Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Secondary Education
June 2008

ADDITIONAL SCIENCE
Unit Chemistry C2

CHY2F

F

CHEMISTRY
Unit Chemistry C2

Foundation Tier

Thursday 5 June 2008 9.00 am to 9.45 am

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

You may use a calculator.

Time allowed: 45 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 spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 45.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Advice
- In all calculations, show clearly how you work out your answer.

For Examiner's Use			
Question	Mark	Question	Mark
1		7	
2		8	
3			
4			
5			
6			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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

1 This label was taken from a cola drink.

The pH of this drink is 2.5.

1 (a) (i) Which **one** of the ingredients in the cola drink causes the low pH?

.....

(1 mark)

1 (a) (ii) Draw a ring around the name of the ion that gives the cola drink its low pH.

chloride **hydrogen** **hydroxide** **sodium**

(1 mark)

1 (b) The preservative used in the cola drink is sodium benzoate.
Sodium benzoate is made using two chemical reactions.

Reaction 1
Methylbenzene is reacted with oxygen, with the help of a catalyst, to form benzoic acid.

Reaction 2
Benzoic acid is neutralised by sodium hydroxide solution to form sodium benzoate and water.

1 (b) (i) How does the catalyst help **reaction 1**?

.....

.....

(1 mark)

1 (b) (ii) **Reaction 1** has a high atom economy.

The table lists several statements. Put a tick (✓) next to the **one** statement which best describes a high atom economy.

Statement	(✓)
All the atoms used are cheap.	
Most of the starting materials end up as useful products.	
Only a small number of atoms are used in the reaction.	

(1 mark)

1 (b) (iii) **Reaction 2** is a neutralisation reaction.

Complete the equation by writing the formula of the product.

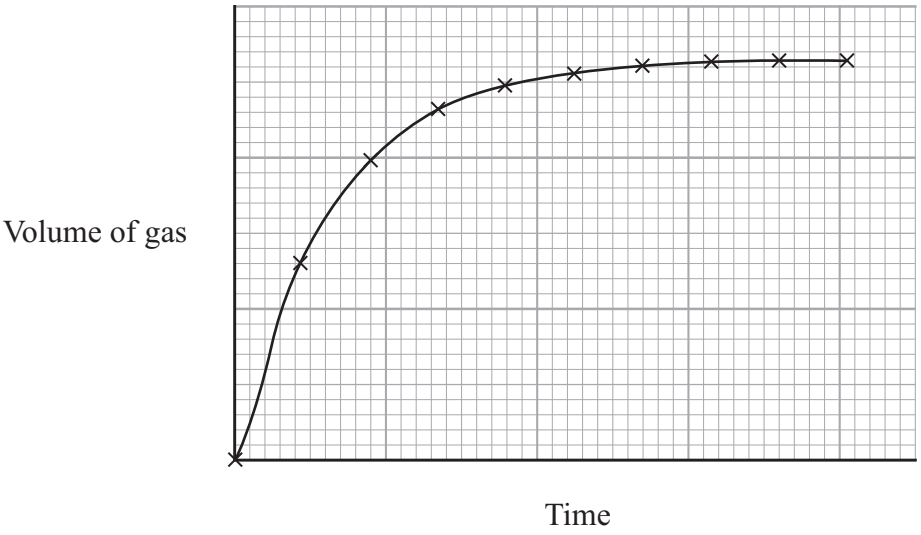
$H^+ + OH^- \rightarrow$ .....

(1 mark)

5

2 Pieces of zinc react with dilute acid to form hydrogen gas.

The graph shows how the volume of hydrogen gas produced changes with time.



2 (a) Describe, as fully as you can, how the volume of gas produced changes with time.

.....

.....

.....

.....

(2 marks)

2 (b) A student wants to make the reaction take place faster.
Some suggestions are given in the table.

Put ticks (✓) next to the **two** suggestions that would make the reaction take place faster.

