

## Teacher Resource Bank

GCE Chemistry

PSA7: AS Organic Chemistry

- Distil a Product From a Reaction (Ethanal)



## AS Organic Chemistry

### PSA7      Distil a product from a reaction (Ethanal)

## Technical Sheet

**To prepare ethanal by the oxidation of ethanol and to distil the ethanal from the reaction mixture.**

Whenever possible, students should work individually. If it is essential to work in a pair or in a small group, because of the availability of apparatus, supervisors must be satisfied that they are able to assess the contribution from each student to the practical activity.

### Requirements

- simple distillation apparatus OR Quickfit apparatus
- acidified potassium dichromate(VI) (see below)
- protective gloves
- stand and clamp
- 10 cm<sup>3</sup> measuring cylinder
- 25 cm<sup>3</sup> measuring cylinder
- anti-bumping granules
- test tube
- thermometer (-10 °C to 110 °C)
- Two 250 cm<sup>3</sup> beakers
- ethanol
- teat pipette
- silver nitrate solution
- dilute ammonia solution
- sodium hydroxide solution
- dilute sulfuric acid

The student sheet assumes that **simple distillation apparatus** will be used and this can be made by using a boiling tube fitted with a bung with a right-angled glass delivery tube. The delivery tube needs to be long enough to go into a test tube which is immersed in cold water in a beaker.

The alternative is for the Centre to provide Quickfit apparatus and guidance to students in its assembly. This apparatus will lead to a more ethanal being collected because it is condensed more efficiently using a water-cooled Liebig condenser.

The **oxidising agent** can be made for the class by dissolving potassium dichromate (VI) in dilute sulfuric acid. The concentration of the potassium dichromate(VI) should be approximately 1 g in every 10 cm<sup>3</sup> of this dilute acid.

**Centres are expected to carry out and be responsible for their own safety risk assessments.**

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### Student Sheet

**It is the responsibility of the student to carry out and be responsible for their own safety risk assessment before carrying out this experiment. Wear safety glasses at all times. Assume that all of the reagents and liquids are toxic, corrosive and flammable.**

#### **Experiment      The oxidation of ethanol to ethanal**

- Using a 25 cm<sup>3</sup> measuring cylinder, carefully measure out 12 cm<sup>3</sup> of the solution of acidified potassium dichromate(VI) which has been provided for this experiment. Pour this oxidising agent into a boiling tube. You should wear protective gloves when handling the corrosive oxidising agent.
- Cool the boiling tube in cold water in a beaker.
- Using a 10 cm<sup>3</sup> measuring cylinder, carefully measure out 2 cm<sup>3</sup> of ethanol.
- Using a teat pipette, **slowly** add the 2 cm<sup>3</sup> of ethanol **dropwise**, to the oxidising agent in the **cooled boiling tube** (immersed in cold water in a beaker), shaking the tube gently to mix the contents.
- After the addition of ethanol, add a few anti-bumping granules to the boiling tube and attach to it a bung fitted with a right-angled glass delivery tube.
- Clamp the boiling tube at an angle in a beaker of water. Heat this beaker of water gently and **slowly** distil off approximately 5 cm<sup>3</sup> of liquid distillate into a test tube **which is immersed in cold water in a beaker**. Keep the test tube cool to avoid loss of the volatile ethanal.
- Carry out the test described below on the distillate to confirm that ethanal has been formed in this reaction.

#### **Test on the distillate to confirm the formation of ethanal**

**Tollens' silver mirror test:** Prepare a sample of Tollens' reagent by adding 5 drops of sodium hydroxide solution to 2 cm<sup>3</sup> of silver nitrate solution in a test tube. To this test tube add **just enough** dilute ammonia solution to dissolve the brown precipitate completely.

Using a beaker of hot water (50 °C to 60 °C), **gently warm** approximately 5 cm<sup>3</sup> of this test reagent in a test tube.

Add 10 drops of the distillate containing ethanal to the warmed test reagent in the test tube. Wait a few minutes and note what happens. You should have produced a silver mirror on the walls of the tube.

**Make sure that you dispose of the Tollens' reagent thoroughly by rinsing it away with plenty of water and then rinsing any glassware that has contained the reagent with a little dilute sulfuric acid when you are finished.**



## Teacher Notes and Marking Guidance

The specific marking guidance in the specification is as follows

**2 marks:** All areas of the task are carried out competently.

The apparatus set-up is safe and appropriate.

Heating is carried out with due care and only as long as necessary.

The yield of product is appropriate.

**1 mark:** One of the areas of the task is performed poorly.

The apparatus set-up is inappropriate **OR**

Heating is carried out with insufficient care or longer than necessary **OR**

The yield of product is inappropriate.

**0 marks:** At least two of the areas of the task are performed poorly.

The apparatus set-up is inappropriate.

Heating is carried out with insufficient care or longer than necessary.

The yield of product is inappropriate.

### Guidance for Teachers and Students

Teachers are expected to exercise professional judgement in assessing the competence of their candidates in following the instructions.

Candidates should have been given guidance in the correct use of equipment and this guidance **can continue during the practical session** for which this PSA forms a part.

If, however, the guidance required is fundamental or frequent, then the student should **not** be awarded 2 marks.

Judgement of 2 marks, 1 mark or 0 marks will depend on whether the candidate has carried out the activity safely, particularly with regard to

- measuring out and transferring the oxidising agent to the boiling tube.
- measuring out and adding the ethanol to the oxidising agent.
- heating the boiling tube in a way which is safe and does not result in its contents boiling over into the cooled test tube.

It is appropriate to consider whether the candidate has followed the instruction to collect approximately 5 cm<sup>3</sup> of distillate and whether this distillate actually contains any ethanal. The candidate should be judged on ability to carry out the distillation rather than on the quality of the silver mirror test; the purpose of this test is simply

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Wear Eye  
Protection

to confirm to the candidate and to the supervisor that ethanal has actually been made.

It is important to remember when marking these practical exercises that PSA is about student competence and that for a student to score full marks on this exercise **perfection is neither expected nor required.**