



General Certificate of Secondary Education

Chemistry 4421

CHY3H Unit 3 Chemistry

Mark Scheme

2008 examination – January 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.

3.8 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

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Question 1

question	answers	extra information	mark
(a)	either: calculations: all correct (ethanol = 6, methanol = 3, peanut oil = 10, vegetable oil = 15) or implication of correct calculation (vegetable oil) gives largest temperature / heat increase <u>per gram</u> (owtte)	ignore repetition of data from table unqualified allow 'produced most heat in proportion to the fuel used' owtte for 1 mark	2
(b)	any one from: <ul style="list-style-type: none"> • smoke • soot • carbon • carbon monoxide • carbon dioxide • global warming / climate change / greenhouse gases • (air) pollution • harmful / poisonous scrub / wash the gases owtte	owtte ignore references to crops/food filter / remove (gases / fumes / appropriate named substance) owtte (add extra oxygen) can burn more efficiently owtte use a cleaner fuel owtte plant more trees or similar linked to CO ₂ any sensible answer 'don't burn so much fuel' insufficient alone ignore extractor fans / air conditioning	1 1

continued...

CHY3H**Question 1 continued...**

question	answers	extra information	mark
(c)(i)	A		1
(c)(ii)	B		1
total			6

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Question 2

question	answers	extra information	mark
(a)(i)	smooth curve through all points over full range finishing between 6.4 and 5.4 at 50°C		1
(a)(ii)	5.6 or from their graph		1
(a)(iii)	10 – 5.6 = 4.4	their reading at 15°C – their (a)(ii) answer from their figures	1 1
(a)(iv)	Yes: the value at 15°C because have values either side owtte or No: more error in a smaller number owtte	accept converse answers based on 50°C accept converse answers based on 50°C	1
(b)(i)	balanced view / involving people / debate / gather information / democracy	owtte any sensible answer ignore 'trout might die'	1
(b)(ii)	undue weight / bias may be given to high status and very experienced people or less experienced/lower status may reduce status of enquiry	owtte any sensible answer	1

continued...

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Question 2 continued...

question	answers	extra information	mark
(b)(iii)	(A) Management: any one from: <ul style="list-style-type: none"> • small amounts may be fine • can cope for short periods • could spread throughout the day • fish still getting (enough) oxygen • rate of photosynthesis could be increased to balance loss of oxygen • water will cool down (quickly) 	any sensible answer	1
	(B) Council: any one from: <ul style="list-style-type: none"> • any rise in temperature would reduce / affect (dissolved) oxygen • water will still be too hot • trout will die above 26°C 	any sensible answer	1
total			9

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Question 3

question	answers	extra information	mark
(a)	scale – (solid) formed when <u>heat</u> decomposes dissolved calcium / magnesium compounds owtte	allow: scale is formed when <u>hard</u> water is heated / boiled (to leave magnesium / calcium compounds)	1
	scale is calcium carbonate / CaCO_3 or magnesium carbonate / MgCO_3	ignore evaporate	
(a)	scum – (ppt) formed when soap reacts with calcium / magnesium (ions) owtte	allow scum is formed when <u>hard</u> water reacts with soap	1
	scum is calcium stearate / magnesium stearate		
(b)	calcium (ions) / Ca^{2+} / magnesium (ions) / Mg^{2+}		1
	replaced by hydrogen ions / H^+ / sodium ions / Na^+		1
total			4

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Question 4

question	answers	extra information	mark
(a)(i)	undiscovered elements owtte		1
(a)(ii)	they would be in the wrong group / have the wrong / different properties / don't fit the pattern owtte	allow atomic weights may have been wrong	1
(b)(i)	any three from: <ul style="list-style-type: none"> elements arranged in proton / atomic number order group: elements in the same group / column have same number of outer electrons owtte group: number of shells increase down group period: elements in the same period / row have the same number of shells / energy levels period: number of protons / electrons increase across period atomic number: link of atomic number to number of protons atomic number gives number of electrons 	ignore mass number / atomic weight / neutrons throughout	3
(b)(ii)	it would mean splitting a proton / electron or implication of splitting proton / electron		1

continued...

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Question 4 continued...

(c)	<p>(outer) electron closer (to nucleus)</p> <p>stronger/est attraction (to nucleus) owtte or less screening (by inner electrons)</p> <p>electron gained more easily</p>	<p>must be a comparison</p> <p>accept fewer (electron) shells / energy levels</p> <p>fluorine is the smaller/est</p> <p>do not allow magnetic / intermolecular forces</p> <p>need some indication of <u>outer</u> electron shell somewhere in explanation otherwise max of 2 marks</p>	<p>1</p> <p>1</p> <p>1</p>
total			9

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Question 5

question	answers	extra information	mark
(a)	NaOH in <u>burette</u>	must be description of a titration no titration = no marks do not accept biuret etc	1
	add NaOH until (indicator) changes colour	if specific colour change mentioned, must be correct – colourless to pink / red or ‘goes pink / red’ do not accept ‘clear’ for colourless	1
	note (burette) volume used or final reading	accept ‘work out the volume’	1
	one other point: eg repeat	accept: (white) tile or add dropwise / slowly or white background or swirling / mix or read meniscus at eye level or wash apparatus	1
(b)	0.054	for 2 marks (0.1×13.5)/25 for 1 mark	2
(c)	don’t know – insufficient evidence to decide or depends on whether acid level is considered safe or unsafe	owtte any sensible answer	1
	yes, safe – acid level low / weak acids / low compared with stomach acid	owtte any sensible answer	
	no, unsafe – acid level (too) high / other substances or bacteria may be present / insufficient evidence to decide	owtte any sensible answer	

continued...

CHY3H**Question 5 continued...**

question	answers	extra information	mark
(d)	(methyl orange) would have changed colour (well) before the end-point / pH7 / neutral	owtte	1
	weak acid present	weak acid-strong base (titration) allow methyl orange used for strong acid-weak base titration	1
total			9

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Question 6

question	answers	extra information	mark
(a)(i)	<p>Na₂CO₃: HCl → (odourless) gas (1) CO₂ / carbon dioxide (1)</p> <p>NaCl: AgNO₃ → white ppt (1) silver chloride (1)</p> <p>NaNO₃: Al + NaOH → pungent /sharp smell / choking gas (1) NH₃ / ammonia (1)</p> <p>Na₂SO₄: BaCl₂ → white ppt (1) barium sulfate (1)</p>	<p>each correct test and one result = 1 mark</p> <p>one other result for any test = 1 mark this mark can only be awarded <u>once</u></p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
(a)(ii)	<p>all would give a <u>yellow</u> / <u>yellow-orange</u> (flame) / <u>same</u> coloured (flame) / <u>same</u> results</p> <p>or</p> <p>they all contain <u>sodium</u> owtte</p>	allow <u>orange</u> (flame)	1
(b)	<p>any two from:</p> <ul style="list-style-type: none"> • fast / quick or comment about speed • small amounts • sensitive / accurate • ease of automation • sample not used up • reliable / efficient • can be left to run / continuous analysis 	<p>ignore cost</p> <p>ignore human error</p> <p>accept any valid answer</p> <p>accept operators do not need <u>chemical</u> skills</p> <p>ignore results can be saved</p>	2
total			8