Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
November 2006

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

Thursday 23 November 2006 Morning Session

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

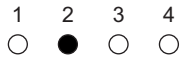
You may use a calculator.

Time allowed: 30 minutes

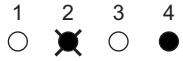
Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Aqueous and Organic Chemistry' printed on it.
- Attempt **one Tier only**, **either** the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

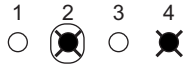
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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

The diagram shows some of the substances that can be produced when coal burns.

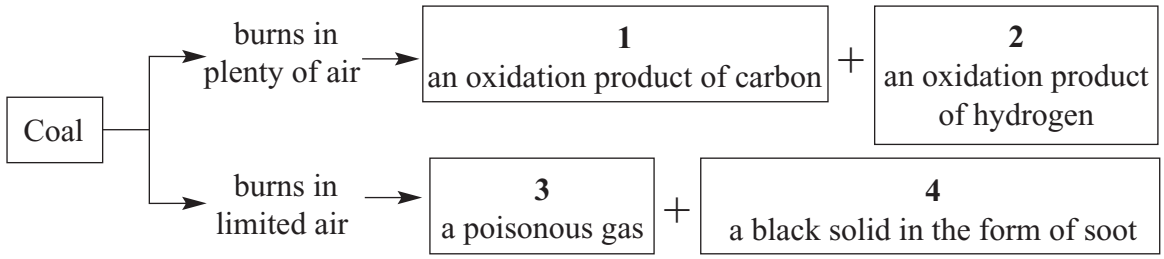
Match words from the list with the numbers **1–4** in the diagram.

carbon

carbon dioxide

carbon monoxide

water (vapour)



QUESTION TWO

This question is about soft and hard water.

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

lather

precipitate

scale

soap

Soft water easily forms a . . . **1** . . . with soap.

The insides of kettles used for boiling hard water often get a layer of . . . **2** . . . .

When sodium carbonate is added to hard water, a white . . . **3** . . . of calcium carbonate is formed.

Hard water reacts with . . . **4** . . . to form a scum.

Turn over for the next question

QUESTION THREE

This question is about four substances that dissolve in water.

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

ammonium nitrate

calcium sulphate

chlorine water

sodium hydroxide

Substance	What we can say about the substance
1	it can help the body to develop strong bones
2	it dissolves in water to produce a solution of a strong alkali
3	it is an artificial fertiliser that can get into drinking water
4	it is used as a bleach

QUESTION FOUR

The diagram shows stages in the preparation of almost pure ethanol.

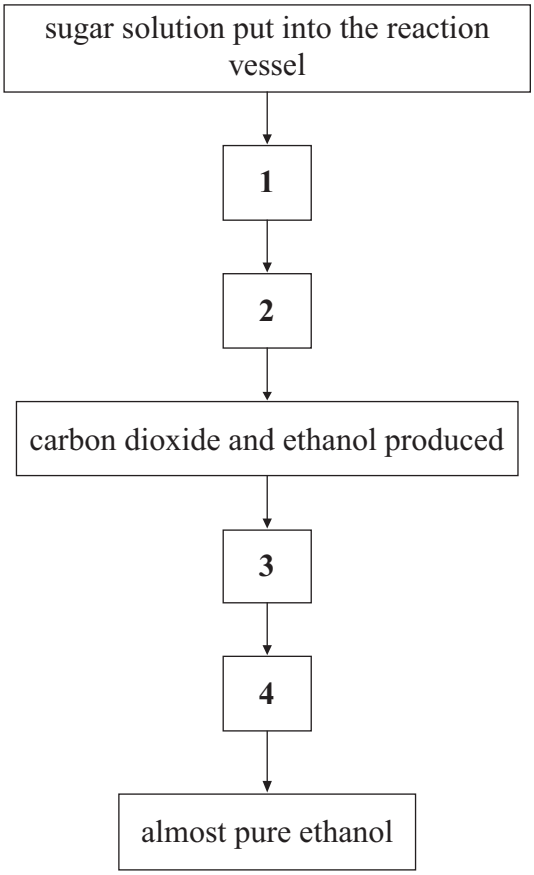
Match words, **E**, **F**, **G** and **H**, from the list with the numbers **1–4** in the flow chart, to explain how the ethanol can be made.

