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| **Foundation Year** | **Identification of Carbonyl Compounds** | **Semester 2** |

**Identification of Carbonyl Compounds**

**Aim**

To use qualititive tests to distinguish between different aldehydes and ketones and gain experience using a fume cupboard

**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 different compounds.

Aldehydes and ketones both contain carbonyl groups. Despite their similarities, the chemistry of aldehydes and ketones are quite different and distinguishing between the two is important. Infrared spectroscopy can clearly identify a carbonyl peak but it can be difficult to distinguish between the various types of compound which contain carbonyl groups.

Tollens’ test, also known as the silver mirror test, and Fehling’s test both come from a time when reactions were named after those who discovered them. They are both still useful today and are bassed on oxidation reactions. In both cases a positive test is seen with aldehydes but not with ketones, as only aldehydes can be oxidised further i.e. to to carboxylic acids.

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| http://www.brooklyn.cuny.edu/bc/ahp/LAD/C4c/graphics/fig_glucose_04.gif  Glucose (aldehyde functional group on the left) | Propanone (also known as acetone) |

**Skills associated with this practical**

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| **Practical Skills**   * Perform tests to identify the presence of different functional groups | **Scientific Skills**   * Make observations during experiments and draw inferences based on your knowledge |

**Signposts**

Further details of the reactions of carbonyl compounds can be found on page 323 of the Conoley and Hills text book.

**Understanding Hazard and Minimising Risk**

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 ALL practical work. Long hair must be tied back, and trousers (jeans are OK) must be worn. Open-toed shoes and clothing revealing bare skin are not permitted.

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| Substance | Amount | Hazards | Minimising Hazards | Disposal / Spillage |
| Acetone | <1 cm3 | Flammable | Keep away from naked flames | Dilute solutions can go down the sink |
| Concentrated ammonia solution | 2-3 drops | Corrosive, strong odour | Use only in fume hood, wear gloves | Dilute solutions can go down the sink |
| 0.1 M AgNO3(aq) | 1 cm3 | Causes stains | Wear gloves (optional) | Dilute solutions can go down the sink |
| 4 M NaOH solution | 1 cm3 | Corrosive | Wear gloves | Dilute solutions can go down the sink |
| Potassium Sodium Tartrate | <10 g | No significant hazard | - | Dilute solutions can go down the sink |
| Copper sulfate solution | 1 cm3 | Harmful | - | \*Place waste in beaker provided |

**Procedure**

Apparatus

PER PAIR: Dropping pipettes Test tubes

Test tube racks 2 x 100 cm3 conical flask

250 cm3 beaker (water bath) Spatula

Kettles will also be available to share between groups

Method

You will experience both the Tollens’ and Fehling’s tests in order identify two unknown compounds as either aldehydes or ketones. You should record your observations in a table. Read the method below and work out the best way of structuring your table. Draw your results table before you start the experiment and show it to a demonstrator for checking.

**Silver mirror (Tollens’) test**

1. Place approximately 1 cm3 of aqueous 0.1 mol dm-3 silver nitrate solution in a test tube.

2. In the fume cupboard add 2-3 drops of concentrated ammonia to the solution. Ensure this is mixed thoroughly before removing from the fume cupboard.

3. Dissolve a small amount of the suspected aldehyde or ketone in <1 cm3 water in another test tube (i.e. a few drops if a liquid, or a small amount from the end of a spatula if a solid).

4. Add the dissolved aldehyde or ketone to the test tube and mix thoroughly. Prepare tubes for both unknowns at the same time.

5. Prepare a hot water bath by adding recently boiled water to a 250 cm3 beaker, and place your test tubes in the water bath. Leave the tubes to heat for at least 5 minutes.

6. Remove the test tubes and record any observations you make. Take photos for your *Skills Portfolio* showing positive and negative results for the test.

7. Repeat this experiment for your other carbonyl compound.

**Fehling’s test**

1. Place approximately 10 cm3 of aqueous copper sulfate solution in a conical flask.

2. Add approximately 1 cm3 (15-20 drops) of concentrated sulfuric acid to the copper sulfate solution, taking care to mix thoroughly. The resulting solution is called ‘Fehling’s A’.

3. Prepare a stock of Fehling’s B solution by making a 1.2 mol dm-3 solution of potassium sodium tartrate (C4H4O6NaK.4H2O) in 10 cm3 of 4 mol dm-3 sodium hydroxide**\*** (**CORROSIVE:** wear gloves) solution in a conical flask.

4. Fehling’s solution is prepared by mixing equal volumes of Fehling’s A and B immediately before use. Add approximately 1 cm3 of each solution to a test tube.

5. Add a small amount of aldehyde or ketone to the Fehling’s solution. Prepare tubes for both unknowns at the same time.

6. Prepare a hot water bath by adding recently boiled water to a 250 cm3 beaker, and place your test tubes in the water bath. Leave the tubes to heat for at least 5 minutes.

7. Remove the test tubes and record any observations you make. Take photos for your *Skills Portfolio* showing positive and negative results for the test.

**\*** Make up 10 cm3 of a solution of potassium tartrate with a concentration of 1.2 mol dm-3. Think carefully about how many moles of potassium tartrate you need. The determination is based on material covered in the first few weeks of Semester 1. Do not be confused by the fact that you are dissolving the potassium tartrate in a solution of sodium hydroxide – the principles are the same as if you were dissolving it in a volume of water.

Using either the silver mirror test or Fehling's test, test the TWO unknown carbonyl compounds to determine whether they are aldehydes or ketones.

**Disposal**

All solutions can go flushed down the sink with plenty of water. Test tubes coated with a silver mirror should be collected separately so that the silver can be reclaimed.

**Deadlines, Assessment and Feedback on Performance**

You are required to complete the Skills Portfolio document associated with this practical (both parts a and b). 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.