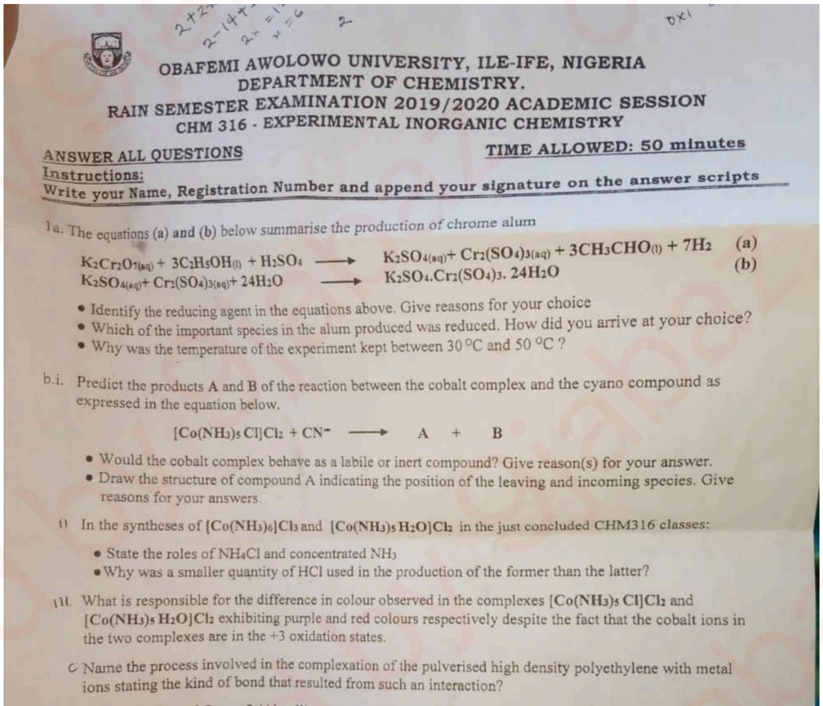
Exp 1: Synthesis of Tetraammineaquosulphatocopper(II) [Cu(NH3)4(H2O)(SO4)]:

1. Why is it necessary to weigh the copper sulfate on a clean piece of paper without colored strips or in a small beaker instead of directly on the balance pan?

Answer: Weighing the copper sulfate on a clean surface or in a small beaker ensures accuracy and prevents contamination from colored strips or residues that may affect the mass measurement. It



OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA
DEPARTMENT OF CHEMISTRY.
RAIN SEMESTER EXAMINATION 2019/2020 ACADEMIC SESSION
CHM 316 - EXPERIMENTAL INORGANIC CHEMISTRY

ANSWER ALL QUESTIONS **TIME ALLOWED: 50 minutes**

Instructions:
Write your Name, Registration Number and append your signature on the answer scripts

1a. The equations (a) and (b) below summarise the production of chrome alum

$$K_2Cr_2O_{7(aq)} + 3C_2H_5OH_{(l)} + H_2SO_4 \longrightarrow K_2SO_{4(aq)} + Cr_2(SO_4)_{3(aq)} + 3CH_3CHO_{(l)} + 7H_2 \quad (a)$$

$$K_2SO_{4(aq)} + Cr_2(SO_4)_{3(aq)} + 24H_2O \longrightarrow K_2SO_4.Cr_2(SO_4)_3.\ 24H_2O \quad (b)$$

- Identify the reducing agent in the equations above. Give reasons for your choice
- Which of the important species in the alum produced was reduced. How did you arrive at your choice?
- Why was the temperature of the experiment kept between 30 °C and 50 °C ?

b.i. Predict the products A and B of the reaction between the cobalt complex and the cyano compound as expressed in the equation below.

$$[Co(NH_3)_5Cl]Cl_2 + CN^- \longrightarrow A + B$$

- Would the cobalt complex behave as a labile or inert compound? Give reason(s) for your answer.
- Draw the structure of compound A indicating the position of the leaving and incoming species. Give reasons for your answers.

ii In the syntheses of $[Co(NH_3)_6]Cl_3$ and $[Co(NH_3)_5H_2O]Cl_2$ in the just concluded CHM316 classes:

- State the roles of NH_4Cl and concentrated NH_3
- Why was a smaller quantity of HCl used in the production of the former than the latter?

iii. What is responsible for the difference in colour observed in the complexes $[Co(NH_3)_5Cl]Cl_2$ and $[Co(NH_3)_5H_2O]Cl_2$ exhibiting purple and red colours respectively despite the fact that the cobalt ions in the two complexes are in the +3 oxidation states.

c Name the process involved in the complexation of the pulverised high density polyethylene with metal ions stating the kind of bond that resulted from such an interaction?

helps to obtain precise and reliable results.

