

Surname		Other Names	
Centre Number			Candidate Number
Candidate Signature			

General Certificate of Secondary Education
March 2006



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

346021

Wednesday 8 March 2006 Morning Session

For this paper you must have:

- a black ball-point pen
- an objective test answer sheet

You may use a calculator.

Time allowed: 30 minutes

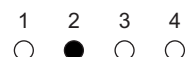
Instructions

- 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.
- Do all rough work in this book, **not** on your answer sheet.

Instructions for recording answers

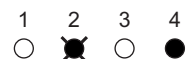
- Use a **black ball-point pen**.

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

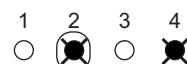


- Do **not** extend beyond the circles.

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



- 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:



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 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 the water cycle.

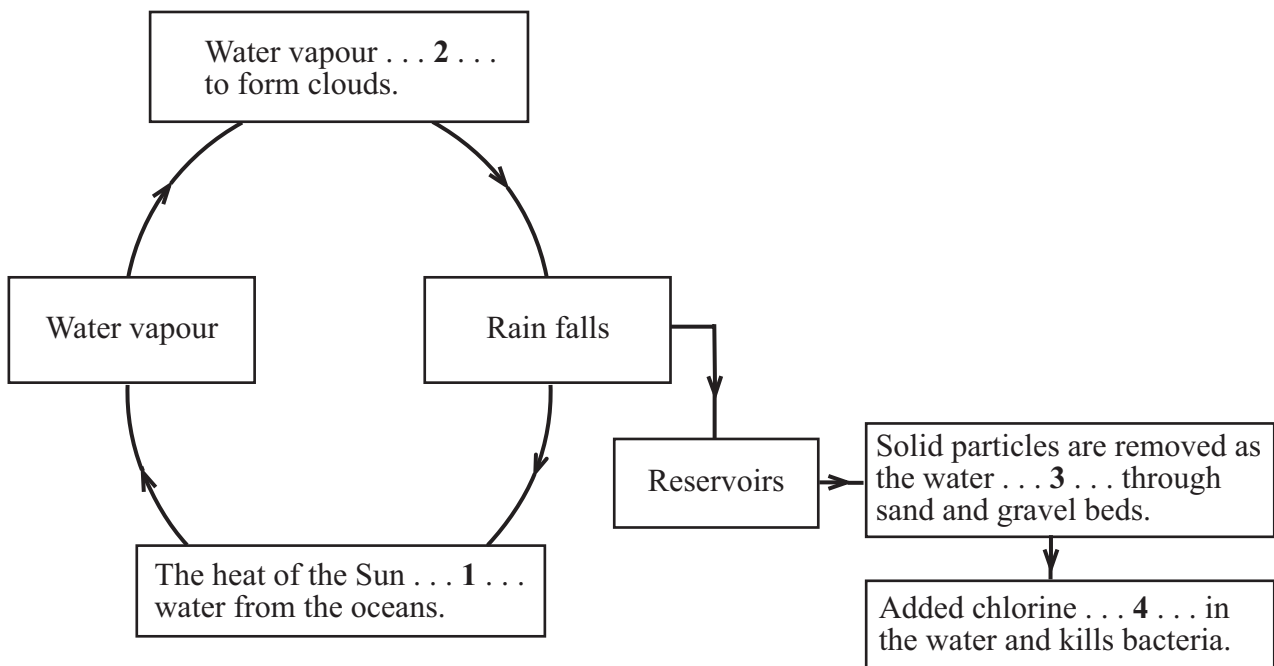
Match words from the list with the numbers **1–4** in the diagram.

