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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Additional Science 4463 / Chemistry 4421

CHY2H Unit 2 Chemistry

Mark Scheme

2009 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.

CHY2H

Question 1

question	answers	extra information	mark
1(a)(i)	a continuous straight line missing anomalous point	allow a line which does not start at zero / origin	1
1(a)(ii)	any **two** sensible errors eg • timing errors and / or example • measurement errors and / or example • apparatus errors and / or example • human / experimental / random error and / or example or 'did not do it right' • temperature fluctuation • anomalous point • results not recorded correctly • plotting error • rate calculated incorrectly	ignore systematic / zero error / weighing error **or** error unqualified could be two from **same** category eg two timing errors – watch not started at the same time plus difficulty in deciding when the cross has disappeared. accept outlier / wrong result ignore 'not repeated'	2
1(b)(i)	straight line **or** as concentration increases the rate goes up **or** converse	accept numerical example accept positive correlation accept same gradient ignore 'most points near / on line of best fit'	1

Question 1 continues on the next page…

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Question 1 Continued

question	answers	extra information	mark
1(b)(ii)	more collisions	accept greater chance of collisions accept collide more successfully accept alternative versions of collide eg 'bump / hit' ignore references to energy / speed of particles / surface area	1
	more particles (in each volume of solution)(i.e. an attempt at defining concentration)	accept 'particles are closer together' allow ions / atoms / molecules for particles ignore reactants accept greater frequency of collisions **or** greater number of collisions per second for **2** marks	1
Total			**6**

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Question 2

question	answers	extra information	mark
2(a)	hydrogen / H^+ /$2H^+$ / H_3O^+	allow H / 2H do **not** accept H_2 apply list principle	1
2(b)(i)	143	correct answer with or without working = **2** marks ignore units if answer is not correct 40 + (2 × 35.5) + (2 × 16) gains **1** mark	2
2(b)(ii)	49.7% (49.6 to 50)	correct answer with or without working = **2** marks answer 49 gains **1** mark if answer is not correct: (71 ÷ 143) × 100 gains **1** mark allow error carried forward from part (b)(i) ie. (71 or their (2 × 35.5) ÷ answer to (b)(i)) × 100 gains **2** marks if calculated correctly and **1** mark if not calculated correctly. **Special case** 35.5 ÷ 143 × 100 = 24.8 to 25% **or** 35.5 ÷ answer to (b)(i) x 100 correctly calculated for **1** mark	2
2(b)(iii)	9.9 to 10g	allow ecf from (b)(i) or (b)(ii)	1

Question 2 continues on the next page…

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Question 2 Continued

question	answers	extra information	mark
2(c)(i)	an alkali	apply list principle accept named alkali accept hydroxide accept soluble base ignore base	1
2(c)(ii)	a solid / insoluble substance (owtte)		1
2(c)(iii)	filter / filtration	allow decant / centrifuge accept filtration followed by evaporation **or** filtration and evaporation do **not** accept filtration or evaporation do **not** accept evaporation and filtration	1
Total			**9**

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Question 3

question	answers	extra information	mark
3(a)	to speed up the reaction **or** it is a catalyst	allow higher level answers such as to reduce the activation energy ignore cost or yield	1
3(b)(i)	reaction is exothermic	accept reverse reaction is endothermic **or** high temperature causes decomposition of ammonia ignore reference to rate	1
3(b)(ii)	more (gaseous) reactant molecules than (gaseous) product molecules	accept 4 volumes / moles of reactant and 2 volumes / moles of product accept lower volume of products **or** volume lower on right hand side accept 'favours the reaction which produces fewer molecules' ignore incorrect number of moles ignore reference to' amount' of product / reactant ignore reference to rate	1
3(c)	(rate is) too slow / slower owtte	allow catalyst would not work accept at higher temperature the rate is quicker accept at lower temperatures particles do not collide as often **or** fewer particles have the activation energy **or** particles do not have the activation energy ignore reaction would not work ignore optimum / compromise type answers	1

Question 3 continues on the next page…

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Question 3 Continued

question	answers	extra information	mark
3(d)	cooled	allow ammonia / it is turned into a liquid **or** is condensed ignore references to boiling point	1
3(e)	nitric (acid)	allow HNO_3 ignore hydrogen nitrate	1
Total			**6**

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Question 4

question	answers	extra information	mark
4	**five** ideas from the following for one mark each • each carbon / atom joined / bonded to three other carbon / atoms **or** each carbon forms 3 bonds • in layers • only weak forces (of attraction) / bonds between layers • layers / atoms can slide over each other • one electron on each carbon is not used for bonding • electrons delocalised **or** electrons free • electrons carry the charge / current • giant structure / lattice • covalent (bonds) • strong bonds **or** a lot of energy needed to break bonds	reference to ionic bonding = **max 4** diagrams could be used: • to show layered structure • to show that each carbon is bonded to three other carbon atoms • to show giant structure (at least 3 rings required) allow weak electrostatic / intermolecular forces /bonds between layers allow 'sea' of electrons	5
Total			**5**

CHY2F

Question 5

question	answers	extra information	mark
5(a)(i)	any **one** from: • they are positive / cations • they are H^+ • opposite charges attract	ignore atom	1
5(a)(ii)	potassium is more reactive (or reverse)	assume 'it' refers to hydrogen allow potassium reacts <u>with</u> water allow potassium is very reactive **or** most reactive metal / element allow hydrogen gains electrons more easily / is reduced more easily accept potassium is higher up the reactivity series	1
5(b)	6 **and** 2	accept correct multiples and fractions	1
5(c)(i)	the reaction / it is reversible **or** a description of a reversible reaction	allow 'it is an equilibrium' allow reversible symbol drawn correctly allow 'the reverse / back reaction'	1

Question 5 continues on the next page…

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Question 5 Continued

question	answers	extra information	mark
5(c)(ii)	**lithium nitride** assume that 'it' or if they do not specify means lithium nitride assume lithium / lithium nitrate refers to lithium nitride • hydrogen is bonded / held / absorbed / has formed a compound / reacted with lithium nitride plus **one** of: • does not explode / cause a fire • is not free / less hydrogen • is not under pressure • does not leak • is only released slowly • compound of hydrogen with lithium nitride / product is (more) stable / less reactive / less chance of a reaction	accept converse for hydrogen as below assume that gas / hydrogen means gas in the cylinder • hydrogen (in cylinder) / gas is not bonded / held / absorbed / in a compound / reacted with lithium nitride plus **one** of: • can explode / cause a fire • is free • is under pressure • can leak • releases quickly	1 1
5(d)(i)	smaller **or** correct indication of size **or** higher surface area	allow very / really small **or** tiny accept few (100) atoms in size allow 1 to 100 nanometres or 10^{-9} metres allow absorption and / or release of hydrogen more quickly allow have different <u>properties</u> allow 'more particles in each volume / area' do not allow reacts more quickly	1

Question 5 continues on the next page…

CHY2H

Question 5 Continued

question	answers	extra information	mark
5(d)(ii)	greater surface area		1
5(e)(i)	loss of an electron **or** loses electrons	do not accept any ref. to oxygen	1
5(e)(ii)	full outer shell of 8 electrons on circle	need not be paired can be ×, dot or e do **not** accept if extra electrons added to inner shell	1
Total			**10**

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Question 6

question	answers	extra information	mark
6(a)	C H O $\frac{0.60}{12}$ $\frac{0.15}{1}$ $\frac{0.40}{16}$ = 0.05 = 0.15 = 0.025 2 6 1 C_2H_6O	**1** mark for dividing the correct amount or multiples of correct amount by A_r **1** mark for proportions **1** mark for whole number ratio – accept any multiple **1** mark for correctly written simplest formula correct formula without working gets only **2** marks correct formula gains full marks provided steps 1 and 2 are correct. ecf can be allowed from step 2 to 3 **or** step 3 to 4 formula can be in any order eg OH_6C_2	1 1 1 1
6(b)	intermolecular forces / bonds are weak **or** forces between molecules **or** bonds between molecules (1) are weak (1)	(covalent) bonds are weak = 0 (attractive) forces are weak = 1 if no marks awarded, allow low boiling point **or** small M_r for **1** mark	1 1

Question 6 continues on the next page…

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Question 6 Continued

question	answers	extra information	mark
6(c)(i)	to check the safety of the perfume (owtte)	accept references to possible harmful / dangerous effects of perfume **or** possible reactions on skin eg to show it does not damage skin / cause cancer etc. allow to see what it smells like <u>on the skin</u> allow so the company do not have to test on animals	1

Question 6 continues on the next page…

CHY2H

Question 6 Continued

question	answers	extra information	mark
6(c)(ii)	any **two** from: idea from text **linked with** an explanation • the company claim to have tested the product: but we cannot be certain they have **or** how thorough they are **or** how accurately reported • companies did not disclose how they did their tests: so they could not be checked **or** so they could not be shown to be reliable / valid **or** so they could not be repeated • companies may not have repeated their tests: so they may not be reliable • companies do their own tests: so they may be biased **or** so they may not be truthful about their results **or** so they may not be reliable • the companies are using different tests: so the results cannot be compared **or** so results will be different **or** so results will not be fair / valid / reliable • companies would not give false information because of damage to reputation **or** it might lead to litigation	or converse eg companies should disclose how they did their tests so that results can be checked etc. or converse eg independent tests should be done so as to ensure there is no bias etc. or converse eg companies should do the same tests so that the results will be fair etc.	2
Total			**9**