

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education  
June 2005



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

**346021**

Tuesday 28 June 2005 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

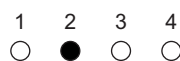
**Instructions**

- 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**

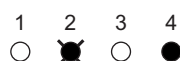
- Use a **black ball-point pen**.

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

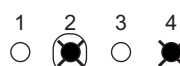


- Do **not** extend beyond the circles.

- 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.

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

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**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.

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**QUESTION ONE**

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**

**carbon dioxide**

**chlorine**

**oxygen**

<b>Substance</b>	<b>What we can say about the substance</b>
<b>1</b>	it is an artificial fertiliser
<b>2</b>	it is needed, in water, for fish to survive
<b>3</b>	it is released from a fizzy drink when the can is opened
<b>4</b>	its solution in water will remove the colour from fabrics

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**QUESTION TWO**

This question is about solubility.

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

**solid**

**solute**

**solution**

**solvent**

Sodium chloride is a crystalline, ionic compound.

When sodium chloride is stirred with water, it dissolves to form a . . . . . **1** . . . . .

The water is the . . . . . **2** . . . . . and the sodium chloride is the . . . . . **3** . . . . .

If a solution of sodium chloride is evaporated, sodium chloride separates out as a white . . . . . **4** . . . . .

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

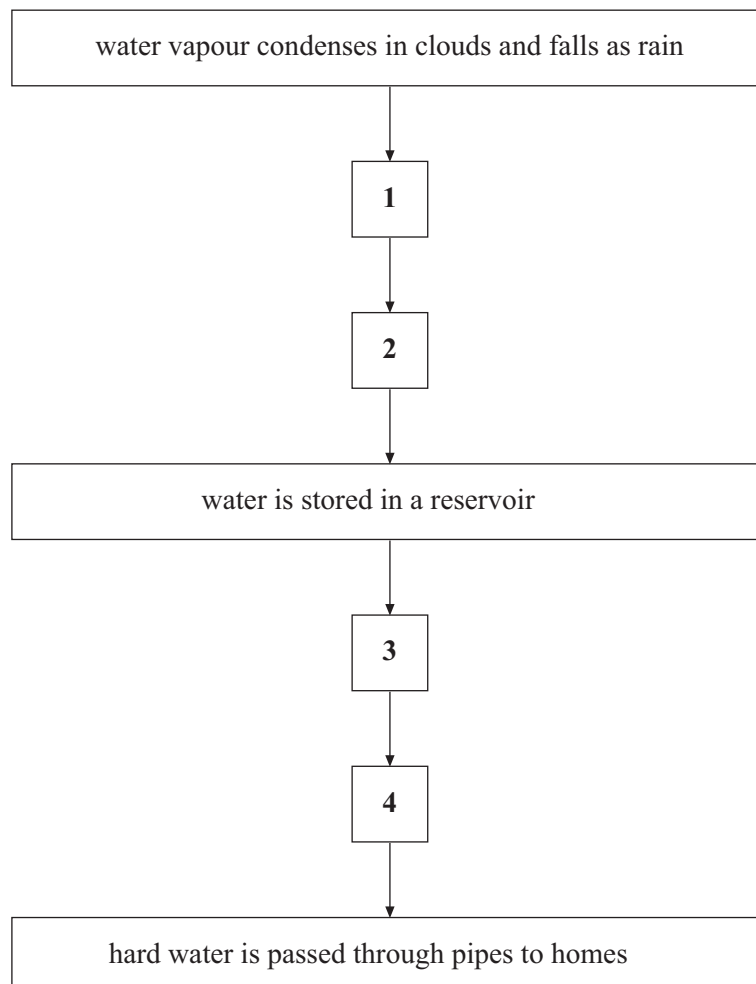
**QUESTION THREE**

The water supplied to a house is hard.

The flow chart shows the stages in the collection and treatment of this water.

Match statements, **J**, **K**, **L** and **M**, from the list with the numbers **1–4** in the flow chart.

- J** chlorine is added to kill bacteria
- K** some of the magnesium or calcium compounds dissolve into the water
- L** water flows through rocks containing magnesium or calcium compounds
- M** water is passed through filter beds to take out solid particles



**QUESTION FOUR**

This question is about ions.

Match words and symbols, **P**, **Q**, **R** and **S**, from the list with the numbers **1–4** in the sentences.