2. Why is it important to carry out the remaining steps under a fume hood?

Answer: Carrying out the remaining steps under a fume hood is essential because the addition of concentrated ammonia solution (conc. NH3) may release ammonia gas, which can be hazardous if inhaled in large quantities. The fume hood provides proper ventilation, ensuring a safe working environment and preventing the accumulation of noxious gases.

3. What is the purpose of adding methanol to the solution after the formation of the complex?

Answer: The addition of methanol aims to induce the precipitation of the complex compound [Cu(NH3)4(H2O)(SO4)]. Methanol reduces the solubility of the complex, causing it to come out of solution as a solid precipitate. This step allows for the separation and collection of the desired product.

4. How would you verify the formation of the complex compound?

Answer: The formation of the complex compound can be verified through various means, such as spectroscopic techniques. UV-Visible spectroscopy can be used to analyze the absorption spectra of the solution and confirm the presence of characteristic absorption bands for the complex. Additionally, the color change from the initial blue copper sulfate solution to the deep blue precipitate upon the addition of ammonia and methanol serves as visual evidence of the formation of the complex compound.

5. What potential sources of error could impact the accuracy of the experiment?

Answer: Some potential sources of error in the experiment include incomplete dissolution of the copper sulfate, loss of material during transfer or filtration, inaccuracies in measurement, and incomplete removal of moisture during drying. Additionally, variations in the concentration or purity of the reagents used may introduce uncertainties in the final product.

EXPERIMENT ONE

Preparation of Tetraammineaquosulphatocopper(II) $[Cu(NH_3)_4(H_2O)(SO_4)]$

Weigh out 7.0 g of $CuSO_4 \cdot 5H_2O$ on a on a clean piece of paper without coloured strips or a small beaker and not directly on the balance pan. Transfer the weighed solid copper sulphate to a 125mL Erlenmeyer flask and add 1.5 mL of water (minimum but enough amount of water to dissolve the salt). Gently heat the flask to dissolve the solid, then cool to room temperature. Carry out the remaining steps under the hood. Add conc. NH_3 solution, a few mL at a time shaking the flask constantly until the first precipitate has completely dissolved. All the copper should now be present in solution as the complex ion $[Cu(NH_3)_4]^{2+}$. Add 10 mL of methanol to the solution; this should result in the formation of deep blue precipitate of $[Cu(NH_3)_4(H_2O)(SO_4)]$. These reactions are represented in the equation below:

introduction of ligand

enough free ion to form Ammonia.

$$[Cu(H_2O)_6]^{2+}_{(aq)} + SO^{2-}_{4(aq)} + 4NH_{3(l)} \underset{\Delta}{\rightarrow} [Cu(NH_3)_4(H_2O)(SO_4)]_{(s)} + 5H_2O_{(l)}$$

Filter off the solution under suction through a Buchner funnel. Dry the solid by pressing it between two pieces of filter paper. Transfer the dried crystals into weighed sample bottle and re-weigh. Stopper the sample bottle and label it with your name, the formula of the compound, and the yield.

$$\frac{\text{Actual yield}}{\text{Theory yield}} \times 100$$

$CuSO_4 . 5H_2O$

Moving to experiment 2>>>>

Exp2: Reagents and their purposes:

$CoCl_2$: Cobalt(II) chloride is the starting material for the synthesis. It provides the cobalt ions needed for the formation of the complex compound. $CoCl_2$ is chosen because it is readily available and easily soluble in water.

Water (H_2O): Water is used to dissolve the solid $CoCl_2$ and create an aqueous solution. It helps in the initial dissolution of the cobalt chloride.

NH_4Cl: Ammonium chloride is added to the solution to provide chloride ions that will react with the cobalt ions to form the desired complex compound.

