AR Chemistry Lab Name_____ M T 1 2 5

Partner(s)_____

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 (gram to gram problems). 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) [← reactants] to generate [products →] carbonic acid (H_2CO_3), which breaks up into water and carbon dioxide gas) and sodium acetate ($NaC_2H_3O_2$), which is a food preservation additive.

A. Chemical Reaction

Use the formulas for the chemical reactants and products to create the balanced chemical reaction for this activity.

B. Procedure

Section 1: Computing the amounts of reactants that we need

You will be reacting 0.050 moles of sodium hydrogen carbonate ($NaHCO_3$)

a. In the space below, determine the molecular (formula) mass for $NaHCO_3$

b. In the space below, determine the grams of $NaHCO_3$ required for the reaction (Convert 0.050 moles $NaHCO_3$ to **grams $NaHCO_3$.**

c. For this lab, we will use _____ grams of sodium hydrogen carbonate ($NaHCO_3$).

Section 2: The reaction

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 here:

Measure # 2 *Mass of tare paper + $NaHCO_3$* _____

Measure # 1 *Mass of tare paper:* _____

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calculated in 1c. *Amount of sodium hydrogen carbonate used:* _____

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

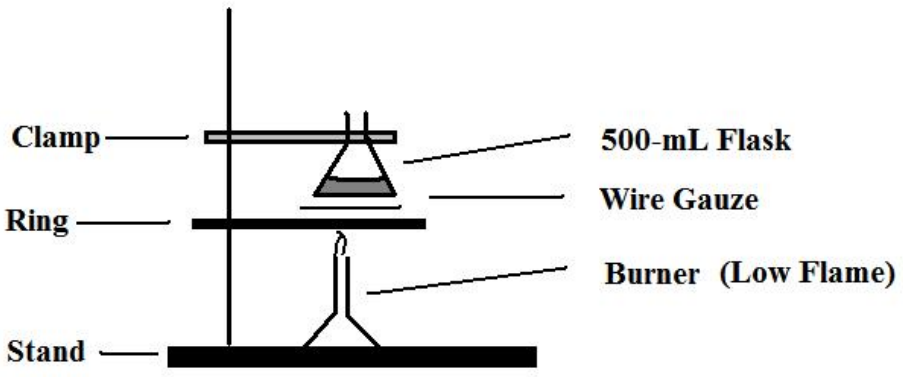
3)___ Weigh a 500 mL flask. You will need the weight of the empty flask at the end of the lab.

Weight of the empty 500 mL flask: _____

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, NOT all at once, 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 burner (see below for diagram) and heat it to boiling. Be careful that the flask does not boil over because this will cause errors in your calculations - a good way to prevent this is to add a boiling stone. Once the flask has started boiling, gently set a watch glass or an upside down 150 mL beaker 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.
Turn the Flam OFF when there is just a little bit of liquid left. The remaining liquid will evaporate from the warm flask. We want white product—black product is burned and will give an inaccurate result.

Weight of the flask, after the reaction: _____

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

Questions:

1) Copy, from **Part A** the equation for this reaction.

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 predicted (theoretical) yield for sodium acetate? (Do a gram to gram calculation from the grams $NaHCO_3$ you used to grams $NaC_2H_3O_2$ that are predicted)

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.

Mass of flask + Sodium Acetate ($NaC_2H_3O_2$) _____

Mass of flask _____

Mass of Sodium Acetate ($NaC_2H_3O_2$) _____

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

$$\text{Percent Yield } NaC_2H_3O_2 = \frac{\text{Mass of } NaC_2H_3O_2 \text{ obtained}}{\text{Predicted Mass of } NaC_2H_3O_2} \times 100 = \frac{\_\_\_\_\_}{\_\_\_\_\_} \times 100 = \_\_\_\_\_\%$$

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: