Stoichiometry Lab

Purpose:

The objectives of this laboratory are to experimentally determine the mole-to-mole ratios and masses between the underlined reactants and products in the following double displacement "gas forming" reaction:

sodium carbonate + aqueous hydrochloric acid \rightarrow aqueous sodium chloride + carbon dioxide gas + liquid water Na2CO₃ (s) + HCl (aq) \rightarrow NaCl (aq) + CO₂ (g) + H₂O (l)

Procedure:

Safety: Be especially careful when handling the 6M HCl (*aq*), as it can cause chemical burns to the skin. If any acid spills on you, rinse immediately under running water for up to 15 minutes and report the accident to your instructor. Acid spills may also be neutralized using the sodium bicarbonate solution by the sinks. Also, be sure to exercise appropriate caution when using the Bunsen burner and handling hot equipment.

Materials and Equipment

Solid sodium carbonate (Na₂CO₃), 6M hydrochloric acid (HCl), electronic balance, evaporating dish, watch glass (to fit as a cover for the evaporating dish), stand and ring clamp, wire gauze, dropper pipette, stir rod and Bunsen burner.

Experimental Procedure

1. Measure and record the mass of your clean dry evaporating dish.

2. Measure 0.5 - 0.6 g of solid sodium carbonate (Na₂CO₃) and record the exact mass. Then carefully add to the evaporating dish. *Do not do this over the balance!* Then measure and record the mass of the evaporating dish + watch glass +Na₂CO₃.

3. Using your dropper pipette, add the HCl *drop by drop* to the sodium carbonate in the evaporating dish. You use about 5-mL quantity of hydrochloric acid (HCl). The reaction will be evident by the bubbling that takes place. Continue adding HCl until the bubbling stops and all of the Na₂CO₃ has reacted –this indicates that the reaction is complete.

4. Assemble the stand, ring clamp and wire gauze apparatus for heating as shown in the figure below. Cover the evaporating dish with the watch glass and place it on the wire gauze.



5. *Gently heat* the solution in the evaporating dish with a Bunsen burner flame in order to remove the water generated in the reaction (as well as any excess HCl present). The flame should be wafted under the evaporating dish constantly. Continue heating until the contents are *completely dry*. (When you think its dry, heat it 2 more minutes! – stop if white salt starts to turn brownish)

6. After allowing the evaporating dish to cool to room temperature, measure and record the mass of the evaporating dish residue (NaCl).

7. The waste from this experiment may be disposed of in the sink.

Data Table 12 – 1Stoichiometery (AKA fluffyometery) Lab Data		
Substance		Mass (g)
1	Mass of clean, dry evaporating dish	
2	Mass of Na ₂ CO3 (sodium carbonate)	
3	Mass of evaporating dish, and Na ₂ CO3 (sodium carbonate) – Calculated (add # 1 and #2 above)	
4	Mass of evaporating dish, and Na ₂ CO3 (sodium carbonate) – Measured on scale (is this very similar to # 3 above?)	
5	Mass of NaCl(sodium chloride) & evaporating dish	
6	Mass of NaCl (sodium chloride) -experimental	
7	Mass of NaCl (sodium chloride) –Theoretical (get this from calculation # 5 below)	
8	Theoretical Yield (in %)	

Questions

1. Balance the following chemical reactions below.

sodium carbonate + aqueous hydrochloric acid \rightarrow aqueous sodium chloride + carbon dioxide gas + liquid water Na2CO3 (s) + HCl (aq) \rightarrow NaCl (aq) + CO2 (g) + H2O (l)

- 2. Using the balanced chemical equation, what is the mole ratio between Na₂CO₃(sodium carbonate), to NaCl, (sodium chloride)?
- 3. Create a Mass to Mass Mole Island map that would allow you to place a value in row #7 of Data Table 12-1 above.
- 4. Referring to your map, what chemical in the equation above is Chemical A and what is chemical is B?
- Using your map to create a stoichiometry bridge, convert grams of Na₂CO₃ used to grams of NaCl produced. You will need to determine the Molar Mass of both chemicals before you do this. Record your answer in row 7 of Data Table 12 -1.
- 6. Solve for percent yield using equation below.

- 7. If there were no errors that occurred during this lab what would your % yield be? Did you have a good percent yield?
- 8. What probably (or did) happened if your % yield was greater than 100 % at first? How would (or did) you fix that problem?
- 9. What improvements can you and your teammates make if you repeated this experiment to achieve a better % yield next time?
- 10. Why does fanning the hot evaporating dish help it cool faster? Try to be as <u>sciency</u> (made up word) as possible in your explanation!!!