

Specimen Paper

Centre Number						Candidate Number					
Surname											
Other Names											
Candidate Signature											



General Certificate of Secondary Education
Foundation Tier

Additional Science

Unit Chemistry C2

Chemistry

Unit Chemistry C2

Chemistry 2F

F

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
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.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 8 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** 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.

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

An alloy is a mixture of

metals.
molecules.
non-metals.

(1 mark)

- 1 (b)** Pure copper can be quite easily bent out of shape.

Which **two** statements in the table explain why copper can be bent?

Tick (✓) **two** boxes.

Statements	Tick (✓)
Copper atoms are arranged in layers.	
Copper atoms are joined by strong covalent bonds.	
Copper atoms can slide over each other.	
Copper is made of small molecules.	

(2 marks)

1 (c) Which **one** statement in the table explains why bronze is harder than pure copper?

Tick (✓) **one** box.

Statements	Tick (✓)
The copper and tin atoms are the same size.	
The layers of atoms are distorted in bronze.	
The copper and tin atoms are joined by strong covalent bonds in bronze.	

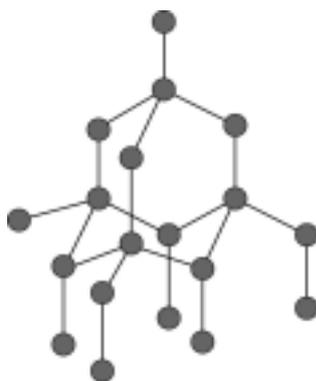
(1 mark)

4

Turn over for the next question

Turn over ►

2 The diagram shows how the atoms are joined in part of a diamond.



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

2 (a) (i) Diamond has a high melting point because

some
a few
all

 of the atoms are joined by strong bonds.

(1 mark)

2 (a) (ii) Each atom is joined to

one
two
four

 other atoms.

(1 mark)

2 (a) (iii) The bonds are

covalent.
ionic.
metallic.

(1 mark)

2 (a) (iv) Diamond is used in cutting tools because it is

hard.
soft.
shiny.

(1 mark)

2 (b) Diamond is made of carbon.

Name a gas produced when carbon reacts with oxygen.

.....

(1 mark)

5

Turn over for the next question

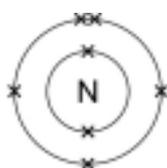
Turn over ►

3 (a) Ammonia has the formula NH_3 . It is made from nitrogen and hydrogen.

How many atoms are in an ammonia molecule?

(1 mark)

3 (b) The diagrams show the electron arrangement in nitrogen and hydrogen.

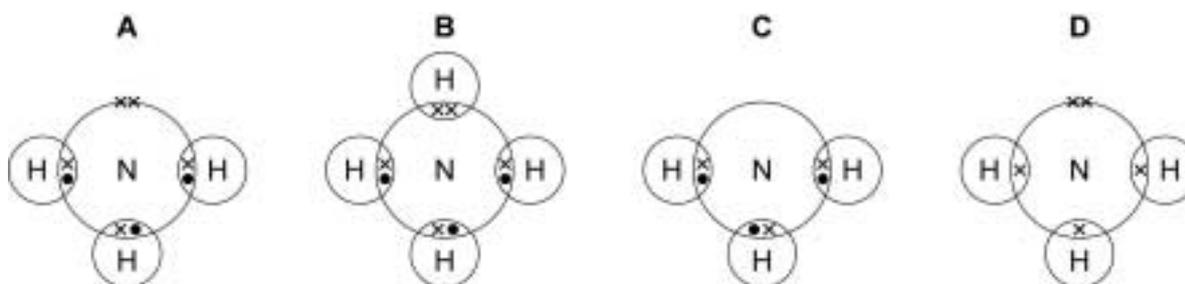


Nitrogen



Hydrogen

Which diagram below, **A**, **B**, **C** or **D**, represents an ammonia molecule?



Write your answer in the box.

Diagram

(1 mark)

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

What does this pH value tell you about ammonia solution?

.....

(1 mark)

3 (d) In industry a large amount of ammonia is neutralised by an acid to make ammonium nitrate.

3 (d) (i) What type of substance is ammonium nitrate?

Tick (✓) **one** box.

acid

alkali

base

salt

(1 mark)

3 (d) (ii) Which acid is added to ammonia to make ammonium nitrate?

Tick (✓) **one** box.

hydrochloric

citric

nitric

sulfuric

(1 mark)

3 (d) (iii) Draw a ring around the main use of ammonium nitrate.

fertiliser

lubricating oil

medicine

plastic

(1 mark)

Question 3 continues on the next page

Turn over ►

3 (e) Instant cold packs are used to treat sports injuries.



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

The outer bag is squeezed so that the inner bag bursts. The ammonium nitrate dissolves in the water. This process is endothermic.

Explain why the bag becomes cold.

.....

.....

.....

.....

(2 marks)

8

- 4 Read the information in the box and then answer the questions.

Sun Creams

Sun creams contain titanium oxide. This compound absorbs harmful radiation.

Traditional sun creams contain normal-sized particles of titanium oxide. Normal-sized particles of titanium oxide are known to be safe to put on the skin.

Many new sun creams contain nano-sized particles of titanium oxide.

Experiments suggest that nano-sized particles might pass through the pores of the skin more easily than normal-sized particles.

- 4 (a) Explain why nano-sized particles might pass more easily through the pores of the skin than normal sized particles.

.....
.....

(1 mark)

- 4 (b) Using these sun creams is beneficial because they absorb harmful radiation.
Suggest **one** possible risk of using these sun creams.

.....
.....

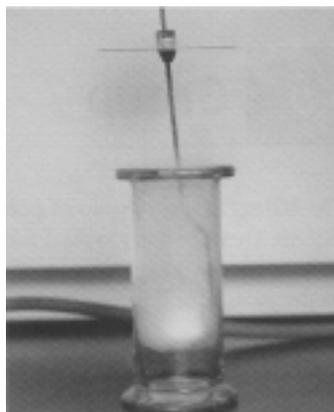
(1 mark)

2

Turn over for the next question

Turn over ►

- 5 The picture shows sodium reacting with chlorine. The reaction forms sodium chloride.



- 5 (a) Use words from the box to answer the questions.

compound	element	hydrocarbon	mixture
----------	---------	-------------	---------

Which word best describes:

- 5 (a) (i) sodium

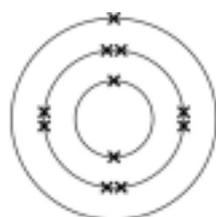
(1 mark)

- 5 (a) (ii) sodium chloride?

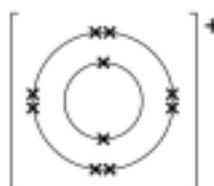
(1 mark)

- 5 (b) When sodium reacts with chlorine the sodium atoms change into sodium ions.

The diagrams below represent a sodium atom and a sodium ion.



Sodium atom (Na)



Sodium ion (Na⁺)

Use the diagrams to help you explain how a sodium atom turns into a sodium ion.

.....

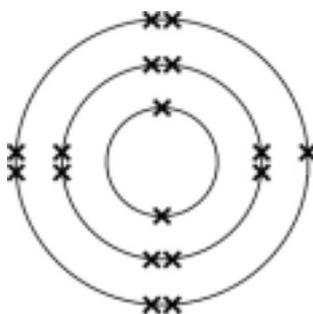
.....

.....

.....

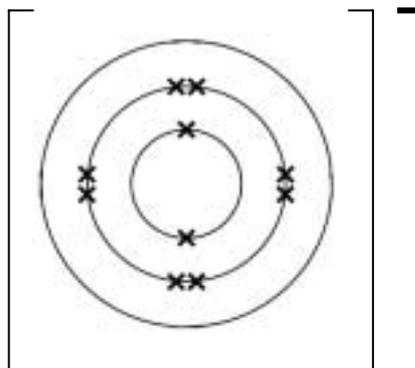
(2 marks)

5 (c) (i) The diagram below represents a chlorine atom.



When chlorine reacts with sodium the chlorine forms negative chloride ions.

Complete the diagram below to show the outer electrons in a chloride ion (Cl^-).



(1 mark)

5 (c) (ii) Chloride ions are strongly attracted to sodium ions in sodium chloride.

Explain why.

.....

.....

(1 mark)

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

The equation shows a method of removing chromium ions from water.



- 6 (a)** This type of reaction is called a precipitation reaction.

Describe what happens in a precipitation reaction

.....
.....

(1 mark)

- 6 (b)** Complete the name of the substance with the formula NaOH.

