Specimen Paper

Centre Number					Candidate Number					
Surname										
Other Names										
Candidate Signature										

Additional Science   Chemistry 2H
Unit Chemistry C2

Chemistry
Unit Chemistry C2

H

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

For this paper you must have:
- a ruler
- the Data Sheet (as an insert).

You may use a calculator.

Time allowed
- 60 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- Question 3(a) should be answered in continuous prose. In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

Answer **all** questions in the spaces provided.

1 A student investigated the rate of reaction between marble and hydrochloric acid.

The student used an excess of marble.

The reaction can be represented by this equation:

$$CaCO_3(s) \ + \ 2HCl(aq) \ \rightarrow \ CaCl_2(aq) \ + \ H_2O(l) \ + \ CO_2(g)$$
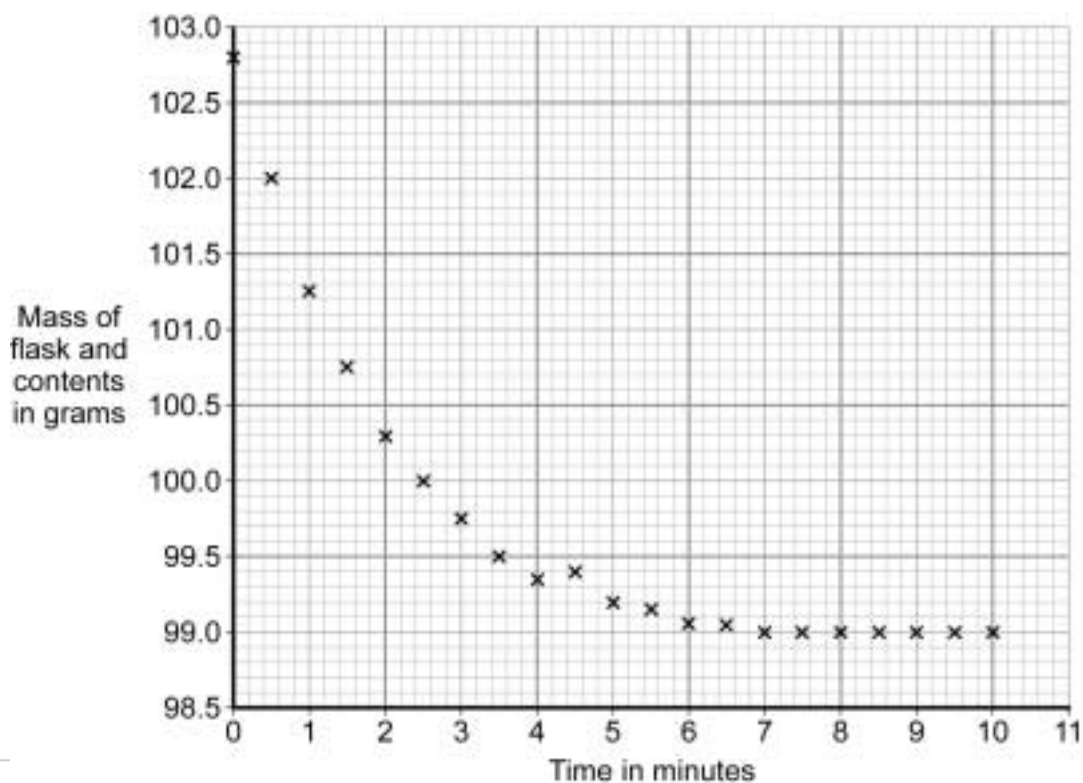
The student used the apparatus shown in the diagram.
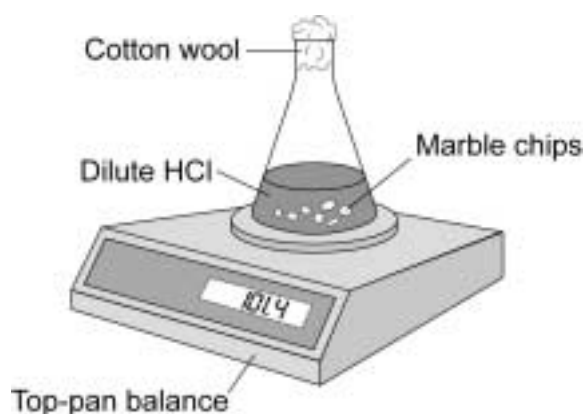
The student measured the mass of the flask and contents for ten minutes.

