Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
March 2007

CHEMISTRY (SPECIFICATION A) (MODULAR) 346021
Aqueous and Organic Chemistry (Module 21)

Wednesday 7 March 2007 Morning Session

For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

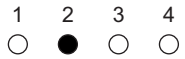
You may use a calculator.

Time allowed: 30 minutes

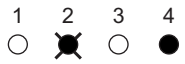
Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Aqueous and Organic Chemistry' printed on it.
- Attempt **one Tier only**, **either** the 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

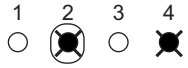
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 from the list with the numbers.

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

Mark your choices on the answer sheet.

QUESTION ONE

This question is about soft and hard water.

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

lather

scale

scum

soap

Soft water will easily form a . . . **1** . . . when shaken with one or two drops of soap solution.

When . . . **2** . . . is shaken with hard water, it reacts with dissolved chemicals to form a . . . **3** . . . .

When hard water is boiled in a kettle, a layer of . . . **4** . . . often forms on the metal parts.

QUESTION TWO

This question is about organic compounds.

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

carbon

carbon dioxide

carbon monoxide

oxygen

All organic compounds contain the element . . . **1** . . . .

When organic compounds burn in a plentiful supply of air, the two main products are . . . **2** . . . and water.

Water is formed by reacting hydrogen with . . . **3** . . . .

In a limited supply of air, organic compounds may produce poisonous . . . **4** . . . when they burn.

QUESTION THREE

This question is about positive and negative ions.

Match ions, **J**, **K**, **L** and **M**, from the list with the numbers **1–4** in the sentences.

J **Ca^{2+} (calcium) ions**

K **H^{+} ions**

L **H^{+}(aq) ions**

M **OH^{-}(aq) ions**

Sulphuric acid can donate protons. Protons are . . . **1** . . . .

In a solution of sulphuric acid, the protons are hydrated and can be represented as . . . **2** . . . .

A solution of sodium hydroxide contains . . . **3** . . . .

Water is hard if it contains . . . **4** . . . .

QUESTION FOUR

This question is about the water cycle.

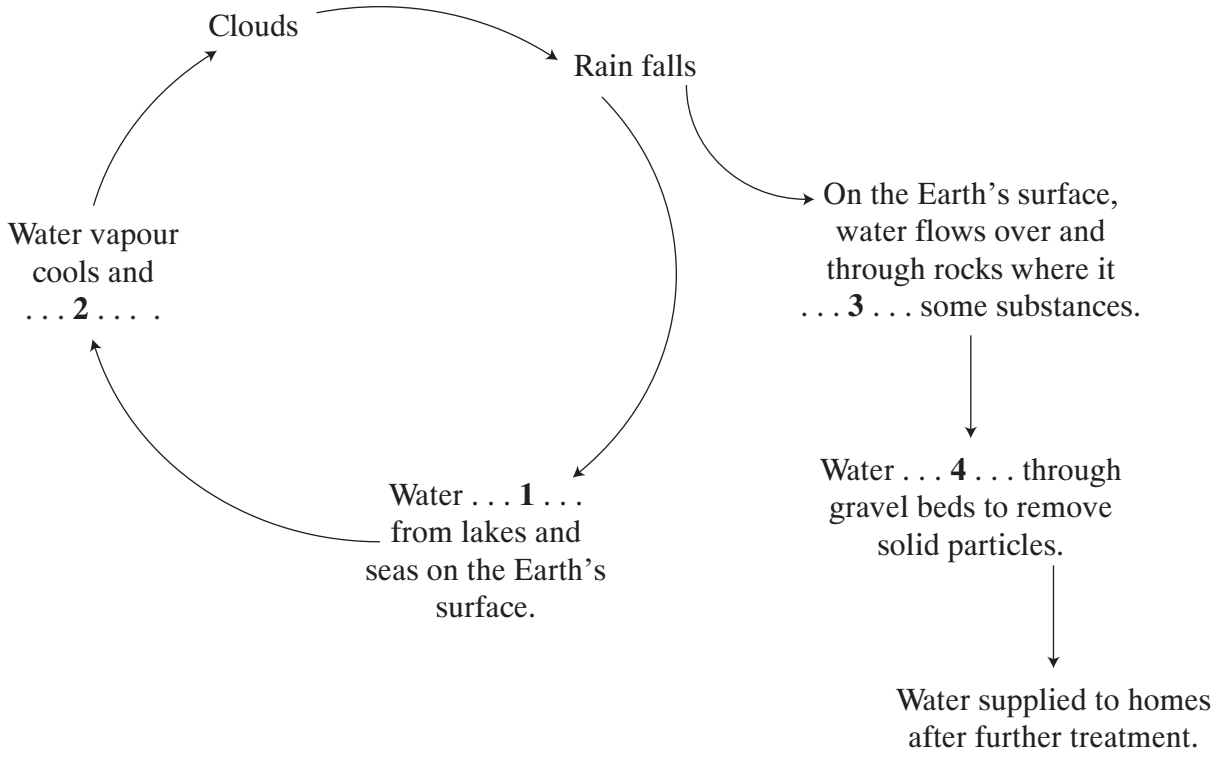
Match words from the list with the numbers **1–4** on the diagram.

