AQA GCSE CHEMISTRY (4421)

CHEMISTRY



EXAM QUESTION PACK

UNIT C3 FOUNDATION TIER CHY3F PAPERS

STEMUP

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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	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
June 2012

Chemistry

CHY3F

Unit Chemistry C3

F

Written Paper

Thursday 24 May 2012 9.00 am to 9.45 am

For this paper you must have:
- a ruler
- 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.

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Do not write outside the box

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

1 Platinum and gold can both be used to make wedding rings.



Use the Data Sheet to help you to answer these questions.

1 (a) Draw a ring around the part of the periodic table in the list below to which platinum and gold belong.

group 1 **group 2** **transition elements** **group 7**

(1 mark)

1 (b) Platinum and gold have properties that make them suitable for wedding rings.

Tick (✓) **two** of these properties.

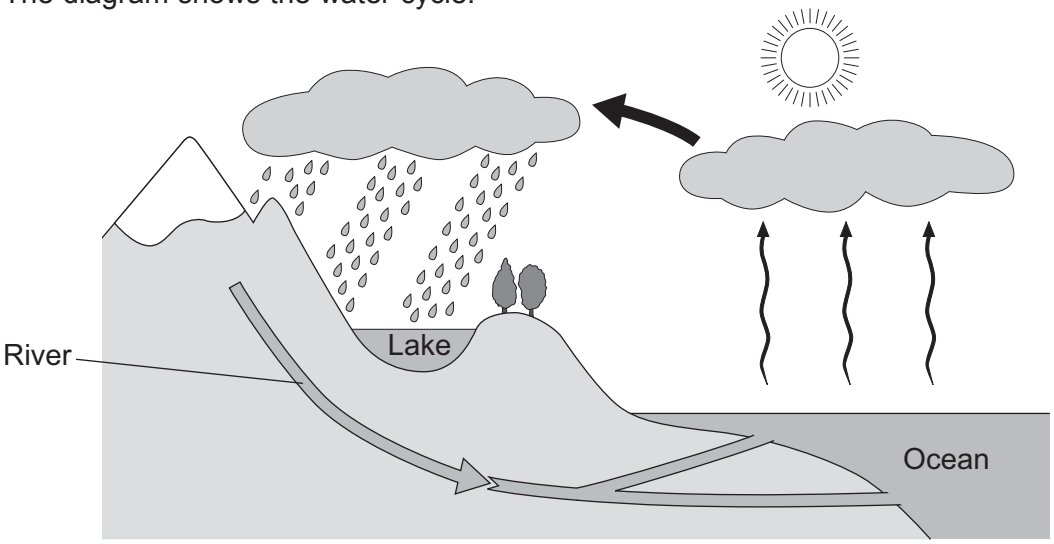
Property	Tick (✓)
These metals do not react with air.	
These metals have low melting points.	
These metals do not react with water.	
These metals have low densities.	

(2 marks)

3

Do not write outside the box

2 The diagram shows the water cycle.



2 (a) Use the diagram and your knowledge of the water cycle to add the **three** missing words to complete the sentences below.

Water in rivers, lakes and oceans ..... because of heat from the ..... to form water vapour. The water vapour rises in the atmosphere and cools so that it ..... to form water droplets. The water droplets form clouds. The water droplets join together to produce rain.

(3 marks)

2 (b) Drinking water often comes from water in lakes and rivers.
Small particles of solid are removed and bacteria are killed before the water is fit to drink.

2 (b) (i) Draw a ring around the method used to remove small particles of solid from the water.

condensation **evaporation** **filtration**

(1 mark)

2 (b) (ii) Draw a ring around the name of the substance added to kill bacteria in the water.

chlorine **helium** **nitrogen**

(1 mark)

2 (c) Why is it important to kill bacteria in the water before it is used for drinking water?

.....

.....

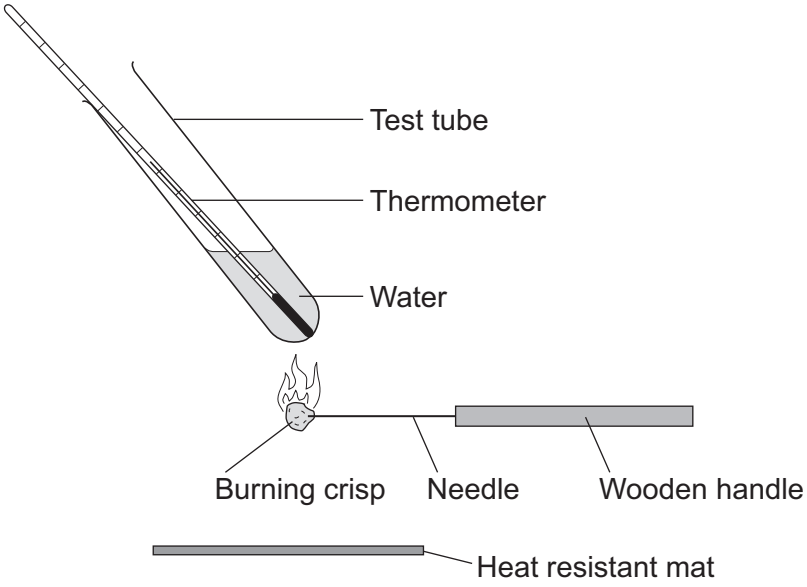
(1 mark)

6

Turn over ▶

Do not write outside the box

3 A student investigated the amount of energy released when four different makes of plain salted crisps were burned.



The following method was used for each make of plain salted crisp. The pieces of crisp were all the same size.

- The starting temperature of the water was measured.
- The piece of crisp was burned underneath the test tube.
- The final temperature of the water was measured.

3 (a) The results of the investigation are shown in the table.

	Make 1	**Make 2**	**Make 3**	**Make 4**
Final temperature of the water in °C	26	25	29	25
Starting temperature of the water in °C	19	20	20	21
Temperature rise of the water in °C	7	5	9	

3 (a) (i) Calculate the temperature rise for **make 4**.

.....

Temperature rise = ... °C

(1 mark)

Do not write outside the box

3 (a) (ii) Which make of crisp, **1**, **2**, **3** or **4**, releases the most energy?

Make .....

Give a reason for your answer.

.....

.....

(2 marks)

3 (b) The energy needed by a student is about 9000 kJ each day.

3 (b) (i) One large bag of crisps states that the energy released by the crisps is 240 kcal.

Calculate the energy of this bag of crisps in kJ.

1 kcal = 4.2 kJ

.....

.....

Answer = ... kJ

(2 marks)

3 (b) (ii) Eating too many crisps is thought to be bad for your health.

Use the information above and your knowledge to explain why.

.....

.....

.....

.....

(2 marks)

7

Turn over for the next question

Do not write outside the box

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

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4 Vinegar can be added to food.

Vinegar is a solution of ethanoic acid in water.



4 (a) Ethanoic acid is a *weak* acid.

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

4 (a) (i) When dissolved in water, an acid forms a solution containing

carbonate ions.

hydrogen ions.

hydroxide ions.

(1 mark)

4 (a) (ii) Ethanoic acid is a *weak* acid because in water it is

completely ionised.

not ionised.

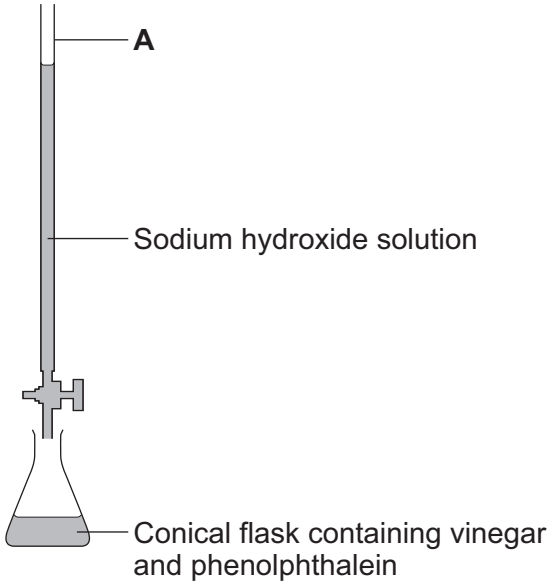
partially ionised.

(1 mark)

Question 4 continues on the next page

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4 (b) The diagram shows the apparatus used to investigate the amount of ethanoic acid in vinegar.



4 (b) (i) Draw a ring around the name of the piece of apparatus labelled **A** on the diagram.

burette **measuring cylinder** **pipette**

(1 mark)

4 (b) (ii) Phenolphthalein is added to the vinegar in the conical flask so that the end point of the titration can be seen.

What type of substance is phenolphthalein?

Draw a ring around the correct answer.

alkali **catalyst** **indicator**

(1 mark)

4 (b) (iii) How would you know that the end point of the titration has been reached?

.....

.....

(1 mark)

Do not write outside the box

4 (c) The results of the titration are shown in the table.

	Rough titration	Accurate titrations		
		1	2	3
Final reading in cm^3	22	21.30	22.50	24.40
Initial reading in cm^3	0	1.00	2.00	4.00
Volume used in cm^3	22	20.30	20.50	20.40

Calculate the best value of the mean volume from these titrations.

.....

.....

.....

Mean volume used = ... cm^3

(2 marks)

4 (d) 25.0 cm^3 of this vinegar contained 1.25 g of ethanoic acid.

Calculate the mass of ethanoic acid in 1 litre (1000 cm^3) of this vinegar.

.....

.....

.....

Mass = ... g

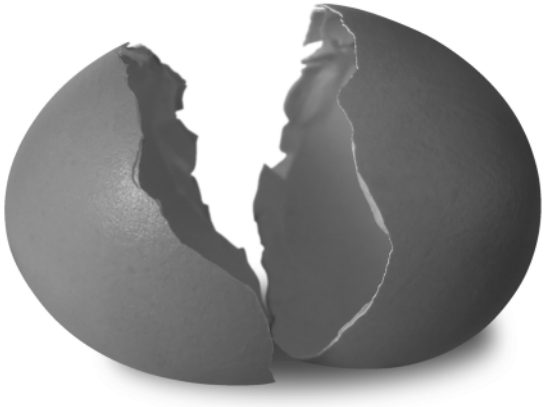
(2 marks)

9

Turn over for the next question

Do not write outside the box

5 A student investigated an egg shell.



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

5 (a) (i) **Test 1**

Dilute hydrochloric acid was added to the egg shell.

Carbon dioxide gas was produced which turned limewater

- milky.
- blue.
- red.

This test shows that the egg shell must contain

- carbonate ions.
- chloride ions.
- sulfate ions.

(2 marks)

5 (a) (ii) **Test 2**

The student then did a flame test.
He used the solution remaining after dilute hydrochloric acid was added to the egg shell.

The flame test showed that the egg shell contained calcium ions because

the flame was

- red.
- blue.
- lilac.

(1 mark)

Do not write outside the box

5 (b) Some scientists investigated the amount of lead found in egg shells.
They used a modern instrumental method which was more *sensitive* and more *accurate* than older methods.

5 (b) (i) Draw a ring around the correct answer to complete the sentence.

The modern instrumental method is more *sensitive*, which means that

it can measure | larger | much larger | smaller | amounts of lead than older methods.

(1 mark)

5 (b) (ii) Tick (✓) the meaning of more *accurate*.

	Tick (✓)
The measurement is given to more decimal places.	
The answer obtained is closer to the true value.	
The equipment used is more expensive.	

(1 mark)

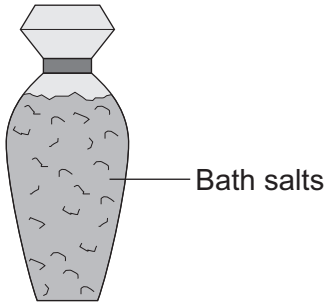
5

Turn over for the next question

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6 In some areas of the UK the water is hard.
Bath salts are added to bath water to soften the water.

6 (a) Bath salts contain sodium carbonate.



The equation shows one reaction in which sodium carbonate removes hardness from bath water.

$MgSO_4(aq)$	+	$Na_2CO_3(aq)$	→	$MgCO_3(s)$	+	$Na_2SO_4(aq)$
magnesium sulfate (dissolved in bath water)		sodium carbonate		magnesium carbonate		sodium sulfate

Use the equation and your knowledge of hard water to explain;

- why this bath water is hard

and

- how sodium carbonate removes hardness from bath water.

.....

.....

.....

.....

.....

.....

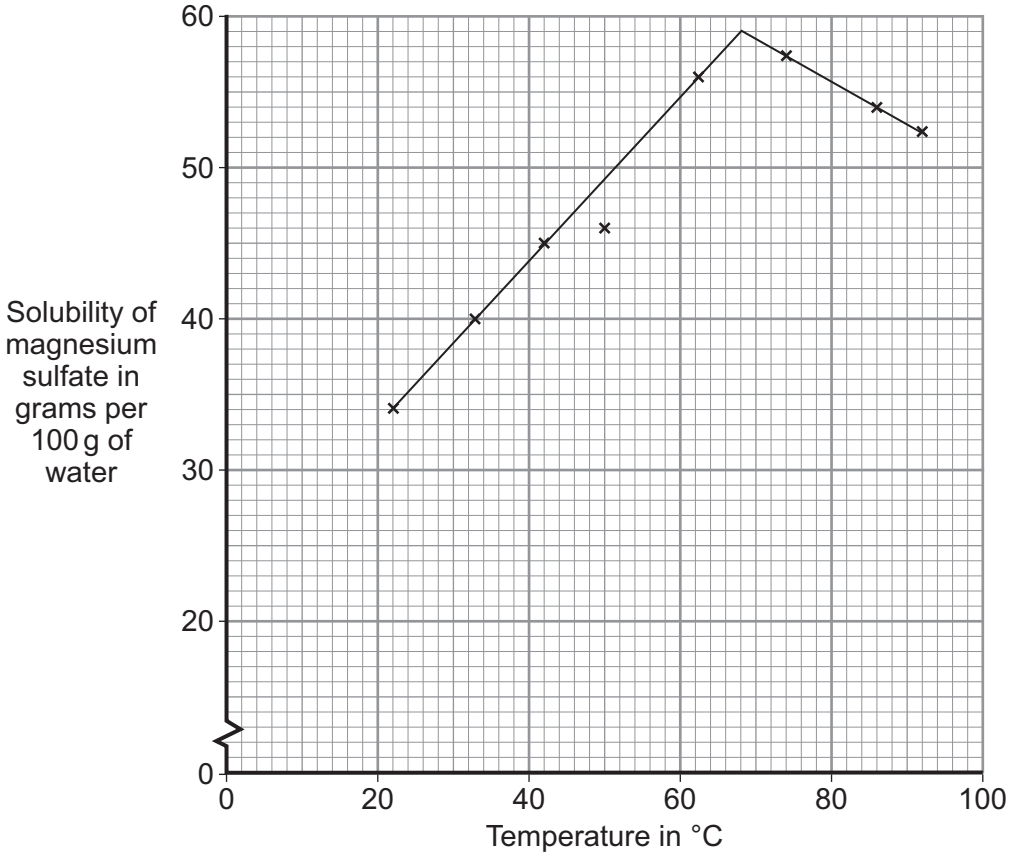
(3 marks)

6 (b) The bath water contains magnesium sulfate.

A student did experiments to find the maximum amount of magnesium sulfate that dissolves in water at different temperatures.

The student's results are shown on the graph.

Do not write outside the box



6 (b) (i) Why did the student **not** draw a line through the point at 50 °C?

.....

.....

(1 mark)

6 (b) (ii) Suggest why the student did **not** do an experiment at 100 °C.

.....

.....

(1 mark)

6 (b) (iii) At what temperature is the solubility of magnesium sulfate greatest?

Temperature = ... °C

(1 mark)

6 (b) (iv) Suggest why the student was surprised by the shape of the solubility graph line.

.....

.....

.....

.....

(2 marks)

8

Turn over ▶

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7 John Newlands was a chemist who worked in a sugar factory.

In 1866 he designed a periodic table.
He arranged the elements in order of their relative atomic masses.

He found a repeating pattern for some of the elements.
Newlands wrote, 'the eighth element starting from a given one, is a kind of repetition of the first, like the eighth note in an octave of music'.

H	Li	G	Bo	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co, Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce, La	Zr	Di, Mo	Ro, Ru
Pd	Ag	Cd	U	Sn	Sb	Te
I	Cs	Ba, V	Ta	W	Nb	Au
Pt, Ir	Tl	Pb	Th	Hg	Bi	Os

Newlands' periodic table

7 (a) In Newlands' periodic table, the elements lithium, sodium and potassium are grouped together.

Give **two** properties of these elements which support the idea that they should be grouped together.

1 .....

.....

2 .....

.....

(2 marks)

Do not write outside the box

7 (b) Newlands' periodic table was not accepted by most chemists in 1866.

Suggest reasons why.
Use the information on page 14 to help you to answer this question.

.....

.....

.....

.....

.....

.....

(3 marks)

7 (c) State **and** explain **one** way in which Mendeleev improved Newlands' periodic table.

.....

.....

.....

.....

(2 marks)

7

END OF QUESTIONS

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Version: 10/08/2012

General Certificate of Secondary Education

Chemistry 4421

CHY3F Unit Chemistry 3

Mark Scheme

2012 examination – June series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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CHY3F

Question 1

question	answers	extra information	mark
1(a)	transition elements		1
1(b)	These metals do not react with air These metals do not react with water		1 1
Total			**3**

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CHY3F

Question 2

question	answers	extra information	mark
2(a)	evaporates Sun condenses		3
2(b)(i)	filtration		1
2(b)(ii)	chlorine		1
2(c)	any **one** from: • so that it is <u>safe</u> to drink • to prevent (spread of) disease • to sterilise it / disinfect	allow bacteria can be harmful	1
Total			**6**

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CHY3F

Question 3

question	answers	extra information	mark
3(a)(i)	4		1
3(a)(ii)	(Make) 3 biggest temperature rise		1 1
3(b)(i)	1008 (kJ)	correct answer with or without working gains **2** marks if incorrect answer given allow evidence of 240 x 4.2 for **1** mark	2
3(b)(ii)	crisps have a high energy content so if you take in more energy than you need the excess is stored as fat **or** crisps contain salt (1) too much salt can cause high blood pressure **or** heart problems **or** kidney problems (1)	allow crisps have lots of calories / kilojoules / fat / one ninth of daily energy intake accept consequences: obesity; heart disease; high blood pressure; diabetes; arthritis	1 1
Total			**7**

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CHY3F

Question 4

question	answers	extra information	mark
4(a)(i)	hydrogen ions		1
4(a)(ii)	partially ionised		1
4(b)(i)	burette		1
4(b)(ii)	indicator		1
4(b)(iii)	colour change or turns pink		1
4(c)	20.4(0)	correct answer with or without working gains **2** marks if answer incorrect allow 20.80 **or** $\frac{20.30 + 20.50 + 20.40}{3}$ for **1** mark	2
4(d)	50 (g)	correct answer with or without working gains **2** marks if answer incorrect allow evidence of 1.25 x 40 for **1** mark	2
Total			**9**

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CHY3F

Question 5

question	answers	extra information	mark
5(a)(i)	milky carbonate ions		1 1
5(a)(ii)	red		1
5(b)(i)	smaller		1
5(b)(ii)	The answer obtained is closer to the true value		1
Total			**5**

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CHY3F

Question 6

question	answers	extra information	mark
6(a)		allow magnesium **or** calcium throughout	
	because the water contains magnesium ions **or** magnesium compounds / magnesium sulphate	allow because the water contains magnesium / Mg^{2+} / Mg / Mg^{+} / $MgSO_4$ **do not** accept other ions	1
	sodium carbonate / carbonate <u>ions</u> reacts with the magnesium <u>ions</u> / magnesium sulfate	allow sodium <u>ions</u> exchange / displace / magnesium <u>ions</u>	1
	to form solid / insoluble / precipitate of magnesium carbonate	allow solid contains magnesium (ions) ignore scale / scum	1
6(b)(i)	any **one** from: • anomalous • does not fit the pattern / straight line	ignore error	1
6(b)(ii)	water boils (at 100 °C)	ignore evaporate	1
6(b)(iii)	68 (°C)		1
6(b)(iv)		'it' = solubility	
	solubility goes up then down (after 68 °C **or** ecf from 1(b)(iii))	allow solubility changes direction allow solubility goes down / decreases after 68°C (or ecf from 1(b)(iii))	1
	solubility usually increases as the temperature increases		1
Total			**8**

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CHY3F

Question 7

question	answers	extra information	mark
7(a)	any **two** from: • react with water **or** very reactive • (react with water) releasing gas / hydrogen / fizzing • (react with water) to form an alkaline / hydroxide solution • form ions with a 1+ charge	 allow lose one electron from the outer shell ignore other references to electronic structure ignore physical properties	2
7(b)	any **three** from: • some boxes contain two elements • groups / columns contain elements with different properties • Newlands not a well-known / respected scientist • new idea (not readily accepted by other scientists)	 allow specific examples: Co, Ni **or** Ce, La **or** Di, Mo **or** Ro, Ru **or** Ba, V **or** Pt, Ir allow groups / columns contain both metals and non-metals ignore examples ignore references to sugar factory allow musical scales thought to be silly by some scientists	3

Question 7 continues on the next page . . .

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CHY3F

Question 7 cont'd..

question	answers	extra information	mark
7(c)	one for improvement **and** one for explanation from: • left gaps (for undiscovered elements) (1) • so that elements were in their correct group (1) **or** • did not always follow order of relative atomic weights / masses (1) • so that elements were in their correct group (1)	 allow so the elements fitted the pattern of properties ignore references to atomic number / electronic structure allow so the elements fitted the pattern of properties	2
Total			**7**

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Question	Mark
1	
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TOTAL	

General Certificate of Secondary Education
Foundation Tier
January 2012

Chemistry

CHY3F

Unit Chemistry C3

F

Written Paper

Thursday 26 January 2012 9.00 am to 9.45 am

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- the Data Sheet (enclosed).

You may use a calculator.

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- 45 minutes

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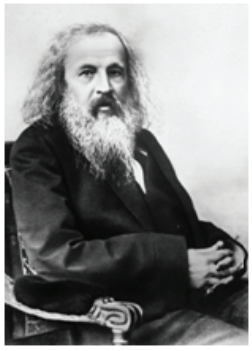
Advice
- In all calculations, show clearly how you work out your answer.

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

1 By 1869, about 60 elements had been discovered.
Mendeleev arranged these elements in a table, in order of their atomic weight.
He put elements with similar chemical properties in the same column.
Mendeleev and part of his table are shown below.



	Column					
1	**2**	**3**	**4**	**5**	**6**	**7**
H						
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl

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

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

In the periodic table the columns are known as

groups.

periods.

rows.

(1 mark)

1 (b) Suggest **one** reason why hydrogen should **not** have been put in column 1.

.....

(1 mark)

1 (c) In 1895, the first of a new family of elements was discovered.
One of the new elements was called helium.

Where has this new family of elements been placed in the modern periodic table?

.....

(1 mark)

1 (d) Complete the sentence.

In the periodic table on your Data Sheet, the elements are arranged in order of their

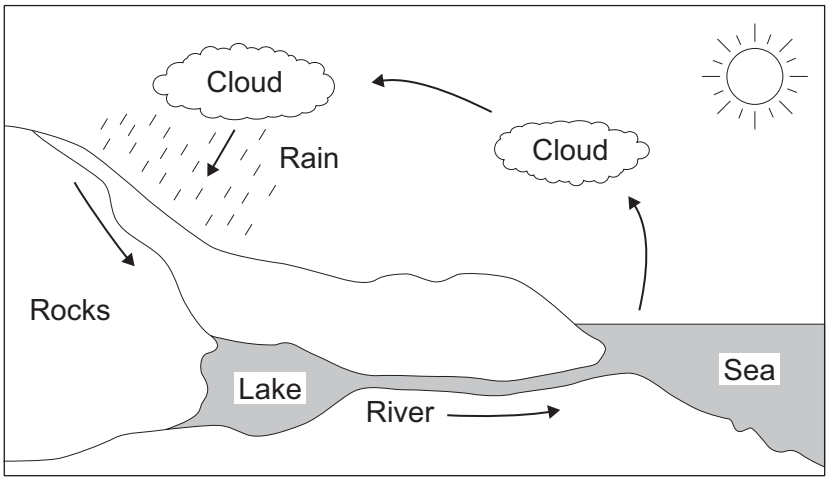
atomic ..... .

(1 mark)

4

Do not write outside the box

2 Most drinking water used in the UK is taken from lakes and rivers.
The water cycle shows how water gets into lakes and rivers.



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

2 (a) (i) During the water cycle, water is

dissolved
evaporated
filtered

from the sea to form water vapour.

(1 mark)

2 (a) (ii) The water vapour rises, cools and is

condensed
dissolved
sterilised

to form clouds and rain.

(1 mark)

2 (a) (iii) Some substances in the rocks are

condensed
dissolved
sterilised

by rainwater.

(1 mark)

2 (a) (iv) Drinking water taken from rivers and lakes is

condensed
evaporated
filtered

to remove solids

and

dissolved
filtered
sterilised

with chlorine.

(2 marks)

Question 2 continues on the next page

Turn over ▶

Do not write outside the box

2 (b) The water in the lake is hard water.

2 (b) (i) What happens when soap is added to hard water?

.....

(1 mark)

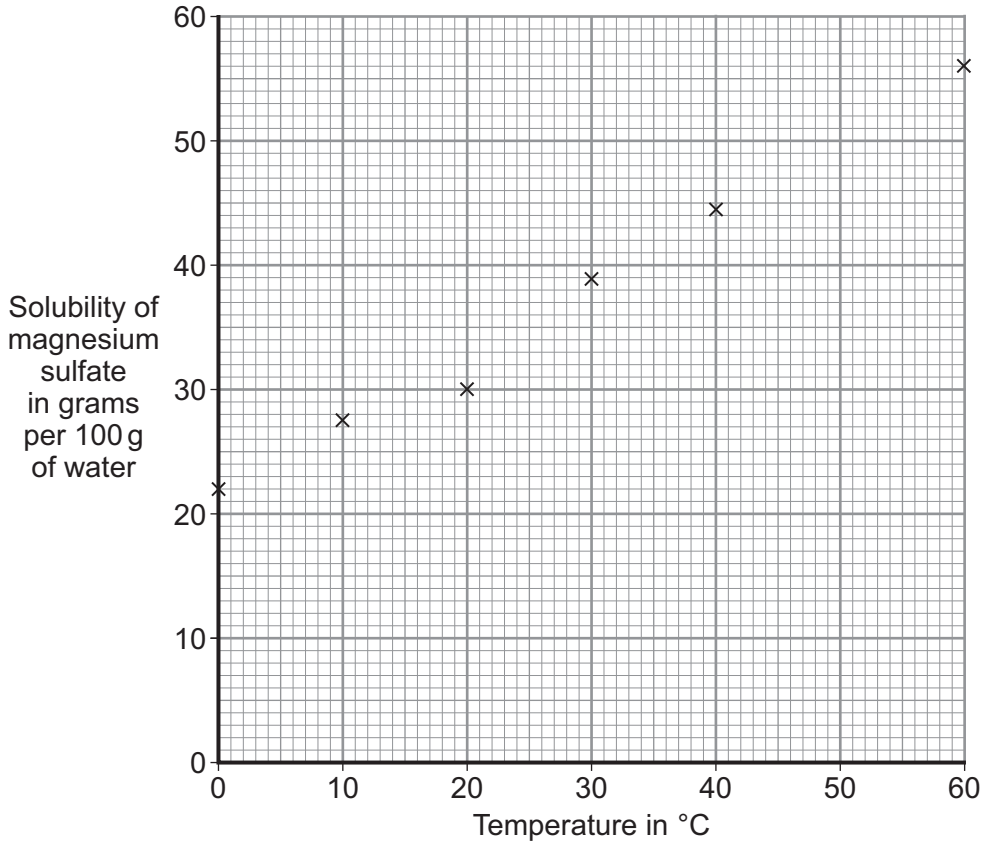
2 (b) (ii) Magnesium ions cause hardness in water.

Which other ions cause hardness in water?
Tick (✓) **one** answer.

	Tick (✓)
calcium ions	
hydrogen ions	
sodium ions	

(1 mark)

2 (c) The water in the lake contains magnesium sulfate.
A student did an investigation to find the maximum mass of magnesium sulfate that dissolves in 100 g of water at different temperatures.
The points on the graph show the results of the investigation.



Do not write outside the box

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

(1 mark)

2 (c) (ii) Use the graph to find the maximum mass of magnesium sulfate that dissolves in 100 g of water at 50 °C.

Mass = ... g

(1 mark)

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

As the temperature increases, the maximum mass of magnesium sulfate that dissolves in 100 g of water

- decreases.
- increases.
- stays the same.

(1 mark)

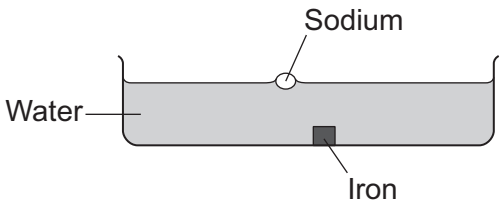
10

Turn over for the next question

Do not write outside the box

3 How a metal is used depends on its properties.

A teacher demonstrated some of the properties of sodium (an alkali metal) and iron (a transition element) by placing a small cube of each metal into water.



A student observed that:

Sodium	Iron
floated on the surface of the water	sank to the bottom of the water
melted to form a molten ball of sodium	did not melt
reacted to produce a gas	did not react
no sodium was left after 5 minutes	the cube of iron remained after 5 minutes

3 (a) Tick (✓) **two** properties of sodium compared with iron that are shown by the student's observations.

Sodium compared with iron	Tick (✓)
sodium has a higher boiling point	
sodium has a lower density	
sodium is harder	
sodium is more reactive	
sodium is softer	

(2 marks)

Do not write outside the box

3 (b) Draw a ring around the correct answer to complete the word equation.

sodium + water → sodium hydroxide + [carbon dioxide / hydrogen / oxygen]

(1 mark)

3 (c) Draw a ring around the correct answer to complete the sentence.

Sodium hydroxide is an alkali because it produces [$H^+(aq)$ / $OH^-(aq)$ / $Na^+(aq)$] ions in aqueous solution.

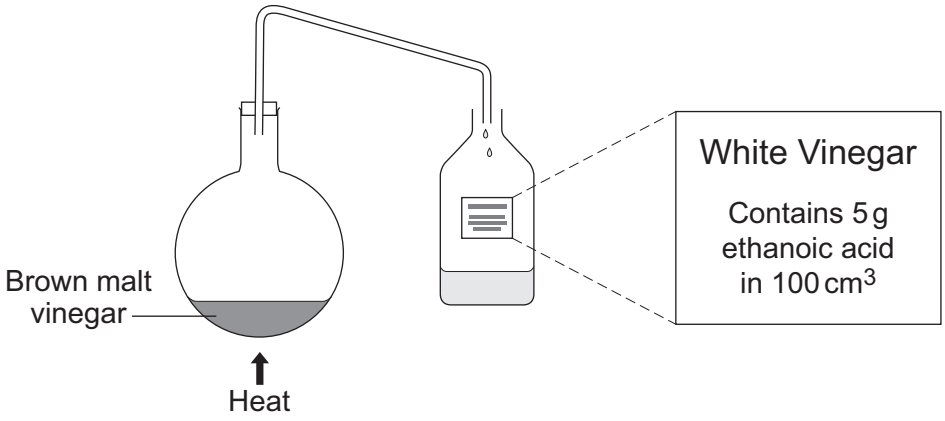
(1 mark)

4

Turn over for the next question

Do not write outside the box

4 White vinegar can be made by distillation of brown malt vinegar.



4 (a) White vinegar contains only water (boiling point 100 °C) and ethanoic acid (boiling point 118 °C).

Suggest why the brown colour remains in the flask during the distillation.

.....

.....

(1 mark)

4 (b) Ethanoic acid is a weak acid.

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

Weak acids are | completely | not | partially | ionised in water.

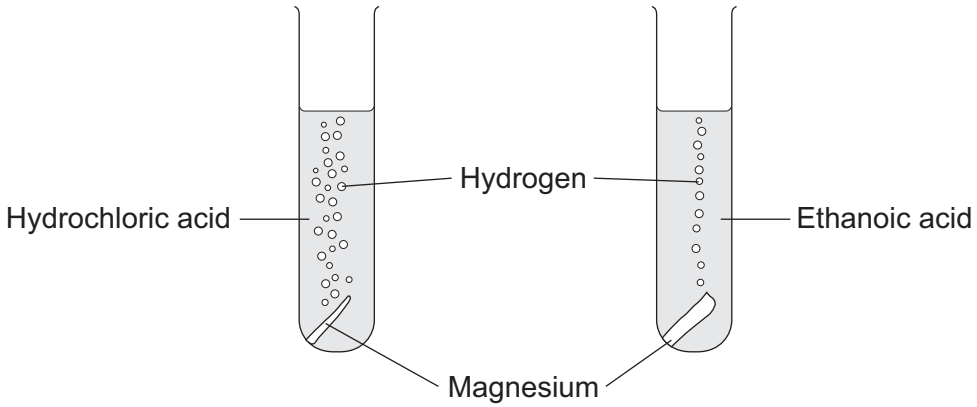
(1 mark)

Do not write outside the box

4 (b) (ii) Hydrochloric acid and ethanoic acid were reacted with magnesium metal to produce hydrogen gas.

At the start:

- both acids were the same concentration
- both pieces of magnesium were the same size.



Give **two** observations which show that ethanoic acid is a weaker acid than hydrochloric acid.

1 .....

.....

2 .....

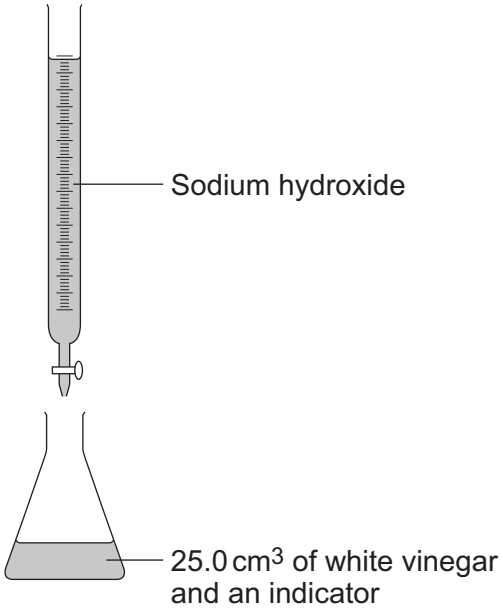
.....

(2 marks)

Question 4 continues on the next page

Do not write outside the box

4 (c) A student did a titration to find out if the white vinegar contains 5 g of ethanoic acid in 100 cm^3.



4 (c) (i) Choose the correct words from the box to complete the sentences.
Use each word once or not at all.

burette	**conical flask**	**pipette**	**thermometer**

To do this titration 25.0 cm^3 of the white vinegar is measured

using a ..... .

The 25.0 cm^3 of white vinegar is then run into a ..... .

An indicator is added to the white vinegar.

Sodium hydroxide solution is added to the white vinegar

from a ..... .

(3 marks)

Do not write outside the box

4 (c) (ii) How does the student know when to stop adding the sodium hydroxide solution?

.....

.....

.....

.....

(2 marks)

4 (d) The titration is repeated three more times. The results are shown in the table.

Titration	**1**	**2**	**3**	**4**
Volume of sodium hydroxide in cm^3	23.5	20.1	19.9	20.0

4 (d) (i) The student decided that the mean of these results was 20.0 cm^3.

Explain why.
Use the figures from the table in your explanation.

.....

.....

.....

.....

(2 marks)

4 (d) (ii) From the results, the student calculated that the concentration of the ethanoic acid was 48 g per cubic decimetre.

