

REPORT SHEETS

Name: Alexander

TA: _____ Section: _____ Due Date: _____ Date Submitted: _____

Report Sheets are to be turned in by the indicated due date. Each student will turn in their own worksheet and plots. Students caught bringing pre-answered Report Sheets into lab will receive a zero for that lab that cannot be replaced.

Synthesis and Percent Yield

Write the balanced reaction for your synthesis below:

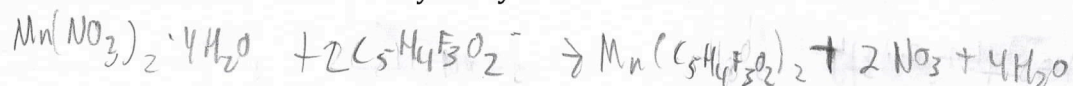


TABLE 7.2 Results	
Formula of Metal Nitrate from Container	$\text{Mn}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$
Molar Mass of Metal Nitrate (mg/mmol or g/mol)	251.01
mg of Starting Sample	150
mmol of M in Starting Sample	0.5976
Theoretical mmol of Product	0.5976
Molar Mass of Product (mg/mmol or g/mol)	361.0976
Theoretical Yield of Product (mg)	215.7868
Maximum Yield Product plus Paper Minus Paper (mg)	180
Maximum Percent Yield	83.41567%
Practical Yield Transferred to Beaker (mg)	180
Practical Percent Yield	83.41567%

Characterization

Identification by Visual Inspection

1. Record the colors and observations.

TABLE 7.3 Identification by Color

Metal	Solid Reactant	Reactant in Solution	Precipitant after Addition of 2,4-Pentanedione	Product Dried	Commercial Product Dried	Product in Acetone
Mn(II)	clear	yellow	yellow	yellow	yellow	yellow
Fe(III)	clear	red	red	red	red	red
Co(II)	blue	pink	pink	pink	pink	pink
Ni(II)	blue	blue	blue	blue	blue	blue
Cu(II)	greenish/white	blue	blue	blue	blue	blue

2. Observations recorded during synthesis (include other groups):

UV-Vis Spectra

Metal used: Nickel

TABLE 7.4 Metal Nitrate Formula: <u>$\text{Ni}(\text{NO}_3)_2$</u>		
Dilution Process Used	Wavelength Maximum	Absorbance
Initial Dilution: _____ mg/25 mL	<u>380 nm</u>	<u>0.11</u>
Other Dilutions If Necessary		
List Other Wavelength Maximums If Present <u>680 nm</u>		

TABLE 7.5 Metal(acac) _n : <u>$\text{Ni}(\text{acac})_2$</u>		
Dilution Process Used	Wavelength Maximum	Absorbance
Initial Dilution: _____ mg/25 mL	<u>380</u>	<u>0.11</u>
Other Dilutions If Necessary		
List Other Wavelength Maximums If Present <u>680 nm</u>		

Questions

1. Using the absorption spectra obtained and the color wheel **explain** the visual color of the $\text{M}(\text{acac})_x$ solution:

- $\text{Mn}(\text{acac})_2$ absorbed the lowest end of the spectrum, reflected yellow
- $\text{Fe}(\text{acac})_3$ absorbed large amounts of the lower end of the spectrum, reflected the higher end (reddish)
- $\text{Co}(\text{acac})_2$ absorbed all colors but the reds the least, lighter red gets reflected
- $\text{Ni}(\text{acac})_2$ absorbed 680 nm (really close to orange) reflected greenish-blueish color
- $\text{Cu}(\text{acac})_2$ absorbed red the most, reflected blue the most, absorbed all other colors to a lesser degree

2. Using the visual inspection and the UV-Vis:

- a. Determine if your product is different from the reactant and if so what supports that claim. Refer to each of the five pairs of spectra (nitrate vs. product).

Nickel: Not different, the product spectrum is very similar to reactant and different from lit

Cobalt: different but not the correct product, both reactant & product spectrums are very different from lit

everything else: different, correct product b/c similar to lit

- b. Compare your solid dried product with the commercial dried product. Discuss evidence that your product does or does not match the commercial product.

~~matches~~, similar

everything else: match, similar color

Nickel: does not match, it is the reactant

Cobalt: does not match, appears purple when it is supposed to be pink

3. Evaluate your percent yield and suggest how it could be improved. How do you know if it was dry?

It could be improved by washing all the product out into the Buchner funnel

It can only be known to be dry after being placed in an oven to dry

4. State a conclusion (claim) that you would use in a report. What evidence supports that claim?

an acetate anion is capable of displacing water ligands

it happened multiple times throughout the lab

5. Attach the five plots with the nitrate and 2,4-pentanedionate complex spectra on the same plot for comparison for each metal.

- a. Compare the UV-Vis spectrum of each lab synthesized product with each of the five commercial products. Discuss similarities and differences.

