

Appendix 1.9A: Test Tube Mystery: Lab Activity (Guidelines)

Purpose

Chemists, like detectives, attempt to identify unknowns through a process of careful and creative analysis. This usually involves observing the colours, odours, and reactions of unknown substances and comparing them with those of known substances. In this experiment, you will try to identify 12 different chemical compounds by reacting them with each other, observing the results, and comparing the results with the known characteristics of some common chemicals.

Chemical Compounds

The 12 chemicals used in this experiment are listed below (in no particular order):

- potassium chromate (K_2CrO_4)
- aluminum chloride ($AlCl_3$)
- sodium carbonate (Na_2CO_3)
- sodium acetate ($NaCH_3COO$)
- hydrochloric acid (HCl)
- sodium hydroxide ($NaOH$)
- ammonium hydroxide (NH_4OH)
- iron(III) nitrate ($Fe(NO_3)_3$)
- silver nitrate ($AgNO_3$)
- copper(II) sulphate ($CuSO_4$)
- nickel(II) chloride ($NiCl_2$)
- lead(II) nitrate ($Pb(NO_3)_2$)

Research and Plan

Before starting the lab activity, you will have to do extensive research on the characteristic colours of the solutions, any distinguishing odours, their flame-test colours, and the colours of any precipitates that may be created through the combination of each different species. Your written plan must include a data table grid that includes each species, the solution and flame-test colours, the colours of potential precipitates, and any other information that you think will help to identify your unknowns.

Materials

On the day of the lab activity, you will be provided with the following materials:

12 test tubes containing 8 mL each of different solutions

well plates

stir sticks

cotton swabs/flame-test wires/moist wooden splints

Bunsen burners

matches

litmus paper

10 micropipettes

gloves

distilled water

Avoid running out of your samples, as you will not be provided with any more. Do not assume that solution sets other groups are using are numbered in the same way – they are not!

Lab Write-up

After recording all your observations in the lab activity, you will attempt to identify each of the unknowns. A formal lab write-up must include a logical explanation of how you determined the identity of each test tube. This will include net ionic equations for any precipitates you saw.

Caution

All solutions must be treated as if they were poisonous and corrosive. Avoid inhaling any fumes. Some reactions may occur very quickly, while others will occur more slowly. Observe each reaction for at least two minutes before disposing of the products. Gas evolution (bubbling) will be immediate. Rinse off your stir stick after each use. As time will be limited, use your time wisely.