Sodium

(1 mark)

- 6 (c)** Draw a ring around the method that could be used to separate the $\text{Cr}(\text{OH})_3(\text{s})$ from the water.

electrolysis

filtration

neutralisation

oxidation

(1 mark)

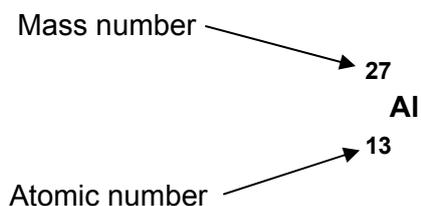
- 6 (d)** It is important to remove chromium ions from water before it is returned to a river.

Suggest why.

.....
.....

(1 mark)

- 7 (a) An atom of aluminium can be represented as shown below.



In this atom of aluminium the number of protons is and
 the number of neutrons is

(2 marks)

- 7 (b) Which statement in the table below describes the mass of an electron?

Tick (✓) **one** box.

Statement	Tick (✓)
Electrons have a very small mass compared to protons.	
Electrons have about the same mass as protons.	
Electrons are much heavier than protons.	
Electrons have about the same mass as neutrons.	

(1 mark)

- 7 (c) Which method is used to extract aluminium from aluminium oxide?

Tick (✓) **one** box.

Method	Tick (✓)
Heating aluminium oxide.	
Heating aluminium oxide with carbon.	
Electrolysis of molten aluminium oxide.	
Heating aluminium oxide with copper.	

(1 mark)

4

Turn over ►

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

Copper sulfate crystals can be made from copper oxide and dilute sulfuric acid.



Describe a method to make copper sulfate crystals from copper oxide and dilute sulfuric acid.

For the method you should include:

- the names of the pieces of apparatus used
- a risk assessment.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6 marks)

6

Turn over for the next question

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

Turn over ►

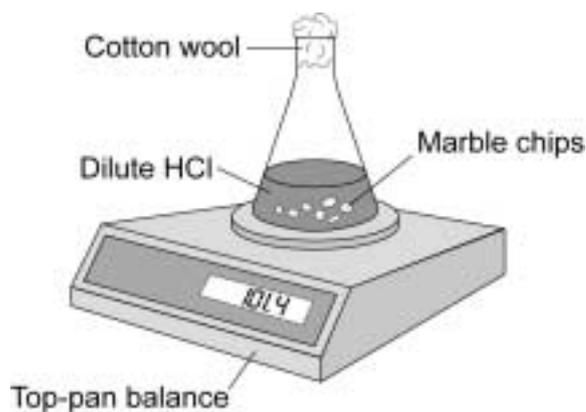
9 A student investigated the rate of reaction between marble and hydrochloric acid.

The student used an excess of marble.

The reaction can be represented by this equation:

