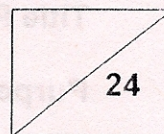


Name of C.S.I. Agent: _____ Date of Investigation: _____

What Did It?



Dear C.S.I. Agent:

You have been called into a case of a dead scientist, Mr. Barium. As you walk into the room, you notice the body on the floor. Police are stumped as to what killed the man, but you suspect that something might be in Mr. Barium's coffee.

From the lab manual left on the desk, it appears that he was looking at various samples of hydrates and it is possible that some might have been added to his coffee. You have asked your team of forensic chemists to collect and analyze the hydrate samples and the coffee.

Being an expert in the field of hydrates, the police are hoping that you can identify which hydrate was responsible for the death of Mr. Barium. A list of the chemical hydrates that were written in the scientist's lab manual is given below. Good luck!

Possible suspected hydrates:

1. magnesium sulfate heptahydrate
2. copper(II) sulfate pentahydrate
3. copper(II) chloride dihydrate
4. barium chloride dihydrate

Materials:

- | | | |
|--|--|---|
| <input type="checkbox"/> Bunsen burner | <input type="checkbox"/> electronic balance | <input type="checkbox"/> small beaker |
| <input type="checkbox"/> Tongs | <input type="checkbox"/> Clay triangle | <input type="checkbox"/> evaporating dish |
| <input type="checkbox"/> Scoopula | <input type="checkbox"/> 3 to 5 g of the hydrated sample "from the coffee" | |

Safety:

1. Wear safety goggles, tie long hair back, remove hats, and remove any loose clothing or jewelry.
2. **Always** handle the evaporating dish with tongs. A **hot evaporating dish** looks exactly like a **cold crucible**.
3. **MSDS** are available for the suspected hydrates

Procedure:

1. Measure the mass of an empty evaporating dish.
2. Add 3 to 5 g of pure unknown hydrated compound.
3. Measure the mass of the dish and hydrate.
4. Set the evaporating dish on the clay triangle and **gently heat for 5 to 10 minutes**. You may need to stir occasionally with the scoopula. Be sure not to lose any of your sample.
5. When the hydrate has lost all of the crystalline luster stop heating.
6. Allow the evaporating dish to completely cool before placing on the electronic balance (at least 15 minutes). You can return the Bunsen burner and start working on your calculations while you are waiting.
7. Find the mass of the crucible and "anhydrous" compound.
8. Transfer the anhydrous compound into a small beaker. Add 20 mL of distilled water. Very carefully and slowly bring touch the sides of the beaker.
9. Return the solution to the designated container. **DO NOT PUT IN THE SINK OR IN THE GARBAGE.**

Marking Scheme:

Title Page (-1 if the page is omitted or not completed in the proper form)

Purpose: State the purpose of this laboratory investigation.

(1 mark)

Materials and Procedure: Make reference to the lab.

Observations:

(4 marks)

Quantitative:

Mass of empty evaporating dish	_____	} before heating
Mass evaporating dish + hydrated compound	_____	
Mass of hydrated compound	_____	
Mass of evaporating dish + anhydrous compound	_____	} after heating
Mass of anhydrous compound	_____	
Mass of water vapour	_____	

Qualitative:

- a) Describe the hydrated compound.
- b) Describe the anhydrous compound.
- c) Describe what happens when the anhydrous compound is added in 20 mL of distilled water.

Analysis: FOR ALL CALCULATIONS in the analysis and question portion of this lab. Show your work, include units and report to the correct number of significant digits.

- 1. Determine the experimental percent by mass of water in your sample of hydrated compound. (2 marks)
- 2. Prepare a table similar to the one shown below. Calculate the percent by mass of water in all four suspected hydrates. (4 marks)

Sample	magnesium sulfate heptahydrate	copper(II) sulfate pentahydrate	Copper(II) chloride dihydrate	Barium chloride dihydrate
Chemical formula				
% by mass of water				

- 3. Compare your answers from question 1 and 2 and explain which hydrate may have caused the death of Mr. Barium. Use a complete sentence(s). (2 marks)
- 4. Write out the balanced chemical equation when the hydrated compound is heated. (1 mark)

Questions:

- 1. a) How many water molecules are present in a 34.6 tonne (1 tonne = 1×10^6 g) sample of sodium sulfate decahydrate? (2 marks).
- b) How many hydrogen atoms are present in 34.6 tonnes of sodium sulfate decahydrate? (1 mark)
- 2. Lead compounds can be toxic and cause neurological damage. Which substance has more atoms of lead, 0.00737 kg of lead(IV) sulfate or 8349 mg of lead (II) nitrate? (7 marks)