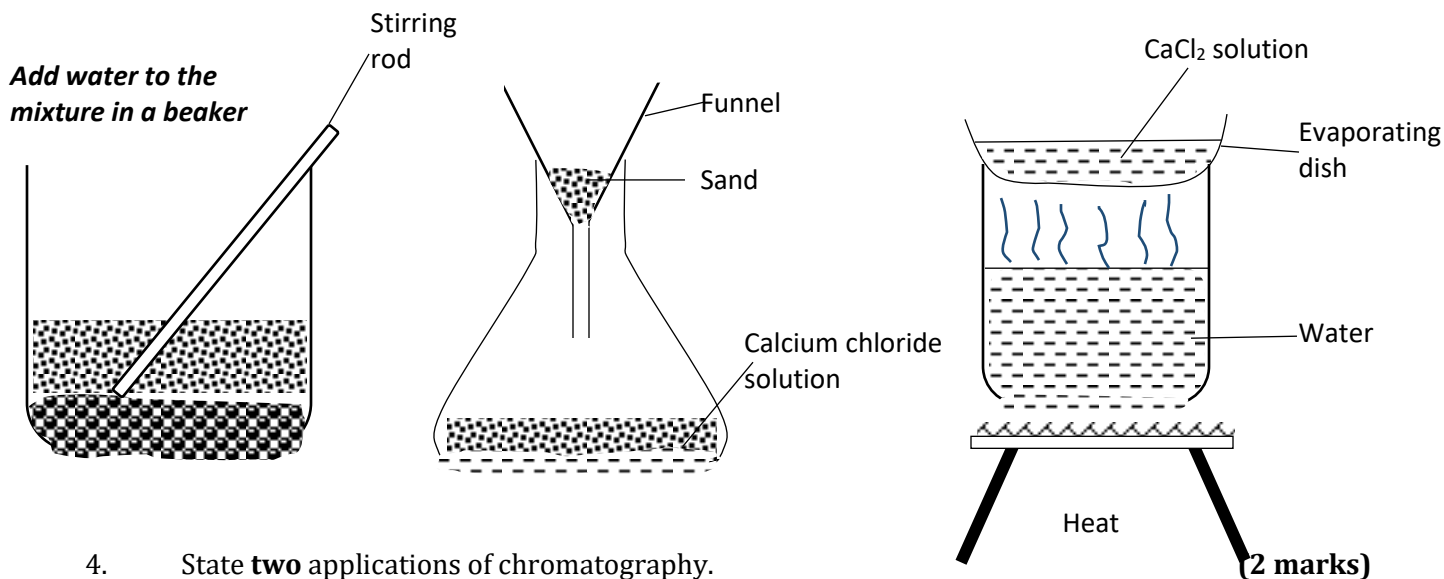
R: *Condensation* (1mk)

2. (a) Give **one** reason some of the laboratory apparatus are made of ceramics. **(1 mark)**
Does not break easily hence can withstand strong heating.

