Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Secondary Education
January 2008

ADDITIONAL SCIENCE
Unit Chemistry C2

CHY2F

F

CHEMISTRY
Unit Chemistry C2

Foundation Tier

Friday 18 January 2008 1.30 pm to 2.15 pm

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

You may use a calculator.

Time allowed: 45 minutes

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- 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.

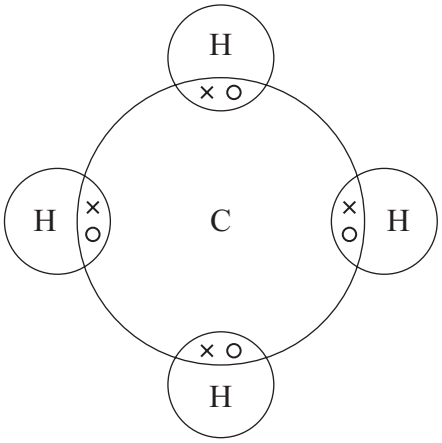
For Examiner's Use			
Question	Mark	Question	Mark
1		6	
2		7	
3		8	
4			
5			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

There are no questions printed on this page

LEAVE MARGIN BLANK

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

1 The diagram represents a particle of methane.



(a) What is the formula of methane? .....

(1 mark)

(b) Choose a word from the box to answer the question.

atom	**ion**	**molecule**

Which of the words best describes the methane particle shown in the diagram?

.....

(1 mark)

(c) Choose a word from the box to answer the question.

covalent	**ionic**	**metallic**

What is the type of bonding shown in the diagram?

.....

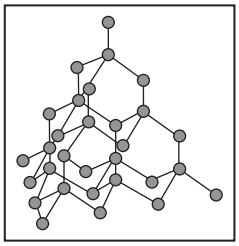
(1 mark)

3

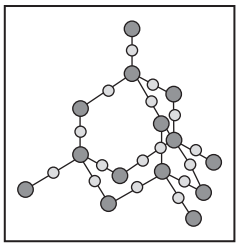
2 This question is about giant structures. Diamond, graphite and silicon dioxide all have giant structures.

(a) The diagrams show the structures of these three substances.

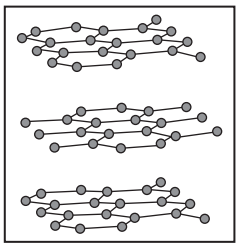
Draw a line from each structure to its name.



Silicon dioxide



Graphite



Diamond

(2 marks)

(b) Complete the sentences using words from the box.

covalent	**four**	**hard**	**ionic**
shiny	**soft**	**three**	**two**

(i) Diamond, graphite and silicon dioxide have high melting points because all the atoms in their structures are joined by strong ..... bonds.
(1 mark)

(ii) In diamond each atom is joined to ..... other atoms.
(1 mark)

(iii) Diamond can be used to make cutting tools because it has a rigid structure which makes it very ..... .
(1 mark)

(iv) In graphite each atom is joined to ..... other atoms.
(1 mark)

(v) Graphite can be used to make pencils because it has a structure which makes it ..... .
(1 mark)

(c) When a diamond is heated to a high temperature and then placed in pure oxygen it burns. Carbon dioxide is the only product.

Name the element in diamond. .....
(1 mark)

8

Turn over for the next question

3 Distress flares are used to attract attention in an emergency.

Flares often contain magnesium. Magnesium burns to form magnesium oxide.

(a) The distress flare burns with a bright flame because the reaction is very *exothermic*.

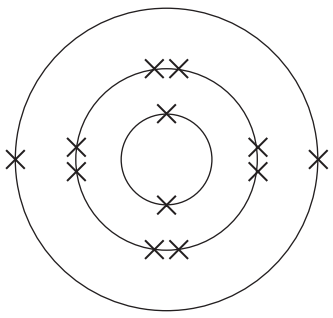
Complete the following sentence using the correct words from the box.

gives out heat	**stores heat**	**takes in heat**

An *exothermic* reaction is one which ..... .

(1 mark)

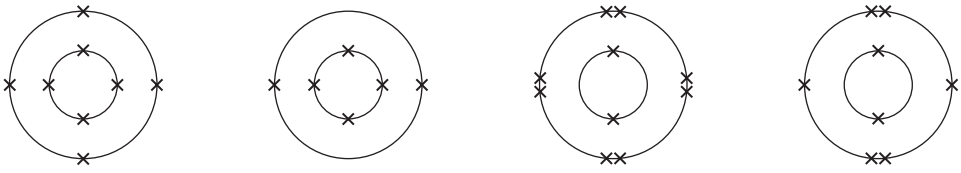
(b) The diagram shows the electronic structure of a magnesium atom.
The atomic (proton) number of magnesium is 12.



