



General Certificate of Secondary Education

**Additional Science 4463 /
Chemistry 4421**

CHY2H Unit Chemistry 2

Mark Scheme

2011 examination - January series

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.

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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Question 1

question	answers	extra information	mark
1(a)	the ions can <u>move</u> / <u>travel</u> / <u>flow</u> / are <u>free</u> or the ions <u>carry</u> the charge / current	accept particles / they for ions allow delocalised ions ignore delocalised / free electrons ignore references to collisions accept converse with reference to solid ignore ions carry electricity	1
1(b)	any one from: • because they are negative / anion • opposite charges / attract	allow Cl ⁻ ignore chlorine	1
1(c)	13		1
1(d)(i)	reasonable attempt at straight line which misses the anomalous point	must touch all five crosses do not allow multiple lines	1
1(d)(ii)	40	ignore 2.2	1

Question 1 continues on the next page

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Question 1 contd

question	answers	extra information	mark
1(d)(iii)	any two sensible errors from: <ul style="list-style-type: none"> • gas escapes • weighing error • error in measuring (volume / amount) of hydrogen • error in measuring (volume / amount) of water • incorrect concentration • timing error • change in voltage / current • change in temperature • recording / plotting error 	ignore systematic / human / apparatus / zero / experimental / random / measurement / reading errors unless qualified allow NaCl not measured correctly allow error in measuring volume / scale for 1 mark if neither hydrogen or water mentioned allow NaCl not fully dissolved or spilled or impure allow faulty power supply	2
1(d)(iv)	any one from: <ul style="list-style-type: none"> • repeat the experiment • results compared with results from /other students / other groups / other laboratories / internet / literature. • results compared with another method 	ignore 'do more tests'	1
1(d)(v)	increases owtte	allow directly proportional or positive correlation allow rate / it is faster / quicker	1
Total			9

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Question 2

question	answers	extra information	mark
2(a)(i)	65	correct answer with or without working = 2 marks if answer incorrect evidence of (81 – 16) for 1 mark ignore units	2
2(a)(ii)	zinc	accept error carried forward from (a)(i) allow correct symbol answer given should be element / metal closest to their answer do not allow compounds	1
2(b)(i)	<ul style="list-style-type: none"> • it loses electrons • three electrons 	sharing / covalency = max 1 mark	1 1
2(b)(ii)	8 electrons shown in second shell.	accept dots / crosses / mixture of dots and crosses / e electrons do not need to be paired do not allow extra electrons in first shell	1
Total			6

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Question 3

question	answers	extra information	mark
3(a)	<ul style="list-style-type: none"> made of layers / rows (atoms / ions / particles) which can slide / slip (over each other) 	ignore free / delocalised electrons	1
	<p>or</p> particles / ions / atoms can slide over each other	reference to incorrect particles / covalency / intermolecular forces = max 1 ignore malleable / ductile / weak bonds	1
3(b)(i)	sulfuric	accept sulphuric ignore formula ignore hydrogen sulfate	1
3(b)(ii)	any two from: <ul style="list-style-type: none"> (hydrogen) gas produced (or any indication of a gas such as bubbles etc.) magnesium / solid disappears / goes into solution gets hot 	list principle applies for incorrect observations ignore just hydrogen produced ignore cloudiness / colour changes accept magnesium / magnesium sulfate / solid / it dissolves accept forms a liquid / solution allow exothermic ignore floats	2
3(b)(iii)	crystallisation or evaporation / heating / boiling / cooling	accept detailed answers such as: evaporate to half volume and then allow the solution to crystallise. ignore any references to filter	1
Total			6

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Question 4

question	answers	extra information	mark
4(a)	gives out heat / energy or energy / heat transferred to the surroundings	allow release / loses allow the products have less energy ignore temperature rises allow more energy given out in forming bonds than taken in to break bonds	1
4(b)(i)	speed up the reaction (owtte)	accept changes the rate accept lowers activation energy accept increases <u>successful</u> collisions accept allows reaction to take place at a lower temperature	1
4(b)(ii)	nitrogen (N ₂) / oxygen (O ₂) / products are safe or not harmful / pollutant / toxic / dangerous / damaging or (harmful) nitrogen monoxide / NO is not released into the air.	ignore releases nitrogen / oxygen unless qualified accept prevents / less acid rain ignore greenhouse gas / ozone layer	1
4(b)(iii)	2 and 2	accept correct multiples or fractions	1
4(b)(iv)	idea of catalyst not being used up	allow not changed by reaction ignore catalyst does not take part ignore catalyst not used in the reaction	1

Question 4 continues on the next page

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question	answers	extra information	mark
4(b)(v)	idea of different reactions (require different catalysts)	accept catalysts work for specific reactions allow different gases	1
4(c)	<ul style="list-style-type: none"> • smaller / very small / or any indication of very small / 1–100 nanometres / a few (hundred) atoms • big(ger) surface area • less (catalyst) needed / small amount of catalyst needed 	ignore just small ignore size of the converter	1 1 1
Total			9

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Question 5

question	answers	extra information	mark
5	<p>three from:</p> <p>structure: (max 2)</p> <ul style="list-style-type: none"> giant structure / macromolecule / all the atoms are joined together covalent (bonds) strong bonds / bonds difficult to break each silicon atom forms <u>4</u> bonds and / or each oxygen atom forms <u>2</u> bonds <p>explanation: (max 2)</p> <ul style="list-style-type: none"> a lot of energy needed to break the bonds high melting point does not burn or react with oxygen 	<p>reference to ionic / metallic / intermolecular / (small) molecules = max 2</p> <p>allow (giant) lattice ignore large structure ignore diamond structure</p> <p>if neither point given accept high temperature needed to break bonds for 1 mark</p>	3
Total			3

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Question 6

question	answers	extra information	mark
6(a)(i)	less drying time and/or less soaking time	allow it is quicker / faster allow converse if they state water	1
6(a)(ii)	forces of attraction / bonds <u>between</u> molecules are weak (owtte) or <u>intermolecular</u> forces / bonds are weak (owtte)	do not accept intramolecular forces / covalent bonds are weak forces of attraction are weak (without specifying between molecules / intermolecular) gains 1 mark (accept easily broken / not much energy needed to break instead of weak) bonds are weak without specifying intermolecular would not gain a mark and would be ignored. made of small molecules / simple molecular gain 1 mark an answer such as, it is made of small molecules with weak forces of attraction, would gain 2 marks	2
6(b)(i)	exothermic reaction (owtte)	accept answers based on Le Chatelier eg when temperature is low the reaction moves to increase the temperature accept reverse argument	1

Question 6 continued on the next page

Question 6 contd

question	answers	extra information	mark
6(b)(ii)	fewer product molecules / particles (than reactants molecules) (owtte)	<p>accept three molecules / particles / volumes / moles on the left and one on the right (numbers given must be correct)</p> <p>accept answers based on Le Chatelier eg when pressure is high, reaction moves to the side with fewest molecules / smaller volume</p> <p>or when pressure is high, reaction moves to reduce the pressure</p> <p>do not accept reference to atoms</p> <p>do not accept more reactants than products unless qualified</p>	1
6(b)(iii)	<p>any two from:</p> <ul style="list-style-type: none"> • molecules / particles / they move faster • collide more (often) / quicker • more of the collisions are successful or more have the activation energy (owtte) <p>or more energetic collisions</p>	<p>ignore move / vibrate more</p> <p>allow harder collisions</p> <p>allow collide with more force</p>	2
6(c)(i)	16	<p>correct answer with or without working</p> <p>accept correct rounding</p> <p>if the answer is incorrect then check the working.</p> <p>for 1 mark look for correct method in one line of the working.</p> <p>Moles of CO = $14/28$ or 0.5 or</p> <p>Mass of CH₃OH = 0.5×32</p> <p>or</p> <p>$28 \rightarrow 32$ or</p> <p>$14 \rightarrow 32/2$ or</p> <p>$\frac{32}{28} \times 14$</p>	2

Question 6 contd

question	answers	extra information	mark
6(c)(ii)	75	<p>correct answer with or without working</p> <p>allow correct answer with ecf from (c)(i) for 2 marks</p> <p>if the answer is incorrect</p> <p>$\frac{12}{16} \times 100$ or $\frac{12}{\text{their (c)(i)}} \times 100$</p> <p>gains 1 mark</p> <p>OR if working from 18 g</p> <p>66.6 recurring or correctly rounded to a max of 67 = 2 marks</p> <p>incorrect rounding eg 66 = 1 mark</p> <p>or</p> <p>$\frac{12}{18} \times 100$ gains 1 mark</p>	2
6(c)(iii)	<p>reversible reaction</p> <p>or</p> <p>not all reactants converted to product (owtte)</p> <p>or</p> <p>other sensible reason such as:</p> <p>loss of product / reactant or</p> <p>impurities in reactants or</p> <p>side reactions / other products or</p> <p>temperature too high / pressure too low</p>	<p>allow 'it did not all react'</p> <p>allow gas is lost</p> <p>ignore mass lost</p> <p>ignore some is lost</p>	1
Total			12