

NYAMIRA NORTH JOINT EXAMINATION

NAME MARKING SCHEME INDEX/NO _____

SCHOOL _____ DATE _____

233/1
CHEMISTRY
Paper 1
(THEORY)
March 2025
Time: 2 Hours

INSTRUCTIONS TO CANDIDATES

1. Write your name and index number in the spaces provided above.
2. Sign and write the date of examination in the spaces provided above.
3. Answer **All** the questions in the spaces provided in the question paper.
4. KNEC mathematical tables and silent non-programmable calculators may be used.
5. All working **Must** be clearly shown where necessary.
6. This paper consists of 11 printed pages.
7. Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
8. Candidates should answer the questions in English.

For Examiner's Use only

Questions	Maximum Score	Candidate's Score
1-27	80	

1. During laboratory preparation of oxygen, manganese (IV) oxide is added to reagent B.

(a) Name reagent B.

(1mk)

Hydrogen peroxide ✓

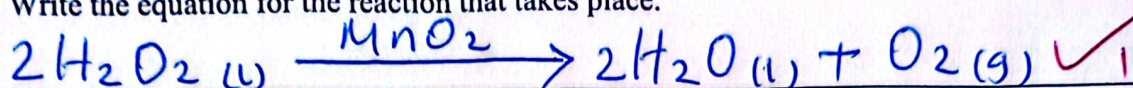
(b) State the role of manganese (IV) oxide in this experiment.

(1mk)

A catalyst ✓

(c) Write the equation for the reaction that takes place.

(1mk)



2. The reaction between lead (II) carbonate and dilute sulphuric (VI) acid stops after a short while. Give a reason.

(2mks)

Insoluble lead (II) sulphate formed coats the unreacted carbonate preventing further reaction. ✓

3. Lead (II) nitrate solution was added to a solution of sodium chloride in a test tube.

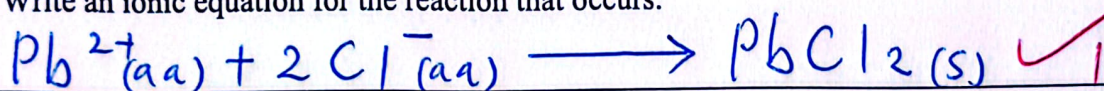
(a) State the observation made when the two solutions mix.

(1mk)

White precipitate formed ✓

(b) Write an ionic equation for the reaction that occurs.

(1mk)



(c) State the observation made when the mixture obtained was heated?

(1mk)

The white precipitate dissolves to form a colourless solution. ✓

4. If it takes 18 seconds for 40 cm³ of hydrogen to diffuse through a porous plate, how long will it take 60 cm³ of oxygen to diffuse through the same plate under similar conditions? (H = 1, O = 16)

(3mks)

$$40\text{cm}^3 \text{ of } \text{H}_2 \longrightarrow 18 \text{ seconds}$$

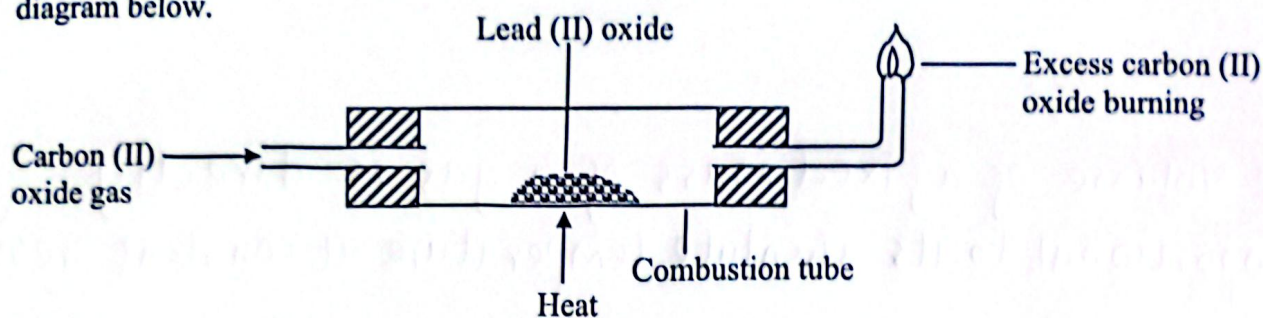
$$60\text{cm}^3 \text{ of } \text{H}_2 \longrightarrow \frac{60}{40} \times 18 \quad \checkmark$$
$$= 27 \text{ seconds}$$

$$\frac{\text{Time of } \text{O}_2}{\text{Time of } \text{H}_2} = \sqrt{\frac{\text{RMM of } \text{O}_2}{\text{RMM of } \text{H}_2}}$$

$$\frac{\text{Time of } \text{O}_2}{27 \text{ seconds}} = \sqrt{\frac{32}{2}} \quad \checkmark$$

$$\text{Time of } \text{O}_2 = 4 \times 27$$
$$= 108 \text{ seconds} \quad \checkmark$$

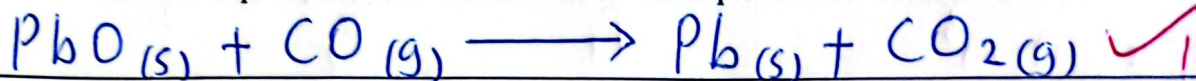
5. In an experiment, carbon (II) oxide gas was passed over heated lead (II) oxide as shown in the diagram below.



(a) State one observation made in the combustion tube. (1mk)

Yellow lead (II) oxide leaves a grey residue. ✓

(b) Write a chemical equation for the reaction which takes place in the combustion tube. (1mk)



(c) State the property of carbon (II) oxide demonstrated in this experiment. (1mk)

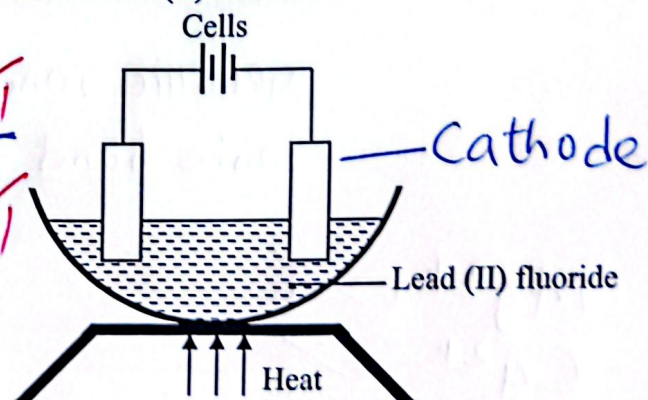
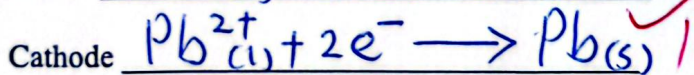
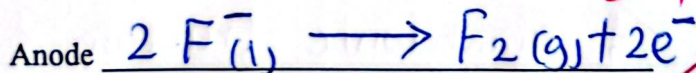
It is a reducing agent ✓

6. Naturally occurring gallium occurs as ${}^{69}_{31}Ga$ and ${}^{71}_{31}Ga$ in the ratio of 3 : 2 respectively. Calculate the relative atomic mass of gallium. (2mks)

$$\begin{aligned}
 RAM &= \frac{3}{5} \times 69 + \frac{2}{5} \times 71 \quad \checkmark \\
 &= 41.4 + 28.4 \\
 &= 69.8 \quad \checkmark
 \end{aligned}$$

7. The set-up below was used during electrolysis of molten lead (II) fluoride.

(a) Write the equation for the reaction that occurs at the anode and cathode. (2mks) ✓



(b) On the diagram above, identify the cathode. (1mk)

(c) State the observation made at the anode. (1mk)

Bubbles of pale yellow gas formed. ✓

8. (a) State Charles's law.

(1mk)

The volume of a fixed mass of a gas is directly proportional to its absolute temperature at constant pressure.

(b) A gas occupies 100 cm^3 at 27°C and 240 Pascals pressure. What will be its volume 37°C and 200 Pascals pressure?