Magnesium atom

The atomic (proton) number of oxygen is 8.

Which diagram, **A**, **B**, **C** or **D**, shows the electronic structure of an oxygen atom?

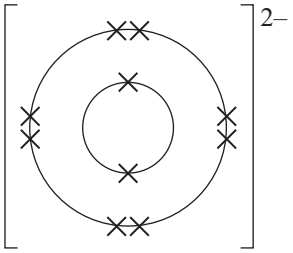


A **B** **C** **D**

Diagram .....

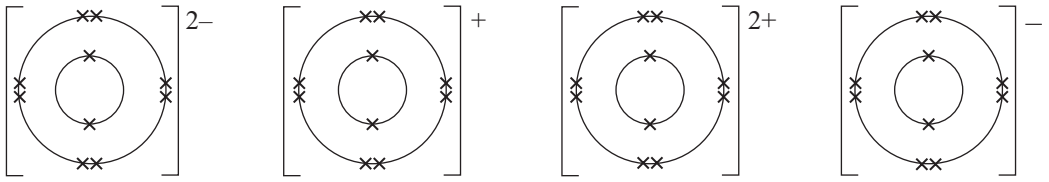
(1 mark)

(c) Magnesium ions and oxide ions are formed when magnesium reacts with oxygen. The diagram shows the electronic structure of an oxide ion.



Oxide ion

Which diagram, **J**, **K**, **L** or **M**, shows the electronic structure of a magnesium ion?



J **K** **L** **M**

Diagram .....

(1 mark)

(d) Indigestion tablets can be made from magnesium oxide. The magnesium oxide neutralises some of the hydrochloric acid in the stomach.

Draw a ring around the name of the salt formed when magnesium oxide reacts with hydrochloric acid.

magnesium chloride **magnesium hydroxide** **magnesium sulfate**

(1 mark)

4

4 The electrolysis of sodium chloride solution produces useful substances.

(a) (i) Choose a word from the box to complete the sentence.

covalent	**ionic**	**non-metallic**

Electrolysis takes place when electricity passes through ..... compounds when they are molten or in solution.

(1 mark)

(ii) Choose a word from the box to complete the sentence.

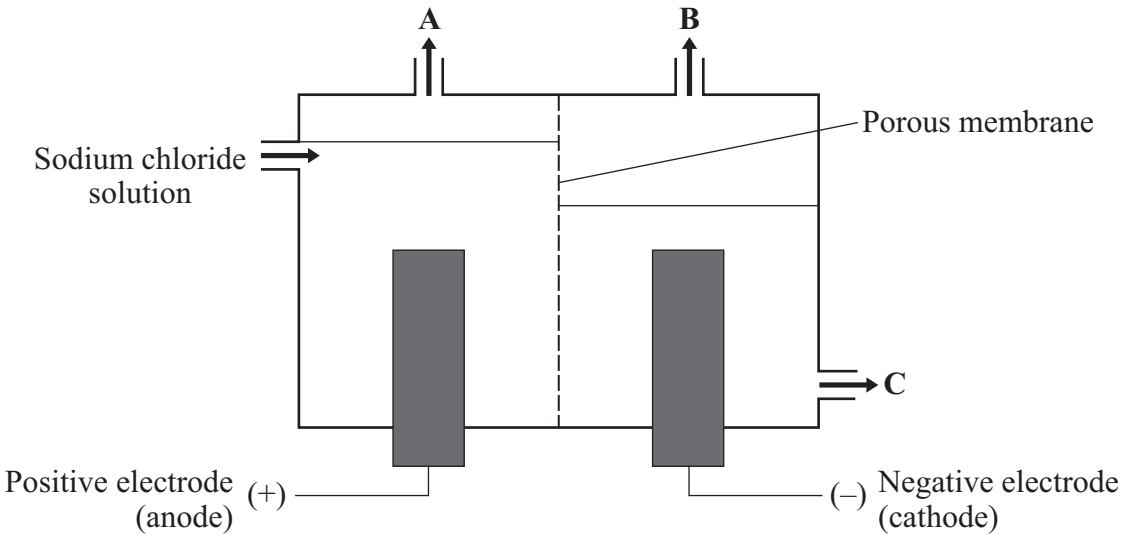
alkenes	**elements**	**salts**

During electrolysis the compound is broken down to form ..... .

(1 mark)

(b) The table of ions on the Data Sheet may help you to answer this question.

The diagram shows an apparatus used for the electrolysis of sodium chloride solution.



Identify the products **A**, **B** and **C** on the diagram using substances from the box.

chlorine gas	**hydrogen gas**	**oxygen gas**
sodium hydroxide solution		**sodium metal**

(i) **A** is ..... .
(1 mark)

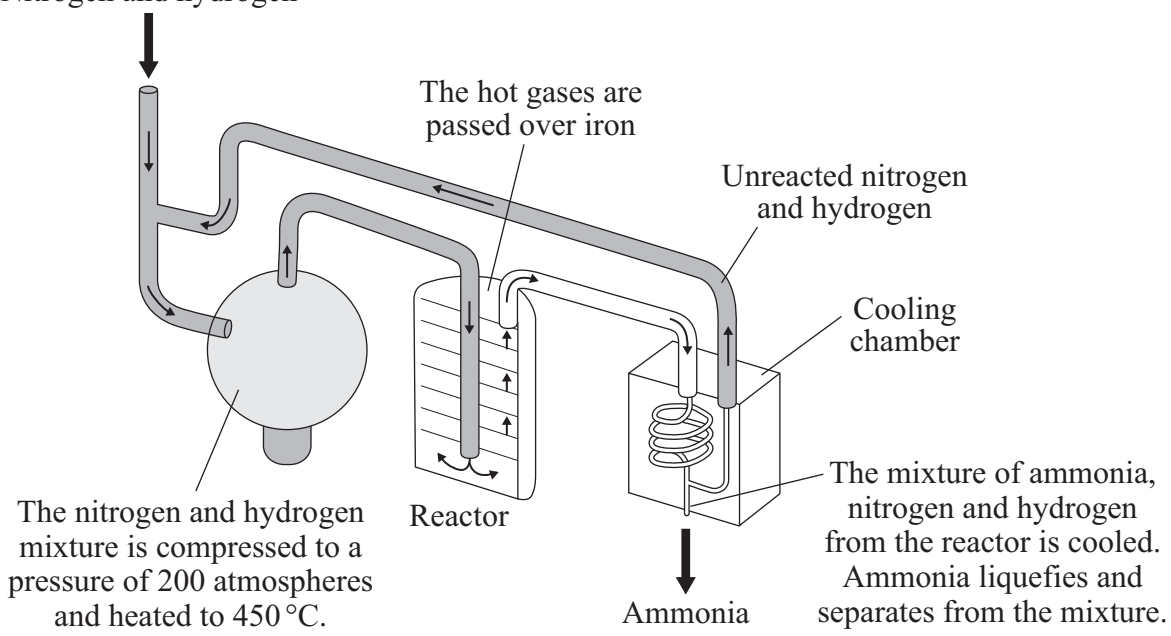
(ii) **B** is ..... .
(1 mark)

(iii) **C** is ..... .
(1 mark)

5

Turn over for the next question

5 The Haber process is named after the German chemist, Fritz Haber.
The diagram shows the main stages in the Haber process.



(a) Use the diagram to help you to answer these questions.

(i) Complete the word equation for the reaction that takes place in the reactor.

nitrogen + ... $\rightleftharpoons$ .....

(1 mark)

(ii) What does the symbol $\rightleftharpoons$ mean?

.....

(1 mark)

(iii) What is the purpose of the iron in the reactor?

.....

(1 mark)

(iv) Ammonia is separated from unreacted nitrogen and hydrogen.
Draw a ring around the physical property that allows this separation to take place.

boiling point **density** **melting point**

(1 mark)

(v) What is done with the unreacted nitrogen and hydrogen?

.....

(1 mark)

(b) Some of the products that can be made from ammonia are:

- fertilisers
- dyes
- explosives
- medicines
- plastics

(i) The Haber process was invented a few years before the start of the First World War. It is thought that the First World War would have finished earlier if the Germans had **not** invented the Haber process.

Suggest why.

.....

.....

(1 mark)

(ii) The Haber process has helped to increase food production.

Explain why.

.....

.....

(1 mark)

(c) Factories that make ammonia are very large and operate night and day.

(i) Ammonia factories are often near towns.

Suggest why.

.....

(1 mark)

(ii) Suggest and explain **one** reason why local people might not want an ammonia factory near their town.

.....

.....

.....

.....

(2 marks)

10

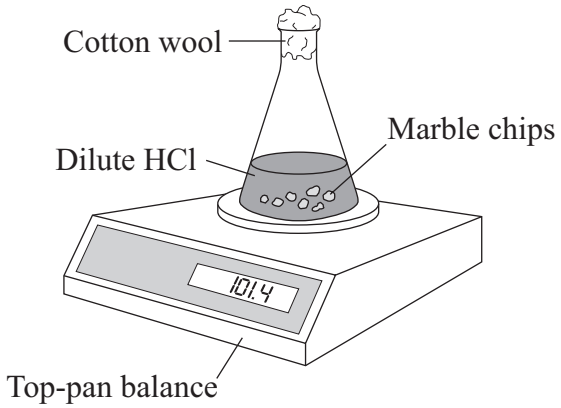
6 A student investigated the rate of reaction between marble and hydrochloric acid.

The student used an excess of marble.

The reaction can be represented by this equation.

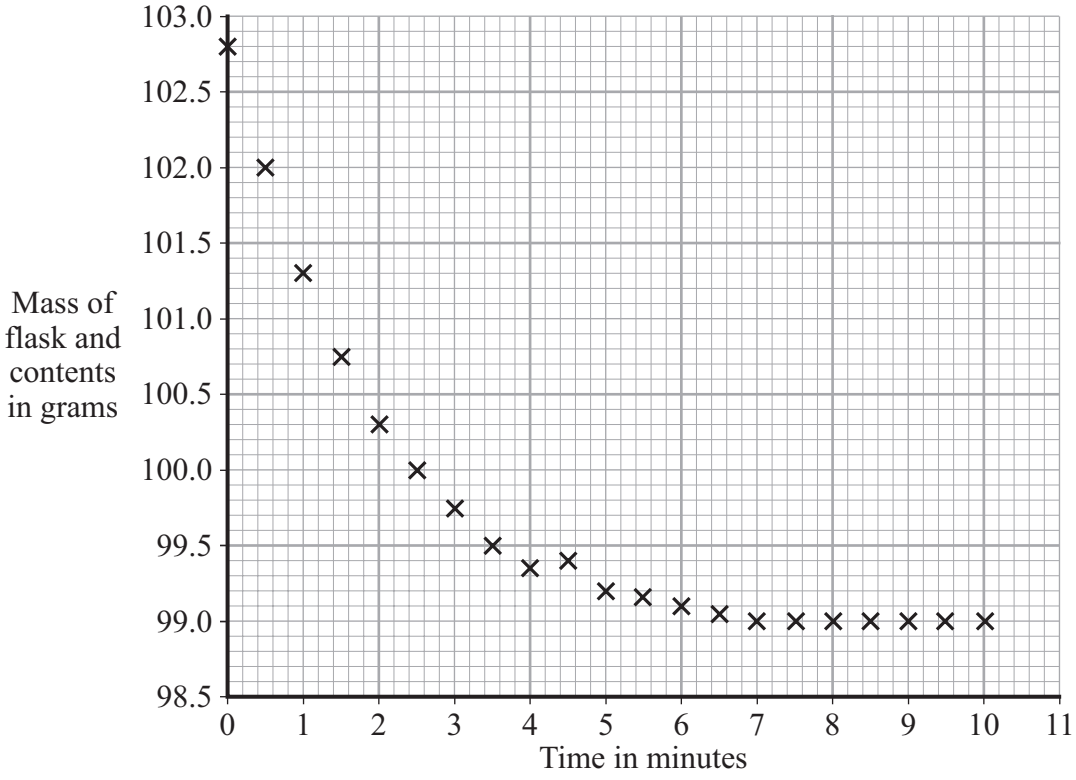
$CaCO_3$ (s) + 2HCl (aq) → $CaCl_2$ (aq) + H_2O (l) + CO_2 (g)

The student used the apparatus shown in the diagram.



The student measured the mass of the flask and contents every half minute for ten minutes.

The results are shown on the graph. Use the graph to answer the questions.



(a) **Complete the graph** opposite by drawing a line of best fit.

(1 mark)

(b) Why did the mass of the flask and contents decrease with time?

.....

.....

(1 mark)

(c) After how many minutes had all the acid been used up?

..... minutes

(1 mark)

(d) The student repeated the experiment at a higher temperature. All other variables were kept the same as in the first experiment. The rate of reaction was much faster.

(i) Draw a line **on the graph** opposite to show what the results for this second experiment might look like.

(2 marks)

(ii) Why does an increase in temperature increase the rate of reaction?

.....

.....

.....

.....

.....

.....

(3 marks)

8

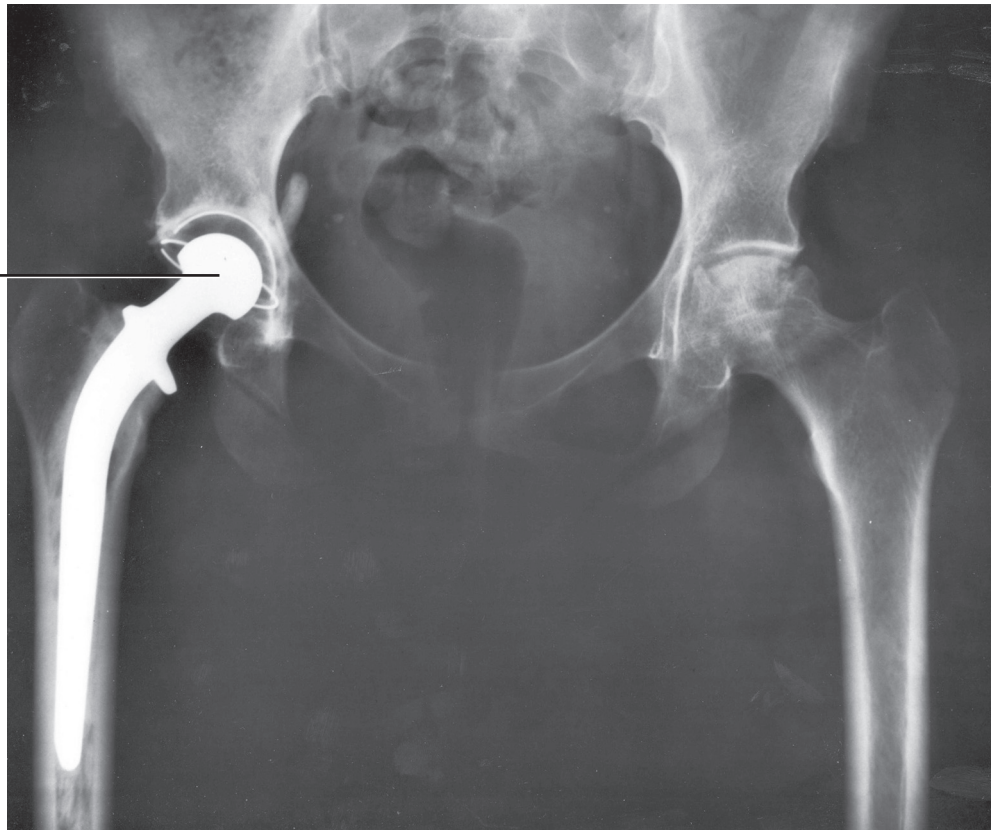
Turn over for the next question

7 Read this passage about metals.

Metals are crystalline materials. The metal crystals are normally about 20 000 nm (nanometres) in diameter. The atoms inside these crystals are arranged in layers.

A new nanoscience process produces nanocrystalline metals. Nanocrystalline metals are stronger and harder than normal metals.

It is hoped that nanocrystalline metals can be used in hip replacements.



The use of nanocrystalline metals should give people better hip replacements which last longer.

(a) State why metals can be bent and hammered into different shapes.

.....

.....

(1 mark)

(b) How is the size of the crystals in nanocrystalline metals different from the size of the crystals in normal metals?

.....

.....

(1 mark)

(c) Hip joints are constantly moving when people walk.

Suggest and explain why the hip replacement made of nanocrystalline metal should last longer than one made of normal metals.

.....

.....

.....

.....

(2 marks)

4

Turn over for the next question

8 (a) A chemist was asked to identify a nitrogen compound. The chemist carried out an experiment to find the relative formula mass (M_r) of the compound.

The M_r of the compound was **44**.

Relative atomic masses: N = 14, O = 16

Draw a ring around the formula of the compound.

NO **NO_2** **N_2O_4** **N_2O**

(1 mark)

(b) Potassium nitrate is another nitrogen compound. It is used in fertilisers. It has the formula **KNO_3**.

The M_r of potassium nitrate is **101**.

Calculate the percentage of **nitrogen** by mass in potassium nitrate.

Relative atomic mass: N = 14.

.....

.....

Percentage of nitrogen = ... %

(2 marks)

3

END OF QUESTIONS

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