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General Certificate of Secondary Education

Chemistry 4421

CHY3H Unit Chemistry 3

Mark Scheme

2010 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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Marking Guidance for Examiners

GCSE Science Papers

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)	contact with rocks (ions) dissolve / soluble / react	 allow water is a solvent ignore 'picks up' / 'gets into' / absorbed	1 1
1(b)	more calcium / Ca^{2+} and / or magnesium / Mg^{2+} (ions in Crete water)	accept 'a lot' of calcium / magnesium allow incorrectly charged Ca and Mg ions accept correct comparison using numbers from the table do **not** accept mention of other ions	1
1(c)	**two** from: • scum / calcium stearate / magnesium stearate • (scum) more soap used • scale / limescale / calcium carbonate / magnesium carbonate • (scale) less efficient heating systems / kettles / appliances • use of a water softener eg sodium carbonate / ion-exchange	if an effect and clarification are given, the clarification must be correct to gain both marks accept does not lather (easily) ignore costs more unqualified ignore fur ignore costs more unqualified ignore blocks pipes unqualified accept salt in dishwashers	2

Question 1 continues on the next page

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Question 1 continued

question	answers	extra information	mark
1(d)	any **one** from: • sodium carbonate / washing soda • ion-exchange • distillation	ignore filter / filtration allow soap accept de-ionised ignore boiling / heating / evaporation	1
Total			**6**

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Question 2

question	answers	extra information	mark
2(a)(i)	straight line through the 'points' and extended to C_8H_{18}	do **not** accept multiple lines	1
2(a)(ii)	5500	range 5400 *to* 5600 accept ecf from their graph	1
2(a)(iii)	it is a straight line graph	allow directly proportional accept constant difference between (energy) values accept C_5H_{12} close to values on the graph **or** C_5H_{12} comes in middle of the graph ignore 'fits the pattern' unqualified ignore 'line of best fit' ignore 'positive correlation'	1
2(a)(iv)	expected ranges for working are: (5400 to 5600) – (2800 to 2900) = (2500 to 2800) **or** their value from (a)(ii) – a value from 2800 to 2900 **or** (5400 to 5600) / their (a)(ii) divided by 2 **or** a value from 2800 to 2900 × 2 no / not quite / almost / yes	accept correct numerical answer as evidence of working this mark is only awarded on evidence from their correct working	1 1

2(b)(i)	Incorrect / no **or** partially correct bio-ethanol produces least energy **or** bio-ethanol produces 29 kJ	ignore references to hydrogen mark independently	1 1
2(b)(ii)	any **two** from: • hydrogen produces only H_2O • coal produces SO_2 • coal produces smoke • both renewable and non-renewable fuels produce CO_2 • (both) the non-renewable fuels produce CO_2 • (both) renewable fuels produce no smoke • (both) renewable fuels produce no SO_2	ignore incorrect / correct accept hydrogen does not produce harmful gases / CO_2 / SO_2 allow coal causes acid rain / respiratory problems allow coal causes global dimming accept bio-ethanol and natural gas / coal produce CO_2 / global warming accept coal and natural gas produce CO_2 / global warming accept hydrogen and bio-ethanol do not produce smoke / global dimming accept hydrogen and bio-ethanol do not produce SO_2 / acid rain	2
Total			**9**

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Question 3

question	answers	extra information	mark
3(a)(i)	UI / solution turns blue / purple	allow violet / lilac	1
	any **two** from:		2
	• floats		
	• melts / forms a sphere		
	• moves	note: moves on surface = **2** marks (points 1 and 3)	
	• effervescence / fizz / bubbles / gas	ignore the name of the gas	
	• (yellow) flame	ignore sparks / ignites / burns allow dissolves	
	• reduces in size	ignore 'reacts violently' unqualified	
		ignore reference to exothermic / heat evolved	
3(a)(ii)	**2**Na + **2**H_2O → **2NaOH** + H_2	correct equation = **2** marks allow correct multiples / fractions	2
		if this equation is unbalanced, allow **1** mark for NaOH	

