



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. Boldening

- 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 boldened. 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 <u>rocks</u>		1
	(ions) dissolve / soluble / react	allow water is a solvent ignore 'picks up' / 'gets into' / absorbed	1
1(b)	<u>more</u> 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 <u>comparison</u> using numbers from the table do not accept mention of other ions	1
1(c)	<p>two from:</p> <ul style="list-style-type: none"> scum / calcium stearate / magnesium stearate (scum) <u>more</u> 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 	<p>if an effect and clarification are given, the clarification must be correct to gain both marks</p> <p>accept does not lather (easily)</p> <p>ignore costs more unqualified</p> <p>ignore fur</p> <p>ignore costs more unqualified</p> <p>ignore blocks pipes unqualified</p> <p>accept salt in dishwashers</p>	2

Question 1 continues on the next page

CHY3H**Question 1 continued**

question	answers	extra information	mark
1(d)	any one from: <ul style="list-style-type: none">• sodium carbonate / washing soda• ion-exchange• distillation	ignore filter / filtration allow soap accept de-ionised ignore boiling / heating / evaporation	1
Total			6

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: <ul style="list-style-type: none"> • hydrogen produces <u>only</u> H₂O • coal produces SO₂ • coal produces smoke • both renewable <u>and</u> non-renewable fuels produce CO₂ • (both) the non-renewable fuels produce CO₂ • (both) renewable fuels produce no smoke • (both) renewable fuels produce no SO₂ 	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 <u>and</u> natural gas / coal produce CO ₂ / global warming accept coal <u>and</u> natural gas produce CO ₂ / global warming accept hydrogen <u>and</u> bio-ethanol do not produce smoke / global dimming accept hydrogen <u>and</u> 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 any two from: <ul style="list-style-type: none"> • floats • melts / forms a sphere • moves • effervescence / fizz / bubbles / gas • (yellow) flame • reduces in size 	allow violet / lilac note: moves on surface = 2 marks (points 1 and 3) ignore the name of the gas ignore sparks / ignites / burns allow dissolves ignore 'reacts violently' unqualified ignore reference to exothermic / heat evolved	1 2
3(a)(ii)	$2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$	correct equation = 2 marks allow correct multiples / fractions if this equation is unbalanced, allow 1 mark for NaOH	2

Question 3 continues on the next page

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Question 3 continued

question	answers	extra information	mark
3(b)	biggest atom or (outer) shell / energy level / electron furthest from nucleus or most (number of) shells	it = francium <u>outer</u> electron / shell / energy level must be mentioned once for all 3 marks	1
	least attraction (to nucleus) or most shielding	allow the attraction is <u>very</u> 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: transition elements: <ul style="list-style-type: none"> • high melting point or high boiling point • high density • strong / hard • not very reactive • catalysts • ions have different charges • coloured compounds 	ignore other properties / specific reactions they / it = transition elements allow if state group 1 elements <ul style="list-style-type: none"> • low melting point or low boiling point • low density • weak / soft • reactive • not catalysts • +1 ions • white compounds 	2
Total			10

CHY3H**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		1
	when dry: HCl gas is covalent / molecular	accept hydrogen still bonded to chloride / chlorine or HCl is not ionic	1
5(b)(i)	(KOH) has hydroxide ions / OH^-		1
	fully ionised / dissociated	allow ions fully dissociate do not accept highly ionising ignore reference to concentration / pH	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

CHY3H**Question 6**

question	answers	extra information	mark
6(a)	<p>either</p> <p>chlorine is an element and sodium chloride is a compound</p> <p>the properties of elements are not transferred to their compounds</p> <p>or</p> <p>chlorine is Cl₂ / has molecules / covalent (1)</p> <p>sodium chloride is Na⁺Cl⁻ / has ions / ionic (1)</p>	owtte	<p>1</p> <p>1</p>
6(b)	too much / large amounts / (very) high concentrations consumed	allow reference to risk of heart disease / high blood pressure	1
Total			3

CHY3H**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 ₂ O		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