

STOICHIOMETRY OF A REACTION PRODUCING A GAS

Introduction:

The Law of Constant Composition states that for any compound that is made or is decomposed, there is a precise amount of each product that is produced. In this experiment, 0.25g of solid sodium bicarbonate will be reacted with approximately 2.0cm³ of 2.00 mol/dm³ sulfuric acid to form a salt, water, and a measurable mass of carbon dioxide. Using the concept of limiting reagent and mole ratios, the theoretical yield of carbon dioxide will be calculated and compared to the experimental mass obtained during the experiment

Hypothesis:

- Using the balanced equation for the reaction, determine which reactant is limiting.
- Calculate the theoretical mass of carbon dioxide that can be produced from the reaction between 2.0cm³ of 2.00 mol/dm³ sulfuric acid and 0.25g of solid sodium bicarbonate.

Apparatus:

well plate
balance
1 micro-tip pipette (2 mL)
spatula
2.00 mol/L solution of sulfuric acid
sodium bicarbonate

Procedure:

1. Fill a 2.0mL pipette with a 2.00 mol/dm³ sulfuric acid solution.
2. Place a well plate on the balance and place the acid-filled pipette in a well with the bulb end down.
3. Place the plate on the balance and record its mass with the acid filled pipette.
4. Zero the balance and use a spatula to add approximately 0.25g of sodium bicarbonate to a well near the centre of the plate.
5. Record the mass of sodium bicarbonate used.
6. Remove the pipette from the well and add the sulfuric acid to the sodium bicarbonate one drop at a time. After each drop, allow the reaction to subside.
7. Continue adding sulfuric acid, one drop at a time, until all the sodium bicarbonate has reacted and there is no further effervescence.
8. Replace the pipette back in the plate and measure the mass of the plate and its contents.

All Observation Tables should be neatly prepared with proper headings. They will be checked prior to the lab.

Observations:

- Record all qualitative observations before, during and at the end of the reaction in a neat table
- Record all quantitative observations with correct units and levels of uncertainty in a neat table.

Calculations/Data Analysis:

1. Calculate the number of moles of sodium bicarbonate used.
2. Calculate the mass of carbon dioxide produced.
3. Calculate the number of moles of carbon dioxide produced.
4. Calculate the percent yield of the carbon dioxide.
5. Calculate the percent error.
6. Assuming standard temperature and pressure conditions, calculate the volume of carbon dioxide produced.

Discussion:

1. Sodium bicarbonate is used in baking. Explain what conditions are necessary for the bicarbonate to be effective (what other ingredient must be present, what consistency must dough have in order to rise and trap gas?)
2. In 1984, a man in the United States sued a baking soda manufacturer because his stomach burst after taking 1 teaspoon (approximately 5.0g) of baking soda. Calculate what volume of gas, at stomach conditions, was produced.

Conclusion

Clearly state a valid conclusion with justification based on the purpose described in the introduction making sure to refer to the results obtained and their analysis. Make sure to evaluate the weaknesses and limitations in the procedure and suggest realistic improvements with respect to the identified weaknesses. Make sure to be specific and mention at least 2 errors.