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| **Foundation Year** | **Preparation of Esters** | **Semester 2** |

**Preparation of ESters**

**Aim**

To carry out a microscale reaction to produce an ester, and to observe the characteristic smells of a range of esters.

**Introduction**

Many distinctive flavours and fragrances are due to the presence of esters. Esters with relatively similar structures can give very different smells, and such compounds are easily prepared in the lab by systematically reacting different alcohols and carboxylic acids. As such, a wide variety of scents can be synthesised very quickly using a simple chemical reaction.

**Skills associated with this practical**

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| **Practical Skills**   * Performing a microscale experiment | **Scientific Skills**   * Make and record observations * Describe different types of fragrance |

**Signposts**

More information about esters can be found in Chapter 18 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 |
| Salicylic acid | <1 g | Irritant | Handle with care (gloves optional) | Down the sink with plenty of water |
| 4 M ethanoic acid | <1 g | Irritant | Handle with care (gloves optional) | Down the sink with plenty of water |
| Sebatic acid | <1 g | Irritant | Handle with care (gloves optional) | Down the sink with plenty of water |
| Hydrocinnamic acid | <1 g | Irritant | Handle with care (gloves optional) | Down the sink with plenty of water |
| Citric acid | <1 g | Irritant | Handle with care (gloves optional) | Down the sink with plenty of water |
| Benzoic acid | <1 g | Irritant | Handle with care (gloves optional) | Down the sink with plenty of water |
| Methanol | 1 cm3 | Flammable | Do not use near naked flames | Down the sink with plenty of water |
| Ethanol | 1 cm3 | Flammable | Do not use near naked flames | Down the sink with plenty of water |
| Propan-2-ol | 1 cm3 | Flammable | Do not use near naked flames | Down the sink with plenty of water |
| Butanol | 1 cm3 | Flammable | Do not use near naked flames | Down the sink with plenty of water |
| Heptanol | 1 cm3 | Flammable Irritant | Do not use near naked flames | Down the sink with plenty of water |
| 0.5 M sodium carbonate solution | 3 cm3 | No hazards | - | Down the sink with plenty of water |
| Concentrated Sulfuric acid | 2-3 drops | Corrosive | Wear gloves | Dilute solutions can go down the sink |

**Procedure**

Apparatus

PER PAIR: 6 Test tubes 250 cm3 beaker (used as water bath)

Dropping pipettes Spatula

Test tube rack Kettles will also be available to share

Pen (to label tubes)

Method

You should record your observations in a table. You will be making six esters altogether from your choices of alcohol and carboxylic acid. Each ester will have a characteristic smell which you will need to describe. Your table should provide details of which alcohol and which carboxylic acid were used for each reaction, the name of the ester formed and a description of its smell.

**Production of esters**

1. Add around 1 cm3 (approximately 1 cm deep) of an alcohol into a test tube.

2. Add one or two drops of concentrated sulfuric acid to the alcohol in test tube.

3. Add around 10 drops of carboxylic acid or if a solid a small amount from the end of a spatula. Ensure that the tube is labelled appropriately.

4. Repeat steps 1-3 for a further 5 combinations of acids and alcohols, giving you 6 in total. Take a photo for your *Skills Portfolio* showing all of the tubes and your systematic labeling.

5. Prepare a hot water bath by half-filling a 250 cm3 beaker with hot water from a kettle.

6. Place all 6 test tubes in the water bath and leave for at least 5 minutes.

7. After 5 minutes of heating, remove the test tubes, place them in the rack and allow to cool.

8. Once cool neutralise each solution by pouring them into a test tube half-filled with sodium carbonate solution. Ensure they are fully mixed by pouring back and forth between the two test tubes.

9. Allow the contents to settle. Each ester will separate out and form a layer above the aqueous solution.

10. Using caution, smell each ester and try to describe the characteristic aromas.

11. All solutions can be disposed of down the sink with plenty of water.

(Naming hint: Esters made from one of the more unusual acids can be named by removing the ‘***ic***’ from the name and replacing it with ‘***ate***’ thus an ester of salycil***ic*** acid is a salycil***ate***).