

Activity: Stoichiometry Balloon Races

Introduction: If a little is good, more is better, right? Does increasing the mass of a reactant in a chemical reaction increase the amount of product that can be formed? This activity will compare the amount of carbon dioxide created when varying amounts of sodium bicarbonate react with a constant amount of acetic acid.



Safety Precautions: Acetic acid is an irritant. Avoid contact with eyes and skin.

Materials:

- Distilled Vinegar 5% (Acetic Acid) - 145 mL
- Baking Soda (Sodium Bicarbonate) - 10.5g
- 6 Balloons
- 6 - 150 mL Erlenmeyer Flasks
- 25 ml graduated cylinder
- Funnel
- Scale
- Weighing Dishes

Preparation:

1. Using a graduated cylinder, add 24 ml of distilled vinegar to each flask.
2. Label 6 balloons (with a felt tip marker)
3. Stretch the balloons by blowing them up to the same size. Check for holes. Then let out as much air as possible.
4. Measure the appropriate amount of baking soda (as shown in Table 1 below) into a weighing dish. Use a funnel to transfer baking soda to each balloon. If you spill, you should start over.
5. Flatten out the balloon (removing as much air as possible) and then carefully place the neck of the balloon over the mouth of Erlenmeyer flask #1.

6. DO NOT ALLOW the baking soda to drop into the flask at this time.
7. Repeat steps 5-8 with the remaining baking soda samples #2 - 6.

Sample	1	2	3	4	5	6
Mass NaHCO_3	0.50 g	1.00 g	1.50 g	2.00 g	2.50 g	3.00 g

Table 1: Mass of baking soda added to balloons

Procedure:

1. Line up the 6 flasks in order 1-6.
2. Lift each balloon in turn and shake it to allow the solid to fall into the solution.
 - a. MAKE SURE THE NECK OF THE BALLOON STAYS FIRMLY ATTACHED TO THE FLASK.
 - b. Tap the balloons to make sure that all of the baking soda has fallen into the flask.
3. The reactions will be immediate and vigorous.
 - a. The white solids will dissolve
 - b. The solutions will start to bubble and fizz
 - c. The balloons will become inflated
4. Allow the reactions to proceed until the bubbling stops. Tap the balloons again. Swirl the flasks to speed the reaction
5. Compare the size of the inflated balloons and whether the solid has dissolved in each case.

Observe:

1. Rank the balloons from largest to smallest. Are some similar in size?
2. Does the solid dissolve equally in every flask?
3. What does this suggest about the reaction between the vinegar and baking soda?