

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	
8	
TOTAL	



General Certificate of Secondary Education
Foundation Tier
January 2010

Additional Science

Unit Chemistry C2

CHY2F

Chemistry

Unit Chemistry C2

F

Written Paper

Monday 18 January 2010 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 marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- 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.



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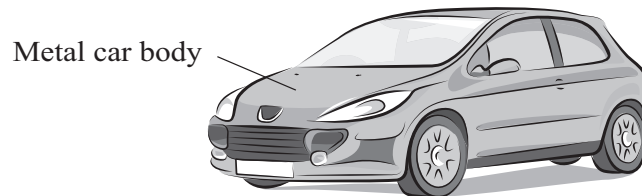
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ANSWER IN THE SPACES PROVIDED**

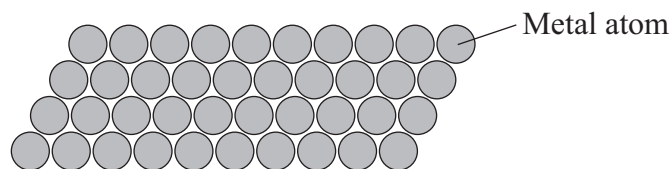


Answer **all** questions in the spaces provided.

1 Metal is bent and shaped to make a car body.



The diagram below represents how atoms are arranged in a metal.



Which **two** statements in the table best explain why the metal can be bent and shaped?

Tick (✓) the **two** statements.

Statement	Tick (✓)
The atoms are in layers.	
The metal is shiny.	
The atoms can slide over each other.	
All the atoms are linked by strong covalent bonds.	

(2 marks)

2

Turn over ►



2 Ammonium salts are used to help farmers grow crops.



2 (a) Use the correct word from the box to complete the sentence.

fertilisers

insecticides

pesticides

Ammonium salts contain nitrogen and are used by farmers as
to replace the nitrogen lost from the soil.

(1 mark)

2 (b) Ammonia is made by reacting nitrogen with hydrogen.

Draw a ring around the name of the raw material that provides the nitrogen.

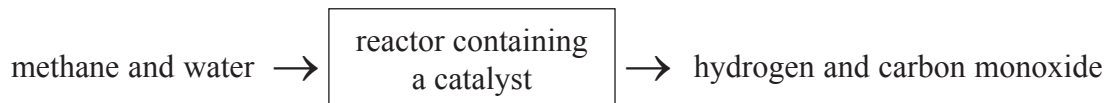
air

crude oil

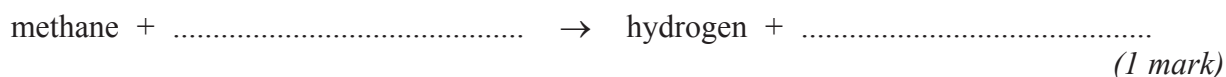
water

(1 mark)

2 (c) Methane and water react together to form the hydrogen.



2 (c) (i) Complete the word equation for this reaction.

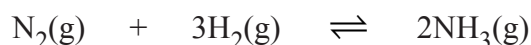


- 2 (c) (ii) How does the catalyst help this reaction?

.....

 (1 mark)

- 2 (d) The reaction between nitrogen and hydrogen to make ammonia can be represented by this equation.



Draw a ring around the meaning of the symbol, \rightleftharpoons

endothermic reaction

precipitation reaction

reversible reaction

(1 mark)

- 2 (e) A solution of ammonia in water is alkaline.

- 2 (e) (i) Which **one** of these values could be the pH of this ammonia solution?

Draw a ring around your answer.

4

7

10

(1 mark)

- 2 (e) (ii) The ammonium salt called ammonium sulfate can be made by reacting ammonia solution with an acid.

Use the correct words from the box to complete the sentences.

hydrochloric

hydrogen

sulfuric

water

Ammonia solution is reacted with acid to make ammonium sulfate.

During the reaction the hydrogen ions from the acid react with hydroxide

ions from the alkali to make.....
 (2 marks)

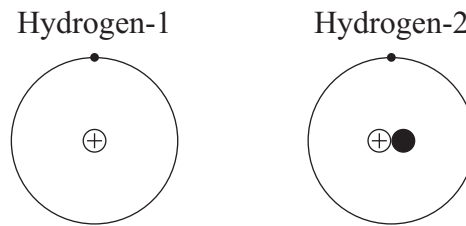
8

Turn over ►



3 Two isotopes of hydrogen are hydrogen-1 (${}^1_1\text{H}$) and hydrogen-2 (${}^2_1\text{H}$).

The diagrams represent atoms of hydrogen-1 and hydrogen-2.



3 (a) Use the correct words from the box to complete the sentences.

electrons	neutrons	protons
-----------	----------	---------

3 (a) (i) The positive particles, \oplus , in the nucleus of atoms are called

.....

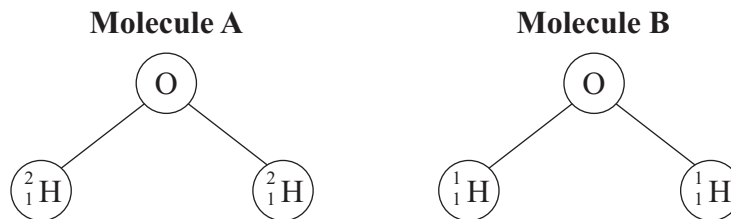
(1 mark)

3 (a) (ii) The particles with no charge, \bullet , in the nucleus of atoms are called

.....

(1 mark)

3 (b) The diagrams show two different types of water molecule.



Draw a ring around the correct answer to complete the sentence.

Molecule A is

heavier than
lighter than
the same mass as

 molecule B.

Explain your answer.

.....

.....

(2 marks)



Turn over for the next question

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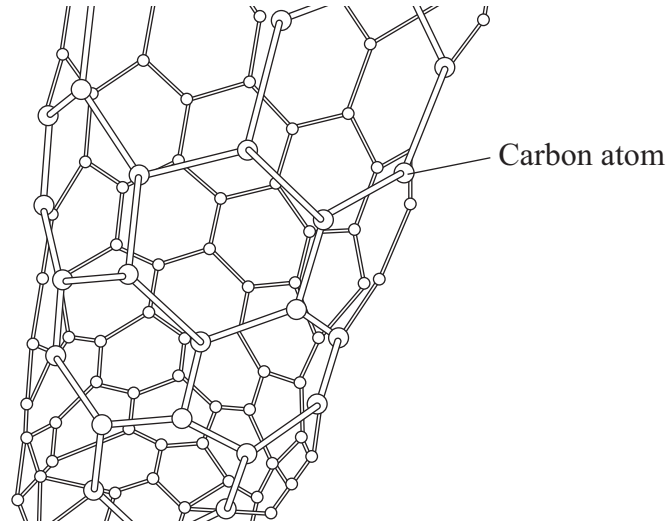


0 7

4 Lightweight handlebars for bicycles are made from materials containing carbon nanotubes.

Carbon nanotubes are lightweight but very strong.

The diagram shows the structure of a carbon nanotube.



4 (a) What does the term 'nano' tell you about the diameter of carbon nanotubes?

Tick (✓) the correct answer in the table.

Answer	Tick (✓)
The diameter of the tube is very small.	
The diameter of the tube is large.	
The diameter of the tube is very large	

(1 mark)



4 (b) Look at the diagram and then draw a ring around the correct word to complete each sentence.

4 (b) (i) Carbon nanotubes are similar to graphite because each carbon atom is joined to

two

three

four

other carbon atoms.

(1 mark)

4 (b) (ii) The carbon atoms are joined by

covalent

ionic

metallic

bonds.

(1 mark)

4 (b) (iii) Carbon nanotubes are very strong because the

atoms

bonds

electrons

are hard to break.

(1 mark)

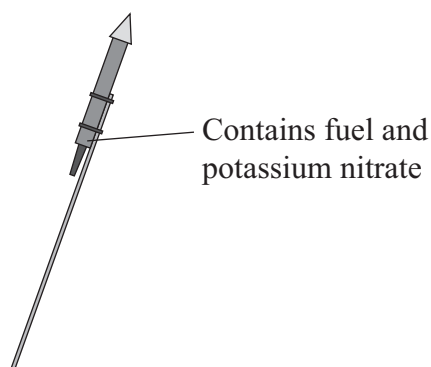
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Turn over for the next question

Turn over ►



- 5 Firework rockets contain fuel and potassium nitrate.



The potassium nitrate provides oxygen for the fuel to react.

- 5 (a) The table shows how a student worked out the relative formula mass (M_r) of potassium nitrate.

Some of the numbers are missing.

Relative atomic masses (A_r): N = 14; O = 16; K = 39.

Name of atom (symbol)	Number of atoms	A_r	Mass
potassium (K)	1	39	39
nitrogen (N)	1	14	14
oxygen (O)		16	
The M_r of potassium nitrate =			101

- 5 (a) (i) The mass of oxygen is not shown in the table.

Draw a ring around the correct mass of oxygen.

16 32 48

(1 mark)

- 5 (a) (ii) Draw a ring around the number of oxygen atoms in the formula of potassium nitrate.

1 2 3

(1 mark)



- 5 (b) When the fuel reacts with the oxygen an *exothermic* reaction takes place.

What does *exothermic* mean?

.....

.....

.....

.....

(2 marks)

- 5 (c) The fuel contains carbon. Carbon reacts with oxygen to make carbon dioxide.

Which **two** statements in the table explain why carbon dioxide is a gas at room temperature?

Tick (✓) the **two** statements.

Statement	Tick (✓)
It has a giant structure	
It has a low boiling point.	
It is made of small molecules.	
It is made of ions.	

(2 marks)

6

Turn over for the next question

Turn over ►



6 Hydrogen fluoride is used to make hydrofluoric acid.

6 (a) A company makes hydrogen fluoride by reacting solid calcium fluoride with sulfuric acid. The reaction takes place in a rotating kiln.



The company want this reaction to take place quickly.

6 (a) (i) Rotating the kiln makes the reaction take place faster.

Suggest why.

.....
.....

(1 mark)

6 (a) (ii) Draw a ring around the correct word in each box.

To make the reaction take place **faster**:

the temperature should be

higher
lower

 so that the particles have

less
more

 energy

the solid calcium fluoride should be

powder
lumps

 to give a

small
big

 surface area

the sulfuric acid solution should be

dilute
concentrated

 to give

less
more

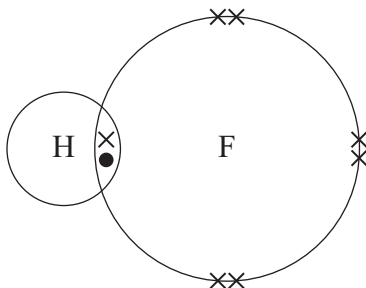
 collisions

between the particles each second.

(3 marks)



- 6 (b) The diagram represents a molecule of hydrogen fluoride.



The hydrogen and fluorine atoms are joined by a covalent bond.

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

electrons

neutrons

protons

In a covalent bond the atoms share
(1 mark)

- 6 (c) Hydrogen fluoride is dissolved in water to make an acidic solution of hydrofluoric acid.

Draw a ring around the symbol of the ion that makes the solution acidic.

\mathbf{H}^+

\mathbf{OH}^-

\mathbf{F}^-

(1 mark)

6

Turn over for the next question

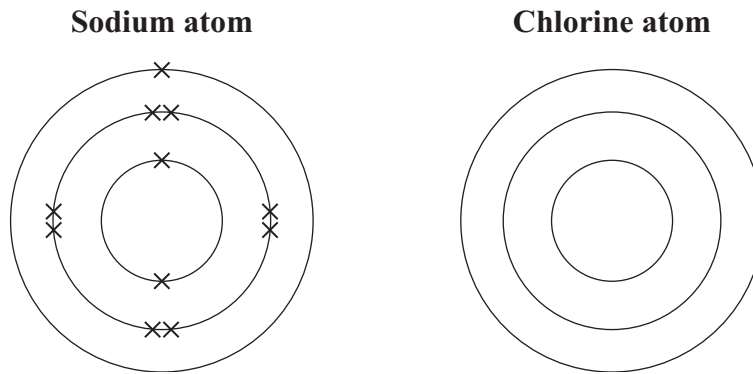
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7 Sodium chloride is a raw material.

7 (a) The electronic structure of a sodium atom is shown below.

Complete the diagram for the electronic structure of a chlorine atom. A chlorine atom has 17 electrons.



(1 mark)

7 (b) When sodium and chlorine react to form sodium chloride they form sodium ions (Na^+) and chloride ions (Cl^-).

How does a sodium atom change into a sodium ion?

.....

.....

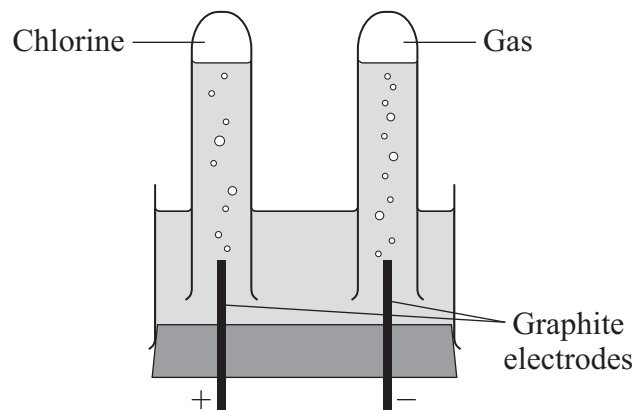
.....

.....

(2 marks)



- 7 (c) The diagram shows apparatus used in a school laboratory for the electrolysis of sodium chloride solution.



The solution contains sodium ions (Na^+), chloride ions (Cl^-), hydrogen ions (H^+) and hydroxide ions (OH^-).

- 7 (c) (i) Why do chloride ions move to the positive electrode?

.....
(1 mark)

- 7 (c) (ii) Name the gas formed at the negative electrode.

.....
(1 mark)

Question 7 continues on the next page

Turn over ►



- 7 (d) Chlorine and chlorine compounds are used to bleach wood pulp that is used to make paper.

The article below is from a newspaper.

Local people have been protesting outside a paper factory. They say:
'We want the company to stop using chlorine compounds. Chlorine compounds release poisons into the environment. The company should use safer compounds.'

The company replied:
'Chlorine has been used safely for many years to treat drinking water. Only tiny amounts of chlorine are released, which cause no harm. Using other compounds will be more expensive and may put us out of business.'

- 7 (d) (i) Why are some local people worried about the use of chlorine compounds?

.....
.....
(1 mark)

- 7 (d) (ii) Why might other local people want the company to continue to use chlorine compounds?

.....
.....
(1 mark)

- 7 (d) (iii) It is decided to have an enquiry.
Why should this be done by independent scientists?

.....
.....
(1 mark)



Turn over for the next question

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8 Read the article.

In the late eighteenth century the French scientist Nicolas Leblanc invented a process to change sodium chloride into sodium carbonate.

The main steps in the original process were:

Step 1. Sodium chloride was reacted with sulfuric acid to make sodium sulfate. Hydrogen chloride was formed and escaped into the atmosphere. The hydrogen chloride damaged plants over a wide area around the factory.

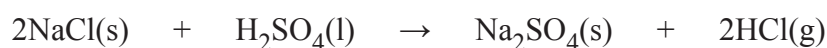
Step 2. The sodium sulfate was heated with limestone and coal. A solid mixture was formed which contained sodium carbonate, calcium sulfide and unreacted coal. The calcium sulfide gave off a very unpleasant smell.

Step 3. The sodium carbonate was dissolved in water and separated from the insoluble calcium sulfide and unreacted coal.

Step 4. Crystals of sodium carbonate were obtained from the solution of sodium carbonate.

The process was later improved.

- The hydrogen chloride produced in **Step 1** was changed into chlorine which was used to make bleach.
- The calcium sulfide produced in **Step 2** was converted into sulfur. This sulfur was used to make sulfuric acid.

8 (a) The symbol equation for the reaction in **Step 1** is shown below.

What property of hydrogen chloride allowed it to escape into the atmosphere?

.....
(1 mark)



8 (b) The insoluble solids, calcium sulfide and unreacted coal were separated from the sodium carbonate solution in **Step 3**.

Suggest how this was done.

.....
.....
(1 mark)

8 (c) Sodium carbonate crystals were obtained from sodium carbonate solution in **Step 4**.

Suggest how this was done.

.....
.....
(1 mark)

8 (d) It has been stated that: ‘the Chemical Industry can turn problems into profit’.

State **two** problems with the original process and explain how they were turned into profit.

1

.....

.....

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.....

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2

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.....

.....

.....

(4 marks)

7

END OF QUESTIONS



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