

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
Winter 2004



CHEMISTRY (MODULAR)
Aqueous and Organic Chemistry (Module 21)

346021

Thursday 18 November 2004 Morning Session

In addition to this paper you will require:

- a black ball-point pen;
 - an answer sheet.
- You may use a calculator.

Time allowed: 30 minutes

Instructions

- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title “Aqueous and Organic Chemistry” printed on it.
- Attempt **one Tier only**, **either** the Foundation Tier **or** the Higher Tier.
- Make sure that you use the correct side of the separate answer sheet; the Foundation Tier is printed on one side and the Higher Tier on the other.
- Answer **all** the questions for the Tier you are attempting.
- Record your answers on the separate answer sheet only. Rough work may be done on the question paper.

Instructions for recording answers

- Use a **black ball-point pen**.

- For each answer **completely fill in the circle** as shown:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

- Do **not** extend beyond the circles.

- If you want to change your answer, **you must** cross out your original answer, as shown:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

- If you change your mind about an answer you have crossed out and now want to choose it, draw a ring around the cross as shown:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Information

- The maximum mark for this paper is 36.

Advice

- Do **not** choose more responses than you are asked to. You will lose marks if you do.
- Make sure that you hand in both your answer sheet and this question paper at the end of the test.
- If you start to answer on the wrong side of the answer sheet by mistake, make sure that you cross out **completely** the work that is not to be marked.

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 14 of this booklet.

FOUNDATION TIER

SECTION A

Questions **ONE** to **FIVE**.

In these questions match the words in the list with the numbers.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

This question is about gases.

Match words from the list with the numbers **1–4** in the table.

carbon dioxide

carbon monoxide

hydrogen

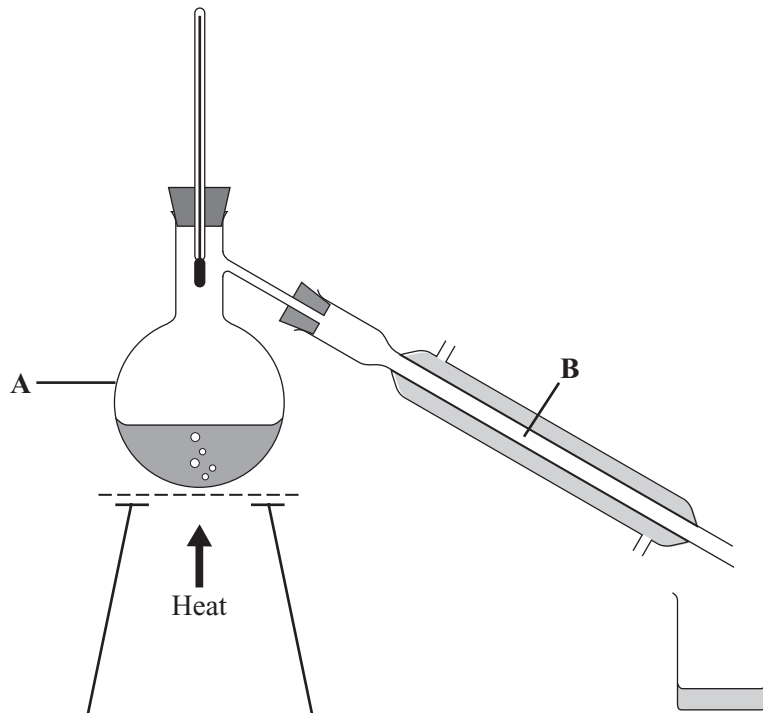
oxygen

Gas	What we can say about the gas
1	it is essential for fish and other aquatic life to survive in water
2	it is produced when organic fuels burn in a limited supply of air
3	it is used to make fizzy drinks
4	water vapour is produced when it is oxidised

QUESTION TWO

This question is about making water fit to drink.

One way to make dirty water drinkable is to use the apparatus below.



Match words from the list with the spaces **1–4** in the sentences.

chlorination

condensation

evaporation

filtration

The process that takes place in the part of the apparatus labelled **A** is **1**

The process that takes place in the part of the apparatus labelled **B** is **2**

Water can also be made drinkable at a water treatment works.

At the water treatment works, solid particles are first removed by **3**

After further processing, **4** is used to kill the bacteria in the water.

Turn over ►

QUESTION THREE

This question is about how we use chemical substances.

Match words from the list with the numbers **1–4** in the table.

ammonium nitrate

ethanol

sodium carbonate

water

Chemical substance	Use
1	as a solvent and fuel
2	as an artificial fertiliser
3	in the manufacture of sulphuric acid
4	to make hard water soft

QUESTION FOUR

The flow diagram below shows the stages in making pure ethanol.

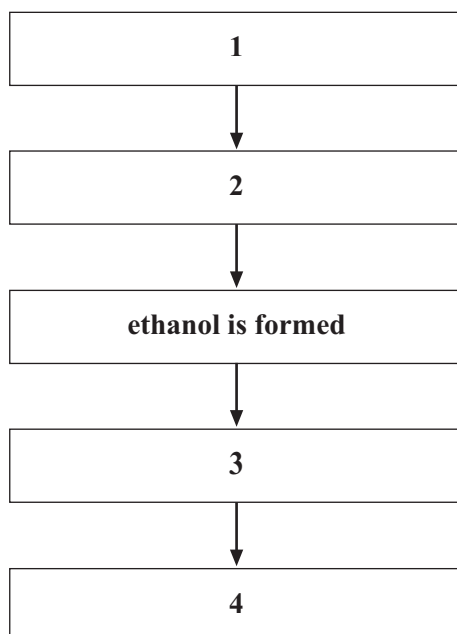
Match words from the list with the spaces 1–4 to describe how pure ethanol is made.

carbon dioxide is allowed to escape

ethanol is separated by fractional distillation

sugar and yeast are mixed with water

the mixture is warmed to just above room temperature



TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION FIVE

The table is about acids and alkalis.

Match words from the list with the numbers 1–4 in the table.

strong acid

strong alkali

weak acid

weak alkali

Substance	What we can say about the substance in aqueous solution	
1	it is fully ionised	it produces H^+ ions
2	it is fully ionised	it produces OH^- ions
3	it is partially ionised	it produces H^+ ions
4	it is partially ionised	it produces OH^- ions

SECTION BQuestions **SIX** and **SEVEN**.In these questions choose the best **two** answers.Do **not** choose more than two.Mark your choices on the answer sheet.

QUESTION SIX

This question is about water.

Which **two** of the following statements are correct?**soft water contains dissolved calcium compounds****water containing dissolved nitrate ions can be harmful to babies****water in lakes is condensed by heat from the Sun****water is a solvent for most covalent compounds****when water vapour in the atmosphere condenses, clouds are formed****QUESTION SEVEN**

This question is about acids and alkalis.

Which **two** of the following statements are correct?**hydrochloric acid is acidic because it contains H^+ (aq) ions****hydrochloric acid contains H^- ions****sodium hydroxide in aqueous solution provides OH^- (aq) ions****sodium hydroxide is partially ionised in water****the OH^- (aq) ion is a proton**

Turn over ►

SECTION CQuestions **EIGHT** to **TEN**.

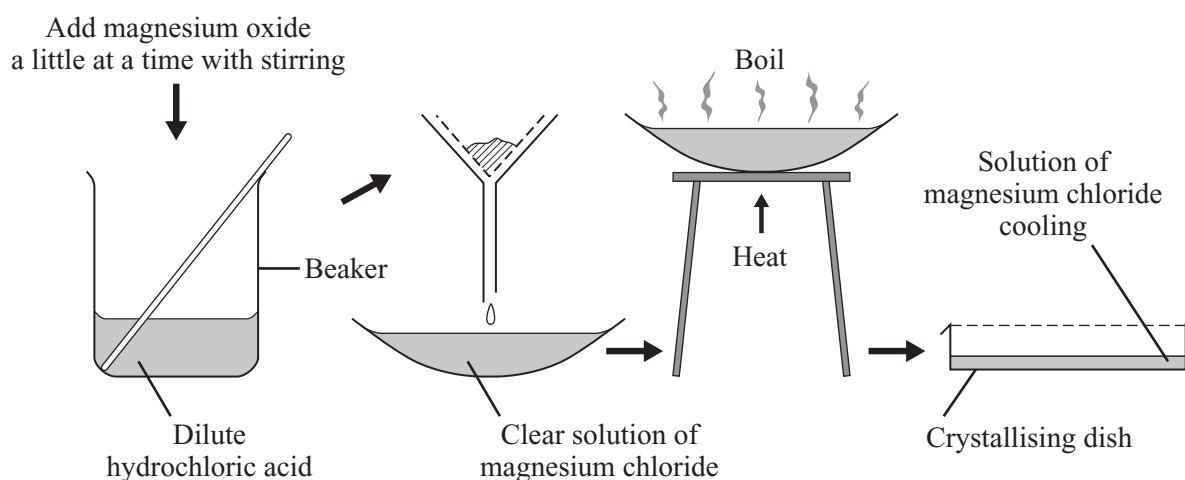
Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION EIGHT

The diagram shows how a student makes crystals of the salt, magnesium chloride.

**8.1** How does the student know when all the hydrochloric acid has been neutralised?

- A A drop of the solution turns litmus paper purple
- B Some magnesium oxide is left unreacted
- C The solution in the beaker becomes clear
- D There are no more bubbles of gas

8.2 Why is the solution of magnesium chloride boiled?

- A To make a more dilute solution of magnesium chloride
- B To make sure all the magnesium oxide has dissolved
- C To remove any excess acid
- D To remove some water from the solution

8.3 Why is the solution of magnesium chloride left to cool?

- A Magnesium chloride is insoluble in cold water
- B Magnesium chloride is insoluble in hot water
- C Magnesium chloride is less soluble in cold water than in hot water
- D Magnesium chloride is more soluble in cold water than in hot water

8.4 Which word equation shows another way in which magnesium chloride can be made?

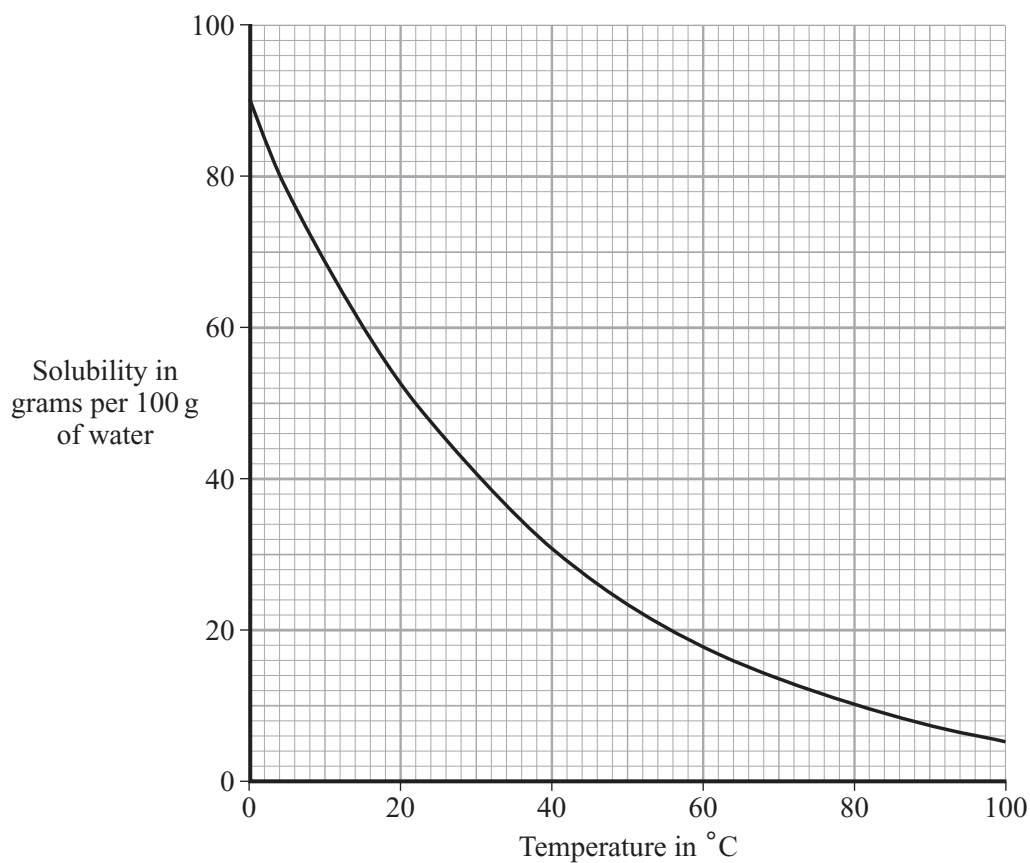
- A magnesium + hydrochloric acid → magnesium chloride + hydrogen
- B magnesium nitrate + hydrochloric acid → magnesium chloride + water
- C magnesium sulphate + hydrochloric acid → magnesium chloride + hydrogen
- D magnesium sulphate + sodium chloride → magnesium chloride + sodium sulphate

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

The graph shows the solubility curve for ammonia gas.



9.1 At what temperature will there be 17 g of ammonia dissolved per 100 g water?

- A 17 °C
- B 55 °C
- C 62 °C
- D 64 °C

9.2 What kind of solution does ammonia make with water?

- A A strong acid
- B A strong alkali
- C A weak acid
- D A weak alkali

9.3 Under what conditions is the solubility of ammonia greatest?

	Temperature	Pressure
A	high	high
B	high	low
C	low	high
D	low	low

9.4 Which gas dissolves in water to form a bleach?

- A** Ammonia
- B** Carbon dioxide
- C** Chlorine
- D** Methane

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

Soap solution can be used to measure the amount of hardness in a water sample.

Four 50 cm³ water samples were used. The table below shows the results of tests on the four samples.

Sample	Volume of soap solution in cm ³ needed to form a permanent lather
Q	1.0
R	8.0
S	4.5
T	2.0

10.1 Which of the four samples was the hardest?

- A Q
- B R
- C S
- D T

10.2 Which ions in the water samples reacted with the soap solution?

- A Calcium ions
- B Hydrogen ions
- C Potassium ions
- D Sodium ions

10.3 1 cm³ of soap solution was added to another 50 cm³ sample of S. The mixture was shaken.

What was seen after the mixture was shaken?

- A A lather
- B A scum
- C The water remained clear but no lather was formed
- D The water sample gave off a gas

10.4 Excess sodium carbonate solution was added to another 50 cm³ sample of **R**. Then 1 cm³ of soap solution was added and the mixture was shaken.

What was seen after the mixture was shaken?

- A** A lather was produced
- B** A scum was produced
- C** No lather or scum was produced
- D** The water sample remained clear and a gas was given off

END OF TEST

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Foundation Tier is earlier in this booklet.

HIGHER TIER**SECTION A**Questions **ONE** and **TWO**.

In these questions match the words in the list with the numbers.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

The table is about acids and alkalis.

Match words from the list with the numbers **1–4** in the table.**strong acid****strong alkali****weak acid****weak alkali**

Substance	What we can say about the substance in aqueous solution	
1	it is fully ionised	it produces H^+ ions
2	it is fully ionised	it produces OH^- ions
3	it is partially ionised	it produces H^+ ions
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QUESTION TWO

This question is about organic chemicals.

Match words from the list with the numbers 1–4 in the table.

aspirin

cholesterol

ethyl ethanoate

vegetable oil

Chemical	Description of the chemical
1	it contains the alcohol group
2	it contains unsaturated fats
3	it is a carboxylic acid
4	it is an ester

TURN OVER FOR THE NEXT QUESTION

Turn over ►

SECTION BQuestions **THREE** and **FOUR**.In these questions choose the best **two** answers.Do **not** choose more than two.Mark your choices on the answer sheet.

QUESTION THREE

This question is about acids and alkalis.

Which **two** of the following statements are correct?**hydrochloric acid is acidic because it contains $\text{H}^+(\text{aq})$ ions****hydrochloric acid contains H^- ions****sodium hydroxide in aqueous solution provides $\text{OH}^-(\text{aq})$ ions****sodium hydroxide is partially ionised in water****the $\text{OH}^-(\text{aq})$ ion is a proton****QUESTION FOUR**Which **two** statements about polyvinylchloride are correct?**it burns to form carbon dioxide, hydrogen chloride and water****it cannot be remoulded after heating****it is a carboxylic acid****it is a thermosetting polymer****it is made from $\text{CH}_2=\text{CHCl}$**

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

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SECTION CQuestions **FIVE** to **TEN**.

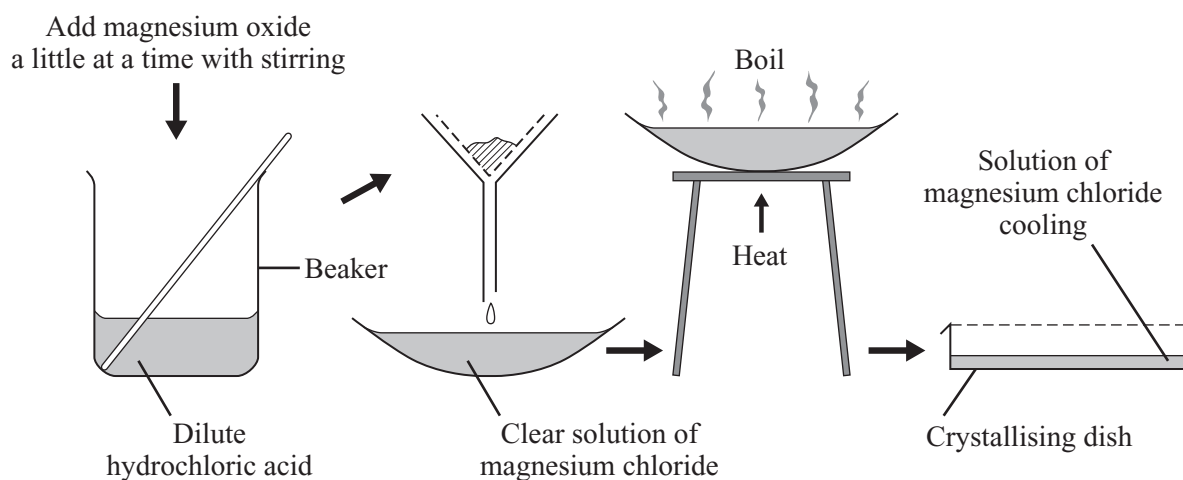
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The diagram shows how a student makes crystals of the salt, magnesium chloride.



5.1 How does the student know when all the hydrochloric acid has been neutralised?

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- C The solution in the beaker becomes clear
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5.2 Why is the solution of magnesium chloride boiled?

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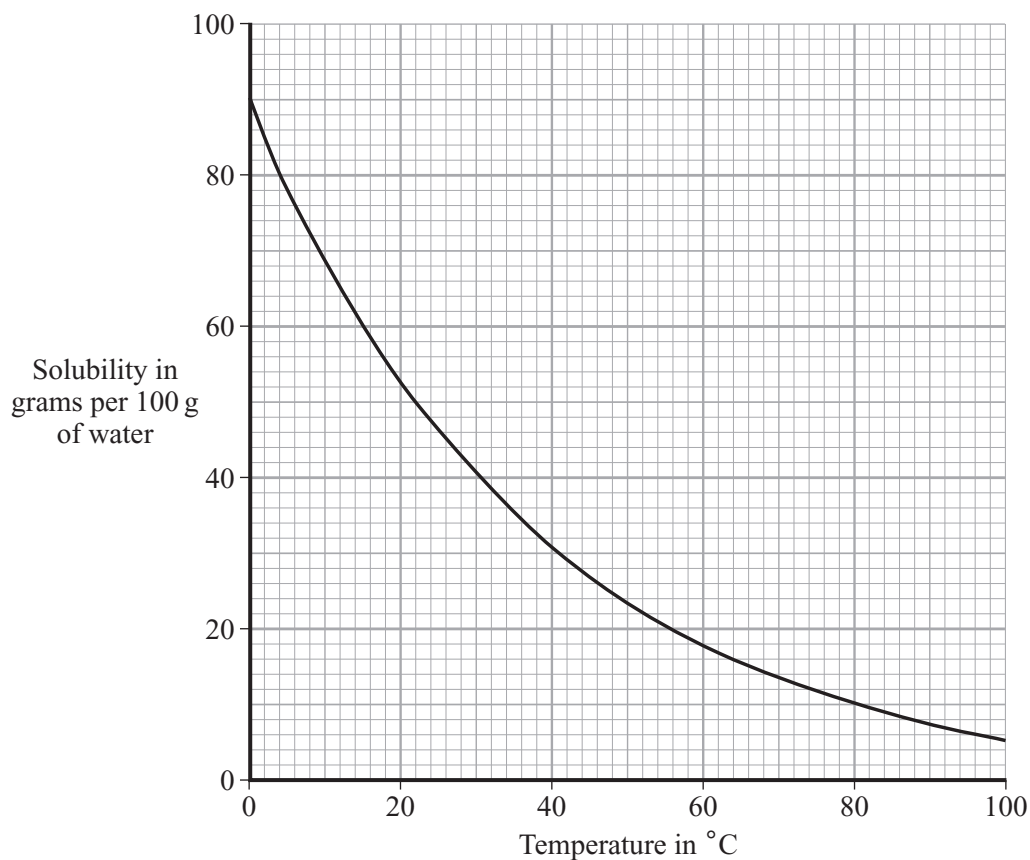
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	Temperature	Pressure
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7.1 Which of the four samples was the hardest?

- A Q
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- C S
- D T

7.2 Which ions in the water samples reacted with the soap solution?

- A Calcium ions
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What was seen after the mixture was shaken?

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- 7.4 Excess sodium carbonate solution was added to another 50 cm^3 sample of **R**. Then 1 cm^3 of soap solution was added and the mixture was shaken.

What was seen after the mixture was shaken?

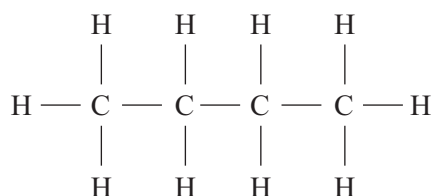
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TURN OVER FOR THE NEXT QUESTION

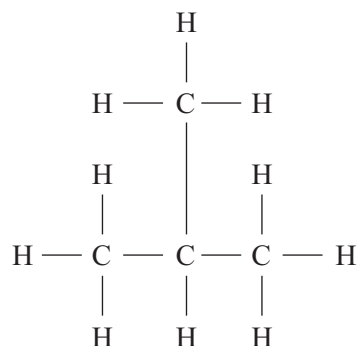
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QUESTION EIGHT

The diagram shows two isomers, both of which have the chemical formula, C_4H_{10} .



Isomer P



Isomer Q

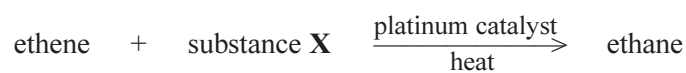
8.1 What is the general formula for the homologous series to which these compounds belong?

- A C_nH_{2n}
- B C_nH_{2n-2}
- C C_nH_{2n+2}
- D $C_{2n}H_n$

8.2 Which isomer will have the higher boiling point and why?

	Higher boiling point	Reason
A	Isomer P	stronger forces between atoms
B	Isomer P	stronger forces between molecules
C	Isomer Q	stronger forces between atoms
D	Isomer Q	stronger forces between molecules

8.3 Ethene can be converted into ethane by this reaction.



What is substance X?

- A Hydrogen
 - B Nitrogen
 - C Oxygen
 - D Water (vapour)
- 8.4 How does ethene react with yellow-brown bromine water? What type of reaction takes place?

Result of reaction	Type of reaction
A bromine water turns colourless	addition
B bromine water turns colourless	substitution
C bromine water turns green	addition
D bromine water turns purple	polymerisation

TURN OVER FOR THE NEXT QUESTION

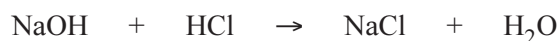
Turn over ►

QUESTION NINE

A student prepares 1 dm³ of a solution of sodium hydroxide with a concentration of 0.1 mol dm⁻³.

The student finds that 25 cm³ of this sodium hydroxide solution are exactly neutralised by 20 cm³ of a solution of hydrochloric acid.

This is the equation for the reaction:



[Relative atomic masses: Cl = 35.5, Na = 23, O = 16, H = 1]

- 9.1** What mass of sodium hydroxide did the student use to prepare 1 dm³ of the solution?
- A 0.1 g
B 0.4 g
C 1.0 g
D 4.0 g
- 9.2** What method could the student use to find the exact volume of hydrochloric acid solution required to neutralise 25 cm³ of sodium hydroxide solution?
- A Combination
B Ionisation
C Precipitation
D Titration
- 9.3** The concentration of the hydrochloric acid solution is
- A 0.08 mol dm⁻³.
B 0.10 mol dm⁻³.
C 0.125 mol dm⁻³.
D 0.15 mol dm⁻³.

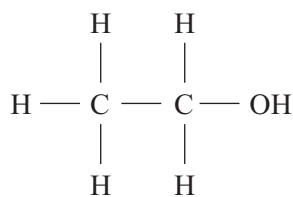
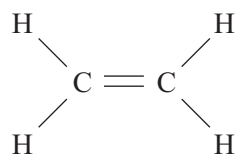
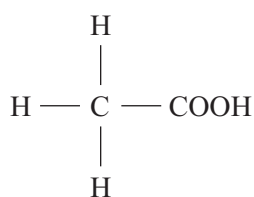
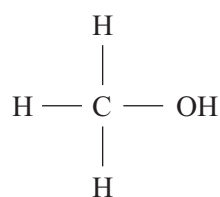
- 9.4** What mass of dry sodium chloride would be produced from a solution containing 8.0 g of sodium hydroxide?
- A** 8.0 g
 - B** 11.7 g
 - C** 44.7 g
 - D** 58.5 g

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

The diagram shows the structural formulae for four organic compounds.

Compound **K**Compound **L**Compound **M**Compound **N**

10.1 Which compound is a weak acid?

- A** Compound **K**
- B** Compound **L**
- C** Compound **M**
- D** Compound **N**

10.2 Which compound is ethanol?

- A** Compound **K**
- B** Compound **L**
- C** Compound **M**
- D** Compound **N**

10.3 Compound **M** will react with compound **N** to produce

- A** a carboxylic acid.
- B** a polymer.
- C** an alkane.
- D** an ester.

10.4 By what type of reaction can compound **K** be converted into compound **M**?

- A** Addition
- B** Combustion
- C** Oxidation
- D** Reduction

END OF TEST