

## Oxidation of ethanol to ethanal

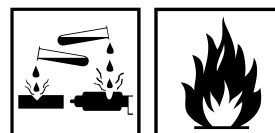
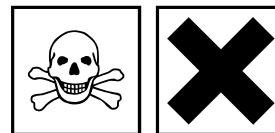
### Aims

To oxidise ethanol to ethanal (an aldehyde), and to compare the properties of these two compounds.



### Apparatus

|              |                           |                    |
|--------------|---------------------------|--------------------|
| Goggles      | Delivery tube and bung    | Stand, boss, clamp |
| Bench mat    | 250cm <sup>3</sup> beaker | Weighing bottle    |
| Boiling tube | Teat pipettes             | Digital balance    |
| Test tubes   | Bunsen burner             | Broken porcelain   |



### Reagents

|                       |                                |                              |
|-----------------------|--------------------------------|------------------------------|
| Ethanol               | 2M sodium hydroxide solution   | Silver nitrate solution      |
| Sodium dichromate(VI) | 1M ammonia solution            | Fehling's solutions 1 and 2  |
| 1M sulphuric acid     | 0.5M sodium carbonate solution | Universal Indicator solution |

### Methods

#### Part One      Oxidation of ethanol to ethanal

- Place about 10cm<sup>3</sup> of dilute sulphuric acid in the boiling tube. Add 2–3g of sodium dichromate(VI) and a few pieces of broken porcelain. Shake the contents of the tube until the solution is complete (warm if necessary).
- Cool the mixture and add 1–2 cm<sup>3</sup> of ethanol **dropwise**, shaking the tube between additions.
- Connect the delivery tube and bung to the boiling tube, and clamp it. Apply **gentle** heat to distil 2–3 cm<sup>3</sup> of your product into a test tube. Make sure that none of the reaction mixture splashes over.

#### Part Two      Tests on your product

- Notice the smell of your product. Compare it with that of ethanol.
- Find out if your product will neutralise sodium carbonate solution.
- Mix 1cm<sup>3</sup> of Fehling's solution 1 with 1cm<sup>3</sup> of Fehling's solution 2 in a test tube. Add a few drops of your product, **carefully** boil the mixture, and note the result.
- Put 2 cm<sup>3</sup> of silver nitrate solution in a test tube, add **one** drop of sodium hydroxide solution, then add just enough ammonia solution to bring the precipitate formed into solution.

**Do not allow this mixture to stand because it sometimes forms dangerously explosive silver salts.**

Add a few drops of your product and warm **very carefully**. Repeat this test with ethanol.

### Analysis

- Fehling's solution contains a copper(II) compound.
  - What might the precipitate be when ethanal was added to the Fehling's solution?
  - What type of reaction has taken place, and what does this tell you about the nature of the aldehyde?
- Write equations for the reactions you have observed.

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### Technician's Notes

In addition to normal laboratory apparatus:

#### Per class

Minimum of one digital top pan balance

Small pieces of broken porcelain

#### Reagents:

Sodium dichromate(VI) with a small spatula

Ethanol (allow 4cm<sup>3</sup> per student)

Fehling's solutions 1 and 2 (allow 2cm<sup>3</sup> of each per student)

0.5M sodium carbonate solution (Na<sub>2</sub>CO<sub>3</sub>) (allow 5cm<sup>3</sup> per student)

Please ensure plentiful supply of:

- bench sulphuric acid
- bench sodium hydroxide solution
- ammonia solution
- silver nitrate solution
- Universal Indicator solution

#### Per student

2 x boiling tubes

4 x test tubes

2 x teat pipettes

1 x wash bottle of de-ionised water

1 x 10cm<sup>3</sup> measuring cylinder

Delivery tube and bung to fit one of the boiling tubes:

