

Mystery White Powder

Objective: To identify an unknown white powder from a list of five substances by observing physical and chemical properties and changes in those properties.

Introduction: In this laboratory you will create a qualitative analysis scheme. To do this you must first carry out a series of tests on the white powders with known identities that are provided to you. Once you have collected data and recorded observations about how these known substances undergo physical and chemical changes you should plan a series of tests to determine the identity of your unknown. Even if you think you know the identity of your unknown you must prove your hypothesis using empirical evidence.

Observations: To make the best observations possible you need to use your senses, use tools and develop a vocabulary for what you observe. Of course you must also be mindful of safety. **Tasting of substances in this laboratory is NOT allowed.** Notice the color of the substance. There are many shades of white. Is the white color bright, creamy, bluish, grayish? Note the luster. Luster is the way light interacts with a surface. Metals are shiny. Clay is dull. Other words for luster are metallic, pearly, resinous, glassy. Texture should also be described carefully. Note the size of the particles that you can see - are they rounded or angular or even rectangular? Do they clump, are they sticky or do they seem to flow by each other easily? As you carry out various tests how does the appearance of the material change? Does its texture change from crystalline to glassy for example? Does the color change? What about odor? Does the substance have an odor? Wave your hand carefully over anything you want to smell and bring the fragrance to your nose. **Don't sniff chemicals.** Do you see any phase changes - melting, boiling? Do you see evidence of a chemical change - evolution of a gas - bubbles?

Some Ideas for Tests: Solubility in a water and oil. Flame test, noting both the color of the flame and characteristics of the smoke (if any). Litmus test^{*}: an acid will turn blue paper red, a base will turn red paper blue, a neutral substance will not change the color of red or blue litmus paper. A bleach will cause the paper to become white. The substance will need to be dissolved in water to use the litmus test. Iodine/KI test for starch (amylose) - add a few drops directly to a small sample of the white powder. Test for evolution of carbon dioxide gas (CO₂) using a few drops of vinegar (5% acetic acid) added directly to the white powder.

* **PLEASE:** One piece of litmus paper may be used for many tests. It only takes a drop. Use small quantities for each test.

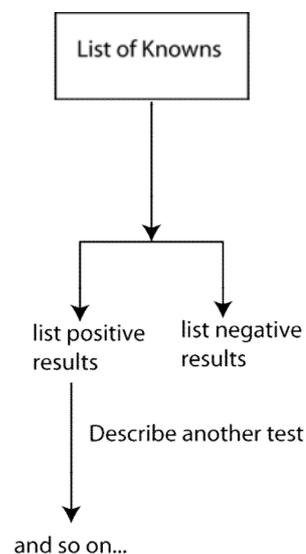
CRITICAL: Take care NOT to contaminate the known substances. Never put any chemical back once it is removed from its container. Use only the spoon designated for that substance. (Don't mix up the spoons.)

Known Substances: Baking Powder, Baking Soda, Potato or Corn Starch, Salt, Sugar

Organization: Use charts to organize your observations. Your lab notebook (or lab report) should have the following sections: Title, Date, Your Name, Objective (Purpose), Plan of Action, List of Materials, Charts of Observations, Hypothesis, Analysis of Results, Comments about Problems or Errors (Reflections), Conclusions, References

Throughout the laboratory you should **create illustrations and diagrams** to explain your procedures and tests. A qualitative scheme follows the following general pattern:

Your instructor may have additional information about how you should write about your experimental results.



Materials Required for Mystery White Powder

Unknowns

36 Unknown Samples (small vial of one of the five powders)

Knowns

4 sets of 100 mL beakers of each powder. Each beaker should have a plastic spoon in it. Also original containers should be provided so that students may examine the list of ingredients on the packaging.

Baking Soda

Baking Powder

Salt

Sugar

Starch (Potato or Corn)

Supplies

4 tubes red litmus paper

4 tubes blue litmus paper

Disposable Pipets (box of at least 40)

32 Spot Plates

Reagents

4 200 mL bottles mineral oil with droppers

4 50 mL bottles "vinegar" (5% Acetic Acid)

4 50 mL bottles with droppers Iodine in Potassium Iodide Solution (Starch Indicator Solution)

Questions

Please include the answers to these questions in your laboratory notebook or report.

1. How does the Iodine/Iodide test for starch work? (Use the Internet to find out.)
2. What is starch?
3. What is the melting point of salt? What is the melting point of sucrose (sugar)?
4. What is the chemical formula of acetic acid? What reactions produce carbon dioxide?
5. How is baking powder different from baking soda?
6. Classify each known as either a compound or a mixture. If it is a mixture - what compounds are in the mixture.