

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education
Foundation Tier
June 2015

Additional Science

Unit Chemistry C2

Chemistry

Unit Chemistry C2

CH2FP
F

Thursday 14 May 2015 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 6(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.

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



J U N 1 5 C H 2 F P O 1

G/KL/110343/Jun15/E6

CH2FP

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

1 This question is about carbon and gases in the air.

1 (a) Carbon atoms have protons, neutrons and electrons.

Complete **Table 1** by writing the relative mass of a neutron and an electron.

[2 marks]

Table 1

Name of particle	Relative mass
proton	1
neutron	
electron	

1 (b) What is the total number of protons and neutrons in an atom called?

[1 mark]

Tick (✓) **one** box.

The atomic number

☐

The mass number

☐

One mole of the atom

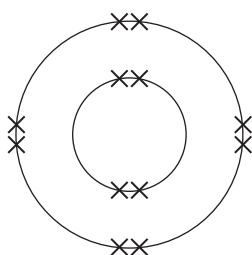
☐

1 (c) An atom of carbon has six electrons.

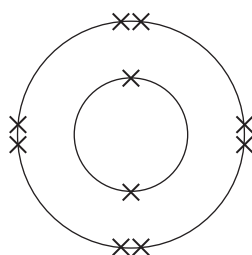
Which structure, **A**, **B** or **C**, represents the electronic structure of the carbon atom?

[1 mark]

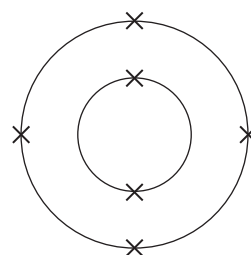
Structure A



Structure B



Structure C



The carbon atom is structure

☐


1 (d) Carbon reacts with oxygen to produce carbon dioxide (CO_2).

1 (d) (i) How many different elements are in one molecule of carbon dioxide?

[1 mark]

.....

1 (d) (ii) What is the total number of atoms in one molecule of carbon dioxide?

[1 mark]

.....

1 (e) Sometimes carbon reacts with oxygen to produce carbon monoxide (CO).

1 (e) (i) Calculate the relative formula mass (M_r) of carbon monoxide.

Relative atomic masses (A_r): C = 12; O = 16

[1 mark]

.....

.....

M_r of carbon monoxide =

1 (e) (ii) Calculate the percentage by mass of carbon in carbon monoxide.

[1 mark]

.....

.....

Percentage by mass of carbon in carbon monoxide =%

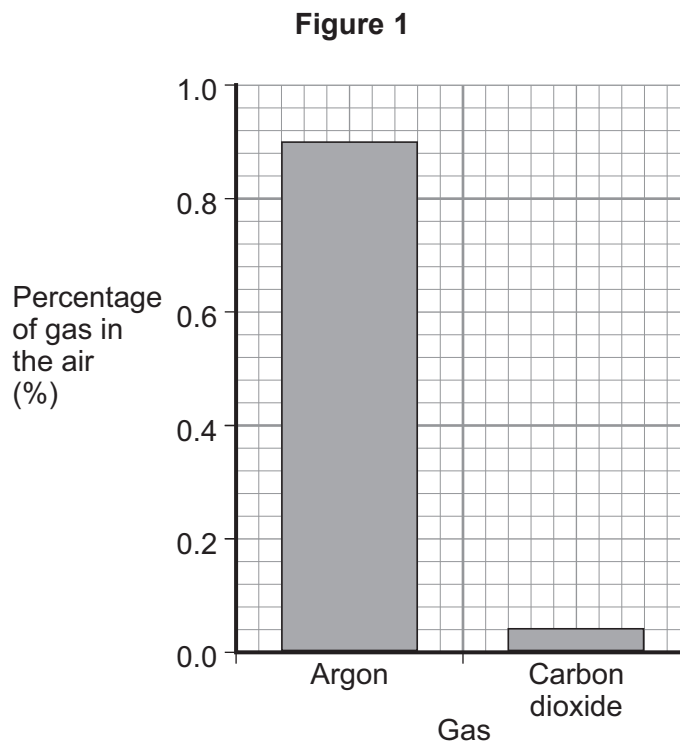
Question 1 continues on the next page

Turn over ►



1 (f) Carbon dioxide is one of the gases in the air.

1 (f) (i) **Figure 1** shows the percentage of argon and the percentage of carbon dioxide in the air.



What is the percentage of argon in the air?

[1 mark]

Percentage of argon = %

1 (f) (ii) An instrumental method is used to measure the amount of carbon dioxide in the air.

Give **one** reason for using an instrumental method.

[1 mark]

.....

.....



2 This question is about salts.

2 (a) Salt (sodium chloride) is added to many types of food.

Sodium chloride is produced by reacting sodium with chlorine.

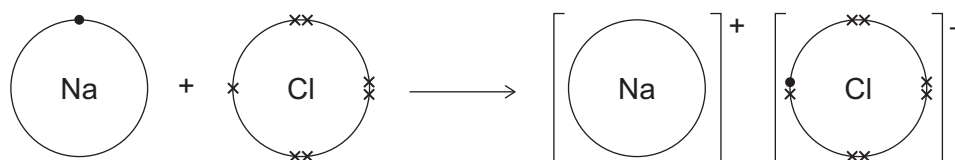


Figure 2 shows what happens to atoms of sodium and chlorine in this reaction.

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

Only the outer electrons are shown.

Figure 2



Describe, in terms of electrons, what happens when a sodium atom reacts with a chlorine atom to produce sodium chloride.

[3 marks]

.....

.....

.....

.....

.....

.....

Question 2 continues on the next page

Turn over ►



2 (b) Lack of iodine can affect the learning ability of children.

One idea is that salt (sodium chloride) should have iodine added.

2 (b) (i) Iodine consists of simple molecules.

What is a property of substances that have simple molecules?

[1 mark]

Tick (✓) **one** box.

Have no overall electric charge

☐

Have high boiling points

☐

Have giant covalent structures

☐

2 (b) (ii) Which one of the following questions cannot be answered by science alone?

[2 marks]

Tick (✓) **one** box.

How much sodium chloride is in food?

☐

What harm does a lack of iodine do?

☐

Should iodine be added to salt in food?

☐

Give **one** reason why this question cannot be answered by science alone.

.....

.....

2 (c) A student produced the salt ammonium nitrate by adding an acid to ammonia solution.

2 (c) (i) Name the acid used.

[1 mark]

.....



2 (c) (ii) Use the correct answer from the box to complete the sentence.

[1 mark]

an acid

an alkali

a salt

Ammonia solution (ammonium hydroxide) is

2 (c) (iii) The student added a few drops of a solution which changed colour when the reaction was complete.

Complete the sentence.

[1 mark]

The solution added is an

2 (d) Farmers buy solid ammonium nitrate in poly(ethene) sacks.

2 (d) (i) How is solid ammonium nitrate made from a solution of ammonium nitrate?

[1 mark]

Tick (✓) **one** box.

Crystallisation

☐

Decomposition

☐

Electrolysis

☐

2 (d) (ii) Why do farmers use ammonium nitrate on their fields?

[1 mark]

.....
.....

2 (d) (iii) The properties of poly(ethene) depend on the reaction conditions when it is made.

State **one** reaction condition that can be changed when making poly(ethene).

[1 mark]

.....
.....



3 Lead iodide is an insoluble salt.

3 (a) What type of substance is lead iodide?

[1 mark]

Tick (✓) **one** box.

An element

☐

A mixture

☐

A compound

☐

3 (b) A student produced lead iodide by a precipitation reaction.

Use the correct answers from the box to complete the word equation.

[2 marks]

lead bromide

lead nitrate

potassium bromide

potassium iodide

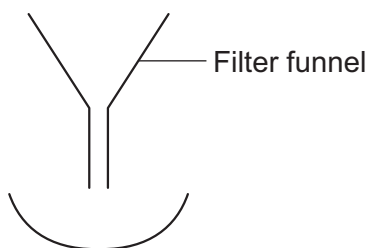
..... + $\longrightarrow$ lead iodide + potassium nitrate



- 3 (c)** The student wanted to separate the precipitate of lead iodide from the solution by using filtration.

The student used the apparatus shown in **Figure 3**.

Figure 3



Explain why the apparatus in **Figure 3** would **not** separate the lead iodide from the mixture.

[2 marks]

.....

.....

.....

.....

- 3 (d)** The student expected to get 5 g of lead iodide but only got 3 g.

- 3 (d) (i)** The student did this calculation.

$$\frac{3}{5} \times 100$$

Use the correct answer from the box to complete the sentence.

[1 mark]

mass of one mole

percentage yield

relative formula mass

The student calculated the

- 3 (d) (ii)** Give **one** reason why the mass the student got was less than expected.

[1 mark]

.....

.....

7

Turn over ►



4 This question is about electrolysis.

4 (a) Metal spoons can be coated with silver.
This is called electroplating.

Suggest **one** reason why spoons are electroplated.

[1 mark]

.....

.....