E **carbon dioxide escapes from the reaction vessel**

F **fractional distillation of the reaction mixture**

G **sugar fermented by yeast**

H **yeast is added**



Turn over for the next question

QUESTION FIVE

Word equations can be used to represent chemical reactions.

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

carbon dioxide

hydrogen

oxygen

water

copper oxide	+	sulphuric acid	→	copper sulphate	+	. . . **1** . . .
hydrocarbon	+	oxygen	→	. . . **2** . . .	+	water
hydrogen	+	. . . **3** . . .	→	water		
magnesium	+	hydrochloric acid	→	magnesium chloride	+	. . . **4** . . .

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 that are soluble or insoluble in water.

Which **two** statements are correct?

carbonated water contains dissolved carbon dioxide

dissolved calcium compounds make water soft

most covalent compounds dissolve in water

oxygen is insoluble in water

oxygen is more soluble in cold water than in hot water

QUESTION SEVEN

This question is about potassium hydroxide.

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

J **potassium hydroxide contains K^+ ions and OH^- ions**

K **potassium hydroxide is a covalent compound**

L **potassium hydroxide is a proton donor**

M **potassium hydroxide is an alkali**

N **potassium hydroxide is an insoluble base**

SECTION C

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

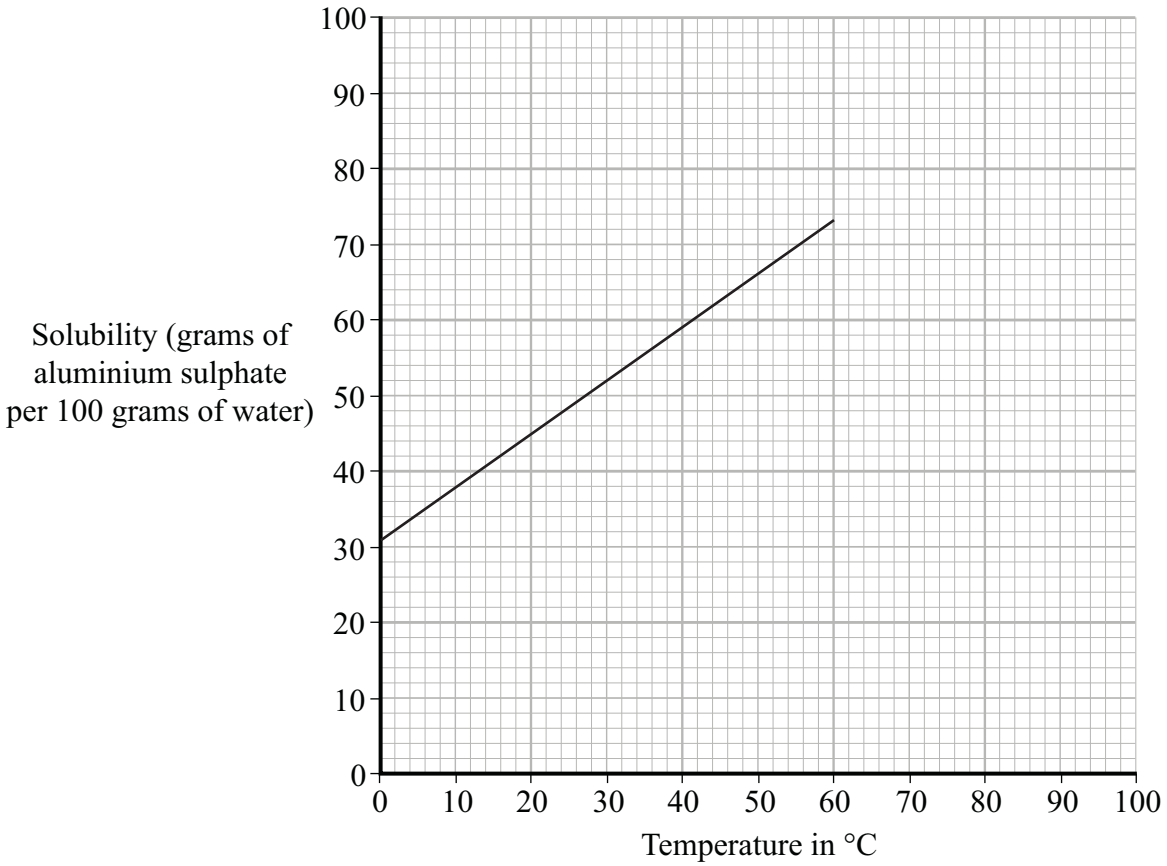
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION EIGHT