The results are shown on the graph. Use the graph to answer the questions.

1 (a) (i) Complete the graph by drawing a line of best fit.

(1 mark)

1 (a) (ii) Use the graph to find the mass of the flask and contents after 1.8 minutes.

.... grams

(1 mark)

1 (a) (iii) The rate of reaction can be measured by the steepness of the graph line.

Describe, as fully as you can, how the rate of reaction changes with time in this experiment.

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(2 marks)

1 (b) The mass of the flask and contents decreased during the experiment.

Use the equation for this reaction to help you explain why.

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(2 marks)

Question 1 continues on the next page

Turn over▶

1 (c) A balance is used to measure the mass of the apparatus.

1 (c) (i) Which balance, **A**, **B**, or **C**, has the highest resolution?

Balance A   Balance B   Balance C

The balance with the highest resolution is balance [   ] .

(*1 mark*)

1 (c) (ii) The balance used for this experiment should have a high resolution.

Explain why.

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(*2 marks*)

1 (d) The student repeated the experiment using powdered marble instead of marble chips.

The rate of reaction between the marble and hydrochloric acid particles was much faster with the powder.

Explain why.

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(*2 marks*)

11

2 The diagram shows the main parts of an instrumental method called gas chromatography linked to mass spectroscopy (GC-MS).
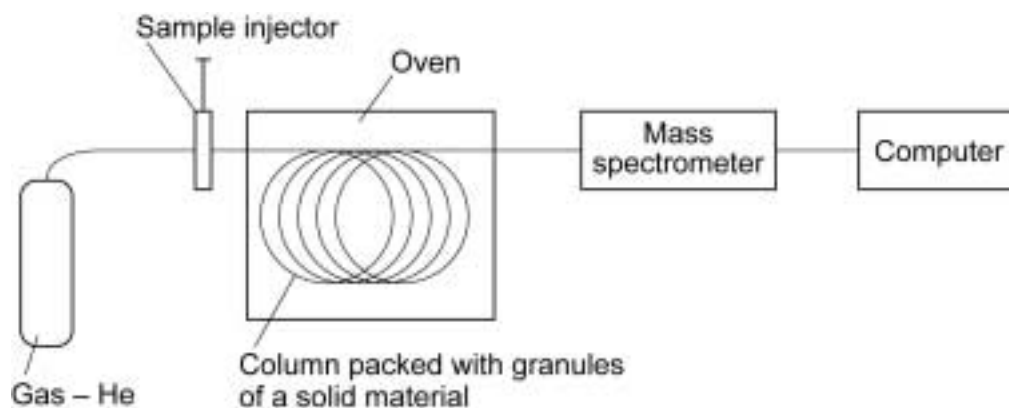
This method separates a mixture of compounds and then helps to identify each of the compounds in the mixture.

2 (a) In which part of the apparatus:

2 (a) (i) is the mixture separated ....

(*1 mark*)

2 (a) (ii) is the relative molecular mass of each of the compounds in the mixture measured?

....

(*1 mark*)

Question 2 continues on the next page

Turn over►

2 (b) (i) Athletes sometimes take drugs because the drugs improve their performance. One of these drugs is ephedrine.

Ephedrine has the formula:

$$C_{10}H_{15}NO$$

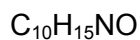What relative molecular mass (M_r) would be recorded by GC-MS if ephedrine was present in a blood sample taken from an athlete?

Show clearly how you work out your answer.

Relative atomic masses: H = 1; C = 12; N = 14; O = 16.

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Relative molecular mass = ...
(2 marks)

2 (b) (ii) Another drug is amphetamine which has the formula:

$$C_9H_{13}N$$
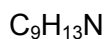
The relative molecular mass (M_r) of amphetamine is 135.

Calculate the percentage by mass of nitrogen in amphetamine.

Relative atomic mass: N = 14

....

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Percentage of nitrogen = ... %
(2 marks)

2 (c) Athletes are regularly tested for drugs at international athletics events.

An instrumental method such as GC-MS is better than methods such as titration.

Suggest **two** reasons why.

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(2 marks)

2 (d) When a blood sample is taken from an athlete the sample is often split into two portions. Each portion is tested at a different laboratory.

Suggest why.

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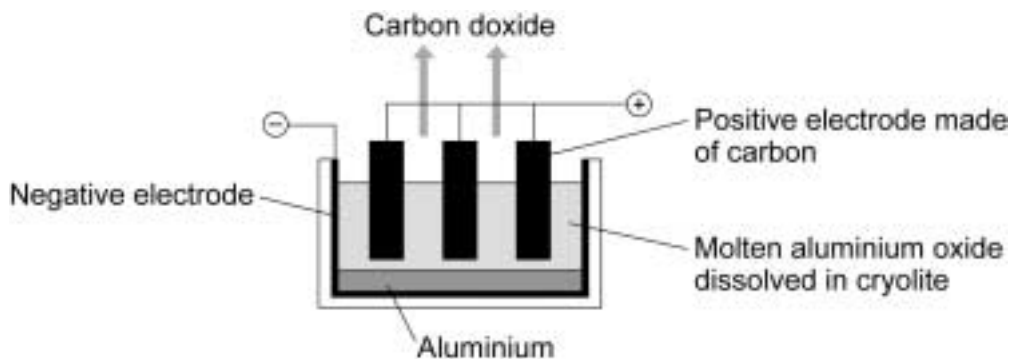
(2 marks)

10

Turn over for the next question

Turn over▶

3 Read the information in the box and then answer the question.

Aluminium is made by the electrolysis of aluminium oxide.

Aluminium oxide is an ionic compound containing aluminium ions (Al^{3+}) and oxide ions (O^{2-}).

The diagram below shows the apparatus used to electrolyse aluminium oxide.

3 (a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Use information in the box and your knowledge and understanding of this process to answer this question.

Explain, as fully as you can, how aluminium and carbon dioxide are formed in this process.

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(6 marks)

3 (b) Aluminium is a metal.

Explain why aluminium conducts electricity.

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(2 marks)

8

4 Waste water from some industrial processes contains metal ions, such as chromium ions. These metal ions must be removed from the water before the water is returned to a river.

4 (a) A method of removing chromium ions (Cr^{3+}) from water is represented by this equation.

Balance the equation.

$$Cr^{3+}(aq) \quad + \quad .... \ OH^-(aq) \quad \rightarrow \quad Cr(OH)_3(s)$$

(1 mark)

4 (b) Suggest a suitable chemical that could be added to the water to provide the OH^- ions.

....

(1 mark)

4 (c) Explain how chromium ions are removed from the water.

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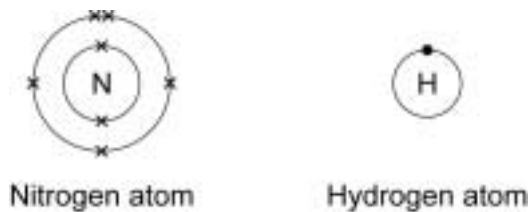
(1 mark)

3

Turn over for the next question

Turn over▶

5   Ammonia has the formula NH_3

The diagrams show how electrons are arranged in nitrogen and hydrogen atoms.

Nitrogen atom   Hydrogen atom

5 (a)   Draw a diagram to show how the electrons are arranged in an ammonia molecule.

You need only show the electrons in the highest energy level.

(2 marks)

5 (b)   Ammonia is a gas at room temperature.

Explain why ammonia has a low boiling point.

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(2 marks)

5 (c) Ammonia dissolves in water to form a solution with a pH of about 10.

5 (c) (i) Name the ion in the ammonia solution that causes the pH of 10.

.... ion

(1 mark)

5 (c) (ii) Ammonium nitrate is made by reacting ammonia with an acid.

Name the acid.

.... acid

(1 mark)

5 (d) Instant cold packs are used to treat sports injuries.

One type of cold pack has a plastic bag with water inside. Inside the bag is a smaller bag containing solid ammonium nitrate.

The outer bag is squeezed so that the inner bag bursts. The pack is shaken and quickly gets cold as the ammonium nitrate dissolves in the water.

Explain why the bag becomes cold.

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(2 marks)

8

Turn over▶

6 This picture shows a sword. The sword is about 3400 years old. It is made of an alloy called bronze.

Bronze is made from copper and tin.

Bronze made better swords than pure copper. This is because bronze is harder than pure copper.

Explain why bronze is harder than pure copper.

Your answer should include details of:

- how the atoms are arranged in pure copper and bronze
- why pure copper is relatively soft
- why bronze is harder.

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(4 marks)

4

7 This drinks bottle is made of thermosoftening plastic.

Drinks bottles of this type can be recycled.

Describe and explain how these used plastic bottles can be changed into new plastic objects.
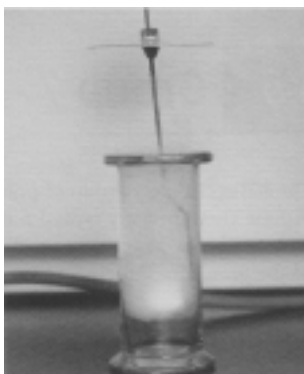
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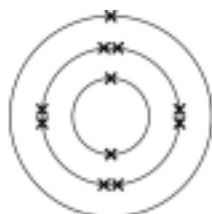
(4 marks)

4

Turn over▶

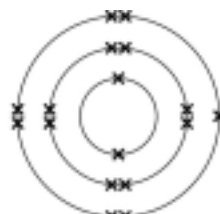**8** The picture shows sodium reacting with chlorine.

The reaction forms sodium chloride, which contains sodium ions and chloride ions.

8 (a) The diagrams show how electrons are arranged in a sodium atom and a chlorine atom.

Sodium atom (Na)   Chlorine atom (Cl)

Explain, in terms of electrons, what happens when sodium reacts with chlorine.

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(3 marks)

8 (b)   Explain, as fully as you can, why sodium chloride has a high melting point.

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(3 marks)

6
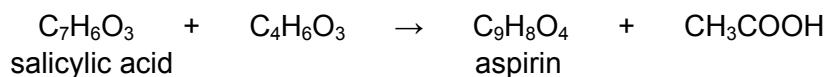
Turn over for the next question

Turn over▶

9   Aspirin tablets have important medical uses.

9 (a)   Aspirin is made when salicylic acid reacts with ethanoic anhydride.

The equation for this reaction is:

$$C_7H_6O_3 \quad + \quad C_4H_6O_3 \quad \rightarrow \quad C_9H_8O_4 \quad + \quad CH_3COOH$$
salicylic acid   aspirin

Calculate the maximum mass of aspirin that could be made from 100 g of salicylic acid.

Show clearly how you work out your answer.

The relative formula mass (M_r) of salicylic acid ($C_7H_6O_3$) is 138.
The relative formula mass (M_r) of aspirin ($C_9H_8O_4$) is 180.

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Maximum mass of aspirin = ...g

(2 marks)

9 (b) (i) In an experiment a chemist calculated that the maximum yield of aspirin is 400 g.

The chemist did the experiment but only made 250 g of aspirin.

Calculate the percentage yield of aspirin for this experiment.

Show clearly how you work out your answer.

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Percentage yield of aspirin = ... %

(2 marks)

9 (b) (ii) Suggest **one** possible reason why the chemist did **not** have a percentage yield of 100 %.

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(1 mark)

9 (c) The use of a catalyst might reduce costs in the industrial production of aspirin.

Suggest how.

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(1 mark)

END OF QUESTIONS

6

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED