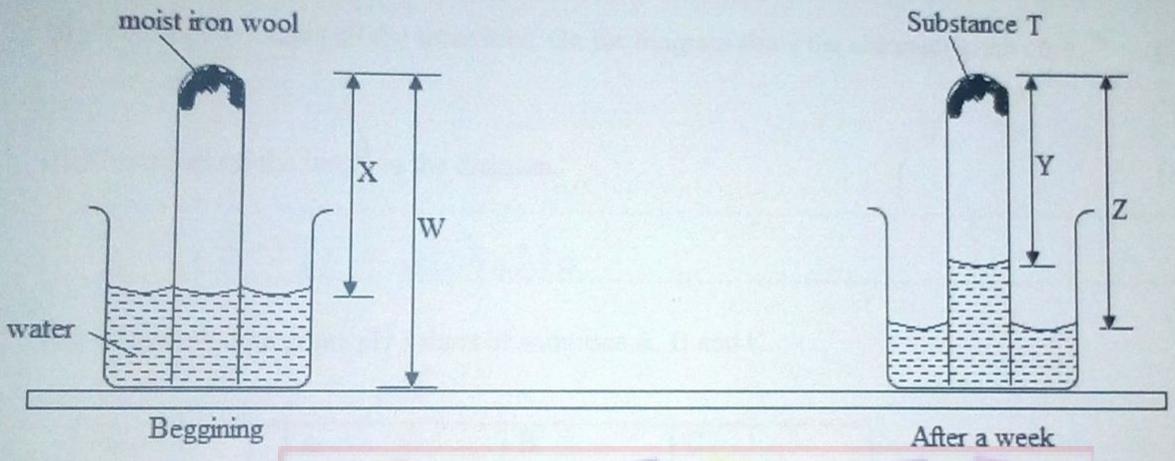
CHEMISTRY FORM 4 MARKING SCHEME

1. A student set up the following apparatus in order to determine percentage of Oxygen by volume of air.



i. State and explain the observations made on the moist iron wool at the end of theexperiment (after a week). (1mk)

The grey moist iron wool turns to red brown.

Iron, water & oxygen combine to form rust (hydrated iron (III) oxide)

ii. Give the expression of the percentage of oxygen by volume in the air in terms of the letter X, W, Y and Z in the diagram. (1mk)

$\frac{Z-Y}{X} \times 100$

iii. Write the formula of substance T. (1mk)

$Fe_2O_3 \cdot H_2O$

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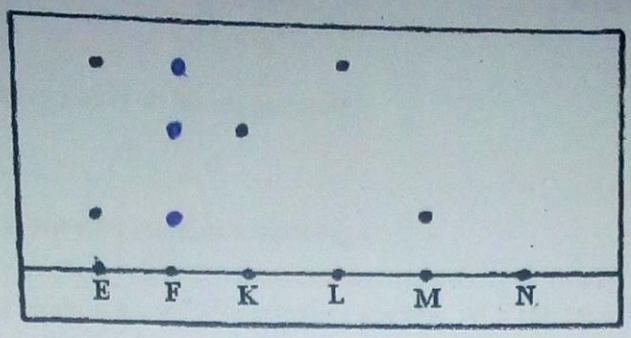
2. The paper chromatography below shows the identification of unknown metal ions E and F. Thereference ions are K,L,M and N are shown. The experiment was done in ascending method.



(i) Name the ions in the mixture E. (1mk)

M & L

(ii) Mixture F contains all the three ions. On the diagram show the chromatogram of F. (1mk)

(iii)Comment on the ion N in the diagram. (1mk)

It is insoluble

3. The following data gives pH values of solutions A, B and C.

Solution	A	B	C
PH	13.6	6.9	1.3

(i) Which solution named produce carbon (IV) oxide where reacted with a carbonate? (1mk)

C

(ii) Write an ionic equation to show how the above reaction a(i) would be represented (1mk)

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

(iii)What would be the colour of solution A after adding a few drops of phenolphthalein? (1mk)

Pink

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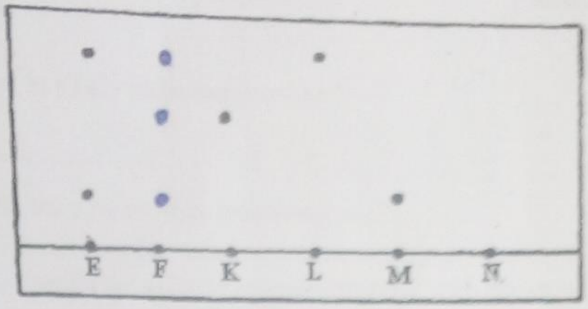

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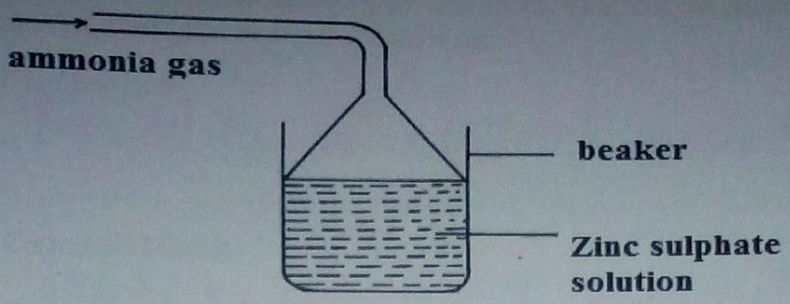
12. A student prepared ammonia gas and let it into a solution of zinc sulphate using the arrangement shown below.



a) State and explain the observations that were made in a beaker. (2mks)

White precipitate formed which eventually dissolved with more ammonia gas.
Zinc hydroxide (white ppt) dissolve in excess ammonia.

b) Write the ionic equation involving zinc ions. (1mk)

$Zn^{2+}_{(aq)} + 2OH^-_{(aq)} \longrightarrow Zn(OH)_{2(s)}$

$Zn(OH)_{2(s)} + NH_{3(aq)} \longrightarrow [Zn(NH_3)_4]^{2+} + 2OH^-_{(aq)}$

13. The melting point of phosphorus trichloride is 90°C while that of magnesium chloride in 715°C in terms of structures and bonding explain the differences in their melting point. (3mks)

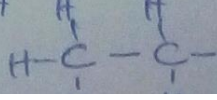
Magnesium chloride exists as giant ionic structure with strong ionic bonds – hence much energy to break
Phosphorus trichloride exist as molecules requiring less heat to break weak van-der Waals forces.

14. (a) Name one property of Neon that makes it possible to be used in electric lamps. (1mk)

unreactive hence provide unreactive environment.

(b) Name any other use of Argon other than in electric lamps. (1mk)

15. A compound with molecular C_2H_6O reacts with sodium metal forming a basic solution.
(a) Draw and name the structure of the compound. CH_3CH_2OH (2mks)



Ethanol

CHEMISTRY FORM 4 MARKING SCHEME

(b) To which homologous series does the compound C_2H_6O belong? (1mk)

Alkanols.

a) In the fractional distillation of liquid air explain how each of the following components are removed prior to liquifaction of air.

i) Dust particles (1mk)

Removed by the electronic precipitation of the dust.

ii) Carbon (iv) Oxide (1mk)

Passing the air through concentrated solution of Sodium hydroxide.

iii) Water Vapour (1mk)

Freezing the air to @ −25°c to remove water in form of ice.

17. A sample of water is suspected to contain Zinc ions and chloride ions. Give a test on how you can identify the presence of the ions. (3mks)

To one portion of the sample add few drops of Sodium hydroxide until excess ~~White precipitate dissolve in excess~~ Zn^{2+}, Pb^{2+}

To one portion add ammonia solution dropwise until in excess. White precipitate dissolving in excess shows the presence of Zn^{2+}.

To another portion add $Pb(NO_3)_2$ solution and warm. White precipitates soluble on warming shows the presence of Cl^- ions.

*18. The mass of a solution of salt of sodium chloride is 70.0g. This solution has 10.0g of sodium chloride dissolved in it. The solubility of this salt 30g/100g of water at 25°C. 12.0g of sodium chloride salt are added to the solution at 25°C. How much sodium chloride will remain undissolved? (3mks) *

NaCl = 10.0g
Total = 70.0g
Water = 70 − 10 = 60g.

100g of H_2O contains 30g
60g of H_2O → ?

$\frac{60 \times 30}{100} = 18g$

The solute should contain only 18g of salt

8g should be added but 16g added.
∴ 4g is in excess.

Undissolved = 4g of NaCl.

CHEMISTRY FORM 4 MARKING SCHEME

When 23 .2g of a hydrocarbon whose empirical formula is C_2H_5 was allowed to evaporate it occupied 9.6dm^3 at R.T.P what is its molecular formula? (molar gas volume= 24dm^3 at R.T.P) (3mks)

$9.6dm^3 \longrightarrow 23.2g$

$24dm^3 \longrightarrow \frac{24 \times 23.2}{9.6}$

$= 58g$

$(C_2H_5)_n = 58$

$(24+5)n = 58$

$29n = 58$

$n = \frac{58}{29}$

$n = 2$

$(C_2H_5)_2$

C_4H_{10}

20. Study the information below and answer the questions that follow.

Number of carbon atoms for molecule	Relative molecular mass of hydrocarbon
2	26
3	40
4	54

(a) Write the general formula of hydrocarbon in the table. (½mk)

C_nH_{2n-2}

(b) Predict the relative molecular mass of the hydrocarbon with 5 carbon atoms. (½mk)

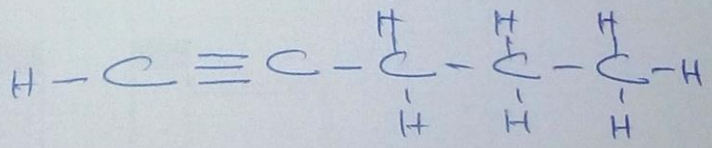
$C_5H_{10-2} = C_5H_8 = (12 \times 5) + 8 = 68$

$54 + 14 = 68$

$60 + 8$

(c) Determine the molecular formular of hydrocarbon in (b) and draw its structural formula (H=1, C=12). (2mks)

C_5H_8



21. X g of sodium hydroxide were dissolved in distilled water to make 100cm^3 of solution. 50cm^3 of this solution required 50cm^3 of 2M nitric(v) acid for complete neutralization. Calculate the mass x of sodium hydroxide dissolved. (Na = 23, O = 16, H=1) (3mks)

$NaOH_{(aq)} + HNO_{3(aq)} \longrightarrow NaNO_{3(aq)} + H_2O_{(l)}$

$1000cm^3 \longrightarrow 2mols$

$50cm^3 \longrightarrow \frac{50 \times 2}{1000}$

$= 0.1mols$

NaOH : HNO_3

1 : 1

∴ NaOH & $50cm^3$

$= 0.1mols$

$50cm^3 \longrightarrow 0.1mols$

$100cm^3 \longrightarrow \frac{100 \times 0.1}{50}$

$= 0.2mols$

$\Rightarrow 0.2 \times 40 = 8g$ NaOH

dissolve in $100cm^3$

CHEMISTRY FORM 4 MARKING SCHEME

When the oxide of element H was heated with powdered carbon, the mixture glowed and carbon(IV)oxide gas was formed. When the experiment was repeated using the oxide of element J, there was no apparent reaction.

(a) Suggest one method that can be used to extract element J from its oxide. (1mk))

Electrolysis of the molten oxide of J

(b) Arrange the elements H, J and carbon in the order of their decreasing reactivity. (1mk)

J, C, H

23. When a sample of concentrated sulphuric (IV) acid was left in an open beaker in a room for two days the volume was found to have increased slightly.

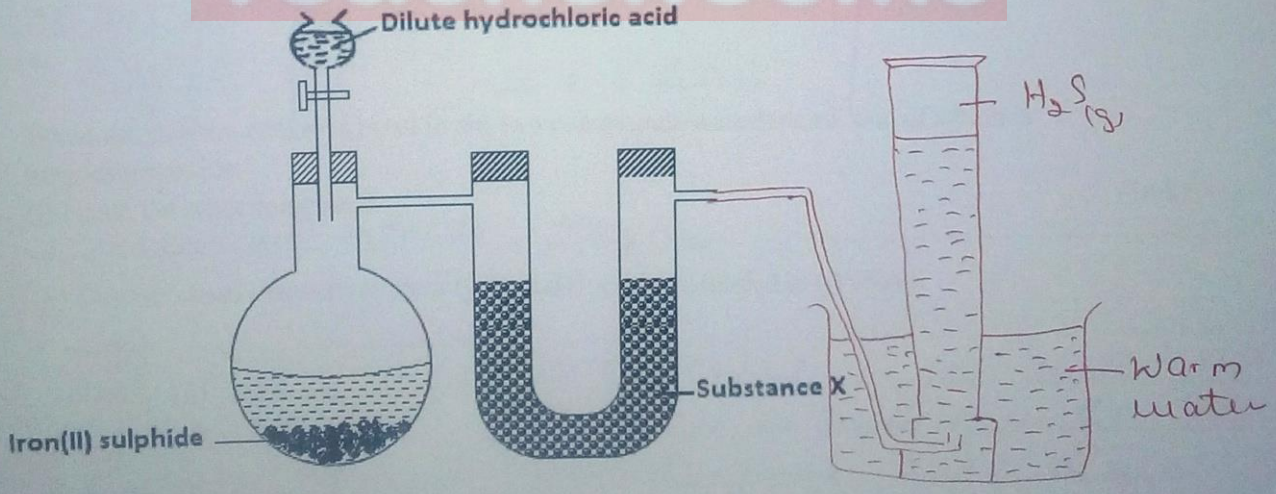
(a) What property of concentrated sulphuric (IV) acid is shown by the above reaction? (1mk)

Hygroscopy

(b) State one use of concentrated sulphuric(IV) acid that depends on the property namedabove. (1mk)

Used as a drying agent for most gases.

24. The diagram below shows a set used to prepare gas Z.



a) Complete the diagram to show how gas z is collected. (1mk)

b) Write an equation for the reaction between iron(II)sulphide and dilute hydrochloric acid. (1mk)

$FeS_{(s)} + 2HCl_{(aq)} \longrightarrow FeCl_{2(aq)} + H_2S_{(g)}$

c) Name substance x. (1mk)

Anhydrous Calcium chloride

CHEMISTRY FORM 4 MARKING SCHEME

A beaker contained 75.0cm^3 of acqueous copper(ii) sulphate at 23.7^{0}c, when a scrap iron was added to the solution the temperature rose to 29.3^{0}c. If 5.83g of copper were deposited, calculate molar enthalpy change in kj/mol.(specific heat capacity of solution = 4.2Jg^{-1}k^{-1}, density of solution = 1g/cm^3, Cu = 64) (2mks)

Mass of $CuSO_4$ = 75.0g

ΔT = 5.6 K

$Q = 75 \times 5.6 \times 4.2$

= 1,764 J

= 1.764 KJ

5.83g of Cu → 1.764 KJ

64g of Cu → $\frac{64 \times 1.764}{5.83}$

= 19.36 KJmol^{-1}

26. Butane burns in air according to the equation below.

$2C_4H_{10(g)} + 13O_{2(g)} \longrightarrow 8\,CO_{2(g)} + 10H_2O_{(l)}$

What volume of butane must be burnt in oxygen to give 11 g of carbon (IV) oxide at r.t.p? (Molar gas volume at r.t.p= 24.0l; C= 12; 0= 16; H=1.0) (3mks)

Moles of CO_2

$\Rightarrow \frac{11}{44} = \frac{1}{4} = 0.25$ moles

From mole ratios

8 ⇒ 0.25 moles

2 ⇒ $\frac{2 \times 0.25}{8}$

0.0625 moles of C_4H_{10}

1 mole → 24.0 litres

0.0625 moles →

$\frac{0.0625 \times 24}{1}$

= 1.5 litres

27. When magnesium ribbon is burnt in air, two compounds were formed, one of which is magnesium oxide:

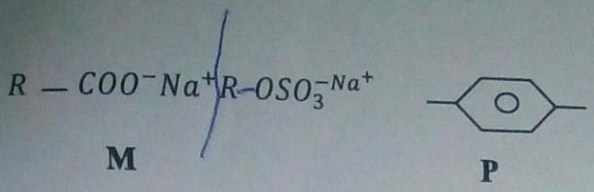
(i) Name the other compound. (1mk)

Magnesium nitride Mg_3N_2

(ii) Describe an experiment to identify the solid you have named in (i) above.

(1mk) Add drops of water to the solid, a gas with a pungent smell and fumes in contact with hydrogen chloride gas confirms that it was a nitride of magnesium

28. The structures below represent two cleaning agents M and P.



M

P

Which cleaning agent would be most suitable for use with water containing calcium sulphate. Give a reason. (2mks)

Cleansing agent P. Because it does not form insoluble salt (scum) with Calcium ions. It forms soluble salt which lathers even in hard water.