Concentrated ammonia solution (conc. NH_3): Ammonia acts as a complexing agent and helps in the formation of the pentammineaquocobalt(III) complex. It acts as a ligand, donating electron pairs to form coordinate covalent bonds with the cobalt ion. The addition of ammonia stabilizes the cobalt complex and determines its coordination number.

Hydrogen peroxide (H_2O_2): Hydrogen peroxide serves as an oxidizing agent. It oxidizes the cobalt(II) ions to cobalt(III) ions, which are required for the formation of the complex.

Concentrated hydrochloric acid (conc. HCl): Hydrochloric acid is added to the solution to promote the precipitation of the complex compound and remove impurities.

Changes observed with the addition of ammonia:

i. A few drops of ammonia added to the aqueous solution of cobalt chloride:

Initially, when a few drops of ammonia are added, the solution may show no visible change.

However, as ammonia reacts with the cobalt chloride, it forms a complex compound, $[Co(NH_3)_x(H_2O)_y]^{3+}$, where x represents the number of ammonia ligands and y represents the number of water ligands.

The addition of a few drops of ammonia may cause the solution to turn pale pink or light purple, indicating the formation of the complex.

ii. Excess ammonia added to the solution:

When excess ammonia is added, it further increases the concentration of the complex compound.

The solution becomes a deeper shade of pink or purple, indicating a higher concentration of the complex.

No further precipitation occurs at this stage as the complex remains soluble due to the excess ammonia.

Reactions for each step:

Dissolution of cobalt chloride in water:

$CoCl_2(s) + H_2O(l) \longrightarrow CoCl_2(aq)$

Formation of the complex compound $[Co(NH_3)_5H_2O]Cl_3$:

$CoCl_2(aq) + NH_4Cl(aq) + 6NH_3(aq) + H_2O_2(aq) \longrightarrow [Co(NH_3)_5H_2O]Cl_3(aq) + H_2O(l)$

Precipitation of the complex compound with hydrochloric acid:

$[Co(NH_3)_5H_2O]Cl_3(aq) + HCl(aq) \longrightarrow [Co(NH_3)_5H_2O]Cl_3(s) + H^+(aq)$

General equation for the experiment:

$2[CoCl_2(aq)] + 10NH_3(aq) + H_2O_2(aq) + 10H_2O(l) + 2HCl(aq) \longrightarrow 2[Co(NH_3)_5H_2O]Cl_3(s) + 10H_2O(l) + 2H^+(aq)$

Exp 2 jottings, but in the manual what I saw was dark red cobalt solution, which is different from what I saw online here

Still on exp2 👇🏾👇🏾👇🏾$[Co(NH_3)_5H_2O]Cl_3$:

Why is it necessary to dissolve $CoCl_2$ in water before adding other reagents?

Answer: Dissolving $CoCl_2$ in water allows for the formation of an aqueous solution, ensuring the cobalt ions are in a suitable state for further reactions. It helps in achieving homogeneity and allows for efficient mixing with other reagents.

What is the purpose of adding ammonium chloride (NH4Cl) to the solution?

Answer: Ammonium chloride is added to provide chloride ions (Cl-) that react with the cobalt ions to form the desired complex compound [Co(NH3)5H2O]Cl3. The presence of chloride ions is crucial for the complex formation.

Why is concentrated ammonia solution (conc. NH3) used in excess?

Answer: Excess ammonia is used to ensure the complete complexation of cobalt ions. The excess ammonia provides an excess of ammonia ligands, which helps stabilize the complex compound and increases its concentration in the solution.

What role does hydrogen peroxide (H2O2) play in the synthesis?

Answer: Hydrogen peroxide acts as an oxidizing agent, converting cobalt(II) ions to cobalt(III) ions. This oxidation step is necessary for the formation of the [Co(NH3)5H2O]Cl3 complex.

Why is concentrated hydrochloric acid (conc. HCl) added at the end?

Answer: The addition of concentrated hydrochloric acid is done to promote the precipitation of the complex compound [Co(NH3)5H2O]Cl3. The acid provides chloride ions that react with the complex, causing it to precipitate out of solution.

How would you determine the yield (%) of the product?

Answer: The yield (%) of the product can be calculated by dividing the actual mass of the obtained product by the theoretical mass of the product, then multiplying by 100. The actual mass is obtained by weighing the dry crystals after filtration and drying, while the theoretical mass is calculated based on the stoichiometry of the reaction and the amount of starting materials used.

