Milk of Magnesia Demonstration

Classifying Matter and Physical versus Chemical Changes

Introduction

A very common misconception that students often possess is that solids are heavier than liquids. This demonstration will expose this misconception because two clear, colorless solutions will react instantly to form a white precipitate. If the total mass of the two solutions is determined, the final mass of the products should remain the same.

Additional topics that can be explored in this simple demonstration include chemical changes and physical changes, precipitates, solubility, and antacids. The required chemicals are readily available and inexpensive. This chemical reaction can provide a relevant example of how typical chemical concepts can be found in our everyday lives. Most students are quite surprised to be able to connect their chemistry class with their real-life experiences.

Concepts

- Law of Conservation of Mass
- Precipitates
- Solubility

Materials

Magnesium sulfate solution, $MgSO_4 \cdot 7H_2O$, 1.0 M, 100 mL
Sodium hydroxide solution, NaOH, 1.0 M, 100 mL
Water, distilled or deionized
Balance, double pan mechanical
Beakers, 150-mL, 3

Safety Precautions

Sodium hydroxide is a corrosive liquid. Skin burns are possible, also very dangerous to eyes. Magnesium sulfate is an irritant to the eyes and respiratory tract. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Wash hands thoroughly with soap and water before leaving the laboratory. Follow all laboratory safety guidelines. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Preparation

1. Measure 1.24 g of magnesium sulfate heptahydrate crystals.
2. Using a 150-mL beaker, dissolve the measured magnesium sulfate in 100 mL of distilled or deionized water.

Procedure

1. Pour 50 mL of 1.0 M sodium hydroxide into a 150-mL beaker.
2. Pour 50 mL of the 1.0 M magnesium sulfate solution into a second 150-mL beaker.
3. Pour the 50 mL of sodium hydroxide into the 150-mL beaker containing 50 mL of magnesium sulfate. A thick, white precipitate will result. *Note:* See discussion for topics to discuss as a class before moving on.
4. Empty the contents of the two beakers and rinse each with water.
5. Repeat steps 1 and 2.
6. Measure the total mass of the two beakers and two solutions.
7. Using a double pan mechanical balance, measure the total mass of the two beakers and the two solutions. Once all three possibilities have been discussed, carefully combine the two solutions together. Set the beaker back onto the balance pan (along with the empty beaker) and allow students to make observations.

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Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. Dispose of all final solutions according to Flinn Suggested Disposal Method #26b.

Tips

- The CRC reference guide will indicate that magnesium hydroxide is essentially insoluble in water. Therefore, the precipitate that was formed by this reaction is magnesium hydroxide.
- Swirl the reaction flask so that it forms a white suspension. Ask the students what it looks like. Inevitably, someone will say, "Milk." This is an excellent opportunity to make the connection between magnesium hydroxide and Milk of Magnesia. Most high school students recognize this name.
- The next logical step in this demonstration is to briefly address how antacids work in heartburn relief. Tell students that magnesium hydroxide is a base and that gastric juice is hydrochloric acid. Thus, the antacid will neutralize the excess acid in our stomach.

Discussion

When sodium hydroxide solution is mixed with magnesium sulfate solution a precipitate is formed. See Equation 1.

$MgSO_4(aq)$	+	$2NaOH(aq)$	→	$Mg(OH)_2(s)$	+	$Na_2SO_4(aq)$	*Equation 1*
magnesium sulfate		sodium hydroxide		magnesium hydroxide		sodium sulfate	

After step 3 of the procedure has been completed it is an excellent time to discuss the following questions as a class. Was this a chemical or physical change? What evidence supports a chemical change has occurred? What is a precipitate? Are precipitates soluble or insoluble?

After step 6 propose the following question. When the two solutions are combined, will the products' mass be greater than, less than or equal to the mass of the reactants? Upon performing step 7 students should understand that even though the molecules have been rearranged, there should be no change in mass. Since no gases are released in the reaction, the total mass of the products should equal the total mass of the reactants.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Systems, order, and organization
Evidence, models, and explanation
Constancy, change, and measurement

Content Standards: Grades 5–8
Content Standard A: Science as Inquiry
Content Standard B: Physical Science, properties and changes of properties in matter

Content Standards: Grades 9–12
Content Standard A: Science as Inquiry
Content Standard B: Physical Science, structure and properties of matter, chemical reactions

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Milk of Magnesia Demonstration* activity, presented by Jeff Bracken, is available in *Classifying Matter and Physical versus Chemical Changes*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *Milk of Magnesia Demonstration* are available from Flinn Scientific, Inc.

Catalog No.	Description
M0018	Magnesium sulfate, 500 g
S0148	Sodium Hydroxide Solution, 500 mL

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.