

Qualitative Analysis Lab

Introduction:

Qualitative analysis determines the presence or absence of a substance, but not how much of a substance is present. The identification of an unknown substance is accomplished using qualitative data. Since substances react in predictable ways, chemists can use chemical reactivity to identify unknown substances.

Objective:

Students will be given four samples of unknown white powders, numbered from 1 to 4. Performing the tests provided, they will design and carry out a procedure to identify the unknown powders.

Materials:

- spot plate
- toothpicks (for stirring)
- (4) unknown substances:
 - potassium iodide
 - lead (II) nitrate
 - calcium carbonate
 - sodium carbonate
- (4) dropper bottles containing the following solutions:
 - 0.25 M NaCl
 - distilled water
 - 1 M HCl
 - sodium carbonate



All students must wear safety goggles, a lab apron, and gloves.

Pre-lab Questions:

1. What are the signs that a chemical change has occurred?
2. What is a precipitate?
3. Write and balance the following equations:
 - a. A solution of sodium chloride is reacted with a sample of lead (II) nitrate.
 - b. A solution of sodium chloride is reacted with a sample of potassium iodide.
 - c. A solution of sodium chloride is reacted with a sample of calcium carbonate.
 - d. A solution of sodium chloride is reacted with a sample of sodium carbonate.

Tests:

1. Sodium Chloride Test:

- Add NaCl (aq) to the sample.
- Silver, mercury, or lead cations are present if a reaction occurs.

2. Solubility Test:

- Add distilled water to the sample.
- The unknown is soluble if it dissolves or partially dissolves in the water.

3. Hydrochloric Acid Test:

- Add HCl (aq) to the sample.
- Carbonate ions are present if bubbles (CO_2) form.

4. Lead (II) Nitrate Test:

- Add lead (II) nitrate solution to the sample.
- If an insoluble product forms, the lead has reacted with a carbonate, chloride, chromate, hydroxide, oxide, phosphate, silicate, sulfate, or sulfide ion.

Procedure:

1. Design a procedure using the tests provided to identify each of the four unknown substances. The tests may be performed in any order. The primary goal is to identify the unknown samples; the secondary goal is to identify the unknowns with as few steps as possible. Write out your full procedure before continuing.
2. Create a table to collect qualitative data.
3. Conduct your procedure and identify each of the four unknown substances.

Post-lab Questions:

1. Identify each of the four unknowns. Justify each answer with at least two pieces of data.
2. Is every test necessary to identify the four unknowns? Explain.
3. If you were to repeat these tests, how would you revise your procedure?