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General Certificate of Secondary Education

Chemistry 4421

CHY3H Unit Chemistry 3

Mark Scheme

2010 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)	sterilise / disinfect (water) **or** kill bacteria / micro-organisms / microbes / germs / pathogens	ignore removes bacteria / impurities / disease ignore cleans the water / makes (water) safe allow destroy bacteria **or** gets rid of bacteria	1
1(b)	any **two** from: • chlorine is toxic / poisonous • so (too much) will be dangerous / harmful / kill people / cause illness / health problems • cause breathing difficulties **or** cause (more) allergic reactions / skin **or** eye irritation • <u>too little</u> will not kill bacteria	ignore reference to safe / unsafe allow causes damage allow bacteria still there	2
1(c)	cheap / easy / quick to use (process)	accept prevents typhoid / cholera ignore reference to specialists or equipment	1
1(d)(i)	fair / more ideas / views / opinions **or** less chance of bias **or** more democratic	allow idea of different points of view / balanced view allow avoids undue influence owtte	1

Question 1 continues on next page

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Question 1 continued

question	answers	extra information	mark
1(d)(ii)	(more likely) to have support / influence / convince people	ignore well respected allow ideas about trust e.g. people will have more confidence in their views / more likely to be believed allow ideas about expertise e.g. more likely to know what they are talking about / have done experiments / tests allow have knowledge / understanding allow (more) reliable	1
1(d)(iii)	(more likely) to be correct / less likely to be incorrect **or** reliable / factual / accurate / based on proof / based on experiments or tests / based on validation	owtte ignore based on evidence unqualified allow hearsay / opinion can be biased	1
Total			**7**

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Question 2

question	answers	extra information	mark
2(a)	reasonable <u>smooth</u> curve through all the points over the range 10 - 80	ignore outside range do **not** accept multiple lines	1
2(b)	5.7	range 5.5–5.9 if outside range check graph	1
2(c)	7.6	correct answer with or without working = **2** marks if answer incorrect 10 **or** 2.4 gains **1** mark	2
Total			**4**

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Question 3

question	answers	extra information	mark
3(a)	hydroxide (ion) / OH^- / OH^-(aq)	ignore OH	1
3(b)	fully / all / completely ionised / dissociated	ignore strongly ionised **or** more ions **or** concentration ignore all 'noise' do **not** accept <u>ions</u> are fully ionised / dissociated	1
3(c)		assume it = sodium hydroxide	
	any valid test	incorrect test / titration = **0** marks for question	1
	linked comparison	correct result / reference to pH with no test = **1** mark	1
	eg UI **or** full range indicator **or** pH paper / solution / (pH) meter (1)		
	NaOH has higher pH **or**	allow converse for weak(er) pH values must be above 7	
	correct <u>comparison</u> of colours (1)	NaOH – purple, Ammonia – blue allow correct comparison of blue or purple	
	or		
	conductivity test (1)		
	NaOH conducts better / more **or** bulb brighter (1)		
Total			**4**

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Question 4

question	answers	extra information	mark
4(a)	(acidified) barium chloride / nitrate	incorrect reagent **or** no reagent = **0** marks do **not** accept acidified with sulfuric acid (still allow result mark if correct) allow solution of barium ions / salt **not** barium solution **do not** accept barium hydroxide	1
	(white) precipitate / solid	do **not** accept incorrect colour for precipitate allow barium sulfate (formed) ignore 'it goes white / cloudy'	1
4(b)	(white) precipitate / solid	allow aluminium hydroxide (formed) **do not** allow incorrect colour for precipitate	1
	(precipitate) dissolves (in excess)	allow sodium aluminate (formed) allow goes clear / colourless if incorrect colour precipitate then allow dissolves (in excess)	1
4(c)	any **two** from: • yellow = sodium (alum) • lilac = potassium (alum) • colourless = ammonium (alum)	apply list principle allow orange **or** yellow orange allow purple if no colours given, allow 'different coloured flames' for **1** mark	2
Total			**6**

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Question 5

question	answers	extra information	mark
5(a)	left gaps		1
	if placed consecutively, then elements would be in wrong group / have wrong properties / owtte	allow some elements didn't fit pattern	1
5(b)	(elements placed in) atomic / proton number order		1
	(elements in) same group have same number of outer electrons		1
	any **one** from: • number of protons = number of electrons • reactions (chemical) properties depend on the (outer) electrons • number of shells gives the period	allow number of shells increases down the group	1
5(c)(i)	(transition elements usually) have same / similar number of outer / 4th shell electrons		1
	inner (3rd) shell / energy level is being filled	ignore shells overlap	1
5(c)(ii)	2nd shell / energy level can (only) have maximum of 8 electrons **or** 2nd shell / energy level cannot have 18 electrons		1
Total			**8**

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Question 6

question	answers	extra information	mark
6(a)	energy of product greater than energy of reactants	allow converse allow energy = heat do **not** accept temperature for energy allow product / nitrogen oxide is higher than reactants allow less energy / heat given out than taken in allow energy / heat is taken in / gained allow ΔH is positive	1
6(b)	(minimum) energy needed to start the reaction / overcome energy barrier	accept (minimum) energy needed for a collision to be successful	1
6(c)(i)	 bonds broken = 945 + 498 = 1443 (kJ) bonds made = 2 $\times$630 = 1260 (kJ) energy change = 1443 – 1260 = (+) 183	correct answer with or without working = **3** marks ignore sign allow ecf	 1 1 1
6(c)(ii)	energy released forming new bonds is less than energy needed to break existing bonds owtte	allow converse accept energy change(ΔH) is + / positive do **not** accept energy <u>needed to form new bonds</u> is less than energy needed to break existing bonds	1
Total			**6**

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Question 7

question	answers	extra information	mark
7(a)	some mention that a proton is a hydrogen ion / H^+ (as an acid) it / aminoethanoic acid has lost / donated a proton / hydrogen ion (as a base) it / aminoethanoic acid has gained / accepted a proton / hydrogen ion	this mark can be gained in either part	1 1 1
7(b)(i)	0.11(04)	correct answer with or without working = **2** marks if answer incorrect (0.15 × 18.4) / 25 gains **1** mark	2
7(b)(ii)	phenolphthalein	allow any correct single acid-base indicator that changes colour in the appropriate pH range (8 – 10) do **not** accept UI / litmus / methyl orange	1
Total			**7**

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Question 8

question	answers	extra information	mark
8	use of (water) filters / ion exchange		1
	containing carbon / charcoal / silver / resins	ignore other substances	1
	any **two** from: • carbon / charcoal removes chlorine • carbon / charcoal removes soluble / dissolved substances • silver kills / prevents growth of microorganisms • ion exchange removes calcium ions / magnesium ions / metal ions • ion exchange replaces (metal ions) with H^+ / Na^+ • ion exchange removes hardness	allow exchange for replace	2
Total			**4**