(3mks)

$$P_1 = 240 \text{ Pa}$$

$$V_1 = 100 \text{ cm}^3$$

$$T_1 = 27 + 273 = 300 \text{ K}$$

$$P_2 = 200 \text{ Pa}$$

$$T_2 = 37 + 273 = 310 \text{ K}$$

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

$$V_2 = \frac{240 \times 100 \times 310}{300 \times 200}$$

$$= 124 \text{ cm}^3$$

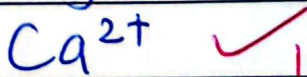
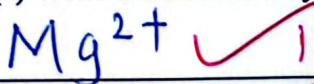
9. State the type of chemical bond and the type of structure present in the following substances.

(2mks)

Substance	Type of Chemical bond	Type of structure
Copper	Metallic bond	Giant metallic structure
Copper (II) chloride	Ionic bond	Giant ionic structure

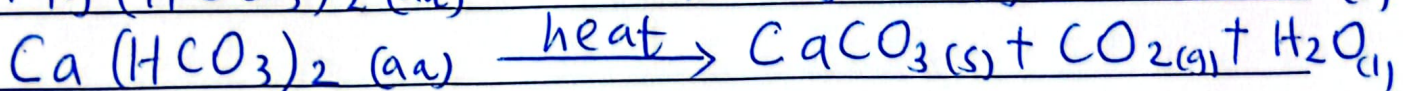
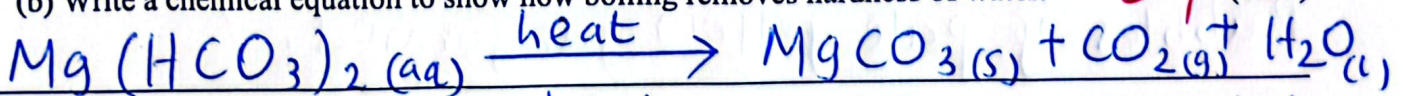
10. (a) Write the chemical symbols of two cations responsible for hardness of water.

(2mks)



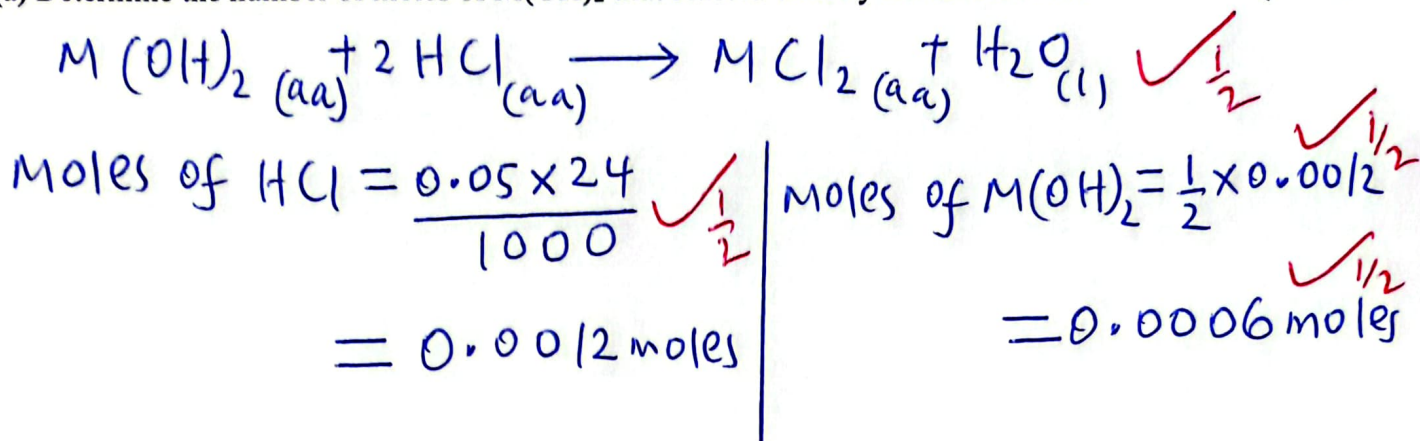
(b) Write a chemical equation to show how boiling removes hardness of water.

