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General Certificate of Secondary Education

Chemistry 4421

CHY3H Unit Chemistry 3

Mark Scheme

2012 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 students' 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 students' 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 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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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 students 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)

Student	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)

Student	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student 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)	A		1
1(a)(ii)	B		1
1(b)(i)	put a lid on (beaker) **or** insulate (top or sides of) beaker **or** use screens to prevent draughts	any addition to the equipment that would prevent energy loss allow bomb calorimeter do **not** allow polystyrene cup ignore 'move the crucible'	1
1(b)(ii)	(temperature change =) 22°C (100 x 4.2 x 22 =) 9240	correct answer is **2** marks with or without working allow ecf from their 22	1 1
1(b)(iii)	any **two** from: • a <u>specified</u> human/measurement error • water should be stirred • not all of the glucose burns • energy used to heat the beaker / container • recorded the room temperature (at the beginning)	 ignore 1g of glucose insufficient ignore 100cm^3 of water too much ignore calculation error ignore not repeated / anomalous results allow thermometer in fixed position allow glucose was impure ignore light energy / evaporation allow room temperature was high<u>er</u>/different to the temperature of the (cold) water allow did not measure the water temperature at the beginning	2

Question 1 continues on the next page . . .

Question 1 continued

question	Answers	extra information	mark
1(c)	any **one** from: • for dietary information • different foods produce different amounts of energy • legal requirement	 allow consequences of diet allow for nutritional information allow eat healthily ignore balanced diet ignore to know how much energy is taken in	1
Total			**8**

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Question 2

question	Answers	extra information	mark
2(a)(i)	carbon dioxide / CO_2	answers must be in the order shown	1
	carbonate / CO_3^{2-}	marks are independent	1
2(a)(ii)	ammonia / NH_3	answers must be in the order shown	1
	litmus	marks are independent	1
2(b)(i)	solution is blue	accept blue precipitate only if sodium hydroxide added allow blue liquid allow copper sulfate / copper ions are blue	1
2(b)(ii)	barium chloride / $BaCl_2$	allow barium nitrate / barium ions / Ba^{2+}	1
	white	answers must be in the order shown marks are independent	1
Total			**7**

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Question 3

question	Answers	extra information	mark
3(a)(i)	smooth curve drawn through <u>all</u> points ± ½ small square	do **not** accept double lines **or** straight lines point to point	1
3(a)(ii)	a value in the range 0.07 – 0.08	or from their graph ± ½ small square	1
3(a)(iii)	0.11	correct answer with or without working gains **2** marks if answer is incorrect allow **1** mark for 0.17 **or** 0.06	2
3(b)	(calcium) carbonate / $CaCO_3$ is the scale	accept clear implication that (calcium) carbonate is scale	1
	because the reaction is reversible **or** because (calcium) hydrogencarbonate decomposes	allow description ignore equilibrium unless qualified accept equation written in reverse	1
3(c)	sodium chloride / dishwater salt contains <u>sodium</u> <u>ions</u>		1
	sodium ions / Na^+ <u>in the resin</u> are used	allow sodium ions <u>in the resin</u> need replacing	1
	to exchange / replace / displace	accept ion exchange	1
	for calcium / magnesium (ions from the hard water)	allow calcium / magnesium (ions) removed (from the hard water)	1
Total			**10**

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Question 4

question	Answers	extra information	mark
4(a)(i)		incorrect or no element = **0** marks	
	hydrogen	allow H / H_2	1
	all the other elements are metals **OR**	allow hydrogen is a not an (alkali / group 1) metal ignore hydrogen is a gas	1
	copper (1)	allow Cu	
	(copper) is not an alkali metal (1)	allow Cu is a transition element / metal allow any valid specific chemical property eg Cu does not react with water ignore references to electronic structure ignore physical properties	
4(a)(ii)	Group 0 / noble gases	ignore Group 8	1
4(b)(i)	scandium / gallium / germanium	accept Sc / Ga / Ge allow Krypton / Kr	1
4(b)(ii)	predicted they were metals	allow atomic mass / weight ignore atomic structure	1
	predicted their (chemical/physical) properties / reactivity	accept any chemical / physical property allow similar properties if mentioned in context of a group	1
4(c)(i)	(both) have <u>one</u> / <u>an</u> electron in the outer energy level / shell	ignore form single plus ions	1

Question 4 continues on the next page . . .

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Question 4 continued

question	Answers	extra information	mark
4(c)(ii)		accept shell for energy level accept converse explanation for lithium if 'outer' not mentioned, max 2 marks ignore sodium reacts more easily	
	sodium loses one outer electron more easily (than lithium)		1
	because outer electrons/energy level further from the nucleus in sodium **or** because sodium has more shells (than lithium)	do **not** accept 'more outer shells' allow sodium (atom) is larger	1
	because forces/attraction to hold outer electron are weaker in sodium (than lithium)	accept more shielding in sodium (than lithium)	1
Total			**10**

Question 5

question	Answers	extra information	mark
5(a)(i)	because (ethanoic acid) is not fully ionised / dissociated	accept (ethanoic acid) is partially ionised ignore weakly ionised ignore reversible reaction / equilibrium do **not** accept (weakly) ionising	1
5(a)(ii)	because (ethanoic acid) forms H^+ / hydrogen ions (in water)	do **not** accept 'it is a proton donor' allow contains hydrogen ions / H^+	1
5(b)		if acid to acid titration described, first two marking points **not** available if a titration not described, **0** marks	
	sodium hydroxide solution in burette		1
	add sodium hydroxide solution until (indicator) changes colour / (from colourless) to pink	do **not** accept incorrect indicator **or** incorrect colour change ignore clear allow red	1
	note (burette) volume used or final reading	allow calculate the volume needed	1
	any **one** from: • repeat • white background • add dropwise or slowly • swirl/mix • read meniscus at eye level • wash/rinse equipment		1
5(c)(i)	20.0		1

Question 5 continues on the next page . . .

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Question 5 continued

question	answers	extra information	mark
5(c)(ii)	(no)	ecf from 5(c)(i)	
	evidence of concentration of ethanoic acid (20/25 x 1.0) is 0.8 moles per cubic decimetre	allow any clear alternative method that leads to the correct answer	1
	evidence of concentration of ethanoic acid (0.8 x 60) is 48g per cubic decimetre		1
	evidence of conversion of 48g per cubic decimetre to 4.8g per $100cm^3$		1
Total			**10**

UMS Conversion Calculator www.aqa.org.uk/umsconversion