4 (b) When sodium chloride solution is electrolysed the products are hydrogen and chlorine.

4 (b) (i) What is made from chlorine?

[1 mark]

Tick (✓) **one** box.

Bleach

☐

Fertiliser

☐

Soap

☐

4 (b) (ii) Sodium chloride solution contains two types of positive ions, hydrogen ions (H^+) and sodium ions (Na^+).

Why is hydrogen produced at the negative electrode and **not** sodium?

[1 mark]

Tick (✓) **one** box.

Hydrogen is a gas.

☐

Hydrogen is less reactive than sodium.

☐

Hydrogen ions move faster than sodium ions.

☐

4 (b) (iii) Hydrogen and chlorine can be used to produce hydrogen chloride.

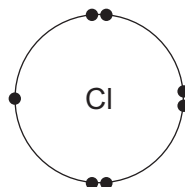
The diagrams in **Figure 4** show how the outer electrons are arranged in an atom of hydrogen and an atom of chlorine.

Figure 4

Hydrogen atom



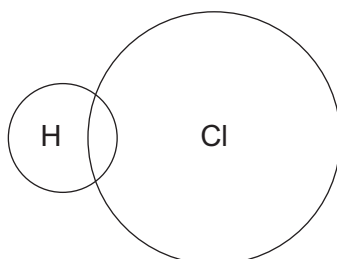
Chlorine atom



Complete **Figure 5** to show how the outer electrons are arranged in a molecule of hydrogen chloride (HCl).

[1 mark]

Figure 5



4 (b) (iv) What is the type of bond in a molecule of hydrogen chloride?

[1 mark]

Tick (✓) **one** box.

Covalent

☐

Ionic

☐

Metallic

☐

Question 4 continues on the next page

Turn over ►



4 (b) (v) Why is hydrogen chloride a gas at room temperature (20 °C)?

[2 marks]

Tick (✓) **two** boxes.

Hydrogen chloride has a low boiling point.

☐

Hydrogen chloride has a high melting point.

☐

Hydrogen chloride is made of simple molecules.

☐

Hydrogen chloride does not conduct electricity.

☐

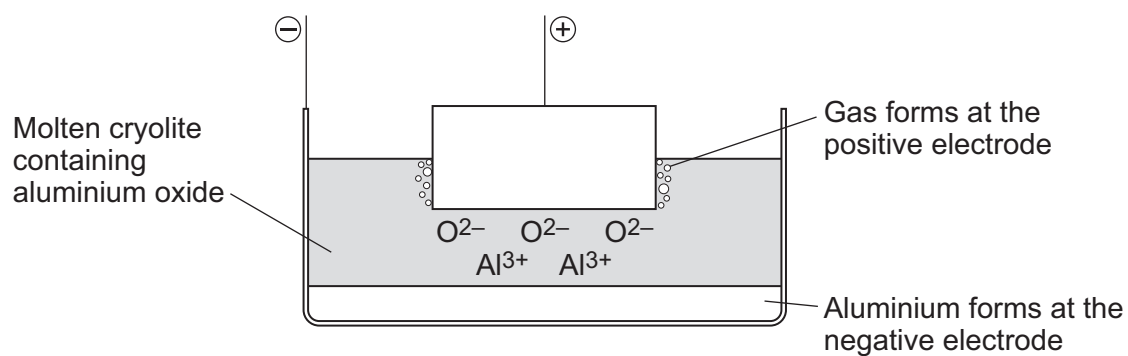
Hydrogen chloride has a giant structure.

☐

4 (c) Aluminium is produced by electrolysis of a molten mixture of aluminium oxide and cryolite.

This is shown in **Figure 6**.

Figure 6



4 (c) (i) Name a gas produced at the positive electrode.

[1 mark]

.....



4 (c) (ii) Aluminium ions move to the negative electrode.

Explain why.

[2 marks]

.....

.....

.....

.....

4 (c) (iii) At the negative electrode, the aluminium ions gain electrons to produce aluminium.

What is this type of reaction called?

[1 mark]

Tick (✓) **one** box.

Combustion

☐

Oxidation

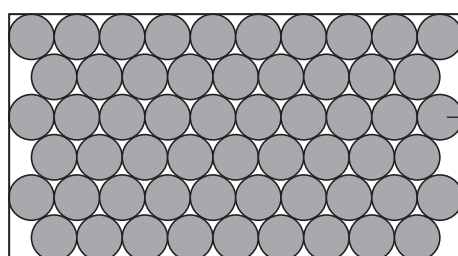
☐

Reduction

☐

4 (c) (iv) Aluminium has layers of atoms, as shown in **Figure 7**.

Figure 7



Aluminium
atom

Complete the sentence.

[1 mark]

Metals can be bent and shaped because the layers of atoms can

Question 4 continues on the next page

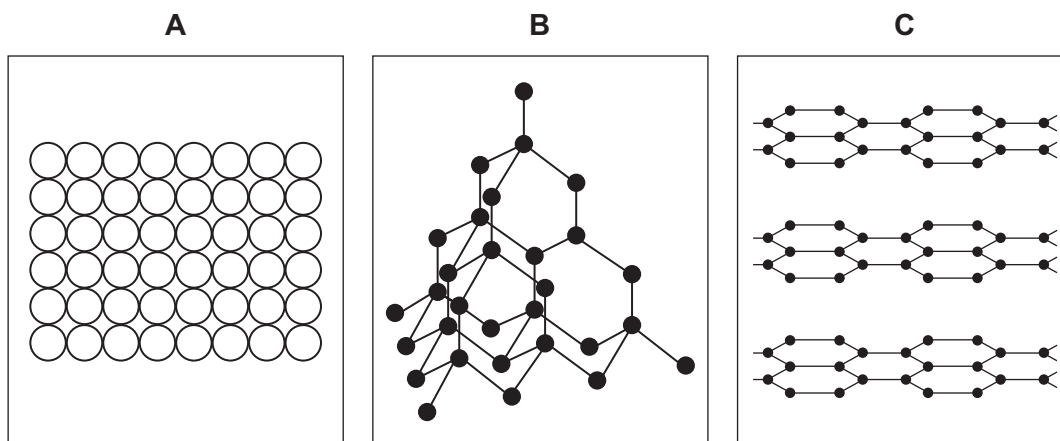
Turn over ►



4 (d) Electrodes used in the production of aluminium are made from graphite.

4 (d) (i) Which diagram, **A**, **B** or **C**, shows the structure of graphite?

[1 mark]



The structure of graphite is shown in diagram

4 (d) (ii) The temperature for the electrolysis is 950 °C.

Use the correct answer from the box to complete the sentence.

[1 mark]

cross links

a giant ionic lattice

strong covalent bonds

The graphite does not melt at 950 °C because

graphite has



Turn over for the next question

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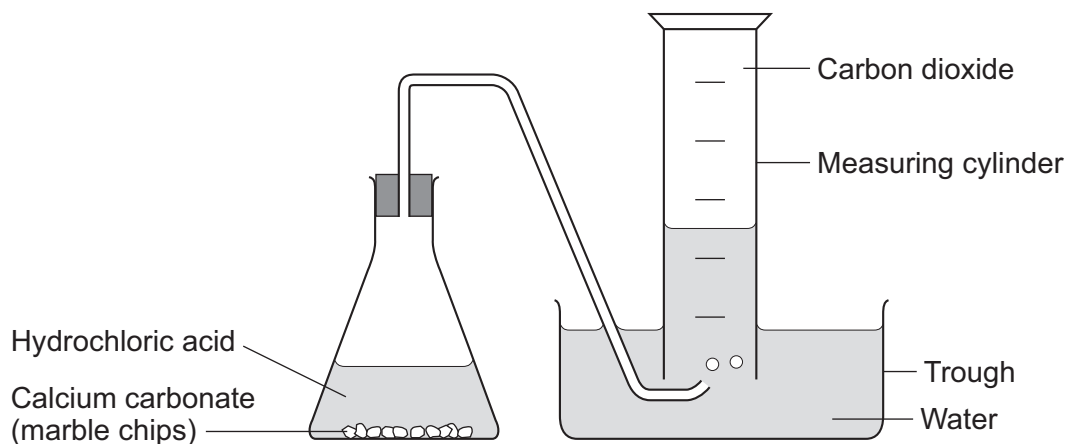
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- 5 A student investigated the rate of reaction between calcium carbonate (marble chips) and hydrochloric acid.

The student used the apparatus shown in **Figure 8**.