(1mk)



11. 10 cm^3 of an alkali, $\text{M}(\text{OH})_2$, completely reacted with 24 cm^3 of 0.05 M hydrochloric acid. The concentration of the alkali was $4.44 \text{ grams per litre}$. ($\text{H} = 1, \text{O} = 16$)

(a) Determine the number of moles of $\text{M}(\text{OH})_2$ that reacted with hydrochloric acid. (2mks)



(b) Find the molar mass of $\text{M}(\text{OH})_2$ and use it to determine the relative atomic mass of M . (2mks)

$$\text{Molarity of M(OH)}_2 = \frac{0.0006 \times 1000}{10} = 0.06 \text{ M}$$

$$\text{Molar mass of M(OH)}_2 = \frac{4.44}{0.06} = 74$$

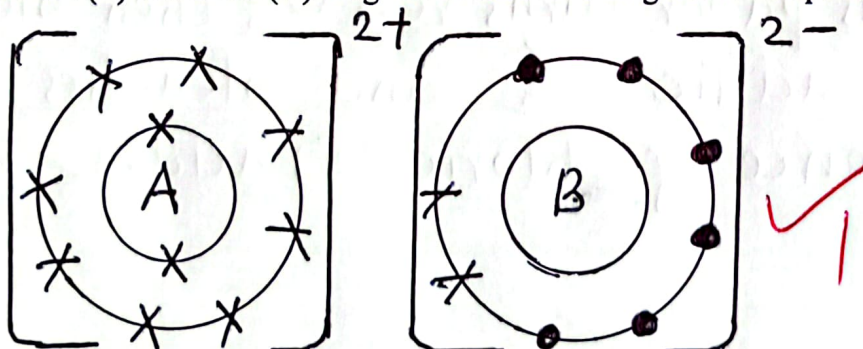
$$\text{RAM of M is: } = 74 - 34 = 40$$

12. The atomic numbers of element A and B are 12 and 8 respectively.

(a) Write the chemical formula of the compound formed between A and B. (1mk)

AB

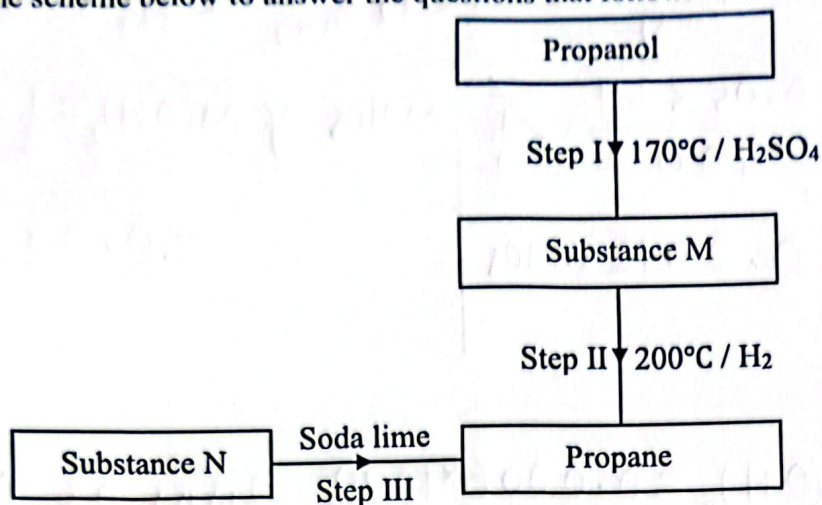
(b) Draw a dot (•) and cross (x) diagram to show bonding in the compound formed between A and B. (1mk)



(c) Element A has a high melting point of 650°C . Give a reason. (1mk)

Its atoms are joined by strong metallic bonds which require a lot of energy to break.

13. Use the scheme below to answer the questions that follow.



(a) Give the names of the substances M and N. (2mks)

M Propene ✓

N Sodium butanoate ✓

(b) Give the name of the process that occurs in step I and step II. (2mks)

Step I Dehydration ✓

Step II Hydrogenation ✓

14. State and explain the observations that would be made if a moist blue litmus paper was placed in a gas jar full of chlorine gas. (2mks)

Blue litmus paper turns red ✓¹/₂ then bleaches ✓¹/₂
chlorine is acidic ✓¹/₂ and bleaches due
to the presence of chloric (I) acid. ✓¹/₂

15. Name the method or process that can be used to separate the following substances. (3mks)

Mixture	Method of separation
Sand and iodine	<u>Sublimation</u> ✓
Iron filings and sulphur powder	<u>use a magnet</u> ✓
Food colouring ingredients in a sauce	<u>Paper chromatography</u> ✓

16. The table below shows the solubility of salt A and salt B at 24°C and at 60°C.

Name of salt	Solubility in grams per 100 grams of water	
	24°C	60°C
Salt A	30	80
Salt B	25	55

When an aqueous mixture containing 38 grams of salt A and 20 grams of salt B in 100g of water at 70°C was cooled to 24°C, crystals formed.