condenses

dissolves

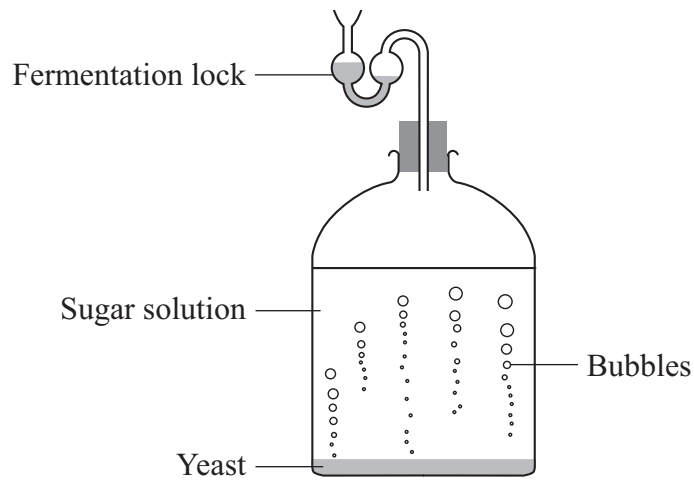
evaporates

filters



QUESTION TWO

The diagram shows a sugar solution being fermented in a reaction vessel.



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

air

catalysts

ethanol

sugar

Yeast contains enzymes which are biological . . . **1**

The enzymes help the yeast to break down the . . . **2**

Carbon dioxide and . . . **3** . . . are produced.

Carbon dioxide escapes from the reaction vessel but . . . **4** . . . cannot enter.

Turn over for the next question

Turn over ►

QUESTION THREE

This question is about four aqueous solutions of the same concentration.

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

strong acid

strong alkali

weak acid

weak alkali

Solution	What we can say about the solution
1	it is highly ionised and accepts protons
2	it is highly ionised and donates protons
3	it is partially ionised and accepts protons
4	it is partially ionised and donates protons

QUESTION FOUR

This question is about ions.

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

calcium ions (Ca²⁺)

hydroxide ions (OH⁻)

nitrate ions (NO₃⁻)

sodium ions (Na⁺)

Ions	What we can say about these ions
1	in drinking water, they can have a harmful effect on babies
2	they are exchanged for magnesium ions to soften water in an ion exchange column
3	they help in forming strong bones and teeth
4	they make solutions alkaline

QUESTION FIVE

Chemical reactions can be shown by word equations.

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

chlorine

magnesium carbonate

nitric acid

zinc sulphate

aluminium + ... **1** ... → aluminium chloride

iron oxide + ... **2** ... → iron nitrate + water

magnesium sulphate + sodium carbonate → sodium sulphate + ... **3** ...

zinc + sulphuric acid → ... **4** ... + hydrogen

Turn over for the next question

Turn over ►

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 statements, **P**, **Q**, **R**, **S** and **T**, are correct?**P** most covalent compounds are soluble in water**Q** most ionic compounds are more soluble in water at 50 °C than at 20 °C**R** in water, acids produce H^- ions**S** in water, alkalis produce OH^- ions**T** water is a solute for many ionic compounds

QUESTION SEVEN

A student tests three samples of water, **Sample K**, **Sample L** and **Sample M**, with soap solution. The student also tests some de-ionised water with soap solution.

The student uses 10 cm³ portions for each test.

Sample of water	Volume of soap solution needed to produce a lather, in cm³	
	Using untreated sample	After boiling sample
De-ionised	1	1
Sample K	10	10
Sample L	15	10
Sample M	20	5

Which **two** statements are correct?

de-ionised water is hard water

some of the hardness is removed from Sample M when it is boiled

the hardest water is Sample L

when soap solution is first added to Sample K, a scum will form

when water is boiled, all the hardness in the water is removed

Turn over for the next question

Turn over ►

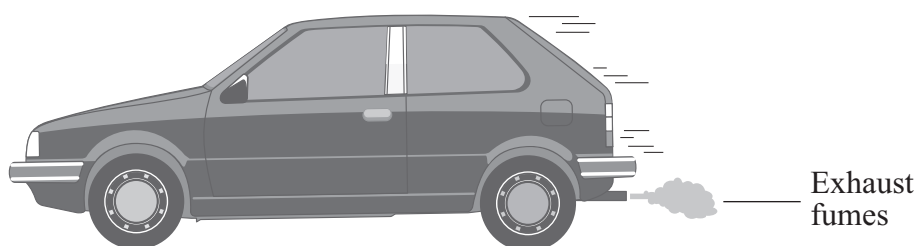
SECTION CQuestions **EIGHT** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

QUESTION EIGHT

Petrol is a mixture of compounds called hydrocarbons.



These are the main substances in the exhaust fumes from the car:

- **carbon, carbon monoxide, carbon dioxide and water;**
- **small amounts of sulphur dioxide and nitrogen oxides.**

8.1 Carbon and carbon monoxide are made when . . .

- A** the petrol burns in plenty of air.
- B** the petrol burns in too small a supply of air.
- C** the petrol contains sulphur as an impurity.
- D** the petrol is of a poor quality.

8.2 When carbon monoxide is breathed in, it can be poisonous.

This is because . . .

- A it cannot be absorbed into the blood.
- B it increases the amount of carbon dioxide in the blood.
- C it reduces the amount of carbon dioxide that the blood can carry.
- D it reduces the amount of oxygen that the blood can carry.

8.3 The water in the exhaust fumes is made . . .

- A by condensation of carbon monoxide.
- B by decomposition of carbon dioxide.
- C by oxidation of hydrogen.
- D by reduction of hydrogen.

8.4 Ethanol is used as a fuel in some car engines.

Which word equation shows the reaction when ethanol (C_2H_5OH) burns in plenty of air?

- A ethanol + oxygen \rightarrow carbon dioxide + hydrogen
- B ethanol + oxygen \rightarrow carbon dioxide + water
- C ethanol + oxygen \rightarrow carbon monoxide + hydrogen
- D ethanol + oxygen \rightarrow carbon monoxide + water

Turn over for the next question

Turn over ►

QUESTION NINE

This question is about some salts called chlorides.

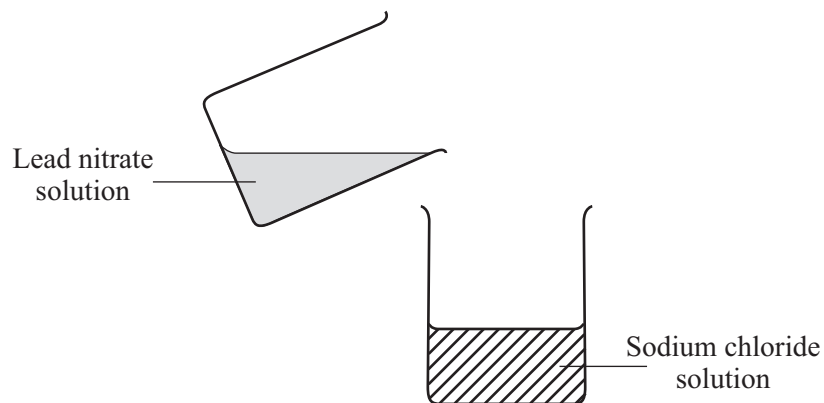
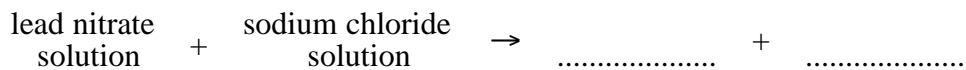
9.1 Silver chloride is an insoluble salt.

Which two substances react to make this salt?

- A** Silver and hydrochloric acid
- B** Silver and magnesium chloride solution
- C** Silver nitrate solution and magnesium chloride solution
- D** Silver nitrate solution and zinc sulphate solution

9.2 Lead chloride is an insoluble salt.

Lead chloride can be made by the reaction shown in the word equation.



Which line describes what is made?

- A** A precipitate of lead chloride + a solution of sodium nitrate
- B** A precipitate of lead chloride + water
- C** A precipitate of sodium nitrate + a solution of lead nitrate
- D** A solution of lead chloride + a solution of sodium nitrate

9.3 The lead chloride made in this reaction can be separated and collected by . . .

- A distillation.
- B filtration.
- C saturation.
- D titration.

9.4 How would you make anhydrous iron chloride?

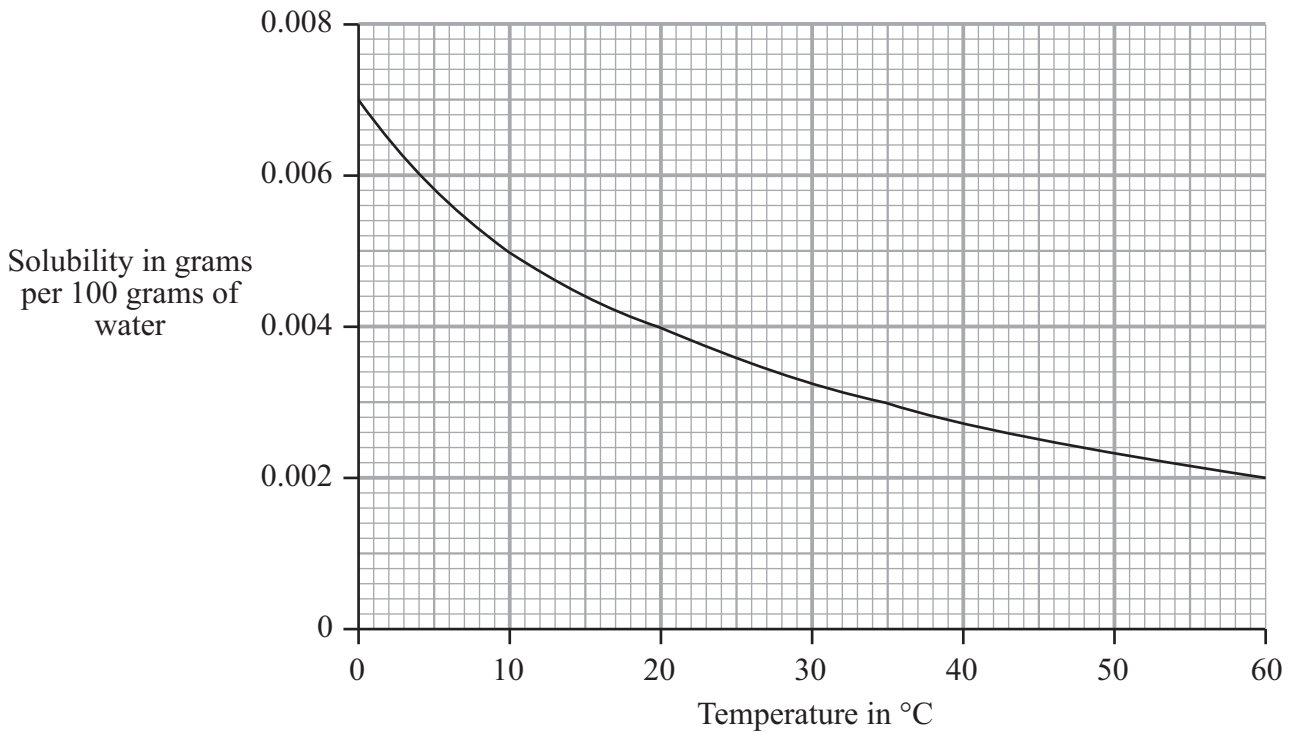
- A By the reaction between iron and chlorine
- B By the reaction between iron and hydrochloric acid
- C By the reaction between iron nitrate and sodium chloride
- D By the reaction between iron oxide and hydrochloric acid

Turn over for the next question

Turn over ►

QUESTION TEN

The graph shows the solubility of oxygen in water between 0 °C and 60 °C.



10.1 What mass of oxygen will dissolve in 100 grams of water at 20 °C?

- A 0.0004 g
- B 0.004 g
- C 0.04 g
- D 0.4 g

10.2 100 grams of water is saturated with oxygen at 10 °C.

The water is then heated to 35 °C.

What mass of oxygen is lost from the water?

- A 0.001 g
- B 0.002 g
- C 0.003 g
- D 0.005 g

10.3 Under what conditions is oxygen most soluble in water?

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

10.4 Plants and animals may not grow well where hot water from a power station is discharged into a river.

This is because . . .

- A** the pressure in the water rises.
- B** the water contains too little oxygen.
- C** the water contains too much carbon dioxide.
- D** the water contains too much oxygen.

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 words in the list with the numbers.

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

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QUESTION ONE

Chemical reactions can be shown by word equations.