Did the white vinegar contain 5 g of ethanoic acid in 100 cm^3?
Explain your answer.

.....

.....

(1 mark)

12

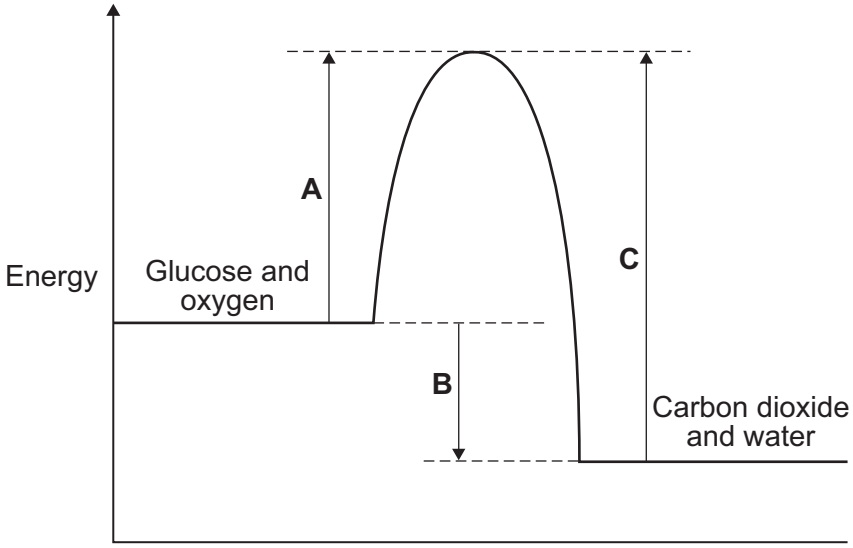
Turn over for the next question

Do not write outside the box

5 Food provides chemicals and energy to keep your body working. In your body, energy is released by respiration when glucose, $C_6H_{12}O_6$, reacts with oxygen.

$$C_6H_{12}O_6 + 6\,O_2 \rightarrow 6\,CO_2 + 6\,H_2O$$

5 (a) The energy level diagram for the reaction of glucose with oxygen is shown.



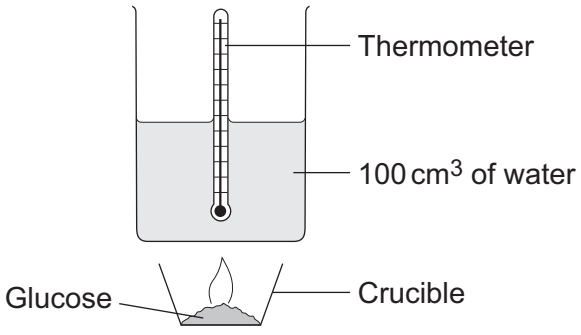
5 (a) (i) Which energy change, **A**, **B** or **C**, represents the activation energy? ☐

(1 mark)

5 (a) (ii) Which energy change, **A**, **B** or **C**, shows that the reaction is exothermic? ☐

(1 mark)

5 (b) A student did an investigation to find the amount of energy released when 1 g of glucose burns in air.



The student:

- recorded the room temperature
- placed 1 g of glucose into the crucible
- set up the equipment as shown in the diagram
- lit the glucose
- recorded the highest temperature of the water.

Do not write outside the box

5 (b) (i) One of the main errors in this experiment is energy loss to the surroundings.

Suggest **one** way that the equipment could be changed to reduce this energy loss.

.....

.....

(1 mark)

5 (b) (ii) The room temperature was 20 °C and the highest temperature recorded was 42 °C.
Use these temperature readings to calculate how much energy is released when 1 g of glucose burns.
The equation that you need to use is:

Energy released in joules = 100 × 4.2 × temperature change

Show clearly how you work out your answer.

.....

.....

.....

Burning 1 g of glucose releases ..... joules
(2 marks)

5 (b) (iii) The amount of energy released by 1 g of glucose should be 16 000 J.

Apart from energy loss to the surroundings, suggest **two** other reasons why the student's value was less than expected.

1 .....

.....

2 .....

.....
(2 marks)

5 (c) Suggest **one** reason why food labels provide information about the energy released by the food.

.....

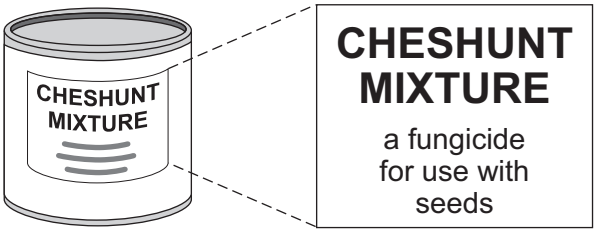
.....
(1 mark)

8

Turn over for the next question

Do not write outside the box

6 Cheshunt mixture is a powder containing copper sulfate, $CuSO_4$, and ammonium carbonate, $(NH_4)_2CO_3$



6 (a) A student tested the Cheshunt mixture.

6 (a) (i) Hydrochloric acid was added.
A gas was produced that turned limewater milky.

Complete the sentence.

The gas was ..... which shows

that ..... ions are in the mixture.

(2 marks)

6 (a) (ii) Sodium hydroxide solution was added.
A gas was produced that indicates that ammonium ions are in the mixture.

Complete the sentence.

The gas was ..... which turns

damp red ..... blue.

(2 marks)

Do not write outside the box

6 (b) Cheshunt mixture is dissolved in water before it is used.
When the student dissolved the Cheshunt mixture in water it formed a blue solution.

6 (b) (i) Suggest how the student knew that copper ions are in this solution.

.....

.....

(1 mark)

6 (b) (ii) The student tested the Cheshunt solution and the result of the test indicated that sulfate ions are in the solution.

Complete the sentence.

The student added a solution of ..... in the presence of

dilute hydrochloric acid and a ..... precipitate was produced.

(2 marks)

7

END OF QUESTIONS

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Version : 07/03/2012

General Certificate of Secondary Education

Chemistry 4421

CHY3F Unit Chemistry 3

Mark Scheme

2012 examination – January series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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CHY3F

Question 1

question	answers	extra information	mark
1(a)	groups		1
1(b)	it is a non-metal	allow it is not a metal	1
1(c)	to the right of column 7 / Group 7	accept in Group 0 ignore Group 8 / noble gases	1
1(d)	(atomic) number	allow proton number	1
Total			**4**

Question 2

question	answers	extra information	mark
2(a)(i)	evaporated		1
2(a)(ii)	condensed		1
2(a)(iii)	dissolved		1
2(a)(iv)	filtered sterilised		2
2(b)(i)	scum forms	accept does not form a lather do **not** accept scale forms	1
2(b)(ii)	calcium ions		1
2(c)(i)	straight line through all the points except the point at 20^{o}C		1
2(c)(ii)	value in the range 50 - 51		1
2(c)(iii)	increases		1
Total			**10**

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CHY3F

Question 3

question	answers	extra information	mark
3(a)	sodium has a lower density sodium is more reactive		1 1
3(b)	hydrogen		1
3(c)	$OH^-(aq)$		1
Total			**4**

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CHY3F

Question 4

question	answers	extra information	mark
4(a)	it / brown colour has a high(er) boiling point	allow it / brown colour is a solid	1
4(b)(i)	partially		1
4(b)(ii)	for ethanoic acid –	accept converse points for hydrochloric acid	
	fewer bubbles **or** gas produced at a slower rate		1
	more magnesium remains **or** magnesium disappears more slowly		1
		accept less temperature rise or less energy released for ethanoic acid	
4(c)(i)	pipette	answers must be in the order shown	1
	conical flask		1
	burette		1
4(c)(ii)	indicator		1
	colour changes	if indicator named then any stated colours must be correct	1
4(d)(i)	23.5 is anomalous / rough titration / overshot		1
	the mean of the other 3 is 20.0		1
4(d)(ii)	(no)		
	it only contained 4.8g of ethanoic acid in $100cm^3$		1
Total			**12**

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CHY3F

Question 5

question	Answers	extra information	mark
5(a)(i)	A		1
5(a)(ii)	B		1
5(b)(i)	put a lid on (beaker) **or** insulate (top or sides of) beaker **or** use screens to prevent draughts	any addition to the equipment that would prevent energy loss allow bomb calorimeter do **not** allow polystyrene cup ignore 'move the crucible'	1
5(b)(ii)	(temperature change =) 22°C (100 x 4.2 x 22 =) 9240	correct answer is **2** marks with or without working allow ecf from their 22	1 1
5(b)(iii)	any **two** from: • a specified human/measurement error • water should be stirred • not all of the glucose burns • energy used to heat the beaker / container • recorded the room temperature (at the beginning)	 ignore 1g of glucose insufficient ignore 100cm^3 of water too much ignore calculation error ignore not repeated / anomalous results allow thermometer in fixed position allow glucose was impure ignore light energy / evaporation allow room temperature was higher/different to the temperature of the (cold) water allow did not measure the water temperature at the beginning	2

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Question 5 continued . . .

question	Answers	extra information	mark
5(c)	any **one** from: • for dietary information • different foods produce different amounts of energy • legal requirement	 allow consequences of diet allow for nutritional information allow eat healthily ignore balanced diet ignore to know how much energy is taken in	1
Total			**8**

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CHY3F

Question 6

question	Answers	extra information	mark
6(a)(i)	carbon dioxide / CO_2 carbonate / CO_3^{2-}	answers must be in the order shown marks are independent	1 1
6(a)(ii)	ammonia / NH_3 litmus	answers must be in the order shown marks are independent	1 1
6(b)(i)	solution is blue	accept blue precipitate only if sodium hydroxide added allow blue liquid allow copper sulfate / copper ions are blue	1
6(b)(ii)	barium chloride / $BaCl_2$ white	allow barium nitrate / barium ions / Ba^{2+} answers must be in the order shown marks are independent	1 1
Total			**7**

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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.

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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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)

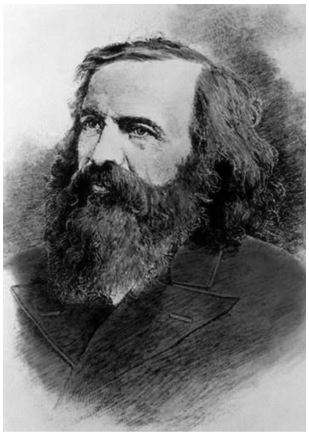
1 (a) (iv) silicon? ☐

(1 mark)

Question 1 continues on the next page

Do not write outside the box

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

Do not write outside the box

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

Do not write outside the box

2 Hydrogen peroxide decomposes slowly to give water and oxygen.

The reaction is *exothermic.*

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

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

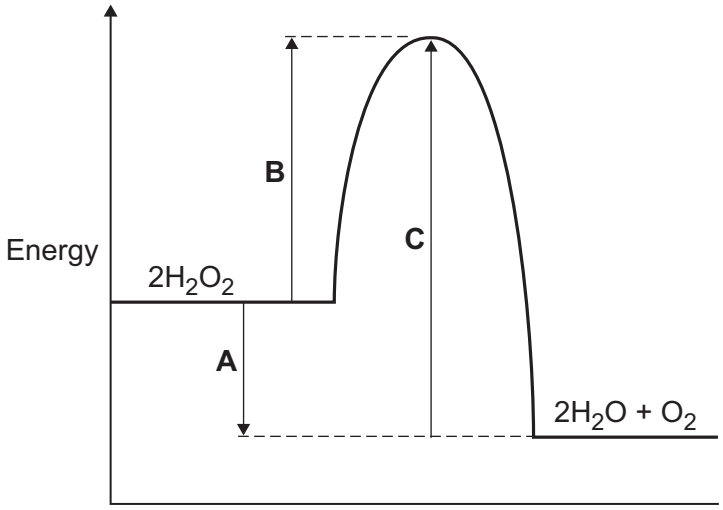
goes down.

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)

Do not write outside the box

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.

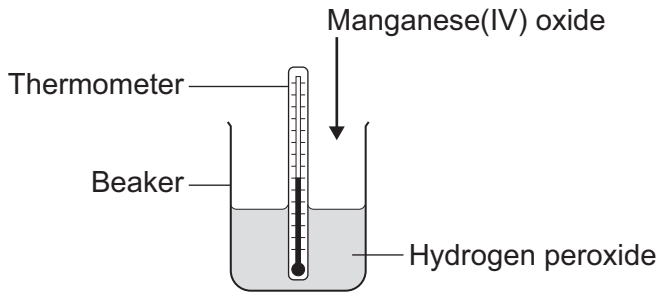
(2 marks)

Question 2 continues on the next page

Do not write outside the box

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.

.....

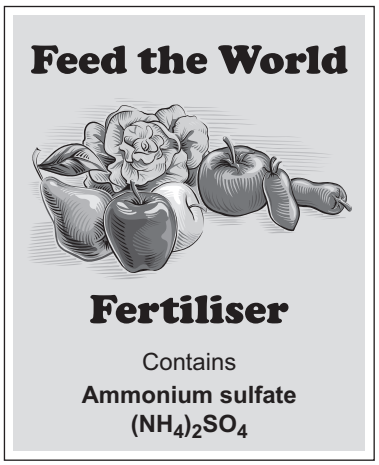
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(1 mark)

7

Do not write outside the box

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 ▶

Do not write outside the box

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_3COO^-	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

- CH_3COO^- ions.
- H^+ ions.
- SO_4^{2-} 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

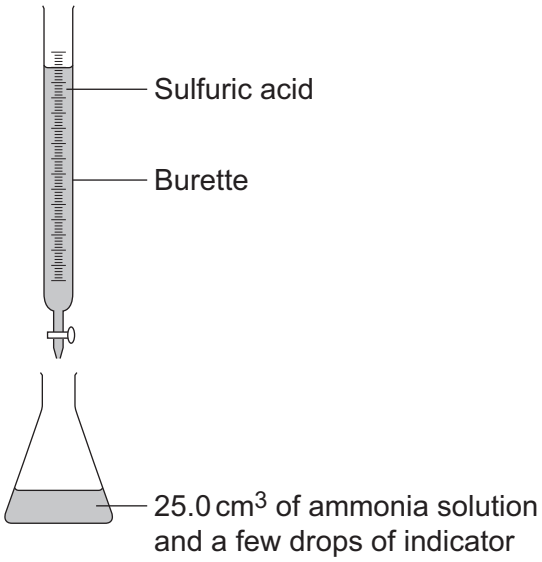
the pH of weaker acids.

(1 mark)

Do not write outside the box

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

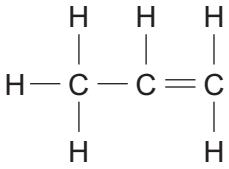
(1 mark)

10

Do not write outside the box

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)

Do not write outside the box

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_2O
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

Do not write outside the box

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

Mountain View

Natural Spring Water

Contains essential minerals for good health

Analysis

Ions present	mg/dm^3
Calcium	65
Magnesium	35
Potassium	5
Sodium	12
Chloride	9
Hydrogencarbonate	269
Sulfate	21

Also tested by the independent Food Standards Agency and approved safe.

Valley Croft

Pure Spring Water

With healthy minerals as Nature intended

Analysis

Ions present	mg/dm^3
Calcium	16
Magnesium	14
Potassium	5
Sodium	34
Chloride	13
Hydrogencarbonate	62
Sulfate	7

Pure and natural – contains no chemicals.

Tested in our own laboratories by our own scientists to keep you safe.

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)

Do not write outside the box

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.

.....

.....

.....

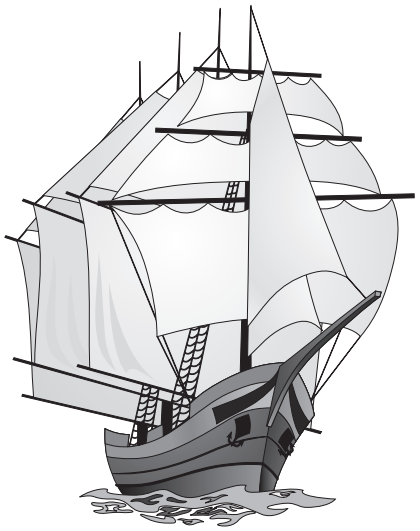
(1 mark)

9

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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

Do not write outside the box

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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ANSWER IN THE SPACES PROVIDED

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Version : 05/08/2011



General Certificate of Secondary Education

Chemistry 4421

CHY3F Unit Chemistry 3

Mark Scheme

2011 examination – June series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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CHY3F

Question 1

question	answers	extra information	mark
1(a)(i)	Sb		1
1(a)(ii)	Se		1
1(a)(iii)	Sn		1
1(a)(iv)	Si		1
1(b)(i)	elements		1
1(b)(ii)	potassium (K)		1
1(b)(iii)	0		1
Total			**7**

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CHY3F

Question 2

question	answers	extra information	mark
2(a)	goes up		1
2(b)(i)	B		1
2(b)(ii)	A		1
2(b)(iii)	a catalyst activation energy		1 1
2(c)(i)	eg (ensures) complete reaction **or** even heating	allow spread heat / energy allow mixes properly or mix them together or to get correct temperature ignore dissolves	1
2(c)(ii)	lid (on beaker) **or** insulate (beaker) / use a plastic cup	accept cover beaker	1
Total			**7**

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CHY3F

Question 3

question	answers	extra information	mark
3(a)(i)	sodium hydroxide solution blue		1 1
3(a)(ii)	barium chloride white		1 1
3(b)	fully ionised in water		1
3(c)(i)	H^+ ions		1
3(c)(ii)	lower than		1
3(d)(i)	(indicator) changed colour / goes colourless	ignore clear / discoloured	1
3(d)(ii)	13.9 **or** (titration) 2		1
3(d)(iii)	13.2	ecf from 3(d)(ii)	1
Total			**10**

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CHY3F

Question 4

question	answers	extra information	mark
4(a)(i)	orange		1
4(a)(ii)	colourless		1
4(a)(iii)	a carbon carbon double bond		1
4(b)(i)	C		1
4(b)(ii)	B		1
4(b)(iii)	only produces water **or** does not produce carbon dioxide	do **not** accept CO^2	1
Total			**6**

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CHY3F

Question 5

question	answers	extra information	mark
5(a)(i)	Mountain View: (65+35 =)100		1
	Valley Croft: (16+14 =) 30 **OR** Mountain View Ca (65) is about 4 times Valley Croft (Ca 16) (1) Mountain View Mg (35) is about twice Valley Croft (Mg 14) (1)		1
		ignore other ions unless used in another calculation or calculations. In this case the list principle applies if no other mark awarded either: Ca 65 compared with Ca 16 **and** Mg 35 compared with Mg 14 gains **1** mark **or** difference in Ca (65 – 16) = 49 **and** Mg (35 – 14) = 21 gains **1** mark	
5(a)(ii)	shake / stir / swirl (water with soap)	allow mix ignore add / use soap / titrate	1
	(about) 3 × the scum / precipitate / solid (compared with Valley Croft)	accept (about) 3 × volume / drops / amount / quantity of soap solution for (permanent) lather (compared with Valley Croft) ignore scale / time	1
	fair test: eg same volume / amount of water **or** shake for same amount of time **or** use same type / concentration of soap	allow same temperature do **not** accept same volume of soap ignore repeat the experiment	1

Question 5 continues on the next page . . .

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CHY3F

Question 5 continued . . .

question	answers	extra information	mark
5(b)	strong(er) teeth / bones **or** good for heart	allow contains calcium (ions / compounds) ignore magnesium **or** charge on the calcium ion do **not** accept any other ions	1
5(c)	any **one** from: • produces scale / limescale / calcium carbonate / magnesium carbonate • produces scum • more soap needed • costs more to soften water • (scale) lowers efficiency of appliances	ignore health effects allow fur for scale allow doesn't lather easily ignore detergent allow costs if qualified ignore just damage to pipes	1
5(d)(i)	water / everything is made of / contains chemicals **or** water contains named ion from the label	accept company (probably) means water contains no added substances ignore water has not been treated	1
5(d)(ii)	Valley Croft scientists may be biased / vested interest	accept Food Standards Agency / independent scientists (more likely to be) unbiased allow Valley Croft scientists may falsify results ignore accuracy / reliability / fairness / validity	1
Total			**9**

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CHY3F

Question 6

question	answers	extra information	mark
6(a)(i)	(copper) stops barnacles / seaweed (sticking)	it = copper accept lead doesn't stop barnacles / seaweed (sticking) ignore all other properties	1
6(a)(ii)	(Muntz Metal) is less expensive / cheaper / cheapest	it = Muntz Metal must be a comparison accept copper is more expensive ignore other properties	1
6(b)(i)	atomic absorption spec(troscopy) / spectrometry **or** mass spec(trometry) / spectroscopy	accept spectroscopy / spectrometry alone allow AAS / MS do **not** allow NMR spectroscopy **or** IR spectrometry **or** chromatography	1
6(b)(ii)	sensitive **or** detect (very) small amounts **or** only small sample needed	it = instrumental method allow (more) precise ignore accurate allow converse for chemical method ignore metal contains small amount / low concentration of iron	1
6(c)	any **two** from: • unreactive / not very reactive • strong / hard • malleable / easy to shape	transition elements (= they) allow does not corrode ignore reference to rust ignore tough / durable / hard wearing ignore ductile / density / melting point	2
Total			**6**

The AQA UMS Conversion Calculator is available on the Results statistics page of the AQA Website

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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	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
January 2011

Chemistry

CHY3F

Unit Chemistry C3

F

Written Paper

Monday 17 January 2011 9.00 am to 9.45 am

For this paper you must have:
- a ruler
- 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.

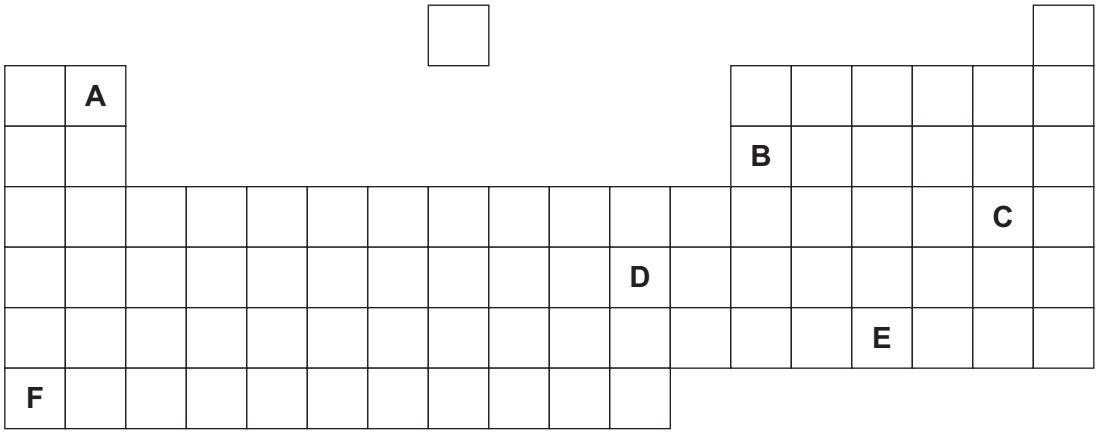
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Do not write outside the box

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

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

1 (a) Part of the periodic table is shown below.



The letters are **not** the symbols of the elements.

Choose your answers **only** from the letters shown in the periodic table above.

Which letter, **A**, **B**, **C**, **D**, **E** or **F**, represents

1 (a) (i) aluminium ☐ *(1 mark)*

1 (a) (ii) a Group 5 element ☐ *(1 mark)*

1 (a) (iii) an alkali metal ☐ *(1 mark)*

1 (a) (iv) the element with atomic (proton) number of 47 ☐ *(1 mark)*

1 (a) (v) an element with seven electrons in its outer shell? ☐ *(1 mark)*

Do not write outside the box

1 (b) The table shows the boiling points of the Group 7 elements.

The elements are arranged **in alphabetical order**.

Group 7 element		
Name	**Symbol**	**Boiling point in °C**
Astatine	At	337
Bromine		58
Chlorine	Cl	–34
Fluorine	F	–188
Iodine	I	184

1 (b) (i) The symbol for bromine is missing from the table.

What is the symbol for bromine? Symbol = ...

(1 mark)

1 (b) (ii) Arrange these elements in order of **decreasing** boiling point. The first one and the last one have been done for you.

At .... F

Highest boiling point ⟶ Lowest boiling point

(1 mark)

1 (c) The table shows some statements about Group 7 elements.

Tick (✓) the **two** correct statements.

	Tick (✓)
They are halogens.	
They are metals.	
They become less reactive down Group 7.	
They are compounds.	

(2 marks)

9

Turn over ▶

Do not write outside the box

2 Read the information in the box and then answer the questions.

> Seidlitz Powder is a medicine.
>
> Seidlitz Powder comes as two powders. One powder is wrapped in white paper and contains tartaric acid. The other powder is wrapped in blue paper and contains sodium hydrogencarbonate.
>
> The contents of the blue paper are dissolved in water and the contents of the white paper are added. This causes a reaction that produces carbon dioxide gas. The mixture is safe to drink when the reaction stops.

2 (a) Suggest why Seidlitz Powder comes as two separate powders.

.....

(1 mark)

2 (b) The reaction produces carbon dioxide gas.

2 (b) (i) What would you see during the reaction?

.....

(1 mark)

2 (b) (ii) Which state symbol in a chemical equation shows that carbon dioxide is a gas?

Draw a ring around **one** answer.

(s) **(l)** **(aq)** **(g)**

(1 mark)

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

Carbon dioxide can be identified because it turns [limescale / limestone / limewater] milky.

(1 mark)

Do not write outside the box

2 (c) Sodium hydrogencarbonate contains sodium ions. Sodium ions can be identified by flame tests.

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

Sodium ions give a [blue / red / yellow] flame.

(1 mark)

2 (d) Some Seidlitz Powder was bought on the Internet for £5. However, when tested, it was found to be only magnesium sulfate, worth a few pence.

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

2 (d) (i) The test for sulfate ions uses [barium chloride / silver nitrate / sodium hydroxide] solution.

(1 mark)

2 (d) (ii) A positive test for sulfate ions produces a [blue / red / white] precipitate.

(1 mark)

2 (d) (iii) Suggest **one** disadvantage of buying medicines on the Internet.

.....

.....

(1 mark)

8

Turn over for the next question

Do not write outside the box

3 This label was on a bottle of vinegar.



Vinegar contains ethanoic acid, which is a *weak* acid.

3 (a) Draw a ring around the correct answer to complete the sentences.

3 (a) (i) Ethanoic acid is an acid because it contains

hydrogen
hydroxide
oxide

ions.

(1 mark)

3 (a) (ii) Ethanoic acid is a *weak* acid because it is

completely
not
partially

ionised in water.

(1 mark)

3 (b) Magnesium ribbon can be used in a test to show that ethanoic acid is a weaker acid than hydrochloric acid.

3 (b) (i) State **one** way of making this test fair.

.....

.....

(1 mark)

3 (b) (ii) Give the results of this test.

.....

.....

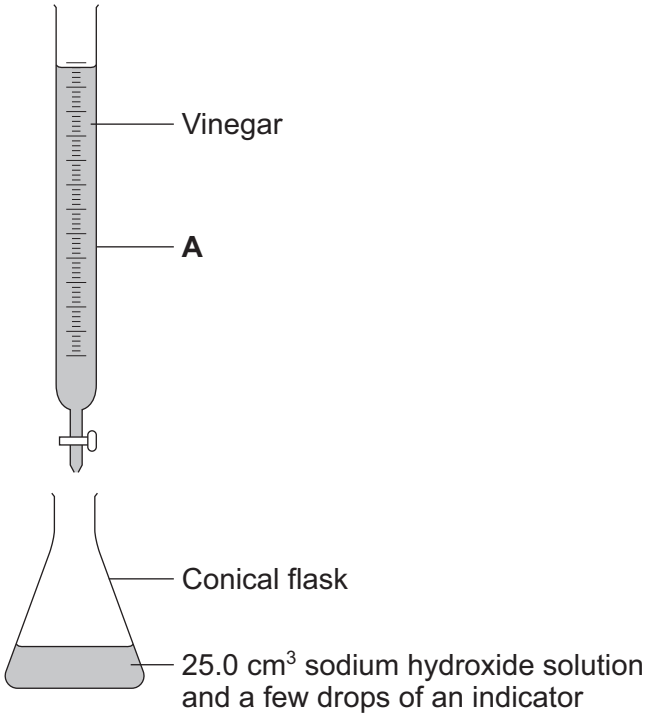
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.....

(2 marks)

Do not write outside the box

3 (c) The diagram shows the apparatus a student used to find the volume of vinegar that reacts with 25.0 cm^3 of sodium hydroxide solution.



3 (c) (i) Choose the correct word from the box to complete the sentence.

filtration	**polymerisation**	**titration**

The name of this method is ..... .

(1 mark)

3 (c) (ii) Which **one** of the following is the correct name for apparatus **A**?

Draw a ring around **one** answer.

burette **measuring cylinder** **pipette**

(1 mark)

3 (c) (iii) State how the student knew when enough vinegar had been added.

.....

.....

(1 mark)

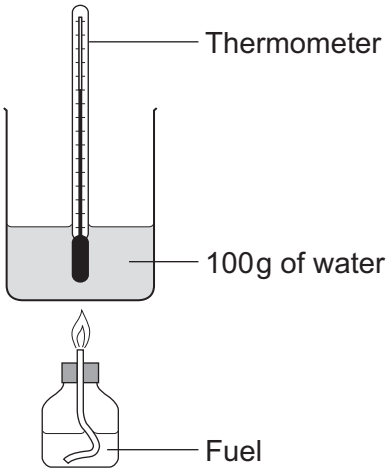
8

Turn over ▶

Do not write outside the box

4 (a) A student burned three liquid fuels and compared the amounts of energy they produced.

The diagram shows the apparatus the student used.



The heat produced when each fuel was burned increased the temperature of 100g of water.

The table shows the student's results.

Fuel	Mass of fuel burned in g	Temperature increase in °C	Type of flame
A	1	5	smoky
B	1	4	not smoky
C	1	5	not smoky

4 (a) (i) The student suggested that fuel **C** was the best fuel.

Give **two** reasons why.

1 .....

.....

2 .....

.....

(2 marks)

Do not write outside the box

4 (a) (ii) Use the following equation to calculate the energy change for burning 1 g of fuel **A**.

energy change in joules = 100 × 4.2 × temperature increase for 1 g of fuel

.....

.....

Answer = ... J

(1 mark)

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

Energy is usually measured in joules.

Some food labels give energy measured in

calories.

degrees.

minutes.

(1 mark)

4 (b) (ii) Suggest why knowing about the energy in food can help towards a healthier lifestyle.

.....

.....

.....

(1 mark)

5

Turn over for the next question

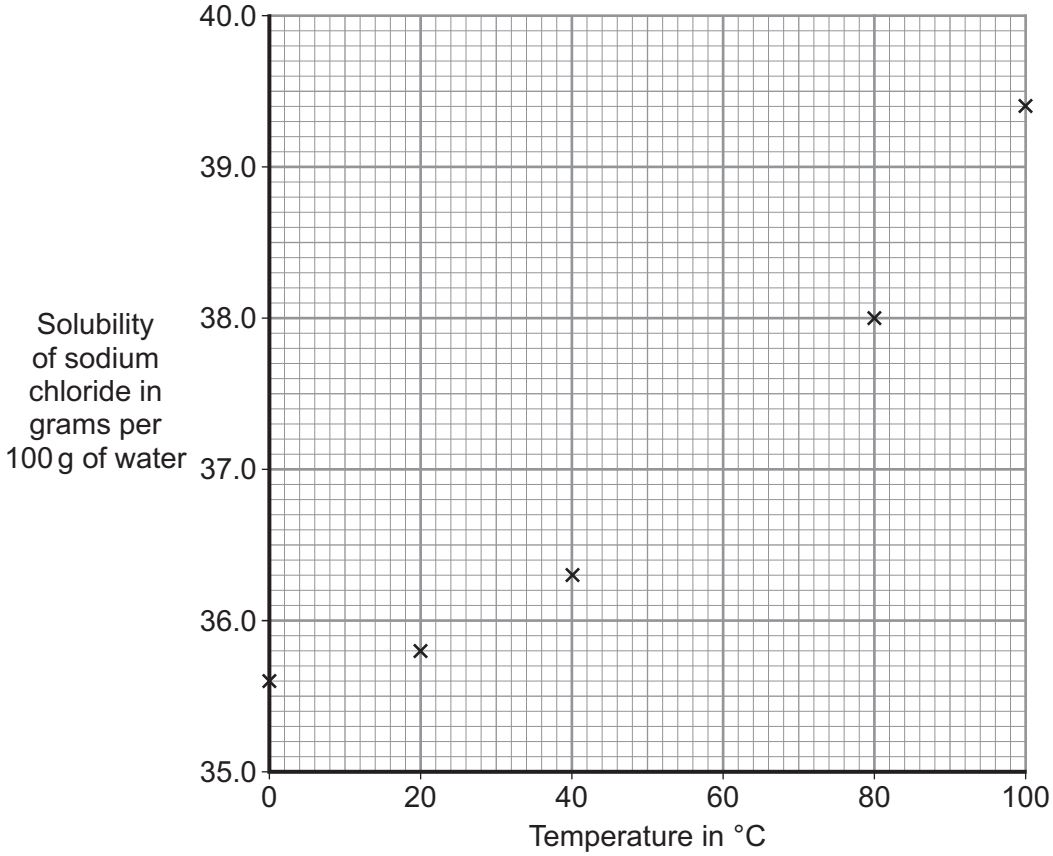
Do not write outside the box

5 The table gives the solubility of sodium chloride in water at different temperatures.

Temperature in °C	**0**	**20**	**40**	**80**	**100**
Solubility in g per 100 g of water	35.6	35.8	36.3	38.0	39.4

5 (a) A student plotted Graph **A** using the data in the table.

Graph A



5 (a) (i) Draw a smooth curve through all the points on Graph **A**. *(1 mark)*

5 (a) (ii) Use this graph to find the mass of sodium chloride that dissolves in 100 g of water at 60 °C.

Mass = ... g

(1 mark)

5 (a) (iii) A saturated solution of sodium chloride in 100 g of water is made at 60 °C. It is then cooled to 20 °C.

What mass of sodium chloride crystallises from the solution?

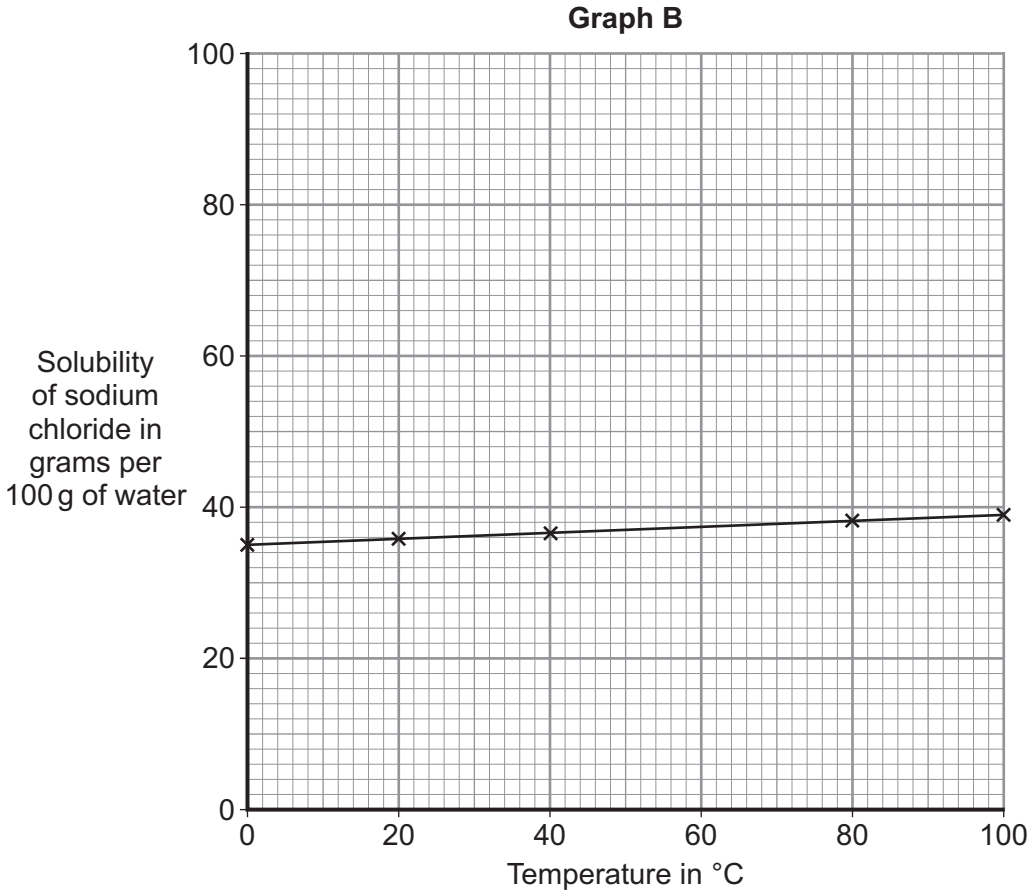
.....

.....

(2 marks)

Do not write outside the box

5 (b) Another student plotted Graph **B** using the same data.



The table shows the conclusion that each student made.

	How solubility changes as temperature increases
1st student (Graph A)	Very large increase
2nd student (Graph B)	Very small increase

Suggest why the students came to such different conclusions even though they had used the same data to plot their graphs.

.....

.....

.....

(1 mark)

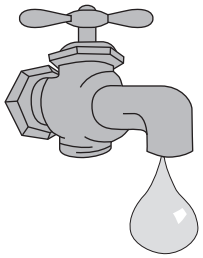
5

Turn over ▶

Do not write outside the box

6 Good quality water is essential for life.

6 (a) In the United Kingdom, water is filtered and treated with chlorine to make it safe to drink.



Explain why the water is:

filtered .....

.....

treated with chlorine. .....

.....

(2 marks)

6 (b) Millions of people in Bangladesh drink water from wells that contain high levels of arsenic. Arsenic is poisonous.

The World Health Organisation recommends that there should be no more than 0.01 mg of arsenic per litre in drinking water.

The table gives some information about two instrumental methods of testing for arsenic.

Factor to consider	**Laboratory Instrumental Method**	**Portable Instrumental Method**
Cost of equipment	£10 000	£50
Skill level of technician	Highly skilled	Little training needed
Where test is done	Laboratory only	Anywhere
Time to prepare the instrument for the test	5 minutes	10 seconds
Sensitivity of the instrument	0.000001 mg of arsenic per litre of water	0.1 mg of arsenic per litre of water

Do not write outside the box

6 (b) (i) Use the information in the table to give **two** advantages and **one** disadvantage of using the Portable Instrumental Method compared with the Laboratory Instrumental Method.

.....

.....

.....

.....

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.....

.....

.....

.....

(3 marks)

6 (b) (ii) The information about these two instrumental methods was provided by the Professional Institute of Water Engineers (PIWE). The Institute has no connection with the companies that make these instruments.

Suggest why many people would accept the views of PIWE rather than the views of the companies that make the instruments.

.....

.....

(1 mark)

6

Turn over for the next question

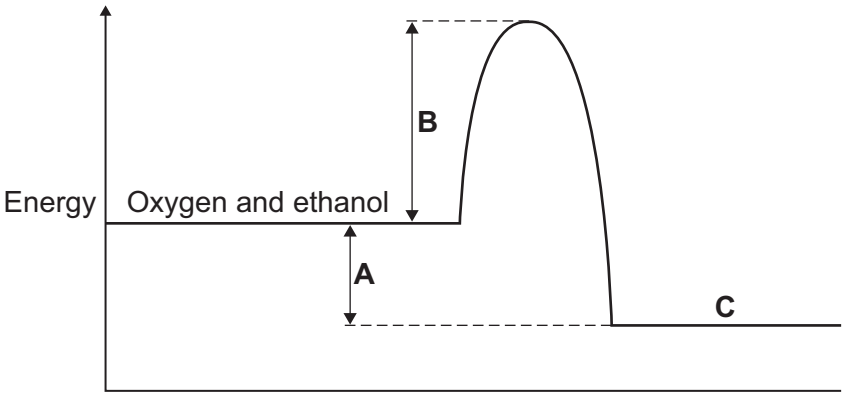
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7 V2 rockets were used during the Second World War.



V2 rockets were powered by liquid oxygen and ethanol. Oxygen and ethanol react to produce carbon dioxide and water.

The energy level diagram represents the energy changes during this reaction.



7 (a) On the energy level diagram what is represented by the letter:

A .....

B .....

C .....

(3 marks)

7 (b) What type of reaction is represented by this energy level diagram?

.....

.....

(1 mark)

4

END OF QUESTIONS

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Version : 08/03/2011



General Certificate of Secondary Education

Chemistry 4421

CHY3F Unit Chemistry 3

Mark Scheme

2011 examination – January series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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CHY3F

Question 1

question	answers	extra information	mark
1(a)(i)	B		1
1(a)(ii)	E		1
1(a)(iii)	F		1
1(a)(iv)	D		1
1(a)(v)	C		1
1(b)(i)	Br	do not accept BR or br or bR ignore numbers allow written in table if answer blank	1
1(b)(ii)	I Br Cl	allow iodine, bromine, chlorine allow I,B,C allow capitals or lower case allow 184, 58, –34 ignore numbers	1
1(c)	they are halogens they become less reactive down Group 7		1 1
Total			**9**

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CHY3F

Question 2

question	answers	extra information	mark
2(a)	stop them reacting	owtte	1
2(b)(i)	fizzing / bubbles / effervescence	owtte	1
2(b)(ii)	(g)		1
2(b)(iii)	limewater		1
2(c)	yellow		1
2(d)(i)	barium chloride		1
2(d)(ii)	white		1
2(d)(iii)	eg don't see what is being bought **or** a comment about quality / purity eg may be impure / contaminated	ignore references to cost	1
Total			**8**

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CHY3F

Question 3

question	answers	extra information	mark
3(a)(i)	hydrogen		1
3(a)(ii)	partially		1
3(b)(i)	same size / mass / amount / length of magnesium (ribbon) **or** same concentration of acids	allow react for same time ignore repeats ignore volume / amount of acid	1
3(b)(ii)	bubbles / gas given off **or** magnesium disappears / dissolves / reacts slower with ethanoic acid **or** faster with hydrochloric acid		1 1
3(c)(i)	titration	allow titration identified in box if answer line blank	1
3(c)(ii)	burette		1
3(c)(iii)	(indicator) changed colour	allow solution changes colour but not vinegar ignore specific colours	1
Total			**8**

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CHY3F

Question 4

question	answers	extra information	mark
4(a)(i)	gives out as much energy / heat as A not smoky **or** no / less pollution	accept gives out most energy / heat ignore temperature	1 1
4(a)(ii)	2100 or 2.1kJ	ignore working	1
4(b)(i)	calories		1
4(b)(ii)	less obesity **or** less heart disease **or** so that diet can be balanced	owtte	1
Total			**5**

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CHY3F

Question 5

question	answers	extra information	mark
5(a)(i)	smooth curve through all points	do **not** accept multiple lines	1
5(a)(ii)	36.9 to 37.2	if outside range accept correct reading from candidate's own curve +/- half small square	1
5(a)(iii)	35.8 (at 20°C) correctly calculated answer to their (a)(ii) – 35.8	 ignore units ecf from incorrect reading of 35.8 or incorrect transfer of (a)(ii) correct answer from (a)(ii) without working = **2** marks	1 1
5(b)	some recognition that the (y-axis) scales are different **or** some indication of the effect this has eg in **B**: values compressed / not fine enough **or** scale in **B** less precise / larger range	do **not** accept x-axis scale is different accept converse for **A** ignore precise graph	1
Total			**5**

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CHY3F

Question 6

question	answers	extra information	mark
6(a)	filtered: removes insoluble / solid	Ignore named substances / minerals do **not** accept ions	1
	chlorine: kills microorganisms / microbes / bacteria / disinfects (water)	allow kills germs / pathogens **or** sterilises allow chlorine is a disinfectant ignore cleans water or removes impurities / bacteria	1
6(b)(i)	<u>advantages of portable</u>: any **two** from : • costs less • little training needed • water can be tested within 10 seconds / immediately / quicker • can be used anywhere <u>disadvantage of portable</u>	accept converse throughout	2
	less precise / sensitive	allow only detect down to 0.1 mg ignore less accurate	1
6(b)(ii)	(PIWE) is unbiased **or**	it / they = PIWE allow honest / trusted / respected / reliable ignore professional / scientific / skilled	1
	company may be biased	allow company trying to sell products	
Total			**6**

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CHY3F

Question 7

question	answers	extra information	mark
7(a)	A = energy / enthalpy change / difference	allow heat change **or** ΔH allow energy released	1
	B = activation energy / EA	allow definition of activation energy	1
	C = carbon dioxide and water	accept products	1
7(b)	exothermic	allow combustion / redox / oxidation ignore reduction / burning	1
Total			**4**

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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 2010

Chemistry

CHY3F

Unit Chemistry C3

F

Wednesday 26 May 2010 9.00 am to 9.45 am

For this paper you must have:
- a pencil
- a ruler
- 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.

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Do not write outside the box

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

1 The table shows some information about acids and alkalis.

Name of acid or alkali	Type	Ions produced in solution		pH	Effect on Universal Indicator
Hydrochloric acid	Strong acid	H^+	Cl^-	1	Goes red
Sodium hydroxide	Strong alkali	Na^+	OH^-	13	Goes purple

Use the information in the table to help you answer parts **(a)** and **(b)**.

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

1 (a) (i) Hydrochloric acid is acidic.

This is because it contains [Cl^- / H^+ / OH^-] ions.

(1 mark)

1 (a) (ii) Sodium hydroxide solution is alkaline.

This is because it contains [H^+ / Na^+ / OH^-] ions.

(1 mark)

1 (a) (iii) The pH of acids is [higher than / lower than / the same as] the pH of alkalis.

(1 mark)

Do not write outside the box

1 (b) Ethanoic acid is a weak acid.

Universal Indicator can be used to show that hydrochloric acid is a stronger acid than ethanoic acid of the same concentration.

Explain how.

.....

.....

.....

.....

(2 marks)

1 (c) Draw a ring around the correct answer to complete this sentence.

Strong acids and strong alkalis are

completely
not
partially

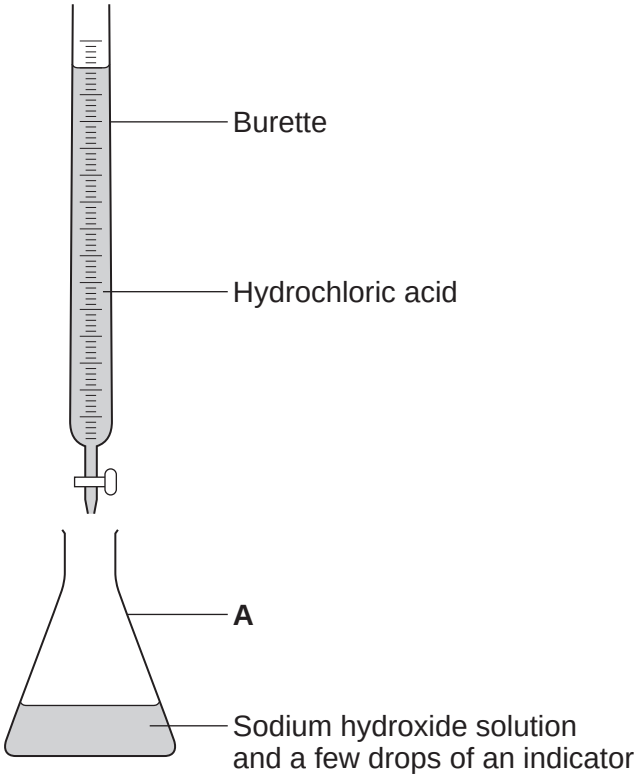
ionised in water.

(1 mark)

Question 1 continues on the next page

Do not write outside the box

1 (d) The diagram shows the apparatus used to find the volume of hydrochloric acid that reacts with 25.0 cm^3 of sodium hydroxide solution.



1 (d) (i) Which **one** of the following is the correct name for **A**?

Draw a ring around your answer.

beaker **conical flask** **pipette**

(1 mark)

1 (d) (ii) Use the correct word from the box to complete the sentence.

distillation	**filtration**	**titration**

The method used to find the volume of acid that reacts with a known volume of alkali is ..... .

(1 mark)

1 (d) (iii) Suggest **one** way to make the results more reliable.

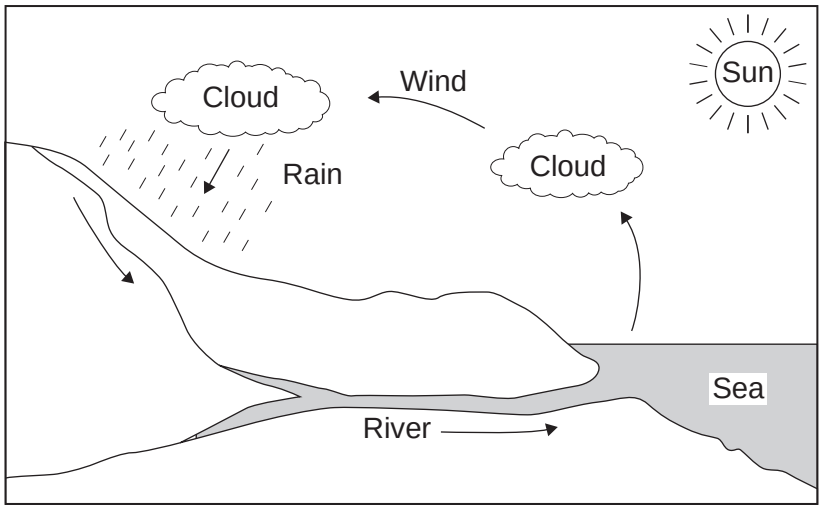
.....

(1 mark)

9

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2 The diagram shows part of the *Water Cycle*.



2 (a) Draw a ring around the correct answer to complete each sentence about the *Water Cycle*.

Heat from the Sun causes water in the sea to

boil.

condense.

evaporate.

This forms water vapour that rises in the atmosphere. As it rises the water vapour cools.

This forms clouds because the water vapour

boils.

condenses.

evaporates.

(2 marks)

2 (b) Suggest why sea water is **not** suitable as drinking water.

.....

.....

(1 mark)

3

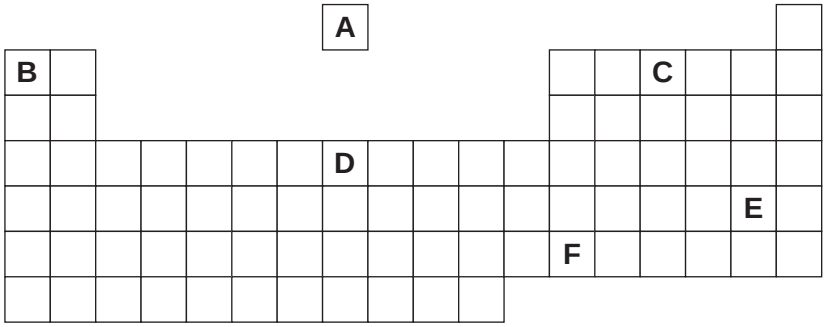
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3 (a) Use the periodic table on the Data Sheet to help you answer these questions.

Part of the periodic table is shown below.

The letters are **not** the symbols of the elements.



Choose your answers **only** from the letters shown in the periodic table above.

Which letter, **A**, **B**, **C**, **D**, **E** or **F**, represents

3 (a) (i) hydrogen Letter ☐

(1 mark)

3 (a) (ii) a Group 3 element Letter ☐

(1 mark)

3 (a) (iii) a halogen Letter ☐

(1 mark)

3 (a) (iv) the element with atomic (proton) number of 7 Letter ☐

(1 mark)

3 (a) (v) an element with one electron in its outer shell? Letter ☐

(1 mark)

Do not write outside the box

3 (b) The table shows the melting points of the Group 1 metals arranged in alphabetical order.

Group 1 metal		
Name	**Symbol**	**Melting point in ºC**
Caesium	Cs	29
Francium	Fr	27
Lithium	Li	180
Potassium	K	64
Rubidium	Rb	39
Sodium	Na	98

3 (b) (i) Arrange these metals in order of increasing melting point. Three have been done for you.

Fr Cs Li

Lowest ⟶ Highest

(1 mark)

3 (b) (ii) Use the periodic table on the Data Sheet **and** your answer in part (b)(i) above to complete this sentence about how the melting points change.

Going down Group 1, the melting points ..... .

(1 mark)

3 (c) The transition metals are a block of elements between Groups 2 and 3 of the periodic table. Transition metals have different properties to Group 1 metals.

Put ticks (✓) next to the **three** correct statements about transition metals in the table below.

Statement	(✓)
They are harder than Group 1 metals	
They have lower densities than Group 1 metals	
They have higher melting points than Group 1 metals	
They are more reactive with water than Group 1 metals	
They often form coloured compounds but Group 1 compounds are usually white	

(3 marks)

10

Turn over ▶

Do not write outside the box

4 Chemical tests can be used to detect and identify elements and compounds.

A jar of a chemical from 1870 is shown.



Copperas was a name used for iron(II) sulfate, $FeSO_4$. It does not contain any copper!

4 (a) A student tested solutions of copperas to show which ions it contained.

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

4 (a) (i) The student tested for iron(II) ions, Fe^{2+}

The student added a solution of

barium chloride.

silver nitrate.

sodium hydroxide.

The colour of the precipitate formed was

green.

red.

white.

The precipitate was a

liquid.

gas.

solid.

(3 marks)

Do not write outside the box

4 (a) (ii) The student tested for sulfate ions, SO_4^{2-}

The student added dilute hydrochloric acid and

barium chloride
silver nitrate
sodium hydroxide

solution.

The colour of the precipitate formed was

green.
red.
white.

Sulfuric acid (H_2SO_4) should **not** be used instead of hydrochloric acid (HCl) when testing for sulfate ions. This is because sulfuric acid contains

chloride ions, Cl^-
nitrate ions, NO_3^-
sulfate ions, SO_4^{2-}

(3 marks)

4 (b) A flame test can be used to identify the metal ions in a compound.

How do you carry out a flame test?

.....

.....

(1 mark)

4 (c) The elements in a compound can also be detected and identified using instrumental methods of analysis.

State **one** advantage of using instrumental methods compared with chemical tests.

.....

.....

(1 mark)

8

Turn over ▶

Do not write outside the box

5 The table gives some information about the composition of three samples of water from wells in the Canary Islands, Crete and Cyprus.

	Mineral content of water in mg per litre		
Ions	**Canary Islands**	**Crete**	**Cyprus**
Calcium, Ca^{2+}	28	82	18
Magnesium, Mg^{2+}	14	41	13
Sodium, Na^{+}	53	7	22
Chloride, Cl^{-}	7	143	39
Hydrogencarbonate, HCO_3^{-}	281	5	93
Sulfate, SO_4^{2-}	2	14	16

5 (a) Describe and explain how ions get into these samples of water.

.....

.....

.....

.....

(2 marks)

5 (b) The sample of water from Crete is harder than the other two.

Use the information in the table to explain why.

.....

.....

(1 mark)

Do not write outside the box

5 (c) People who use hard water can expect higher costs than people who use soft water.

Explain why.

.....

.....

.....

.....

(2 marks)

5 (d) Hard water can be made soft by removing the ions that cause hardness.

State **one** way these ions can be removed.

.....

.....

(1 mark)

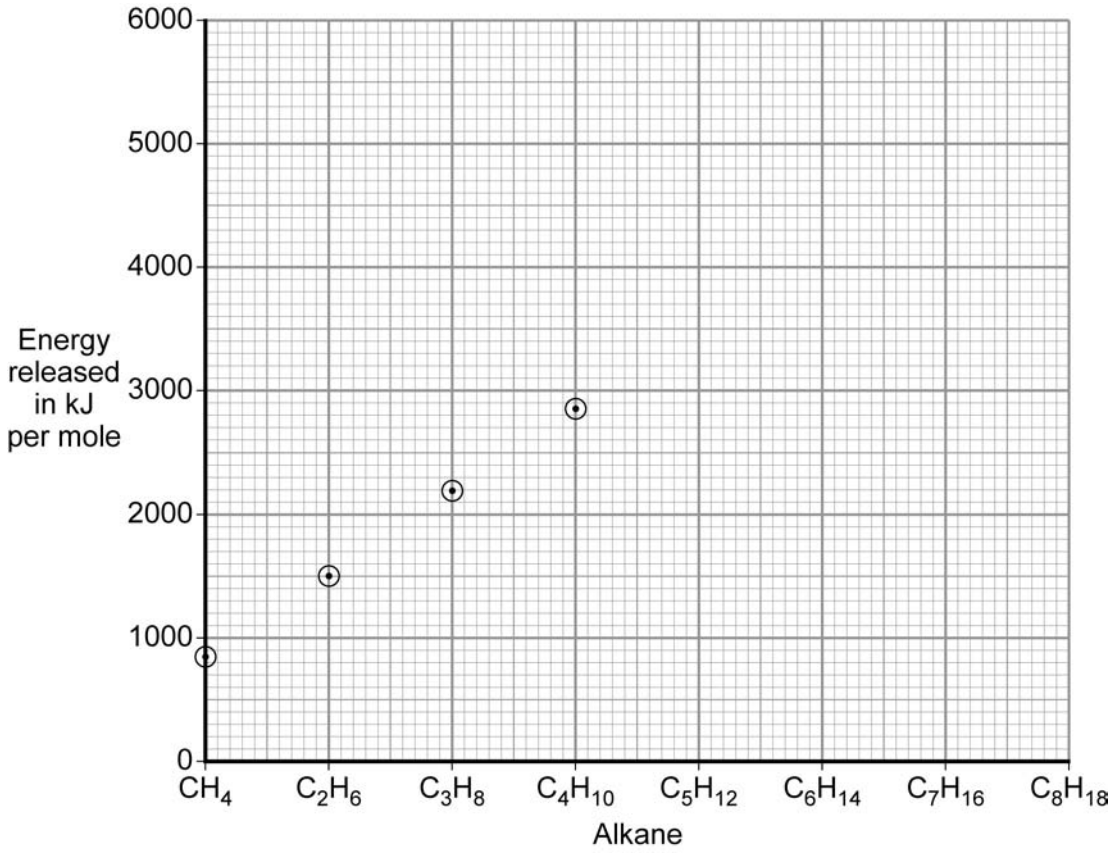
6

Turn over for the next question

Do not write outside the box

6 (a) Alkanes are important hydrocarbon fuels. They have the general formula C_nH_{2n+2}

The points on the graph show the amount of energy released when 1 mole of methane (CH_4), ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10}) are burned separately.



6 (a) (i) Draw a line through the points and extend your line to the right-hand edge of the graph.
(1 mark)

6 (a) (ii) Use the graph to estimate the amount of energy released when 1 mole of octane (C_8H_{18}) is burned.

Energy released = ... kJ
(1 mark)

Do not write outside the box

6 (a) (iii) Suggest why we can make a good estimate for the energy released by 1 mole of pentane (C_5H_{12}).

.....

.....

(1 mark)

6 (a) (iv) A student noticed that octane (C_8H_{18}) has twice as many carbon atoms as butane (C_4H_{10}), and made the following prediction:

"When burned, 1 mole of octane releases twice as much energy as 1 mole of butane."

Use the graph to decide if the student's prediction is correct. You **must** show your working to gain credit.

.....

.....

.....

.....

(2 marks)

Question 6 continues on the next page

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6 (b) Some information about four fuels is given in the table.

Fuel	Type	Heat released in kJ per g	Combustion products			Type of flame
			CO_2	SO_2	H_2O	
Bio-ethanol	Renewable	29	✓		✓	Not smoky
Coal	Non-renewable	31	✓	✓	✓	Smoky
Hydrogen	Renewable	142			✓	Not smoky
Natural gas	Non-renewable	56	✓		✓	Not smoky

From this information a student made two conclusions.

For each conclusion, state if it is correct **and** explain your answer.

6 (b) (i) "Renewable fuels release more heat per gram than non-renewable fuels."

.....

.....

.....

.....

(2 marks)

6 (b) (ii) "Non-renewable fuels are better for the environment than renewable fuels."

.....

.....

.....

.....

.....

.....

.....

(2 marks)

9

END OF QUESTIONS

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Version: 17/08/2010

General Certificate of Secondary Education

Chemistry 4421

CHY3F Unit Chemistry 3

Mark Scheme

2010 Examination – June Series

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

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where consequential marking needs to be considered in a calculation;

or the answer may be on the diagram or at a different place on the script.

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2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

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3.1 Marking of lists

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Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct

substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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CHY3F

Question 1

question	answers	extra information	mark
1(a)(i)	H^+		1
1(a)(ii)	OH^-		1
1(a)(iii)	lower than		1
1(b)	with HCl: UI goes red / pink has a pH 0 ,1 ,2 **or** 3 **or** with ethanoic acid: UI goes orange / yellow (1) has a pH 4 / or above (but less than 7) (1)	 allow a comparison eg redder than ethanoic acid allow a comparison eg has pH less than ethanoic acid. do **not** accept an incorrect pH. allow a comparison with HCl allow a comparison with HCl	 1 1
1(c)	completely		1
1(d)(i)	conical flask		1
1(d)(ii)	titration		1
1(d)(iii)	repeat **or** take average	allow compare with another students results	1
Total			**9**

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CHY3F

Question 2

question	answers	extra information	mark
2(a)	evaporate condenses		1 1
2(b)	high amounts of / too much (dissolved) solids in the water **or** not sterilised	allow contains (dissolved) salt / sewage / micro-organisms / toxins / oil etc	1
Total			**3**

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CHY3F

Question 3

question	answers	extra information	mark
3(a)(i)	**A**		1
3(a)(ii)	**F**		1
3(a)(iii)	**E**		1
3(a)(iv)	**C**		1
3(a)(v)	**A or B**		1
3(b)(i)	Rb K Na	allow rubidium, potassium, sodium do **not** accept RB or NA	1
3(b)(ii)	decrease **or** become lower / smaller / less	allow from 180° C to 27° C	1
3(c)	They are harder than Group 1 metals. They have higher melting points than Group 1 metals. They often form coloured compounds but Group 1 compounds are usually white.		1 1 1
Total			**10**

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Question 4

question	answers	extra information	mark
4(a)(i)	sodium hydroxide green solid		1 1 1
4(a)(ii)	barium chloride white sulfate ions, SO_4^{2-}		1 1 1
4(b)	some indication of contact between (colourless) flame and the chemical	ignore colour of flame	1
4(c)	any **one** from: • accurate • precise • sensitive • reliable • rapid • only small amount needed	ignore reference to cost / safer	1
Total			**8**

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CHY3F

Question 5

question	answers	extra information	mark
5(a)	contact with rocks (ions) dissolve / soluble / react	 allow water is a solvent ignore 'picks up' / 'gets into' / absorbed	1 1
5(b)	more calcium / Ca^{2+} and / or magnesium / Mg^{2+} (ions in Crete water)	accept 'a lot' of calcium / magnesium allow incorrectly charged Ca and Mg ions accept correct comparison using numbers from the table do **not** accept mention of other ions	1
5(c)	**two** from: • scum / calcium stearate / magnesium stearate • (scum) more soap used • scale / limescale / calcium carbonate / magnesium carbonate • (scale) less efficient heating systems / kettles / appliances • use of a water softener eg sodium carbonate / ion-exchange	if an effect and clarification are given, the clarification must be correct to gain both marks accept does not lather (easily) ignore costs more unqualified ignore fur ignore costs more unqualified ignore blocks pipes unqualified accept salt in dishwashers	2

Question 5 continues on the next page

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CHY3F

Question 5 continued

question	answers	extra information	mark
5(d)	any **one** from: • sodium carbonate / washing soda • ion-exchange • distillation	ignore filter / filtration allow soap accept de-ionised ignore boiling / heating / evaporation	1
Total			**6**

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CHY3F

Question 6

question	answers	extra information	mark
6(a)(i)	straight line through the 'points' and extended to C_8H_{18}	do **not** accept multiple lines	1
6(a)(ii)	5500	range 5400 *to* 5600 accept ecf from their graph	1
6(a)(iii)	it is a straight line graph	allow directly proportional accept constant difference between (energy) values accept C_5H_{12} close to values on the graph **or** C_5H_{12} comes in middle of the graph ignore 'fits the pattern' unqualified ignore 'line of best fit' ignore 'positive correlation'	1
6(a)(iv)	expected ranges for working are: (5400 to 5600) – (2800 to 2900) = (2500 to 2800) **or** their value from (a)(ii) – a value from 2800 to 2900 **or** (5400 to 5600) / their (a)(ii) divided by 2 **or** a value from 2800 to 2900 × 2 no / not quite / almost / yes	accept correct numerical answer as evidence of working this mark is only awarded on evidence from their correct working	1 1

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6(b)(i)	incorrect / no **or** partially correct bio-ethanol produces least energy **or** bio-ethanol produces 29 kJ	ignore references to hydrogen mark independently	1 1
6(b)(ii)	any **two** from: • hydrogen produces only H_2O • coal produces SO_2 • coal produces smoke • both renewable and non-renewable fuels produce CO_2 • (both) the non-renewable fuels produce CO_2 • (both) renewable fuels produce no smoke • (both) renewable fuels produce no SO_2	ignore incorrect / correct accept hydrogen does not produce harmful gases / CO_2 / SO_2 allow coal causes acid rain / respiratory problems allow coal causes global dimming accept bio-ethanol and natural gas / coal produce CO_2 / global warming accept coal and natural gas produce CO_2 / global warming accept hydrogen and bio-ethanol do not produce smoke / global dimming accept hydrogen and bio-ethanol do not produce SO_2 / acid rain	2
Total			**9**

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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

Chemistry

CHY3F

Unit Chemistry C3

F

Written Paper

Monday 18 January 2010 9.00 am to 9.45 am

For this paper you must have:
- a ruler
- 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.

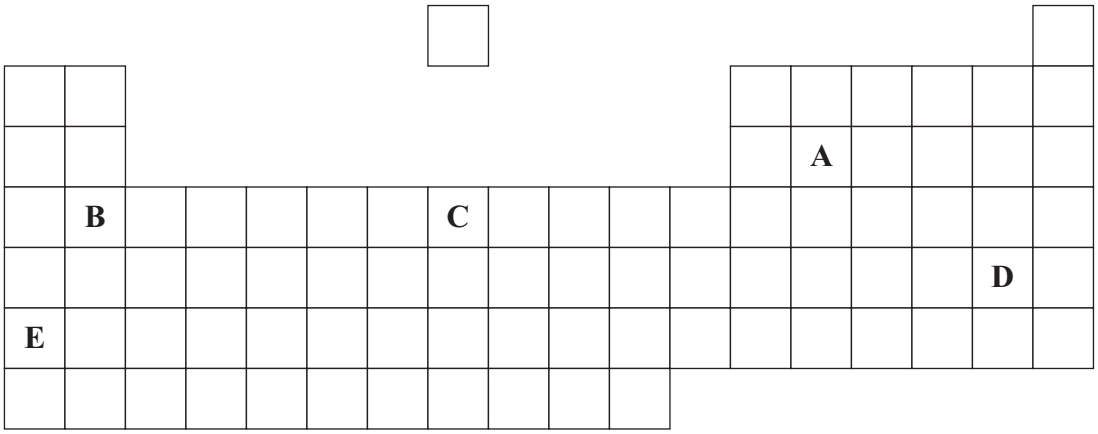
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Areas outside the box will not be scanned for marking

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

1 (a) The periodic table on the Data Sheet may help you to answer these questions.

Part of the periodic table is shown below.



The letters are **not** the symbols of these elements.

Choose your answers **only** from the letters shown in the periodic table above.

Which letter, **A, B, C, D** or **E**, represents:

1 (a) (i) an alkali metal Letter ☐

(1 mark)

1 (a) (ii) the element calcium Letter ☐

(1 mark)

1 (a) (iii) a transition element Letter ☐

(1 mark)

1 (a) (iv) a Group 4 element? Letter ☐

(1 mark)

Areas outside the box will not be scanned for marking

1 (b) A chemistry teacher demonstrated the reaction between sodium and water to some students. One of the students wrote the following notes.

The reaction between sodium and water

A piece of sodium was cut easily into smaller pieces with a knife.

The sodium was added to water in a trough.

The sodium:
- floated
- melted quickly to give a silvery ball
- moved on the surface of the water
- fizzed.

Use the information in the box to help you to answer these questions.

What evidence is there that:

1 (b) (i) sodium has a low melting point

.....

.....

(1 mark)

1 (b) (ii) sodium is soft

.....

.....

(1 mark)

1 (b) (iii) a gas was produced?

.....

.....

(1 mark)

7

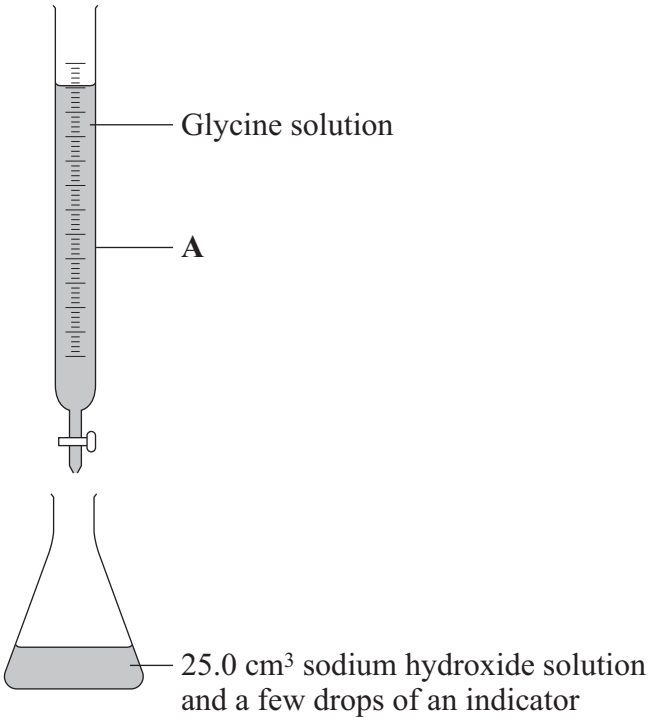
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Areas outside the box will not be scanned for marking

2 Glycine is an amino acid. It is found in fish, meat, beans and dairy produce.

A student carried out a titration to find the amount of glycine solution that reacts with 25.0 cm^3 of sodium hydroxide solution.

The diagram shows the apparatus that the student used.



2 (a) Which **one** of the following words is the correct name for apparatus **A**?

Draw a ring around your answer.

burette **cylinder** **pipette**

(1 mark)

2 (b) How would the student know when enough glycine solution had been added to react with all of the sodium hydroxide solution?

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

2 (c) The student's results are given in the table.

Titration	Volume of glycine solution added in cm^3
1	18.5
2	18.3
3	18.4

2 (c) (i) What is the range?

.....

(1 mark)

2 (c) (ii) Calculate the mean.

.....

(1 mark)

2 (c) (iii) Suggest why the student repeated the titration.

.....

.....

(1 mark)

5

Turn over for the next question

Areas outside the box will not be scanned for marking

3 During a thunderstorm lightning strikes the Eiffel Tower.



In lightning the temperature can reach 30 000 °C. This causes nitrogen and oxygen in the air to react, producing nitrogen oxide. This reaction has a high *activation energy* and is *endothermic*.

3 (a) Nitrogen and oxygen in the air do not react easily.

What makes nitrogen and oxygen react during thunderstorms?

.....

(1 mark)

3 (b) Complete the word equation for the reaction of nitrogen with oxygen.

nitrogen + ... → .....

(1 mark)

3 (c) In an *endothermic* reaction, energy is taken in from the surroundings.

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

In an *endothermic* reaction, the energy needed to break existing bonds is

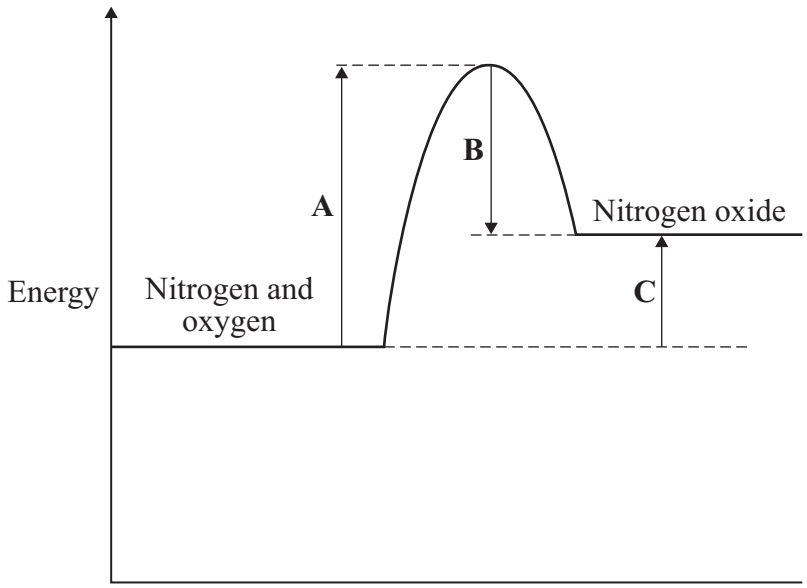
less than
more than
the same as

the energy released from forming new bonds.

(1 mark)

Areas outside the box will not be scanned for marking

3 (d) The energy level diagram for this reaction is shown.



Use the energy level diagram to help you to answer these questions.

3 (d) (i) Which energy change, **A**, **B** or **C**, represents the *activation energy*?

(1 mark)

3 (d) (ii) Which energy change, **A**, **B** or **C**, shows that this reaction is *endothermic*?

(1 mark)

5

Turn over for the next question

Areas outside the box will not be scanned for marking

4 Alums are salts. They have been used since ancient times in dyeing and medicine and still have many uses today.

Three alums are shown in the table:

Name	Ions present		
Ammonium alum	NH_4^+	Al^{3+}	SO_4^{2-}
Potassium alum	K^+	Al^{3+}	SO_4^{2-}
Sodium alum	Na^+	Al^{3+}	SO_4^{2-}

A student tested these alums to show which ions were present.

4 (a) The student did a flame test on these alums. A sample of each alum was held on a wire in a colourless flame.

In (a)(i) and (a)(ii) use the correct word from the box to complete each sentence.

blue	**lilac**	**yellow**	**green**

4 (a) (i) Sodium ions give a ..... flame.

(1 mark)

4 (a) (ii) Potassium ions give a ..... flame.

(1 mark)

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

The wire used in a flame test should have a high

density.
electrical conductivity.
melting point.

(1 mark)

Areas outside the box will not be scanned for marking

4 (b) Draw a ring around the correct word to complete the sentences.

4 (b) (i) The student tested a solution of each salt for sulfate ions (SO_4^{2-}).

The student added dilute hydrochloric acid and [barium chloride / nitric acid / silver nitrate] solution and a white [gas / liquid / solid] was formed.

(2 marks)

4 (b) (ii) The student tested a solution of each salt for aluminium ions (Al^{3+}).

The student added sodium hydroxide solution and a [green / red / white] precipitate was formed. When excess sodium hydroxide solution was added, the precipitate [boiled. / condensed. / dissolved.]

(2 marks)

7

Turn over for the next question

Areas outside the box will not be scanned for marking

5 Some people use water filters because they are concerned about the quality of drinking water.

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

5 (a) (i) One of the active chemicals in many water filters is

carbon.
magnesium.
sulfur.

(1 mark)

5 (a) (ii) In many areas of the United Kingdom the water is hard.

The hardness in water is caused by

bromide
calcium
hydrogen

ions.

(1 mark)

5 (b) Describe and give the result of a test to show that some drinking water is hard.

Test .....

.....

Result of test .....

.....

(2 marks)

5 (c) State and explain **one** benefit of drinking hard water.

.....

.....

.....

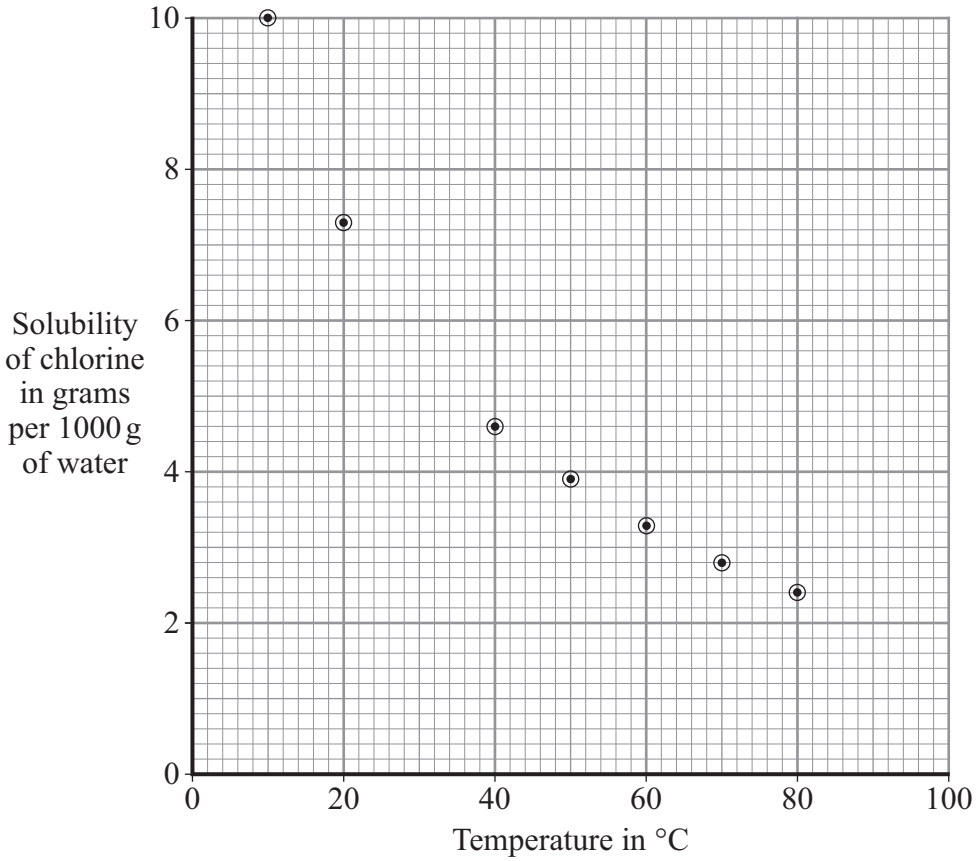
.....

(2 marks)

6

Areas outside the box will not be scanned for marking

6 The points on the graph show the mass of chlorine that dissolves in 1000 g of water at different temperatures.



Use the graph to answer the following questions.

6 (a) Draw a smooth curve through all the points.

(1 mark)

6 (b) What is the mass of chlorine that dissolves in 1000 g of water at 30 °C?

Mass = ... g

(1 mark)

6 (c) Calculate the mass of chlorine that bubbles out of 1000 g of water when the temperature increases from 10 °C to 80 °C.

.....

.....

Mass = ... g

(2 marks)

4

Turn over ▶

Areas outside the box will not be scanned for marking

7 Read the following information and then answer the questions.

Chlorine – for better, for worse?



Chlorine is used to make bleaches, plastics and medicines. Swimming pool water is often treated with chlorine.

Chlorine is used to make water safe to drink. It is relatively cheap and easy to use. People who drink untreated water risk dying from typhoid and cholera.

However, chlorine is a poisonous chemical. It causes breathing difficulties and can kill people. Some people are also allergic to chlorine.

7 (a) How does chlorine make water safe to drink?

.....

.....

(1 mark)

7 (b) The amount of chlorine in swimming pool water should be carefully monitored and controlled.

Explain why.

.....

.....

.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

7 (c) Developing countries are likely to choose chlorination as their method of making water safe to drink.

Suggest why.

.....

.....

.....

(1 mark)

7 (d) A government is setting up an enquiry into the safety of using chlorine.

7 (d) (i) Suggest why people from all political parties should be represented.

.....

.....

.....

(1 mark)

7 (d) (ii) Suggest why the opinion of a well-respected scientist might change the outcome of any discussion.

.....

.....

.....

(1 mark)

7 (d) (iii) The decision taken about the safety of using chlorine should be based on evidence and data rather than on hearsay and opinion.

Suggest why.

.....

.....

.....

(1 mark)

7

Areas outside the box will not be scanned for marking

8 Go Grease is a drain and oven cleaner.



The active ingredient in Go Grease is the alkali sodium hydroxide (NaOH).

8 (a) Name or give the formula of the ion that makes solutions alkaline.

.....

(1 mark)

8 (b) Sodium hydroxide is a *strong* alkali.

In terms of ionisation, what is meant by the word *strong*?

.....

.....

(1 mark)

8 (c) You are given solutions of sodium hydroxide and ammonia of the same concentration.

Describe and give the results of a test to show that sodium hydroxide is a stronger alkali than ammonia solution.

.....

.....

.....

.....

.....

(2 marks)

4

END OF QUESTIONS

There are no questions printed on this page

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Version : 09/03/2010



General Certificate of Secondary Education

Chemistry 4421

CHY3F Unit Chemistry 3

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2010 examination – January series

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Dr Michael Cresswell Director General

MARK SCHEME

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However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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CHY3F

Question 1

question	answers	extra information	mark
1(a)(i)	E		1
1(a)(ii)	B		1
1(a)(iii)	C		1
1(a)(iv)	A		1
1(b)(i)	quickly melted	allow melts in contact with water, allow bp 100 °C (of water) shows mp is low ignore one other piece of information	1
1(b)(ii)	easily cut	ignore one other piece of information	1
1(b)(iii)	effervescence / fizzing / bubbling	ignore named gas ignore one other piece of information	1
Total			**7**

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CHY3F

Question 2

question	answers	extra information	mark
2(a)	burette		1
2(b)	indicator changed colour	allow any indication of colour change	1
2(c)(i)	0.2 **or** 18.3 to 18.5		1
2(c)(ii)	18.4		1
2(c)(iii)	improve reliability	allow improve accuracy allow to calculate a mean / average **or** get rid of anomalous result ignore fair test / correct results / random results	1
Total			**5**

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CHY3F

Question 3

question	answers	extra information	mark
3(a)	electricity / (high) temperatures	allow lightning / heat ignore energy	1
3(b)	nitrogen + oxygen → nitrogen oxide / monoxide	allow any oxide of nitrogen	1
3(c)	more than		1
3(d)(i)	A		1
3(d)(ii)	C		1
Total			**5**

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CHY3F

Question 4

question	answers	extra information	mark
4(a)(i)	yellow		1
4(a)(ii)	lilac		1
4(a)(iii)	melting point		1
4(b)(i)	barium chloride solid		1 1
4(b)(ii)	white dissolved		1 1
Total			**7**

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CHY3F

Question 5

question	answers	extra information	mark
5(a)(i)	carbon		1
5(a)(ii)	calcium		1
5(b)	(shake with) soap (solution) scum	ignore detergent accept less lather with hard water allow solid / precipitate ignore bubbles incorrect test = **0** marks for question correct results with no test score **1**	1 1
5(c)	any **two** from: • good for health / healthier • stronger bones / teeth • less heart disease	 ignore vitamins	2
Total			**6**

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CHY3F

Question 6

question	answers	extra information	mark
6(a)	reasonable <u>smooth</u> curve through all the points over the range 10 - 80	ignore outside range do **not** accept multiple lines	1
6(b)	5.7	range 5.5–5.9 if outside range check graph	1
6(c)	7.6	correct answer with or without working = **2** marks if answer incorrect 10 **or** 2.4 gains **1** mark	2
Total			**4**

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CHY3F

Question 7

question	answers	extra information	mark
7(a)	sterilise / disinfect (water) **or** kill bacteria / micro-organisms / microbes / germs / pathogens	ignore removes bacteria / impurities / disease ignore cleans the water / makes (water) safe allow destroy bacteria **or** gets rid of bacteria	1
7(b)	any **two** from: • chlorine is toxic / poisonous • so (too much) will be dangerous / harmful / kill people / cause illness / health problems • cause breathing difficulties **or** cause (more) allergic reactions / skin **or** eye irritation • too little will not kill bacteria	ignore reference to safe / unsafe allow causes damage allow bacteria still there	2
7(c)	cheap / easy / quick to use (process)	accept prevents typhoid / cholera ignore reference to specialists or equipment	1
7(d)(i)	fair / more ideas / views / opinions **or** less chance of bias **or** more democratic	allow idea of different points of view / balanced view allow avoids undue influence owtte	1

Question 7 continues on next page

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CHY3F

Question 7 continued

question	answers	extra information	mark
7(d)(ii)	(more likely) to have support / influence / convince people	ignore well respected allow ideas about trust eg people will have more confidence in their views / more likely to be believed allow ideas about expertise eg more likely to know what they are talking about / have done experiments / tests allow have knowledge / understanding allow (more) reliable	1
7(d)(iii)	(more likely) to be correct / less likely to be incorrect **or** reliable / factual / accurate / based on proof / based on experiments or tests / based on validation	owtte ignore based on evidence unqualified allow hearsay / opinion can be biased	1
Total			**7**

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CHY3F

Question 8

question	answers	extra information	mark
8(a)	hydroxide (ion) / OH^- / OH^-(aq)	ignore OH	1
8(b)	fully / all / completely ionised / dissociated	ignore strongly ionised **or** more ions **or** concentration ignore all 'noise' do **not** accept ions are fully ionised / dissociated	1
8(c)	any valid test linked comparison eg UI **or** full range indicator **or** pH paper / solution / (pH) meter (1) NaOH has higher pH **or** correct comparison of colours (1) **or** conductivity test (1) NaOH conducts better / more **or** bulb brighter (1)	assume it = sodium hydroxide incorrect test / titration = **0** marks for question correct result / reference to pH with no test = **1** mark allow converse for weak(er) pH values must be above 7 NaOH – purple, Ammonia – blue allow correct comparison of blue or purple	1 1
Total			**4**

STEMUP.CO.UK

Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Secondary Education
January 2009

CHEMISTRY **CHY3F**
Unit Chemistry C3

F

Foundation Tier

Thursday 15 January 2009 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 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		5	
2		6	
3			
4			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

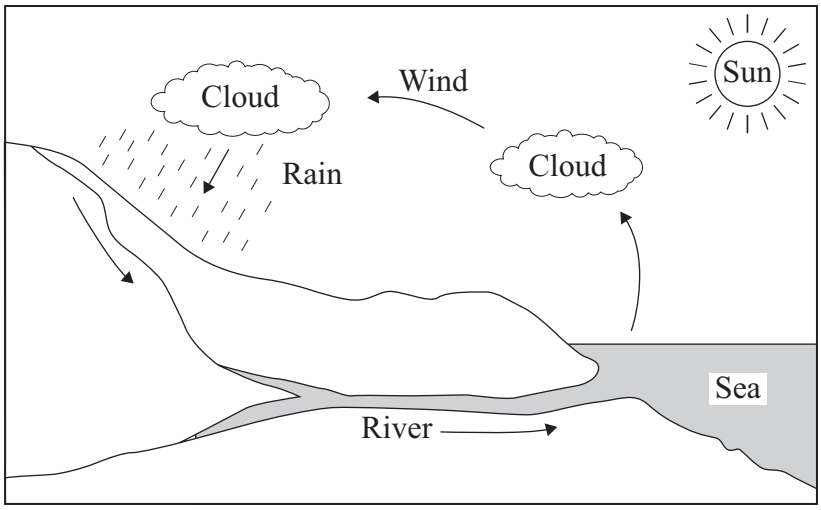
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Areas outside the box will not be scanned for marking

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

1 Water is a natural resource.

1 (a) The diagram shows the *water cycle*.



Use the diagram to help you describe what happens in the *water cycle*.

.....

.....

.....

.....

.....

.....

.....

.....

(3 marks)

Areas outside the box will not be scanned for marking

1 (b) In some parts of the world the water is hard, but in other parts the water is soft.

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

1 (b) (i) When water comes into contact with rocks, ions

condense
dissolve
evaporate

into the water.

(1 mark)

1 (b) (ii) Hardness in water is caused by

calcium
hydrogen
sodium

ions.

(1 mark)

1 (b) (iii) Hard water can be made soft by adding

sodium carbonate.
sodium chloride.
sodium sulfate.

(1 mark)

1 (b) (iv) The ions that cause hardness are removed by adding a substance

which

neutralises
oxidises
precipitates

them.

(1 mark)

Question 1 continues on the next page

Areas outside the box will not be scanned for marking

1 (c) Hard water reduces the efficiency of kettles.

The picture shows a heating element from a kettle.



Explain how hard water reduces the efficiency of kettles.

.....

.....

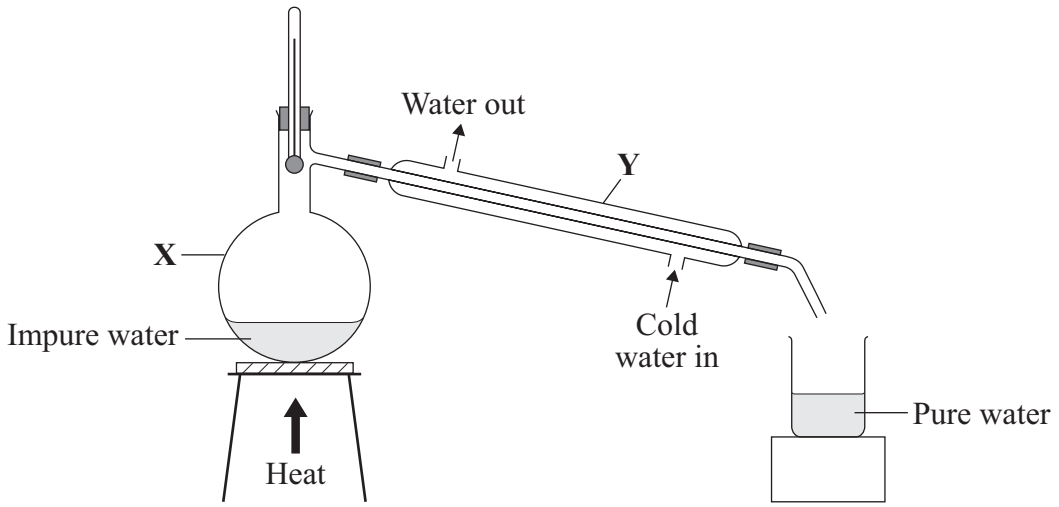
.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

1 (d) The diagram shows how pure water can be made from impure water by distillation.



Choose the correct words from the box to name apparatus **X** and **Y**.

beaker	**condenser**	**flask**	**thermometer**

1 (d) (i) Apparatus **X** is a ..... .

(1 mark)

1 (d) (ii) Apparatus **Y** is a ..... .

(1 mark)

11

Turn over for the next question

Areas outside the box will not be scanned for marking

2 Lemons contain citric acid.

Pure citric acid is a white solid that dissolves in water to form a weak acid.

2 (a) A student tested some solid citric acid with universal indicator paper.

Suggest why the universal indicator paper did **not** change colour.

.....

.....

(1 mark)

2 (b) Citric acid produces hydrogen ions in aqueous solution.

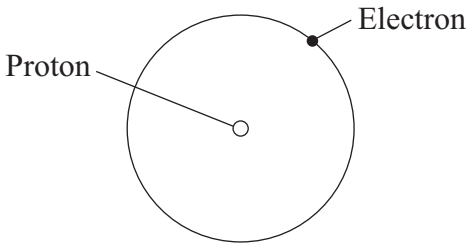
These ions can be represented as $H^+(aq)$.

Complete this sentence.

The (aq) means that the acid has been dissolved in ..... .

(1 mark)

2 (c) The diagram represents a hydrogen atom, H.



Use the diagram to explain why a hydrogen ion, H^+, is a proton.

.....

.....

(1 mark)

2 (d) Citric acid is a *weak* acid.

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

The word *weak* means that the acid

- has a low boiling point.
- is dilute.
- is partially ionised in water.

(1 mark)

Areas outside the box will not be scanned for marking

2 (e) A student measured the pH of four acids, **A**, **B**, **C** and **D**.

The acids were the same concentration. The same quantity of magnesium ribbon was added to each of the acids. The volume of gas produced after 5 minutes was recorded.

The results are shown in the table.

Acid	pH	Volume of gas in cm^3
A	2	18
B	5	6
C	1	24
D	4	12

2 (e) (i) State **one** way in which the student made sure that the experiment was fair.

.....

(1 mark)

2 (e) (ii) Use the results to arrange the acids, **A**, **B**, **C** and **D** in order of **decreasing** acid strength.

Most acidic ..... Least acidic.

(1 mark)

2 (f) When acids react with alkalis, the hydrogen ions from the acid react with the hydroxide ions from the alkali.

2 (f) (i) Which **one** of the following represents the formula of a hydroxide ion?

Draw a ring around your answer.

H^- **O^-** **OH^-**

(1 mark)

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

A solution with more hydrogen ions than hydroxide ions is

acidic.

alkaline.

neutral.

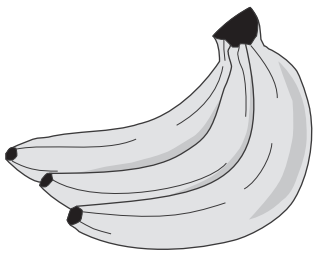
(1 mark)

8

Turn over ▶

Areas outside the box will not be scanned for marking

3 Ethene causes bananas to ripen.



Unsaturated organic molecules such as ethene can be identified by a chemical test using bromine water.

3 (a) Draw a ring around the correct answer to complete these sentences.

3 (a) (i) *Unsaturated* means that the molecule

contains a carbon carbon single bond.

contains a carbon carbon double bond.

does **not** contain a carbon carbon bond.

(1 mark)

3 (a) (ii) The colour of bromine water is

blue.

green.

orange.

(1 mark)

3 (a) (iii) When ethene is shaken with bromine water, the bromine water is

darkened.

decolourised.

denatured.

(1 mark)

Areas outside the box will not be scanned for marking

3 (b) Ethene can also be identified using instrumental methods.

3 (b) (i) Name **one** instrumental method used to identify elements or compounds.

.....

.....

(1 mark)

3 (b) (ii) Give **one** advantage of using instrumental methods compared with chemical tests.

.....

.....

(1 mark)

5

Turn over for the next question

Areas outside the box will not be scanned for marking

4 The periodic table on the Data Sheet may help you to answer some of these questions.

4 (a) Draw a ring around the correct answer to complete these sentences.

4 (a) (i) Dimitri Mendeleev attempted to classify

compounds.

elements.

mixtures.

(1 mark)

4 (a) (ii) He arranged them in order of their

atomic weight.

boiling point.

electrical conductivity.

(1 mark)

4 (a) (iii) They are now arranged in order of their

atomic (proton) number.

atomic weight.

mass number.

(1 mark)

4 (b) In the periodic table between Groups 2 and 3 there is a block of metals which includes chromium, iron and nickel.

4 (b) (i) Which **one** of the following is the correct name for this block of metals?

Draw a ring around the correct answer.

alkali metals **reactive metals** **transition metals**

(1 mark)

4 (b) (ii) The properties of iron and those of the Group 1 metal sodium are different.

Put a tick (✓) next to the **two** correct phrases which could complete the following sentence.

Compared to sodium, iron

	(✓)
has a higher melting point.	
has a lower density.	
is harder.	
is more reactive.	
is weaker.	

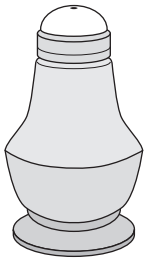
(2 marks)

6

Areas outside the box will not be scanned for marking

5 The label is from a packet of Low Sodium Salt.

LOW SODIUM SALT



INGREDIENTS

potassium chloride
sodium chloride

Anti-caking agent: magnesium carbonate

5 (a) A student tested some Low Sodium Salt to show that it contains carbonate ions and chloride ions.

5 (a) (i) Describe and give the result of a test for carbonate ions.

.....

.....

.....

.....

(2 marks)

5 (a) (ii) A student identified chloride ions using acidified silver nitrate solution.

State what you would **see** when acidified silver nitrate solution is added to a solution of Low Sodium Salt.

.....

(1 mark)

5 (a) (iii) Flame tests can be used to identify potassium ions and sodium ions.

Suggest why it is difficult to identify **both** of these ions in Low Sodium Salt using a flame test.

.....

.....

(1 mark)

Question 5 continues on the next page

Turn over ▶

Areas outside the box will not be scanned for marking

5 (b) Read the following information and then answer the questions.

Salt – friend or foe?

Sodium chloride (salt) is an essential mineral for our health. It is used to flavour and preserve foods. Too much sodium in our diet may increase the risk of high blood pressure and heart disease. Heart disease is the biggest cause of death in the United Kingdom. Some people claim that excess sodium is a poison that can cause cancer, while others say that more evidence is needed.

Many processed foods contain salt, so it is easy to exceed the recommended daily upper limit of about 5 g of salt per person. A 'healthier' amount should be about 3 g. In the United Kingdom many people consume over 10 g of salt each day.

One way to reduce sodium in our diet is to use Low Sodium Salt. This has two thirds of the sodium chloride replaced by potassium chloride.

A national newspaper asked readers for their views on two options.

Option **1**: Ban the use of sodium chloride in foods.

Option **2**: Reduce the amount of sodium chloride in **all** foods to a 'healthier' level.

5 (b) (i) Suggest why Option **1** was rejected.

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

5 (b) (ii) Suggest **two** advantages and **one** disadvantage of Option **2**.

.....

.....

.....

.....

.....

.....

.....

(3 marks)

8

Turn over for the next question

Areas outside the box will not be scanned for marking

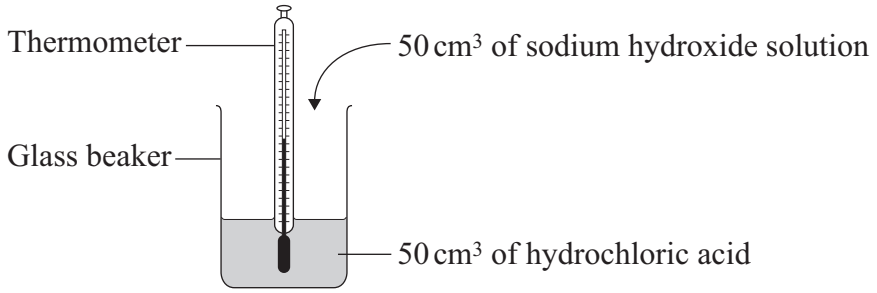
6 Read the information about energy changes and then answer the questions.

A student did an experiment to find the energy change when hydrochloric acid reacts with sodium hydroxide.

The equation which represents the reaction is:

$$HCl + NaOH \rightarrow NaCl + H_2O$$

The student used the apparatus shown in the diagram.



The student placed 50 cm^3 of hydrochloric acid in a glass beaker and measured the temperature.

The student then quickly added 50 cm^3 of sodium hydroxide solution and stirred the mixture with the thermometer. The highest temperature was recorded.

The student repeated the experiment, and calculated the temperature change each time.

	Experiment 1	**Experiment 2**	**Experiment 3**	**Experiment 4**
Initial temperature in °C	19.0	22.0	19.2	19.0
Highest temperature in °C	26.2	29.0	26.0	23.5
Temperature change in °C	7.2	7.0	6.8	4.5

Areas outside the box will not be scanned for marking

6 (a) The biggest error in this experiment is heat loss.

Suggest how the apparatus could be modified to reduce heat loss.

.....

.....

(1 mark)

6 (b) Suggest why it is important to stir the chemicals thoroughly.

.....

(1 mark)

6 (c) Which **one** of these experiments was probably carried out on a different day to the others?

Explain your answer.

.....

.....

(1 mark)

6 (d) Suggest why experiment 4 should **not** be used to calculate the average temperature change.

.....

.....

(1 mark)

6 (e) Calculate the average temperature change from the first three experiments.

.....

Answer = ... °C

(1 mark)

6 (f) Use the following equation to calculate the energy change for this reaction.

energy change in joules = 100 × 4.2 × average temperature change

.....

Answer = ... J

(1 mark)

Question 6 continues on the next page

Turn over ▶

Areas outside the box will not be scanned for marking

6 (g) Which **one** of these energy level diagrams, **A** or **B**, represents the energy change for this reaction?

Explain why.

Diagram A

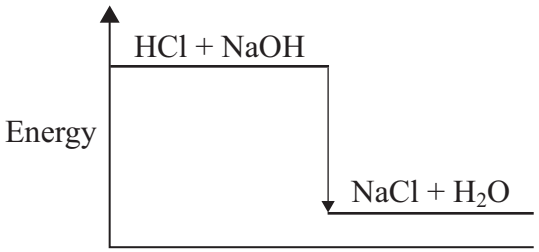
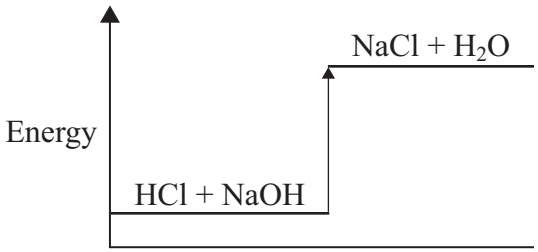


Diagram B



.....

.....

(1 mark)

7

END OF QUESTIONS

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Version 1.0: 0109

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Chemistry 4421

CHY3F Unit Chemistry 3

Mark Scheme

2009 examination – January series

STEMUP.CO.UK

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Dr Michael Cresswell Director General

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

COMPONENT NUMBER: CHY3F

COMPONENT NAME: Chemistry

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
1(a)	any **three** from: • heat / sun / energy • (water) evaporates • (water) vapour rises • vapour cools • condenses • droplets of water form **or** clouds form • rain / snow / hail / sleet / "precipitation"		3
1(b)(i)	dissolve		1
1(b)(ii)	calcium		1
1(b)(iii)	sodium carbonate		1
1(b)(iv)	precipitates		1
1(c)	any **two** from: • (lime)scale • acts as insulator / covers element / prevents heat passing through • requires more energy	accept precipitate ignore scum ignore references to time	2

Question 1 continued on next page…

COMPONENT NUMBER: CHY3F

COMPONENT NAME: Chemistry

STATUS: Final

DATE: January 2009

Question 1 continued…

question	answers	extra information	mark
1(d)(i)	flask	accept clear mispellings	1
1(d)(ii)	condenser	accept clear mispellings	1
Total			**11**

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question	answers	extra information	mark
2(a)	(UI) paper is dry **or** no water present when (UI) paper used owtte	accept citric acid is a solid accept 'it is not a liquid / solution'	1
2(b)	water / H_2O / hydrogen oxide		1
2(c)	eg H (atom) loses an electron to form H^+ **or** <u>only</u> a proton left		1
2(d)	is partially ionised in water		1
2(e)(i)	eg same concentration / quantity of Mg	accept: volume of acid / ribbon for both / same time accept: volume of gas measured under the same conditions	1
2(e)(ii)	C A D B		1
2(f)(i)	OH^-		1
2(f)(ii)	acidic		1
Total			**8**

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question	answers	extra information	mark
3(a)(i)	contains a carbon carbon double bond		1
3(a)(ii)	orange		1
3(a)(iii)	decolourised		1
3(b)(i)	correct named instrumental method eg atomic absorption spectroscopy / spectrometry **or** mass spectrometry / spectroscopy **or** infrared (spectrometry) / IR **or** ultraviolet / spectroscopy / UV **or** nuclear magnetic spectroscopy / nmr **or** gas-liquid chromatography / GLC	accept atomic / absorption spectroscopy accept aas accept mass spec	1

Question 3 continued on the next page...

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Question 3 continued...

question	answers	extra information	mark
3(b)(ii)	any **one** from: • fast / quick **or** comment about speed • small amount • sensitive / accurate / precise • ease of automation • reliable / efficient • can be left to run / continuous analysis	ignore lost ignore human error accept operators do not need <u>chemical</u> skills ignore safe / easier to use	1
Total			**5**

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question	answers	extra information	mark
4(a)(i)	elements		1
4(a)(ii)	atomic weight		1
4(a)(iii)	atomic (proton) number		1
4(b)(i)	transition metals		1
4(b)(ii)	has a higher melting point is harder		1 1
Total			**6**

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question	answers	extra information	mark
5(a)(i)	hydrochloric acid / HCl carbon dioxide / CO_2	accept any (named) acid accept bubbles / fizz / gas **or** limewater gets milky ignore 'add limewater' do **not** accept other named gases 2^{nd} mark dependant on first mark accept for this answer only heat gives CO_2 / limewater milky = **1** mark	1 1
5(a)(ii)	(white) precipitate / solid	ignore names of substances even if incorrect accept white deposit / substance do **not** accept any coloured precipitate	1
5(a)(iii)	eg flame colour of (Na) and flame colour of (K) interfere / mask / mix with each other	accept 'can't see the colours' **or** 'difficult to determine the colour' **or** 'both produce different colours' **or** a correct statement of colours **or** hard to distinguish	1
5(b)(i)	eg essential (mineral) **or** everyone needs it / some (salt) **or** problems with health if have no salt	accept preservative / flavouring / taste it = salt (all) foods contain / use it / sodium chloride / salt	1

Question 5 continued on the next page...

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Question 5 continued...

question	answers	extra information	mark
5(b)(ii)		mark positively ie no list principle	
	advantages		2
	any **two** from: • more people will be healthier • (should have) less heart disease • (should have) less cancer • (more people with) lower blood pressure	ignore economic arguments throughout **or** people eat less salt	
	disadvantages		1
	any **one** from: • not everyone affected • not enough evidence • does not provide choice • undemocratic • less taste / flavour • shorter shelf life / not preserved (as long) • too much potassium chloride might be bad	ignore references to too much / too little (salt) ignore no flavour / taste ignore references to sell by dates	
Total			**8**

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question	answers	extra information	mark
6(a)	eg plastic (beaker) / insulation / lid / cover **or** any mention of enclosed	any sensible modification to reduce heat loss ignore prevent draughts ignore references to gas loss	1
6(b)	all the substances react **or** all (the substances) react fully / completely **or** heat evolved quickly **or** distribute heat	accept to mix them 'so they react' is insufficient for the mark accept increase chances of (successful) collisions / collision rate increase do **not** accept rate of reaction increase / make reaction faster	1
6(c)	experiment 2 **and** different / higher / initial / starting temperature	accept experiment 2 **and** the room is hotter / at higher temperature do **not** accept temperature change / results higher	1
6(d)	temperature change does not fit pattern	accept anomalous / odd **or** it is the lowest **or** it is lower than the others **or** it is different to the others 'results are different' is insufficient	1
6(e)	7 / 7.0		1
6(f)	(100 × 4.2 × 7) = 2940	ecf from (e)	1
6(g)	diagram A **and** reaction exothermic / heat evolved / Δ H is negative / temperature rises	accept energy is lost (to the surroundings)	1
Total			**7**