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General Certificate of Secondary Education

Additional Science 4408 / Chemistry 4402

CH2HP Unit Chemistry 2

Mark Scheme

2012 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 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	Neptune, Mars, Moon	1
2	Neptune, 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.

Quality of Written Communication and levels marking

In Question 2(a) students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: Basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: Clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: Detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

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Question 1

question	answers	extra information	mark
1(a)(i)	prevent evaporation of solvent	allow prevent loss of solvent allow to support the (chromatography) paper	1
1(a)(ii)	ink dissolves in the solvent **or** carbon / graphite does not dissolve in the solvent	allow ink 'runs' / spreads **or** pencil does not 'run' / spread allow ink would affect the result / mixes with colours accept pencil for carbon / graphite	1
1(b)(i)	4		1
1(b)(ii)	any **one** from: • because not all colours match • not all colours are safe • some colours could be unsafe • some colours travelled higher (than safe colours)	no mark for 'no / don't know' ignore numbers	1
1(c)(i)	any **two** from: • rapid / quick • accurate • sensitive **or** detects very small quantities	ignore reliable / precise accept small sample	2

Question 1 continues on the next page . . .

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Question 1 cont'd…..

question	answers	extra information	mark
1(c)(ii)	separates		1
1(c)(iii)	identifies solvents / compounds / substances	accept (relative) molecular mass accept formula mass accept M_r accept relative mass accept molecular ion peak	1
Total			**8**

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Question 2

question	answers	extra information	mark
2(a)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2, and apply a 'best-fit' approach to the marking.		**6**

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a simple description of a laboratory procedure for obtaining potassium chloride.	There is a clear description of a laboratory procedure for obtaining potassium chloride from potassium hydroxide solution and hydrochloric acid that does not necessarily allow the procedure to be completed successfully by another person. The answer must include the use of an indicator / pH meter **or** a method of obtaining crystals.	There is a detailed description of a laboratory procedure for obtaining potassium chloride from potassium hydroxide solution and hydrochloric acid that can be followed by another person. The answer must include the use an indicator / pH meter **and** a method of obtaining crystals

examples of the chemistry points made in the response:

- One reagent in beaker (or similar)
- Add (any named) indicator
- Add other reagent
- Swirl **or** mix
- Add dropwise near end point
- Stop addition at change of indicator colour
- Note volume of reagent added
- Repeat without indicator, adding same volume of reagent **or** remove indicator using charcoal
- Pour solution into basin / dish
- Heat (using Bunsen burner)
- Leave to crystallise / leave for water to evaporate / boil off water

Accept any answers based on titration

Question 2 continues on the next page . . .

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Question 2 cont'd…

question	answers	extra information	mark
2(b)	nitric (acid)	allow HNO_3 ignore incorrect formula	1
2(c)(i)	because it is a fertiliser / helps plants grow	allow plant food do **not** accept pesticide / herbicide / neutralising soil	1
2(c)(ii)	tick by: 'Should farmers stop using ammonium nitrate on their land?' any **two** from: • cannot be done by experiment • based on opinion / view • ethical **or** economic issue	 accept difficult to get / not enough evidence allow must be done by survey if top box ticked allow **1** mark for drinking water varies from place to place	1 2
Total			**11**

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Question 3

question	answers	extra information	Mark
3(a)	gives out energy **or** heat		1
3(b)(i)		accept qualified answers in terms of volume of gas related to time	
	fast initially		1
	slows down		1
	reaction stops	accept reaction is now very slow	1
3(b)(ii)	21		1
3(b)(iii)	84	correct answer with or without working = **2** marks allow ecf from 3(b)(ii) correctly calculated for **2** marks allow evidence of 21/25 **or** 3(b)(ii)/25 for **1** mark	2
3(c)	because they / particles have more energy / move faster	ignore particles move more / vibrate	1
	(and so) particles collide more often / more frequently **or** particles more likely to collide	ignore collide faster ignore more collisions	1
	(and) more of the collisions are successful **or** particles collide with more energy / harder **or** more of the particles have the activation energy	accept more successful collisions	1
Total			**10**

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Question 4

question	answers	extra information	mark
4(a)	118		1
4(b)	it loses / transfers electrons	it = Au / gold atom	1
	three electrons		1
		sharing / covalency = max **1** mark	
4(c)(i)	O_2		1
	2 CO and **2** CO_2	accept correct multiples / fractions throughout	1
	or		
	correct balancing of equation from O		
4(c)(ii)		reference to incorrect bonding = **1** mark max	
	because carbon dioxide is simple molecular / small molecules		1
	there are intermolecular forces (between the molecules)	allow intermolecular bonds	1
	so a small amount of energy needed (to separate molecules) **or** (intermolecular forces) are weak		1

Question 4 continues on the next page . . .

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Question 4 cont'd…

question	answers	extra information	mark
4(d)	any **three** from: • gold is the only catalyst for some reactions • catalysts are not used up • improves speed of reaction • reduces amount of energy **or** process needs low(er) temperature • only small quantities (of catalyst) needed	if no mark awarded, allow catalyst reduce costs (of the process) for **1** mark	3
Total			**11**

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Question 5

question	answers	extra information	mark
5(a)	52.9(411765) / 53	correct answer with or without working = **2** marks if answer incorrect allow 2 x 27= 54 **or** 27/102 x 100 **or** 26.5 for **1** mark	2
5(b)(i)	because it lowers the melting point (of the aluminium oxide) so less energy is needed (to melt it)	allow lowers the temperature needed do **not** accept lowers boiling point accept so that the cell / equipment does not melt	1 1
5(b)(ii)	**2** O^{2-} on left hand side **4e**$^{-}$ on right hand side	accept correct multiples or fractions accept –**4e**$^{-}$ on left hand side	1 1
5(b)(iii)	because the electrode reacts with oxygen **or** because the electrode burns to form carbon dioxide **or** electrode made from carbon / graphite		1 1
Total			**8**

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Question 6

question	answers	extra information	mark
6(a)	because calcium is +2 and hydroxide is –1 **or** to make the compound neutral (in terms of charges)	accept to balance the charges allow calcium needs to lose 2 electrons and hydroxide needs to gain one electron	1
6(b)	particles of size 1-100 nm **or** particles with a few hundred atoms / ions **or** particles with a high surface area (to volume ratio) **or** as different properties to 'normal' size particles of the same substance	allow clear comparison to 'normal' size particles	1
6(c)	M_r CaO = 56 **and** M_r $Ca(OH)_2$= 74 2/56 (x74) **or** 0.036 (x74) **or** 74/56 (x2) **or** 1.3(214…) (x2) 2.6(428…) in range 2.6 to 2.96	 allow ecf from step 1 correct answer with or without working gains **3** marks allow ecf carried through from step 1 ignore final rounding to 3	1 1 1
Total			**5**

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Question 7

question	answers	extra information	mark
7(a)	**Graphite:**	it = graphite	
	because the layers (of carbon atoms) in graphite can move / slide		1
	this is because there are only weak intermolecular forces **or** weak forces between layers	accept Van der Waals' forces allow no covalent bonds between layers	1
	Diamond:		
	however, in diamond, each carbon atom is (strongly / covalently) bonded to 4 others	allow diamond has three dimensional / tetrahedral structure	1
	so no carbon / atoms able to move / slide	allow so no layers to slide **or** so diamond is rigid	1
7(b)	because graphite has delocalised electrons / sea of electrons	allow free / mobile / roaming electrons	1
	which can carry charge / current **or** move through the structure		1
	however, diamond has no delocalised electrons	accept however, diamond has all (outer) electrons used in bonding	1
Total			**7**

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