Coordinate Compound Experiment

Week of September 20th
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The week of September 27th
Experiment: Redox Titration of Oxalate with Permanganate
Quiz: Material in lab manual
Due next week: Synthesis of Coordination Compound lab report
Due this week: Pennies lab report

An Overview

• Coordination compounds are compounds that contain complexes.
  - A complex is an assembly of a metal ion and Lewis bases (ligands) bonded to it.
  - Ligands:
    1. can be negatively charged or neutral.
    2. can have one or more electron pairs to bond to the central atom.
    3. function as Lewis bases (electron-pair donors).
    4. Metal ions, particularly transition-metal ions, have empty valence orbitals.
      • Act as Lewis acids (electron-pair acceptors).
  • The bond formed between the metal ion and the ligand is the result of the sharing of a pair of electrons that was initially on the ligand.
    • In forming a complex, the ligands are coordinated to the metal, which makes the coordination sphere of the complex.
An Overview, con’t:

- The coordination compound to be made today is potassium trioxalatoferrate(III) trihydrate
  \[3K_2C_2O_4\cdot H_2O + FeCl_3 \rightarrow K_3[Fe(C_2O_4)_3]\cdot 3H_2O + 3KCl\]
  potassium oxalate hydrate   ferric chloride

- Today, you will be synthesizing this coordination compound and calculating the percent yield.

Stage I – The Preparation

1. Weigh into a preweighed 150mL beaker ~ 10g \(K_2C_2O_4\cdot H_2O\). Add ~25-30mL of \(H_2O\) and place the beaker on a hot plate to warm gently. Stir this solution until it becomes hot and the solid is completely dissolved.
2. Carefully remove the beaker from the heat and add 8mL of 1.85M \(FeCl_3\) solution. Stir well and cool the solution to 0°C in an ice-water bath to crystallize your product.
3. Decant the solution and save the solid material in the beaker.
4. Wash the solid by means of vacuum filtration. Speed dry the crystals by pulling air through them.
5. Spread the crystals out on a piece of paper towel to “paper dry” them, then weigh the dried product.
6. Enter all the masses, volumes and molarities you have recorded down into the Excel spreadsheet.

Outside of Class

1. Download the “raw data” from the instructor’s homepage. You will also use Excel to make a “class results” spreadsheet showing:
   - moles of \(K_2C_2O_4\cdot H_2O\)
   - moles of \(FeCl_3\)
   - theoretical yield of \(K_3[Fe(C_2O_4)_3]\cdot 3H_2O\)
   - experimental yield of \(K_3[Fe(C_2O_4)_3]\cdot 3H_2O\)
   - percent yield of \(K_3[Fe(C_2O_4)_3]\cdot 3H_2O\)
2. Use Excel to make a histogram showing the distribution of the percent yield results.
3. Answer the last two Discussion questions on your Coordination Compound handout and include your answers as part of your Discussion/Conclusion on your lab report.
In addition...

- For your individual results only, please include in your lab report the calculations for:
  - moles of K₂C₂O₄·H₂O
  - moles of FeCl₃
  - theoretical yield of K₃[Fe(C₂O₄)₃]·3H₂O
  - experimental yield of K₃[Fe(C₂O₄)₃]·3H₂O
  - percent yield of K₃[Fe(C₂O₄)₃]·3H₂O

- Calculations may be hand-written. Include this as a part of your “Results and Calculations” section in your lab report. Pay attention to your sig figs.