(a) Identify the crystals formed. (1mk)

Salt A ✓

(b) Determine the mass of the crystals formed. (1mk)

$$= 38 - 30 \checkmark \frac{1}{2}$$

$$= 8 \text{ grams } \checkmark \frac{1}{2}$$

(c) Name the method used to obtain the crystals. (1mk)

Fractional crystallisation ✓

17. When 94.5 grams of hydrated barium hydroxide, $\text{Ba(OH)}_2 \cdot n\text{H}_2\text{O}$, were heated to constant mass, 51.3 grams of anhydrous barium hydroxide were obtained. Determine the empirical formula of the hydrated barium hydroxide. (Ba = 137, O=16, H=1) (3mks)

$$\text{Mass of water} = 94.5 - 51.3 = 43.2$$

Element	Ba(OH)_2	H_2O
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Mass in grams	51.3	43.2
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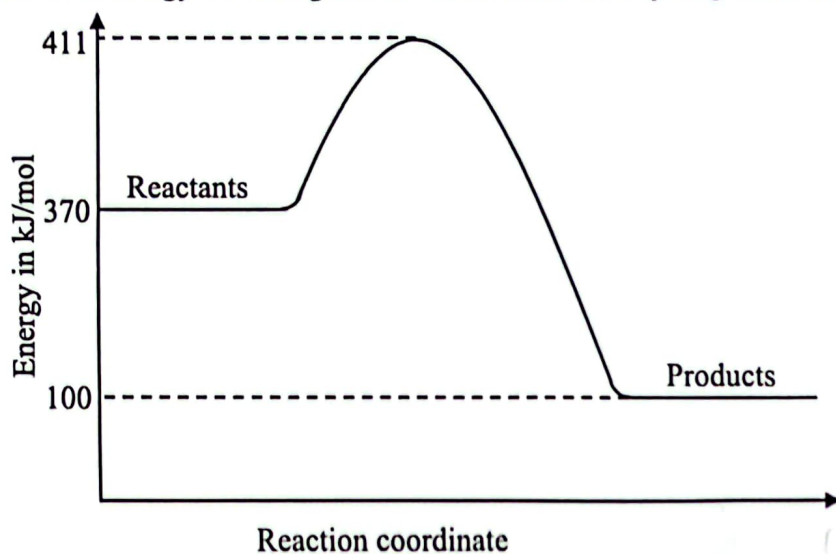
moles	$\frac{51.3}{171} = 0.3$	$\frac{43.2}{18} = 2.4 \checkmark$
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Divide by smaller number	$\frac{0.3}{0.3} = 1$	$\frac{2.4}{0.3} = 8 \checkmark$
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Mole ratio	1	: 8
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Empirical formula	$\text{Ba(OH)}_2 \cdot 8\text{H}_2\text{O} \checkmark$
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18. Below is an energy level diagram for the formation of hydrogen fluoride.



(a) Calculate the enthalpy change for the formation of hydrogen fluoride. (1mk)

$$= 100 - 370 \quad \checkmark \frac{1}{2}$$

$$= -270 \text{ kJ/mol} \quad \checkmark \frac{1}{2}$$

(b) Calculate the activation energy of the reaction. (1mk)

$$= 411 - 370 \quad \checkmark \frac{1}{2}$$

$$= +41 \text{ kJ/mol} \quad \checkmark \frac{1}{2}$$

(c) State and explain the type of reaction represented by the profile. (2mks)

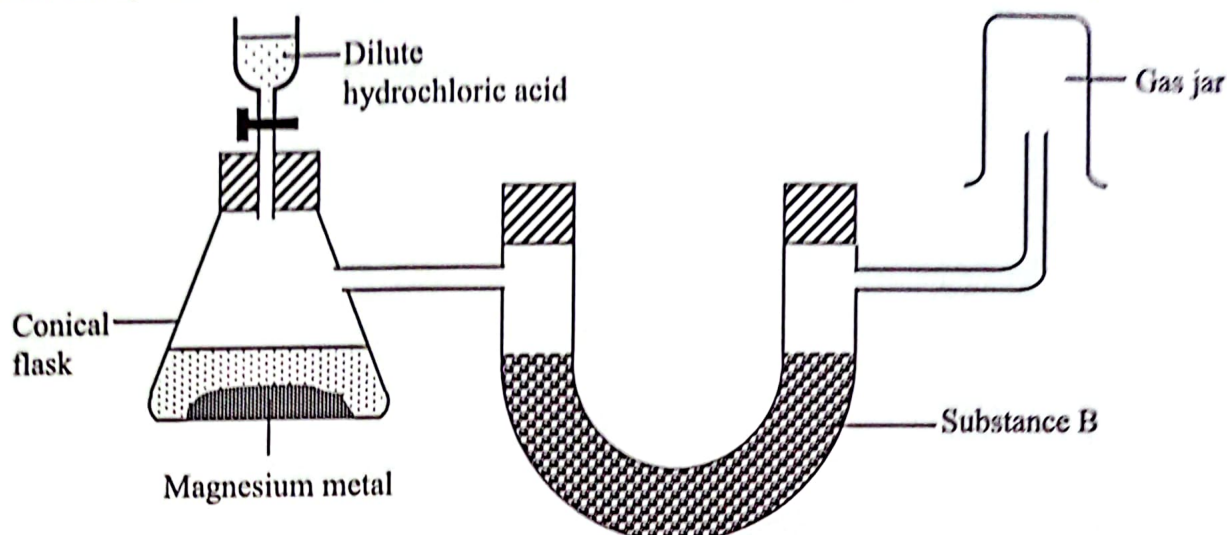
Exothermic reaction \checkmark because the products are at a lower energy level than the reactants. \checkmark

19. Give a reason why calcium hydroxide solution is used to detect the presence of carbon (IV) oxide gas while sodium hydroxide is not. (2mks)

Calcium hydroxide forms a white precipitate with carbon (IV) oxide which can be observed. \checkmark

Sodium carbonate is soluble hence sodium hydroxide will not form a precipitate with carbon (IV) oxide. \checkmark

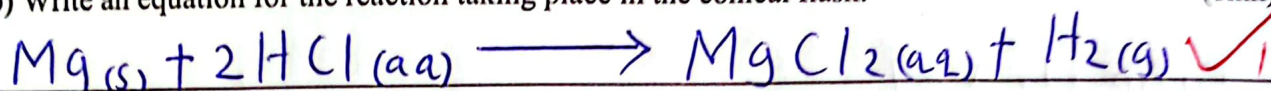
20. The set-up below was used by a student to prepare dry hydrogen gas in the laboratory.



(a) Name one substance that can be used as substance B. (1mk)

Calcium oxide ✓ / Anhydrous calcium chloride

(b) Write an equation for the reaction taking place in the conical flask. (1mk)



(c) Give the property of hydrogen gas that enables it to be collected as shown in the diagram. (1mk)

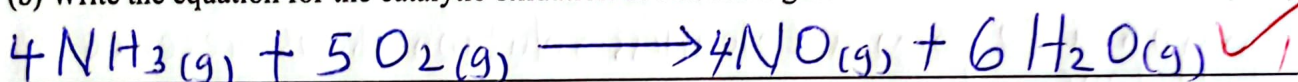
It is lighter than air. ✓

21. The first step in the industrial manufacture of nitric (V) acid is catalytic oxidation of ammonia gas.

(a) What is the name of the catalyst used? (1mk)

Platinum ✓

(b) Write the equation for the catalytic oxidation of ammonia gas. (1mk)



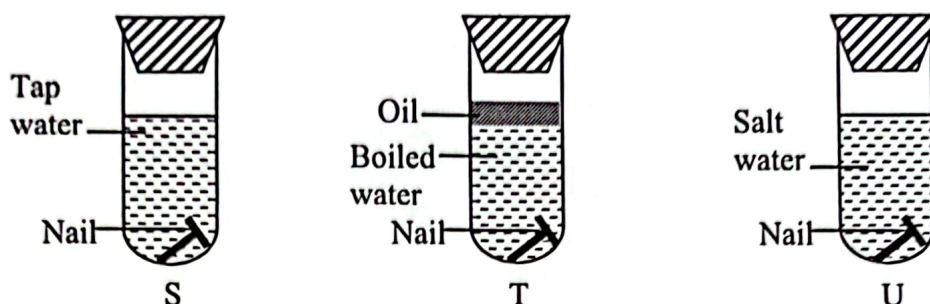
(c) The reaction between copper metal with 50% concentrated nitric (V) acid in an open test tube produces brown fumes. Give a reason. (1mk)

The reaction produces nitrogen (II) oxide which reacts with oxygen in air to form brown fumes of nitrogen (IV) oxide. ✓

22. Give the name of a reagent which when reacted with concentrated hydrochloric acid produces chlorine gas. (1mk)

Potassium manganate (VII) ✓ / Manganese (IV) oxide

23. Three test tubes were set up to investigate rusting of iron as shown below. The set up was allowed to stand for one week.



(a) In which tube did rusting not occur? Explain.

(2mks)

Tube T. ✓

Oxygen was absent. ✓

(b) In which tube was there more rusting? Explain.

(2mks)

Tube U. ✓

Salt increases the rate of rusting. ✓

24. A sample of river water is suspected to contain zinc ions and sulphate ions. Describe how the presence of zinc ions and sulphate ions can be established.

(a) Zinc ions.

(2mks)

Add ammonia solution to the water sample dropwise till excess. ✓ A white precipitate which dissolves in excess ammonia to form a colourless solution shows presence of Zn^{2+} ions. ✓

(b) Sulphate ions.

(2mks)

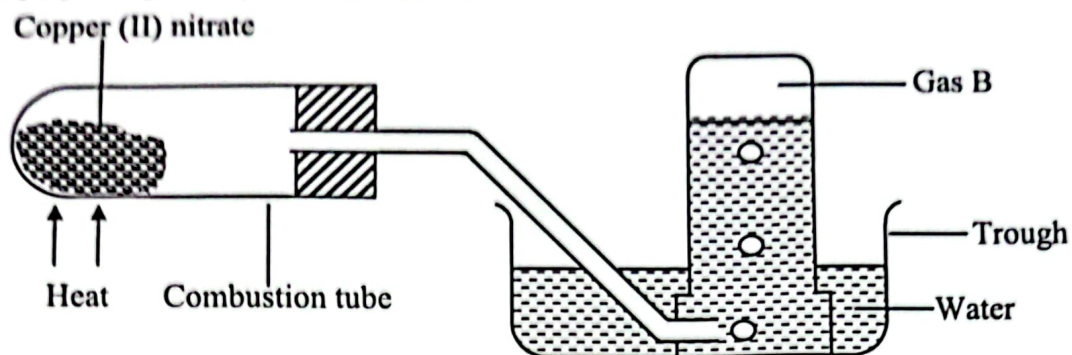
Add a few drops of acidified barium nitrate to the water sample. ✓ A white precipitate formed shows presence of SO_4^{2-} ions. ✓

25. What is an amphoteric oxide?

(1mk)

An oxide which shows both acidic and basic properties. ✓

26. A student prepared gas B by heating copper (II) nitrate as shown below.



(a) State two observations made in the combustion tube. (2mks)

Blue copper (II) nitrate leave a black residue.
Brown fumes are formed. ✓

(b) What will happen to the pH of water in the trough after one hour. Give an explanation. (2mks)

The pH decreases. ✓ Nitrogen (IV) oxide formed dissolves in the water to form nitric (V) acid which is a strong acid. ✓

27. When a mixture of iron filings and sulphur powder was heated, a red glow spread throughout the mixture even after the mixture was removed from the heat. The glow continued until the reaction was complete leaving a black solid.

(a) Name the black solid. (1mk)

Iron (II) Sulphide. ✓

(b) What does continuation of the glow even after removal of the heat source indicate. (1mk)

An exothermic reaction. ✓

(c) What would be observed when the black solid is mixed with dilute hydrochloric acid. (1mk)

Effervescence with evolution of a gas with a smell of rotten eggs. ✓

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