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

- *100cm³ measuring cylinder.*
- *Graduated 100cm³ beaker.*

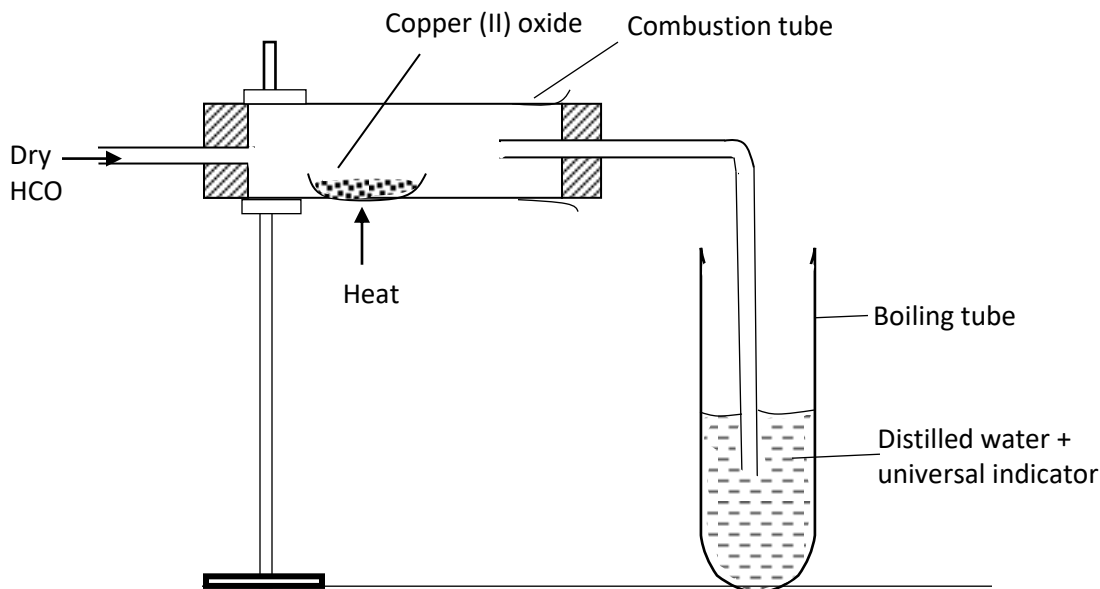
3. Draw the procedural set-ups that can be used to separate a mixture of sand and calcium chloride to obtain crystals of calcium chloride. **(3 marks)**



4. State **two** applications of chromatography.

- *In sports to identify banned substances.*
- *To test purity of drugs in pharmacy.*
- *Identify contaminants in food and drinks.*
- *Identify harmful substances in cosmetics.*

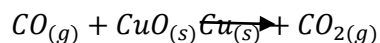
5.



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)



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

(2 marks)

The solution turns red, CO₂ formed dissolves to form an acidic solution.

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 ✓1

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

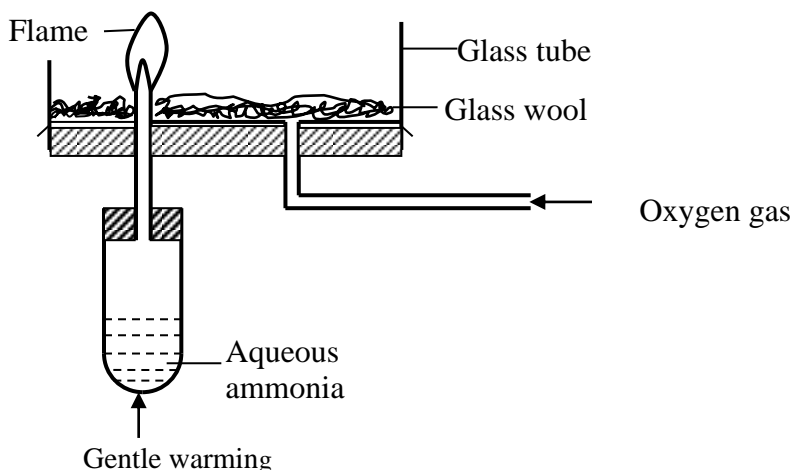
(2 Marks)

K ✓½ and M ✓½. This is because K is acidic and M is basic and aluminium hydroxide being amphoteric would react with both. ✓1

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)

<i>Element</i>	<i>Si</i>		<i>H</i>
<i>Mass (g)</i>	8		1.12g (9.12 – 8.0) ✓½
<i>No. of moles</i>	$\frac{8}{28} = 0.286$ ✓1		$\frac{1.12}{1} = 1.12$ ✓½
<i>Mole ratio</i>	$\frac{0.286}{0.286} = 1$		$\frac{1.12}{0.286} = 4$ ✓½
<i>∴ Empirical formula is SiH₄</i> ✓¼			

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



- (a) Why is aqueous ammonia warmed gently? (1 Mark)
To liberate ammonia gas rapidly ✓1
- (b) What is the colour of the flame? (1 Mark)
Green-yellow ✓
- (c) Write the chemical equation for the reaction that takes place (1Mark)
 $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{l})$ ✓1
 UB eqn = zero mk
 Penalise ½ mk for wrong or missing S.S.

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)
To dry chlorine
- (ii) Write the equation for formation of chlorine. (1 mark)
 $\text{MnO}_2(\text{s}) + 4\text{HCl}(\text{aq}) \rightarrow \text{MnCl}_2(\text{aq}) + \text{Cl}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$
- (iii) What is the role of manganese (IV) oxide? (1 mark)
Oxidizes HCl to chlorine
10. (a) State Boyle's law. (1 mark)

The volume a fixed mass of a gas, is inversely proportional to the pressure at constant temperature.

- (b) A gas occupies 270cm³ at a pressure of 660mmHg at 37°C. What is the new volume if pressure is changed to 810 mmHg at 63°C? **(2 marks)**

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$P_1 = 660$$

$$P_2 = 810$$

$$V_1 = 270$$

$$V_2 = ?$$

$$T_1 = 37 + 273 = 310^{\circ}K$$

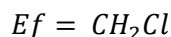
$$T_2 = 336$$

$$V_2 = \frac{P_1 V_1 T_2}{P_2 T_1} = \frac{660 \times 270 \times 336}{810 \times 310}$$

$$= 338.4516 \text{ cm}^3$$

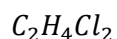
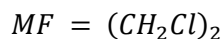
11. An organic compound contains 24.24% carbon, 4.04% hydrogen and the rest chlorine. If its relative molecular mass is 99, what is its molecular formula? **(3 marks)**
(C = 12, H = 1, Cl = 35.5)

Element	C	H	Cl
%Mass	24.24	4.04	71.72
RAM	12	1	35.5
Moles	24.24/12	4.04/1	71.72/35.5
	$\frac{2.02}{2.02} = 1$	$\frac{4.04}{2.02} = 2$	$\frac{2.02}{2.02} = 1$
Mole ratio	1	2	1

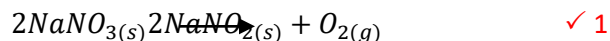


$$MF = (EF)_n$$

$$n = \frac{R.M.M}{EFM} = 99/49.5 = 2$$



12. A given mass of sodium nitrate was heated completely and 320 cm³ 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)



Moles of O₂ produced

If 1 mole evolve 22400cm³

? " 320cm³
 $\frac{320}{22400} = 0.0143 \text{ moles}$ ✓ ½

From r.r. of 1 : 2

Moles of NaNO₃ = 2 × 0.0143 = 0.0286moles ✓ ½

RFM NaNO₃ = 23 + 14 + (16)³ = 85

If 1 mole → 85g

0.0286 → ?

$\frac{0.0286}{1} \times 85 = 2.431g$ ✓ ½

✓ ½

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

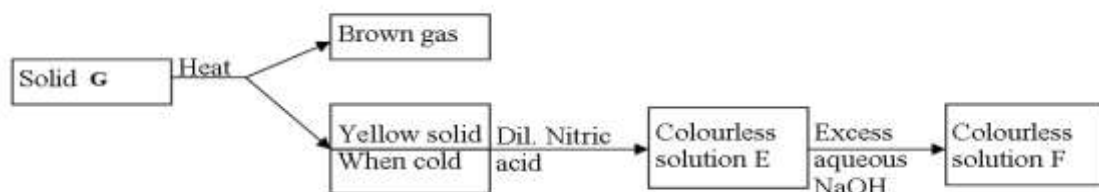
Shows distinct colours in acids, bases and neutral solutions unlike phenolphthalein which cannot differentiate between acids and neutral solutions.

- (b) Three drops of litmus solution was added to 20 cm³ of 2M hydrochloric acid in a beaker followed by 20 cm³ of 2M ammonium hydroxide. State and explain the observation made. (2 marks)

The colour changed from red to colourless.

The acid was neutralized completely by the ammonium hydroxide.

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



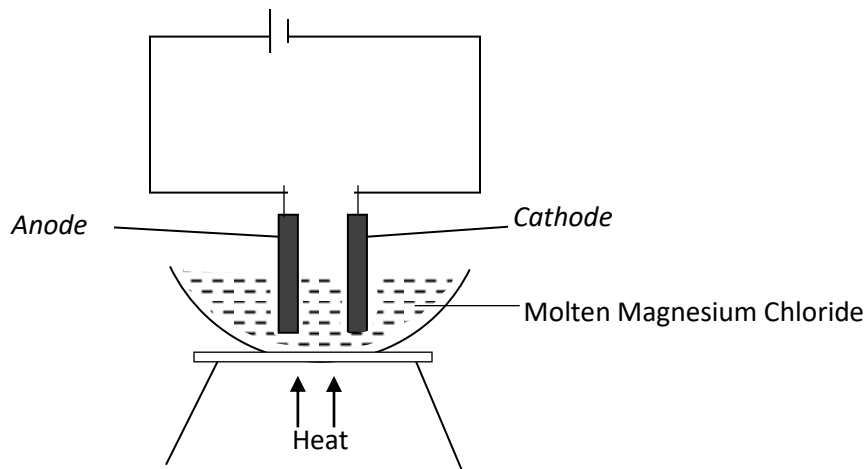
- (a) **Identify** solid G..... (1mk)



- (a) Write a balanced *chemical equation* between the yellow solid and dilute nitric acid. (1mk)



15. Study the diagram below and answer the questions that follow.



- (a) Define the term electrolysis. (1 mark)
Process by which an electrolyte gets decomposed when an electric current is passed through it.
- (b) On the diagram, label the Anode and Cathode. (2 marks)
- (c) Write the equation at the anode. (1 mark)
 $2\text{Cl}^-_{(l)} \xrightarrow{\text{Heat}} \text{Cl}_{2(g)} + 2e^-$
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 absorb CO₂
- (ii) concentrated sulphuric (VI) acid? (1 mark)
To absorb water 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)
 $2\text{NaHCO}_3(s) \xrightarrow{\text{Heat}} \text{Na}_2\text{CO}_3(s) + \text{CO}_2(g) + \text{H}_2\text{O}(l)$

(c) Give **one** use of sodium carbonate. (1 mark)

- Manufacture glass
- softening hard water

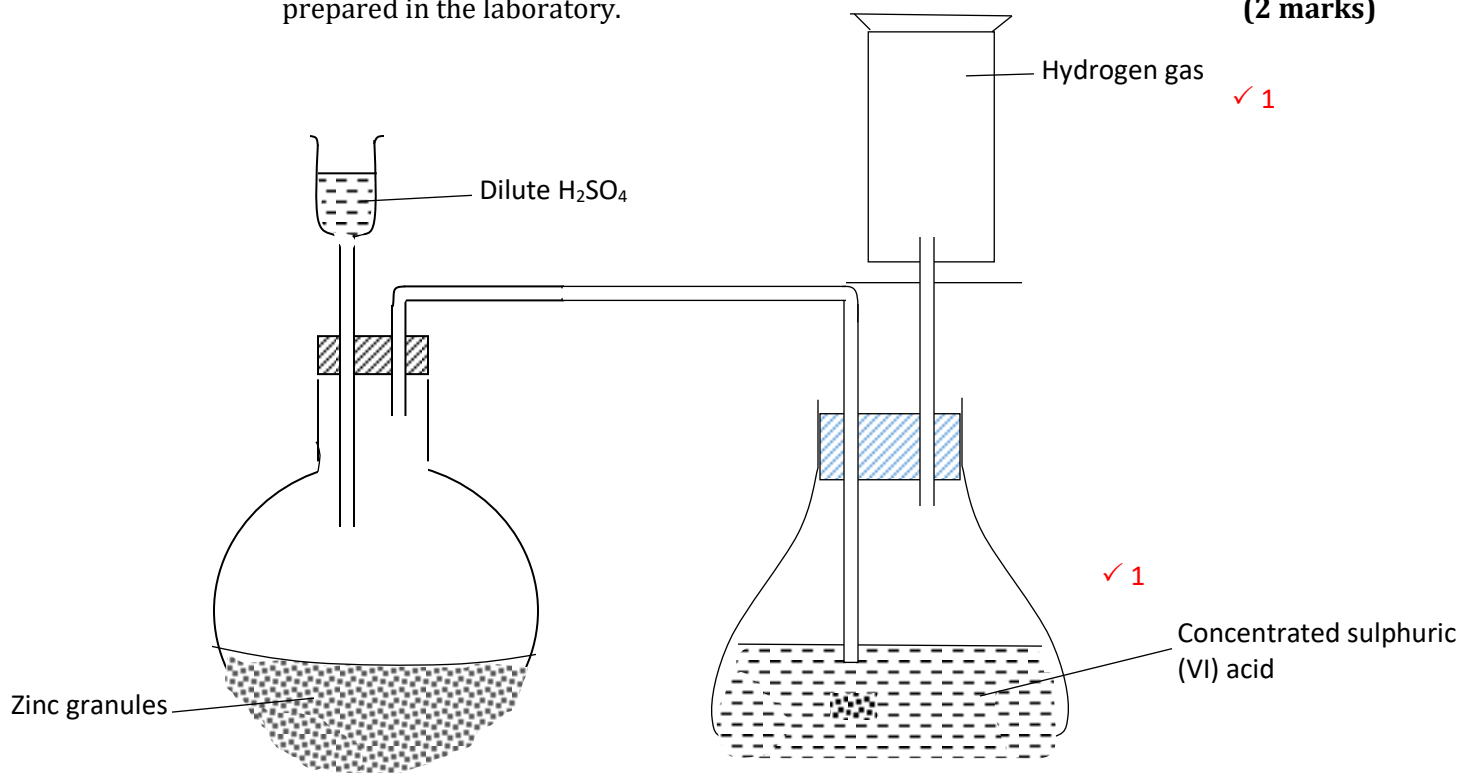
18. Describe how to prepare crystal of magnesium sulphate starting with magnesium powder. **(3mks)**

To some amount of dilute sulphuric (VI) acid in beaker

- Add magnesium powder as you stir till in excess.
- Filter to obtain magnesium sulphate as filtrate.
- Heat the filtrate to concentrate.
- Cool in order to form crystals.
- Dry between filter papers.

½ marks each

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



(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.

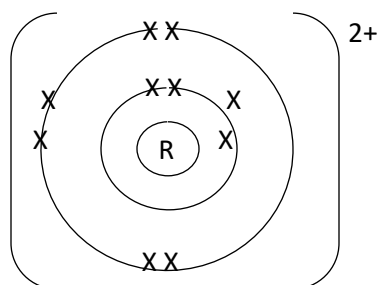
(a) What are isotopes? (1 mark)

Atoms of the same element with same atomic number but different mass number due to difference in the number of neutrons.

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

$$\begin{aligned}
 R.A.M &= \frac{(59 \times 3) + (61 \times 2)}{5} && \checkmark \frac{1}{2} \\
 &= \frac{177 + 122}{5} && \checkmark \frac{1}{2} \\
 &= \frac{299}{5} && \checkmark \frac{1}{2} \\
 &= 59.8 && \checkmark \frac{1}{2}
 \end{aligned}$$

21. An element: ${}_{12}^{24}R$
- (a) To which chemical family does it belong? (1 mark)
Alkaline earth metals
- (b) Write the electron arrangement of the atom. (1 mark)
 2.8.2
- (c) Draw the structure of its ion. (1 mark)



