

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
Spring 2005



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

346021

Wednesday 2 March 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:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

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

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

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

- 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:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

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 12 of this booklet.

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.

QUESTION ONE

This question is about soft and hard water.

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

lather

precipitate

scum

soap

A good **1** forms when soft water is shaken with soap.

Compounds in hard water react with **2** to form **3**

When sodium carbonate is added to hard water, a white **4** of calcium carbonate is formed.

QUESTION TWO

This question is about water and the water cycle.

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

cools

deposits

dissolves

evaporates

Water **1** from the oceans on the Earth's surface.

The rising water vapour **2** and forms clouds.

Rain water flowing over and below the Earth's surface **3** some of the compounds from rocks.

Some of these compounds make the water hard.

When hard water is heated, it **4** scale in heating systems.

QUESTION THREE

This question 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 dissolves to produce carbonated water
2	it is essential for aquatic life
3	its solution kills bacteria
4	its solution can help to reduce heart illnesses

Turn over ►

QUESTION FOUR

This question is about fuels.

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

carbon

carbon dioxide

carbon monoxide

oxygen

All organic compounds contain **1**

When an organic compound burns in a plentiful supply of air, the products are **2** and water (vapour).

The poisonous gas **3** is formed when an organic fuel burns in a limited air supply.

This gas is poisonous because it reduces the amount of **4** that the blood can carry.

QUESTION FIVE

This question is about weak and strong acids and alkalis.

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

ammonia solution

ethanoic acid

nitric acid

potassium hydroxide solution

Acid or alkali	What we can say about the acid or alkali
1	it has a pH of 13
2	it is highly ionised and donates protons
3	it is partially ionised and accepts protons
4	it reacts very slowly, even with reactive metals such as magnesium

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 the gas chlorine.

Which **two** statements about chlorine are correct?**chlorine is insoluble in water****chlorine water will bleach materials****more chlorine dissolves in water at 60 °C than in the same volume of water at 30 °C****the solubility of chlorine in water is greater if the pressure is increased****water containing dissolved chlorine is hard water****QUESTION SEVEN**

This question is about bases.

Which **two** of the following statements are correct?**a base in aqueous solution produces H^+ (aq) ions****a base is a proton acceptor****a base reacts with an acid to produce a salt and hydrogen****an insoluble base will not react with an acid****a soluble base is called an alkali**

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

There are several general methods of making salts.

These are three of them:

- Method 1 the reaction of a metal with an acid;
Method 2 the reaction between two solutions to form an insoluble salt;
Method 3 the direct combination of two elements.

8.1 Magnesium sulphate, MgSO_4 , which is soluble in water, could be prepared by

- A** method 1 only.
B methods 1 and 2.
C methods 1 and 3.
D methods 2 and 3.

8.2 Anhydrous aluminium chloride could be prepared by

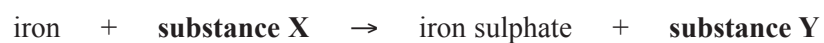
- A** methods 1 and 2.
B methods 1 and 3.
C method 2 only.
D method 3 only.

8.3 Lead sulphate, an insoluble salt, can only be prepared by method 2.

Which solution would react with lead nitrate solution to produce lead sulphate?

- A** Lead chloride
B Potassium nitrate
C Potassium sulphate
D Sodium hydroxide

8.4 Complete the word equation for the reaction to produce iron sulphate from iron.



	Substance X	Substance Y
A	hydrochloric acid	carbon dioxide
B	sodium hydroxide	hydrogen
C	sulphuric acid	hydrogen
D	sulphuric acid	water

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

The table shows the solubility of four different substances in water, at three different temperatures.

Substance	Solubility in grams per 100 grams of water		
	at 20°C	at 40°C	at 60°C
J	25	40	80
K	10	20	40
L	35	60	120
M	5	15	70

9.1 The substance most soluble at 20°C is

- A **J**
- B **K**
- C **L**
- D **M**

9.2 The substance whose solubility does **not** double between 40°C and 60°C is

- A **J**
- B **K**
- C **L**
- D **M**

9.3 At 40°C

- A **J** is less soluble than **M**.
- B **J** is more soluble than **K**.
- C **K** is more soluble than **L**.
- D **L** is less soluble than **J**.

9.4 A saturated solution of **J** in 100 g of water, at 60 °C, is cooled to 20 °C.

What mass of solute separates out?

- A 30 g
- B 40 g
- C 55 g
- D 65 g

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

The table gives information about some fuels.

Name of fuel	Amount of carbon in the fuel	Cost per kg	Heat energy released per kg
Coal	98%	24p	36 000J
Heating oil	85%	42p	46 000J
Natural gas	75%	39p	52 000J
Petrol	84%	72p	49 000J

10.1 The fuel that releases the most heat energy per kg is

- A coal.
- B heating oil.
- C natural gas.
- D petrol.

10.2 Which fuel could contain 25% hydrogen?

- A Coal
- B Heating oil
- C Natural gas
- D Petrol

10.3 When 1 kg of each fuel is completely burnt, the fuel that produces the least amount of carbon dioxide is

- A coal.
- B heating oil.
- C natural gas.
- D petrol.

10.4 It is possible to calculate which of these fuels is best value for money, using the following equation.

$$\text{value for money (J/p)} = \frac{\text{heat energy released per kg (J)}}{\text{cost per kg (p)}}$$

The value for money of petrol in J/p is

- A 490
- B 583
- C 681
- D 1114

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 the 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 weak and strong acids and alkalis.

Match words from the list with the numbers **1–4** in the table.**ammonia solution****ethanoic acid****nitric acid****potassium hydroxide solution**

Acid or alkali	What we can say about the acid or alkali
1	it has a pH of 13
2	it is highly ionised and donates protons
3	it is partially ionised and accepts protons
4	it reacts very slowly, even with reactive metals such as magnesium

QUESTION TWO

This question is about alkanes and alkenes.

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

hydrocarbons

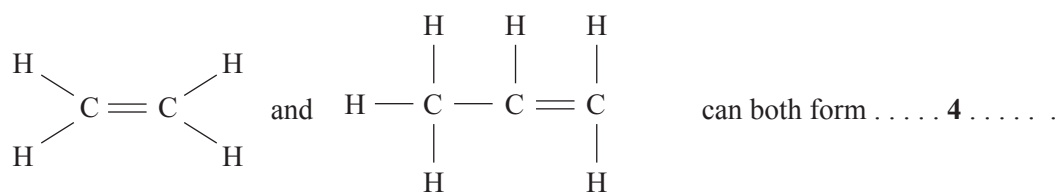
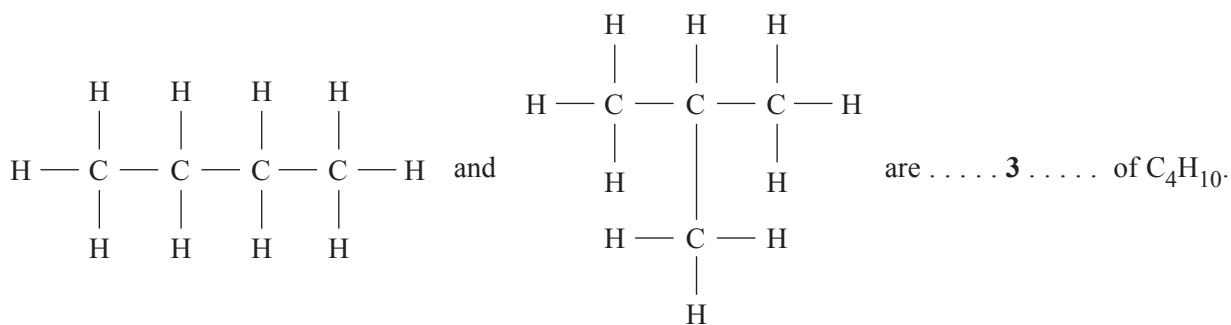
isomers

polymers

unsaturated

Alkanes and alkenes are similar in that they are both **1**

Alkenes differ from alkanes in that alkenes are **2**



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

This question is about bases.

