Procedure

Notes:

1. **Properly label your test tubes as you proceed through the experiment**
2. **All solid and liquid wastes are to be placed in the chemical waste containers**

1. Analysis of a known (~0.1 M Ag^+, Al^{3+}, Mn^{2+}, Sr^{2+}, K^+)

    1. Setup a hot water bath in the hood using your 400-mL beaker and the water bath test tube rack supplied at your benchtop.
    2. ***Separation of Group A:*** Add 10 drops of known (or unknown) to a 13x100 mm test tube. Slowly, with mixing, add 2 drops of 3 M HCl. If no precipitate forms, go to Step 3. If a white precipitate forms, centrifuge and then add 1 additional drop of 3 M HCl and see if any more precipitate forms. If yes, add another drop of 3 M HCl and centrifuge; if not, decant (pour) the supernatant (solution layer) into another labeled test tube and save it for Step 3.
    3. ***Separation of Group B:*** Using the supernatant from Step 2, add 6 M NH_3 dropwise, slowly and with mixing, until the pH of the solution is approximately 10. If a precipitate forms, it will indicate the presence of manganese (II) ion and/or aluminum (III) ion. Centrifuge and decant the supernatant into another labeled test tube and save it for Step 4.
        a. ***Separation of Group B1 & B2:*** Wash the precipitate twice with 10 drops of deionized water. Centrifuge after each wash and discard the washings. Add 10 drops of 6 M NaOH and 2 drops of 3% H_2O_2 (hydrogen peroxide) to the test tube with the precipitate and place in a hot water bath for 2 minutes. If a black precipitate forms, this confirms the presence of the manganese ion as MnO_2. Centrifuge and decant the supernatant into another labeled test tube for Step 3b.
        b. ***Confirmation of Group B2 (Al^{3+}):*** To the supernatant from the previous step, add 3 M HCl dropwise until acidic. Add 2 drops of aluminon reagent and then add 6 M NH_3 dropwise until the solution tests basic to pH paper. Centrifuge and if a red precipitate forms, this confirms the presence of the aluminum ion.
    4. ***Separation of Group C:*** Using the supernatant from Step 3, add 6 drops of saturated ammonium carbonate, $(NH_4)_2CO_3$, mix well, and centrifuge. The appearance of a white precipitate indicates the presence of strontium ion. Decant the supernatant into a labeled test tube for Step 5.
    5. ***Confirmation of Group E (Soluble metal cations):*** To the supernatant from Step 4, conduct a flame test for potassium. In order to perform this test, clean a platinum wire by immersing it in concentrated HCl, then heating it over a burner. Repeat this procedure until the flame is not discolored by the presence of the wire. Then immerse your clean platinum wire into your supernatant and heat it over a burner. The appearance of a brief lavender flame confirms the presence of the potassium (I) ion. A lingering red color, which is seen after the lavender, is indicative of the strontium (II) ion which would present if the precipitation step for Group C is incomplete.

2. Analysis of an unknown: Repeat steps 2 – 5 above using your unknown.

3. Report:

    a. Copy the flow chart on the next page into your lab notebook for your known, and fill it completely.
    b. For your unknown, complete the attached flow chart by indicating what is present and the confirmatory compounds. Report both your unknown number and the ions found in your unknown.

(Based on Szafran, Z.; Pike, R.M.; Foster, J.C. *Microscale General Chemistry Laboratory (with Selected Macroscale Experiments)*, 2nd ed., Wiley & Sons (2003))