Moving to experiment 3>>>>

Name and reason for each reagent used in Experiment 3:

CoCl2: CoCl2 is used as the source of cobalt ions in the synthesis. It provides the necessary cobalt ions for the formation of the complex compound.

NH4Cl: Ammonium chloride is added to provide chloride ions (Cl-) that react with the cobalt ions to form the desired complex compound [Co(NH3)6]Cl3.

Activated charcoal (Norite): Activated charcoal is used as an adsorbent to remove impurities from the reaction mixture. It helps to purify the solution and improve the quality of the final product.

Concentrated aqueous ammonia (conc. NH_3): Concentrated aqueous ammonia is used as a complexing agent. It forms ammine ligands with cobalt ions, facilitating the formation of the $[Co(NH_3)_6]Cl_3$ complex.

Hydrogen peroxide (H_2O_2): Hydrogen peroxide acts as an oxidizing agent in the reaction. It oxidizes cobalt(II) ions to cobalt(III) ions, which are necessary for the formation of the complex compound.

Concentrated hydrochloric acid (conc. HCl): Concentrated hydrochloric acid is added to the filtrate to cause the precipitation of the orange-colored $[Co(NH_3)_6]Cl_3$ complex.

Changes observed when ammonia is added to the aqueous solution of copper sulphate:

i. A few drops of ammonia: The addition of a few drops of ammonia to the copper sulphate solution will result in the formation of a blue precipitate of copper hydroxide. This is due to the reaction between copper ions (Cu^{2+}) and hydroxide ions (OH^-) from ammonia, forming an insoluble compound.

ii. Excess ammonia: When excess ammonia is added, the blue precipitate of copper hydroxide will dissolve, forming a deep blue solution of the complex compound $[Cu(NH_3)_4(H_2O)_2]^{2+}$. This complex is formed by the coordination of ammonia ligands to the copper ion, stabilizing it in solution.

Reactions for each step in Experiment 3:

Dissolution of $CoCl_2$ in water:

$CoCl_2(s) + H_2O(l) \rightarrow CoCl_2(aq)$

Formation of the complex compound $[Co(NH_3)_6]Cl_3$:

$CoCl_2(aq) + NH_4Cl(s) + 6NH_3(aq) + H_2O_2(aq) \rightarrow [Co(NH_3)_6]Cl_3(aq) + H_2O(l)$

Precipitation of the complex compound with hydrochloric acid:

$[Co(NH_3)_6]Cl_3(aq) + HCl(aq) \rightarrow [Co(NH_3)_6]Cl_3(s) + H^+(aq)$

General equation for the experiment:

$2CoCl_2(aq) + NH_4Cl(s) + 6NH_3(aq) + H_2O_2(aq) + 20H^+(aq) \rightarrow 2[Co(NH_3)_6]Cl_3(s) + 12H_2O(l)$

In Experiment 2, we synthesized Pentammineaquocobalt(III) Chloride [Co(NH3)5H2O]Cl3. The volume of HCl in Experiment 3 is higher than that of Experiment 2 because the excess hydrochloric acid is used to ensure the complete precipitation of the complex compound [Co(NH3)6]Cl3. The higher volume of HCl helps to provide an excess of chloride ions, which reacts with the complex, causing.

The higher volume of HCl in Experiment 3 compared to Experiment 2 is intended to provide an excess of chloride ions for the complete precipitation of the complex compound [Co(NH3)6]Cl3, ensuring a purer product.

Moving to experiment 4>>>>

Experiment 4---

Name and state the reason why each reagent is used:

a) For Part A:

Pentammineaquocobalt(III) chloride [Co(NH3)5H2O]Cl3: This complex compound is used as the starting material for the synthesis. It provides the cobalt ion necessary for the reaction.

Bunsen burner: The burner is used to provide heat, which aids in the decomposition and transformation of the complex compound.

Hydrochloric acid (HCl): It is used to remove any remaining impurities and excess reactants, leading to the formation of the final product.

b) For Part B:

Complexes from Experiments One and Three: These are the synthesized complex compounds from previous experiments, namely [Cu(NH3)4(H2O)(SO4)] and [Co(NH3)6Cl3].

Water: It is used as a solvent to dissolve the complexes for further observation and testing.

Concentrated hydrochloric acid (HCl): It is added to observe any changes in color or behavior of the complex solutions.