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



8.1 What is the maximum mass of aluminium sulphate that can be dissolved in 100 grams of water at 60 °C?

A 42 g

B 66 g

C 71 g

D 73 g

8.2 Predict the solubility of aluminium sulphate at 80 °C.

A 72 grams per 100 grams water

B 83 grams per 100 grams water

C 87 grams per 100 grams water

D 100 grams per 100 grams water

8.3 What mass of aluminium sulphate in 100 grams of water will give a saturated solution?

A 29 grams at 0 °C

B 38 grams at 10 °C

C 42 grams at 20 °C

D 50 grams at 30 °C

8.4 What mass of aluminium sulphate will crystallise out from a saturated solution in 100 grams of water as it cools from 50 °C to 20 °C?

A 21 g

B 28 g

C 45 g

D 65 g

Turn over for the next question

QUESTION NINE

The diagrams show some of the particles present in four different acid solutions in water.

The acids are:

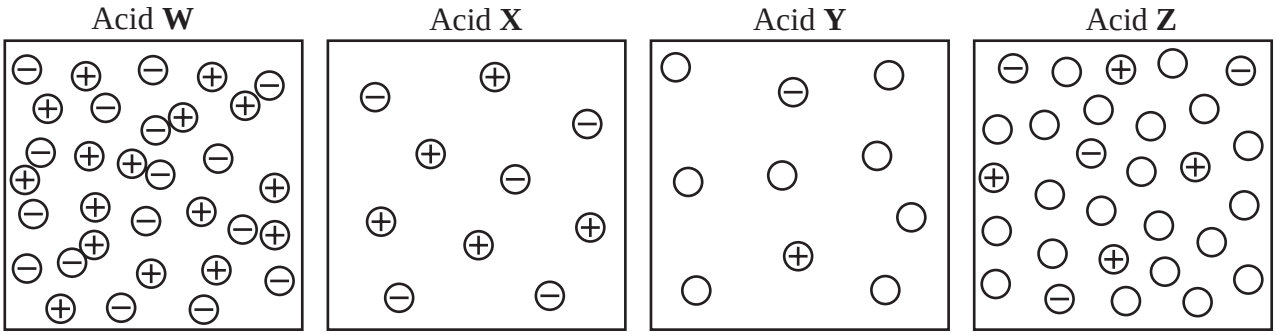
- dilute ethanoic acid
- concentrated ethanoic acid
- dilute hydrochloric acid
- concentrated hydrochloric acid.

Water particles are present but not shown.

⊕ = hydrogen ions $H^+(aq)$

⊖ = negative ions

◯ = acid particles not ionised



9.1 Which diagram could represent a dilute solution of hydrochloric acid?

A Acid **W**

B Acid **X**

C Acid **Y**

D Acid **Z**

9.2 Which diagram could represent a concentrated solution of ethanoic acid?

A Acid **W**

B Acid **X**

C Acid **Y**

D Acid **Z**

9.3 Which row in the table shows examples of a weak acid and a strong alkali?

	Weak acid	**Strong alkali**
A	citric acid	potassium hydroxide
B	ethanoic acid	ammonia solution
C	nitric acid	potassium hydroxide
D	sulphuric acid	sodium hydroxide

9.4 Which row in the table shows the properties of a weak acid and a strong acid of the same concentration?

	Weak acid	**Strong acid**
A	pH number 1, fast reaction with zinc	pH number 4, slow reaction with zinc
B	pH number 1, slow reaction with zinc	pH number 1, fast reaction with zinc
C	pH number 4, fast reaction with zinc	pH number 4, slow reaction with zinc
D	pH number 4, slow reaction with zinc	pH number 1, fast reaction with zinc

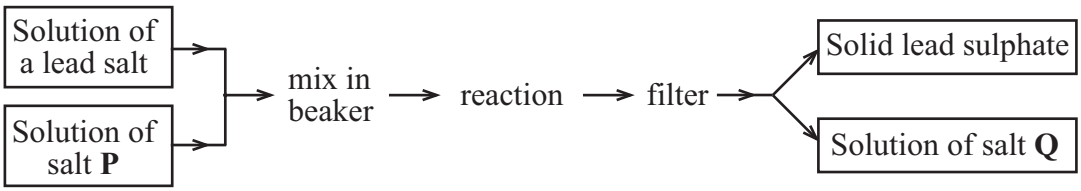
Turn over for the next question

QUESTION TEN

Use the following information to help you to answer this question.

All carbonates except sodium, potassium and ammonium are insoluble in water.
All nitrates are soluble in water.
All chlorides except those of silver and lead are soluble in water.
All sulphates except those of barium and lead are soluble in water.

The flow diagram shows how you can make the insoluble salt, lead sulphate.



10.1 Which lead salt is used in the preparation of lead sulphate?

A Lead carbonate

B Lead chloride

C Lead nitrate

D Lead sulphate

10.2 Salt **P** could be . . .

A barium sulphate.

B potassium sulphate.

C sodium chloride.

D zinc carbonate.

10.3 Which of the following will form when the solution of the lead salt and the solution of salt **P** are mixed in a beaker?

A A precipitate

B A scum

C Bubbles of carbon dioxide

D Bubbles of hydrogen

10.4 Salt **Q** can be obtained from its solution by . . .

A condensation.

B crystallisation.

C distillation.

D filtration.

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**.

Mark your choices on the answer sheet.

QUESTION ONE

Word equations can be used to represent chemical reactions.

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

carbon dioxide

hydrogen

oxygen

water

copper oxide	+	sulphuric acid	→	copper sulphate	+	. . . **1** . . .
hydrocarbon	+	oxygen	→	. . . **2** . . .	+	water
hydrogen	+	. . . **3** . . .	→	water		
magnesium	+	hydrochloric acid	→	magnesium chloride	+	. . . **4** . . .

QUESTION TWO

This question is about one of the products in each of four reactions. The reactions involve organic compounds.

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

an alkane

carbon dioxide

hydrogen

vinegar

Product	Reaction in which it is produced
1	ethanoic acid + sodium carbonate
2	ethanol + oxygen
3	ethanol + sodium
4	ethene + 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 potassium hydroxide.

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

J **potassium hydroxide contains K^+ ions and OH^- ions**

K **potassium hydroxide is a covalent compound**

L **potassium hydroxide is a proton donor**

M **potassium hydroxide is an alkali**

N **potassium hydroxide is an insoluble base**

QUESTION FOUR

This question is about poly(propene).

Which **two** statements are correct?

poly(propene) burns to form water, carbon dioxide and hydrogen cyanide

poly(propene) can be remoulded when heated

poly(propene) has long molecules with strong bonds between atoms

poly(propene) is also known as PVC

poly(propene) is formed from the monomer chloroethene

Turn over for the next question

SECTION C

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

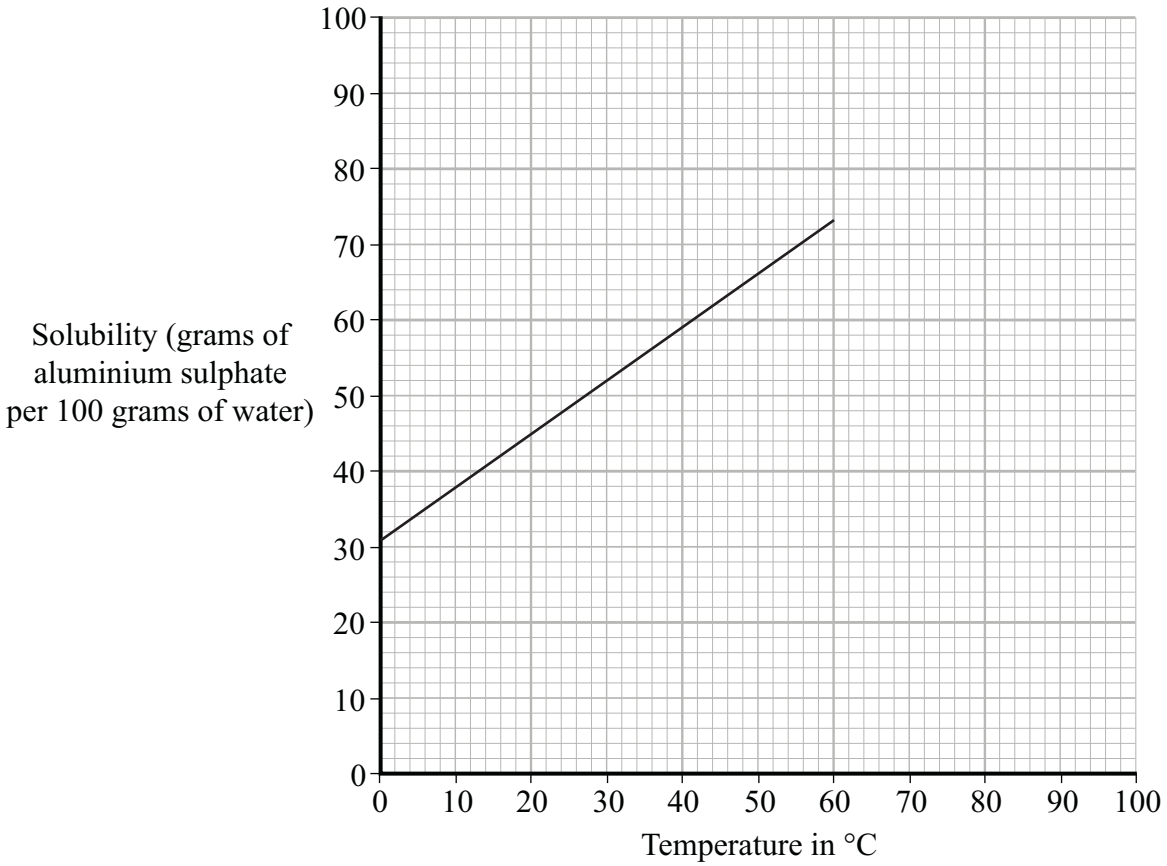
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION FIVE

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



5.1 What is the maximum mass of aluminium sulphate that can be dissolved in 100 grams of water at 60 °C?

A 42 g

B 66 g

C 71 g

D 73 g

5.2 Predict the solubility of aluminium sulphate at 80 °C.

A 72 grams per 100 grams water

B 83 grams per 100 grams water

C 87 grams per 100 grams water

D 100 grams per 100 grams water

5.3 What mass of aluminium sulphate in 100 grams of water will give a saturated solution?

A 29 grams at 0 °C

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C 42 grams at 20 °C

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5.4 What mass of aluminium sulphate will crystallise out from a saturated solution in 100 grams of water as it cools from 50 °C to 20 °C?

A 21 g

B 28 g

C 45 g

D 65 g

Turn over for the next question

QUESTION SIX

The diagrams show some of the particles present in four different acid solutions in water.

The acids are:

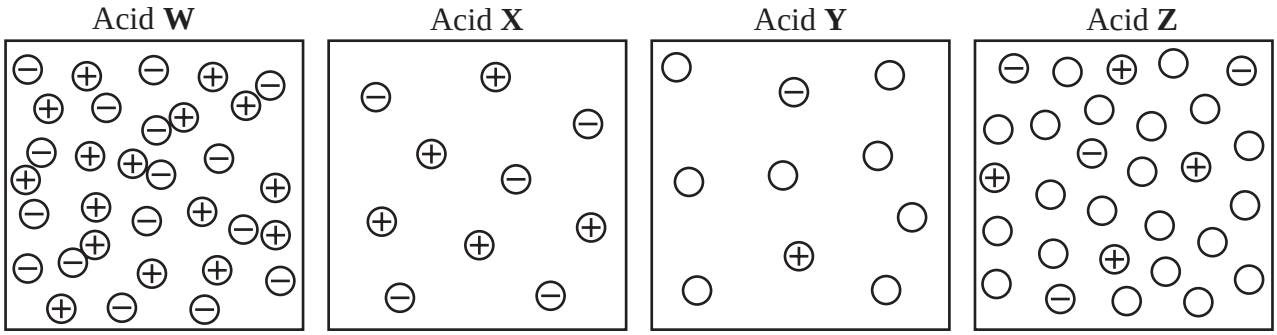
- dilute ethanoic acid
- concentrated ethanoic acid
- dilute hydrochloric acid
- concentrated hydrochloric acid.

Water particles are present but not shown.

⊕ = hydrogen ions $H^+(aq)$

⊖ = negative ions

○ = acid particles not ionised



6.1 Which diagram could represent a dilute solution of hydrochloric acid?

A Acid **W**

B Acid **X**

C Acid **Y**

D Acid **Z**

6.2 Which diagram could represent a concentrated solution of ethanoic acid?

A Acid **W**

B Acid **X**

C Acid **Y**

D Acid **Z**

6.3 Which row in the table shows examples of a weak acid and a strong alkali?

	Weak acid	**Strong alkali**
A	citric acid	potassium hydroxide
B	ethanoic acid	ammonia solution
C	nitric acid	potassium hydroxide
D	sulphuric acid	sodium hydroxide

6.4 Which row in the table shows the properties of a weak acid and a strong acid of the same concentration?

	Weak acid	**Strong acid**
A	pH number 1, fast reaction with zinc	pH number 4, slow reaction with zinc
B	pH number 1, slow reaction with zinc	pH number 1, fast reaction with zinc
C	pH number 4, fast reaction with zinc	pH number 4, slow reaction with zinc
D	pH number 4, slow reaction with zinc	pH number 1, fast reaction with zinc

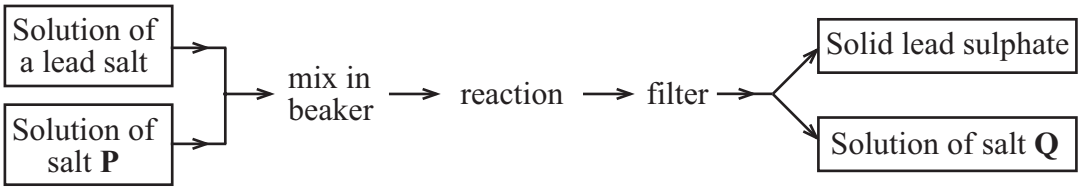
Turn over for the next question

QUESTION SEVEN

Use the following information to help you to answer this question.

All carbonates except sodium, potassium and ammonium are insoluble in water.
All nitrates are soluble in water.
All chlorides except those of silver and lead are soluble in water.
All sulphates except those of barium and lead are soluble in water.

The flow diagram shows how you can make the insoluble salt, lead sulphate.



7.1 Which lead salt is used in the preparation of lead sulphate?

A Lead carbonate

B Lead chloride

C Lead nitrate

D Lead sulphate

7.2 Salt **P** could be . . .

A barium sulphate.

B potassium sulphate.

C sodium chloride.

D zinc carbonate.

7.3 Which of the following will form when the solution of the lead salt and the solution of salt **P** are mixed in a beaker?

A A precipitate

B A scum

C Bubbles of carbon dioxide

D Bubbles of hydrogen

7.4 Salt **Q** can be obtained from its solution by . . .

A condensation.

B crystallisation.

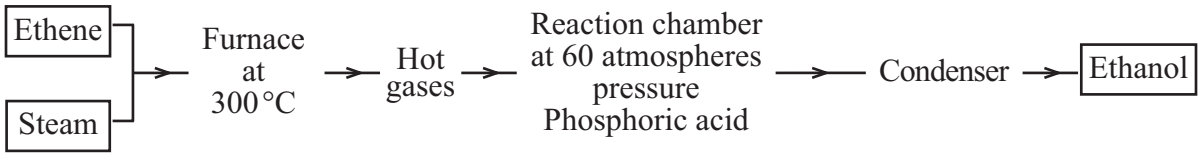
C distillation.

D filtration.

Turn over for the next question

QUESTION EIGHT

Ethanol can be made by the reaction of ethene with steam.



8.1 Which set of conditions will most increase the rate of reaction of the ethene and steam?

A High pressure, high temperature, acid catalyst

B High pressure, low temperature, acid catalyst

C Low pressure, high temperature, acid catalyst

D Low pressure, low temperature, acid catalyst

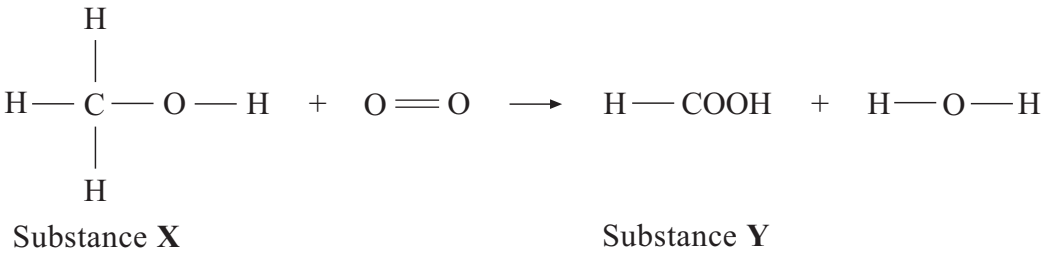
8.2 Ethanol can also be made by the fermentation of sugars.

Which row in the table shows one advantage and one disadvantage of fermentation compared with the reaction of ethene with steam?

	Advantage of fermentation	**Disadvantage of fermentation**
A	batch process	ethanol has to be distilled from the reaction mixture
B	ethanol is pure	slow process
C	slow process	batch process
D	sugar is a renewable raw material	batch process

8.3 Alcohols contain the functional group –OH.

In this reaction, what are substances **X** and **Y**?



Substance **X** Substance **Y**

	Substance X	Substance Y
A	ethanol	ethanoic acid
B	ethanol	ethyl ethanoate
C	methanol	methanoic acid
D	methanol	methyl ethanoate

8.4 Which type of substance is produced when an alcohol reacts with a carboxylic acid?

A A hydrogencarbonate

B A vitamin

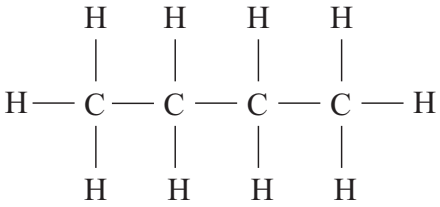
C An alkene

D An ester

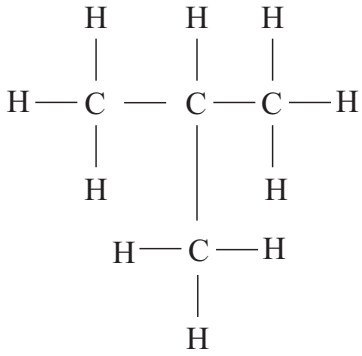
Turn over for the next question

QUESTION NINE

The diagram shows the structural formulae of two organic compounds.



