

Chemistry A

General Certificate of Secondary Education

Unit **A172/01**: Modules C4, C5, C6 (Foundation Tier)

Mark Scheme for January 2013

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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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1. 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
<u>words</u>	underlined words must be present in answer to score a mark
ecf	error carried forward
AW/owtte	credit alternative wording / or words to that effect
ORA	or reverse argument

Available in scripts 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
	no benefit of doubt
	reject
	correct response

<input type="checkbox"/> L1 , <input type="checkbox"/> L2 , <input type="checkbox"/> L3	indicate level awarded for a question marked by level of response
<input type="checkbox"/> ^	information omitted

2. Subject-specific Marking Instructions

- a. Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).
- 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.

e.g. for a one-mark question where ticks in the third and fourth boxes are required for the mark:

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

This would be worth 1 mark.

This would be worth 0 marks.

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, e.g. 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-box questions:

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 and other markings. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses. Credit should be given according to the instructions given in the guidance column for the question. 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.

e.g. *if a question requires candidates to identify cities in England:*

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	NR

e. For answers marked by levels of response:

- i. **Read through the whole answer from start to finish**
- ii. **Decide the level that best fits the answer** – match the quality of the answer to the closest level descriptor
- iii. **To determine the mark within the level**, consider the following:

Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

- iv. Use the **L1, L2, L3** annotations in Scoris to show your decision; do not use ticks.

Quality of Written Communication skills assessed in 6-mark extended writing questions include:

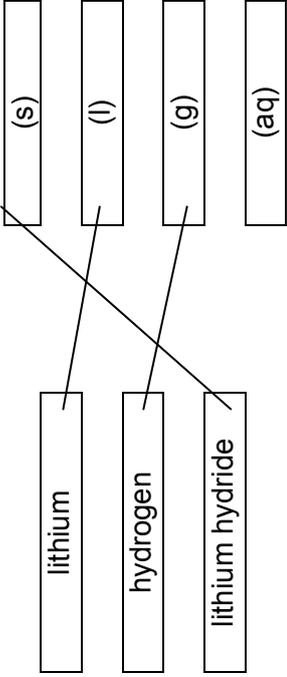
- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

Question		Answer	Marks	Guidance
1	(a)	heat/use a (Bunsen) flame (1) <i>Plus one from:</i> (mineral) on a wire / spill / spray etc; (1) use a small amount; (1) Look at the colour / compare the colour / see if it's blue(1)	2	
	(b)	(i) calcium would give a red flame; (1) sodium would give a yellow flame(1)	2	allow flame is not red or yellow for 2 marks allow flame would not be blue for 1 mark
		(ii) <i>any two from:</i> blue flame could mean caesium; (1) other metals give blue colour / copper gives blue colour; (1) some other colours difficult to see / difficult to tell green or purple from blue. (1)	2	allow caesium and copper would give the same colour for 1 mark
Total			6	

Question	Answer	Marks	Guidance
2 (a)	(boiling point for) bromine / -59; (1) bromine is a liquid / must have a boiling point above 20°C / above room temperature / should be higher than chlorine / boiling point should increase (down the group) / boiling point should be higher than the melting point (1)	2	<p>ignore 'it is too low' alone ignore 'it does not fit the pattern'</p> <p>If chlorine is given as answer.... For (1) mark max accept 'chlorine (or -35) because boiling points should increase (down the group)' / 'chlorine boiling point should be lower than bromine (or below -59)' /AW ignore 'chlorine boiling point should be lower' alone, needs a comparison</p>
(b)	Must give bromine as answer in (a) (+)59 / accept answers between 20 and 150°C	1	Must be a numerical value accept a numerical range if both values fall between 20 and 150°C
(c)	At ₂	1	do not accept at ₂ or AT ₂ do not accept At2. 2 must be smaller than letters or subscripted.
	Total	4	

Question	Answer	Marks	Guidance
3	<p>(a)</p> <p>Level 3 (5–6 marks) Comparisons are made for some similarities and differences for hydrogen and lithium. Both sides of argument are discussed. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) A comparison is made between a similarity and a difference for lithium and hydrogen. Quality of written communication impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Points are linked to one person's point of view, but not to both. Quality of written communication partially impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to C</p> <p>Relevant points include:</p> <p>Similarities (Fay)</p> <ul style="list-style-type: none"> • Both have 1 electron in the outer shell • Both form an ion with a single positive charge • Both react with chlorine • Both form a chloride with a similar formula <p>Differences (Guy)</p> <ul style="list-style-type: none"> • Hydrogen is a gas but lithium is a solid • Hydrogen is a non-metal and lithium is a metal • Hydrogen is flammable/pops when lit, whereas lithium only burns when heated strongly • Hydrogen does not react with water but lithium does <p>ignore other properties mentioned that are not given in the table.</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>

Question	Answer	Marks	Guidance
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Question	Answer	Marks	Guidance								
3 (b) (i)	<p>chemical</p> <p>lithium <input type="text"/></p> <p>hydrogen <input type="text"/></p> <p>lithium hydride <input type="text"/></p> <p>state symbol</p> <p><input type="text"/> (s)</p> <p><input type="text"/> (l)</p> <p><input type="text"/> (g)</p> <p><input type="text"/> (aq)</p> 	2	all correct = 2 marks 1 / 2 correct = 1 mark								
(ii)	<table border="1" data-bbox="671 1111 815 1877"> <tr> <td>It has a very low melting point</td> <td><input type="checkbox"/></td> </tr> <tr> <td>It is insoluble in water</td> <td><input type="checkbox"/></td> </tr> <tr> <td>The solid does not conduct electricity</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>The solid is made of crystals</td> <td><input checked="" type="checkbox"/></td> </tr> </table>	It has a very low melting point	<input type="checkbox"/>	It is insoluble in water	<input type="checkbox"/>	The solid does not conduct electricity	<input checked="" type="checkbox"/>	The solid is made of crystals	<input checked="" type="checkbox"/>	2	
It has a very low melting point	<input type="checkbox"/>										
It is insoluble in water	<input type="checkbox"/>										
The solid does not conduct electricity	<input checked="" type="checkbox"/>										
The solid is made of crystals	<input checked="" type="checkbox"/>										
	Total	10									

Question	Answer	Marks	Guidance
4	<p>Level 3 (5–6 marks) Links a <u>similar</u> and a <u>different</u> property to both structures. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Links a property to the structure for diamond <u>or</u> graphite. Quality of written communication partially impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Compares properties and/or makes points about structures. Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to C</p> <p>Relevant points include:</p> <p>Properties (look for comparison)</p> <ul style="list-style-type: none"> • both have high/similar melting points • both have high/similar boiling points • both are insoluble in water • graphite conducts but diamond does not • diamond is <u>harder</u> (than graphite) (needs comparison) • Graphite flakes/marks paper <u>and</u> diamond does not (needs comparison) • Appearance of diamond and graphite is different <p>Structures</p> <ul style="list-style-type: none"> • Both have strong bonds • Both have covalent bonds • Both have giant structure / lattice structure / lots of bonds / macromolecule • Both contain carbon atoms • graphite has layers • diamond has four bonds / tetrahedral • graphite has three bonds • graphite has delocalised electrons (accept 'free' electrons) • graphite has weak bonds/ intermolecular forces <u>between layers</u> • graphite has rings / hexagonal structure <p>Similar properties linked to structure</p> <ul style="list-style-type: none"> • (both) high melting / boiling point because strong bonds / giant structure • (both) insoluble because covalently bonded <p>Different properties linked to structure</p> <ul style="list-style-type: none"> • (diamond) hard because strong bonds/ each atom bonded to 4 others and (graphite) Soft/flakes because of layers / weak bonds <u>between layers</u> • (diamond) does not conduct because electrons cannot move and (graphite) conducts because electrons move/are 'free'/delocalised <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	6	

Question	Answer	Marks	Guidance
5 (a) (i)	$12 \div 200$ (1) $= 0.06$ g (1)	2	correct answer scores (2)
(ii)	60 g	1	allow ecf (answer to (i) x 1000)
(iii)	Ore 2; (1) It contains the most copper <u>per gram/ kg</u> of ore; (1)	2	allow ecf from (a) (ii) If ecf and over 75g then answer must be ore 3
(b) (i)	<i>Any three from:</i> copper can be sold for a high price; (1) needed for electrical goods; (1) produces sulfur dioxide; (1) causes acid rain (1)	3	ignore references to equipment in chimneys here
(ii)	use ores that don't contain sulfur; put equipment in chimneys/trap sulphur dioxide	1	
(iii)	CuS and Cu ₂ S	1	
	Total	10	

Question	Answer	Marks	Guidance
6 (a)	<p>Most of the atmosphere on Mars is nitrogen. The gases on Mars are all found on Earth. All of the gases are elements There is more argon than oxygen on Mars. The percentage of oxygen on Mars is the same as on Earth.</p>	2	
(b)	<p>The diagram shows three boxes labeled 'nitrogen', 'argon', and 'oxygen'. Lines connect these boxes to a set of chemical formula boxes: NO₂, N₂, Ar, Ar₂, O, and O₂. Specifically, 'nitrogen' points to N₂, 'argon' points to Ar, and 'oxygen' points to O₂.</p>	2	all correct = 2 marks 2 / 1 correct = 1 mark
	Total	4	

Question	Answer	Marks	Guidance
7 (a)	calcium carbonate; (1) water (1) CO ₂ (1)	3	
(b)	<p>Level 3 (5–6 marks) Describes a logical sequence for the experiment which includes some details of fair testing, a quantity used and links this to Alex's prediction. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Identifies aspects of a method/fair test and a quantity used. Quality of written communication partially impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Identifies an aspect of a method/fair test or a quantity used. Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to E</p> <p>Indicative scientific points include:</p> <p>Quantities used</p> <ul style="list-style-type: none"> • 25cm³ of acid • 5g of calcium carbonate • Collect 20 cm³ gas <p>Method/fair test</p> <ul style="list-style-type: none"> • Larger lumps are used • same volume / amount of acid • same mass / amount of calcium carbonate • Same temperature (of acid) • Same concentration of acid • Same volume of gas collected • Repeat to identify outliers/ check reliability • Measurement of time (to collect gas) <p>How he will know the prediction is right</p> <ul style="list-style-type: none"> • It would take more time for larger chips OWTTE • Same volume of gas collected in a longer time <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>

Question	Answer	Marks	Guidance										
7 (c)	<table border="1"> <tr><td>use a more concentrated acid</td><td></td></tr> <tr><td>use a catalyst</td><td></td></tr> <tr><td>shake the flask</td><td></td></tr> <tr><td>use a lower temperature</td><td>✓</td></tr> <tr><td>add water to the acid</td><td>✓</td></tr> </table>	use a more concentrated acid		use a catalyst		shake the flask		use a lower temperature	✓	add water to the acid	✓	2	
use a more concentrated acid													
use a catalyst													
shake the flask													
use a lower temperature	✓												
add water to the acid	✓												
	Total	11											
8 (a)	<table border="1"> <tr><td>The first result is usually lower than the others.</td><td></td></tr> <tr><td>The first titration is done without an indicator.</td><td></td></tr> <tr><td>The students do not follow the method carefully the first time.</td><td></td></tr> <tr><td>The first result is used to give a rough idea of the volume needed.</td><td>✓</td></tr> </table>	The first result is usually lower than the others.		The first titration is done without an indicator.		The students do not follow the method carefully the first time.		The first result is used to give a rough idea of the volume needed.	✓	1			
The first result is usually lower than the others.													
The first titration is done without an indicator.													
The students do not follow the method carefully the first time.													
The first result is used to give a rough idea of the volume needed.	✓												
(b)	<p>Any 3 from: (Dee's result) is too low / lower than the others;</p> <p>Amy (going past the end point would make) volume of sodium hydroxide higher / volume would be 'too high';</p> <p>Ben (If the vinegar was more concentrated) more sodium hydroxide would be needed/ volume would be 'too high' / all from the same bottle/ same concentration;</p> <p>Carl Must have measured out <u>too little</u> vinegar at the start / AW;</p>	3	<p>no marks for 'Carl' alone all marks are for explanations Maximum 2 marks can be scored if Carl is not given as answer</p> <p>ignore 'Dee's result is very different / it is an outlier'</p> <p>ignore 'made mistakes when she measured the volume'</p>										

Question		Answer	Marks	Guidance
8	(c)	Neutralisation	1	
		Total	5	
9	(a)	15 g	1	
	(b)	(i) 5.5 g	1	
		(ii) shows 5.5 anywhere in calculation (1) 55% (1)	2	Correct answer with no working = 2 marks allow ecf from (b)(i)
		Total	4	

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