Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
June 2006

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

Tuesday 27 June 2006 Morning Session

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

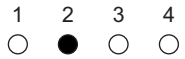
You may use a calculator.

Time allowed: 30 minutes

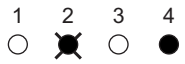
Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Aqueous and Organic Chemistry' printed on it.
- Attempt **one Tier only**, **either** the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

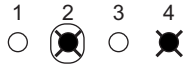
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 burning natural gas using a Bunsen burner.

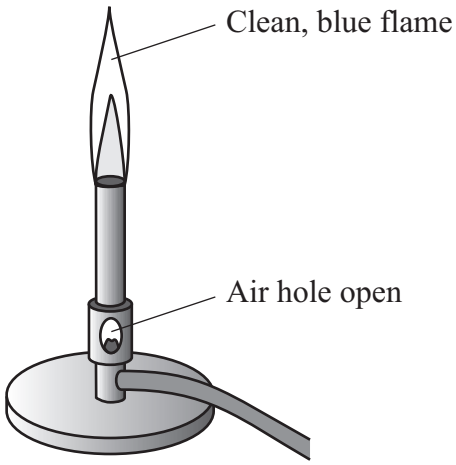
Match words from the list with the numbers **1–4** in the sentences.

carbon

carbon dioxide

carbon monoxide

hydrogen



When the air hole is open, the natural gas burns to form water (vapour) and . . . **1** . . . .

The water (vapour) is made by oxidation of . . . **2** . . . .

A yellow Bunsen burner flame contains particles of . . . **3** . . . .

If natural gas burns in a limited supply of air, poisonous . . . **4** . . . is formed.

QUESTION TWO

The table is about substances that dissolve in water.

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

calcium sulphate

carbon dioxide

chlorine

oxygen

Substance	What we can say about the substance
1	it is essential for fish living in the water
2	it is used to make fizzy water
3	it will make the water hard
4	its solution is a bleach

Turn over for the next question

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.

ammonia solution

dilute ethanoic acid

dilute nitric acid

potassium hydroxide solution

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 substances that can be useful.

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

calcium sulphate

chlorine

ethanol

water

Substance	How it can be useful
1	as a coolant and to make sulphuric acid
2	as a solvent and as a fuel
3	to help the body to develop strong bones
4	to kill bacteria in water for drinking

QUESTION FIVE

Word equations show what happens in a chemical reaction.

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

iron chloride

lead sulphate

nitric acid

sulphuric acid

iron + chlorine → . . . **1** . . .

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

lead nitrate + sodium sulphate → . . . **3** . . . + sodium nitrate

ammonia + . . . **4** . . . → ammonium nitrate + water

Turn over for the next question

SECTION B

Questions **SIX** and **SEVEN**.

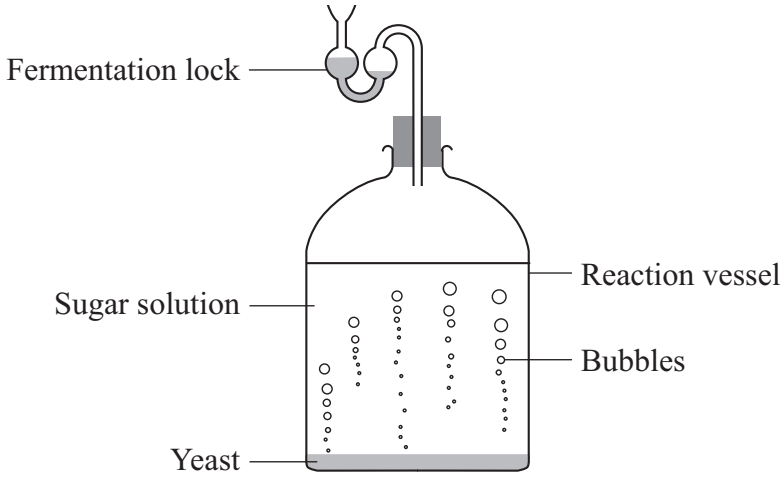
In these questions choose the best **two** answers.

Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION SIX

The diagram shows a sugar solution being fermented.



Which **two** statements are correct?

ethanol and carbon dioxide are made in the reaction

the fermentation lock stops air from entering the reaction vessel

the fermentation lock stops carbon dioxide from escaping from the reaction vessel

the mixture in the reaction vessel must be warmed to about 80 °C

the yeast feeds on enzymes

QUESTION SEVEN

This question is about chemicals and water.

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

J **ethanol can be separated from water by fractional distillation**

K **most ionic compounds are soluble in water**

L **potassium hydroxide is an insoluble base**

M **sugars are covalent compounds, insoluble in water**

N **water is a solute for sugar**

Turn over for the next question

SECTION C

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

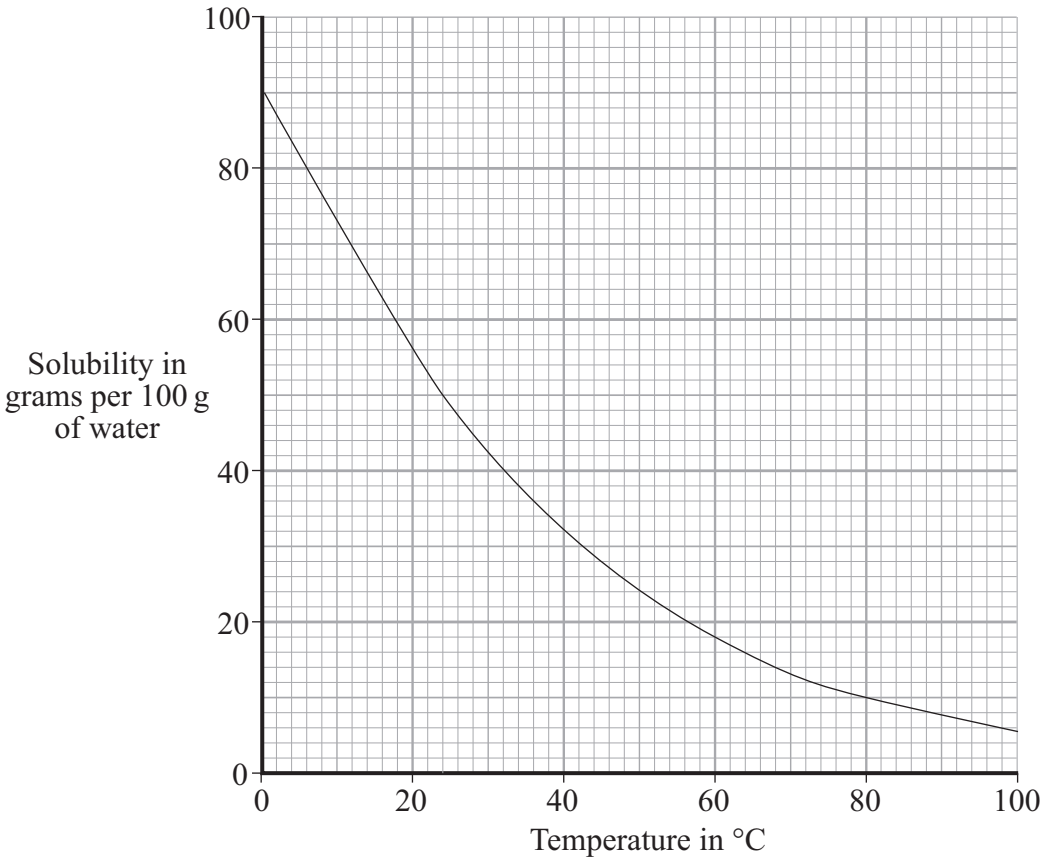
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION EIGHT

The graph shows the solubility curve of Substance **F**.



8.1 What mass of Substance **F** dissolves in 100 grams of water at 60 °C?

A 14 g

B 15 g

C 18 g

D 24 g

8.2 How much more of Substance **F** dissolves in 100 grams of water at 60 °C than at 80 °C?

A 8.0 g

B 13.5 g

C 15.0 g

D 18.0 g

8.3 100 grams of water are saturated with Substance **F** at 0 °C.

The water is heated to 50 °C.

What mass of Substance **F** will no longer be dissolved in the water?

A 22 g

B 24 g

C 66 g

D 68 g

8.4 Substance **F** is probably . . .

A a covalent solid.

B a gas.

C a liquid.

D an ionic solid.

Turn over for the next question

QUESTION NINE

This question is about hard water.

Using hard water in industry and in the home can increase costs.

9.1 Which statement gives a **disadvantage** of using hard water in heating systems?

A Hard water does not easily flow through the pipes.

B Hard water forms a scum with soap.

C Hard water is poisonous.

D Hard water makes scale build up in the pipes.

9.2 One reason why using hard water can increase costs is that . . .

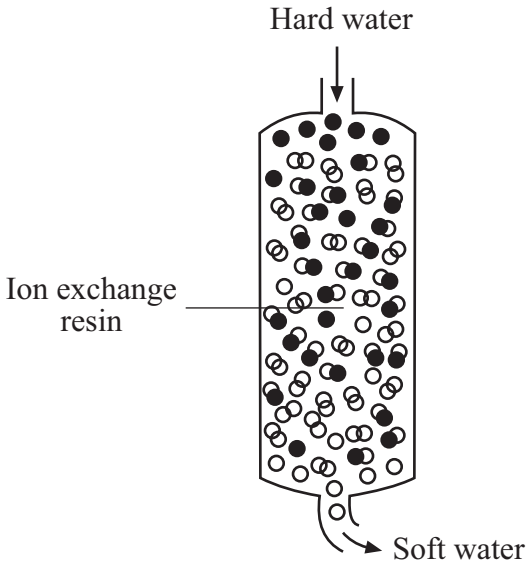
A it can increase heart illnesses.

B it cannot be used for cooking.

C it prevents the development of healthy teeth.

D more soap is needed to produce a lather.

9.3 Water can be softened by using an ion exchange column.



Compared with hard water, the water leaving the column contains . . .

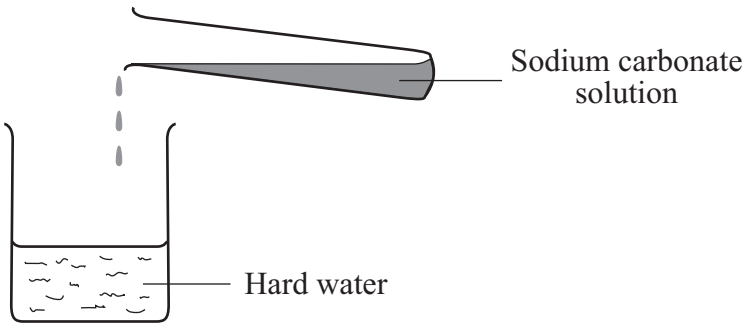
A fewer calcium ions.

B fewer sodium ions.

C more calcium ions.

D more magnesium ions.

9.4 What will you see when sodium carbonate reacts with hard water?



A A lather

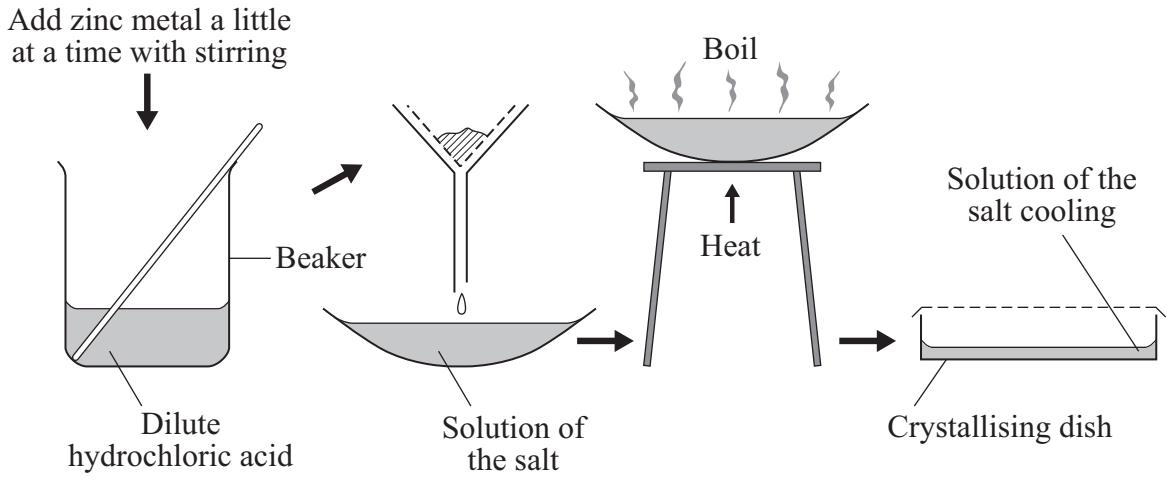
B A scum

C A white precipitate

D Bubbles of gas given off

QUESTION TEN

The diagram shows how a student makes crystals of a salt.



10.1 How does the student know when all the hydrochloric acid has been used up?

A The solution in the beaker becomes clear.

B The solution in the beaker turns blue.

C There are no more bubbles of gas.

D Zinc metal settles at the bottom of the beaker.

10.2 Why does the student filter the contents of the beaker?

A To remove any unreacted acid

B To remove any unreacted zinc

C To remove the excess water produced

D To remove the salt

10.3 What are the products of this reaction?

A Zinc chloride and hydrogen

B Zinc chloride and water

C Zinc sulphate and hydrogen

D Zinc sulphate and water

10.4 Why do crystals of the salt form only as the solution in the crystallising dish cools?

A The salt is insoluble.

B The salt is insoluble in hot water.

C The salt is less soluble in cold water than in hot water.

D The salt is more soluble in cold water than in hot water.

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 show what happens in a chemical reaction.

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

iron chloride

lead sulphate

nitric acid

sulphuric acid

iron + chlorine → . . . **1** . . .

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

lead nitrate + sodium sulphate → . . . **3** . . . + sodium nitrate

ammonia + . . . **4** . . . → ammonium nitrate + water

QUESTION TWO

This question is about the families to which some chemical compounds belong.

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

cholesterol

ethyl ethanoate

pentane

vitamin C

Substance	Family of substances to which it belongs
1	alcohols
2	alkanes
3	carboxylic acids
4	esters

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 chemicals and water.

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

J **ethanol can be separated from water by fractional distillation**

K **most ionic compounds are soluble in water**

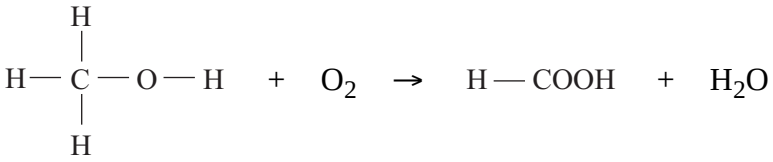
L **potassium hydroxide is an insoluble base**

M **sugars are covalent compounds, insoluble in water**

N **water is a solute for sugar**

QUESTION FOUR

The equation shows a reaction between an organic compound and oxygen.



Which **two** of the statements, **P**, **Q**, **R**, **S** and **T**, about this reaction are correct?

P **an ester is formed**

Q **in this reaction, methanol is oxidised**

R **the products are methanoic acid and water**

S **the reactants are ethanol and oxygen**

T **the reaction only takes place with concentrated sulphuric acid as a catalyst**

Turn over for the next question

SECTION C

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

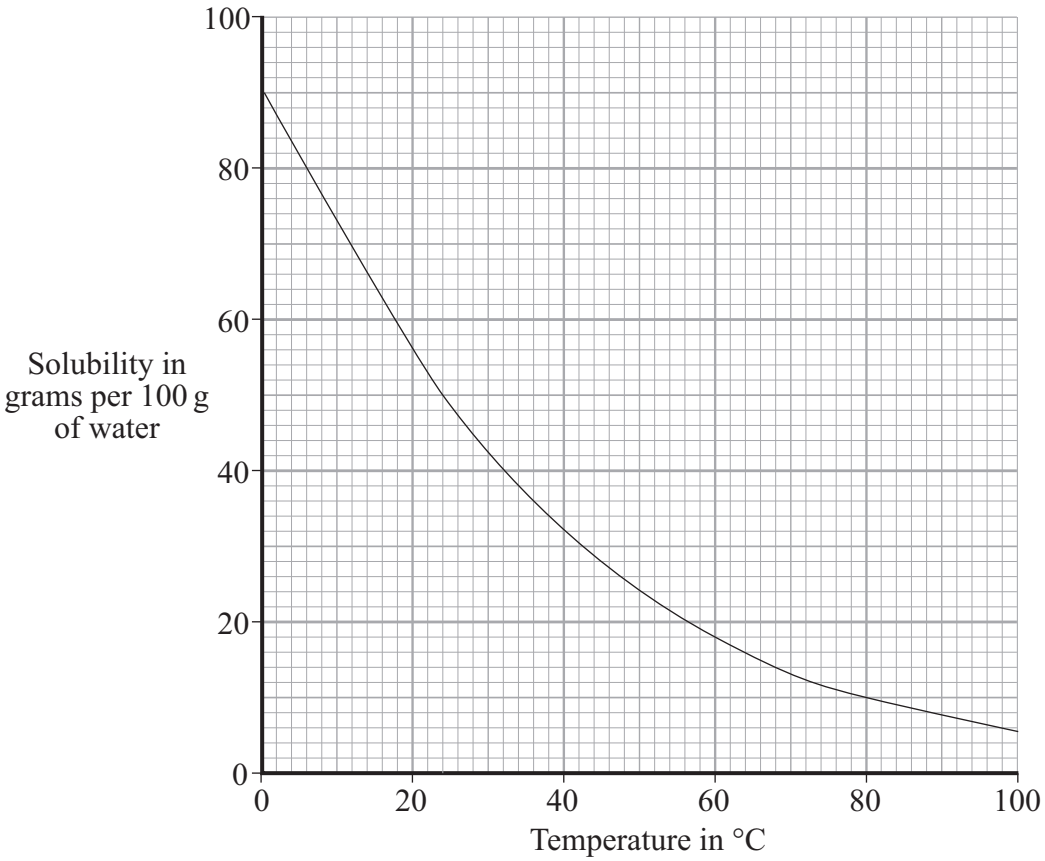
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION FIVE

The graph shows the solubility curve of Substance **F**.



5.1 What mass of Substance **F** dissolves in 100 grams of water at 60 °C?

A 14 g

B 15 g

C 18 g

D 24 g

5.2 How much more of Substance **F** dissolves in 100 grams of water at 60 °C than at 80 °C?

A 8.0 g

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5.3 100 grams of water are saturated with Substance **F** at 0 °C.

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A 22 g

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5.4 Substance **F** is probably . . .

A a covalent solid.

B a gas.

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D an ionic solid.

Turn over for the next question

QUESTION SIX

This question is about hard water.

Using hard water in industry and in the home can increase costs.

6.1 Which statement gives a **disadvantage** of using hard water in heating systems?

A Hard water does not easily flow through the pipes.

B Hard water forms a scum with soap.

C Hard water is poisonous.

D Hard water makes scale build up in the pipes.

