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| **Foundation Year** | **Identifying Unknowns Using Flames Tests and Silver Nitrate** | **Semester 1** |

**Identifying Unknowns Using Flames Tests and Silver Nitrate**

**Aim**

After completing this practical, you will be able to:

(a) Describe laboratory tests for a range of ions using flame tests, AgNO3 and NH3.

(b) Give an account of what you would observe and what inference can be drawn from a particular observation.

(c) In the case of silver nitrate tests for halides, write ionic equations with state symbols to explain what is observed.

**Introduction**

The use of chemical tests to identify unknown compounds is a crucial skill in chemistry. The tests you will use in this practical are examples of qualitative analysis, where you will observe the outcome of an experiment to help you identify the different compounds.

In this experiment, the ‘unknown’ samples labelled A-E are all ionic compounds made up of an alkali metal cation and a halide anion. You will perform a flame test on each of the compounds to identify the alkali metal ion present. Metal ions give a characteristic colour when heated directly in a Bunsen flame. Once you have observed the outcome of the flame test, you will be able to make an inference regarding the identity of the alkali metal cation present in the compound.

Adding silver nitrate solution to a solution of a halide salt leads to the formation of a precipitate of the silver halide salt which is produced. An example equation showing what happens when silver nitrate is added to sodium chloride is given below:

NaCl(aq) + AgNO3(aq) 🡪 AgCl(s) + NaNO3(aq)

*How does the equation indicate that a precipitate is formed during this reaction?*

The precipitates formed from chloride, bromide and iodide salts are different in appearance, and they have different solubilities in dilute/concentrated ammonia solution. In this practical, you will explore the nature of the precipitates formed from different halide salts and you will devise a procedure that somebody could use to test an unknown sample for the presence of the different halides and to make the correct idenitification.

**Skills associated with this practical**

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| **Practical Skills**   * Performing a flame test * Correctly handling a concentrated, corrosive solution * Making observations | **Scientific Skills**   * Writing ionic equations |

**Signposts**

Chemistry, Conoley & Hills, 3rd Edition, Chapter 23, Page 465.

**Understanding Hazard and Minimising Risk**

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| --- | --- | --- | --- | --- |
| Substance | Amount | Hazards | Minimising Hazards | Disposal / Spillage |
| (1 M) Nitric Acid (HNO3) | 2-3 drops | Corrosive, causes burns. | Wear gloves, lab coat. | Pour down sink with copious amounts of water. |
| (0.5 M) Ammonia solution (NH4OH) | 5 cm3 | Irritant. | Wear gloves, lab coat. | Pour down sink with copious amounts of water. |
| Conc. Ammonia solution (NH4OH) | 5 cm3 | Corrosive, causes burns. | Wear gloves, lab coat, **use in fumehood**. | Dilute and pour down sink **(in fumehood)** with copious amounts of water. |
| (0.1 M) Silver Nitrate (AgNO3) | 5 cm3 | Irritant, stains skin. | Wear gloves, lab coat**.** | Pour down sink with copious amounts of water. |

You must stand up throughout the practical, and safety glasses must be worn at all times in the lab. You must wear a labcoat whilst you are carrying out practical work. Long hair must be tied back, and trousers (jeans are OK) must be worn. Open-toed shoes are not permitted.

**Procedure**

Apparatus

PER PAIR: Test tube rack

Solutions of chloride, bromide and iodide salts (0.1 M)

3 test tubes

Silver nitrate solution (0.1 M)

2 dropping pipettes

Nitric acid (1 M)

Ammonia (0.5 M) **and** concentrated ammonia

Method

It is suggested that you record your observations in a table. Read the method below to work out the structure of your table. Draw your results table before you start the experiment.

**Flame Tests**

5 flame test stations have been set up, one for each of the unknown compounds A-E. Each station has its own Bunsen burner along with a heating wire (nichrome) mounted on a cork.

1. Dip the heating wire in the beaker of hydrochloric acid and heat the wire in a roaring blue Bunsen flame for about one minute. Repeat this process a second time.
2. Dip the heating wire in the distilled water, and then into the solid unknown compound you are testing. There should be a small amount of the solid attached to the heating wire.
3. Heat the wire in a roaring blue Bunsen flame, positioning the wire so the solid compound is at the edge of the blue cone in the flame. Get your partner to take a photo of you performing the flame test for your Key Skills portfolio.
4. Make a note of any colour you observe. Take photos of the different coloured flames you observe to include in your Key Skills portfolio.
5. Clean the heating wire by repeating step (1).

**Silver Nitrate Test for Halide Ions**

1. Pour samples of each of the solutions A-E into 5 separate test tubes to a depth of **no more than 1 cm (this is important!).**
2. Using a dropping pipette, add 2-3 drops of 1 M nitric acid to each test tube.
3. Using a different dropping pipette, add about 0.5 cm3 of 0.1 M silver nitrate to each tube. Make a note of your observations (with particular reference to colour). Take photos of each of the different coloured precipitates you observe for your Key Skills portfolio.
4. Add dil. ammonia solution (0.5 M) to each tube to a depth of ~5 cm & note any observations.
5. Take the tubes which didn’t show any change in step 4 to the fume cupboard and add concentrated ammonia (don’t add more than 5 cm3 of conc. ammonia) and again note your observations. **Wear gloves and be extremely vigilant.** Get your partner to take a photograph of you pouring the concentrated ammonia for your Key Skills portfolio.

**Disposal**

Pour any tubes containing concentrated ammonia down the sink at the back of the fume cupboard with plenty of water. All other solutions can be washed down the sinks in the lab.

**Observations and Analysis**

**1) Draw tables to show what is observed (a) when different metal ions are subjected to flame tests and (b) different halide ions are subjected to silver nitrate solution.**

**2) Write ionic equations to show what happens when silver nitrate is added to each of the 3 halides tested in this experiment.**

**Deadlines, Assessment and Feedback on Performance**

You are required to complete the Skills Portfolio document associated with this practical. This should be completed electronically with all photos inserted in the appropriate places and accompanying text typed in. The submission deadline for Skills Portfolios will normally be midnight on the Sunday following the practical, although you will be given specific guidance during the practical session. Submission is via the e-submission system Turnitin which you will be able to access in the appropriate folder in the Laboratories and Coursework Blackboard course.