

Stoichiometry II – Reacting Mole Ratios

Leading Question

Is it possible to determine by experiment the ratio of reacting moles in a chemical reaction that will lead to both reactants being used up at the same time?

Introduction

By doing what amounts to a continual variation on the amounts of two reactants, it is possible to determine the proper ratio of two reactants that will produce the maximum amount of product while, at the same time, both reactants will be used up with nothing remaining except the product(s).

Purpose

This lab provides the opportunity to determine the mole ratio of two reactants in a chemical reaction.

Safety

1. Wear safety goggles and an apron in the lab at all times. Do not ingest the chemicals. Wash your hands after working with the chemicals.
2. Your instructor will provide you with safety information about the chemical solutions you will use in this activity.

Materials (for a class of 24 students)

- 24-well microplate
- Reagents (Solutions) A, B, C, and water (H_2O)

Procedure

1. Place 4 drops of water in each of 9 wells in the 24-well plate.
2. Add 1 drop of Reagent A to well A1, 2 drops to well A2, 3 drops to well A3, etc., until you add 9 drops to well B3.
3. Add 9 drops of Reagent B to well A1, 8 drops to well A2, 7 drops to well A3, etc. until you add 1 drop to well B3.
4. Mix the contents of each filled well in the plate by gently shaking, being careful not to spill any of the contents. Allow about 20 minutes for any observed precipitate to settle. While waiting prepare Experiment 2.
5. Observe the solids in each of the well. Write observations- what you see- for each well. Visually determine which well has the most precipitate. If two wells are difficult to rank, redo those in the extra wells.
6. Compare your results with at least 2 other lab groups to determine which well was identified most often as the one with the maximum precipitate.

Microplate

A1	A2	A3	A4	A5	A6
B1	B2	B3	B4	B5	B6
C1	C2	C3	C4	C5	C6
D1	D2	D3	D4	D5	D6

Data Analysis

1. Which well did your group identify as the one with the maximum precipitate?
2. Which well was identified by most of the other lab groups in the class?
3. What does the amount of precipitate tell you about the chemical reaction that took place in the wells of the microplate?
4. What was the ratio of drops of Reagent A to Reagent B in that well?

Concept Development

1. Write the balanced equation for the reaction in this lab. Note the precipitate is the produce containing carbonate.
2. What is the mole ratio of the two solutions you used?
3. Given your answers to questions 1-2, how does the observed Ratio of drops in A and B relate to the ratio of moles in the balanced equation?

Experiment 2: Repeat Procedure thru Concept Development for Reagents A and C. Complete data table below with your observations. Answer Data Analysis and Concept Development questions for Reagents A and C.

Summary

Write a brief summary (complete sentences) comparing your results of the two experiments. Use your Data Analysis and Concept Development responses to help summarize observations.

Experiment 1 – Fill out the observations and tables below.Reagent A: Na_2CO_3 Reagent B: AgNO_3

Well	Drops of H ₂ O	Drops Reagent A	Drops Reagent B	Precipitation Observations
A1	4	1	9	1
A2	4	2	8	1: 4
A3	4	3	7	
A4	4	4	6	2: 3
A5	4	5	5	
A6	4	6	4	2: 4
B1	4	7	3	
B2	4	8	2	2: 1
B3	4	9	1	

Ratio with maximum Precipitate:

Your Observations:

Group 1:

Group 2:

Observations – Write at least one COMPLETE sentence describing your observations.**Experiment 2 – Fill out the observations and tables below.**Reagent A: Na_2CO_3 Reagent C: $\text{Sr}(\text{NO}_3)_2$

Well	Drops of H ₂ O	Drops Reagent A	Drops Reagent C	Precipitation Observations
C1	4	1	9	
C2	4	2	8	
C3	4	3	7	
C4	4	4	6	
C5	4	5	5	
C6	4	6	4	
D1	4	7	3	
D2	4	8	2	
D3	4	9	1	

Ratio with maximum Precipitate:

Your Observations:

Group 1:

Group 2:

Observations – Write at least one COMPLETE sentence describing your observations.