Intelligent questions and answers for Part A and Part B:

Part A:

Q1: Why is the pentammineaquocobalt(III) chloride [Co(NH3)5H2O]Cl3 heated on the wire gauze?

A1: The heating on the wire gauze allows controlled decomposition of the complex, leading to the formation of the desired product, pentamminechlorocobalt(II) chloride [Co(NH3)4Cl2].

Q2: Why is hydrogen peroxide (H2O2) not mentioned as a reagent in Part A?

A2: Hydrogen peroxide is not explicitly mentioned as a reagent, but it is likely present in the concentrated aqueous ammonia (NH3) solution used. It aids in the decomposition of the complex compound during the reaction.

Part B:

Q1: What is the purpose of adding concentrated hydrochloric acid (HCl) to the complex solutions?

A1: The addition of HCl helps to test the relative lability of the complex ions. It can cause ligand substitution reactions, resulting in changes in color or formation of new compounds.

Q2: How does the addition of HCl affect the [Cu(NH3)4(H2O)(SO4)] complex solution?

A2: The addition of HCl to the [Cu(NH3)4(H2O)(SO4)] solution may result in the replacement of some ligands, leading to the formation of new complexes or changes in the color and appearance of the solution.

Reactions and general equation:

Part A:

The reaction for the synthesis of pentamminechlorocobalt(II) chloride [Co(NH3)4Cl2] can be represented as follows:

[Co(NH3)5H2O]Cl3 → Heating → [Co(NH3)4Cl2] + H2O + HCl

Part B:

The reaction between the complexes and HCl can be represented generally as ligand substitution reactions:

[Cu(NH3)4(H2O)(SO4)] + HCl → [Cu(NH3)4(H2O)Cl] + H2SO4

[Co(NH3)6Cl3] + HCl → [Co(NH3)5Cl]Cl2 + HCl2

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From Part B of experiment 4, which of the complex is labile And which is Inert?, And why?

From Part B of Experiment 4, the $[Cu(NH_3)_4(H_2O)(SO_4)]$ complex is labile, while the $[Co(NH_3)_6Cl_3]$ complex is inert.

Reason:

Labile Complex: $[Cu(NH_3)_4(H_2O)(SO_4)]$

The $[Cu(NH_3)_4(H_2O)(SO_4)]$ complex is labile because it undergoes ligand substitution reactions easily. When concentrated hydrochloric acid (HCl) is added, it can replace the water (H_2O) ligand, resulting in the formation of $[Cu(NH_3)_4(H_2O)Cl]$. This substitution reaction occurs because the Cu(II) ion in the complex has an incomplete d-orbital, making it more susceptible to ligand exchange. The labile nature of the complex allows for the facile replacement of one ligand with another.

Inert Complex: $[Co(NH_3)_6Cl_3]$

The $[Co(NH_3)_6Cl_3]$ complex is inert because it exhibits a low reactivity and does not readily undergo ligand substitution reactions. When concentrated hydrochloric acid (HCl) is added, the complex remains unchanged. This inert behavior can be attributed to the high stability and coordination of the cobalt(III) ion in the complex. The octahedral coordination geometry and the presence of six ammonia (NH_3)

ligands around the cobalt ion contribute to the inertness of the complex, as the ligands are tightly bound and do not easily exchange with other species.

In summary, the labile complex [Cu(NH3)4(H2O)(SO4)] undergoes ligand substitution reactions easily, while the inert complex [Co(NH3)6Cl3] shows a low reactivity and does not readily undergo ligand exchange due to its high stability and tightly bound ligands.

Exp 5.... Q1: What is the purpose of adding sodium hydroxide (NaOH) to the cobalt complex in Experiment 5?

Answer: Sodium hydroxide is added to alkalize the solution, driving off the ammonia gas released from the complex upon heating. It ensures the complete expulsion of ammonia and allows for further reactions.

Q2: Why is potassium iodide (KI) added to the alkalized solution in Experiment 5?

Answer: Potassium iodide reacts with cobalt(III) ions to form cobalt(III) iodide (CoI3), a reddish-brown precipitate. This step helps in the separation and estimation of cobalt(III) in the complex.

Q3: What is the role of concentrated hydrochloric acid (HCl) in Experiment 5?

