

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education
Foundation Tier
June 2014

Additional Science

Unit Chemistry C2

Chemistry

Unit Chemistry C2

Thursday 15 May 2014 9.00 am to 10.00 am

For this paper you must have:

- a ruler
 - the Chemistry Data Sheet (enclosed).
- You may use a calculator.

Time allowed

- 1 hour

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 spaces 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 7 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.

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

CH2FP
F



J U N 1 4 C H 2 F P O 1

G/KL/101856/Jun14/E4

CH2FP

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

1 This question is about diamonds.

Draw a ring around the correct answer to complete each sentence.

1 (a) Diamonds are found in meteorites.

1 (a) (i) Meteorites get very hot when they pass through the Earth's atmosphere, but the diamonds do not melt.

Diamond has a

high
low
very low

 melting point.

[1 mark]

1 (a) (ii) Most diamonds found in meteorites are nanodiamonds.

A nanodiamond contains a few

hundred
thousand
million

 atoms.

[1 mark]

1 (b) Diamonds are used for the cutting end of drill bits.

Diamonds can be used for drill bits because they are

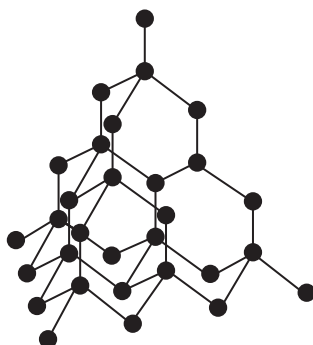
hard.
shiny.
soft.

[1 mark]



1 (c) Figure 1 shows the arrangement of atoms in diamond.

Figure 1



1 (c) (i) Diamond is made from

carbon
nitrogen
oxygen

atoms.

[1 mark]

1 (c) (ii) Each atom in diamond is bonded to

three
four
five

other atoms.

[1 mark]

1 (c) (iii) Diamond has a giant

covalent
ionic
metallic

structure.

[1 mark]

1 (c) (iv) In diamond

all
none
some

of the atoms are bonded together.

[1 mark]

7

Turn over ►



- 2 Dental braces are made from nitinol wires. Nitinol is a mixture of metals.



Dental brace

- 2 (a) Nitinol can return to its original shape after being deformed.

Draw a ring around the correct answer to complete the sentence.

[1 mark]

Nitinol is a shape memory

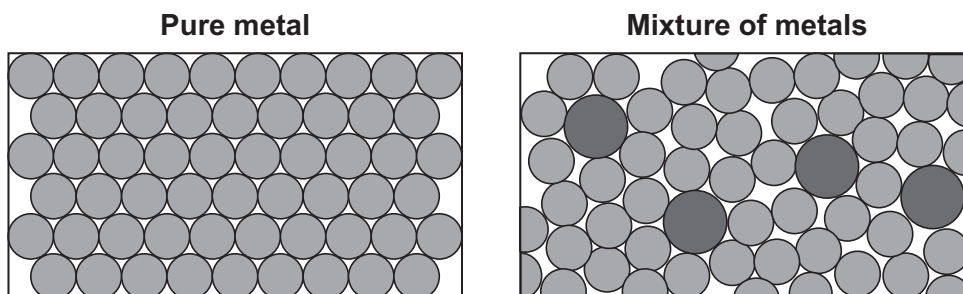
alloy.

catalyst.

polymer.

- 2 (b) **Figure 2** shows the arrangement of atoms in a pure metal and in a mixture of metals.

Figure 2



The mixture of metals is harder than the pure metal.

Use **Figure 2** to explain why.

[2 marks]

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.....

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2 (c) Gold and stainless steel are also used for dental braces.

Suggest **two** factors to consider when choosing which metal to use for dental braces.

[2 marks]

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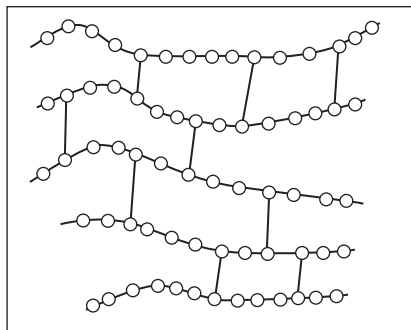
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2 (d) A thermosetting polymer is used to hold dental braces on the teeth.

Figure 3 shows the structure of a thermosetting polymer.

Figure 3

Thermosetting polymer



How can you tell from **Figure 3** that the polymer is thermosetting?

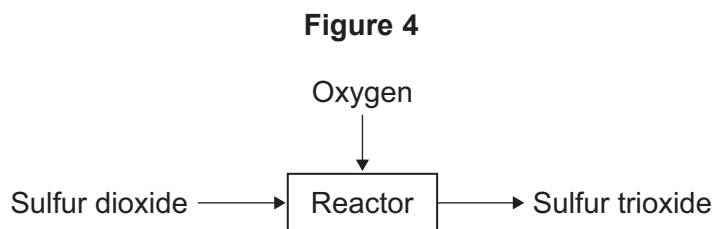
[1 mark]

.....

.....



- 3** **Figure 4** represents the reaction of sulfur dioxide with oxygen.



- 3 (a) (i)** Complete the word equation for the reaction of sulfur dioxide with oxygen.

[1 mark]

sulfur dioxide + →

- 3 (a) (ii)** Draw a ring around the correct answer to complete the sentence.

[1 mark]

Sulfur dioxide (SO₂) is

a compound.

an element.

a mixture.

- 3 (b)** The reactants are gases.

When the pressure of the gases is increased, the reaction gets faster.

Complete the sentence.

[1 mark]

When the pressure of the gases is increased,

the frequency of the collisions



3 (c) The particles need energy to react.

Complete the sentence.

[1 mark]

The minimum amount of energy that particles need to react is called
the energy.

3 (d) Give **one** way of increasing the rate of the reaction other than changing the pressure.

[1 mark]

.....
.....

5

Turn over for the next question

Turn over ►



- 4 Fertilisers contain elements that plants need.

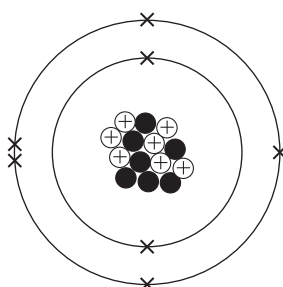
AQAGROW
Plant Fertiliser

Contains:

- Nitrogen
- Phosphorus
- Potassium

- 4 (a) **Figure 5** represents a nitrogen atom.

Figure 5



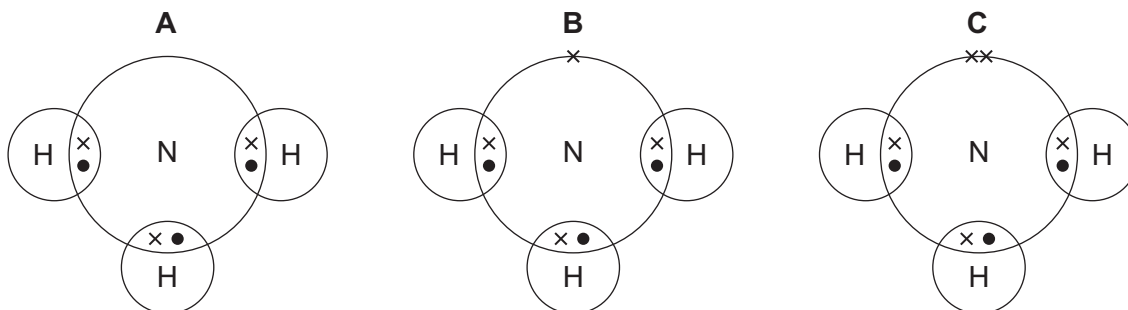
Complete each sentence.

- 4 (a) (i) The mass number of this nitrogen atom is [1 mark]
- 4 (a) (ii) Atoms of nitrogen with different numbers of neutrons are called [1 mark]
- 4 (a) (iii) Compared with a proton, the mass of an electron is [1 mark]



4 (b) Fertilisers can be made from ammonia.

4 (b) (i) Which diagram, **A**, **B**, or **C**, represents the electronic structure of an ammonia molecule?
[1 mark]



The electronic structure of an ammonia molecule is shown in diagram

4 (b) (ii) What is the correct formula of ammonia?

Draw a ring around the correct answer.

[1 mark]



Question 4 continues on the next page

Turn over ►



4 (c) A student made ammonium nitrate by reacting ammonia solution with an acid.

4 (c) (i) Name the acid used to make ammonium nitrate.

[1 mark]

.....

4 (c) (ii) Complete the sentence.

[1 mark]

The student added a few drops of, which changed colour when the ammonia solution had neutralised the acid.

4 (c) (iii) The student added charcoal and filtered the mixture.

This produced a colourless solution of ammonium nitrate.

How is solid ammonium nitrate obtained from the solution?

[1 mark]

.....

4 (c) (iv) A farmer put ammonium nitrate fertiliser onto a field of grass.

Suggest what would happen to the grass.

[1 mark]

.....

.....



4 (d) Some fertilisers contain potassium chloride.

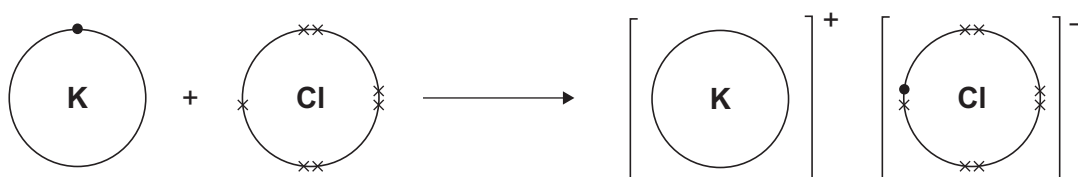
Potassium reacts with chlorine to produce potassium chloride.

Figure 6 shows how this happens.

The dots (•) and crosses (x) represent electrons.

Only the outer shell is shown.

Figure 6



Use **Figure 6** to help you answer this question.

Describe, as fully as you can, what happens when potassium reacts with chlorine to produce potassium chloride.

[4 marks]

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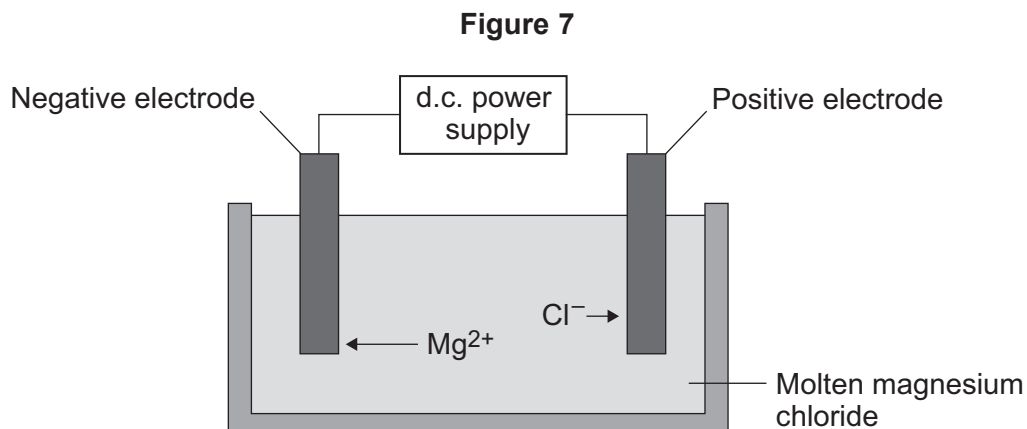
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5 Some students investigated reactions to produce magnesium.

5 (a) The students used electrolysis to produce magnesium from magnesium chloride, as shown in **Figure 7**.



5 (a) (i) Magnesium chloride contains magnesium ions and chloride ions.

Why does solid magnesium chloride **not** conduct electricity?

[1 mark]

.....

.....

5 (a) (ii) One of the products of the electrolysis of molten magnesium chloride is magnesium.

Name the other product.

[1 mark]

.....

5 (a) (iii) Why do magnesium ions (Mg^{2+}) move to the negative electrode?

[1 mark]

.....

.....



- 5 (a) (iv)** At the negative electrode, the magnesium ions (Mg^{2+}) gain electrons to become magnesium atoms.

How many electrons does each magnesium ion gain?

[1 mark]

.....

- 5 (b)** The students did the experiment four times and weighed the magnesium produced.

Table 1 shows their results.

Table 1

Experiment	Mass of magnesium produced in grams
1	1.13
2	0.63
3	1.11
4	1.09

- 5 (b) (i)** There is an anomalous result.

Suggest **one** possible reason for the anomalous result.

[1 mark]

.....
.....

- 5 (b) (ii)** Calculate the mean mass of magnesium produced, taking account of the anomalous result.

[2 marks]

.....
.....
.....

Mean mass = g

Turn over ►



5 (c) The formula of magnesium chloride is MgCl_2

The relative formula mass of magnesium chloride is 95.

The relative atomic mass of magnesium is 24.

5 (c) (i) Use the equation to calculate the percentage mass of magnesium in magnesium chloride.

$$\text{Percentage mass of magnesium} = \frac{\text{mass of magnesium}}{\text{mass of magnesium chloride}} \times 100\%$$

[2 marks]

.....

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.....

Percentage mass of magnesium in magnesium chloride = %

5 (c) (ii) Draw a ring around the relative mass of chlorine in MgCl_2

[1 mark]

71

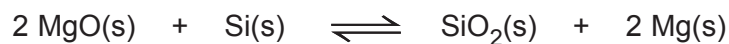
95

119



5 (d) Magnesium is also produced from the reaction of magnesium oxide with silicon.

5 (d) (i) The equation for the reaction is:



What is the meaning of this symbol $\rightleftharpoons$?

Draw a ring around the correct answer.

[1 mark]

neutralisation reaction

precipitation reaction

reversible reaction

5 (d) (ii) The forward reaction is endothermic.

Draw a ring around the correct answer to complete the sentence.

[1 mark]

In an endothermic reaction the temperature of the surroundings

decreases.

increases.

stays the same.

Turn over for the next question

Turn over ►



- 6** The label shows the ingredients in a drink called Cola.

Cola

Ingredients:

Carbonated water
Sugar
Colouring
Phosphoric acid
Flavouring
Caffeine

- 6 (a) (i)** The pH of carbonated water is 4.5.

The pH of Cola is 2.9.

Name the ingredient on the label that lowers the pH of Cola to 2.9.

[1 mark]

.....

- 6 (a) (ii)** Which ion causes the pH to be 2.9?

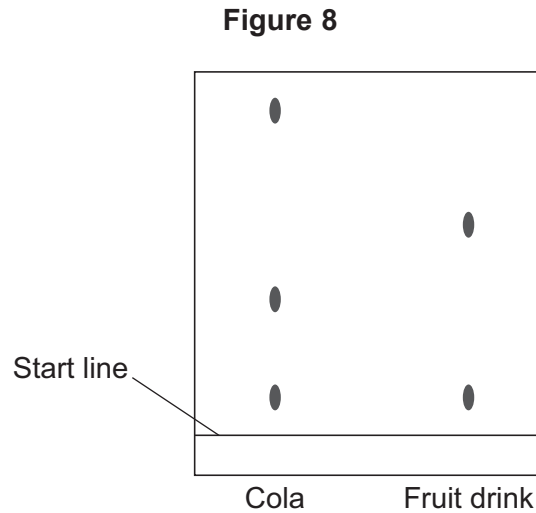
[1 mark]

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- 6 (b)** A student investigated the food colouring in Cola and in a fruit drink using paper chromatography.

The chromatogram in **Figure 8** shows the student's results.



- 6 (b) (i)** Complete the sentence.

The start line should be drawn with a ruler and

Give a reason for your answer.

[2 marks]

.....

.....

- 6 (b) (ii)** Suggest **three** conclusions you can make from the student's results.

[3 marks]

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Turn over ►



- 6 (c)** Caffeine can be separated from the other compounds in the drink by gas chromatography.

Why do different compounds separate in a gas chromatography column?

[1 mark]

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- 6 (d)** Caffeine is a stimulant.

Large amounts of caffeine can be harmful.

- 6 (d) (i)** Only **one** of the questions in the table **can** be answered by science alone.

Tick (✓) **one** question.

[1 mark]

Question	Tick (✓)
Should caffeine be an ingredient in drinks?	
Is there caffeine in a certain brand of drink?	
How much caffeine should people drink?	

- 6 (d) (ii)** Give **two** reasons why the other questions **cannot** be answered by science alone.

[2 marks]

Reason 1

.....

Reason 2

.....



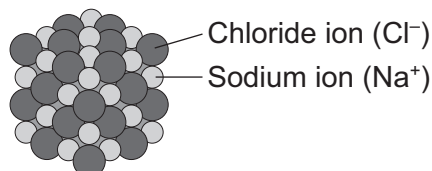
- 7 In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Explain why chlorine (Cl_2) is a gas at room temperature, but sodium chloride (NaCl) is a solid at room temperature.

Chlorine



Sodium chloride



Include a description of the bonding and structure of chlorine and sodium chloride in your answer.

[6 marks]

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Extra space

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END OF QUESTIONS



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