

Limiting Reagents & % Yield Making Chalk Lab

Name: _____

Period: _____

Discussion: In this lab, we are going to see a precipitation reaction. This is a reaction where two soluble salts are added together and the result is the precipitation of a single product while the other remains in solution. We will be starting with known amounts of sodium carbonate and calcium chloride. We will then create solutions of the two salts and react them to create a precipitate. We will separate and dry this precipitate to measure our actual yield. We will then compare our actual yield to the theoretical yield to compute our percent yield for our experiment.

Limiting Reagents: I like one thick slice of ham between two slices of bread in my sandwiches. If I only have three slices of ham at my disposal, all I can make is three sandwiches; that is assuming that I have six slices of bread. In fact, it doesn't matter whether I have six slices or forty-six slices of bread, I can only make three sandwiches since I am limited by the amount of ham I have.

The same is true of reactions. I have a large quantity of Na_2CO_3 but I cannot produce any chalk unless I also have CaCl_2 . Stoichiometry allows us to compare the amount of various substances involved in a reaction, so we can calculate the amounts of other substances produced or needed. In order to determine which of the reactants the limiting reactant is, we must take into account both the amounts present and how they relate stoichiometrically in the balanced equation.

Percent Yield... Efficiency: Reactions are expected to go to completion, but it is always another matter when you go into the lab and perform it. Preparations often require a variety of manipulations and transfers that cause a loss of product. Some of these losses are due to human error that can be eliminated with experience and improved technique. However, more often it is due to the actual procedure involved. Percent Yield is a measure of the efficiency of the experimental design.

$$\%Yield = \frac{\text{Mass of Product Obtained}}{\text{Calculated Mass of Product Expected}} \times 100$$

Experimental Procedure for Making Chalk:

Day 1

1. Mark a piece of tape with you and your lab partners' names with a sharpie. Stick to bottom of petri dish. Obtain a piece of filter paper and add to this dish. Measure the mass of dish, tape & filter to the nearest 0.01g. Record the mass in value in the data table.
2. Measure 1.5 grams of sodium carbonate in weigh boat (piece paper). Record its mass to the nearest 0.01g.
3. Place sodium carbonate into a 250 mL beaker and add about 150 mL of hot water to dissolve. Swirl.
4. Mass the empty weigh boat after transferring salt.
5. Weigh out about 2.5 grams of calcium chloride in another weigh boat (piece paper) and record its actual mass to the nearest 0.01g in the data table.
6. Pour calcium chloride into your solution of sodium carbonate and swirl/stir until it seems to be all reacted.
7. Mass the empty weigh boat after transferring salt.
8. Gravity filter the white product using Büchner flask for receiving. This is done by placing your filter paper in the Büchner funnel in the flask, connecting the vacuum hose, running the water, squirting water to seal the paper down, then pouring the solution into the center of the filter paper taking care not to let it get around the edges of the filter paper. Wash the side of the beaker with a small amount of water and add this to the filter paper. Try to get the entire white solid on the filter paper.
9. Carefully remove the filter paper from funnel and place back in your labelled petri dish. Put away in cupboard near your lab station.

Day 2

10. Mass the petri dish, tape, filter paper, and calcium carbonate to the nearest 0.01g. Record in your data table

Pre-calculations: Calculate the Molar Masses needed for this experiment.

CaCl ₂ =	Na ₂ CO ₃ =	CaCO ₃ =
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Data Table:

Mass of petri dish, tape, & filter paper:	_____g
Mass of 1 st weigh boat and Sodium Carbonate:	_____g
Mass of 1 st weigh boat:	_____g
Mass of 2 nd weigh boat and Calcium Chloride:	_____g
Mass of 2 nd weigh boat:	_____g
Mass of petri dish, tape , filter paper, and Calcium Carbonate :	_____g

Analysis and Conclusion:

Day 1

1. Determine the moles of sodium carbonate used. Show work:
2. Determine the moles of calcium chloride used. Show work:
3. Determine the moles of calcium carbonate produced. Show work:
4. Write the balanced equation for the experiment.
5. Using you data above, determine the limiting reagent for this experiment. Show work:
6. Using the limiting reagent, determine the mass of calcium carbonate that should have been produced. (this is your theoretical yield.)
7. Calculate the Percent Yield for your experiment. Show work: