

Name:

Period:

Seat#:

Required Sections: (Refer to R-5 for guidelines and requirements. Make note of any specific changes given by your teacher in class)

Prelab: Answer Pre-Lab Questions, Materials, Reagent Table, Procedures, and set up Data Table before you get to class.

During Lab: Data section – Fill out your data table that is already set up from the prelab.

Post-lab: Calculation section, Post Lab Discussion Questions section, Post-Lab Two Pager done on separate worksheet.

Introduction

Sometimes during a chemical reaction you may have too much, or too little of a particular chemical. When this happens one reactant is said to be the “limiting reagent” and one is the “excess reagent.” In this lab you will determine, through calculations, which reactant is limiting and which is in excess. You will then calculate your theoretical yield, perform the lab, determine your actual yield, and identify sources of error within the lab as well as ways to improve upon the lab to result in a better percent yield.

Pre-Lab Questions

1. Describe what a double displacement/replacement reaction is.
2. Write and balance the equation for the reaction of Calcium Chloride with Sodium Carbonate.
3. Write the net ionic equation for the reaction in Question #2.
4. Look up a picture of a Büchner Funnel being used with a vacuum filtration set up. Sketch a picture and describe how it works and why you would want to use this kind of set up instead of a cone funnel sitting on top of a flask.
5. Watch this video and jot down notes so I know you actually watched it ☺

It goes over the lab technique you will be using. It is important you show up

knowing what to do so you can finish on time! <https://youtu.be/1E4YmuSY4Ek>



Materials

- * 0.15M CaCl₂
- * 0.25M Na₂CO₃
- One 150mL beaker
- One 50mL beaker
- Two pipettes
- Stir rod
- Rubber policeman or scoopula
- Graduated Cylinder
- Wash bottle with distilled H₂O
- Büchner Funnel
- Filter paper
- Filter flask
- Rubber tubing
- Aspirator on the sink faucet
- Rubber collar
- Weigh boat

Procedure

- 1) Label your weigh boat and 50mL beaker using masking tape. Include your class period and your lab bench number.
- 2) Weigh and record masses for your LABELED weigh boat WITH the dry filter paper inside it, and also for your LABELED 50mL beaker before you start! You will need this information at the end when weighing your products!
- 3) Using a graduated cylinder, measure 15ml of CaCl₂ and put into the 150mL beaker.
- 4) Rinse the graduated cylinder with the wash bottle with distilled H₂O so nothing reacts in the graduated cylinder when you measure the next chemical.
- 5) Measure 15mL of Na₂CO₃ and add to the CaCl₂ in your 150mL beaker.
- 6) Record your observations in your data table.
- 7) Separate your precipitate from your solute by using the filter set up shown to you by your teacher.
 - a. Make sure you wet your filter paper down before you pour!
 - b. Make sure to use your wash bottle to get all the products out of your beaker!
- 8) Dry the weigh boat with the filter paper and precipitate, and the 50mL beaker with filtrate in the drying oven or fume hood overnight.
- 9) Weigh your dried weigh boat with the filter paper, and your dried 50mL beaker with filtrate.
 - a. Make sure you are recording all numbers necessary to do this!

Data Table

Remember, you need to make sure your data table has all required elements!

This is just to get you started on the right track

Mass of Dry Filter Paper and Weigh Boat	Mass of Empty 50mL Beaker	Mass of Filter Paper, Weigh Boat, and Precipitate AFTER Drying	Mass of Beaker and Dried Filtrate after Drying	Mass of <u>Just</u> Dried Precipitate	Mass of <u>Just</u> Dried Filtrate after Drying
Observations	SAMPLE TABLE				

Dougherty Valley HS Chemistry

Adv. Chemical Ratios - Limiting Reagent Lab

Calculations

1. Calculate the number of moles of Calcium Chloride and Sodium Carbonate that were used.

**Hint* Molarity is a concentration and the formula for it is Molarity = moles/liter*

Example using different numbers/formulas than this lab

Example with different chemicals and numbers:

How many moles of SrCl₂ are present in 25 mL of a 0.35 M CaCl₂ solution?

$$\frac{25\text{mL SrCl}_2}{1000\text{ mL}} \times \frac{1\text{ L}}{1\text{ L}} \times \frac{0.35\text{ moles SrCl}_2}{1\text{ L}} = 0.00875\text{ mol SrCl}_2$$

2. Calculate which reactant is the limiting reactant and which is the excess reactant.
3. Calculate your theoretical yield of both products.
4. Calculate your % yields for both products.

Post Lab Discussion Questions

1. Based on your net ionic equation, which chemical was your original precipitate product, and what were your spectator ions?
2. Explain how you were able to take your aqueous spectator ions and convert them into a solid that you were then able to measure. What was the formula for this product?
3. If a student failed to dry their precipitate in the oven long enough, how would this affect the percent yield? Why?
4. If a student failed to wet their filter paper down before filtering, how would this affect the percent yield of each product? Why?
5. Hypothetical Lab Scenario for a student using different chemicals but the same techniques as this lab:
 - a. If Marie started this lab with 10.7 grams of strontium chloride and 12.5 grams of sodium carbonate, what would her limiting reagent and excess reagent be?
 - b. What should Marie's theoretical yields be for each product?
 - c. If Marie actually got 6.95 grams of the sodium containing product, did she get a better or worse percent yield than your lab group did for that same product? Show the calculations to determine this.