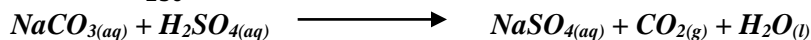
22. If 25cm³ of 0.1M H₂SO₄ solution neutralized a solution contain 1.06g of sodium carbonate in 250cm³ of solution, calculate the molarity and volume of sodium carbonate solution. (3 Marks)
 (Na = 23, O = 16, C = 12)

$$\text{No. of moles of NaCO}_3 = \frac{1.06}{106} = 0.01 \text{ moles}$$

0.01 moles contained in 250cm³

? moles contained in 1000cm³

$$= \frac{0.01 \times 1000}{250} = 0.04M$$



Reacting mole ration Na₂CO₃: H₂SO₄

1 : 1

Moles of Na₂CO₃ = Moles of H₂SO₄

$$\text{Moles of H}_2\text{SO}_4 = \frac{0.1}{1000} = 0.0025 \text{ moles} = \text{Moles of Na}_2\text{CO}_3$$

0.04 moles – 1000cm³

0.0025 - ?

$$\begin{aligned} &\Rightarrow \frac{0.0025 \times 1000}{0.04} \\ &= 62.5 \text{ cm}^3 \checkmark 1 \end{aligned}$$

23. 50 cm^3 of oxygen gas diffused through a porous plug in 80 seconds. How long will it take 100 cm^3 of sulphur (IV) oxide to diffuse through the same plug? (S = 32, o = 16) (3 Marks)

$$\begin{aligned} &50 \text{ cm}^3 \text{ of } O_{2(g)} \text{ take sec} \\ &100 \text{ cm}^3 \text{ of } O_{2(g)} \text{ take sec ?} \\ &\frac{80 \text{ sec} \times 100}{50} = 160 \text{ sec} \\ &M/\text{mass of } O_2 = 32 \\ &SO_2 = 32 + 32 = 64 \\ &\sqrt{\frac{M_{SO_2}}{M_{O_2}}} = \frac{T_{SO_2}}{T_{O_2}} \\ &\sqrt{\frac{64}{32}} = \frac{T_{SO_2}}{160 \text{ sec}} \\ &\Rightarrow \left(\sqrt{\frac{64}{32}} \right) = \frac{T_{SO_2}}{160^2} \\ &^2 \frac{64}{32} = \frac{T_{SO_2}}{25600} \\ &T_{SO_2} = \frac{25,600 \times 64}{32} \\ &T_{SO_2} = 226.27 \text{ sec} \end{aligned}$$

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)

Increases $\checkmark 1/2$ the surface area for condensation $\checkmark 1/2$ process.

(ii) Fractionating column (1 Mark)

It allows water vapour to condense $\checkmark 1/2$ into liquid and flow $\checkmark 1/2$ back into the flask before the boiling point of water is reached.

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

During oil refinery, crude oil is separated into a number of fractions $\checkmark 1$

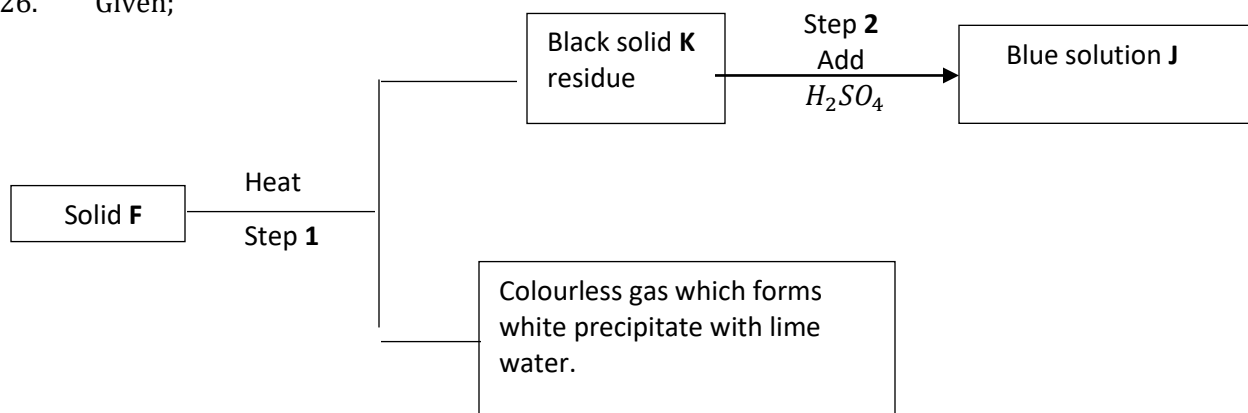
25. (a) State what is observed when sodium hydroxide pellets are left in air overnight. (1 mark)

It forms a solution.

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

Deliquescence

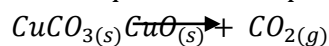
26. Given;



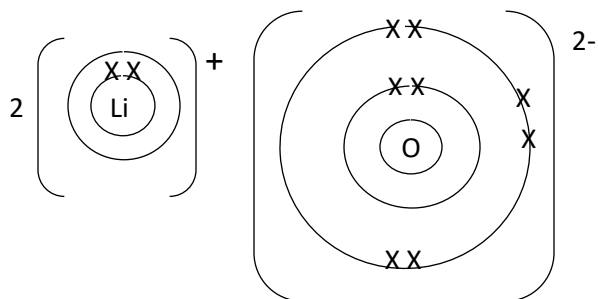
(a) Identify;
Solid F - $CuCO_3$ (1 mark)

Solid J - $CuSO_4$ (1 mark)

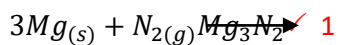
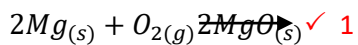
(b) Write equation for step 1. (1 mark)



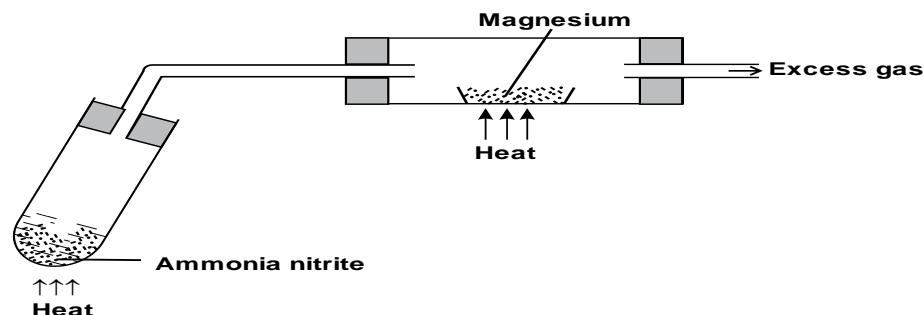
27. Use dot (•) and cross (X) to show the bonding in Lithium oxide. (2 mark)



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)



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



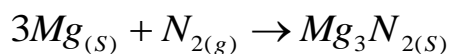
a) **Give** a reason why it is not advisable to heat magnesium before heating ammonium nitrite. (1mk)

Magnesium would react with air in the combustion tube since nitrogen gas has not yet been produced.

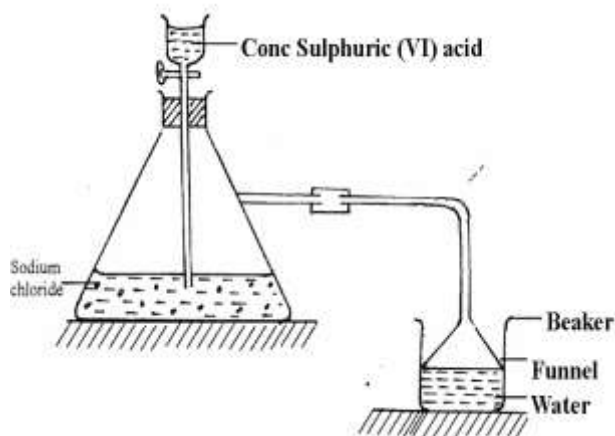
b) i) **Identify** gas A..... (1mk)

Nitrogen gas

ii) **Write** a chemical equation for the reaction between gas A and magnesium (1mk)



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)

Hydrogenchloride ✓

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

It prevents sucking back/increases surface area for dissolving ✓

iii) How does the gas affect the P^H of the water in the beaker?
The p^H of the water drops ✓

(1 mark)