6.2 One reason why using hard water can increase costs is that . . .

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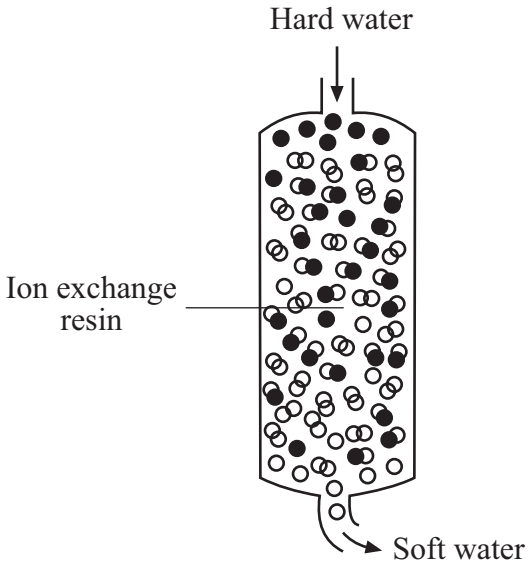

Compared with hard water, the water leaving the column contains . . .

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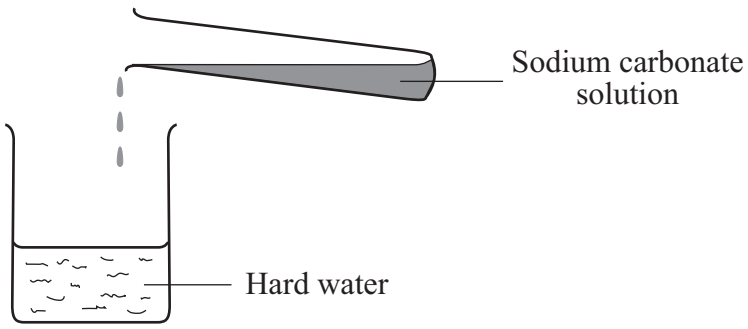
B fewer sodium ions.

C more calcium ions.

D more magnesium ions.

6.4 What will you see when sodium carbonate reacts with hard water?



A A lather

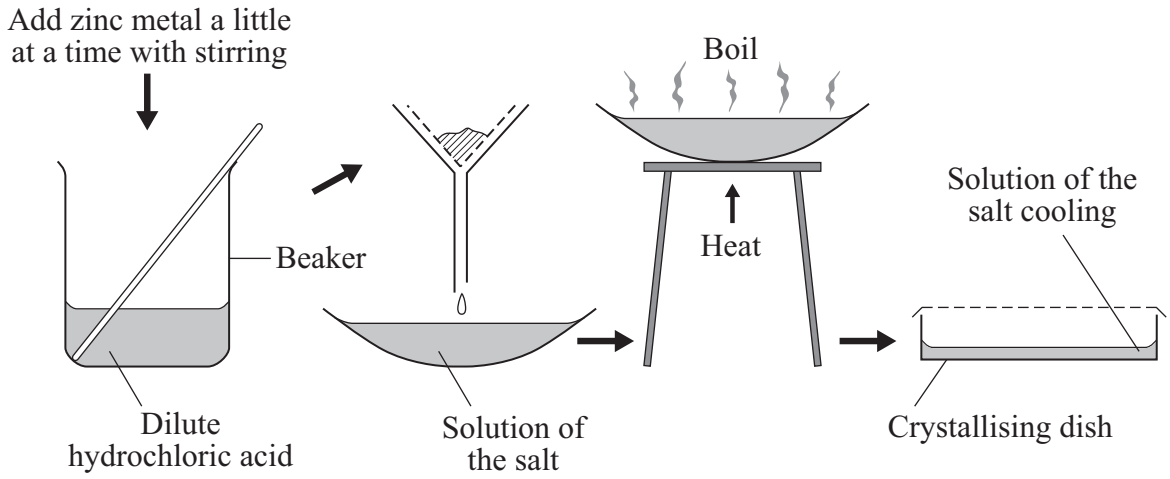
B A scum

C A white precipitate

D Bubbles of gas given off

QUESTION SEVEN

The diagram shows how a student makes crystals of a salt.



7.1 How does the student know when all the hydrochloric acid has been used up?

A The solution in the beaker becomes clear.

B The solution in the beaker turns blue.

C There are no more bubbles of gas.

D Zinc metal settles at the bottom of the beaker.

7.2 Why does the student filter the contents of the beaker?

A To remove any unreacted acid

B To remove any unreacted zinc

C To remove the excess water produced

D To remove the salt

7.3 What are the products of this reaction?

A Zinc chloride and hydrogen

B Zinc chloride and water

C Zinc sulphate and hydrogen

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7.4 Why do crystals of the salt form only as the solution in the crystallising dish cools?

A The salt is insoluble.

B The salt is insoluble in hot water.

C The salt is less soluble in cold water than in hot water.

D The salt is more soluble in cold water than in hot water.

Turn over for the next question

QUESTION EIGHT

Ethanol can be manufactured in two different ways:

- by fermentation of sugars;
- by the reaction between ethene and steam.

8.1 Under what conditions do ethene and steam react?

A High temperature and high pressure with a carbonic acid catalyst

B High temperature and low pressure with a carbonic acid catalyst

C High temperature and high pressure with a phosphoric acid catalyst

D Low temperature and high pressure with a phosphoric acid catalyst

8.2 Which line gives an advantage and a disadvantage of manufacturing ethanol by fermentation rather than from ethene and steam?

	Advantage	**Disadvantage**
A	ethanol needs to be distilled	slow process
B	slow process	batch process
C	slow process	ethanol needs to be distilled
D	sugar is a renewable resource	batch process

8.3 The word equation shows a reaction of ethanol.

$$\text{ethanol} + \text{Substance } \mathbf{X} \xrightarrow[\text{catalyst}]{\text{concentrated sulphuric acid}} \text{ethyl ethanoate} + \text{water}$$

What is Substance **X**?

A Ethane

B Ethanoic acid

C Ethene

D Hydrogen

8.4 With which substance will ethanol react to produce hydrogen gas?

A Copper

B Sodium

C Sodium hydroxide

D Steam

Turn over for the next question

QUESTION NINE

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

Relative atomic masses: H = 1; O = 16; Cl = 35.5; K = 39

$$KOH + HCl \rightarrow KCl + H_2O$$

A student prepares 500 cm^3 of a solution of potassium hydroxide by dissolving 2.8 grams of potassium hydroxide in water.

9.1 The number of moles in 2.8 grams of potassium hydroxide is . . .

A 0.02

B 0.05

C 2.00

D 20.00

9.2 The concentration of the potassium hydroxide solution is . . .

A 0.02 mol per dm^3

B 0.05 mol per dm^3

C 0.10 mol per dm^3

D 1.00 mol per dm^3

In an experiment, the student finds that 25 cm^3 of a 0.04 mol per dm^3 solution of potassium hydroxide exactly reacts with 20 cm^3 of a solution of hydrochloric acid.

9.3 What process did the student use to find this result?

A Decomposition

B Saturation

C Substitution

D Titration

9.4 What is the concentration of the hydrochloric acid solution used in this experiment?

A 0.032 mol per dm^3

B 0.05 mol per dm^3

C 0.20 mol per dm^3

D 20.00 mol per dm^3

Turn over for the next question

QUESTION TEN

This question is about thermosoftening and thermosetting polymers.

10.1 The two types of polymer are similar because they . . .

A are both produced from compounds containing the C═Cl bond.

B are both produced from ethane.

C both have covalent bonds between atoms in the molecule.

D both have ionic bonds between atoms in the molecule.

10.2 Which line correctly shows a difference between the two types of polymer?

	Thermosoftening polymer	**Thermosetting polymer**
A	can be remoulded	cannot be remoulded
B	short molecules	long molecules
C	strong bonds between molecules	weak bonds between molecules
D	weak bonds between atoms	strong bonds between atoms

10.3 Which of the following is a thermosetting polymer?

A Melamine

B Poly(ethene)

C Poly(propene)

D PVC

10.4 PVC burns to produce . . .

A carbon dioxide, chlorine and water.

B carbon dioxide, hydrogen chloride and water.

C carbon dioxide, hydrogen cyanide and water.

D hydrogen chloride only.

END OF TEST