02.13

General Certificate of Secondary Education
January 2013

Additional Science / Chemistry CH2HP

(Specification 4408 / 4402)

Unit 2: Chemistry 2

Final

Mark Scheme

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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process 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 standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised 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 from: aqa.org.uk

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX.

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 bullet points 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.

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

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	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, 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 or by each stage of a longer calculation.

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.

3.8 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Quality of Written Communication and levels marking

In Question 2(d) students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

CH2HP

question	answers	extra information	mark
1(a)	because sulfur / S forms which is insoluble / a solid / a precipitate		1 1
1(b)(i)	32	correct answer with or without working gains **2** marks accept evidence of 31 + 33 / 2 for **1** mark allow 35 for **1** mark	2
1(b)(ii)	reaction rate increases because of more particles (per unit volume) and because there is an increase in frequency of collisions	if incorrect reference to energy = max **2** allow because particles are closer together accept because particles are more likely to collide **or** higher chance of collision ignore more (successful) collisions	1 1 1
Total			**7**

CH2HP

question	answers	extra information	mark
2(a)(i)	because they are positively charged	accept they are positive / H^+ accept oppositely charged **or** opposites attract ignore they are attracted	1
2(a)(ii)	gains one / an electron	accept $H^+ + e^- \rightarrow H$ or multiples allow gains electrons	1
2(b)	3 bonding pairs 1 lone pair	 accept 2 non-bonding electrons on outer shell of nitrogen	1 1
2(c)(i)	hydroxide / OH^-	do **not** accept sodium hydroxide	1
2(c)(ii)	$H^+ + OH^- \rightarrow H_2O$	ignore state symbols ignore word equation	1

CH2HP

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>2(d)</td><td colspan="2">Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5.</td><td>6</td></tr>
<tr><td>0 marks</td><td>Level 1 (1-2 marks)</td><td>Level 2 (3-4 marks)</td><td>Level 3 (5-6 marks)</td></tr>
<tr><td>No relevant content.</td><td>There are basic descriptions of advantages or disadvantages of the electrolysis cells.</td><td>There are clear descriptions of environmental or economic advantages or disadvantages of the electrolysis cells. Comparisons may be implied.</td><td>There are detailed descriptions of environmental and economic advantages and disadvantages, comparing the electrolysis cells.</td></tr>
<tr><td colspan="4">examples of chemistry points made in the response:
Accept converse where appropriate.
• mercury cell is more expensive to construct
• mercury is recycled but membranes must be replaced
• mercury is toxic but membrane / polymer is not
• removing traces of mercury from waste is expensive
• mercury cell uses more electricity
• mercury cell produces chlorine that is purer
• mercury cell produces higher concentration / better quality of sodium hydroxide (solution)</td></tr>
<tr><td>Total</td><td></td><td></td><td>12</td></tr>
</table>

CH2HP

question	answers	extra information	mark
3(a)(i)	to increase the rate of reaction		1
3(a)(ii)	H_2SO_4 on the left hand side H_2O on right hand side		1 1
3(a)(iii)	filtration	allow centrifuging **or** decanting ignore evaporation if after filtration	1
3(a)(iv)	crystallisation **or** evaporation / heating / boiling / cooling	ignore reference to filtration unless given as an alternative	1
3(a)(v)	any **one** from: • because of an incomplete reaction • because some (copper sulfate) lost on filtering **or** when poured into evaporating basin **or** boiled over **or** left in apparatus • weighing error (of copper sulfate)	 accept not all acid reacted accept impure reactants accept unexpected reaction ignore reversible reaction must specify when lost accept some (copper sulfate **or** acid) spilt	1
3(b)(i)	reversible (reaction)		1
3(b)(ii)	300(J) (energy) given out / released	allow the same accept exothermic / – ignore increasing **or** decreasing energy	1 1

Question 3 continues on the next page

CH2HP

Question 3 cont'd

question	answers		extra information	mark
3(c)	$\frac{3.81}{63.5}$	$\frac{0.28}{14}$	**1** mark for dividing mass by A_r (max **2** if A_r divided by mass)	1
	= 0.06	= 0.02	**1** mark for correct proportions	1
	3	1	**1** mark for correct whole number ratio (allow multiples). Can be awarded from formula	1
	Cu_3N		**ecf** allowed from **step 2 to step 3** and **step 3 to step 4** if sensible attempt at step 1 correct formula gains **1** mark	1
Total				**13**

CH2HP

question	answers	extra information	mark
4(a)	it is not used up	accept does not change accept reusable allow does not react	1
4(b)	they would melt **or** they have a low melting point	allow would lose their shape ignore soften	1
	because there are no cross links **or** there are weak intermolecular forces	accept there are weak bonds / forces between (polymer) chains	1
4(c)(i)		ignore reference to mass spectroscopy do **not** accept other incorrect process described	
	substances carried by gas	allow named gas	1
	(through) column / coil / tube **or** (through) solid (material) / powder		1
	at different speeds	accept different retention times	1
4(c)(ii)	(relative) molecular mass / M_r	allow (relative) formula mass **or** relative mass ignore relative atomic mass ignore identity of substance / molecule	1
Total			**7**

CH2HP

question	answers	extra information	mark
5(a)	Will kelp last longer than coal as an energy source?		1
5(b)	any **two** from: • cannot be determined by experiment • based on opinion • ethical **or** environmental **or** economic reason	 allow can't predict how long kelp / coal will last allow more testing needed allow could damage ecosystem allow reference to cost	2
5(c)(i)	7		1
5(c)(ii)	 sodium (atom) loses (electron) **and** iodine (atom) gains (an electron) 1 electron (electrostatic) attraction **or** forms ionic bond(s)	reference to incorrect bonding **or** incorrectly named particle = max **2** any or all marks can be obtained from a labelled diagram ignore inner shell electrons if shown	 1 1 1
5(c)(iii)	<u>ions</u> can move (in the solution)		1
5(c)(iv)	**2** I^- → $\mathbf{I_2}$ + **2** e^-		1

Question 5 continues on the next page

CH2HP

Question 5 cont'd

question	answers	extra information	mark
5(c)(v)	hydrogen is formed because sodium is more reactive (than hydrogen)		1 1
Total			**11**

CH2HP

question	answers	extra information	mark
6		reference to incorrect bonding **or** incorrect particles **or** incorrect structure = max **3**	
	high melting point	accept will not melt (at high temperatures) ignore withstand high temperatures	1
	because a lot of energy needed to break bonds		1
	because it is covalent **or** has strong bonds	accept bonds are hard to break	1
	and because it is a giant structure **or** a macromolecule **or** a lattice	ignore many bonds	1
Total			**4**

CH2HP

question	answers	extra information	mark
7(a)	copper has delocalised electrons	accept copper has free electrons ignore sea of electrons **or** mobile electrons	1
	(electrons) which can move through the metal / structure	allow (electrons) which can carry a charge through the metal / structure	1
7(b)(i)		correct answer with or without working gains **3** marks	
	(M_r $FeCl_3$ =) 162.5 **or** 2 (moles of) $FeCl_3$ = 325 **or** 112 → 325	can be credited from correct substitution in step **2**	1
	$\frac{11.20}{56} \times 162.5$	allow ecf from step 1 accept $\frac{325}{112} \times 11.2$	1
	= 32.5	accept 32.48	1
7(b)(ii)	74.8	accept 74.77 - 75 accept ecf from 7 (b)(i) if there is no answer to part(i) **or** if candidate chooses not to use their answer then accept 86.79 - 87	1
Total			**6**

UMS conversion calculator www.aqa.org.uk/umsconversion