



General Certificate of Secondary Education

Additional Science 4463 / Chemistry 4421

CHY2H Unit 2 Chemistry

Mark Scheme

2008 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.

3.8 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

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Question 1

question	answers	extra information	mark
(a)	sensible line of best fit which goes through or close to all the points except the anomalous point	allow wobbly / short double lines $\pm \frac{1}{2}$ square	1
(b)	loss of gas / loss of CO ₂	idea of gas produced / formed	1
(c)	7		1
(d)(i)	steeper line from around the same starting point and left of the points	allow crosses if they are fully correct for 1 mark	1
	levelling off at 99	accept short level line at 99 $\pm \frac{1}{2}$ square	1
(d)(ii)	any three from: <ul style="list-style-type: none"> • particles / molecules / atoms/ ions have more energy • move faster • collide <u>more</u> often or <u>more</u> chance of collisions or bump into each other <u>more</u> • collide with <u>more</u> force / energy or <u>more</u> particles have the activation energy or <u>more</u> collisions result in reaction or <u>more</u> collisions are successful 	allow given / gain / get energy ignore move about more ignore vibrate more / faster ignore collide quicker / faster	3
total			8

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Question 2

question	answers	extra information	mark
(a)	any one from: <ul style="list-style-type: none"> they are made of layers atoms / ions / particles / layers (of atoms) can slide over each other 	do not accept line / rows / lattice	1
(b)	any one from: <ul style="list-style-type: none"> smaller / tiny or very small correct size range 1 to 100 nanometres a few hundred atoms in size 	do not allow small alone if they state smaller and give a size outside range ignore size if it is less than 20,000	1
(c)	harder plus one from: <ul style="list-style-type: none"> so does not wear as quickly / erode as quickly less vulnerable to damage owtte because they have a high surface area to volume ratio or stronger (1) plus one from: (1) <ul style="list-style-type: none"> less likely to break / do not break not as vulnerable to damage owtte do not bend out of shape because they have a high surface area to volume ratio 	ignore corrode harder to wear down = 1 mark accept withstand pressure harder and stronger alone gains 1 mark	1 1
total			4

CHY2H**Question 3**

question	answers	extra information	mark
(a)	N ₂ O		1
(b)	13.8 to 14	gains full marks without working if answer incorrect 13 gains 1 mark or 14/101 × 100 gains 1 mark	2
total			3

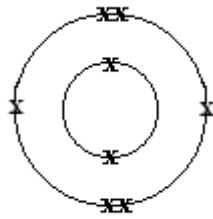
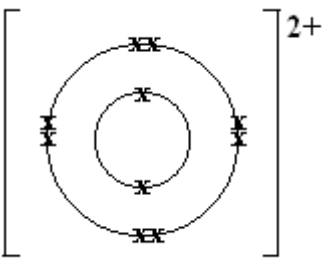
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Question 4

question	answers	extra information	mark
(a)	electric current / electricity		1
	plus one from: <ul style="list-style-type: none"> • is passed through <u>ionic</u> compound / substance / electrolyte • passed through molten/aqueous <u>compound</u> / <u>substance</u> • causing decomposition 	must be linked to electricity allow liquid compound / substance do not allow solution / liquid alone accept split up / breakdown / breaking up owtte ignore separated accept elements are formed ignore new substances form	1
(b)	hydrogen	accept H ₂ do not accept H / H ²	1
(c)	one electron from each atom	accept each carbon is bonded to three other carbon atoms leaving one (unbonded) electron owtte	1
	is delocalised / free (to move)	must be linked to electrons answers of delocalised / free electrons only, gains 1 mark accept each carbon is bonded to three other carbon atoms leaving delocalised / free electrons = 2 marks maximum 1 mark if graphite described as a metal / giant ionic lattice	1
total			5

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Question 5

question	answers	extra information	mark
(a)	any one from: <ul style="list-style-type: none"> • gives out heat / energy • transfers energy from a substance to the surroundings • ΔH / energy change / enthalpy change is negative 	accept releases / gives off owtte ignore references to light	1
(b)	$2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$	accept correct multiples / fractions	1
(c)		electrons do not need to be paired accept dots / circles / e instead of crosses do not allow 2.6 without diagram	1
(d)		electrons do not need to be paired allow without brackets must have the charge accept dots / circles / e instead of crosses ignore extra empty outer shells ignore nucleus do not allow $[2.8]^{2+}$ without diagram	1

continued...

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Question 5 continued...

question	answers	extra information	mark
(e)	oppositely charged (ions / atoms)	allow positive and negative(ions / atoms)	1
	(they) attract	must be in correct context accept held by electrostatic forces ignore ionic bonding maximum 1 if they refer to intermolecular forces / attractions / covalent bonds	1
(f)	magnesium chloride	accept MgCl_2 (if correctly written)	1
total			7

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Question 6

question	answers	extra information	mark
(a)	Compound A any one from: <ul style="list-style-type: none"> • sodium bromide • potassium bromide • ammonium bromide • hydrogen bromide • any metal bromide except silver and lead. 	accept correct formulae	1
	Compound B silver nitrate	accept silver sulfate	1
(b)	the silver compound will decompose / silver ions be reduced to silver (owtte)	accept film would darken owtte accept any idea of light changing silver bromide / silver ions / silver nitrate / silver sulfate allow 'forms a black solid' / it would turn black	1
(c)	precipitation	accept descriptions of precipitation reactions accept double decomposition accept precipitate do not allow displacement	1
(d)	electrons		1
	are gained	the second mark must be linked to electrons accept it / silver / silver ions gains electrons for both marks ignore references to oxygen	1
total			6

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Question 7

question	answers	extra information	mark
(a)	<p>1213.8 to 1214.3</p> <p>correct answer not given then check working</p> <p>1) moles of N₂ = $\frac{1000}{28}$ = 35.7 mol</p> <p>2) moles of NH₃ = 2 × (answer from (1)) = 71.4 mol</p> <p>3) mass of NH₃ = (answer from 2) × 17 = 71.4 × 17 = 1214 g</p> <p>or</p> <ul style="list-style-type: none"> • 28g of N₂ → 34g of NH₃ • 1g of N₂ → $\frac{34}{28}$ = 1.214g NH₃ • 1000 g of N₂ → 1000 × 1.214 = 1214g <p>or</p> <ul style="list-style-type: none"> • $1000 \times \frac{34}{28}$ <p>or</p> <p>other correct methods</p>	<p>gains 3 marks without working</p> <p>1 mark for each correct step</p> <p>do not penalise rounding errors in this part</p> <p>1 mark for each correct step</p> <p>do not penalise rounding errors in this part</p> <p>allow error carried forward eg</p> <p>gains 2 marks if correct answer not given</p> <p>$1000 \times \frac{28}{34}$ gains 1 mark, 2 marks if correctly calculated (823.5g)</p> <p>$1000 \times \frac{28}{17}$ gains 1 mark if calculated correctly (1647.05g)</p> <p>look for the key ideas in the methods above</p>	3

continued...

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Question 7 continued...

question	answers	extra information	mark
(b)	25 / 25.035 or ecf from (a) or using figures from part (b) 27.6 / 28	gains 2 marks even when there is no working incorrect answer then $304/(\text{their answer from (a)}) \times 100$ gains 1 mark gains 2 marks even when there is no working accept 27 for 1 mark if answers incorrect then $304/1100 \times 100$ gains 1 mark	2
(c)(i)	increase yield reaction is exothermic or allow decreased yield because rate of reaction is slower / fewer collisions for 2 marks	must get both points for 2 marks	1 1
(c)(ii)	increase yield plus one from: <ul style="list-style-type: none"> more (gaseous) reactant molecules than (gaseous) product molecules (owtte) increased rate of reaction / more collisions 	accept greater volume on the left than the right owtte	1 1

continued...

CHY2H

Question 7 continued...

question	answers	extra information	mark
(d)	<p>any one from:</p> <p>economic</p> <ul style="list-style-type: none"> • large town provides workforce • workers do not have to travel far to the factory. (owtte) • transport infrastructure already in place for large town. (owtte) • factory brings prosperity to town (owtte) • factory provides employment • reduced tourism • reduction in local house prices • any other sensible economic factor linked to town <p>any one from:</p> <p>safety</p> <ul style="list-style-type: none"> • <u>escape</u> of dangerous / harmful chemicals / gases (owtte) • <u>danger</u> of increased traffic • risk of explosion.(owtte) /danger of high pressure • consequences of an accident could be severe if the town is close • any other sensible safety idea 	<p>do not allow polluting gases unqualified</p>	<p>1</p> <p>1</p>

continued...

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Question 7(d) continued...

question	answers	extra information	mark
	any one from: environmental <ul style="list-style-type: none"> • factory might be unsightly (owtte) • screening of factory (owtte) • loss of habitats (owtte) • plant trees/ hedges etc on and around plant site • pollution of water / air / soil could harm plants / animals or noise pollution • CO₂ is produced by burning fuels / heating • CO₂ causes global warming / any effect of global warming • eye sore • any other sensible environmental factor 	must be explained	1
total			12