Nickel seems to not have reacted

Cobalt seems to have been the wrong reactants

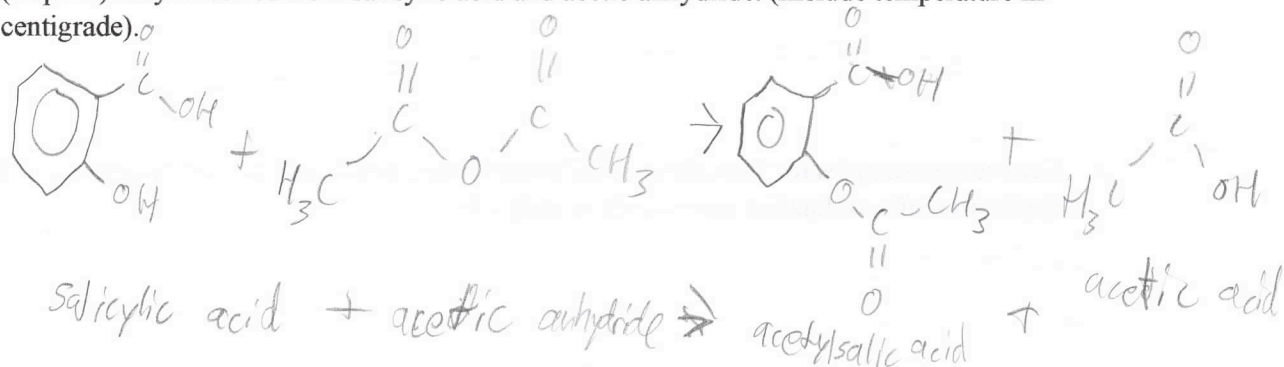
everything else was similar

TA Signature

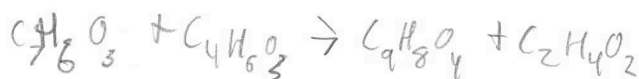
Ask your TA to review your work and sign your report. The TA will sign above once satisfied that the student has performed the entire procedure. The report will not be accepted or graded unless signed.

Use the videos, textbook, and slides to answer the following questions and submit with your Report Worksheets.

1. Use the structural formulas to write the chemical equation to show how acetylsalicylic acid (Aspirin) is synthesized from salicylic acid and acetic anhydride. (Include temperature in centigrade).



@ 100°



2. Calculate the percent yield of Aspirin. (% yield = Actual yield/theoretical yield).

Mass of dried Aspirin produced is 5.032 grams.

Molar mass of aspirin is 180.158 g/mol

Molar mass of Salicylic acid is 138.121 g/mol.

Use the mass (grams) of salicylic acid used from the video posed on pilot.

Theoretical yield: 6.522g

Show calculations

$$\frac{5g}{138.121g} \times \frac{1mol}{1mol} \times \frac{180.158g}{1mol} = 6.522g$$

% yield 77.16%

Show calculations

$$\frac{5.032g}{6.522g} \times 100 = 77.16\%$$

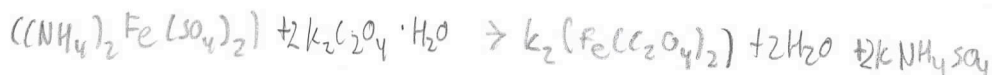
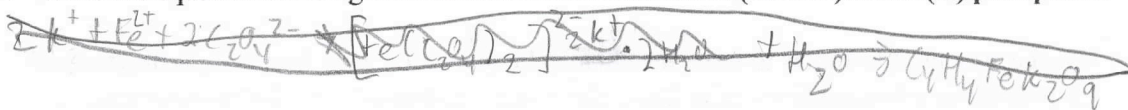
6.522g

3. If your actual yield of Aspirin is higher than your theoretical yield, what could be some possible causes for this occurrence?" (Explain briefly in ~2 lines)

Not properly dried, water could still be in there inflating the weights

Unreacted reactants were also weighed inflating the measured weight

4. Write the equation showing the formation of Potassium bis(oxalate)ferrate(II) precipitate.



5. Give some examples for Monodentate, bidentate, polydentate ligands. Some examples of the application of coordination compounds in daily life.

bidentate: oxalate

monodentate: NH_3

polydentate: Ethylenediamine + macro + acid acid (EDTA)

Used as catalysts to make things

Carbonic anhydrase buffers the blood

6. Write a brief summary of the video Synthesis of metal oxalates/Intro & theory. (Write about what you understand from each topic (3 topics were covered in that video)).

Coordination Complexes

all the electrons come from the ligand

The metal has an anion associated that isn't shown

They can be used for many purposes like as catalysts

Metal Oxalate Complexes

oxalate can act as 2 ligands (bidentate) with its two negatively charged oxygens

It can bind with different metals forming different complexes (Fe binds with 3, Cu binds with 2 & 2 H_2O , Co binds with 2 and 2 H_2O but is also a chain with other Co)

Inorganic synthesis

Metal salt hydrate \rightarrow dissolve

(metal source +

inert spectator ion)

mix

\rightarrow cool in ice bath

\rightarrow filter

(for crystals to form)

to only get crystals left

$K_2C_2O_4$

oxalic acid

\rightarrow dissolve

to encourage crystal formation: seed crystal, gently scratch the bottom of the beaker, add ethanol

Environmental ~~factor~~ impact (E-factor)

$$E\text{-factor} = \frac{\text{mass of waste}}{\text{mass of product}}$$