Figure 8



The student:

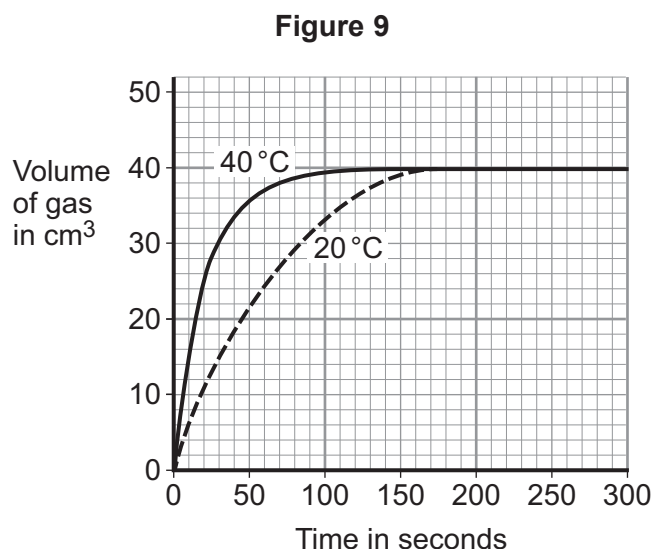
- recorded the volume of gas collected every 5 seconds
- repeated the experiment using hydrochloric acid at different temperatures.

The equation for the reaction is:



- 5 (a)** The student plotted results for the hydrochloric acid at 20 °C and 40 °C on a graph.

Figure 9 shows the student's graph.



Use information from **Figure 9** to answer these questions.

- 5 (a) (i)** State **one** conclusion the student could make about the effect of temperature on the rate of the reaction.

[1 mark]

.....

.....

- 5 (a) (ii)** Give **one** reason why the student could make this conclusion.

[1 mark]

.....

.....

- 5 (a) (iii)** For the hydrochloric acid at 60 °C the student had collected 30 cm³ after 15 seconds.

Calculate the average rate of reaction from 0 to 15 seconds.

[1 mark]

.....

.....

Rate of reaction = cm³ per second

Turn over ►



5 (b) The student then investigated how the surface area of marble chips affected the rate of reaction.

5 (b) (i) Which **two** variables should the student keep constant?

[2 marks]

Tick (✓) **two** boxes.

Amount of water in the trough

☐

Concentration of acid

☐

Mass of marble chips

☐

Size of marble chips

☐

Volume of measuring cylinder

☐

5 (b) (ii) Explain, in terms of particles and collisions, the effect that increasing the surface area of the marble chips has on the rate of reaction.

[2 marks]

.....

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5 (c) Calcium carbonate is a catalyst for the industrial production of biodiesel.

Give **one** reason why using a catalyst reduces costs.

[1 mark]

.....

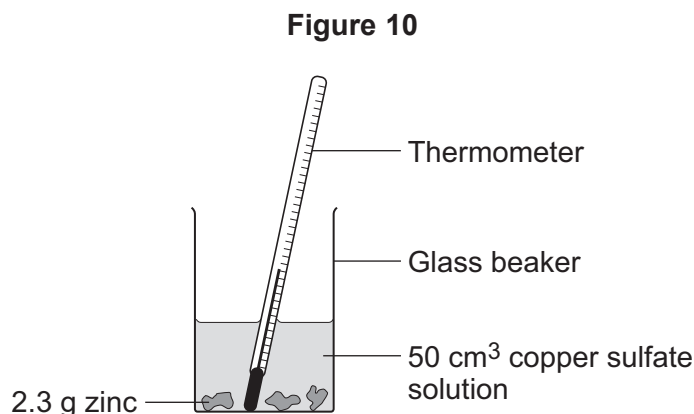
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- 6 A student investigated the temperature change when zinc reacts with copper sulfate solution.

The student used a different concentration of copper sulfate solution for each experiment.

The student used the apparatus shown in **Figure 10**.



The student:

- measured 50 cm³ copper sulfate solution into a glass beaker
- measured the temperature of the copper sulfate solution
- added 2.3 g zinc
- measured the highest temperature
- repeated the experiment using copper sulfate solution with different concentrations.

The equation for the reaction is:



zinc + copper sulfate solution $\longrightarrow$ copper + zinc sulfate solution

- 6 (a) The thermometer reading changes during the reaction.

Give **one** other change the student could **see** during the reaction.

[1 mark]

.....

.....

Question 6 continues on the next page

Turn over ►



6 (b) Suggest **one** improvement the student could make to the apparatus in **Figure 10**.

Give a reason why this improves the investigation.

[2 marks]

Improvement

.....

Reason

.....

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

The student's results are shown in **Table 2**.

Table 2

Experiment number	Concentration of copper sulfate in moles per dm ³	Increase in temperature in °C
1	0.1	5
2	0.2	10
3	0.3	12
4	0.4	20
5	0.5	25
6	0.6	30
7	0.7	35
8	0.8	35
9	0.9	35
10	1.0	35



Describe **and** explain the trends shown in the student's results.

[6 marks]

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Extra space

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9

END OF QUESTIONS



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