**P**  $\text{H}^+$  (aq) ions

**Q** calcium ions ( $\text{Ca}^{2+}$  ions)

**R** nitrate ions ( $\text{NO}_3^-$  ions)

**S**  $\text{OH}^-$  ions

In solution in water, hydrochloric acid produces hydrated protons which are represented as . . . . . **1** . . . . .

In solution in water, potassium hydroxide produces  $\text{K}^+$  ions and . . . . . **2** . . . . .

Water that contains . . . . . **3** . . . . . helps the development of strong teeth.

Water that contains . . . . . **4** . . . . . may be harmful to babies.

**QUESTION FIVE**

The table shows ways to make salts.

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

**anhydrous iron chloride**

**insoluble lead sulphate**

**potassium chloride**

**zinc sulphate**

Salt	How the salt is made
<b>1</b>	by direct combination of the elements
<b>2</b>	by precipitation
<b>3</b>	by the reaction of an alkali with an acid
<b>4</b>	by the reaction of an insoluble base with an acid

Turn over ►

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**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.

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**QUESTION SIX**

This question is about three fuels.

Name of fuel	Cost per kg	Heat energy released per kg	Waste products	
			Soot	Ash
Coal	24 p	36 000 J	Yes	Yes
Heating oil	46p	46 000 J	Yes	No
Natural gas	40p	52 000 J	No	No

Which **two** of the following statements are correct?**heating oil is more expensive, per kg, than natural gas****heating oil produces most heat per kg****natural gas, when burned, is the cleanest fuel****only coal produces soot****only natural gas contains carbon**

**QUESTION SEVEN**

This question is about hard and soft water.

The table shows the results of tests on three different samples of water.  
50 cm<sup>3</sup> of water is used in each test.

Sample	Volume of soap solution, in cm <sup>3</sup> , needed to form a permanent lather
<b>K</b>	0.5
<b>L</b>	5.5
<b>M</b>	2.0

Which **two** of the following statements are correct?

**a lather forms when 1 cm<sup>3</sup> of soap solution is shaken with M**

**a white precipitate forms when sodium carbonate solution is added to L**

**no lather forms when 1 cm<sup>3</sup> of soap solution is shaken with K**

**the hardest water is L**

**the softest water is M**

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

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**SECTION C**Questions **EIGHT** to **TEN**.

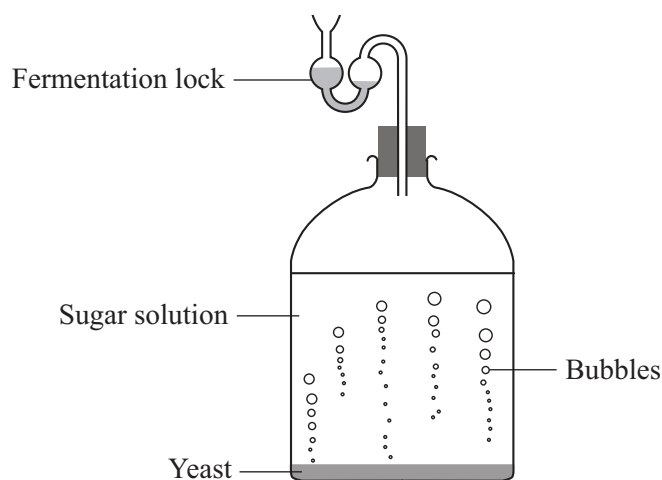
Each of these questions has four parts.

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

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**QUESTION EIGHT**

A student set up a reaction vessel containing a sugar solution and yeast.



**8.1** The yeast contains biological catalysts called . . . . .

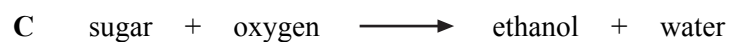
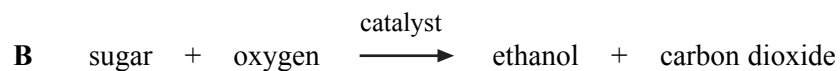
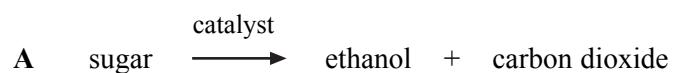
- A bacteria.
- B cells.
- C enzymes.
- D fungi.

**8.2** These biological catalysts . . . . .

- A keep the solution at the correct temperature.
- B remove air from the reaction vessel.
- C speed up the breakdown of the sugar.
- D sterilise the solution.



8.3 Which word equation represents the fermentation reaction?



8.4 After 12 days, there were no more bubbles in the reaction vessel.

This is probably because . . . . .

A the pressure in the vessel was too great.

B the sugar was used up.

C the water was used up.

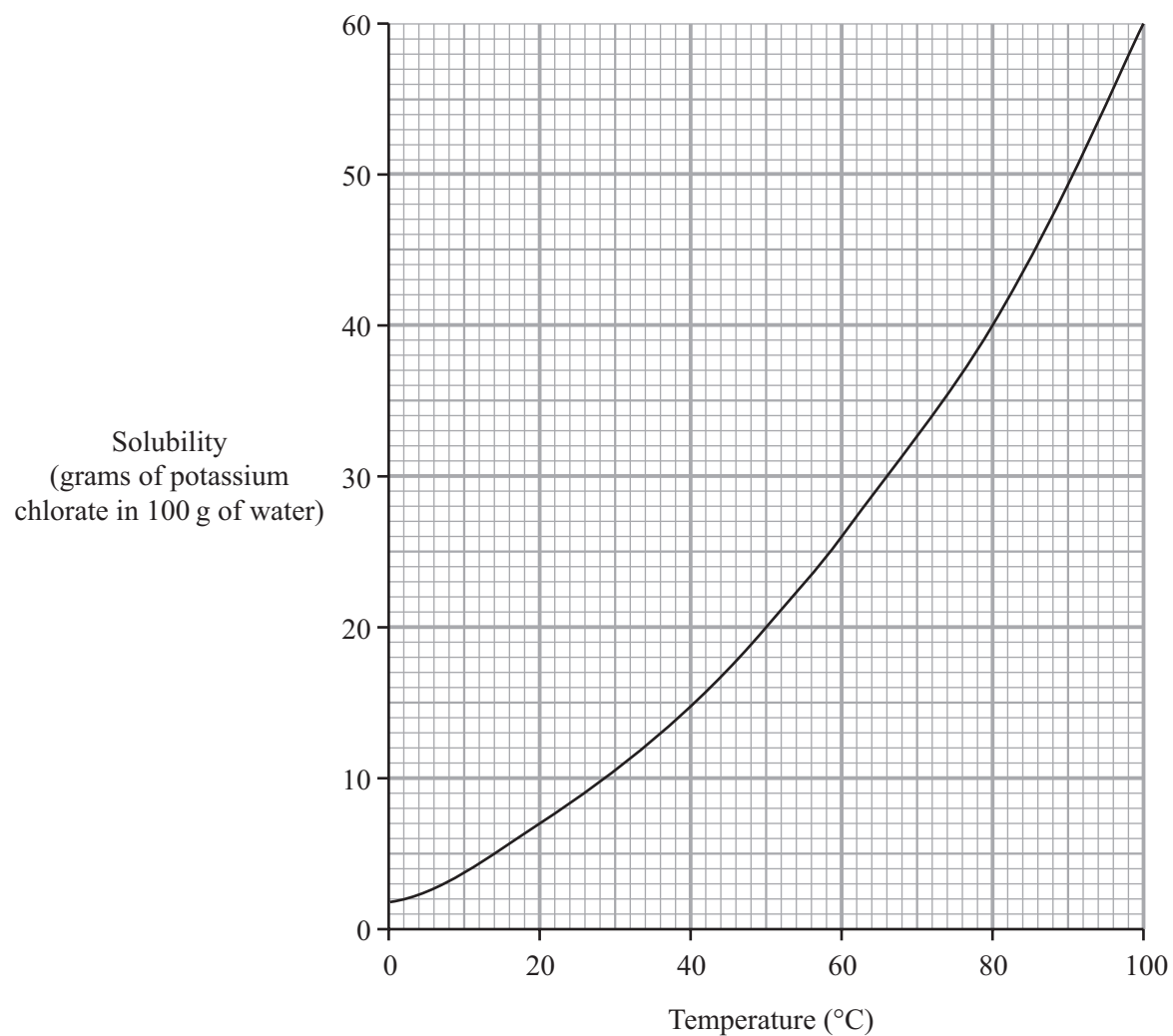
D the yeast was used up.

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**QUESTION NINE**

The graph shows the solubility curve for potassium chlorate.



**9.1** What mass of potassium chlorate will dissolve in 100 g of water at 60 °C?

- A** 15 g
- B** 26 g
- C** 40 g
- D** 100 g

**9.2** What mass of potassium chlorate will dissolve in 50 g of water at 50 °C?

- A 10.0 g
- B 20.0 g
- C 45.5 g
- D 91.0 g

A solution contains 20 g of potassium chlorate in 100 g of water. It is allowed to cool from 100 °C.

**9.3** At what temperature will the solution begin to crystallise?

- A 7 °C
- B 50 °C
- C 60 °C
- D 90 °C

**9.4** This solution continues to cool down to 20 °C.

What mass of potassium chlorate crystals will form?

- A 7 g
- B 13 g
- C 14 g
- D 50 g

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**QUESTION TEN**

This question is about acids and alkalis.

The table shows the pH numbers for solutions of two acids of the same concentration.

	<b>Acid X</b>	<b>Acid Y</b>
pH number	1	5

**10.1** Which line shows a correct description of the two acids?

	<b>Acid X</b>	<b>Acid Y</b>
<b>A</b>	strong acid	strong acid
<b>B</b>	strong acid	weak acid
<b>C</b>	weak acid	strong acid
<b>D</b>	weak acid	weak acid

**10.2** Which of these statements about the two acids is correct?

- A** **Acid X** will react faster than **Acid Y** with zinc metal
- B** **Acid X** will react more slowly than **Acid Y** with zinc metal
- C** **Acid X** will react with alkalis but **Acid Y** will not
- D** **Acid X** will react with carbonates but **Acid Y** will not

**10.3** Which line shows possible names for **Acid X** and **Acid Y**?

	<b>Acid X</b>	<b>Acid Y</b>
<b>A</b>	citric acid	ethanoic acid
<b>B</b>	ethanoic acid	hydrochloric acid
<b>C</b>	hydrochloric acid	sulphuric acid
<b>D</b>	sulphuric acid	citric acid

**10.4** Why is sodium hydroxide a stronger alkali than ammonia?

- A** In solution, sodium hydroxide is completely ionised
- B** Sodium hydroxide has smaller molecules
- C** Sodium hydroxide is more concentrated
- D** Sodium hydroxide molecules are joined by covalent bonds

**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.

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**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.

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**QUESTION ONE**

The table shows ways to make salts.

Match words from the list with the numbers **1–4** in the table.**anhydrous iron chloride****insoluble lead sulphate****potassium chloride****zinc sulphate**

<b>Salt</b>	<b>How the salt is made</b>
<b>1</b>	by direct combination of the elements
<b>2</b>	by precipitation
<b>3</b>	by the reaction of an alkali with an acid
<b>4</b>	by the reaction of an insoluble base with an acid

**QUESTION TWO**

This question is about one of the products in each of four reactions.

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

**hydrogen**

**hydrogen chloride**

**hydrogen cyanide**

**silver chloride**

<b>Product</b>	<b>Reaction in which it is produced</b>
<b>1</b>	burning polyvinylchloride in a limited supply of air
<b>2</b>	burning nylon, a nitrogen-containing polymer, in a limited supply of air
<b>3</b>	the reaction between magnesium chloride and silver nitrate
<b>4</b>	the reaction between magnesium and hydrochloric acid

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

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**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.

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**QUESTION THREE**

This question is about hard and soft water.

The table shows the results of tests on three different samples of water.  
50 cm<sup>3</sup> of water is used in each test.

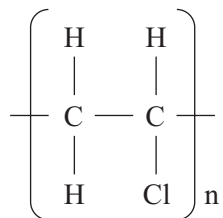
Sample	Volume of soap solution, in cm <sup>3</sup> , needed to form a permanent lather
K	0.5
L	5.5
M	2.0

Which **two** of the following statements are correct?**a lather forms when 1 cm<sup>3</sup> of soap solution is shaken with M****a white precipitate forms when sodium carbonate solution is added to L****no lather forms when 1 cm<sup>3</sup> of soap solution is shaken with K****the hardest water is L****the softest water is M**



**QUESTION FOUR**

The diagram shows the structural formula for a polymer.



Which **two** of the following statements are correct?

**the atoms in the polymer molecules are joined together by strong ionic bonds**

**the diagram represents a molecule of polyvinylchloride**

**polymers are made by polymerisation of compounds with a C – Cl bond**

**polyvinylchloride is a thermosetting polymer**

**polyvinylchloride will soften when it is heated and then harden as it cools**

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**SECTION C**Questions **FIVE** to **TEN**.

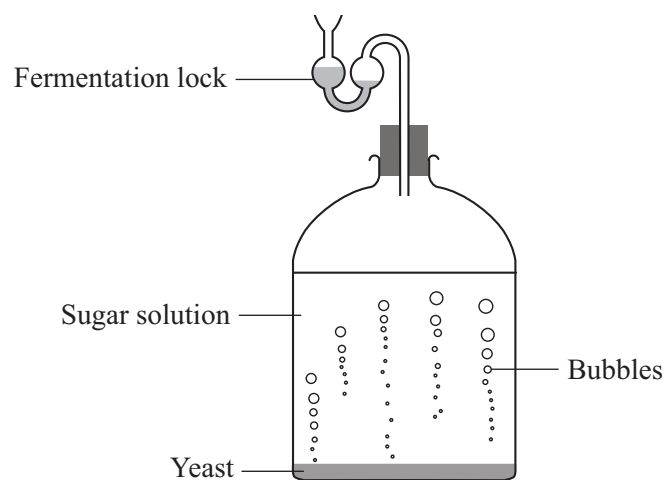
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

**QUESTION FIVE**

A student set up a reaction vessel containing a sugar solution and yeast.

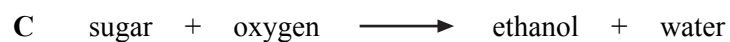
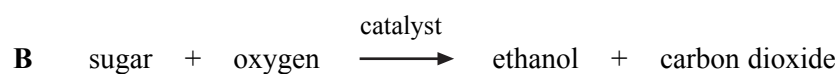
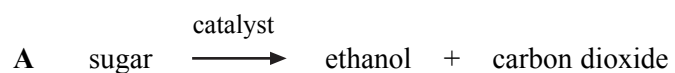
**5.1** The yeast contains biological catalysts called . . . . .

- A** bacteria.
- B** cells.
- C** enzymes.
- D** fungi.

**5.2** These biological catalysts . . . . .

- A** keep the solution at the correct temperature.
- B** remove air from the reaction vessel.
- C** speed up the breakdown of the sugar.
- D** sterilise the solution.

5.3 Which word equation represents the fermentation reaction?



5.4 After 12 days, there were no more bubbles in the reaction vessel.

This is probably because . . . . .

A    the pressure in the vessel was too great.

B    the sugar was used up.

C    the water was used up.

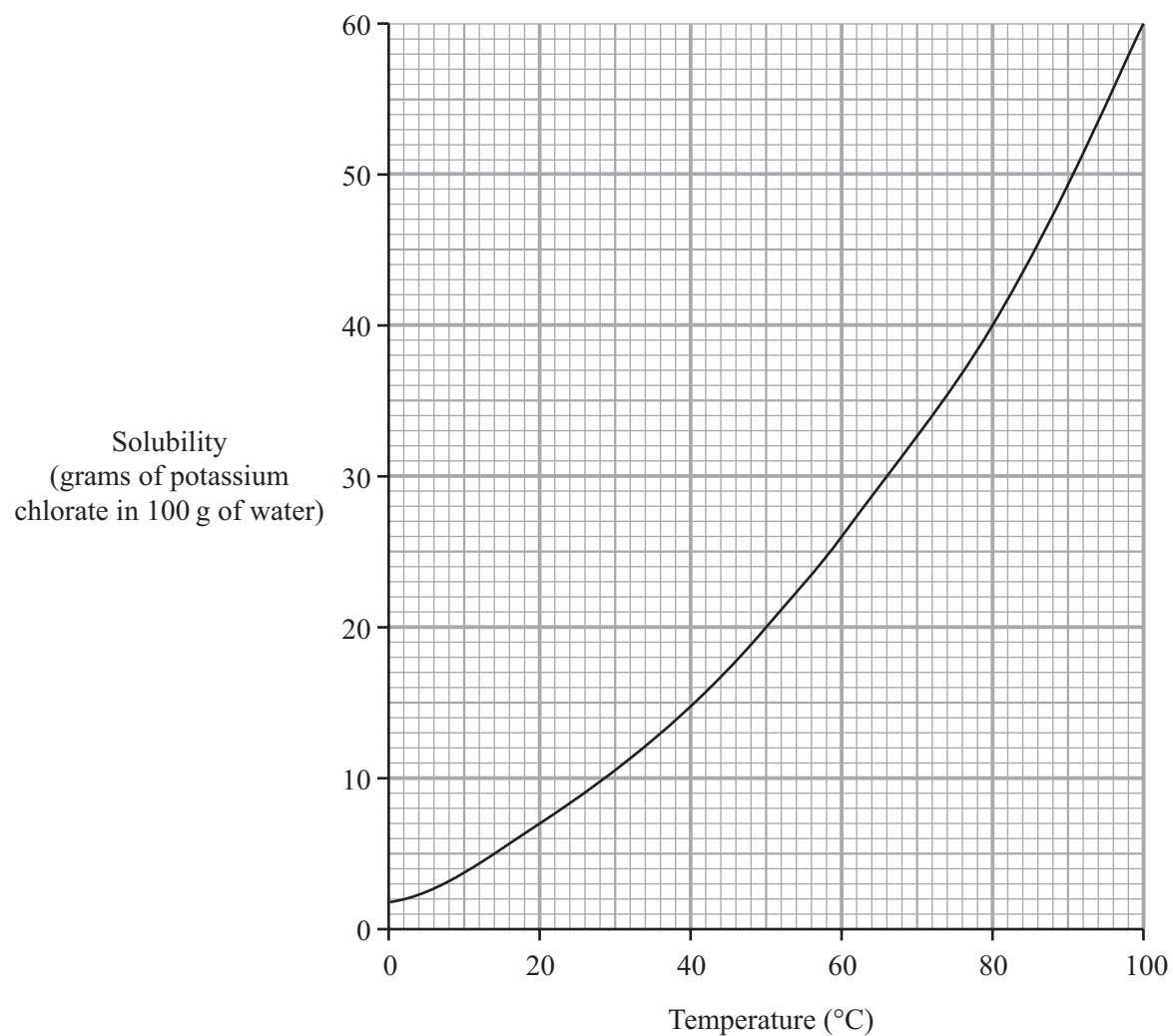
D    the yeast was used up.

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**QUESTION SIX**

The graph shows the solubility curve for potassium chlorate.



**6.1** What mass of potassium chlorate will dissolve in 100 g of water at 60 °C?

- A** 15 g
- B** 26 g
- C** 40 g
- D** 100 g

**6.2** What mass of potassium chlorate will dissolve in 50 g of water at 50 °C?

- A 10.0 g
- B 20.0 g
- C 45.5 g
- D 91.0 g

A solution contains 20 g of potassium chlorate in 100 g of water. It is allowed to cool from 100 °C.

**6.3** At what temperature will the solution begin to crystallise?

- A 7 °C
- B 50 °C
- C 60 °C
- D 90 °C

**6.4** This solution continues to cool down to 20 °C.

What mass of potassium chlorate crystals will form?

- A 7 g
- B 13 g
- C 14 g
- D 50 g

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**QUESTION SEVEN**

This question is about acids and alkalis.

The table shows the pH numbers for solutions of two acids of the same concentration.

	<b>Acid X</b>	<b>Acid Y</b>
pH number	1	5

**7.1** Which line shows a correct description of the two acids?

	<b>Acid X</b>	<b>Acid Y</b>
<b>A</b>	strong acid	strong acid
<b>B</b>	strong acid	weak acid
<b>C</b>	weak acid	strong acid
<b>D</b>	weak acid	weak acid

**7.2** Which of these statements about the two acids is correct?

- A** **Acid X** will react faster than **Acid Y** with zinc metal
- B** **Acid X** will react more slowly than **Acid Y** with zinc metal
- C** **Acid X** will react with alkalis but **Acid Y** will not
- D** **Acid X** will react with carbonates but **Acid Y** will not

**7.3** Which line shows possible names for **Acid X** and **Acid Y**?

	<b>Acid X</b>	<b>Acid Y</b>
<b>A</b>	citric acid	ethanoic acid
<b>B</b>	ethanoic acid	hydrochloric acid
<b>C</b>	hydrochloric acid	sulphuric acid
<b>D</b>	sulphuric acid	citric acid

**7.4** Why is sodium hydroxide a stronger alkali than ammonia?

- A** In solution, sodium hydroxide is completely ionised
- B** Sodium hydroxide has smaller molecules
- C** Sodium hydroxide is more concentrated
- D** Sodium hydroxide molecules are joined by covalent bonds

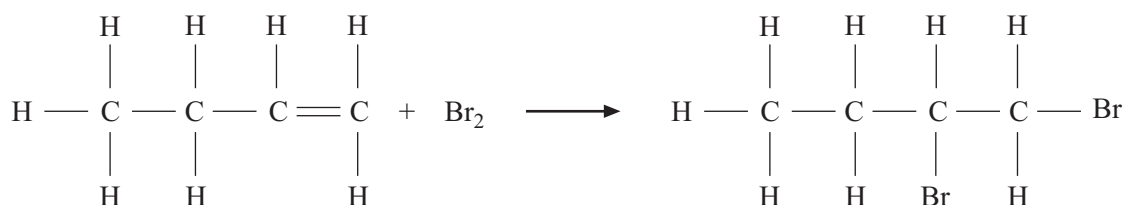
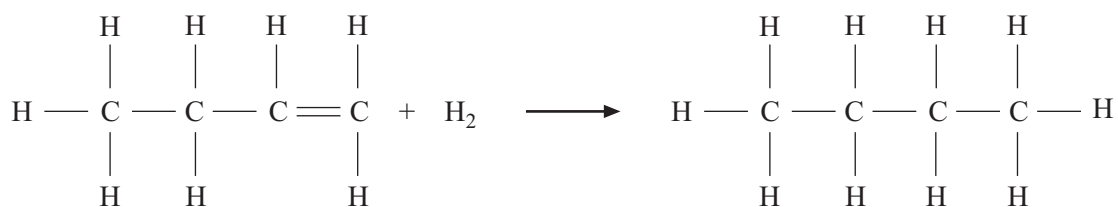
**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**QUESTION EIGHT**

This question is about addition reactions.

The equations show two addition reactions for an alkene called butene.

**Reaction 1****Reaction 2**

**8.1** Why does butene undergo addition reactions?

- A Butene has a carbon carbon double bond
- B Butene has weak covalent bonds between atoms
- C Butene has weak intermolecular forces
- D Butene reacts reversibly

**8.2** **Reaction 1** can be used to distinguish butene from . . . . .

- A butane.
- B ethene.
- C pentene.
- D propene.



**8.3** The product in **Reaction 2** is . . . . .

- A butane.
- B ethene.
- C pentane.
- D propene.

**8.4** With which substance will butene undergo an addition reaction to produce an alcohol?

- A An acid
- B An alkali
- C Oxygen
- D Steam

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

## QUESTION NINE

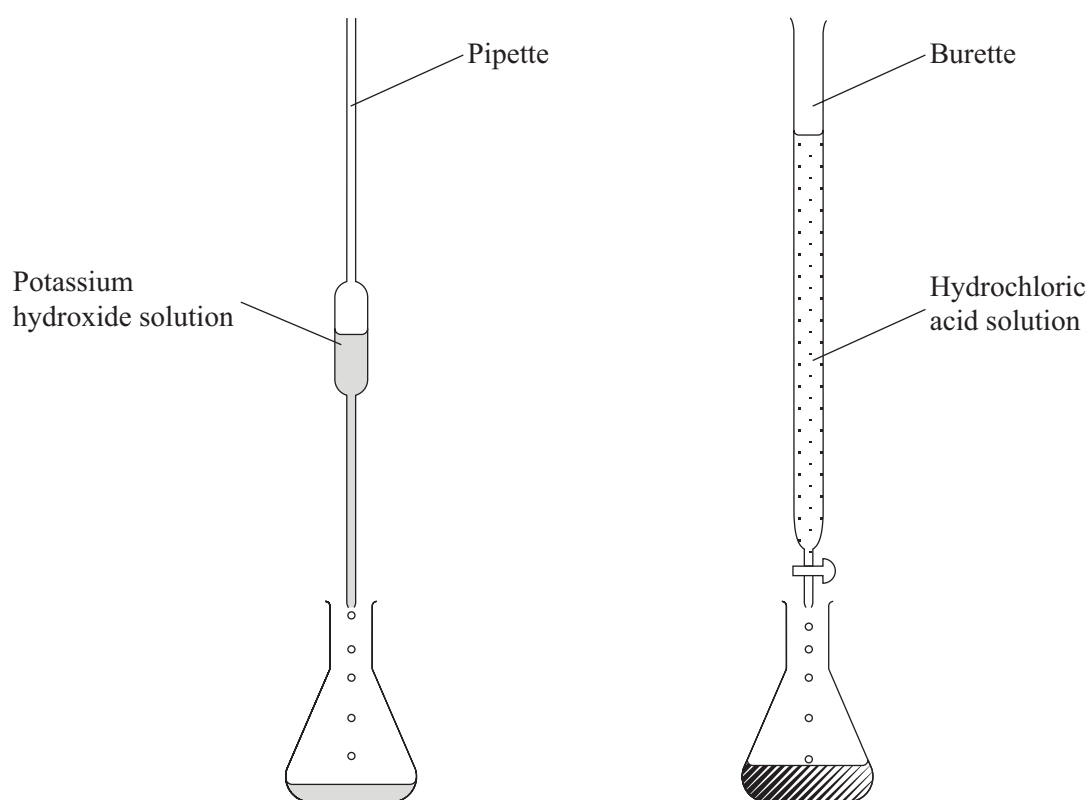
You may find the following information useful when answering parts of this question.



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

A student does a titration to find the concentration of some hydrochloric acid solution.

The diagram shows the apparatus that the student uses.



The student pipettes  $25 \text{ cm}^3$  of  $0.05 \text{ mol per dm}^3$  potassium hydroxide solution into a conical flask and adds a few drops of indicator.

The student fills a burette with the hydrochloric acid to the zero mark, then carefully adds the acid to the flask, swirling it occasionally, until the indicator just begins to change colour. The student records the volume of acid that needs to be added.

- 9.1** Why does the student use an indicator?
- A To know when the salt started to form
  - B To measure the pH of the hydrochloric acid solution
  - C To measure the pH of the potassium hydroxide solution
  - D To show when all of the potassium hydroxide has been just neutralised
- 9.2** What mass of potassium hydroxide is required to prepare  $250\text{ cm}^3$  of  $0.05\text{ mol per dm}^3$  potassium hydroxide solution?
- A 0.7 g
  - B 2.8 g
  - C 5.6 g
  - D 56.0 g
- 9.3** The student finds that the indicator just begins to change colour when  $40\text{ cm}^3$  of the hydrochloric acid has been added.
- What is the concentration of the acid?
- A  $0.03125\text{ mol per dm}^3$
  - B  $0.08\text{ mol per dm}^3$
  - C  $0.025\text{ mol per dm}^3$
  - D  $1.0\text{ mol per dm}^3$
- 9.4** How much potassium chloride could be produced from a solution containing 2.8 g of potassium hydroxide?
- A 0.3725 g
  - B 1.33 g
  - C 3.725 g
  - D 13.3 g

Turn over ►

**QUESTION TEN**

This question is about an alcohol and a carboxylic acid.

**10.1** The equation shows the reaction between sodium and ethanol.



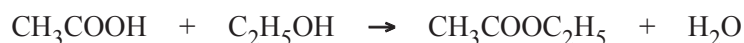
What is substance X?

- A Carbon dioxide
- B Carbon monoxide
- C Hydrogen
- D Water

**10.2** Alcoholic drinks turn sour when the ethanol they contain is oxidised to . . . .

- A ascorbic acid.
- B citric acid.
- C ethanoic acid.
- D propanoic acid.

**10.3** The equation shows the reaction between two organic compounds.



In this reaction, the substance produced along with the water is . . . . .

- A aspirin.
- B cholesterol.
- C ethyl ethanoate.
- D methyl ethanoate.

**10.4** Ethanoic acid reacts with sodium hydroxide to form . . . . .

- A** sodium ethanoate and carbon dioxide.
- B** sodium ethanoate and hydrogen.
- C** sodium ethanoate and water.
- D** sodium ethanoate only.

**END OF TEST**

**THERE ARE NO QUESTIONS PRINTED ON THIS PAGE**

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