Name _____ Date _____ Period ___

Stoichiometry Lab

In class, you've learned to compute how much of a chemical product you can make when you mix measured amounts of chemical reactants. In this lab, you will be actually using this information to predict how much product will be made; you will then calculate the percent yield gained from the amount that you actually recover.

The reaction you will be working with should be familiar to you from elementary school science fair volcanoes: You will be mixing baking soda ($NaHCO_3$) with vinegar (CH_3COOH) to generate carbonic acid (H_2CO_3, which breaks up into water and carbon dioxide gas) and sodium acetate ($NaCH_3COO$), which is a food preservation additive.

Prelab

1) If we mix 25 grams of sodium bromide with a large amount of potassium chloride, what will our theoretical yield of sodium chloride be?

2) If our actual yield from this reaction was 18 grams of sodium chloride, what would be our percent yield for this reaction?

3) Is the answer in question 2 reasonable? If so, explain why you think this was a reasonable answer. If not, explain what is wrong with it and discuss possible reasons you might get this answer in the laboratory.

4) What are some factors that might cause our percent yield to be greater than 100%? What are some factors that might cause it to be less than 100%? Make sure you discuss specific cases of how both might happen.

Section 1: Computing the amounts of reactants that we need

In this lab, you will need to do a reaction where baking soda will react with an excess of vinegar. By doing this, you will (hopefully!) ensure that you will get 100% actual yield for the reaction.

For our reaction, we will need to use 0.05 moles of baking soda, which we will call by its chemical name, sodium hydrogen carbonate, for the rest of this lab. If we use much more than 0.05 moles of baking soda, the reaction will be too large and we will risk having some of the reaction products pour over the side of the flask when we mix it with the vinegar (which we will call acetic acid).

On your data sheet, calculate how much sodium hydrogen carbonate we will need for this lab.

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Section 2: The reaction

In this section of the lab, we will be doing the reaction discussed in the prelab.

1) Measure out the weight of sodium hydrogen carbonate that you calculated you would need in the first section of this lab. Make sure that the amount you use is as close as you can make it to this amount. Write the exact amount of sodium hydrogen carbonate that you used in your lab book.

2) Dissolve the sodium hydrogen carbonate in about thirty milliliters of water. Stir the solution until most or all of it is dissolved (if a little won't dissolve, that's OK).

3) Weigh a 500 mL flask. You will need the weight of the empty flask at the end of the lab.

4) Add the sodium hydrogen carbonate solution to the preweighed 500 mL flask.

5) Obtain 150 mL of acetic acid (a.k.a. vinegar) and slowly add it to the sodium hydrogen carbonate solution. You will observe the formation of bubbles when the acetic acid is added to the sodium hydrogen carbonate solution. Wait until the bubbling subsides before adding more acetic acid. When all of the acetic acid has been added, stir for two minutes before moving on to step 6.

6) When the solution is again calm (there may be a few bubbles rising from the bottom of the flask - this is normal), move the flask to a hot plate and heat it to boiling. Be careful that the flask does not boil over because this will cause errors in your calculations. Once the flask has started boiling, gently set a watch glass on its mouth to keep any of the liquid inside from splattering.

7) When all of the liquid in the solution has boiled away, remove the flask from the hot plate. The powder that you observe inside is the product of the reaction, sodium acetate. Once the flask has had a few minutes to cool down to room temperature, measure and record its weight.

8) When this is done, you can rinse out the flask and any other glassware you used. All waste can go down the sink.

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Questions:

1) Write down the equation of the reaction that we did in this lab. (Hint: The reaction is discussed in the introduction to this lab.)

2) Using the exact weight of sodium hydrogen carbonate that you measured in step 1 and the equation that you wrote in the problem above, what is the theoretical yield of this reaction?

3) Calculate the actual yield of sodium acetate that you recovered in this lab, using the weight of the empty flask and the weight of the flask after the reaction.

4) Using the actual yield of sodium acetate that you measured in question 3 and the theoretical yield of sodium acetate that you calculated in question 2, calculate the percent yield of sodium acetate recovered in this lab.

5) Was your percent yield of sodium acetate 100%? What factors do you think caused any error that you found? Explain, using specific examples.

6) Do you think it is common for chemists to get 100% yields for chemical reactions? Why or why not?

7) If you had to do this lab again, what would you do differently to improve your answers? Explain, using specific examples.

