Rewarding Learning

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Centres are responsible for their own hazard analysis and risk assessment before beginning this practical work with pupils.

Chemistry

Unit AS2: Practical Manual

Content/Specification Section — Page

Practical 8.1

Test for unsaturation using bromine water
(spec ref: 2.4.2)

Introduction

Unsaturated hydrocarbons contain at least one carbon-carbon double bond or carbon-carbon triple bond. Bromine water is yellow/orange/brown and when mixed with an unsaturated hydrocarbon it will react and the colour will change to colourless.

Apparatus and materials

- safety goggles
- test tube
- 2 × plastic dropping pipettes
- cyclohexene
- bromine water

Procedure

1. Using a plastic dropping pipette, add 2–3 cm^3 of cyclohexene to a test tube.
2. Using a plastic dropping pipette, add 2–3 cm^3 of bromine water to the test tube.
3. Shake the test tube gently and record observations.

Questions

1. State two observations made when bromine water is added to cyclohexene.

_____

_____

2. Write an equation for the reaction of cyclohexene, C_6H_{10}, with bromine water.

_____

Practical 9.1

Prepare a halogenoalkane using the techniques of refluxing, separating with a funnel, removing acidity, drying and distillation (spec ref: 2.5.4)

Introduction

Halogenoalkanes can be prepared from an alcohol by the reaction with a hydrogen halide, HX. In this practical you will react the alcohol butan-1-ol, C_4H_9OH, with hydrogen bromide using techniques associated with the preparation, isolation and purification of organic liquids.

$C_4H_9OH(l) + HBr(aq) \rightarrow C_4H_9Br(l) + H_2O(l)$

Apparatus and materials

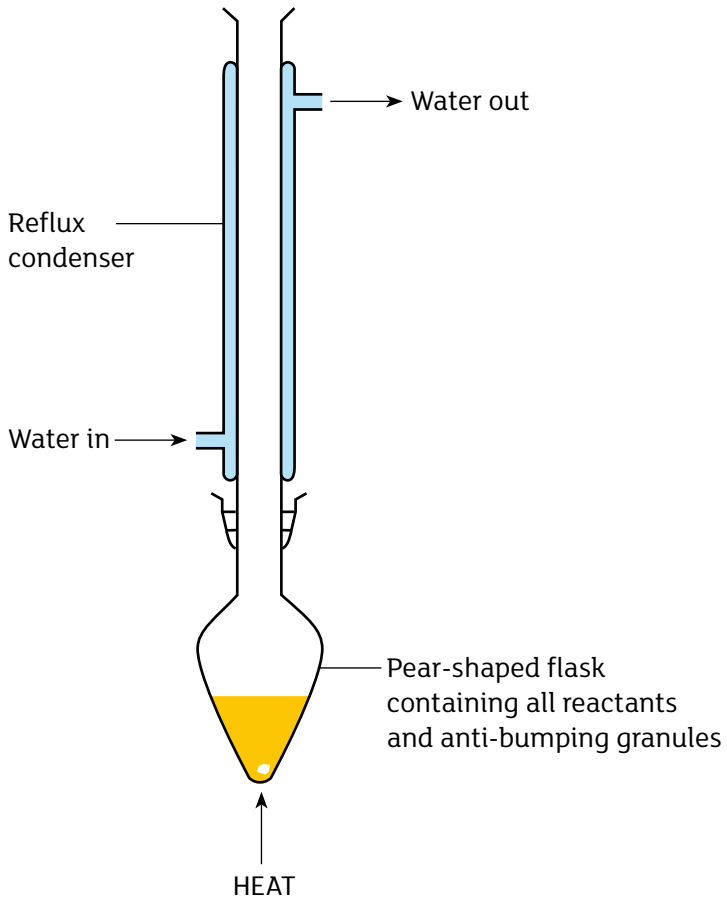
- safety goggles
- 25 cm^3 measuring cylinder
- weighing boat
- electronic balance (1 d.p)
- retort stands & clamps
- Quick fit apparatus: 100 cm^3 pear-shaped flask / still head / condenser / receiver
- thermometer (0–110°C) and Quick fit adapter
- 250 cm^3 beaker
- heat mat / tripod / wire gauze / Bunsen burner
- spatula
- plastic dropping pipettes
- conical flask
- separating funnel (and stopper)
- anti-bumping granules
- bottle of deionised water
- ice
- filter funnel and paper
- sodium bromide
- butan-1-ol
- concentrated sulfuric acid
- concentrated hydrochloric acid
- sodium hydrogencarbonate solution
- anhydrous sodium sulfate

Practical 9.1

Prepare a halogenoalkane using the techniques of refluxing, separating with a funnel, removing acidity, drying and distillation (spec ref: 2.5.4)

Procedure

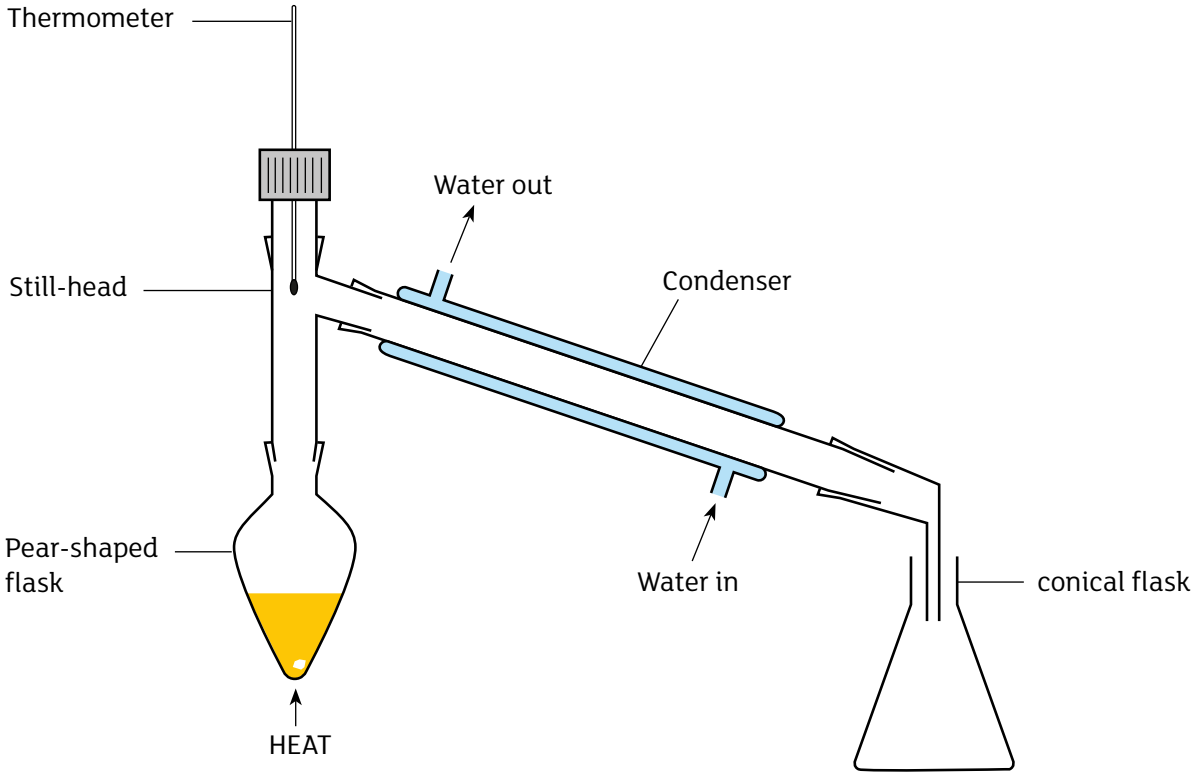
1. Weigh 10 g of sodium bromide and add to the pear-shaped flask.
2. Measure 7.5 cm^3 (6 g) of butan-1-ol and 10 cm^3 of water using a measuring cylinder and add to the pear-shaped flask.
3. Place the flask in a beaker of ice cold water. Slowly add 10 cm^3 of concentrated sulfuric acid dropwise, carefully swirling the flask in the beaker.
4. Add a spatula measure of anti-bumping granules to the flask. Attach a reflux condenser and heat the mixture under reflux for 30 minutes.



5. Rearrange the apparatus for distillation and distil off the crude product between 100–104 °C.

Practical 9.1

Prepare a halogenoalkane using the techniques of refluxing, separating with a funnel, removing acidity, drying and distillation (spec ref: 2.5.4)



6. Transfer the distillate to a separating funnel. Using a plastic dropping pipette, add 2–3 cm^3 of concentrated hydrochloric acid to the separating funnel. Stopper and shake gently. Invert and open to tap to release any gas pressure.
7. Allow the layers to settle; the organic layer is the lower layer (density of 1-bromobutane = 1.3 g cm^{-3}) and the aqueous layer is the upper layer. Separate the layers and return the organic layer to the separating funnel. Discard the aqueous layer.
8. Add 10 cm^3 of sodium hydrogencarbonate solution to the separating funnel. Stopper and shake gently. Invert and open the tap to release any gas pressure. Separate the layers and discard the aqueous layer.
9. Transfer the 1-bromobutane to a conical flask and add a spatula measure of anhydrous sodium sulfate to the flask, swirling after each addition, until the 1-bromobutane is clear.
10. Filter the sodium sulfate or decant the 1-bromobutane into a pear-shaped flask.
11. Distil the 1-bromobutane and collect between 101–103 °C. Weigh the product obtained.

Practical 9.1

Prepare a halogenoalkane using the techniques of refluxing, separating with a funnel, removing acidity, drying and distillation (spec ref: 2.5.4)

Questions

1. Calculate the percentage yield of pure 1-bromobutane obtained based on the mass of butan-1-ol used (density of butan-1-ol = 0.81 g cm^{-3}).

2. Suggest practical and theoretical reasons why the yield is less than 100%.

3. Explain why the pear-shaped flask is cooled during the addition of concentrated sulfuric acid.

4. Explain, with an equation, the purpose of concentrated sulfuric acid in this preparation.

5. Explain the purpose of the anti-bumping granules.

Practical 9.1

Prepare a halogenoalkane using the techniques of refluxing, separating with a funnel, removing acidity, drying and distillation (spec ref: 2.5.4)

6. Explain the purpose of heating the reaction mixture under reflux.

7. Suggest why concentrated hydrochloric acid is added to the distillate.

8. Describe how the aqueous layer could be determined without access to density values.

9. Explain, with an equation, the purpose of adding sodium hydrogencarbonate solution to the organic layer.

10. Explain why anhydrous sodium sulfate is added to the organic product.

11. Explain the process of decanting.

Practical 9.2

Prepare alcohols from halogenoalkanes using alkali/investigate the relative rates of hydrolysis of halogenoalkanes (spec ref: 2.5.5/2.5.7)

Introduction

Halogenoalkanes undergo hydrolysis, forming alcohols when they react with water. For example:

$C_4H_9Cl(l) + H_2O(l) \rightarrow C_4H_9OH(l) + HCl(aq)$

The reaction is faster using sodium hydroxide solution and can be carried out by heating a mixture of the halogenoalkane, sodium hydroxide solution and anti-bumping granules under reflux in a pear-shaped flask. The alcohol can then be distilled off from the reaction mixture. For example:

$C_4H_9Cl(l) + NaOH(aq) \rightarrow C_4H_9OH(l) + NaCl(aq)$

In this practical you will compare the rates of hydrolysis of three halogenoalkanes, C_4H_9X.

Apparatus and materials

- safety goggles
- 3 × test tubes
- 250 cm^3 beaker
- 5 × plastic dropping pipettes
- stopwatch
- 1-chlorobutane
- 1-bromobutane
- 1-iodobutane
- ethanol
- silver nitrate solution

Practical 9.2

Prepare alcohols from halogenoalkanes using alkali/investigate the relative rates of hydrolysis of halogenoalkanes (spec ref: 2.5.5/2.5.7)

Procedure

1. Using a plastic dropping pipette, add 1 cm^3 of ethanol to each of three test tubes.
2. Using a plastic dropping pipette, add a few drops of 1-chlorobutane to each of the other test tubes. Repeat with 1-bromobutane and 1-iodobutane. Gently shake each test tube and stand the test tubes in a beaker of hot water for 2–3 minutes.
3. Using a plastic dropping pipette, add 1 cm^3 of silver nitrate solution to each of the three test tubes. Start the stopwatch.
4. Observe the test tubes and record the time when any precipitate appears.

Halogenoalkane	Colour of precipitate	Time taken for precipitate to form / s
1-chlorobutane		
1-bromobutane		
1-iodobutane		

Questions

1. Explain why ethanol is added to each test tube.

2. Write balanced symbol equations, including state symbols, for the reaction of each halogenoalkane with water.

Practical 9.2

Prepare alcohols from halogenoalkanes using alkali/investigate the relative rates of hydrolysis of halogenoalkanes (spec ref: 2.5.5/2.5.7)

3. Write balanced symbol equations, including state symbols, for reaction involving silver nitrate solution that results in the formation of the precipitate in each test tube.

4. Write ionic equations, including state symbols, for reaction involving silver nitrate solution that results in the formation of the precipitate in each test tube.

5. Which halogenoalkane undergoes hydrolysis quickest? Which halogenoalkane undergoes hydrolysis slowest? How do your results indicate this?

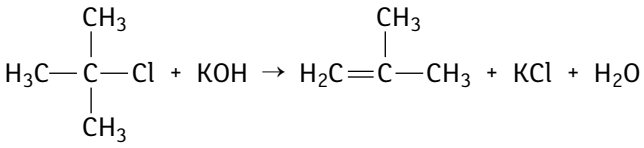
6. The C–I bond is the least polar compared to C–Br and C–Cl, however it also has the lowest bond enthalpy. Based on your results, suggest which factor is more dominant when comparing the rates of hydrolysis of halogenalkanes.

Practical 9.3

Carry out the elimination of hydrogen halides from halogenoalkanes using ethanolic potassium hydroxide (spec ref: 2.5.8)

Introduction

Halogenoalkanes undergo elimination reactions with ethanolic hydroxide ions to produce alkenes. For example, 2-chloro-2-methylpropane undergoes elimination to produce methylpropene:



Apparatus and materials

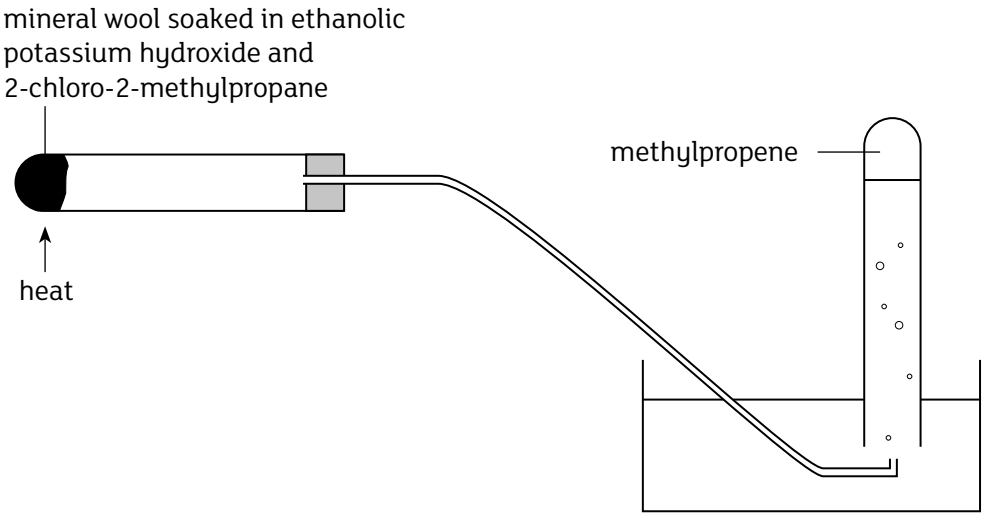
- safety goggles
- boiling tube
- ceramic wool
- retort stand and clamp
- delivery tube with bung to fit boiling tube
- water trough
- test tubes
- Bunsen burner
- plastic dropping pipette
- ethanolic potassium hydroxide
- 2-chloro-2-methylpropane
- access to bromine water

Practical 9.3

Carry out the elimination of hydrogen halides from halogenoalkanes using ethanolic potassium hydroxide (spec ref: 2.5.8)

Procedure

1. Using a plastic dropping pipette, add 2 cm^3 of ethanolic potassium hydroxide to a boiling tube.
2. Using a plastic dropping pipette, add 0.5 cm^3 of 2-chloro-2-methylpropane to the boiling tube.
3. Push a loose plug of ceramic wool into the mixture in the boiling tube. Clamp the boiling tube horizontally.
4. Connect a bung and delivery tube to the boiling tube and place an inverted test tube filled with water over the other end of the delivery tube in a water trough.



5. Heat the contents of the boiling tube gently and collect the gas produced in the test tube.
6. Using a plastic dropping pipette, add a 2–3 cm^3 of bromine water to the test tube and shake gently.

Practical 9.3

Carry out the elimination of hydrogen halides from halogenoalkanes using ethanolic potassium hydroxide (spec ref: 2.5.8)

Questions

1. Explain the purpose of the mineral wool.

2. Explain why, as the methylpropene fills the test tube, the amount of water in the test tube decreases.

3. Describe the observation made when bromine water is added to the test tube. Explain how this confirms that the elimination reaction took place.

4. Explain why, if the reaction was completed using aqueous potassium hydroxide, the apparatus used would not allow the product to be as easily obtained.

Practical 10.1

Carry out test tube reactions of alcohols with sodium, hydrogen bromide/hydrobromic acid and phosphorous pentachloride (spec ref: 2.6.5)

Introduction

Alcohols react with sodium, hydrogen bromide and phosphorous pentachloride. In this practical you will investigate the reaction of ethanol with sodium and phosphorous pentachloride (the reaction with hydrogen bromide is covered in practical 9.1).

$2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$

$C_2H_5OH + PCl_5 \rightarrow C_2H_5Cl + POCl_3 + HCl$

Apparatus and materials

- safety goggles
- plastic dropping pipettes
- boiling tubes
- scalpel
- filter paper
- spatula
- ethanol
- sodium
- phosphorous pentachloride

Practical 10.1

Carry out test tube reactions of alcohols with sodium, hydrogen bromide/hydrobromic acid and phosphorous pentachloride (spec ref: 2.6.5)

Procedure

1. Using a plastic dropping pipette, add 1 cm^3 of ethanol to a boiling tube.
2. Using a scalpel, cut a 2 × 2 × 2 mm piece of sodium and use filter paper to remove excess oil from it.
3. Add the piece of sodium to the boiling tube and record observations.
4. Using a plastic dropping pipette, add 1 cm^3 of ethanol to a boiling tube.
5. Add a half spatula measure of phosphorous pentachloride to the boiling tube and record observations.

Reaction	Observations
Addition of sodium	
Addition of phosphorous pentachloride	

Questions

1. When ethanol reacts with sodium, a gas is produced. Describe the test for this gas, giving the result.

2. When ethanol reacts with phosphorous pentachloride, a gas is produced. Describe the test for this gas, giving the result.

Practical 10.2

Prepare aldehydes, ketones and carboxylic acids using acidified potassium dichromate(VI) (spec ref: 2.6.6)

Introduction

Alcohols undergo oxidation when heated with acidified potassium dichromate(VI), which acts as an oxidising agent. Primary alcohols can be oxidised to aldehydes and further to carboxylic acids whereas secondary alcohols can be oxidised to ketones. Tertiary alcohols are not oxidised by potassium dichromate(VI). In this practical you will oxidise ethanol, a primary alcohol, to the corresponding aldehyde ethanal. You will then oxidise a separate portion to the corresponding carboxylic acid, ethanoic acid.

$CH_3CH_2OH + [O] \rightarrow CH_3CHO + H_2O$

$CH_3CH_2OH + 2[O] \rightarrow CH_3COOH + H_2O$

Apparatus and materials

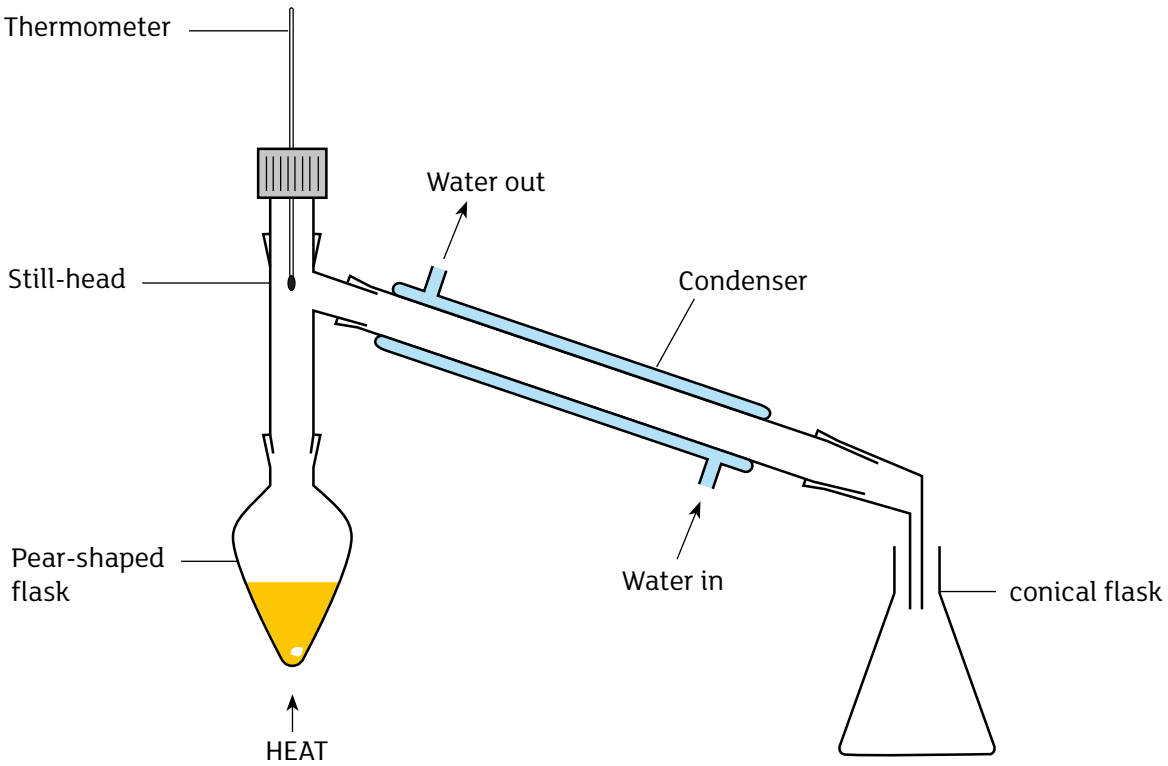
- safety goggles
- 10 cm^3 measuring cylinder
- plastic dropping pipettes
- weighing boat
- spatula
- Quick fit apparatus: 50 cm^3 pear-shaped flask / still head / condenser / receiver
- thermometer (0–200°C) and Quick fit adapter
- retort stands and clamps
- heat mat / tripod / wire gauze / Bunsen burner
- 250 cm^3 beaker
- 1 mol dm^{-3} sulfuric acid
- concentrated sulfuric acid
- ethanol
- potassium dichromate(VI)
- mass balance (1 d.p)
- anti-bumping granules
- Universal indicator paper
- sodium carbonate

Practical 10.2

Prepare aldehydes, ketones and carboxylic acids using acidified potassium dichromate(VI) (spec ref: 2.6.6)

Procedure: Preparation of ethanal

1. Measure 10 cm^3 of 1 mol dm^{-3} sulfuric acid using a measuring cylinder and add to a 50 cm^3 pear-shaped flask.
2. Weigh 3.0 g of potassium dichromate(VI) and add to the flask followed by one spatula measure of anti-bumping granules. Swirl the flask until all the oxidising agent has dissolved.
3. Using a plastic dropping pipette, slowly add 5 cm^3 of ethanol to the flask and swirl to mix.
4. Set up distillation apparatus, including setting up a heat mat, tripod, wire gauze and Bunsen burner beneath the pear-shaped flask. Leave a small gap between the wire gauze and the bottom of the pear-shaped flask.



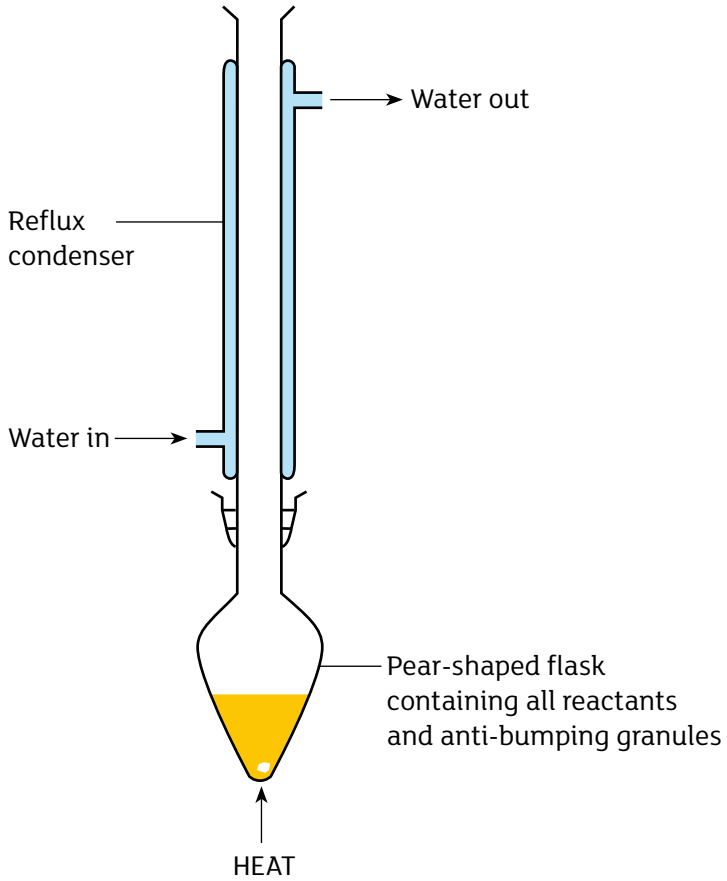
5. Heat the bottom of the pear-shaped flask gently, until 2–3 cm^3 of liquid has distilled over. Note the temperature that the distillate comes over at.
6. Keep the distillate and smell cautiously.

Practical 10.2

Prepare aldehydes, ketones and carboxylic acids using acidified potassium dichromate(VI) (spec ref: 2.6.6)

Procedure: Preparation of ethanoic acid

1. Measure 10 cm^3 of 1 mol dm^{-3} sulfuric acid using a measuring cylinder and add to a 50 cm^3 pear-shaped flask.
2. Weigh 5.0 g of potassium dichromate(VI) and add to the flask followed by one spatula measure of anti-bumping granules. Swirl the flask until all the oxidising agent has dissolved.
3. Place the pear-shaped flask in a beaker filled with cold water. Using a plastic dropping pipette, slowly add 2 cm^3 of concentrated sulfuric acid with care and then attach a condenser to the flask.
4. Using a plastic dropping pipette, add 1 cm^3 ethanol dropwise down the reflux condenser. This must be done slowly. Allow for any reaction to subside after each addition before adding more.
5. Set up a heat mat, tripod, wire gauze and Bunsen burner beneath the pear-shaped flask. Leave a small gap between the wire gauze and the bottom of the pear-shaped flask.
6. Gently reflux the contents of the pear-shaped flask for 15–20 minutes.



Practical 10.2

Prepare aldehydes, ketones and carboxylic acids using acidified potassium dichromate(VI) (spec ref: 2.6.6)

7. Allow the flask to cool then rearrange the apparatus so it is set up for simple distillation.
8. Distil off about 3–4 cm^3 of liquid and perform the following tests:

- Smell cautiously
- Test with Universal indicator paper
- Add a spatula measure of solid sodium carbonate

Reaction	Observations
Preparation of ethanal Smell	
Preparation of ethanoic acid Smell Universal indicator paper Sodium carbonate	

Practical 10.2

Prepare aldehydes, ketones and carboxylic acids using acidified potassium dichromate(VI) (spec ref: 2.6.6)

Questions

1. If 3.0 cm^3 of ethanal is collected, calculate the percentage yield assuming all other reactants are in excess.
   (density of ethanol = density 0.79 g cm^{-3}, density of ethanal = 0.82 g cm^{-3}).

2. Explain how the results of the tests completed on the distillate when preparing ethanoic acid confirm that the ethanol was oxidised to ethanoic acid.

3. Explain how IR spectroscopy could be used to track the oxidation of ethanol and how it could be used to identify which oxidation product is obtained.

4. Explain why, if propan-2-ol was oxidised using potassium dichromate(VI), it wouldn't matter if the reaction mixture was heated under reflux prior to distillation of the crude product.

Practical 11.1

Determine the enthalpy change for combustion and neutralisation using simple apparatus (spec ref: 2.8.6)

Introduction

The standard enthalpy change of combustion is the enthalpy change when one mole of an element or compound in its standard state reacts completely with oxygen under standard conditions. To determine an enthalpy of combustion value, the experiment usually involves using the heat generated to heat a known quantity of water in a boiling tube or copper can. In this practical, you will determine the enthalpies of combustion of ethanol, propan-1-ol and butan-1-ol.

$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

$2C_3H_7OH + 9O_2 \rightarrow 6CO_2 + 8H_2O$

$2C_4H_9OH + 12O_2 \rightarrow 8CO_2 + 10H_2O$

Practical 11.1

Determine the enthalpy change for combustion and neutralisation using simple apparatus (spec ref: 2.8.6)

Apparatus and materials

- safety goggles
- 25 cm^3 measuring cylinder
- boiling tube/copper can
- retort stand and clamp
- 3 × spirit burners, one containing ethanol, one containing propan-1-ol and one containing butan-1-ol
- thermometer (0–100°C)
- Bunsen burner
- splints
- access to a mass balance

Procedure:

1. Using a measuring cylinder, measure 25 cm^3 of water and transfer into a boiling tube/copper can. Clamp the boiling tube at an angle over the spirit burner.
2. Measure the temperature of the water using a thermometer.
3. Weigh the spirit burner containing ethanol.
4. Place the burner under the boiling tube and light the fuel.
5. Heat the water until the temperature has risen by 20 °C.
6. Stir and measure the final temperature of the water using the thermometer.
7. Reweigh the spirit burner.
8. Repeat steps 1–7 for the other 2 fuels.

Practical 11.1

Determine the enthalpy change for combustion and neutralisation using simple apparatus (spec ref: 2.8.6)

Fuel	Initial mass of burner / g	Final mass of burner / g	Mass of fuel used / g	Initial Temp / °C	Final Temp / °C	Temp change / °C	Heat Energy evolved / J	RFM of fuel	Moles of fuel used / mol	Enthalpy of Combustion / kJ mol^{-1}
Ethanol C_2H_5OH										
Propan-1-ol C_3H_7OH										
Butan-1-ol C_4H_9OH										

Questions

1. Which fuel gave out the most heat energy per mole? Explain why.

Practical 11.1

Determine the enthalpy change for combustion and neutralisation using simple apparatus (spec ref: 2.8.6)

2. The 'book' values of the enthalpies of combustion are: ethanol -1367 kJ mol^{-1}, propan-1-ol -2021 kJ mol^{-1} and butan-1-ol -2676 kJ mol^{-1}. Is the general trend the same as what was obtained in the experiment? Are the values obtained in the experiment similar to the 'book' values?

3. Why do you think the 'book' answers given in 2 are different from the answers you obtained?

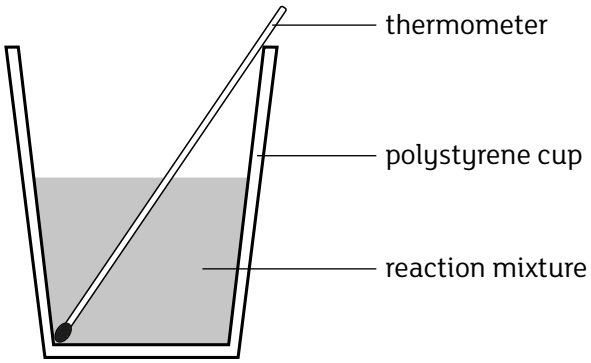
Practical 11.2

Determine the enthalpy change for combustion and neutralisation using simple apparatus
(spec ref: 2.8.6)

Introduction

The standard enthalpy change of neutralisation is the enthalpy change when an acid reacts with a base to form one mole of water under standard conditions. The enthalpy of neutralisation can be determined experimentally by adding a known volume of a standard solution of an acid to a known volume of a standard solution of an alkali and measuring the temperature change. In this practical you will determine the enthalpy of neutralisation between hydrochloric acid and sodium hydroxide solution:

$NaOH + HCl \rightarrow NaCl + H_2O$



Apparatus and materials

- safety goggles
- polystyrene cups & lids
- 250 cm^3 beakers
- thermometers (-10 to 100°C) – 0.1°C calibration
- 25.0 cm^3 pipettes
- pipette filler
- stopwatch
- hydrochloric acid
- sodium hydroxide solution

Practical 11.2

Determine the enthalpy change for combustion and neutralisation using simple apparatus (spec ref: 2.8.6)

Procedure:

1. Place a clean, dry polystyrene cup into a beaker.
2. Pipette 25.0 cm^3 of the hydrochloric acid into the polystyrene cup and attach the lid.
3. Place a thermometer into the cup through the lid.
4. Pipette 25.0 cm^3 of the sodium hydroxide solution into a second clean, dry polystyrene cup placed in a beaker. Attach a lid to the cup.
5. Place a thermometer into the cup through the lid.
6. Give both solutions a few minutes to allow their temperatures to settle to the same temperature.
7. Pour the alkali into the acid and place the lid on the cup.
8. Stir using the thermometer and record the maximum temperature reached.

Initial temperature of acid / °C	
Initial temperature of alkali / °C	
Maximum temperature reached / °C	
Temperature change / °C	
Heat energy evolved / J	
Moles of water produced / mol	
Enthalpy change / kJ mol^{-1}	

Practical 11.2

Determine the enthalpy change for combustion and neutralisation using simple apparatus (spec ref: 2.8.6)

Questions

1. Give two reasons why the polystyrene cups are placed in beakers.

2. Give two assumptions made about the reaction mixture in this experiment.

3. The quoted value for the enthalpy change for this reaction is −57.1 kJ mol^{-1}. Compare the value you calculated to this value and suggest reasons for the difference.

Practical 12.1

React Group II metals and other metals with oxygen, water and dilute acids and determine the masses of solids and volumes of gases produced (spec ref: 2.11.3)

Introduction

In this practical you will react magnesium with oxygen, calcium with water and magnesium with acid in order to investigate the reactivity of these Group II metals.

$2MgO + O_2 \rightarrow 2MgO$
$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$
$Mg + 2HCl \rightarrow MgCl_2 + H_2$

Apparatus and materials

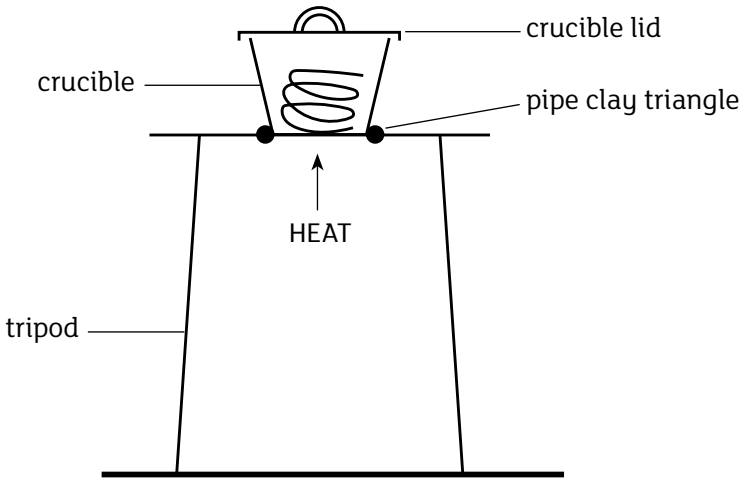
- safety goggles
- crucible with lid
- tongs
- pipe clay triangle
- Bunsen burner
- heat resistant mat
- emery paper (optional)
- 250 cm^3 beaker
- test tube
- funnel
- spatula
- splint
- retort stand and clamp
- 50 cm^3 measuring cylinder
- 100 cm^3 gas syringe, delivery tube and bung
- 250 cm^3 conical flask
- access to mass balance (2 d.p)
- bottle of deionised water
- magnesium ribbon
- calcium granules
- hydrochloric acid

Practical 12.1

React Group II metals and other metals with oxygen, water and dilute acids and determine the masses of solids and volumes of gases produced (spec ref: 2.11.3)

Procedure – reaction of magnesium with oxygen:

1. Cut a piece of magnesium about 10–15 cm long.
2. Weigh the crucible with the lid. Twist the magnesium into a coil and place in the crucible. Weigh the crucible and lid with the magnesium.
3. Set up the Bunsen burner on the heat resistant mat with the tripod. Place the pipe clay triangle over the tripod. Place the crucible containing the magnesium in the pipe clay triangle and put the lid on.



4. Heat the crucible gently to start. Once the crucible is hot, gently lift the lid with the tongs for a few seconds to allow some air to get in.
5. Continue heating and lifting the lid until you see no further reaction. At this point, remove the lid and heat for another couple of minutes. Replace the lid if it appears that you are losing some product.
6. Allow the apparatus to cool then reweigh the crucible with lid containing the product.
7. Heat the crucible again for a couple of minutes and once again allow to cool. Repeat this step until the mass readings are consistent.

Practical 12.1

React Group II metals and other metals with oxygen, water and dilute acids and determine the masses of solids and volumes of gases produced (spec ref: 2.11.3)

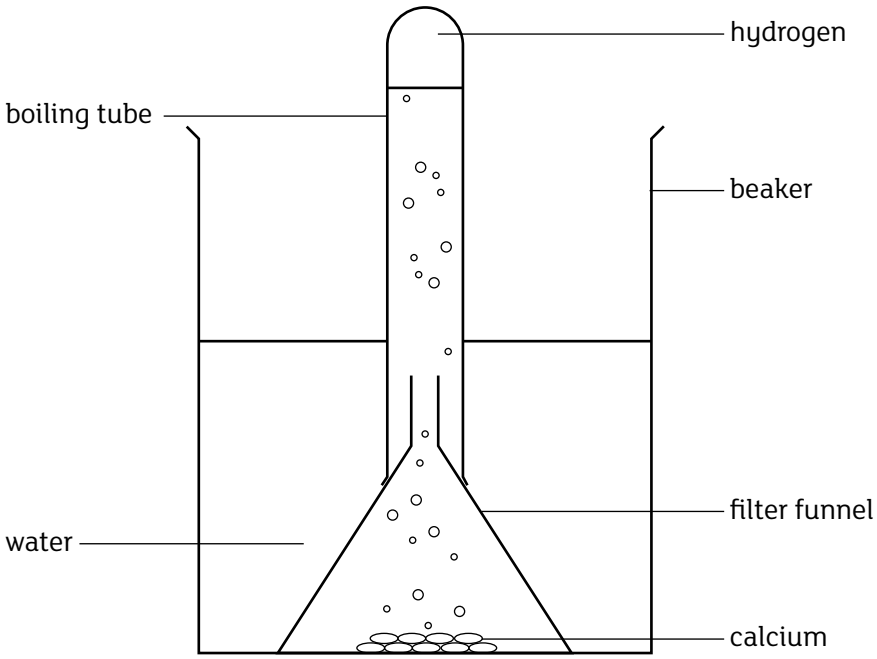
Mass of crucible and lid / g	
Mass of crucible and lid with magnesium / g	
Mass of magnesium / g	
Mass of crucible and lid with magnesium after heating 1 / g	
Mass of crucible and lid with magnesium after heating 2 / g	
Mass of oxygen reacting / g	
Moles of oxygen reacting / g	
Moles of magnesium oxide / g	
Mass of magnesium oxide / g	

Practical 12.1

React Group II metals and other metals with oxygen, water and dilute acids and determine the masses of solids and volumes of gases produced (spec ref: 2.11.3)

Procedure – reaction of calcium with water:

1. Half fill a 250 cm^3 beaker with deionised water.
2. Add a half spatula of calcium granules to the beaker and cover with an inverted funnel.
3. Place a test tube filled with water over the end of the funnel.
4. Once the test tube fills with gas, remove and test the gas with a lit splint.



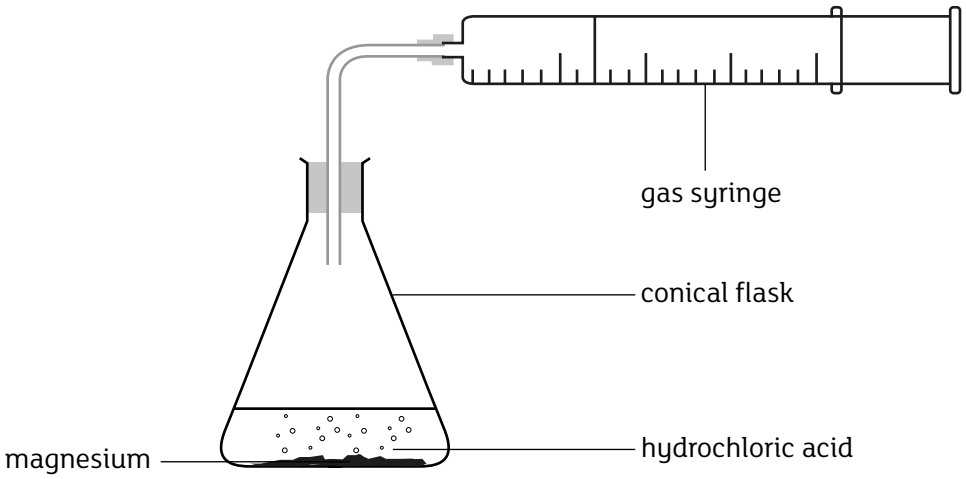
Observations during reaction	
Gas test observation	

Practical 12.1

React Group II metals and other metals with oxygen, water and dilute acids and determine the masses of solids and volumes of gases produced (spec ref: 2.11.3)

Procedure – reaction of magnesium with hydrochloric acid:

1. Measure 50 cm^3 of hydrochloric acid, using a measuring cylinder, and add to conical flask.
2. Accurately weigh 0.10 g of magnesium ribbon using the mass balance.
3. Add the magnesium ribbon to the conical flask, place the bung firmly into the top of the flask. Record the volume of gas obtained in the syringe when the reaction is finished.



Volume of gas collected in gas syringe / cm^3	

Practical 12.1

React Group II metals and other metals with oxygen, water and dilute acids and determine the masses of solids and volumes of gases produced (spec ref: 2.11.3)

Questions

1. Calculate the theoretical mass of magnesium oxide, based on the mass of magnesium used in the reaction with oxygen, and compare with the mass of magnesium oxide obtained by calculating the percentage yield. Suggest reasons for the difference.

2. Explain why the lid of the crucible should only be lifted **briefly** during the reaction of magnesium with oxygen.

3. Describe how the presence of the alkali product could be detected in the beaker when the reaction between calcium and water is finished.

Practical 12.1

React Group II metals and other metals with oxygen, water and dilute acids and determine the masses of solids and volumes of gases produced (spec ref: 2.11.3)

4. Calculate the theoretical volume of hydrogen, based on the mass of magnesium used in the reaction with hydrochloric acid, and compare with the volume of hydrogen obtained. Suggest reasons for the difference.