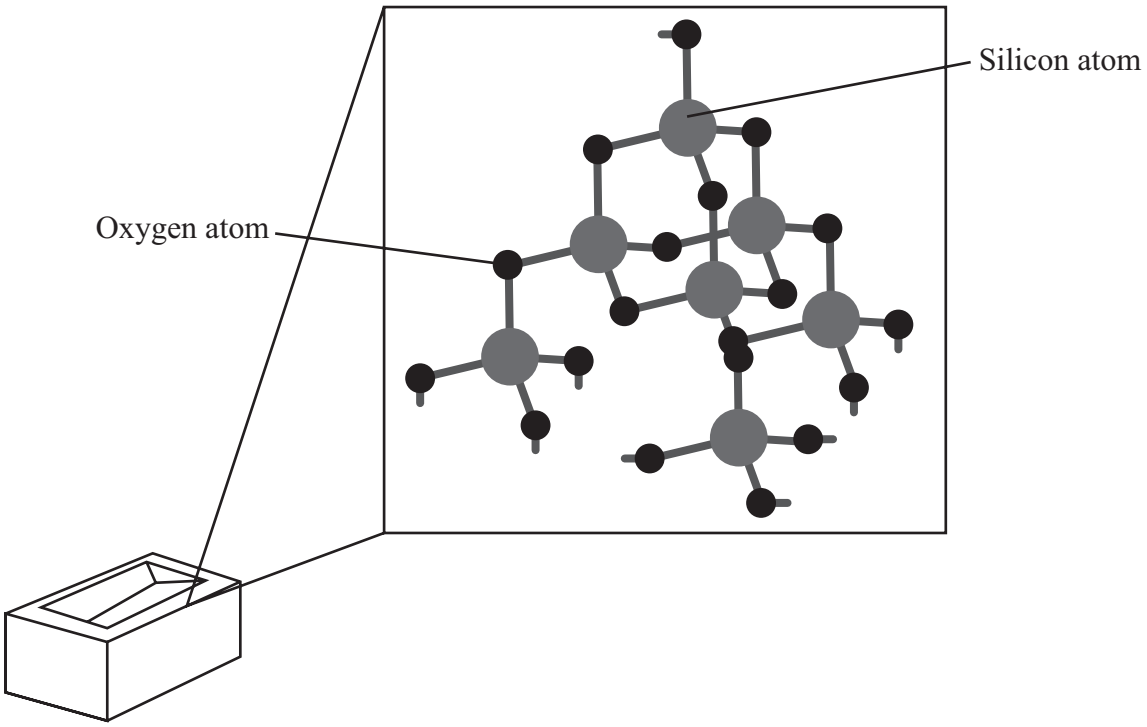
Suggestions	(✓)
Use bigger pieces of zinc.	
Use a more concentrated acid.	
Use zinc powder.	
Decrease the temperature of the acid.	

(2 marks)

4

3 Bricks made from silica (silicon dioxide) are used to line furnaces that operate at high temperatures.

Part of the structure of silica is shown in the diagram.



Use words from the box to complete the sentences.

covalent	**giant**	**low**	**small**
four	**high**	**six**	**weak**

One reason for using silica to make bricks for high-temperature furnaces is that silica has a

..... melting point.

Silica has this property because it is a ..... structure in which each silicon atom is joined to ..... oxygen atoms by ..... bonds.

(4 marks)

4

4 Instant cold packs are used to treat sports injuries.

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

The outer bag is squeezed so that the inner bag bursts. The pack is shaken and quickly gets very cold as the ammonium nitrate dissolves in the water.

4 (a) **One** of the statements in the table is correct.

Put a tick (✓) next to the correct statement.

Statement	(✓)
The bag gets cold because heat energy is given out to the surroundings.	
The bag gets cold because heat energy is taken in from the surroundings.	
The bag gets cold because plastic is a good insulator.	

(1 mark)

4 (b) Draw a ring around the word that best describes the change when ammonium nitrate dissolves in water.

electrolysis **endothermic** **exothermic**

(1 mark)

4 (c) Suggest and explain why the pack is shaken after the inner bag has burst.

.....

.....

.....

.....

(2 marks)

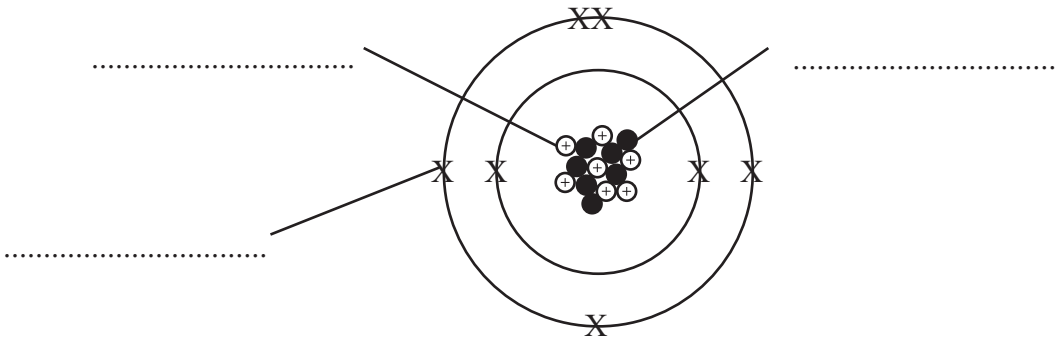
4

Turn over for the next question

5 (a) The diagram represents an atom of nitrogen.