Answer: Concentrated hydrochloric acid is used to acidify the solution after the reaction with potassium iodide. Acidification converts cobalt(III) iodide back to cobalt(III) ions, facilitating titration.

Q4: Why is sodium thiosulfate (Na2S2O3) used as a titrant in Experiment 5?

Answer: Sodium thiosulfate is a reducing agent that reacts with liberated iodine (I2) in the solution. The titration of iodine with sodium thiosulfate allows for the determination of the amount of cobalt(III) in the cobalt complex.

Q5: How is the percentage of cobalt(III) in the cobalt complex calculated in Experiment 5?

Answer: The percentage of cobalt(III) is calculated by dividing the moles of cobalt(III) by the initial mass of the sample and multiplying by 100. The moles of cobalt(III) are determined from the stoichiometry of the reaction and the volume of sodium thiosulfate solution used in the titration

Moving to experiment 6 CHROME ALUM, WHERE REAL WORK STARTS🥲>>>>

EXP. 6:

Why is sulfuric acid added to the potassium dichromate solution?

Sulfuric acid is added to acidify the solution and create the necessary conditions for the reduction of potassium dichromate. It helps in facilitating the reaction and converting the hexavalent chromium to the trivalent form.

Why is ethanol used in the preparation of chrome alum?

Ethanol acts as the reducing agent in the reaction, converting the hexavalent chromium in potassium dichromate to trivalent chromium, which is present in chrome alum. It plays a crucial role in the reduction process.

What is the purpose of maintaining the temperature below a certain limit during the addition of sulfuric acid and ethanol?

Controlling the temperature is essential to prevent unwanted side reactions and ensure the desired reaction proceeds efficiently. Excessive heat can lead to decomposition or evaporation of the solution, affecting the quality and yield of the product.

How are the violet-colored crystals of chrome alum separated from the mother liquor?

The separation of crystals from the mother liquor can be achieved through methods such as filtration or decantation. Filtration involves passing the solution through a filter medium, allowing the crystals to be retained while the liquid passes through. Decantation involves carefully pouring off the liquid while leaving the crystals at the bottom of the container.

Why is it necessary to dry the crystals before weighing?

Drying the crystals removes any residual moisture, ensuring accurate weighing and determination of the yield. Moisture content can affect the mass of the crystals, leading to inaccurate measurements.

Please note that the answers provided are based on the information given in the experimental guide.

1. Identify the reducing agent in Experiment 6, give reason for this.

2. Which of the species in the alum produced was reduced? how did you arrive at your choice?

3. Why was the temperature kept between 30°C to 50°C?

✅The reducing agent in Experiment 6 is ethanol (C2H5OH).

Reason: Ethanol acts as a reducing agent by donating electrons to the hexavalent chromium (Cr(VI)) present in potassium dichromate (K2Cr2O7). It undergoes oxidation itself while reducing chromium from +6 to +3 oxidation state. The alcohol group (-OH) in ethanol is oxidized to aldehyde or ketone, depending on the reaction conditions, in the process of reducing chromium. This transfer of electrons from ethanol to chromium results in the conversion of Cr(VI) to Cr(III) in the formation of chrome alum.

✅The species that was reduced in the formation of chrome alum is hexavalent chromium (Cr(VI)).

Reason: Potassium dichromate (K2Cr2O7) is the source of hexavalent chromium in the experiment. During the reaction with ethanol, the Cr(VI) ions are reduced to trivalent chromium (Cr(III)) ions, which are present in chrome alum. The change in oxidation state from +6 to +3 indicates the reduction of Cr(VI) to Cr(III). The violet-colored crystals obtained are characteristic of the presence of trivalent chromium ions in chrome alum.

✅The temperature was kept between 30°C to 50°C to control the reaction rate and prevent excessive heat buildup.

Reason: The temperature range specified in the experiment helps maintain optimal reaction conditions. Temperatures above 50°C could lead to undesirable side reactions or evaporation of the solution, affecting the yield and quality of the product. By limiting the temperature to 30°C to 50°C, the reduction of potassium dichromate proceeds at a suitable rate while minimizing the risk of thermal decomposition or loss of volatile components. Additionally, controlling the temperature allows for better control over the reaction progress and ensures a more controlled formation of the desired chrome alum crystals.

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Reason: The temperature range specified in the experiment helps maintain optimal reaction conditions. Temperatures above 50°C could lead to undesirable side reactions or evaporation of the solution, affecting the yield and quality of the product. By limiting the temperature to 30°C to 50°C, the reduction of potassium dichromate proceeds at a suitable rate while minimizing the risk of thermal decomposition or loss of volatile components. Additionally, controlling the temperature allows for better control over the reaction progress and ensures a more controlled formation of the desired chrome alum crystals.

Remaining 7&8😞

Here are the answers to the questions related to Experiment 7:

Chelate formation in Alum: Chelate formation refers to the bonding of a metal ion (in this case, aluminum) to a ligand (such as sulfate) through multiple coordination sites. In the case of alum, the aluminum ion (Al3+) forms chelate complexes with the sulfate ions ($SO4^{2-}$) in a crystal lattice structure. The chelate formation helps stabilize the structure of alum crystals and contributes to their unique properties.

Double metals in alum and the type of reaction they undergo: Alums have double metals because they are formed by the combination of two different metal ions. In the case of aluminum-based alum, it consists of potassium ions (M1) and aluminum ions (M2). The double metals undergo a redox reaction, where the aluminum ion is reduced while the other metal ion is oxidized. This redox reaction is responsible for the formation of the alum compound. ✅Digestion carried out in an acidic medium: The digestion process, which involves reacting aluminum foil with sulfuric acid, is carried out in an acidic medium to facilitate the reaction. The acidic environment helps to dissolve the aluminum metal and promote the formation of aluminum sulfate. It also helps to prevent the precipitation of other unwanted compounds during the reaction.

Confirmation of the gas tested with KMnO4: Potassium permanganate (KMnO4) solution is commonly used as an oxidizing agent and can indicate the presence of certain reducing agents. In Experiment 7, the gas evolved during the reaction between aluminum and sulfuric acid is tested with KMnO4 solution to check for the presence of any reducing gases, such as hydrogen (H2). If the KMnO4 solution turns from purple to colorless, it confirms the presence of a reducing gas.

Reason for baking the alum: Baking the alum product at 150 °C serves two purposes. Firstly, it helps to remove any residual moisture that may be present in the crystals, ensuring complete drying of the product. Secondly, baking at this temperature can enhance the crystal structure and stability of the alum compound, leading to improved physical properties and shelf life.

Relationship between insoluble matter, purity, and yield: The presence of insoluble matter in the produced alum can indicate impurities or incomplete reactions. Higher amounts of insoluble matter may suggest lower purity of the alum product. Additionally, the presence of insoluble matter can also affect the yield of the experiment as it contributes to the mass of the final product. Therefore, a higher yield may be obtained if the alum product has less insoluble matter and higher purity.

Better digestion observed in smaller-sized aluminum foils: Cutting the aluminum foils into smaller sizes increases their surface area, which provides more contact sites for the sulfuric acid to react with the aluminum. This increased surface area facilitates the reaction and enhances the digestion process, resulting in better dissolution of the aluminum and formation of aluminum sulfate

Remaining Exp 8!! The final Lap😞🥺🙏🏾 - Pulverized polyethylene ✅

Experiment 8, Questions along with their corresponding answers:

Question: What is the purpose of Part A in the preparation of calcium (II) complexes from polyethylene waste?

Answer: The purpose of Part A is to dissolve the polyethylene waste in kerosene, separate any impurities, and obtain purified polyethylene particulates.

Question: Explain the role of ethanol in Part A and Part B of the experiment.

Answer: Ethanol is added to prevent the formation of lumps during cooling. It aids in the precipitation of polyethylene particulates and helps in separating the particulates from the liquid.

Question: Why is it important to wash the obtained particulates with water until they are free of kerosene?

Answer: Washing the particulates with water removes any residual kerosene, which is important to ensure the purity of the final product and eliminate any potential contamination.

Question: What is the purpose of adding calcium chloride (CaCl2) in Part B of the experiment?

Answer: The addition of calcium chloride in Part B forms calcium (II) complexes with the dissolved polyethylene. This step allows for the formation of the desired calcium (II) complexes from the polyethylene waste.

Question: What precautions should be taken while handling the boiling mixture in both Part A and Part B?

Answer: Precautions should be taken to avoid inhaling fumes from the boiling mixture, as the fumes can be harmful. Proper ventilation or working in a fume cupboard is recommended to ensure safety.

Question: Why is it necessary to sun-dry the washed particulates before weighing them?

Answer: Sun-drying the washed particulates helps remove any remaining moisture, ensuring accurate weighing and calculation of the percentage yield of the product.

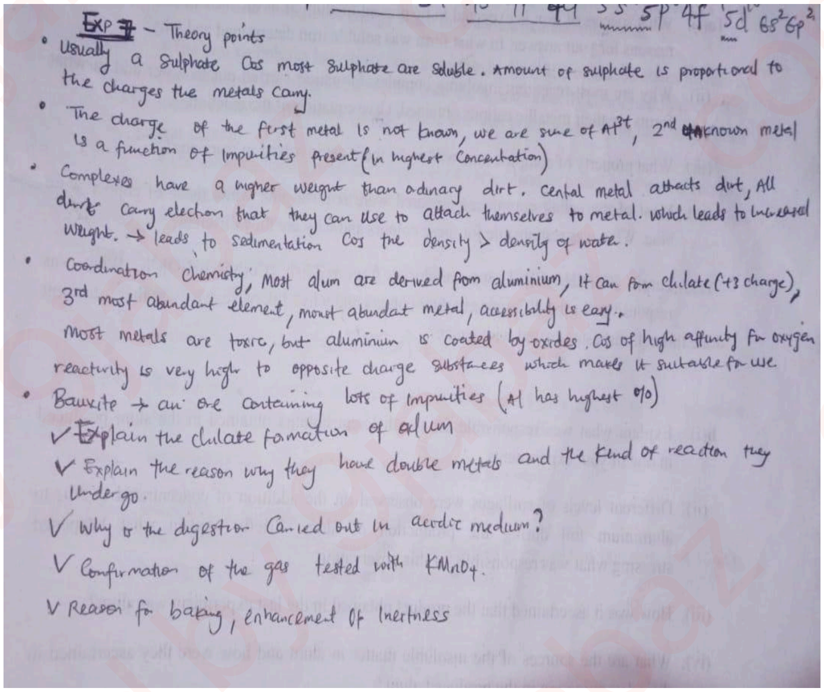
Question: What is the significance of calculating the percentage yield in this experiment?

Answer: Calculating the percentage yield provides an indication of the efficiency of the process and allows for evaluation of the success of converting polyethylene waste into viable products

PQ -The process involved in the complexation of the pulverized high-density polyethylene with metal ions is known as coordination or complex formation. In this process, the metal ions coordinate with the functional groups present in the polyethylene, forming coordination complexes.

PQ- The interaction between the metal ions and the functional groups of polyethylene results in the formation of coordination bonds. These bonds are typically characterized by the donation of electron pairs from the polyethylene's functional groups (such as oxygen or nitrogen) to the metal ion, forming coordinate covalent bonds.

If the containers used by the members of Group 2 contained rust, it could potentially have an effect on their product. Rust is a form of iron oxide, and if it comes in contact with the polyethylene during the process, it may introduce iron impurities into the final product. This can affect the purity and properties of the resulting complex, potentially altering its intended characteristics.



5p 4f 5d $6s^2 6p^2$

Exp 7 – Theory points

- Usually a Sulphate Cos most Sulphate are Soluble. Amount of sulphate is proportional to the charges the metals Carry.
- The charge of the first metal is not known, we are sure of Al^{3+}, 2nd ~~un~~known metal is a function of impurities present (in highest Concentration)
- Complexes have a higher weight than ordinary dirt. Central metal attracts dirt, All dirt carry electron that they can use to attach themselves to metal. which leads to increased weight. → leads to sedimentation Cos the density > density of water.
- Coordination Chemistry; Most alum are derived from aluminium, It can form chelate (+3 charge), 3rd most abundant element, most abundant metal, accessibility is easy.

  Most metals are toxic, but aluminium is coated by oxides. Cos of high affinity for oxygen reactivity is very high to opposite charge substances which makes it suitable for use
- Bauxite → an ore containing lots of impurities (Al has highest %)

✓ Explain the chelate formation of alum

✓ Explain the reason why they have double metals and the kind of reaction they undergo.

✓ Why is the digestion carried out in acidic medium?

✓ Confirmation of the gas tested with $KMnO_4$.

✓ Reason for baking, enhancement of Inertness