Which **two** of the following statements are correct?**a base in aqueous solution produces H^+ (aq) ions****a base is a proton acceptor****a base reacts with an acid to produce a salt and hydrogen****an insoluble base will not react with an acid****a soluble base is called an alkali****QUESTION FOUR**Which **two** statements about carboxylic acids are correct?**all carboxylic acids are insoluble in water****all carboxylic acids have the functional group $-COOH$** **all carboxylic acids react with alkalis to produce salts****hydrochloric acid is a carboxylic acid****some carboxylic acids are found in fresh fruits**

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

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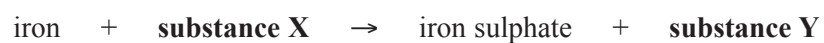
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- B** J is more soluble than K.
- C** K is more soluble than L.
- D** L is less soluble than J.

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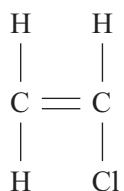
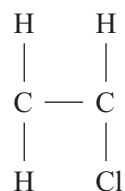
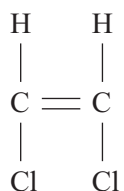
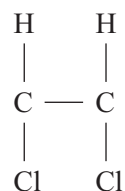
TURN OVER FOR THE NEXT QUESTION

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QUESTION EIGHT

Polyvinylchloride, PVC, is a polymer produced from chloroethene.

8.1 The formula for a molecule of chloroethene is

**A****B****C****D**

8.2 When polyvinylchloride burns the products are

- A** carbon dioxide and chlorine.
- B** carbon dioxide and hydrogen cyanide.
- C** carbon dioxide, water and hydrogen chloride.
- D** water and hydrogen chloride.

- 8.3** When polyvinylchloride is warmed
- A** covalent bonds between C and H atoms break.
 - B** cross linkages form between adjacent chains of atoms.
 - C** strong covalent bonds form between chains of atoms.
 - D** the molecules can move more freely because there are only weak forces between them.
- 8.4** Which of the following is a thermosetting polymer?
- A** Melamine
 - B** Poly(ethene)
 - C** Poly(propene)
 - D** Polyvinylchloride

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

This question is about calculations involving aqueous solutions.

9.1 What is the relative formula mass of sulphuric acid (H_2SO_4)?

Relative atomic masses: H = 1, O = 16, S = 32

- A 49
- B 50
- C 98
- D 194

9.2 How many moles of nitric acid (HNO_3) are present in 25.2 g of the acid?

Relative atomic masses: H = 1, N = 14, O = 16

- A 0.27
- B 0.40
- C 1.23
- D 2.50

9.3 Which of the following solutions contains the greatest number of moles?

- A 100 cm^3 of a solution of concentration 1.5 mol per dm^3
- B 250 cm^3 of a solution of concentration 0.8 mol per dm^3
- C 400 cm^3 of a solution of concentration 0.6 mol per dm^3
- D 500 cm^3 of a solution of concentration 0.3 mol per dm^3

- 9.4 What is the concentration, in mol per dm^3 , of a solution of copper sulphate (CuSO_4) containing 8 grams per dm^3 ?

Relative atomic masses: O = 16, S = 32, Cu = 64

- A 0.02
- B 0.05
- C 0.07
- D 0.08

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

Ethanol can be manufactured in two different ways:

Method 1 by fermentation of sugars;

Method 2 by reaction between ethene and steam.

10.1 An advantage of **method 1** over **method 2** is that

- A it is a continuous process.
- B it is a fast process.
- C pure ethanol is obtained.
- D sugar is a renewable resource.

10.2 An advantage of **method 2** over **method 1** is that

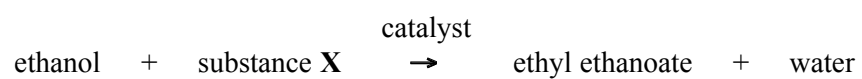
- A it is a batch process.
- B it is a continuous process.
- C only a low temperature and a low pressure are required.
- D the reactants are renewable materials.

10.3 Ethanol can be oxidised and this results in alcoholic drinks turning sour.

The substance responsible for this sour taste is

- A ethane.
- B ethanoic acid.
- C ethyl ethanoate.
- D methanol.

10.4 The equation shows a reaction of ethanol.



What is substance X?

- A** Ethane
- B** Ethanoic acid
- C** Ethene
- D** Propene

END OF TEST

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE