Baking Soda & Vinegar Limiting Reactant *Lab*

PURPOSE: To demonstrate to students the concept of limiting reactants.

MATERIALS: 600 mL beaker (extra large), 250 mL beaker (large), 100 mL beaker (medium), 50 mL beaker (small), triple beam balance (the "scale"), baking soda, vinegar, rag, eyedropper, spoon or scoopula.

The 600 mL beaker will be the reaction vessel, the 250 mL beaker will be the vinegar supply beaker, the 100 mL beaker will be the baking soda supply beaker and the 50 mL beaker will be the baking soda measuring beaker.

PROCEDURE

1. Make sure the 600 mL and 50 mL beakers are clean and dry. "Zero" your scale. Place the 600 mL (extra large) and 50 mL (small) beakers on the scale and measure their combined mass.

Σ **tare mass =** _____ **g** = combined mass of the empty 50mL and 600 mL beakers

2. Add 100 to the "Σ tare mass" value from step #1 and record the result below.

desired gross mass, vinegar only = _____ **g** = 50 mL beaker + 600 mL beaker + desired amount of vinegar

Is the number in the above blank exactly 100 bigger than the number in the first blank? If it is, you are ready to proceed.

Add vinegar to your 250 mL (large) beaker until you have about 150 mL of vinegar.

Set the sliders of the triple beam balance to the above mass value. Place the 600 mL beaker and the 50 mL beaker on the scale. Pour vinegar from the 250 mL beaker into the 600 mL beaker until the white needles on the balance meet each other. Use the eyedropper to transfer very small amounts of vinegar back and forth between the 600 mL and 250 mL beakers until the scale balances.

3. If he has not already told you, ask your instructor how much baking soda you should be using and record it in the blank below.

desired net mass of baking soda = _____ **g** = baking soda only

4. Add this number to the "desired gross mass, vinegar only" from step #2, and record that sum in the blank below.

desired gross mass, vinegar and baking soda = _____ **g** = 50 mL & 600 mL beakers + vinegar + baking soda

Add baking soda to your 100 mL beaker until it is about half full.

Set the sliders on the triple beam balance to the above number (desired gross mass, vinegar and baking soda). Place the 600 mL and 50 mL beakers on the scale. Use the spoon or scoopula to transfer baking soda from your 100 mL beaker into your 50 mL beaker until the scale balances. Transfer baking soda back to the 100 mL beaker if you add too much to the 50 mL beaker.

5. Now, you should have a 600 mL beaker and a 50 mL beaker sitting on your scale, the 600 mL beaker with 100 grams of vinegar in it, and the 50 mL beaker with a certain amount of white baking soda in it. Get your teacher's approval before going to the next step.

TEACHER'S INITIALS: _____

6. SLOWLY pour the baking soda into the 600 mL beaker. SLOWLY means SLOWLY. Record your observations in the space below.

_____

_____

7. During this step, keep in mind that the small beaker is still on the scale and could be easily knocked off and broken. Also keep in mind that it is important not to lose any liquid from the 600 beaker. Pick up the 600 mL beaker and carefully move it far away from the 50 mL beaker. Without touching the liquid inside with any device or body part, *carefully and gently* swirl the 600 mL beaker clockwise and counterclockwise. This swirling should help to mix the remaining baking soda with the vinegar, speeding the reaction. The swirling should also help to loosen the carbon dioxide that may be still dissolved in the vinegar, allowing it to bubble out and escape into the air. Replace the 600 mL beaker on the scale and measure the combined mass after swirling. Continue to swirl the 600 mL beaker and re-measure the mass of the two-beaker system until there are no visible bubbles and continued swirling seems to not change the mass anymore. Record the final mass of the two beaker system in the space below.

post-reaction gross mass = _____ **g** = 50 mL beaker + 600 mL beaker + vinegar/BS mixture