



General Certificate of Secondary Education

Chemistry 4421

CHY3H Unit Chemistry 3

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)(i)	smooth <u>curve</u> through all points	do not accept multiple lines	1
1(a)(ii)	36.9 to 37.2	if outside range accept correct reading from candidate's own curve +/- half small square	1
1(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
1(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 <u>x-axis</u> scale is different accept converse for A ignore precise graph	1
Total			5

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Question 2

question	answers	extra information	mark
2(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
2(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> less precise / sensitive	accept converse throughout allow only detect down to 0.1 mg ignore less accurate	2 1
	2(b)(ii)	(PIWE) is unbiased or company may be biased	it / they = PIWE allow honest / trusted / respected / reliable ignore professional / scientific / skilled allow company trying to sell products
Total			6

CHY3H**Question 3**

question	answers	extra information	mark
3(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
3(b)	exothermic	allow combustion / redox / oxidation ignore reduction / burning	1
Total			4

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Question 4

question	answers	extra information	mark
4(a)(i)	a correct link between any two named elements eg same group / column same properties / number of outer electrons	allow some link between any two elements in the same group (in both Newlands' and or the modern periodic table)	1
4(a)(ii)	any two from: <ul style="list-style-type: none"> elements still being discovered or no gaps for undiscovered elements some boxes have 2 elements in them metals and non-metals in same column / mixed up pattern for first 16 or so elements only 	ignore statements about lack of evidence / proof accept some elements in same column have different properties. allow any sensible suggestion about misplaced elements eg copper in group 1 elements allow did not work for all elements	2
4(b)(i)	Cl > Br > I or I < Br < Cl Cl has 2 reactions, Br has 1 reaction, I doesn't react	accept reactivity / it decreases down the group owtte allow Cl has most / more reactions and I has least / less reactions (must be clear about where Br fits in)	1 1

Question 4 continues on the next page

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Question 4 contd

question	answers	extra information	mark
4(b)(ii)	Br ₂	allow multiples / fractions if correctly completed and balanced	1
4(b)(iii)	(they) have <u>7 outer</u> electrons	allow (they) have <u>7</u> electrons in highest occupied (energy) level / shells / rings	1
4(c)	<p>down group (atom / elements) <u>bigger</u></p> <p>or</p> <p>outer electrons (level / shell / ring) <u>further</u> from nucleus / centre</p> <p>or</p> <p><u>more</u> shells / level / rings</p> <p>force(s) / attraction(s) are <u>weaker</u></p> <p>or</p> <p><u>more</u> shielding</p> <p>or</p> <p>attracts <u>less</u></p> <p>electron(s) <u>lost more</u> easily</p>	<p>outer / last / final must be mentioned once in correct context, otherwise max 2 marks comparative required on all three points</p> <p>accept converse ie less reactive up group</p> <p>ignore more electrons</p> <p>do not accept more <u>outer</u> shells for this mark</p> <p>allow electron(s) <u>attracted</u> less easily</p> <p>allow electron(s) less under influence (of nucleus)</p> <p>do not accept magnetic / gravitational / intermolecular forces</p> <p>allow electron(s) more likely to be lost</p> <p>allow easier to give away</p>	<p>1</p> <p>1</p> <p>1</p>
Total			10

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Question 5

question	answers	extra information	mark
5(a)	limewater / calcium hydroxide	do not allow this mark if lime water added to solution or powder	1
	(limewater) goes milky / cloudy or gives white precipitate / solid		1
5(b)	eg flame colour of (Na) and flame colour of (K) interfere / mask / mix with each other	accept difficult to determine the colour or hard to distinguish accept some indication that two distinct colours are not seen	1
5(c)(i)	barium chloride (solution) / BaCl ₂	ignore mention of acidification but do not allow sulfuric acid. wrong reagent = no mark	1
	white precipitate / white solid	allow white barium sulfate or barium sulfate precipitate	1
5(c)(ii)	white precipitate / white solid	ignore goes milky do not accept any mention of precipitate dissolving	1
Total			6

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Question 6

question	answers	extra information	mark
6(a)(i)	H^+ and CH_3COO^-	allow H_3O^+ for H^+ allow CH_3CO_2^- for CH_3COO^-	1
6(a)(ii)	not fully ionised / dissociated	accept partially / slightly ionised / dissociated accept does not ionise well ignore (does not produce many ions) do not accept ions ionise	1
6(a)(iii)	proton donor(s)	do not accept H^+ ions	1
6(b)(i)	colour change in right (pH) range or this is a weak acid and strong alkali titration	it = phenolphthalein accept methyl orange does not change colour or methyl orange changes in the wrong (pH) range accept methyl orange is for strong acid and weak alkali titration.	1

Question 6 continues on the next page

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Question 6 contd

question	answers	extra information	mark
6(b)(ii)	NaOH / alkali in burette	<p>must be description of an acid / alkali titration ie quantitative measures of volume</p> <p>no titration = 0 marks</p> <p>vinegar = ethanoic acid = acid</p> <p>accept phonetic spelling</p> <p>do not accept biuret</p>	1
	add NaOH until (indicator) changes from colourless to pink or until (indicator) changes colour	<p>do not accept incorrect indicator or incorrect colour change</p> <p>allow unit indicator changes</p>	1
	note (burette) volume used or final volume	<p>allow work out the volume</p> <p>or see how much is used</p>	1
	any one other point from <ul style="list-style-type: none"> • repeat • white tile / background • add dropwise / slowly • swirling / mix • read meniscus at eye level • some indication that some apparatus has been washed 	<p>ignore stir (with rod)</p>	1

Question 6 continues on the next page

CHY3H**Question 6 contd**

question	answers	extra information	mark
6(c)	0.06	correct answer with or without working = 2 marks if answer is incorrect (0.1 x 15)/25 or 0.0015 x 40 gains 1 mark	2
Total			10

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Question 7

question	answers	extra information	mark
7(a)	M1: (bonds broken) = 2148 (kJ)	correct answer with or without working = 3 marks	1
	M2: (bonds made) = 2354 (kJ)		1
	M3: change in energy = (-) 206 (kJ)	ecf ignore sign	1
7(b)	energy released from forming new bonds is greater than energy needed to break existing bonds	allow the energy needed to break bonds is less than the energy released in forming bonds do not accept energy needed to form bonds	1
Total			4