



**AQA Certificates
June 2013**

Science: Double Award

8404/C/2H

(Specification 8404)

Chemistry Paper 2: Higher Tier

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.

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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 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	green, 5	0
2	red*, 5	1
3	red*, 8	0

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

Candidate	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, 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, 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 **not** 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.

4. Quality of Communication and levels marking

In Question 2(a) candidates 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.

Candidates 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.

question	answers	extra information	mark
1(a)	88		1
	73		1
1(b)	17(.0)	ecf from (a) if answer incorrect, allow for 1 mark either $(88 - 73 =) 15$ or $(73 / 88 \times 100) = 83$	2
1(c)	volume of gas/air (at end) would be too large		1
	because not all oxygen removed / reacted	if no other mark awarded, allow 1 mark for either water would not move as far up the measuring cylinder or if more iron had been used, more oxygen would have reacted or volume would have been less	1

Question 1 continues on the next page

Question 1 continued

question	answers	extra information	mark
1(d)	<p>for statement 1</p> <p>true for Venus and Mars</p> <p>(but not true) for Earth (which is closer to the Sun than Mars) because <u>only</u> nitrogen is one of the most common gases</p> <p>OR</p> <p>(true / partly true) because Venus, Mars and Earth all have nitrogen (1)</p> <p>(but not true) for Earth, which does not have (much) carbon dioxide or has oxygen (1)</p> <p>for statement 2</p> <p>true because Venus and Mars have low(est) relative masses</p> <p>but not true / partly true because Earth has nitrogen or does not have (much) carbon dioxide or has oxygen</p> <p>for either statement 1 or 2</p> <p>true because carbon dioxide and nitrogen are not common on Jupiter and / or Saturn</p> <p>or</p> <p>(in the table there is) no information about other planets or information about other planets might not support the statement(s)</p>	<p>allow not true for all three closest planets</p> <p>allow not true because Earth (also) has a low relative mass</p> <p>allow Jupiter and / or Saturn have helium and hydrogen (as the two most common gases)</p> <p>allow name(s) of other planets</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
Total			11

question	answers	extra information	mark
2(a)			max. 6
<p>Marks awarded for this answer will be determined by the quality of communication (QoC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a best-fit approach to the marking.</p>			
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content	There is a statement of what to do or a safety precaution or an observation or a pH test.	There is a description of how to do the experiment, and either a safety precaution or an observation or a pH test.	There is a description of a correct method, a safety precaution, an observation and a way of testing that magnesium oxide is basic.
examples of chemistry points made in the response		extra information	
<ul style="list-style-type: none"> • heat sample in Bunsen flame or in a crucible • use tongs, safety glasses, blue glass, etc • magnesium burns rapidly / with bright flame • white solid / white smoke forms • add solid / solution to Universal Indicator, observe colour change • add solid to acid, observe if it (completely) dissolves 		accept other (named) acid-base indicators	
2(b)	s g g		1
2(c)	acid rain		1
	damages trees / plants or kills aquatic organisms or damages buildings / statues or causes respiratory problems	allow harmful to living things	1
Total			9

question	answers	extra information	mark
3(a)(i)	risk of fire or explosion	allow flammable ignore dangerous / hazardous do not accept poisonous / toxic	1
3(a)(ii)	colour change	allow specific colour change if correct	1
3(a)(iii)	water hydrogen reacts with oxygen from copper(II) oxide or copper(II) oxide is reduced	allow from the oxide or the oxide is reduced correct word or symbol equation can be accepted for MP2 or MP3 for 1 mark	1 1 1
3(b)	because magnesium is more reactive (than copper)	'it' = magnesium	1
3(c)	delocalised electrons move <u>through the metal</u>	allow free electrons	1 1
3(d)	atoms of other metal are different size which causes distortion / disruption of the layers so the layers / atoms do not slide (as easily)	accept ions in place of atoms any mention of molecules / incorrect bonding max. 2 marks ignore rolling	1 1 1
Total			11

question	answers	extra information	mark
4(a)	(put paper in) water / solvent so that level (of water / solvent) is below food colourings then leave (for some time) or allow the water to run up the paper until water / solvent (nearly) reaches top or paper (removed and) dried or compare how far the spots have moved		1 1 1 1
4(b)	any three from: <ul style="list-style-type: none"> • M contains 3 colourings • M contains A and D • M does not contain B and C • M contains an / one unknown colouring 	} M contains A and D and <u>one</u> other colouring gains 2 marks	3
Total			7

question	answers	extra information	mark
5(a)	reversible	allow goes in either direction or goes both ways allow equilibrium	1
5(b)	(re)heat the evaporating basin	accept heat to constant mass for 2 marks	1
	weigh (again) or mass will not change	dependent on first mark if no other mark awarded allow 1 mark for a chemical test for water	1
5(c)	106	correct answer with or without working gains 2 marks if answer incorrect, allow (2×23) $+ 12 + (3 \times 16)$ for 1 mark	2
5(d)(i)	0.25	correct answer with or without working gains 3 marks if answer incorrect, mass of water $= (7.5 - 3.0 =) 4.5$ g gains 1 mark $M_r(\text{H}_2\text{O}) = 18$ gains 1 mark	3
5(d)(ii)	9 if given value of 0.16 mol water used: 6	correct answer with or without working gains 2 marks if answer incorrect, allow $n = 0.25$ $\div 0.028$ for 1 mark allow ecf from 5(d)(i) if answer incorrect allow $0.16 \div$ 0.028 for 1 mark	2
Total			10

question	answers	extra information	mark
6(a)	(final) temperature would be high(er) (because) gains heat energy from surroundings	allow warms back up (towards room temperature)	1 1
6(b)	<p>variable: start temperature or temperature of water</p> <p>explanation: the higher / lower the start temperature, the more / less energy it contains</p> <p>so the higher / lower the final temperature</p> <p>variable: the time at which the temperature is measured</p> <p>explanation: if left longer may gain energy from surroundings or warm up or if measured too soon not all ammonium chloride will have dissolved</p> <p>so final temperature would be higher</p> <p>variable: rate of dissolution or speed of dissolving or amount of stirring</p> <p>explanation: if it dissolves faster or is stirred faster then it will cool more quickly</p> <p>so final temperature would be lower (because less energy absorbed from surroundings)</p> <p>variable: material of beaker</p> <p>explanation: different materials are better / poorer conductors</p> <p>so final temperature may be higher / lower (dependent on material specified)</p> <p>variable: shape of beaker</p> <p>explanation: larger / smaller surface area gains energy more quickly / slowly</p> <p>so final temperature too high / low</p>	<p>1 mark for variable and 2 marks for explanation linked to that variable</p> <p>allow size of ammonium chloride crystals</p>	3

Question 6 continues on the next page

Question 6 continued

question	answers	extra information	mark
6(c)	polystyrene is good insulator or poor conductor	allow reduces gain of heat energy	1
6(d)(i)	not all of the ammonium chloride would dissolve / the solution is saturated	allow water limiting factor or all water used	1
	so no more heat would be absorbed		1
6(d)(ii)	valid extrapolation of line back to mass of 0g	accept curve or straight line	1
	correct value read from graph	award 1 mark for 20–21 if no extrapolation shown	1
6(d)(iii)	greater volume of water was used or volume was twice as large	allow different volume of water	1
	so temperature decrease was less than the first student's result	dependent on first mark allow so final temperature was higher	1
	or starting temperature / room temperature was higher (1) so final temperature was greater than the first student's result (1)	dependent on first mark accept by 6°C or was any value in range 26-27°C	
Total			12

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