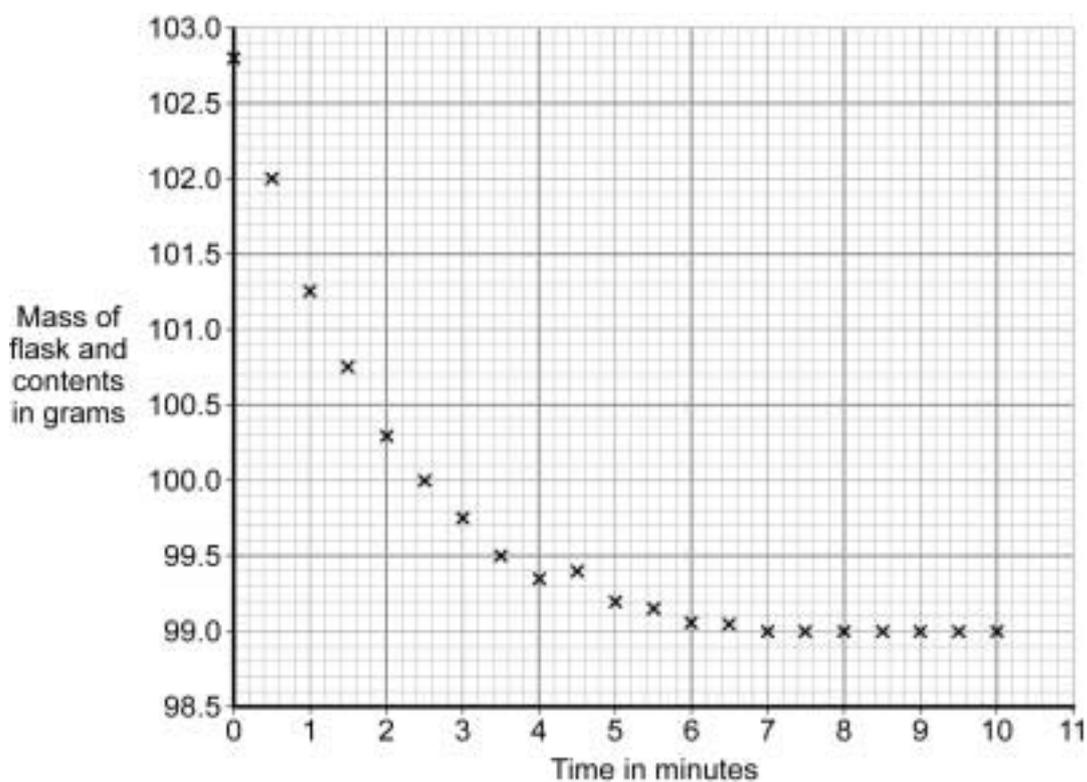


The student used the apparatus shown in the diagram.



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.



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

(1 mark)

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

..... grams

(1 mark)

9 (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.

.....

.....

.....

.....

(2 marks)

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

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

.....

.....

.....

.....

(2 marks)

Question 9 continues on the next page

Turn over ►

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

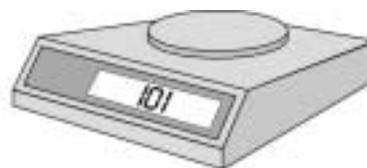
9 (c) (i) Which balance, **A**, **B**, or **C**, has the highest resolution?



Balance A



Balance B



Balance C

The balance with the highest resolution is balance .

(1 mark)

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

Explain why.

.....

.....

.....

.....

(2 marks)

9 (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.

.....

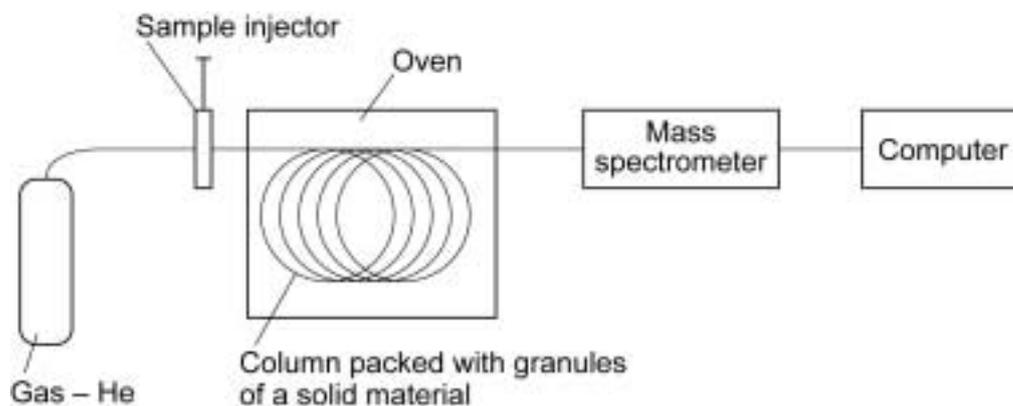
.....

.....

.....

(2 marks)

- 10** 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.

- 10 (a)** In which part of the apparatus:

10 (a) (i) is the mixture separated?
(1 mark)

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

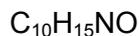
.....
(1 mark)

Question 10 continues on the next page

Turn over ►

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

Ephedrine has the formula:



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.

.....

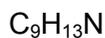
.....

.....

.....

Relative molecular mass =
(2 marks)

- 10 (b) (ii)** Another drug is amphetamine which has the formula:



The relative molecular mass (M_r) of amphetamine is 135.

Calculate the percentage by mass of nitrogen in amphetamine.

Relative atomic mass: N = 14

.....

.....

Percentage of nitrogen = %
(2 marks)

10 (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.

.....

.....

.....

.....

(2 marks)

10 (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.

.....

.....

.....

.....

(2 marks)

10

END OF QUESTIONS

Turn over ►

There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

ACKNOWLEDGEMENT OF COPYRIGHT HOLDERS AND PUBLISHERS

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements in future papers if notified.

Question 1: Photograph © O.Louis Mazzatenta / Getty Images

Copyright © 2011 AQA and its licensors. All rights reserved.