condenses

dissolves

evaporates

filters



QUESTION FIVE

This question is about four of the substances in the word equations.

The word equations show reactions used for making salts.

copper oxide	+	sulphuric acid	→	copper sulphate	+	water
sodium hydroxide	+	hydrochloric acid	→	sodium chloride	+	water
sodium sulphate	+	lead nitrate	→	lead sulphate (precipitate)	+	sodium nitrate

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

copper oxide

copper sulphate

lead sulphate

sodium hydroxide

Substance	What we can say about the substance
1	it is a soluble base
2	it is a soluble salt
3	it is an insoluble base
4	it is an insoluble salt

Turn over for the next question

SECTION B

Questions **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 substances dissolved in water.

Which **two** statements are correct?

chlorine in water will remove the colour from fabrics

dissolved sodium compounds make water hard

fish in water need dissolved carbon monoxide

fizzy drinks contain dissolved carbon dioxide

harmful bacteria in water are killed by dissolved nitrogen

QUESTION SEVEN

This question is about ammonium nitrate.

Which **two** statements are correct?

it can be made by reacting ammonia solution with nitric acid

it can be made by the direct combination of ammonia with nitrogen

it dissolves to make water hard

it helps the development of strong bones and teeth

it is used as a fertiliser for crops

Turn over for the next question

SECTION C

Questions **EIGHT** to **TEN**.

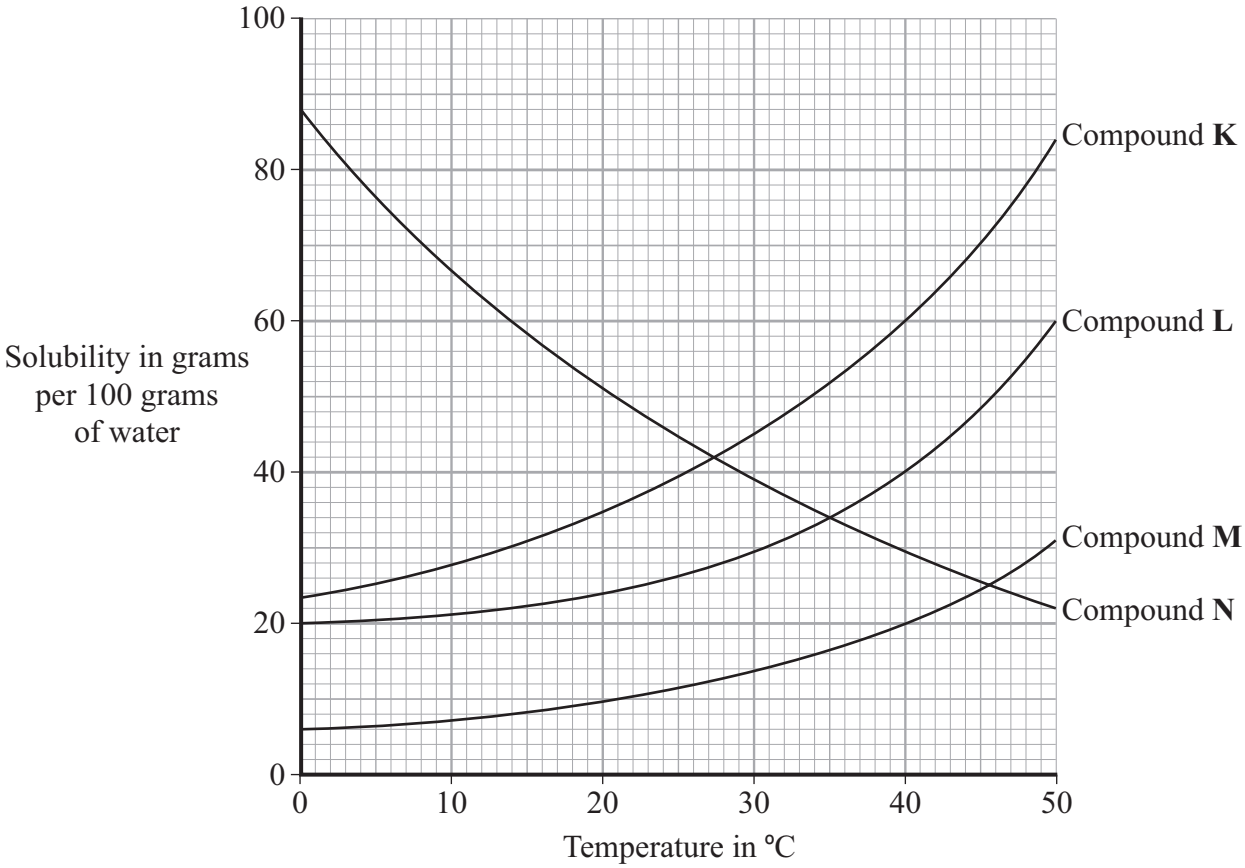
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION EIGHT