Question 3 continues on the next page

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Question 3 continued

question	answers	extra information	mark
3(b)		it = francium	
		outer electron / shell / energy level must be mentioned once for all **3** marks	
	biggest atom **or (**outer) shell / energy level / electron furthest from nucleus **or** most (number of) shells		1
	least attraction (to nucleus) **or** most shielding	allow the attraction is very weak do **not** allow less magnetic / gravitational attraction	1
	(outer) electron more easily lost / taken	ignore francium reacts more easily / vigorously	1
3(c)	any **two** from:	ignore other properties / specific reactions they / it = transition elements	2
	transition elements: • high melting point **or** high boiling point • high density • strong / hard • not very reactive • catalysts • ions have different charges • coloured compounds	allow if state group 1 elements • low melting point **or** low boiling point • low density • weak / soft • reactive • not catalysts • +1 ions • white compounds	
Total			**10**

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Question 4

question	answers	extra information	mark
4(a)(i)	sodium hydroxide / NaOH (solution)	accept potassium hydroxide / KOH accept ammonia (solution) / $NH_3(aq)$ / NH_4OH do **not** accept limewater / calcium hydroxide incorrect reagent **or** no reagent = **0** marks	1
	(pale) <u>green</u> <u>precipitate</u> / <u>solid</u>	allow iron(II) hydroxide / $Fe(OH)_2$ (formed) allow OH^- / hydroxide solution gives a green precipitate for **1** mark	1
4(a)(ii)	(acidified) barium chloride / $BaCl_2$ **or** barium nitrate / $Ba(NO_3)_2$	do **not** accept sulphuric acid incorrect reagent **or** no reagent = **0** marks	1
	<u>white</u> <u>precipitate</u> / <u>solid</u>	allow barium sulfate / $BaSO_4$ (formed) allow a solution of barium ions / Ba^{2+} gives a white precipitate for **1** mark	1
4(b)(i)	carbonate (ions) give (white) ppt (with silver nitrate)	credit can not be obtained for incorrect reactions owtte	1
	(nitric) acid reacts with / removes / displaces carbonate (ions)	owtte	1

Question 4 continues on the next page

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Question 4 continued

question	answers	extra information	mark
4(b)(ii)	hydrochloric acid is a chloride / contains chloride (ions) / Cl^-	accept hydrochloric acid reacts with silver nitrate do **not** accept chlorine	1
Total			**7**

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Question 5

question	answers	extra information	mark
5(a)	in water: hydrogen ions / H^+ present when dry: HCl gas is covalent / molecular	 accept hydrogen still bonded to chloride / chlorine **or** HCl is not ionic	1 1
5(b)(i)	(KOH) has hydroxide ions / OH^- fully ionised / dissociated	 allow ions fully dissociate do **not** accept highly ionising ignore reference to concentration / pH	1 1
5(b)(ii)	equal concentrations / numbers / amounts of H^+ and OH^- ions **or** KCl: doesn't have any excess H^+ or OH^- ions	accept the acid / base has been neutralised **or** the reaction is a neutralisation accept H^+ react with / cancel out OH^- (to form water)	1
5(c)(i)	(base) is a <u>proton acceptor</u>	do **not** accept 'accepts hydrogen ions / H^+' ignore reference to OH^- ions	1
5(c)(ii)	B&L: building on established ideas **or** were reputable scientists owtte	Arrhenius was 'the first' / a student **or** his views not accepted by established scientific community owtte ignore references to technology / equipment	1
Total			**7**

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Question 6

question	answers	extra information	mark
6(a)	**either** chlorine is an element and sodium chloride is a compound the properties of elements are not transferred to their compounds **or** chlorine is Cl_2 / has molecules / covalent (1) sodium chloride is Na^+Cl^- / has ions / ionic (1)	owtte	1 1
6(b)	too much / large amounts / (very) high concentrations consumed	allow reference to risk of heart disease / high blood pressure	1
Total			**3**

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Question 7

question	answers	extra information	mark
7	$\frac{17.6}{44}$ (moles) **or** 0.4 (moles) CO_2		1
	$\frac{7.2}{18}$ (moles) **or** 0.4 (moles) H_2O		1
	empirical formula = CH_2	allow 1C:2H **or** correct simplest ratio related to elements **or** ecf from previous stage allow this mark for correct formula alone	1
Total			**3**