Specimen Paper

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

General Certificate of Secondary Education
Higher Tier

Science A
Unit Chemistry C1

Chemistry
Unit Chemistry C1

Chemistry 1H

H

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

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.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 2(c) 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.

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

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

1 (a) The chemical equation for a reaction of sodium is shown below.

$$2Na + Cl_2 \longrightarrow 2NaCl$$

Describe this reaction of sodium in terms of the names of the substances and the numbers of the atoms involved.

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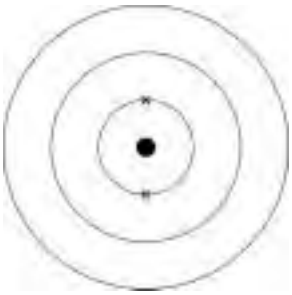
(3 marks)

1 (b) Use the periodic table on the data sheet to help you to answer this question.

1 (b) (i) Complete the electronic structure of sodium.



(2 marks)

1 (b) (ii) How is the electronic structure of sodium different from the electronic structure of chlorine?

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(1 mark)

6

Turn over for the next question

2 Most plastic bags are made from poly(ethene).

Poly(ethene) is a polymer made from ethene.

Ethene is made by cracking saturated hydrocarbons from crude oil.

2 (a) Use words from the box to complete the sentences about cracking.

alkanes	**alkenes**	**catalyst**	**fuel**	**gas**

Cracking involves heating the ..... to make a vapour. The vapour is either passed over a hot ..... or mixed with steam and heated to a very high temperature so that thermal decomposition reactions happen.

(2 marks)

2 (b) Poly(ethene) molecules are made from ethene molecules by a polymerisation reaction.

Describe what happens in a polymerisation reaction.

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(2 marks)

Do not write outside the box

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

There are millions of plastic bags in use. After use most of these plastic bags are buried in landfill sites. The amount sent to landfill could be reduced if the plastic bags:

- could be reused
- could be recycled by melting and making them into new plastic products
- could be burned to release energy.

Use the information above and your knowledge and understanding to give the positive and negative environmental impacts of using these methods to reduce the amount of plastic bags sent to landfill.

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(6 marks)

10

Turn over for the next question

3 Evidence shows that the Earth formed from a molten ball of rocks and minerals.

Before 1900 many scientists thought that the Earth's mountains and continents formed in fixed positions when the molten ball of rocks and minerals cooled and wrinkled.

3 (a) In 1912 Alfred Wegener suggested his hypothesis of continental drift.

The areas of rocks shown on **Map 1** contain fossils of the same type of animals.

Today animals in Africa are different from animals in South America.

Map 1
Wegener suggested his hypothesis that all of the continents, including Africa and South America, had been joined together but then drifted slowly apart.

Map 2
In 1920 other scientists stated that all of the continents were in fixed positions, including Africa and South America, and that they had once been joined together by a land bridge.

3 (a) (i) Use the information to suggest **two** pieces of evidence that may have led Wegener to propose his hypothesis that continents move.

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(2 marks)

Do not write outside the box

3 (a) (ii) Suggest why, in 1920, other scientists thought that Wegener's hypothesis was wrong.

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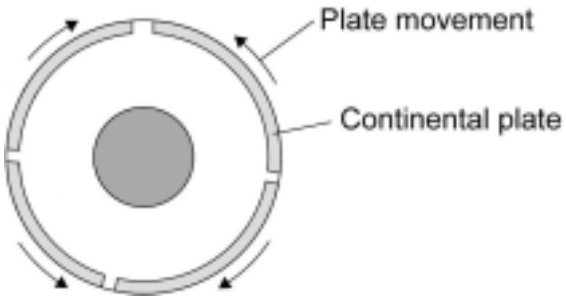
(2 marks)

3 (b) In 1962 scientists produced the theory of plate tectonics.

The theory of plate tectonics supported Wegener's hypothesis that continents move.



Tectonic plates move a few centimetres a year.

Complete the sentences about what causes the movement of the Earth's tectonic plates.

Deep inside the Earth ..... processes release large amounts of energy. These processes heat up the substances in the Earth's..... producing convection currents.

(2 marks)

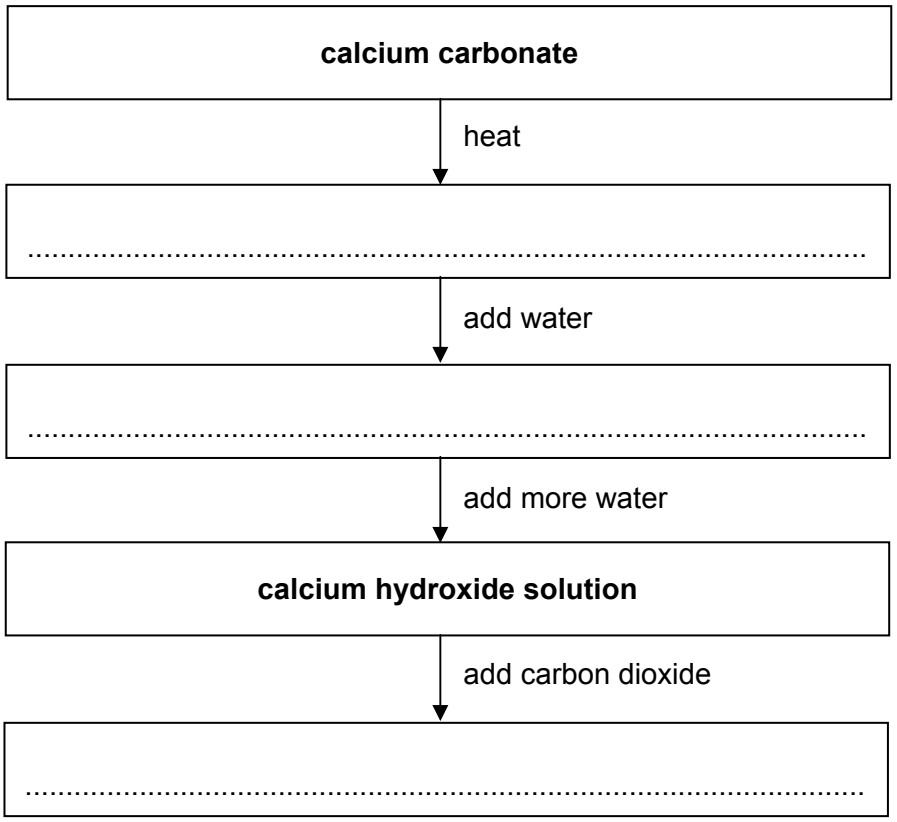
6

Turn over for the next question

4 Limestone contains calcium carbonate, $CaCO_3$.

4 (a) The flow chart shows the stages in the limestone cycle.

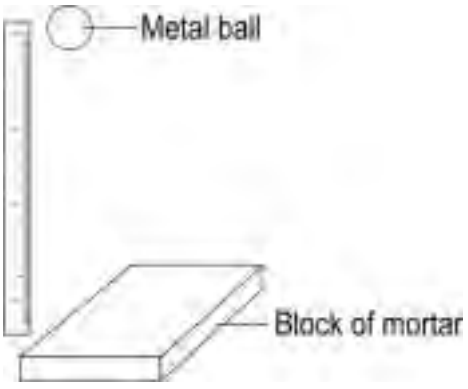
Write the name of the correct calcium compound in each empty box to complete the flow chart.



(3 marks)

4 (b) Limestone is heated with clay to make cement.
Cement is mixed with sand to make mortar.

A student investigated the strength of six mortar mixtures. Each mortar mixture contained 100cm^3 cement but each contained a different volume of sand.



To do the investigation the student:

- added and stirred water into each mortar mixture
- put each mixture into the same sized moulds
- left each mixture to set hard
- dropped a metal ball from increasing heights until the mortar cracked
- recorded the results in a table.

Volume of sand in cm^3	Volume of cement in cm^3	Height the metal ball was dropped from to crack the mortar in cm
700	100	24
600	100	30
500	100	36
400	100	37
300	100	48
200	100	54

4 (b) (i) What happens to the strength of the mortar as the volume of sand increases?

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(1 mark)

4 (b) (ii) The student was worried about an anomalous result.

Which result was anomalous?

Volume of sand = ... cm^3

Explain why you have chosen this result.

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(2 marks)

4 (c) The student repeated the investigation but used six concrete mixtures.

From the results the student concluded correctly that concrete was stronger than mortar.

Suggest **one** reason why concrete is stronger than mortar.

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(1 mark)

7

Turn over for the next question

5 Copper is found in the Earth's crust as an ore containing copper sulfide. Large areas of land, where this ore was once quarried, are contaminated with low percentages of copper sulfide. Copper would be too expensive to extract from this contaminated land using the traditional method of quarrying and then heating in a furnace.

5 (a) The percentage of copper ore in the contaminated land is low.

5 (a) (i) It would be too expensive to extract from this land by the traditional method.

Explain why.

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(1 mark)

5 (a) (ii) Extracting copper from this land by the traditional method would have a major environmental impact.

Give **one** reason why.

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(1 mark)

5 (b) One way to extract the copper from land that contains low percentages of copper sulfide is by bioleaching. Bioleaching uses bacteria. The bacteria produce a solution of copper sulfate.

It is possible to get copper from a solution of copper sulfate using scrap iron.

5 (b) (i) It is economical to use scrap iron to get copper.

Give **one** reason why.

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(1 mark)

5 (b) (ii) Why can iron be used to get copper from copper sulfate solution?

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(1 mark)

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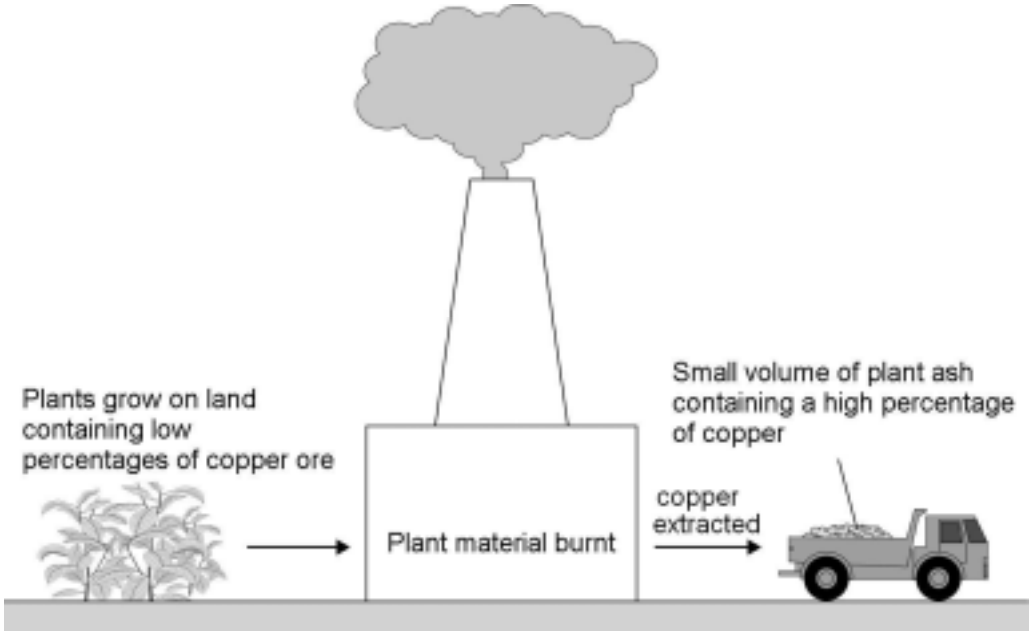
5 (c) A new way to extract the copper from land that contains low percentages of copper ore is phytomining.

Phytomining uses plants. Plants are grown on this land and absorb copper compounds through their roots.



5 (c) (i) Use this information to give **two** advantages of phytomining compared to the traditional method.

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(2 marks)

5 (c) (ii) Use this information to suggest **one** disadvantage of phytomining compared to the traditional method.

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(1 mark)

7

Turn over for the next question

6 This question is about the use of hydrocarbons and the production of compounds from hydrocarbons.

6 (a) The equation shows a reaction involving hydrocarbons.

C_8H_{18}	→	C_2H_4	+	C_6H_{14}
Hydrocarbon **J**		Hydrocarbon **K**		Hydrocarbon **L**

Choose the correct processes from the box to complete the sentences.

combustion	**hydration**	**thermal decomposition**	**polymerisation**

6 (a) (i) Hydrocarbons **K** and **L** are produced by ..... .

(1 mark)

6 (a) (ii) Ethanol can be produced from hydrocarbon **K** by..... .

(1 mark)

6 (a)(iii) Describe a test to distinguish between hydrocarbons **K** and **L** and give the result of the test.

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(2 marks)

6 (b) Hydrocarbon **J** burns completely in oxygen to produce carbon dioxide and water vapour.

$2\ C_8H_{18} + 25\ O_2 \rightarrow 16\ CO_2 + 18\ H_2O$

6 (b) (i) When 114g of hydrocarbon **J** burns completely in 400g of oxygen it produces 162g of water vapour.

What mass of carbon dioxide would be produced from burning 114g of hydrocarbon **J**?

Show clearly how you work out your answer.

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Answer = ...g

(2 marks)

Do not write outside the box

6 (b) (ii) The mass of carbon dioxide produced is greater than the 114g of hydrocarbon J that was burned.
Explain why.

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(2 marks)

6 (c) Two different processes are used to produce ethanol.

Process 1	Process 2
Fermentation of a sugar solution by yeast in a reaction vessel. The reaction vessel has to be emptied, cleaned and refilled every few days. The process produces a 15% ethanol solution in water.	Reaction of ethene (from crude oil) with steam in a reactor. The reaction is only stopped if there is a fault in the reactor. The process produces 100% ethanol.

6 (c) (i) Give **one** advantage that **Process 1** has over **Process 2**.

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(1 mark)

6 (c) (ii) What advantages to a manufacturer of ethanol, does **Process 2** have over **Process 1**?

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(2 marks)

11

Turn over for the next question

7 An advert for crisps claimed that they are healthier because they are cooked in sunflower oil.

7 (a) A student found the following information about four oils that are used to make crisps.

	Rapeseed oil	Sunflower oil	Olive oil	Corn oil
Saturated fat (%)	6.6	12.0	14.3	14.4
Poly-unsaturated fat (%)	29.3	63.3	8.2	51.3
Melting point (°C)	+5	–18	–12	–15

One hypothesis is that oils are thought to be healthier if they are:

- low in saturated fat
- high in poly-unsaturated fat.

7 (a) (i) Use the table to decide which oil should be healthiest. Explain your decision by comparing this oil with other oils from the table that you think are less healthy.

Healthiest oil is .....

Explanation .....

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(2 marks)

7 (a) (ii) These oils can be hardened by reacting them with hydrogen.
A student said that hardening would make sunflower oil healthier.
Is this student's hypothesis correct?

Explain your answer.

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(2 marks)

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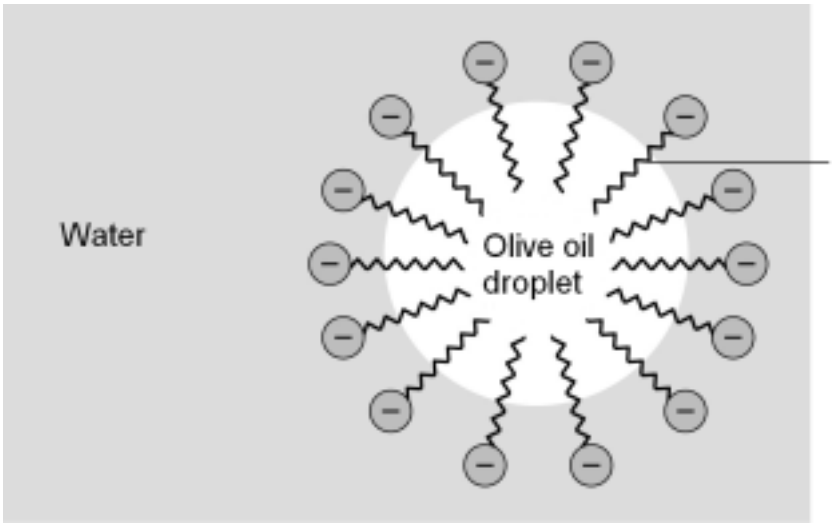
7 (b) A mixture of the olive oil, water and egg yolk was shaken and left to stand. The olive oil and water do not separate.

The diagram shows a simple model of how a stable mixture of olive oil and water is produced by the addition of egg yolk.



Use this simple model to explain how the molecules in the egg yolk are able to produce a stable mixture of olive oil and water.

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(3 marks)

7

Turn over for the next question

8 Air is a mixture of gases and contains various pollutants. The gases are useful and can be separated by fractional distillation of liquid air. The table gives information about some of the gases in air.

Name of gas	Formula	Melting point in °C	Boiling point in °C
Helium	He	–272.2	–269.0
Oxygen	O_2	–219.0	–183.0
Nitrogen	N_2	–210.0	–195.9
Argon	Ar	–189.0	–185.9
Carbon dioxide	CO_2	–78.5	–78.5
Water vapour	H_2O	0.0	100.0

To separate these gases:

- the air is filtered
- water is removed first
- carbon dioxide is then removed by absorption
- the gases remaining are compressed and cooled to –200 °C.

8 (a) The air is filtered before the gases are separated.

Suggest why.

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(1 mark)

8 (b) Water vapour and carbon dioxide are removed before the gases are compressed and cooled.

Use the information in the table to suggest why.

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(2 marks)

Do not write outside the box

8 (c) After the water and carbon dioxide have been removed, which gas stays liquid over the greatest temperature range?

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(1 mark)

8 (d) After the water and carbon dioxide have been removed, the four gases that are left are compressed and cooled to –200 °C.

8 (d) (i) Which gas does **not** liquefy?

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(1 mark)

8 (d) (ii) The three liquefied gases are then allowed to warm up.

Give the order in which the three liquefied gases would vaporise.

1st .....

2nd .....

3rd .....

(1 mark)

6

END OF QUESTIONS

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