Name:_____ Pd: ____ Due Date: _____

Stoichiometry Lab: Can You Make 1.00 Grams of a Compound?

OBJECTIVE: Use your skills of predicting chemical reactions, balancing equations, and calculating molar mass to solve a complex stoichiometry problem. Then test your laboratory techniques by mixing the reactants and isolating exactly 1.00 g of a compound (precipitate).

MATERIALS: ***(General - May have to revise during actual lab)***

50 mL beaker	distilled water	wash bottle
100 mL beaker	glass stirring rod	filter paper
250 mL filtration flask	Buchner funnel	balance
50 mL graduated cylinder	evaporating dish/watch glass	scoopula
ring stand w/ clamps	mass (g) of reactants (x2)	rubber hose

EXPECTATIONS: Use the following guidelines to perform a stoichiometry quantitative analysis illustrating the calculations and procedures necessary to collect a known amount of substance in a chemical reaction:

- **(2 pts)** Follow the step-by-step procedures below, ensuring that each step is followed as precisely as possible. ***FILL IN ALL THE BLANKS WITH THE ACTUAL AMOUNTS (VOLUMES/MASSES) AND CHEMICAL FORMULAS OF MATERIALS (WATER/CHEMICALS) USED.***
- **(1 pt)** Write the reaction number assigned to your group.
- **(4 pts)** Write the full balanced equation including phases *(states of matter)* of reactants **AND** products.
- **(12 pts)** Show **FULL** work for **ALL** calculations:
  - Mass-mass stoichiometry calculations of **both** reactants (x2) ***(6 pts)***
  - Data collection ***(1/2 pt each ; 4 pts total)***
  - Percent yield calculation ***(1 pt)***
  - Percent error calculation ***(1 pt)***
- **(2 pts)** Complete the data table and include the following:
  - Calculated theoretical mass of both reactants ***(1/2 pt each)***
  - Actual mass of product recovered/collected ***(1/2 pt)***
  - percent yield of the product (precipitate) ***(1/2 pt)***
- **(4 pts)** Percent error *(accuracy)* for the experiment *(see grading rubric)*.

PRE-LAB REQUIREMENTS:

a) Write a **balanced** chemical equation for your assigned reaction including phases *(states of matter)* of reactants **AND** products.
b) Use the solubility rules *(reference table)* to predict the state of matter of each reactant and which product will form a precipitate.
c) Use mass-mass stoichiometry dimensional analysis to determine the mass of **EACH** reactant necessary to form 1.00 grams of your precipitate. * **If reactant is a hydrate, the TOTAL molar mass of the hydrate MUST include the number of water molecules present ***
d) Fill in any blank within the procedures of the lab.

PROCEDURES: *FILL IN ALL THE BLANKS WITH THE ACTUAL AMOUNTS (VOLUMES/MASSES) AND CHEMICAL FORMULAS OF MATERIALS (WATER/CHEMICALS) USED.* ***(2 pts)***

1) Weigh out and record *(in data section)* the mass of the filter paper on the electronic scale/balance.
2) Write group members' initials/names on the filter paper with a **PENCIL**.
3) Thoroughly clean and dry out all glassware **BEFORE** beginning the filtration process.
4) Place the pre-massed filter paper inside the Buchner funnel. Wet it down with **DISTILLED** water to keep it flat onto the funnel. ***(Make sure filter paper sits FLAT in funnel as to prevent pockets/folds).***

5) Assemble the ring stand and clamp system to the _____ mL filtration flask *(If not already done so).*
    a. Assemble the rubber hose by connecting it to the side of the metal sink spicket and to the side arm of the filtration flask.
    b. Place the rubber stopper end of the Buchner funnel *(with filter paper inside)* onto the filtration flask and carefully clamp down the neck of the filtration flask with the ring clamp.

6) Weigh out **PRECISELY** and record *(in data section)* the calculated theoretical mass of _____ grams of _____ ***(formula of reactant A)*** onto a weigh boat/evaporating dish.

7) Weigh out **PRECISELY** and record *(in data section)* the calculated theoretical mass of _____ grams of _____ ***(formula of reactant B)*** onto a weigh boat/evaporating dish.

8) Transfer exact grams of **REACTANT A** into a _____ mL beaker.

9) Transfer exact grams of **REACTANT B** into a _____ mL beaker.

10) Fully dissolve **BOTH** reactants with 20 mL of **DISTILLED** water. ***(Use more water if necessary to fully dissolve the reactants)***.

11) Transfer **BOTH** dissolved reactant solutions into a _____ mL beaker and stir with a stirring rod until the product *(precipitate)* is formed. ***(Some reactions may take longer than others. Likewise, some reactions may produce a greater/thicker volume of precipitate than others).***

12) Turn on the sink faucet to allow the suction filtration process to begin.
13) After both reactant solutions have been combined and reacted, isolate the precipitate by filtering the solution. Pour the precipitate solution very carefully and slowly down a stirring rod into the **CENTER** of the Buchner funnel. ***(Be careful to not let the solution flow over the funnel. The slower the better).***
14) Wash/rinse out the beaker containing the precipitate solution several times with distilled water from the wash bottle provided. Pour each washing back into the Buchner funnel to reclaim any precipitate that may have stuck to the sides of the beaker. ***(This is where most of percent error will occur).***

15) After all of the _____ ***(formula of precipitate)*** has filtrated through the Buchner funnel, very **GENTLY** rinse the precipitate with distilled water to force all of the filtrate to rinse through.

16) When the suction filtration process is complete, use the flat edge of a metal spatula to carefully and gently remove the filter paper *(containing the filtered precipitate)* from the Buchner funnel.
17) Carefully place the filter paper with the precipitate onto a watch glass/paper towel and set in a designated location to allow to air-dry overnight.
18) **THOROUGHLY** clean all lab materials by rinsing out with sink water and drying with paper towel.
19) After the precipitate has fully dried overnight, weight out and record *(in data section)* the mass of the filter paper + precipitate onto the electronic scale.

GROUP REACTION #: _____ ***(1 pt)***

***** PRE-LAB:** ***BALANCED* CHEMICAL EQUATION *(With States of Matter)*: *(4 pts)***

EXAMPLE: $1\ MgSO_4 \bullet 7H_2O_{(aq)} + 1\ Na_2CO_{3\ (aq)} \rightarrow 1\ MgCO_{3\ (s)} + 1\ Na_2SO_{4\ (aq)} + \mathbf{7H_2O}$

Equation: _____

***** PRE-LAB:** **STOICHIOMETRY CALCULATIONS FOR *REACTANTS*: *(6 pts)***

EXAMPLE: Mass-Mass Stoichiometry Calculation

$$\frac{1.00\ g\ MgCO_3}{1} \times \frac{1\ mol\ MgCO_3}{84.32\ g\ MgCO_3} \times \frac{1\ mol\ Na_2CO_3}{1\ mol\ MgCO_3} \times \frac{105.99\ g\ Na_2CO_3}{1\ mol\ Na_2CO_3} = 1.26\ g\ Na_2CO_3$$

1. **PRODCUT → REACTANT A** *(Mass-Mass stoichiometry calculation)*

2. **PRODUCT → REACTANT B** *(Mass-Mass stoichiometry calculation)*

DATA COLLECTION / ANALYSIS: *(6 pts)*

1. Mass of Filter Paper: _____ grams
2. Mass of Reactant A: _____ grams of _____ *(Chemical Formula)*
3. Mass of Reactant B: _____ grams of _____ *(Chemical Formula)*
4. Mass of Filter Paper + Precipitate: _____ grams
5. Mass of Precipitate ONLY: _____ grams of _____ *(Chemical Formula)*
6. Percent Yield Calculation (SHOW FULL WORK): _____% Yield

7. Percent Error Calculation (SHOW FULL WORK): _____% Error

DATA TABLE: ***(2 pts)***

Reactant/Product	Theoretical Mass	Actual Mass	% Yield
Reactant A *(Formula)*	_____ g	----------	----------
Reactant B *(Formula)*	_____ g	----------	----------
Product C	----------	----------	----------
Product D – Precipitate *(Formula)*	1.00 g	_____ g	_____ %

** Include actual formulas of reactants/products in the first column **