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

chlorine

magnesium carbonate

nitric acid

zinc sulphate

aluminium + ... **1** ... → aluminium chloride

iron oxide + ... **2** ... → iron nitrate + water

magnesium sulphate + sodium carbonate → sodium sulphate + ... **3** ...

zinc + sulphuric acid → ... **4** ... + hydrogen

QUESTION TWO

This question is about polymers.

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

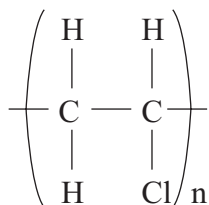
carbon dioxide

chloroethene

hydrogen chloride

hydrogen cyanide

Polyvinylchloride has the formula



It is made by polymerising the monomer . . . **1**

The three main products formed when polyvinylchloride burns are water, . . . **2** . . . and the poisonous gas . . . **3**

Nylon is a polymer which contains nitrogen.

When it burns, it can produce a poisonous gas called . . . **4**

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

A student tests three samples of water, **Sample K**, **Sample L** and **Sample M**, with soap solution. The student also tests some de-ionised water with soap solution.

The student uses 10 cm^3 portions for each test.

Sample of water	Volume of soap solution needed to produce a lather, in cm^3	
	Using untreated sample	After boiling sample
De-ionised	1	1
Sample K	10	10
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Which **two** statements are correct?

de-ionised water is hard water

some of the hardness is removed from Sample M when it is boiled

the hardest water is Sample L

when soap solution is first added to Sample K, a scum will form

when water is boiled, all the hardness in the water is removed

QUESTION FOUR

This question is about the alcohols.

Which **two** of the statements, **J**, **K**, **L**, **M** and **N**, are correct?

- J** the alcohols are neutralised by alkalis
- K** the alcohols are oxidised to carboxylic acids
- L** the alcohols are weakly alkaline
- M** the alcohols form a homologous series with the general formula $C_nH_{2n+1}OH$
- N** the alcohols react with sodium to give off carbon dioxide

Turn over for the next question

Turn over ►

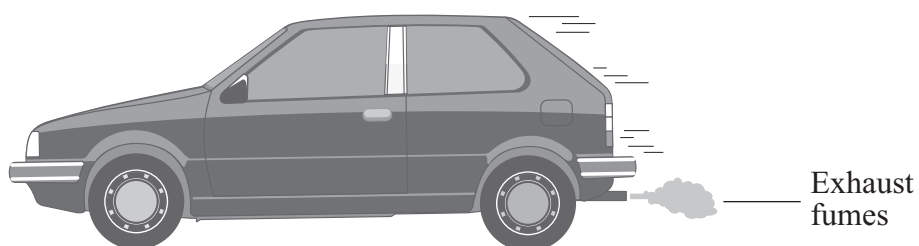
SECTION CQuestions **FIVE** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

QUESTION FIVE

Petrol is a mixture of compounds called hydrocarbons.



These are the main substances in the exhaust fumes from the car:

- **carbon, carbon monoxide, carbon dioxide and water;**
- **small amounts of sulphur dioxide and nitrogen oxides.**

5.1 Carbon and carbon monoxide are made when . . .

- A** the petrol burns in plenty of air.
- B** the petrol burns in too small a supply of air.
- C** the petrol contains sulphur as an impurity.
- D** the petrol is of a poor quality.

5.2 When carbon monoxide is breathed in, it can be poisonous.

This is because . . .

- A it cannot be absorbed into the blood.
- B it increases the amount of carbon dioxide in the blood.
- C it reduces the amount of carbon dioxide that the blood can carry.
- D it reduces the amount of oxygen that the blood can carry.

5.3 The water in the exhaust fumes is made . . .

- A by condensation of carbon monoxide.
- B by decomposition of carbon dioxide.
- C by oxidation of hydrogen.
- D by reduction of hydrogen.

5.4 Ethanol is used as a fuel in some car engines.

Which word equation shows the reaction when ethanol (C_2H_5OH) burns in plenty of air?

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- B ethanol + oxygen \rightarrow carbon dioxide + water
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Turn over for the next question

Turn over ►

QUESTION SIX

This question is about some salts called chlorides.

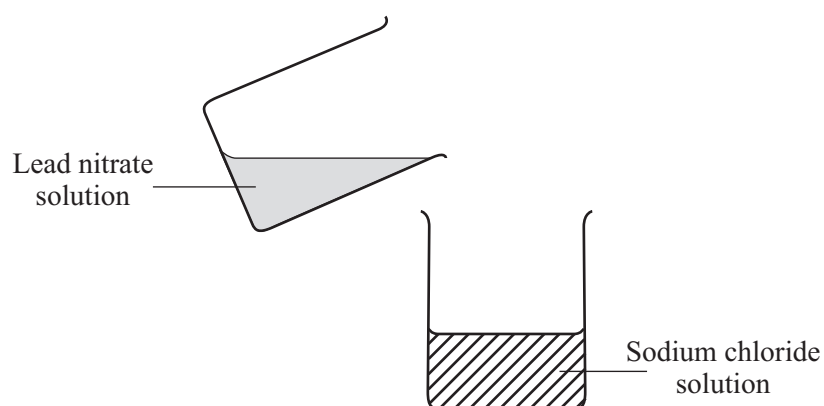
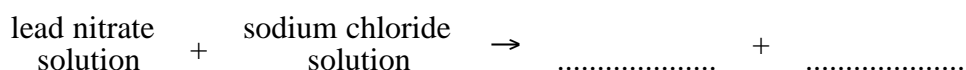
6.1 Silver chloride is an insoluble salt.

Which two substances react to make this salt?

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Which line describes what is made?

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- B** A precipitate of lead chloride + water
- C** A precipitate of sodium nitrate + a solution of lead nitrate
- D** A solution of lead chloride + a solution of sodium nitrate

6.3 The lead chloride made in this reaction can be separated and collected by . . .

- A distillation.
- B filtration.
- C saturation.
- D titration.

6.4 How would you make anhydrous iron chloride?

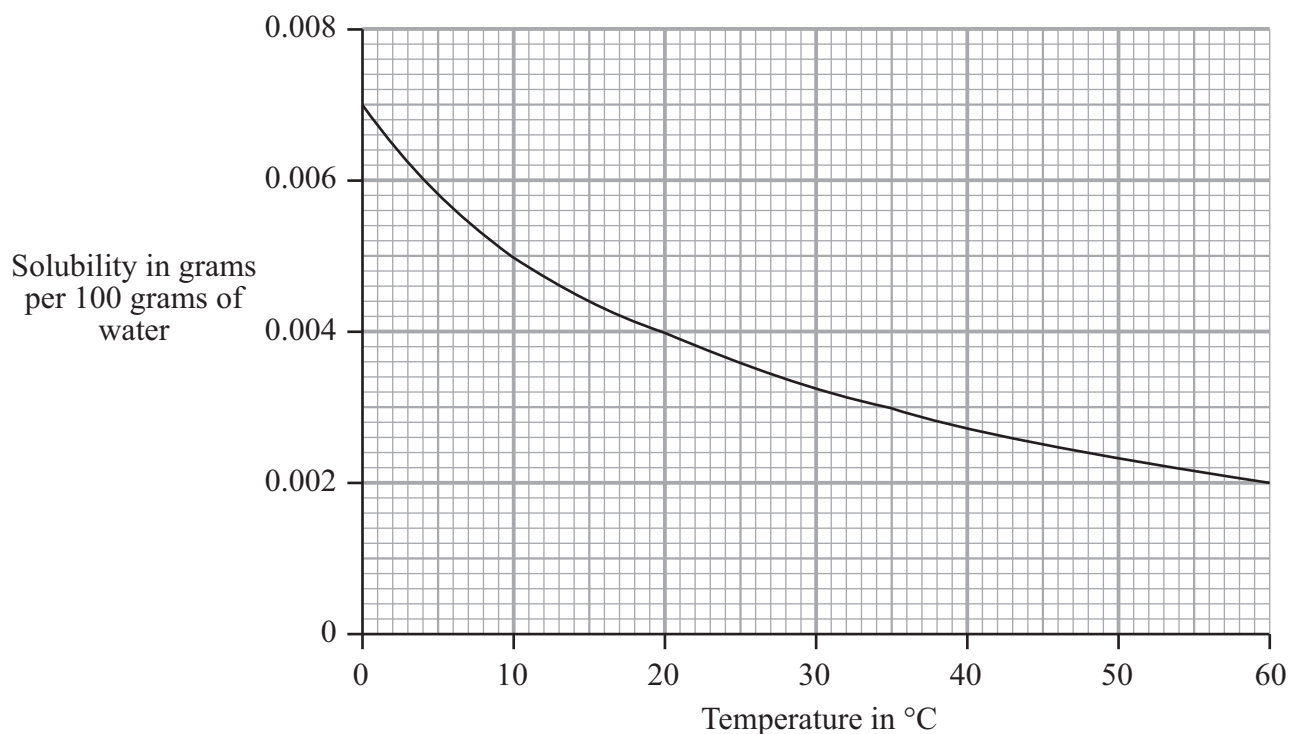
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- C By the reaction between iron nitrate and sodium chloride
- D By the reaction between iron oxide and hydrochloric acid

Turn over for the next question

Turn over ►

QUESTION SEVEN

The graph shows the solubility of oxygen in water between 0 °C and 60 °C.



7.1 What mass of oxygen will dissolve in 100 grams of water at 20 °C?

- A 0.0004 g
- B 0.004 g
- C 0.04 g
- D 0.4 g

7.2 100 grams of water is saturated with oxygen at 10 °C.

The water is then heated to 35 °C.

What mass of oxygen is lost from the water?

- A 0.001 g
- B 0.002 g
- C 0.003 g
- D 0.005 g

7.3 Under what conditions is oxygen most soluble in water?

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

7.4 Plants and animals may not grow well where hot water from a power station is discharged into a river.

This is because . . .

- A** the pressure in the water rises.
- B** the water contains too little oxygen.
- C** the water contains too much carbon dioxide.
- D** the water contains too much oxygen.

Turn over for the next question

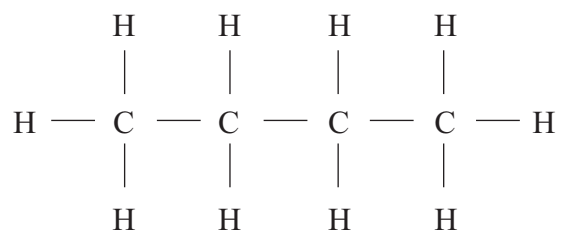
Turn over ►

QUESTION EIGHT

There are two different forms of the hydrocarbon with the formula C_4H_{10}

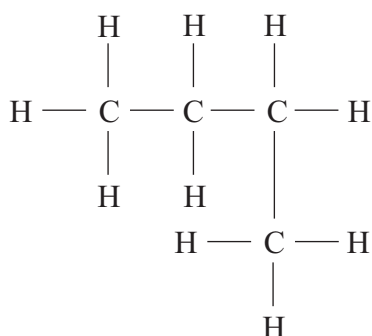
They are called butane and 2-methylpropane.

The structural formula for butane is:

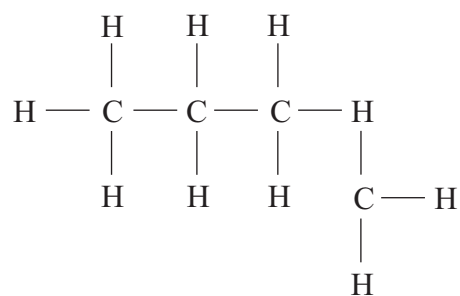


8.1 The structural formula for 2-methylpropane is . . .

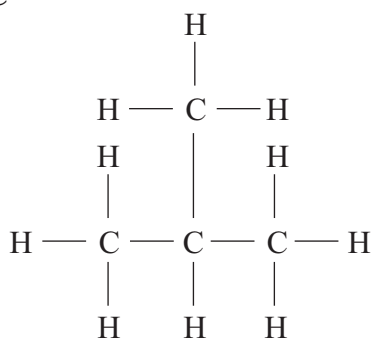
A



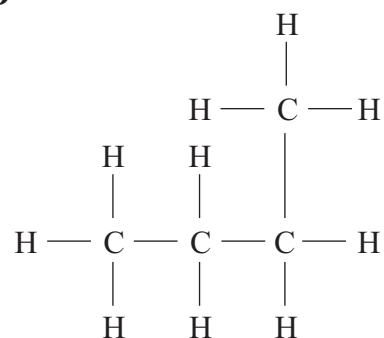
B



C



D



8.2 The two forms of butane are . . .

- A esters.
- B isomers.
- C isotopes.
- D polymers.

8.3 Which of the two forms of C_4H_{10} has the higher boiling point and why?

- A 2-methylpropane, because the forces between atoms are greater
- B 2-methylpropane, because the forces between molecules are greater
- C Butane, because the forces between atoms are greater
- D Butane, because the forces between molecules are greater

8.4 The homologous series to which butane belongs, and the general formula for the series, are . . .

- A the alkanes, C_nH_{2n+1}
- B the alkanes, C_nH_{2n+2}
- C the alkenes, C_nH_{2n}
- D the alkenes, C_nH_{2n+2}

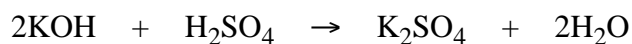
Turn over for the next question

Turn over ►

QUESTION NINE

You may find the following information useful when answering parts of this question.

Relative atomic masses: H = 1; O = 16; S = 32; K = 39



A student finds that 25 cm³ of a 0.04 mol per dm³ solution of potassium hydroxide is exactly neutralised by 20 cm³ of a solution of sulphuric acid.

9.1 What mass of potassium hydroxide is dissolved in 25 cm³ of a 0.04 mol per dm³ solution?

- A 0.028 g
- B 0.056 g
- C 1.4 g
- D 2.24 g

9.2 What method could the student use to find the exact volume of the sulphuric acid solution needed to neutralise the potassium hydroxide solution?

- A Crystallisation
- B Precipitation
- C Saturation
- D Titration

9.3 The concentration of the sulphuric acid solution is . . .

- A 0.025 mol per dm³
- B 0.032 mol per dm³
- C 0.25 mol per dm³
- D 0.50 mol per dm³

9.4 How much potassium sulphate could be made from a solution containing 5.6 g of potassium hydroxide, by reaction with sulphuric acid?

- A** 1.55 g
- B** 2.80 g
- C** 3.60 g
- D** 8.70 g

Turn over for the next question

Turn over ►

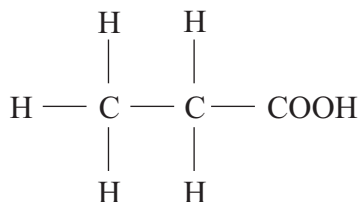
QUESTION TEN

The carboxylic acids form a homologous series of organic compounds.

10.1 What is the general formula for the carboxylic acids?

- A** $C_nH_{2n}COOH$
- B** $C_nH_{2n-1}COOH$
- C** $C_nH_{2n+1}COOH$
- D** $C_nH_{2n+2}COOH$

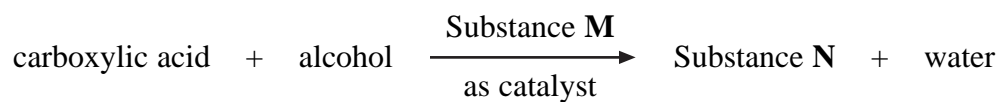
10.2 This is the structure of a molecule of a carboxylic acid.



Which carboxylic acid does this represent?

- A** Ascorbic acid
- B** Ethanoic acid
- C** Methanoic acid
- D** Propanoic acid

10.3 Carboxylic acids will react with alcohols.



What are substances **M** and **N**?

	Substance M	Substance N
A	concentrated sulphuric acid	an ester
B	dilute phosphoric acid	an alkene
C	iron	a polymer
D	platinum	a steroid

10.4 Which carboxylic acid do some people take to reduce the chance of a heart attack?

- A** Ascorbic acid
- B** Aspirin
- C** Citric acid
- D** Ethanoic Acid

END OF TEST

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