5 (a) (i) Use words from the box to label the diagram.

electron	**neutron**	**nucleus**	**proton**



(2 marks)

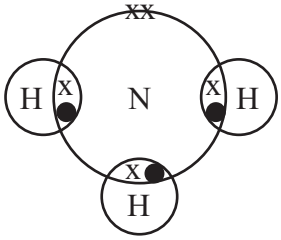
5 (a) (ii) Draw a ring around the mass number of this atom.

5 **7** **14** **21**

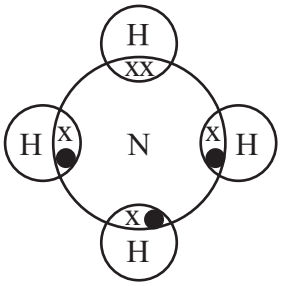
(1 mark)

5 (b) Nitrogen can react with hydrogen to make ammonia, NH_3.

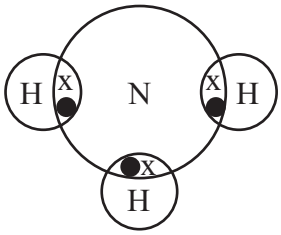
A



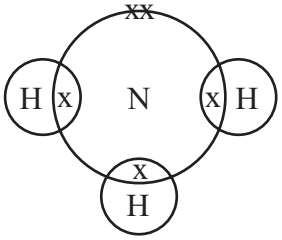
B



C



D



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

(1 mark)

5 (c) Ammonia is made using the Haber process. The word equation for this reaction is shown below.

nitrogen + hydrogen $\rightleftharpoons$ ammonia

5 (c) (i) Which **two** of the statements in the table do you know are true **only** by looking at the word equation?

Put a tick (✓) next to these **two** true statements.

Statement	(✓)
The reaction is very fast.	
Ammonia can break up to form nitrogen and hydrogen.	
Ammonia is made from nitrogen and hydrogen.	
The reaction that makes ammonia is endothermic.	

(2 marks)

5 (c) (ii) Draw a ring around the name of the raw material from which nitrogen is obtained.

air **methane** **oil** **water**

(1 mark)

5 (d) Some of the ammonia produced is neutralised by nitric acid to make a salt. This salt is used as a fertiliser.

Put a tick (✓) next to the name of the salt produced when ammonia is neutralised with nitric acid.

Name of salt	(✓)
ammonia nitrate	
ammonia nitride	
ammonium nitrate	
ammonium nitride	

(1 mark)

8

Turn over ▶

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

6 Read the article about the use of nanoparticles in sun creams.

Sun creams

Many sun creams use nanoparticles. These sun creams are very good at absorbing radiation, especially ultraviolet radiation. Owing to the particle size, the sun creams spread more easily, cover better and save money because you use less. The new sun creams are also transparent, unlike traditional sun creams which are white. The use of nanoparticles is so successful that they are now used in more than 300 sun cream products.

Some sun creams contain nanoparticles of titanium oxide. Normal-sized particles of titanium oxide are safe to put on the skin.

It is thought that nanoparticles can pass through the skin and travel around the body more easily than normal-sized particles. It is also thought that nanoparticles might be toxic to some types of cell, such as skin, bone, brain and liver cells.

6 (a) (i) How is the size of nanoparticles different from normal-sized particles of titanium oxide?

.....

(1 mark)

6 (a) (ii) Suggest how the size of nanoparticles might help them to enter the body more easily.

.....

.....

(1 mark)

6 (b) Give **two** advantages of using nanoparticles in sun creams.

1 .....

.....

2 .....

.....

(2 marks)

6 (c) Why might nanoparticles be dangerous inside the body?

.....

.....

(1 mark)

5

Turn over ▶

7 Toothpastes often contain fluoride ions to help protect teeth from attack by bacteria.

Some toothpastes contain tin(II) fluoride.

This compound has the formula SnF_2.

7 (a) Calculate the relative formula mass (M_r) of SnF_2.
Relative atomic masses: F = 19; Sn = 119

.....

.....

.....

.....

Relative formula mass (M_r) = ...

(2 marks)

7 (b) Calculate the percentage by mass of fluorine in SnF_2.

.....

.....

.....

.....

Percentage by mass of fluorine = ... %

(2 marks)

7 (c) A tube of toothpaste contains 1.2 g of SnF_2.

Calculate the mass of fluorine in this tube of toothpaste.

.....

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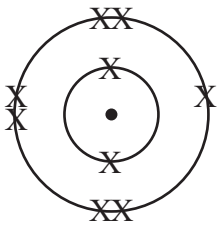
.....

.....

Mass of fluorine = ... g

(1 mark)

7 (d) The diagram represents the electron arrangement of a fluorine atom.



Explain how a fluorine atom can change into a fluoride ion, F^-.

.....

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(2 marks)

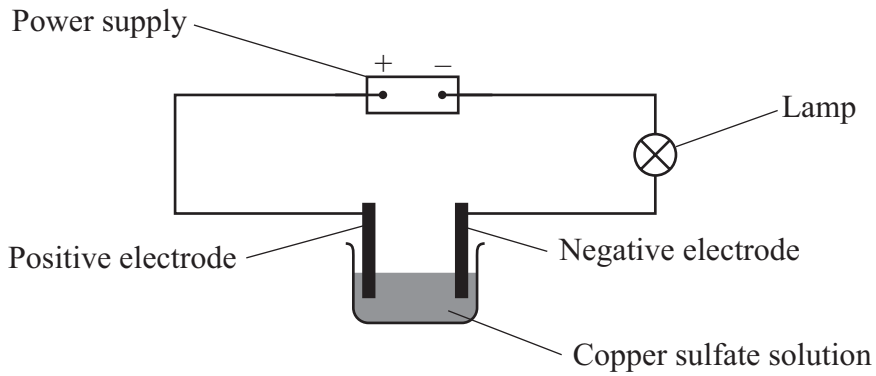
7

Turn over for the next question

8 A student investigated the electrolysis of copper sulfate solution.
The student's method is shown in the box.

Two clean pieces of copper were weighed. One piece was used as the positive electrode and the other piece was used as the negative electrode.

The circuit was set up as shown in the diagram.



After the electrolysis, the pieces of copper were:

- washed with distilled water
- washed with propanone (a liquid with a lower boiling point than water)
- allowed to dry
- weighed.

8 (a) Explain why the electrode would dry faster when washed with propanone instead of water.

.....

.....

(1 mark)

8 (b) The student's results are given in the table.

	Positive electrode	**Negative electrode**
mass of electrode before electrolysis, in grams	16.41	15.46
mass of electrode after electrolysis, in grams	16.10	15.75

The mass of the positive electrode decreased by 0.31 g.

8 (b) (i) What is the change in mass of the negative electrode? ..... g

(1 mark)

8 (b) (ii) The mass lost by the positive electrode should equal the mass gained by the negative electrode.

Suggest **two** reasons why the results were **not** as expected.

1 .....

.....

2 .....

.....

(2 marks)

8 (c) Describe and explain how electrolysis is used to make pure copper from a lump of impure copper.

.....

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.....

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.....

.....

.....

(4 marks)

8

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

ASSESSMENT and QUALIFICATIONS ALLIANCE

Data Sheet

1. Reactivity Series of Metals

Potassium	most reactive
Sodium	↑
Calcium	
Magnesium	
Aluminium	
Carbon	
Zinc	
Iron	
Tin	
Lead	
Hydrogen	
Copper	
Silver	
Gold	↓
Platinum	least reactive

(elements in italics, though non-metals, have been included for comparison)

2. Formulae of Some Common Ions

Positive ions		Negative ions	
Name	Formula	Name	Formula
Hydrogen	H^+	Chloride	Cl^-
Sodium	Na^+	Bromide	Br^-
Silver	Ag^+	Fluoride	F^-
Potassium	K^+	Iodide	I^-
Lithium	Li^+	Hydroxide	OH^-
Ammonium	NH_4^+	Nitrate	NO_3^-
Barium	Ba^{2+}	Oxide	O^{2-}
Calcium	Ca^{2+}	Sulfide	S^{2-}
Copper(II)	Cu^{2+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}	Carbonate	CO_3^{2-}
Zinc	Zn^{2+}		
Lead	Pb^{2+}		
Iron(II)	Fe^{2+}		
Iron(III)	Fe^{3+}		
Aluminium	Al^{3+}		

Turn over ▶

3. The Periodic Table of Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112 – 116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

Cu and **Cl** have not been rounded to the nearest whole number.