The graph shows the solubility curves for four compounds, **K**, **L**, **M** and **N**.



8.1 Which compound is a gas?

A Compound **K**

B Compound **L**

C Compound **M**

D Compound **N**

8.2 Which compound is most soluble at 25 °C?

A Compound **K**

B Compound **L**

C Compound **M**

D Compound **N**

8.3 The temperature at which Compound **L** and Compound **N** have the same solubility is . . .

A 28 °C

B 34 °C

C 35 °C

D 46 °C

8.4 What is the difference in solubility between Compound **K** and Compound **M** at 40 °C?

A 10 grams per 100 grams of water

B 20 grams per 100 grams of water

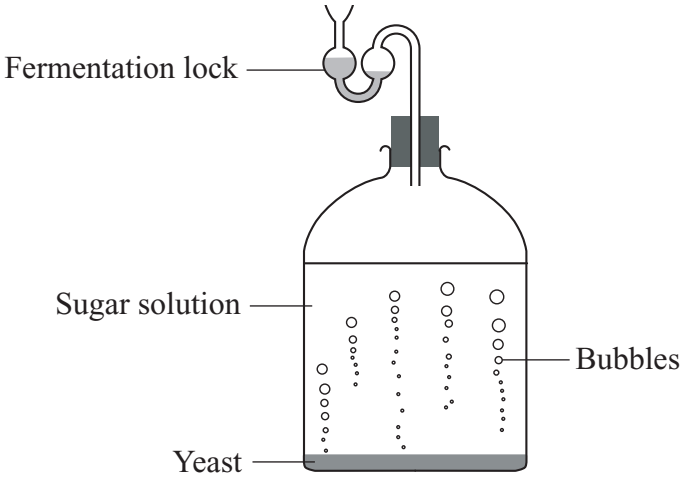
C 35 grams per 100 grams of water

D 40 grams per 100 grams of water

Turn over for the next question

QUESTION NINE

The diagram shows how we can make ethanol in a reaction vessel.



9.1 The gas produced when the yeast acts on the sugar is . . .

A carbon dioxide.

B chlorine.

C nitrogen.

D oxygen.

9.2 The yeast causes this reaction because it . . .

A contains enzymes.

B increases the temperature and pressure.

C makes the mixture acid.

D makes the mixture alkaline.

9.3 One purpose of the fermentation lock is . . .

A to allow extra sugar to be added.

B to maintain the correct temperature in the reaction vessel.

C to stop air entering the reaction vessel.

D to stop ethanol escaping from the reaction vessel.

9.4 When the reaction has finished, the mixture from the reaction vessel is fractionally distilled.

This is done so that . . .

A any unused sugar can be collected.

B the ethanol can be separated.

C the reaction vessel can be sterilised.

D the yeast can be recycled.

Turn over for the next question

QUESTION TEN

The equation shows how hydrochloric acid splits up in water.

$$HCl \xrightarrow{water} H^+(aq) + Cl^-(aq)$$

10.1 Carbonic acid (H_2CO_3) splits up in a similar way.

Which equation shows how carbonic acid splits up in water?

A $H_2CO_3 \xrightarrow{water} H^-(aq) + CO_3^{2+}(aq)$

B $H_2CO_3 \xrightarrow{water} H^-(aq) + CO_3^{2-}(aq)$

C $H_2CO_3 \xrightarrow{water} 2H^+(aq) + CO_3^{2-}(aq)$

D $H_2CO_3 \xrightarrow{water} H_2^+(aq) + CO_3^{2-}(aq)$

Solutions of the two acids are made with exactly the same concentration.

10.2 Which row in the table shows the correct pH numbers for these solutions of the two acids?

	Hydrochloric acid	**Carbonic acid**
A	pH 1	pH 1
B	pH 1	pH 5
C	pH 5	pH 1
D	pH 5	pH 5

10.3 The hydrochloric acid solution would . . .

A react faster than the carbonic acid solution with zinc.

B react more slowly than the carbonic acid solution with zinc.

C react with a weak alkali but the carbonic acid solution would not.

D react with a strong alkali but the carbonic acid solution would not.

10.4 Which row in the table correctly shows a weak alkali and a strong alkali?

	Weak alkali	**Strong alkali**
A	ammonia solution	potassium hydroxide
B	potassium hydroxide	ammonia solution
C	potassium hydroxide	sodium hydroxide
D	sodium hydroxide	ammonia solution

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 from the list with the numbers.

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QUESTION ONE

This question is about four of the substances in the word equations.

The word equations show reactions used for making salts.

copper oxide	+	sulphuric acid	→	copper sulphate	+	water
sodium hydroxide	+	hydrochloric acid	→	sodium chloride	+	water
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Match words from the list with the numbers **1–4** in the table.

copper oxide

copper sulphate

lead sulphate

sodium hydroxide

Substance	What we can say about the substance
1	it is a soluble base
2	it is a soluble salt
3	it is an insoluble base
4	it is an insoluble salt

QUESTION TWO

This question is about four organic compounds.

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

butane

ethanoic acid

ethene

methanol

Organic compound	What we can say about the compound
1	it belongs to a series with the general formula C_nH_{2n+2}
2	it can be oxidised to a carboxylic acid
3	it will react with sodium carbonate to produce carbon dioxide
4	it will take part in an addition reaction with hydrogen

Turn over for the next question

SECTION B

Questions **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 ammonium nitrate.

Which **two** statements are correct?

it can be made by reacting ammonia solution with nitric acid

it can be made by the direct combination of ammonia with nitrogen

it dissolves to make water hard

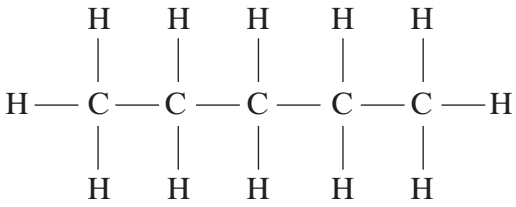
it helps the development of strong bones and teeth

it is used as a fertiliser for crops

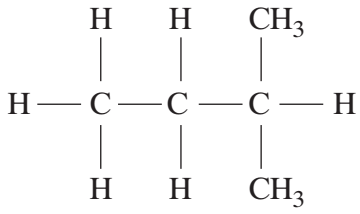
QUESTION FOUR

The diagram shows two isomers.

Isomer **M**



Isomer **N**



Which **two** statements about isomers **M** and **N** are correct?

isomer M has stronger forces between molecules

isomer N has stronger forces between atoms

isomer N has the higher boiling point

isomers M and N have the same chemical formula

only isomer M undergoes addition reactions

Turn over for the next question

SECTION C

Questions **FIVE** to **TEN**.

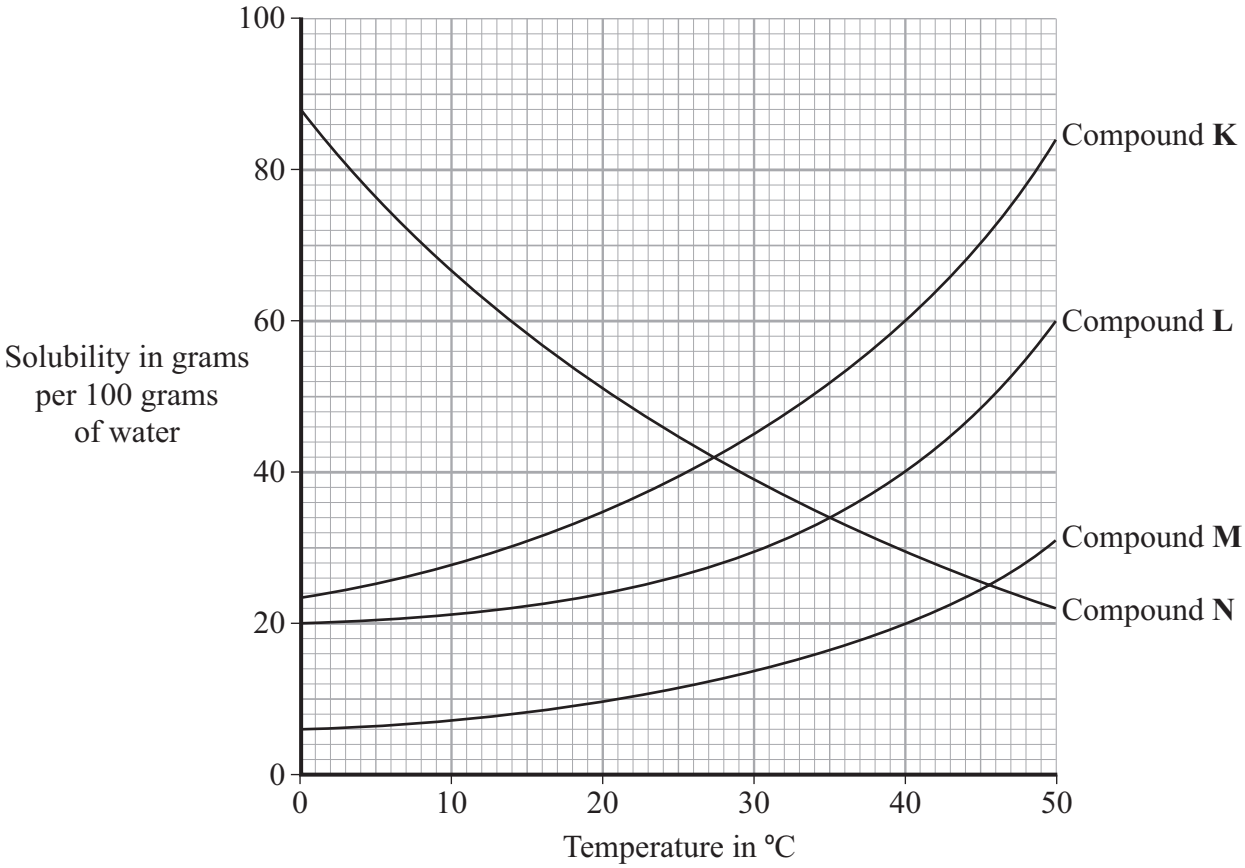
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION FIVE

The graph shows the solubility curves for four compounds, **K**, **L**, **M** and **N**.



5.1 Which compound is a gas?

A Compound **K**

B Compound **L**

C Compound **M**

D Compound **N**

5.2 Which compound is most soluble at 25 °C?

A Compound **K**

B Compound **L**

C Compound **M**

D Compound **N**

5.3 The temperature at which Compound **L** and Compound **N** have the same solubility is . . .

A 28 °C

B 34 °C

C 35 °C

D 46 °C

5.4 What is the difference in solubility between Compound **K** and Compound **M** at 40 °C?

A 10 grams per 100 grams of water

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C 35 grams per 100 grams of water

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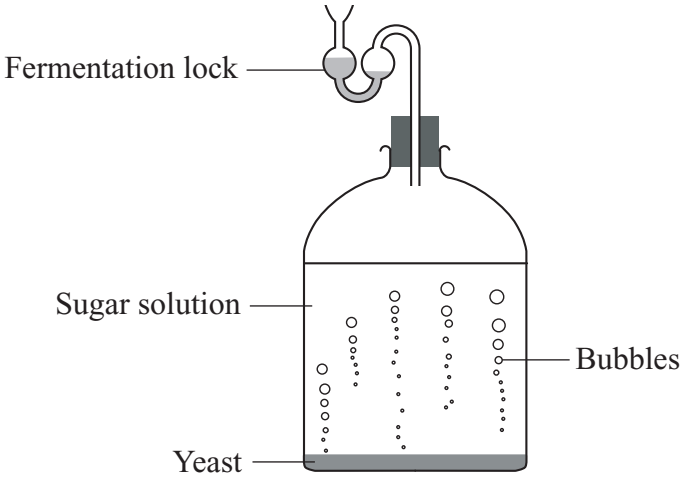
Turn over for the next question

QUESTION SIX

The diagram shows how we can make ethanol in a reaction vessel.



6.1 The gas produced when the yeast acts on the sugar is . . .

A carbon dioxide.

B chlorine.

C nitrogen.

D oxygen.

6.2 The yeast causes this reaction because it . . .

A contains enzymes.

B increases the temperature and pressure.

C makes the mixture acid.

D makes the mixture alkaline.

6.3 One purpose of the fermentation lock is . . .

A to allow extra sugar to be added.

B to maintain the correct temperature in the reaction vessel.

C to stop air entering the reaction vessel.

D to stop ethanol escaping from the reaction vessel.

6.4 When the reaction has finished, the mixture from the reaction vessel is fractionally distilled.

This is done so that . . .

A any unused sugar can be collected.

B the ethanol can be separated.

C the reaction vessel can be sterilised.

D the yeast can be recycled.

Turn over for the next question

QUESTION SEVEN

The equation shows how hydrochloric acid splits up in water.

$$HCl \xrightarrow{water} H^+(aq) + Cl^-(aq)$$

7.1 Carbonic acid (H_2CO_3) splits up in a similar way.

Which equation shows how carbonic acid splits up in water?

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C $H_2CO_3 \xrightarrow{water} 2H^+(aq) + CO_3^{2-}(aq)$

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Solutions of the two acids are made with exactly the same concentration.

7.2 Which row in the table shows the correct pH numbers for these solutions of the two acids?

	Hydrochloric acid	**Carbonic acid**
A	pH 1	pH 1
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C	pH 5	pH 1
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7.3 The hydrochloric acid solution would . . .

A react faster than the carbonic acid solution with zinc.

B react more slowly than the carbonic acid solution with zinc.

C react with a weak alkali but the carbonic acid solution would not.

D react with a strong alkali but the carbonic acid solution would not.

7.4 Which row in the table correctly shows a weak alkali and a strong alkali?

	Weak alkali	**Strong alkali**
A	ammonia solution	potassium hydroxide
B	potassium hydroxide	ammonia solution
C	potassium hydroxide	sodium hydroxide
D	sodium hydroxide	ammonia solution

Turn over for the next question

QUESTION EIGHT

This question is about calculations involving aqueous solutions.

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

Relative atomic masses: H = 1; N = 14; O = 16; Na = 23

8.1 What is the relative formula mass of nitric acid (HNO_3)?

A 31

B 63

C 93

D 184

8.2 How many moles of sodium hydroxide (NaOH) are in 8.0 grams?

A 0.125

B 0.20

C 1.00

D 2.00

8.3 A student prepares 500 cm^3 of a solution of sodium hydroxide (NaOH) by dissolving 2.0 grams in water.

What is the concentration of the sodium hydroxide solution in mol per dm^3?

A 0.1

B 0.2

C 2.0

D 4.0

8.4 What is the maximum mass of dry sodium nitrate that could be made from a solution containing 4.0 grams of sodium hydroxide?

$$NaOH + HNO_3 \rightarrow NaNO_3 + H_2O$$

A 0.47 g

B 4.25 g

C 8.50 g

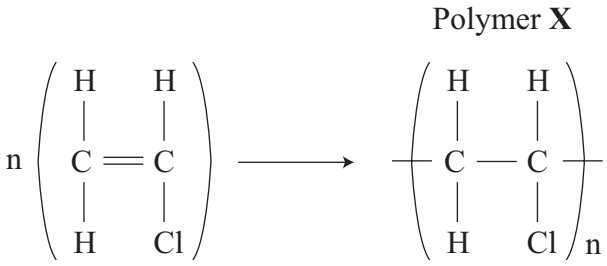
D 17.00 g

Turn over for the next question

QUESTION NINE

This question is about polymers.

In this reaction, a polymer **X** is produced.



9.1 What is the name of polymer **X**?

A Melamine

B Poly(ethene)

C Poly(propene)

D Polyvinylchloride

9.2 Polymer **X** can be remoulded on heating.

Which line best describes the structure of polymer **X**?

A Strong covalent bonds between atoms; strong forces between molecules

B Strong covalent bonds between atoms; weak forces between molecules

C Weak covalent bonds between atoms; strong forces between molecules

D Weak covalent bonds between atoms; weak forces between molecules

9.3 A thermosetting polymer cannot be softened and remoulded.

This is because, when it is heated, . . .

A cross-linkages form between atoms within each molecule.

B strong covalent bonds form between molecules.

C the covalent bonds between atoms break.

D the molecules can slide freely past each other.

9.4 When polymer **X** burns in a limited supply of air, the products include . . .

A carbon and chlorine.

B carbon dioxide and chlorine.

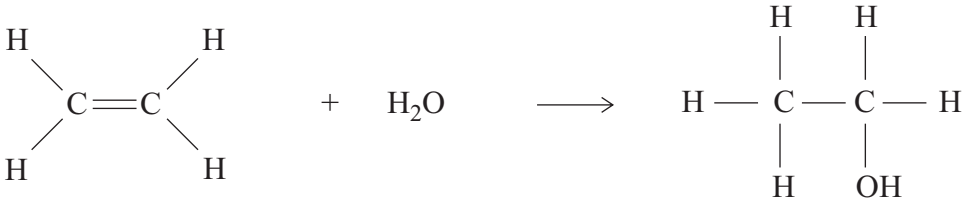
C carbon dioxide, chlorine and water.

D carbon dioxide, hydrogen chloride and water.

Turn over for the next question

QUESTION TEN

The equation shows the reaction of ethene with steam.



10.1 The product of this reaction is . . .

A ethane.

B ethanoic acid.

C ethanol.

D ethyl ethanoate.

10.2 On a large scale, under what conditions is this reaction carried out?

	Temperature	**Pressure**	**Catalyst**
A	very high	very high	strong alkali
B	moderately high	very low	strong acid
C	moderately high	high	strong acid
D	very low	high	strong alkali

10.3 An ester is produced in a reaction between a carboxylic acid and . . .

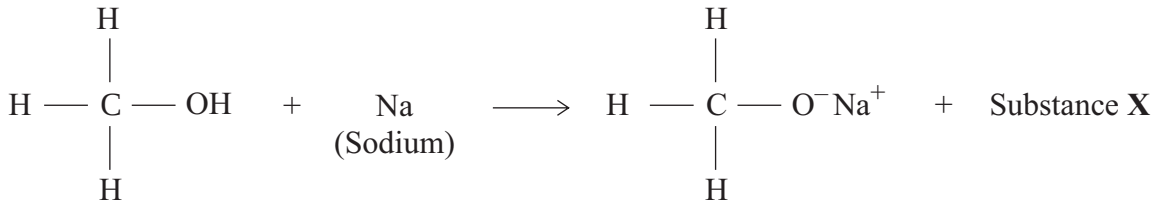
A an alcohol.

B an alkali.

C an alkene.

D carbon dioxide.

10.4 The equation shows how an organic compound reacts with sodium.



Substance **X** is . . .

A carbon dioxide.

B hydrogen.

C oxygen.

D water.

END OF TEST

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