

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	
TOTAL	



General Certificate of Secondary Education
Foundation Tier
June 2014

Additional Science

Unit Chemistry C2

CH2FP

F

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.



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

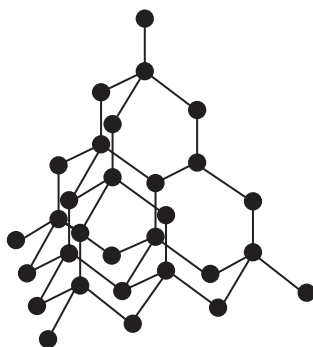
hard.
shiny.
soft.

[1 mark]



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

Figure 1



1 (c) (i) Diamond is made from

carbon

nitrogen

atoms.

oxygen

[1 mark]

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

three

four

other atoms.

five

[1 mark]

1 (c) (iii) Diamond has a giant

covalent

ionic

structure.

metallic

[1 mark]

1 (c) (iv) In diamond

all

none

of the atoms are bonded together.

some

[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.

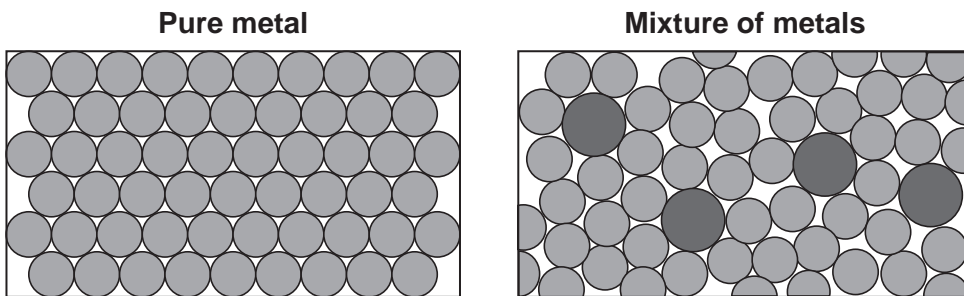
[1 mark]

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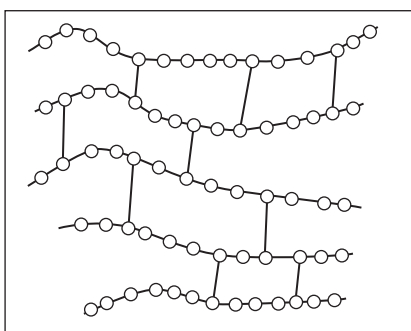
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2 (d) A thermosetting polymer is used to hold dental braces on the teeth.

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]

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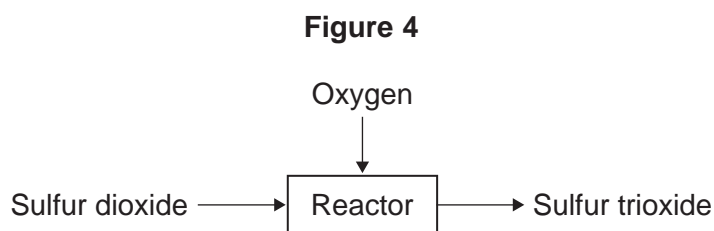
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6

Turn over ►



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]

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.....

5

Turn over for the next question

Turn over ►



4 Fertilisers contain elements that plants need.

AQAGROW

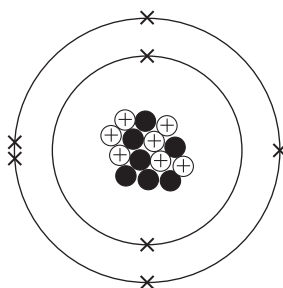
Plant Fertiliser

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]

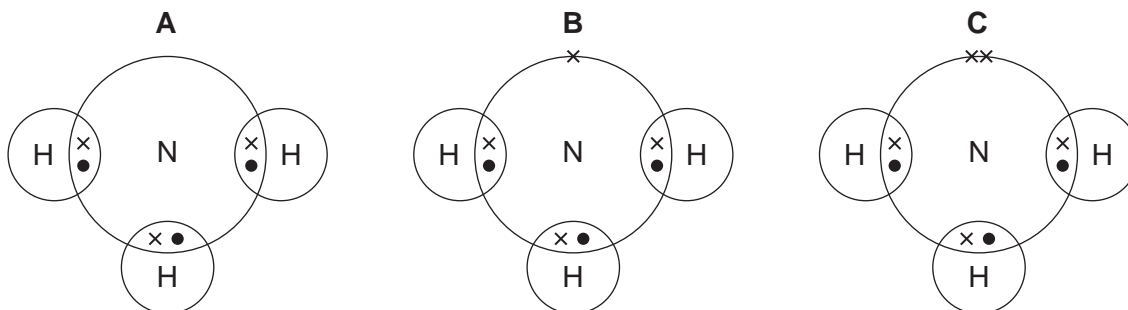
4 (a) (iii) Compared with a proton, the mass of an electron is

[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]

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.....



4 (d) Some fertilisers contain potassium chloride.

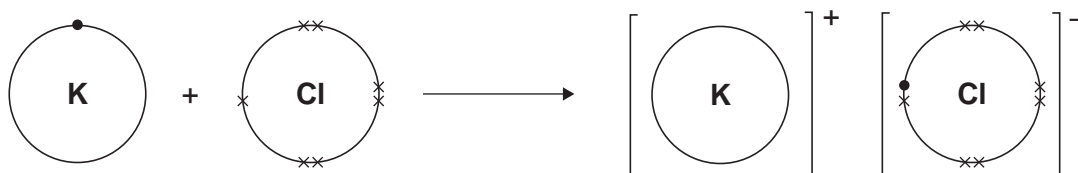
Potassium reacts with chlorine to produce potassium chloride.

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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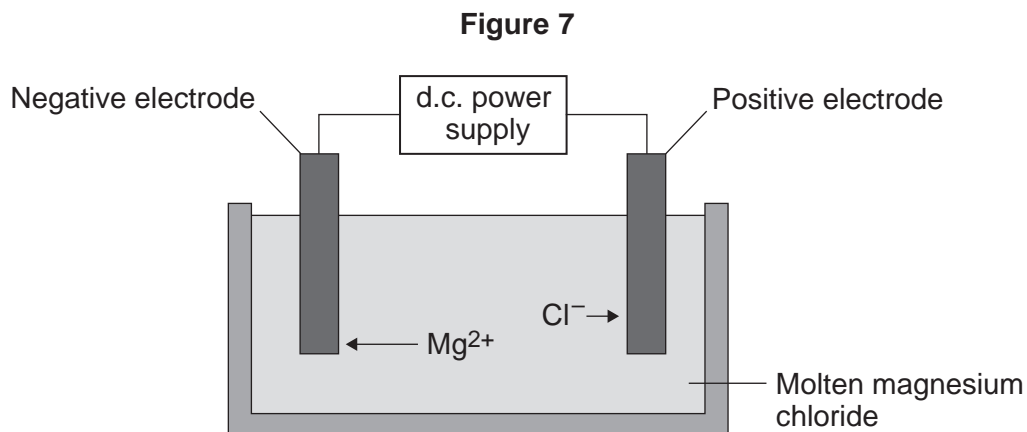
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5 Some students investigated reactions to produce magnesium.

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

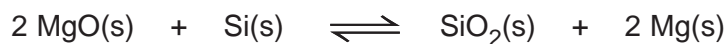
95

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.

12

Turn over for the next question

Turn over ►



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

<p style="text-align: center;">Cola</p> <p>Ingredients:</p> <p>Carbonated water Sugar Colouring Phosphoric acid Flavouring Caffeine</p>
--

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]

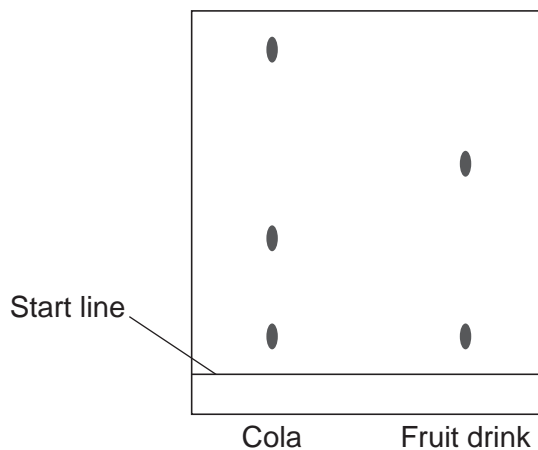
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6 (b) A student investigated the food colouring in Cola and in a fruit drink using paper chromatography.

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

Figure 8



6 (b) (i) Complete the sentence.

The start line should be drawn with a ruler and

Give a reason for your answer.

[2 marks]

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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

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Reason 2

.....

11



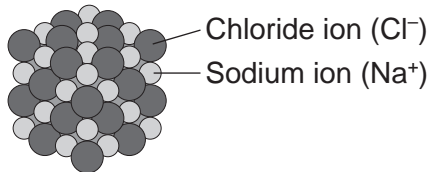
7 In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

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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6

END OF QUESTIONS



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