Compound **M**
Boiling point –0.5 °C



Compound **N**
Boiling point –12 °C

9.1 To which group of organic compounds do these two compounds belong?

A Alcohols

B Alkanes

C Alkenes

D Esters

9.2 The two compounds have . . .

A different chemical formulae and different structures.

B different chemical formulae but the same structure.

C the same chemical formula and the same structure.

D the same chemical formula but different structures.

9.3 Which compound has the higher boiling point and why?

A Compound **M** because it has stronger forces between atoms in its molecules

B Compound **M** because it has stronger forces between its molecules

C Compound **N** because it has stronger forces between its molecules

D Compound **N** because its molecules pack more closely together

9.4 The compounds **M** and **N** are not very reactive because . . .

A they are compounds of carbon and hydrogen only.

B they are saturated compounds.

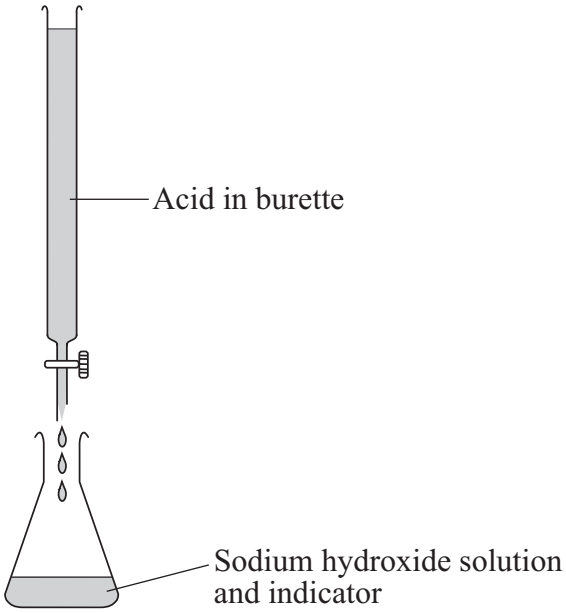
C they can only undergo addition reactions.

D they have ionic bonds between atoms.

Turn over for the next question

QUESTION TEN

A student titrates a solution of sulphuric acid against a solution of sodium hydroxide which has a concentration of 0.05 mol per dm^3.



The student puts exactly 25 cm^3 of the alkali into a conical flask, adds a few drops of indicator, and then records the level of the acid in the burette.

The student adds the acid to the flask, swirling to mix the solutions, until the indicator just begins to change colour.

The student then takes the reading on the burette. The first titration gives an approximate result.

The student repeats the titration three more times to find an accurate result.

Results				
	1st titration	**2nd titration**	**3rd titration**	**4th titration**
Reading on the burette at the end (cm^3)	24.4	47.0	22.4	44.9
Reading on the burette at the start (cm^3)	0.0	24.4	0.0	22.4

10.1 25 cm^3 of the sodium hydroxide solution reacts exactly with . . .

A 22.4 cm^3 of the sulphuric acid solution.

B 22.5 cm^3 of the sulphuric acid solution.

C 22.6 cm^3 of the sulphuric acid solution.

D 24.4 cm^3 of the sulphuric acid solution.

Question 10 continues on the next page

Use the following information to help you to answer the next three parts of this question.

Relative atomic masses: H = l; O = 16; Na = 23; Cl = 35.5

$NaOH + HCl \rightarrow NaCl + H_2O$

In another experiment, the student finds that 25.0 cm^3 of the 0.05 mol per dm^3 sodium hydroxide solution is exactly neutralised by 20.0 cm^3 of a solution of hydrochloric acid.

10.2 What is the relative formula mass of sodium hydroxide?

A 39

B 40

C 75.5

D 80

10.3 The number of moles of NaOH in 25 cm^3 of the sodium hydroxide solution is . . .

A 0.001

B 0.00125

C 0.0125

D 2.0

10.4 The concentration of the hydrochloric acid solution is . . .

A 0.04 mol per dm^3

B 0.0625 mol per dm^3

C 0.40 mol per dm^3

D 0.625 mol per dm^3

END OF TEST

There are no questions printed on this page

There are no questions printed on this page