Testing for Cation and Anions

OBJECTIVE:

- Determine the presence of a cation or anion by a chemical reaction
- Determine the cation and anion in an unknown solution

All salt solutions have both positive (Cations) and negative (Anions) ions dissolved in it. In this experiment you will observe chemical reactions to determine the presence of specific anions and cations.

Compare your observations with the reactions of the known solutions and the unknown solution to determine the ions present in the unknown solution.

You will use a flame test for the cations, Na\(^+\), K\(^+\), and Ca\(^{2+}\)

Perform qualitative tests for Ca\(^{2+}\), NH\(_4\)^+, Fe\(^{3+}\).

Qualitative tests will be used to identify anions, Cl\(^-\), SO\(_4\)^2-, PO\(_4\)^3-, and CO\(_3\)^2-.

Expected results of the qualitative test and the reactions are included in your procedure.

PROCEDURE:

Obtain from the stock room a solid unknown salt to be analyzed for the presence of both cation and anion.

HC\(_1\), HNO\(_3\) are strong acids and NaOH is a strong base so be careful when using them.

Use the plastic pipettes on the center counter to dispense your unknown solution.

Approx. 20 drops is equal to 1 mL,

All waste go in the waste jar labeled for your class.

**Bunsen Burner Safety.**

- Make sure you are able to get a spark out of the striker **consistently**!
- Turn the gas needle valve counter clockwise completely.
- Adjust the burner barrel so your are able to see through the air inlet
- Check the rubber tubing and place the rubber hose on the gas nozzle.
- Turn the gas jet 90 degrees.
- Open the gas needle valve until you hear the gas and light.
- If you are not successful in lighting the burner, turn the gas off and try again.

**Cation Tests**

A1. Flame Test

- Label 3 test tubes, Na\(^+\), K\(^+\) and Ca\(^{2+}\). Bring the test tubes to the stockroom window to get your wood splint soaked in each of the solution. You will also be given an unused wood splint to use for your unknown. Get your solid unknown as well.
- Soak the unused wood splint in water.
- Observe the change in flame color when the known solutions above are burned.
  - K\(^+\) gives a very fleeting color change.
  - Ca\(^{2+}\) gives a very similar flame color as Na\(^+\).
- Now that you know how observed how Na\(^+\), K\(^+\) and Ca\(^{2+}\), you will test your unknown.
- Transfer a small amount of solid unknown to a scoopula and roll the wood splint
that was soaking in water in the solid unknown and burn.

- By the end of Part A1, you should be able to conclude the presence or absence of Na⁺ or K⁺ and maybe Ca²⁺.

Chemical Tests

A2
- Because the flame test for Ca²⁺ is sometimes inconclusive, the oxalate test is performed.
- If no immediate precipitation (cloudiness) is observed, heat in a water bath for 5 minutes. Water bath is set up in the southwest hood.

A3
- Ammonium chloride, NH₄Cl, reacts with sodium hydroxide, NaOH, to form ammonia, NH₃ gas.
- The presence of the NH₃ gas is confirmed using a moistened red litmus paper place on the mouth of the test tube. Ammonia gas is basic and will turn red litmus paper blue.

A4
- Fe³⁺, iron ion, react with potassium thiocyanate, KSCN, to form a blood red solution.

By the end of Part A you should be able to identify your one cation. You must do all Tests for the known solutions.

Part B

This part of the experiment test for the presence of anions, Cl⁻, SO₄²⁻, PO₄³⁻, and CO₃²⁻.

B1
- Chloride ion, Cl⁻, reacts with silver nitrate, AgNO₃ to form a precipitate that does not dissolve in HNO₃.

B2
- Sulfate ion, SO₄²⁻, reacts with barium chloride, BaCl₂, to form a precipitate that does not dissolve in HNO₃.

B3.
- Phosphate ion, PO₄³⁻, reacts with ammonium molybdate solution, (NH₄)₂MoO₄, in acidic solution to form a yellow precipitate. A yellow solution only is a negative result.

B4
- Carbonate ion, CO₃²⁻, reacts with HCl to form CO₂ gas that is observed as bubbles.

Part C. Each island will have a consumer product to test.