

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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



General Certificate of Secondary Education
Foundation Tier
June 2011

Chemistry

CHY3F

Unit Chemistry C3

F

Written Paper

Wednesday 25 May 2011 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. 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 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.



J U N 1 1 C H Y 3 F 0 1

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ANSWER IN THE SPACES PROVIDED**



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

1 Use the periodic table on the Data Sheet to help you to answer these questions.

1 (a) The following is a list of symbols of some elements.

Sb	Se	Si	Sn	Sr
-----------	-----------	-----------	-----------	-----------

Choose your answers **only** from the symbols shown in the box above.

Which symbol represents

1 (a) (i) a Group 5 element

(1 mark)

1 (a) (ii) the element in the same group as oxygen (O)

(1 mark)

1 (a) (iii) the element with atomic (proton) number of 50

(1 mark)

1 (a) (iv) silicon?

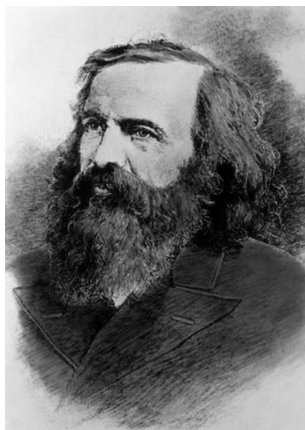
(1 mark)

Question 1 continues on the next page

Turn over ►



1 (b)



Mendeleev suggested his version of the periodic table in 1869.

Part of Mendeleev's table is shown below.

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
H						
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca	#	Ti	V	Cr	Mn
Cu	Zn	#	#	As	Se	Br



There are differences between Mendeleev's table and the periodic table on the Data Sheet.

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

1 (b) (i) Mendeleev left gaps (shown by #) in his table.

Mendeleev left gaps for

compounds
elements
mixtures

 that had not been discovered.

(1 mark)

1 (b) (ii) Mendeleev put copper (Cu) in the same box as

bromine (Br).
chromium (Cr).
potassium (K).

(1 mark)

1 (b) (iii) Mendeleev did **not** have a Group

0.
3.
5.

(1 mark)

7

Turn over for the next question

Turn over ►



2 Hydrogen peroxide decomposes slowly to give water and oxygen.

The reaction is *exothermic*.



2 (a) In an *exothermic* reaction, energy is given out.

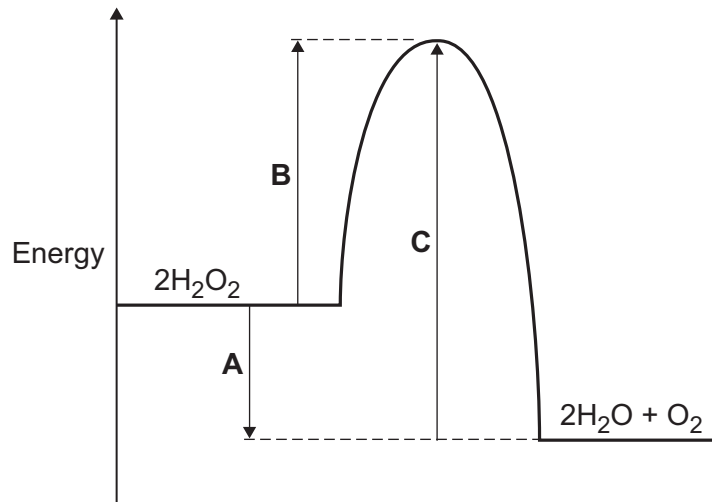
Draw a ring around the correct answer to complete the sentence.

In an *exothermic* reaction, the temperature

- | |
|-----------------|
| goes down. |
| goes up. |
| stays the same. |

(1 mark)

2 (b) The energy level diagram for this reaction is shown below.



The energy changes, **A**, **B** and **C**, are shown on the diagram.

Use the diagram to help you answer these questions.

2 (b) (i) Which energy change, **A**, **B** or **C**, is the activation energy?

(1 mark)

2 (b) (ii) Which energy change, **A**, **B** or **C**, shows that this reaction is exothermic?

(1 mark)



2 (b) (iii) Hydrogen peroxide decomposes quickly when a small amount of manganese(IV) oxide is added.

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

Hydrogen peroxide decomposes quickly because

manganese(IV) oxide is

a catalyst.
an element.
a solid.

The manganese(IV) oxide has lowered the

activation energy.
boiling point.
temperature.

(2 marks)

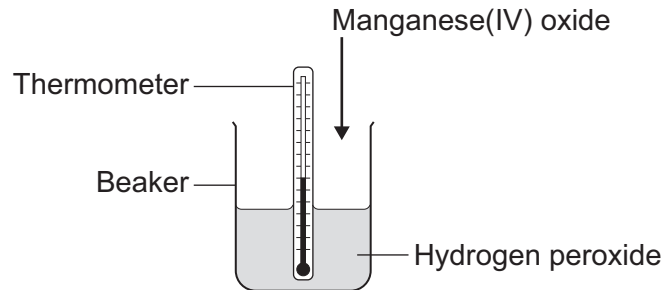
Question 2 continues on the next page

Turn over ►



- 2 (c)** A student did an experiment to find the amount of energy produced when hydrogen peroxide solution is decomposed using manganese(IV) oxide.

The apparatus the student used is shown in the diagram.



The student first measured the temperature of the hydrogen peroxide. Then the student added the manganese(IV) oxide, stirred the mixture and recorded the highest temperature.

- 2 (c) (i)** Suggest why the student stirred the mixture before recording the highest temperature.

.....
.....

(1 mark)

- 2 (c) (ii)** The biggest error in this experiment is heat loss.

Suggest how the student could change the apparatus so that less heat is lost.

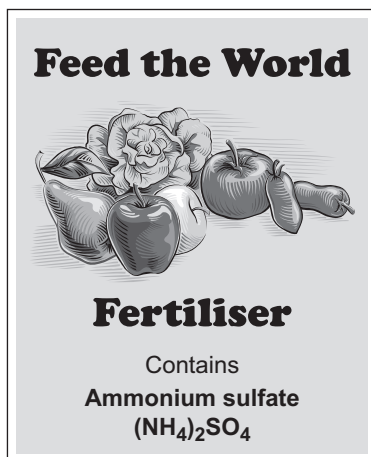
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.....

(1 mark)

7



3 Ammonium sulfate is an artificial fertiliser.



3 (a) A student tested this fertiliser to prove that it contained ammonium ions and sulfate ions.
Draw a ring around the correct answer to complete each sentence.

3 (a) (i) Test for ammonium ions (NH_4^+).

The student added

sodium chloride solution
sodium hydroxide solution
dilute sulfuric acid

to the fertiliser.

A gas called ammonia was produced.

Ammonia turns damp litmus paper

blue.
green.
red.

(2 marks)

3 (a) (ii) Test for sulfate ions (SO_4^{2-}).

The student added

barium chloride
silver nitrate
sodium chloride

solution to a solution of the fertiliser.

A

blue
red
white

precipitate was formed.

(2 marks)

Turn over ►



3 (b) Ammonium sulfate is made by reacting sulfuric acid with ammonia solution.

Sulfuric acid is a *strong* acid.

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

The word *strong* means that the acid is

difficult to break.

very concentrated.

fully ionised in water.

(1 mark)

3 (c) Use the information about acids in the table to help you answer these questions.

Name of chemical	Ions produced in aqueous solution		pH	Universal Indicator added
Ethanoic acid	H ⁺	CH ₃ COO ⁻	5	Goes orange
Sulfuric acid	H ⁺	SO ₄ ²⁻	1	Goes red

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

3 (c) (i) Sulfuric acid and ethanoic acid are both acids because they contain

CH₃COO⁻ ions.

H⁺ ions.

SO₄²⁻ ions.

(1 mark)

3 (c) (ii) Sulfuric acid is a stronger acid than ethanoic acid.

The pH of stronger acids is

higher than

lower than

the same as

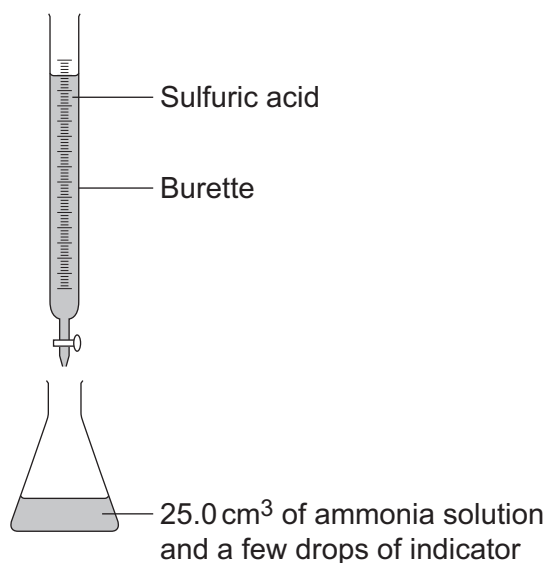
the pH of weaker acids.

(1 mark)



- 3 (d)** The volume of sulfuric acid that reacts with 25.0 cm^3 of ammonia solution can be found by titration.

The diagram shows the apparatus used for the titration.



A student did the titration five times and recorded the following results.

Titration	1	2	3	4	5
Volume of acid added in cm^3	13.3	13.9	13.2	13.1	13.2

- 3 (d) (i)** How did the student know when enough sulfuric acid had been added to neutralise the ammonia solution?

.....

 (1 mark)

- 3 (d) (ii)** The student did **not** use one of the results because it was anomalous.

Which result was anomalous?

(1 mark)

- 3 (d) (iii)** Use the **other** four results to calculate the mean volume of sulfuric acid that reacted with the ammonia.

.....

Mean volume = cm^3
 (1 mark)

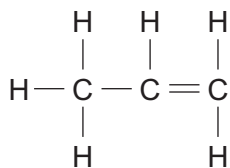
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Turn over ►



4 Propene (C_3H_6) is an *unsaturated* hydrocarbon used to make polymers.

The structure of a propene molecule is shown below.



Bromine water can be used to show that propene is *unsaturated*.

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

4 (a) (i) Bromine water is

blue.
green.
orange.

(1 mark)

4 (a) (ii) Bromine water reacts with propene and turns

colourless.
purple.
red.

(1 mark)

4 (a) (iii) Propene is *unsaturated* because it contains

a carbon carbon double bond.
a carbon carbon single bond.
carbon hydrogen single bonds.

(1 mark)



4 (b) Hydrocarbons are often used as fuels.

Some information about three fuels is given in the table.

Fuel	Mass of fuel burned in g	Heat released in kJ	Price of fuel in pence per g	Combustion products	
				CO ₂	H ₂ O
A	1	30	3p	Yes	Yes
B	1	20	1p	Yes	Yes
C	1	40	5p	No	Yes

4 (b) (i) Which fuel, **A**, **B** or **C**, releases the most heat per gram?

(1 mark)

4 (b) (ii) Which fuel, **A**, **B** or **C**, releases the most heat per penny?

(1 mark)

4 (b) (iii) Suggest why fuel **C** is the most environmentally friendly.

.....

.....

(1 mark)

6

Turn over for the next question

Turn over ►



- 5 These labels have been taken from two bottles of spring water.

<p style="text-align: center;"><i>Mountain View</i></p> <p style="text-align: center;"><i>Natural Spring Water</i></p> <p style="text-align: center;"><i>Contains essential minerals for good health</i></p> <p style="text-align: center;">Analysis</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Ions present</th> <th style="width: 50%;">mg/dm³</th> </tr> </thead> <tbody> <tr><td>Calcium</td><td>65</td></tr> <tr><td>Magnesium</td><td>35</td></tr> <tr><td>Potassium</td><td>5</td></tr> <tr><td>Sodium</td><td>12</td></tr> <tr><td>Chloride</td><td>9</td></tr> <tr><td>Hydrogencarbonate</td><td>269</td></tr> <tr><td>Sulfate</td><td>21</td></tr> </tbody> </table> <p style="text-align: center;">Also tested by the independent Food Standards Agency and approved safe.</p>	Ions present	mg/dm ³	Calcium	65	Magnesium	35	Potassium	5	Sodium	12	Chloride	9	Hydrogencarbonate	269	Sulfate	21	<p style="text-align: center;">Valley Croft</p> <p style="text-align: center;">Pure Spring Water</p> <p style="text-align: center;">With healthy minerals as Nature intended</p> <p style="text-align: center;">Analysis</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Ions present</th> <th style="width: 50%;">mg/dm³</th> </tr> </thead> <tbody> <tr><td>Calcium</td><td>16</td></tr> <tr><td>Magnesium</td><td>14</td></tr> <tr><td>Potassium</td><td>5</td></tr> <tr><td>Sodium</td><td>34</td></tr> <tr><td>Chloride</td><td>13</td></tr> <tr><td>Hydrogencarbonate</td><td>62</td></tr> <tr><td>Sulfate</td><td>7</td></tr> </tbody> </table> <p style="text-align: center;">Pure and natural – contains no chemicals.</p> <p style="text-align: center;">Tested in our own laboratories by our own scientists to keep you safe.</p>	Ions present	mg/dm ³	Calcium	16	Magnesium	14	Potassium	5	Sodium	34	Chloride	13	Hydrogencarbonate	62	Sulfate	7
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- 5 (a) Mountain View and Valley Croft spring waters are hard because they contain calcium and magnesium ions.

- 5 (a) (i) Mountain View spring water is about **three** times as hard as Valley Croft spring water.

Use the information on the labels to explain why.

.....

.....

.....

.....

(2 marks)



5 (a) (ii) Describe how a student could use soap solution to show that Mountain View spring water is about **three** times as hard as Valley Croft spring water.

You should state how the experiment is made fair and give the expected result.

.....

.....

.....

.....

.....

.....

(3 marks)

5 (b) Why is hard water good for health?

.....

.....

(1 mark)

5 (c) Give **one** disadvantage of hard water.

.....

(1 mark)

5 (d) (i) Suggest why people should be concerned about the claim that Valley Croft spring water “contains no chemicals”.

.....

.....

.....

(1 mark)

5 (d) (ii) Suggest why people should be concerned that Valley Croft spring water has only been tested by their own scientists.

.....

.....

.....

(1 mark)

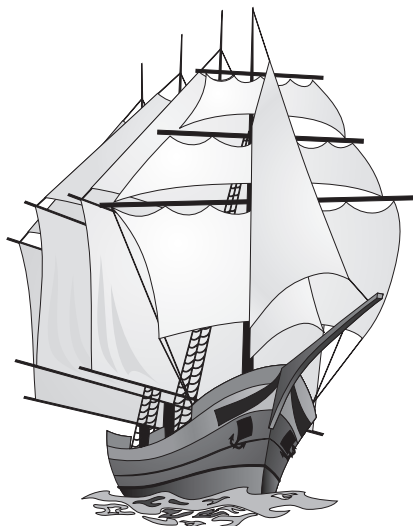
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Turn over ►



6 Read the information about protecting the bottoms of ships.

A Copper-bottomed Investment



From the 16th to the 19th century, the bottoms of many wooden ships were protected from marine organisms by being covered with sheets of metal.

At first lead was used on the bottoms of ships, then copper was used until 1832 when Muntz Metal replaced it. Muntz Metal is an alloy of two transition metals, copper and zinc.

Table of data

	Lead	Copper	Muntz Metal
Cost (£/kg)	£1.20	£3.20	£2.30
Melting point (°C)	327	1083	904
Stops sea worms attacking wood	Yes	Yes	Yes
Stops barnacles and seaweed sticking to the bottom of the ship	No	Yes	Yes



6 (a) Use the information to answer the following questions.

6 (a) (i) Suggest why copper replaced lead.

.....
.....

(1 mark)

6 (a) (ii) Suggest why Muntz Metal replaced copper.

.....
.....

(1 mark)

6 (b) A sample of Muntz Metal contains a very small amount of iron as an impurity.

6 (b) (i) Name an instrumental method of analysis that could be used to detect iron.

.....

(1 mark)

6 (b) (ii) Suggest why an instrumental method would detect the iron in this sample of Muntz Metal but a chemical method is **not** likely to be successful.

.....
.....

(1 mark)

6 (c) Today, ships are made from steel. Steels are alloys of iron, a transition metal.

Give **two** properties of transition metals that make them suitable for making ships.

Property 1

.....

Property 2

.....

(2 marks)

6

END OF QUESTIONS



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