

Chemistry A

General Certificate of Secondary Education

Unit **A322/02**: Modules C4, C5, C6 (Higher Tier)

Mark Scheme for January 2012

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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





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Annotations

Used in the detailed Mark Scheme:

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
not/reject	answers which are not worthy of credit
ignore	statements which are irrelevant - applies to neutral answers
allow/accept	answers that can be accepted
(words)	words which are not essential to gain credit
words	underlined words must be present in answer to score a mark
ecf	error carried forward
AW/owtte	alternative wording
ORA	or reverse argument

Available in scoris to annotate scripts

	indicate uncertainty or ambiguity
	benefit of doubt
	contradiction
	incorrect response
	error carried forward
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response

	no benefit of doubt
	reject
	correct response
	draw attention to particular part of candidate's response
	information omitted

Subject-specific Marking Instructions

- a. If a candidate alters his/her response, examiners should accept the alteration.
- b. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

Eg

For a one mark question, where ticks in boxes 3 and 4 are required for the mark:

Put ticks (✓) in the two correct boxes.

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

This would be worth 1 mark.

Put ticks (✓) in the two correct boxes.

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

This would be worth 0 marks.

Put ticks (✓) in the two correct boxes.

<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

This would be worth 1 mark.

c. The list principle:

If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, eg one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

d. Marking method for tick boxes:

Always check the additional guidance.

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.

If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, eg shading or crosses.

Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

Eg If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third should be blank (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	x	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	x		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

Question		Answer	Marks	Guidance
1	(a)	<p>the flames flash at different rates <input type="checkbox"/></p> <p>the flames are different colours <input checked="" type="checkbox"/></p> <p>sodium burns much faster than potassium <input type="checkbox"/></p> <p>the height of the flames is different in each test <input type="checkbox"/></p>	1	

Question		Answer	Marks	Guidance
1	(b)	<p>any four from:</p> <p>mixture contains same (three) lines as potassium / contains spectrum of potassium;</p> <p>does not contain the line/spectrum for sodium;</p> <p>extra <u>lines</u> in mixture spectrum / <u>lines</u> in mixture that are not in potassium or sodium spectrum;</p> <p><u>links</u> extra lines to another element in mixture;</p> <p>can identify unknown by comparison with spectra for other elements;</p> <p>each element has a characteristic/unique spectrum;</p> <p>reference to <u>position</u> of lines / idea of lines in the <u>same</u> place;</p>	4	<p>accept 'pattern' for 'lines' accept other similar words for lines eg bars / marks etc</p> <p>allow 'mixture contains same line/lines as potassium', but do not allow incorrect number of lines (should be three).</p> <p>ignore 'the results show potassium' / 'the results do not show sodium' etc. (same wording as question)</p> <p>ignore references to colour</p> <p>ignore 'spectrum shows another unknown element' (rewords the question) accept 'compound / atom / molecule' for 'element'</p> <p>ignore the numbers of extra lines</p> <p>need idea of spectrum, not just 'compare to unknown sample'</p> <p>ignore 'in similar places'</p>

Question		Answer	Marks	Guidance
1	(c)	lithium 2.8.1 19	2	if name is missing, allow correct symbol, Li i.e not Li ₂ / li / LI 3 correct = 2 marks 2/1 correct = 1 mark
Total			7	

2	(a)	(i)	<p>the surface bubbles and fizzes <input type="checkbox"/></p> <p>a flame appears <input type="checkbox"/></p> <p>the surface changes from shiny to dull <input checked="" type="checkbox"/></p> <p>the piece of lithium gets smaller <input type="checkbox"/></p>	1	
		(ii)	<p>Li₂O (1)</p> <p>CO₃²⁻ or CO₃⁻² (1)</p>	2	<p>formula must be close to that written, ie Li, not LI, or li. 2 must be subscripted or clearly smaller than Li. do not accept Li20 / Li²O do not accept LiO₂</p> <p>3 must be subscripted. 2- must be superscripted</p>
	(b)	(i)	hydrogen (1)	1	
		(ii)	lithium hydroxide (1)	1	accept LiOH (correct formula) ignore any other partially correct or incorrect formula

Question			Answer	Marks	Guidance	
2	(c)	(i)	both elements are in the same vertical column of the Periodic Table	✓		2 5 correct = 2 3/4 correct = 1 1/2 correct = 0
			they are both non-metal elements		✓	
			the boiling points and densities of both elements are the same		✓	
			an atom of caesium has the same number of protons as a lithium atom		✓	
			the atoms have the same number of electrons in the outer shell	✓		
		(ii)	the caesium reaction takes a much longer time	<input type="checkbox"/>	1	
a different gas is made in each reaction	<input type="checkbox"/>					
the caesium reaction is much faster	<input checked="" type="checkbox"/>					
the caesium reaction makes an acid	<input type="checkbox"/>					
a different compound is made in each reaction	<input checked="" type="checkbox"/>					
			Total	8		

Question		Answer	Marks	Guidance																								
3	(a)	metallic; ionic; covalent	2	all correct = 2 2/1 correct = 1																								
	(b)	<table border="1"> <thead> <tr> <th>statement</th> <th>ionic</th> <th>covalent</th> <th>both</th> </tr> </thead> <tbody> <tr> <td>... dissolved in water</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>...below room temperature</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>... between molecules</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>... electrons</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>... solids at room temperature</td> <td></td> <td></td> <td>✓</td> </tr> </tbody> </table>	statement	ionic	covalent	both	... dissolved in water	✓			...below room temperature		✓		... between molecules		✓		... electrons		✓		... solids at room temperature			✓	3	all 5 correct = 3 marks 4 correct = 2 marks 3 correct = 1 mark 2/ 1 correct = 0
statement	ionic	covalent	both																									
... dissolved in water	✓																											
...below room temperature		✓																										
... between molecules		✓																										
... electrons		✓																										
... solids at room temperature			✓																									
		Total	5																									

Question		Answer	Marks	Guidance
4	(a)	<p>Similarity: both contain carbon, hydrogen <u>and</u> oxygen (atoms);</p> <p>all bonds are covalent;</p> <p>maximum of three from: Difference: contain different numbers of carbon, hydrogen <u>and</u> oxygen;</p> <p>sugar contains more carbon / 6 carbons in sugar and 3 carbons in the amino acid;</p> <p>sugar contains more hydrogen / 12 hydrogens in sugar and 7 hydrogens in the amino acid ;</p> <p>sugar contains more oxygen / 6 oxygen in sugar and 2 in the amino acid;</p> <p>amino acid contains nitrogen and/or sulfur / more (different) elements ORA;</p> <p>amino acid is a smaller / lighter molecule / fewer (total) atoms ORA;</p> <p>sugar is a chain (molecule) / amino acid (molecule) is branched;</p>	4	<p>4 marks <u>must include</u> at least one similarity.</p> <p>ignore contain C, H and O (not enough)</p> <p>ignore 'molecular' bonding</p> <p>ignore 'more Cs' or 'more Hs' or 'more Os' if numbers are given, they must be correct. ignore C₆ / C⁶ etc.</p> <p>ignore 'sugar is straight / amino acid is round' or similar</p>
	(b)	C ₃ H ₇ O ₂ NS (1)	1	<p>elements may be in any order eg C₃H₇SO₂N etc do not accept lower case letters eg h or n</p>
Total			5	

Question			Answer	Marks	Guidance
6	(a)	(i)	sulfuric (acid) H ₂ SO ₄	1	both needed accept formula in a different order eg SO ₄ H ₂ etc. do not accept H ₂ SO ₄ / H ² SO ₄ ; numbers should be half way down the letters or lower.
		(ii)	hydrogen H ₂	1	both needed do not accept H ₂ / H ²
	(b)	(i)	experiment 5 (1)	1	
		(ii)	States a pattern to link concentration to rate: decreased concentration decreases rate of reaction / increased concentration increases rate of reaction; (1) Refers to volume or time in the table: lower volume of acid decreases rate / lower concentration of acid takes a longer time / lower volume of acid takes a longer time; ORA (1)	2	allow 'it is faster' / 'gas is made quicker' for increased rate allow 'it is slower' for decreased rate allow 'less acid' / 'more water' for lower volume of acid allow 'more acid' / 'less water' for higher volume of acid; allow 'takes longer' for a longer time ignore numbers quoted from table without any additional explanation
		(iii)	(acid) <u>particles</u> closer together / more <u>particles</u> per unit volume idea ORA(1) more frequent collisions / collide more often ORA(1)	2	allow ions / atoms / molecules for particles ignore 'more particles' alone ignore 'faster/'slower' collisions / 'takes longer to collide' ignore 'more collisions' alone ignore 'more successful collisions' allow 'more chance of collisions' / collisions are more likely do not allow second marking point if answer refers to particles having more or less energy or moving faster or moving more slowly

Question		Answer	Marks	Guidance
6	(c)	zinc carbonate zinc oxide zinc hydroxide	2	3 correct = 2 marks 2 correct = 1 1 correct = 0
Total			9	

7	(a)	(i)	1.0 and 12.0 / 1 and 12;	1	need both
		(ii)	35 / 35.0 (1)	1	
	(b)		<p>acid A is more concentrated than B <input checked="" type="checkbox"/></p> <p>some of..... solution <input type="checkbox"/></p> <p>the total volume acid B <input type="checkbox"/></p> <p>potassium chloride both titrations <input type="checkbox"/></p>	1	
	(c)		$\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$ / $\text{OH}^- + \text{H}^+ \rightarrow \text{H}_2\text{O}$ (1)	1	
Total			4		

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