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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Additional Science 4463 / Chemistry 4421

CHY2H Unit 2 Chemistry

Mark Scheme

2008 examination – June 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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COMPONENT NAME: Additional Science / Chemistry

STATUS: Final

DATE: June 2008

question	answers	extra information	mark
1(a)	157	correct answer with **or** without working (2 ×19 + 119) for **1** mark only allow (119 + 19 =) 138 for **1** mark only ignore units	2
1(b)	24.2	accept answers in the range 24 to 24.2038..... ignore incorrect rounding after correct answer 25 only without working gains **1** mark **or** 38/157 × 100 gains **1** mark **or** (19/157 × 100 =) 12 to 12.1 gains **1** mark allow error carried forward from part(a) 38/(a) × 100 gains **2** marks if calculated correctly (19/138 ×100 =) 13.8 gains **1** mark	2
1(c)	0.29	accept answers in the range 0.28 to 0.3 allow error carried forward from part (b) (b)/100 × 1.2 correctly calculated ignore units	1

Question 1 continued on the next page…

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Question 1 continued…

question	answers	extra information	mark
1(d)	an <u>electron</u>	allow electrons allow electron shared / lost for **1** mark apply list principle for additional particles	1
	is gained owtte	must be linked to electron accept can hold / take in if in correct context eg it can hold another electron (in its outer shell) = **2** marks it can take an electron (from another atom) = **2** marks ignore reference to fluoride ions incorrect number of electrons gained does **not** gain the second mark	1
Total			**7**

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question	answers	extra information	mark
2(a)	(propanone) has a low(er) boiling point **or** (propanone) evaporates fast(er) owtte	**or** water has a high(er) boiling point **or** water evaporates slow(er) allow propane / solution / it allow evaporates at lower temperature **or** boils quicker ignore density / reactivity / melting point	1
2(b)(i)	0.29	ignore + **or** – ignore units	1
2(b)(ii)	any **two** sensible suggestions eg: • weighing error • (copper) lost during washing owtte • (copper) lost during electrolysis / reaction owtte • electrodes not completely dry • impurities in the electrode • copper falling off when removing electrode / copper from cell	 accept human error **or** inaccurate measurements allow different washing of electrodes ignore timing errors ignore 'fair test' ignore sludge ignore gases produced	2

Question 2 continued on next page…

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DATE: June 2008

Question 2 continued…

question	answers	extra information	mark
2(c)	any **four** from: • impure copper is anode / positive (electrode) • pure copper is cathode / negative (electrode) • copper sulfate solution **or** any soluble copper salt in solution		4
	• copper loses electrons **or** copper is oxidised • copper forms positive ions / particles	as alternative to these two points $Cu \rightarrow Cu^{2+} + 2e^{-}$ = **2** marks
	• copper gains electrons **or** copper reduced at <u>negative electrode</u> • copper attracts to / collects at <u>negative electrode</u>	**or** $Cu^{2+} + 2e^{-} \rightarrow Cu$ at <u>negative electrode</u>
	• sludge / impurities collect at the bottom owtte	allow sludge left behind **or** sludge left in solution **or** impurities separated from copper
	• impurities not attracted to electrode	ignore get rid of impurities
Total			**8**

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question	answers	extra information	mark
3(a)(i)	sulfuric	accept $\underline{H_2SO_4}$ accept sulphuric allow phonetic spellings	1
3(a)(ii)	$CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$	**1** mark for reactants **1** mark for products ignore state symbols max **1** mark for incorrect balancing	2
3(b)	any **two** from: • particles gain energy **or** particles have more energy • particles move faster • collide more often • collide more energetically • more of the collisions are successful **or** more particles have the activation energy	 allow have more activation energy allow they collide faster / quicker ignore move / vibrate more allow more collisions **NB** more successful collisions alone = **1** mark if particles are identified as electrons = max **1** mark	2
Total			**5**

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question	answers	extra information	mark
4		max **3** if ionic / metallic bonding mentioned	
		ignore electrostatic	
		ignore molecules / intermolecular forces	
	any **four** points from:		4
	• high melting point owtte	ignore boiling point	
	• <u>many</u> **or** <u>all</u> atoms joined together		
	• each silicon (atom) joined to four oxygen (atoms) **or** each oxygen joined to two silicon		
	• <u>covalent</u> (bonds)		
	• many bonds would need to be broken		
	• strong bonds	allow hard to break bonds	
	• lot of energy / heat needed to break bonds	allow high temperature needed to break bonds	
	• giant / macromolecular / lattice / diamond structure		
	• unreactive	allow doesn't react with materials within furnace = **1** mark	
	• rigid / hard structure		
	• no free electrons		
	• poor conductor of heat	giant covalent structure = **2** marks	
Total			**4**

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question	answers	extra information	mark
5(a)	Pb Cl C O $\frac{76}{207}$ $\frac{13}{35.5}$ $\frac{2.2}{12}$ $\frac{8.8}{16}$ = 0.367 = 0.366 = 0.183 = 0.55 2 2 1 3 **or $Pb_2Cl_2CO_3$**	**1** mark for dividing **one** mass by A_r allow upside down ratio to lose this mark only **1** mark for **one** correct proportion – accept to one d.p. or rounded up to 1 d.p. **1** mark for **all four** correct proportions correctly rounded **1** mark for correctly written formula **or** correct whole number ratio correct formula without working gets only **1** mark. e.c.f. can be allowed from incorrect proportions to formula **or** ratio	1 1 1 1
5(b)(i)	any **one** from: • $NaOH^-$ / sodium hydroxide is <u>formed</u> / an alkali • hydroxide / OH^- ions <u>formed</u>	 **not** just alkali is formed increase number of hydroxide / OH^- ions	1
5(b)(ii)	filter	accept centrifuge / decant allow filter and evaporate ignore further steps unless contradictory	1
Total			**6**

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question	answers	extra information	mark
6(a)	nanoparticles / they are small(er)	accept 1–100 nm or a few atoms in size	1
	so can easily pass through pores / skin / cell / membranes / arteries / veins / capillaries / into blood stream owtte	must be a comparative statement can be inferred from small<u>er</u> particles allow absorbed for pass through	1
6(b)	any **one** from: • may be toxic (to cells / specific cells) • to ensure safety **or** reduce risk **or** risk of litigation • nanoparticles may have different properties • to see if they pass into the body	 allow may harm / damage / kill cells / organs / tissues **or** may cause cancer allow may cause allergies / side effects ignore harmful / dangerous unqualified eg harmful to body / people	1

Question 6 continued on the next page...

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Question 6 continued...

question	answers	extra information	mark
6(c)	any **two** sensible ideas from eg: • testing is expensive **or** testing costs money • testing is time consuming • don't see any reason to test since normal sized particles (of titanium oxide) do not cause harm • don't want to risk not producing a popular product (owtte) • testing process / unfavourable results might cause alarm / reduce sales / reduce profit (less money) • do not want to be seen doing animal testing	allow it costs money ignore litigation accept normal sun cream does **not** cause harm owtte eg if unsafe will have to stop production **or** have to remove product if toxic	2
Total			**5**

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question	answers	extra information	mark
7(a)	2.8.3 on diagram as Xs / dots **or** e	accept paired **or** unpaired	1
7(b)	any **two** from: • electrons in highest energy level **or** electrons in outer shell • electrons are delocalised **or** sea of electrons • electrons are free **or** electrons move around / flow • electrons carry charge / current	 ignore carry electricity	2
Total			**3**

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question	answers	extra information	mark
8(a)	25.4(%)	correct answer with **or** without working accept 25(%) accept 25.433……..(%) allow 26(%) for **1** mark if incorrect answer **1** mark for identification of 44 as M_r of useful product **or** 173 as total M_r of reactants / products	2
8(b)	any **two** sensible ideas from eg: • no / less waste • less materials / reactants needed / used • fewer / no environmental problems **or** less / no pollution • better for sustainable development / resources running out • more useful use of atoms • less purification / separation of products owtte	ignore references to energy / cheaper / profit / cost / efficient	2

Question 8 continued on next page…

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Question 8 continued...

question	answers	extra information	mark
8(c)	increase yield more (gaseous) reactant molecule than (gaseous) product molecule owtte	owtte accept more molecules on left hand side **or** converse accept Le Chatelier based answers for second mark ignore rate of reaction	1 1
8(d)	reduce yield **or** less product owtte	allow no yield ignore waste / less efficient	1
Total			**7**