Name _____ Date _____ Class _____

miniLAB 11

Percent Composition and Gum

Interpreting Data Water soluble sweeteners and flavorings are added to chewing gum. Are these chemicals added as an outside coating or are they mixed throughout the gum?

Materials balance, weighing paper, 250-mL beakers (2), pieces of chewing gum (2), stirring rod, paper towels, window screen (10 cm × 10 cm), scissors, clock or timer

Procedure

CAUTION: *Do not taste or eat any items used in the lab.*

1. Unwrap two pieces of chewing gum. Measure the mass of each separately on a piece of weighing paper. Label the weighing papers with the masses to avoid mixing up your data. Record the masses.
2. Add 150 mL of cold tap water to a 250-mL beaker. Place one piece of chewing gum in the water and stir for 2 minutes.
3. Remove the gum from the water and pat dry using paper towels. Measure and record the mass of the dried gum.
4. Use scissors to cut the second piece of gum into small pieces, each about the width of a pea. Repeat step 2 using fresh water. Use the stirring rod to keep the pieces of gum from clumping together.
5. Use the window screen to strain the water from the gum. Pat the gum dry using paper towels. Measure and record the mass of the dried gum.
6. Discard the gum in a waste container.

Analysis

1. For the uncut piece of gum, calculate the mass of sweeteners and flavorings that dissolved in the water. The mass of sweeteners and flavorings is the difference between the original mass of the gum and the mass of the dried gum.

2. For the gum that was in small pieces, calculate the mass of dissolved sweeteners and flavorings.

3. For both pieces of gum, calculate the percent of the original mass that was soluble sweeteners and flavorings. For help, refer to *Percents* in the **Math Handbook** on page 909 of your textbook.

4. What can you infer from the two percentages? Is the gum sugar-coated or are the sweeteners and flavorings mixed throughout?

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CHEMLAB 11

Hydrated Crystals

Hydrates are compounds that incorporate water molecules in their crystalline structures. The ratio of moles of water to one mole of the compound is a small whole number. For example, in the hydrated compound copper(II) sulfate pentahydrate ($CuSO_4 \cdot 5H_2O$), the ratio is 5:1. The ratio of moles of water to one mole of a hydrate can be determined experimentally by heating the hydrate to remove water.

Problem

How can you determine the moles of water in a mole of a hydrated compound?

Objectives

- **Heat** a known mass of hydrated compound until the water is removed.
- **Calculate** the formula for a hydrate using the mass of the hydrated compound and the mass of the anhydrous compound.

Materials

Bunsen burner
ring stand and ring
crucible and lid
clay triangle
crucible tongs
balance
Epsom salts (hydrated $MgSO_4$)
spatula
spark lighter or matches

Safety Precautions

- **Always wear safety goggles and a lab apron.**
- **Hot objects will not appear to be hot.**
- **Use the Bunsen burner carefully.**
- **Turn off the Bunsen burner when not in use.**

Pre-Lab

1. Read the entire **CHEMLAB**.
2. Prepare all written materials that you will take into the laboratory. Be sure to include safety precautions and procedure notes. Use the data table on the next page.
3. Explain how you will obtain the mass of water and the mass of anhydrous $MgSO_4$ contained in the hydrate.

4. How will you convert the masses of anhydrous $MgSO_4$ and water to moles?

5. How can you obtain the formula for the hydrate from the moles of anhydrous $MgSO_4$ and the moles of water?

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CHEMLAB 11

Sample Data

Mass Data and Observations of Epsom Salts	
Observations of hydrated MgSO	
Mass of crucible and lid	
Mass of crucible, lid, and hydrated $MgSO_4$	
Mass of hydrated $MgSO_4$	
Mass of crucible, lid, and anhydrous $MgSO_4$	
Mass of anhydrous $MgSO_4$	
Mass of water in hydrated $MgSO_4$	
Moles of anhydrous $MgSO_4$	
Moles of water in hydrated $MgSO_4$	
Observation of anhydrous $MgSO_4$	

Procedure

1. Measure to the nearest 0.01 g the mass of a clean, dry crucible with a lid. Record the mass.
2. Add about 3 g hydrated $MgSO_4$ to the crucible. Measure the mass of the crucible, lid, and hydrate to the nearest 0.01 g and record the mass.
3. Record your observations of the hydrate.
4. Place the triangle on the ring of the ring stand. Carefully place the crucible in the triangle.
5. Place the crucible lid on the crucible slightly cocked to help prevent spattering and allow vapor to escape. Begin heating with a low flame, then gradually progress to a stronger flame. Heat for about 10 minutes.
6. When heating is complete, remove the crucible using tongs. Place the lid on the crucible and allow the crucible and contents to cool.
7. Measure the mass of the crucible, lid, and $MgSO_4$ and record the mass in the data table.
8. Observe the anhydrous $MgSO_4$ and record your observations.

Cleanup and Disposal

1. Discard the anhydrous $MgSO_4$ in a trash container or as directed by your teacher.
2. Return all lab equipment to its proper place and clean your lab station.
3. Wash your hands thoroughly when all lab work and cleanup are complete.

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CHEMLAB 11

Analyze and Conclude

1. **Using Numbers** Use your experimental data to calculate the formula for hydrated $MgSO_4$.

2. **Observing and Inferring** How did your observations of the hydrated $MgSO_4$ crystals compare with those of the anhydrous $MgSO_4$ crystals?

3. **Drawing Conclusions** Why might the method used in this experiment not be suitable for determining the water of hydration for all hydrates?

4. **Error Analysis** What is the percent error of your calculation of the water of hydration for $MgSO_4$ if the formula for the hydrate is $MgSO_4 \cdot 7H_2O$? What changes would you make in the procedure to reduce error?

5. **Predicting** What might you observe if the anhydrous crystals were left uncovered overnight?

Real-World Chemistry

1. Packets of the anhydrous form of a hydrate are sometimes used to keep cellars from being damp. Is there a limit to how long a packet could be used?

2. Gypsum ($CaSO_4 \cdot 2H_2O$) is a mineral used for making wallboard for construction. The mineral is stripped of three-quarters of its water of hydration in a process called calcining. Then, after mixing with water, it hardens to a white substance called plaster of paris. Infer what happens as calcined gypsum becomes plaster of paris.