OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry A

General Certificate of Secondary Education

Unit **A172/02**: Modules C4, C5, C6 (Higher Tier)

Mark Scheme for June 2013

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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	credit alternative wording / or words to that effect
ORA	or reverse argument

Available in scoris to annotate scripts:

	correct response
	incorrect response
BOD	benefit of doubt
NBOD	no benefit of doubt
ECF	error carried forward
0 , L1 , L2 , L3	indicate level awarded for a question marked by level of response

Λ	information omitted
CON	contradiction
R	reject
?	indicate uncertainty or ambiguity
⬭	draw attention to particular part of candidate's response

ADDITIONAL OBJECTS: You **must** assess and annotate the additional objects for each script you mark. Where credit is awarded, appropriate annotation must be used. If no credit is to be awarded for the additional object, please use annotation as agreed at the SSU.

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:

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 <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	**2**	**2**	**1**	**1**	**1**	**1**	**0**	**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)		$H_2 + F_2 \rightarrow 2HF$ correct formulae (1) correct equation balanced (1)	2	**Do not allow** h_2 h^2 H^2 F^2 **Allow one mark** for balancing if formulae of hydrogen and/or fluorine contain minor errors e.g. h_2 h^2 H^2 F^2
	(b)	(i)	HCl(g) → H^+ (aq) + Cl^- (aq)	1	
		(ii)	one of ions made is a hydrogen ion	1	
	(c)		hydrogen iodide (1) HI (1)	2	**Do not allow** hydrogen iodine **Accept** 2HI
	(d)	(i)	become less reactive (down the group)	1	
		(ii)	less reactive than chlorine / reacts more slowly than chlorine (1) more reactive than iodine / reacts faster than iodine (1)	2	Chlorine or iodine must be mentioned. **Ignore** repeated observations from the table. **Ignore** 'because the reactivity decreases down the group'. **If 2 marks are not scored. Allow (1)** for idea of fitting between chlorine and iodine;
			Total	**9**	

Question			Answer	Marks	Guidance
2	(a)		sodium hydroxide (1) hydrogen (1)	2	Either order **Allow** correct formula(NaOH and H_2)
	(b)		add UI or pH paper/solution (1) goes blue/purple / check the colours against a reference idea / gives pH above 7 (1) **OR** pH probe(1) gives pH above 7 (1)	2	If no correct indicator is given, accept Litmus (goes blue) for 1 mark only
	(c)		the two reactions have different rates the two reactions make different alkalis	1	Both needed
			Total	**5**	

Question			Answer	Marks	Guidance
3	(a)		**Level 3 (5–6 marks)** Explains points linked to support and a point linked to lack of support for Alex's idea OR a point linked to support and points linked to lack of support for Alex's idea. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Identifies a point linked to support AND a point linked to lack of support for Alex's idea. Points may be identified by person's name only. Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** Identifies a point linked to support or lack of support for Alex's idea. Points may be identified by person's name only. Links may not be emphatically stated. Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to C** **Indicative scientific points may include:** **Points that support Alex's Ideas** • K and Rb give purple flames (Bea) / two people have got the same colours for K and Rb (Alex and Bea) • Cs also gives a purple flame (Bea) / Cs is also in Group 1 • Group 2 elements don't give purple flames (Carl) • No other elements except group 1 have purple flames (Elly) • Bea/Elly/(partly) Carl support Alex's ideas (insufficient at level 3) **Points that do not support Alex's ideas** • Na gives a yellow flame/not a purple flame/ Na is in group 1 (Dan) • Li does not give a purple flame (Fay)/ Li is in group 1 • Elements in Group 2 all have different coloured flames (Carl) • Fay/Dan/(partly) Carl do not support Alex (insufficient at level 3) **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer	Marks	Guidance
3	(b)		**Any 2 from:** (Peer review involves…) scientists; checking data / checking results ; checking or repeating methods/experiments/tests ; evaluation of the work / judgment of the work / assessment of the work / checking claims made ; publication/post publication	2	**Allow** reverse argument **Look for idea** of repeating/checking /judging Alex's work **Ignore** answers which refer to looking at 'each other's' work **Ignore** answers which imply checking information from internet or other secondary sources. **Ignore** 'see if they are right' / 'see if they agree' alone
			Total	**8**	

Question			Answer	Marks	Guidance
4	(a)		**Any 4 from:** Links hardness to concentration of calcium ions e.g. the harder the water the higher the concentration of calcium ions / harder water contains more calcium ions ; Joe's town has the hardest water (clear statement) ; Plymouth has the softest water (clear statement) ; Joe's town water is 'very hard' ; Plymouth water is 'soft' ; London water is 'hard'	4	**Look for** clear not implied described trend of higher concentration/more calcium ions harder water. **Ignore** 'Joe's town contains the most calcium ions' alone. Needs to be linked to hardness. Must use specific terms from first table i.e. 'very hard', 'soft' 'hard'
	(b)	(i)	to keep the solid dry (1) to make sure that the mass reading is accurate (1)	2	
		(ii)	correct answer = 0.4 g/dm^3 (2) *If answer is not fully correct allow (1) mark for:* converts volume to dm^3 (50 ÷ 1000) (=0.05 dm^3) OR gives answer 0.0004 g/dm^3	2	
		(iii)	400	1	**Allow** ECF answer to (ii) x 1000
		(iv)	the water contained ions other than calcium	1	
			Total	**10**	

Question			Answer	Marks	Guidance
5	(a)		**Level 3 (5–6 marks)** Makes statements about a similarity and a difference and links both properties to structure or bonding. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Makes one clear link between a property and structure or bonding for a compound OR makes statements about a similarity and a difference in properties and makes a correct statement about structure or bonding (not necessarily clearly linked to a property). Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** Makes statements about a similarity and a difference in properties OR makes a correct statement about structure or bonding for a compound. Answer may only contain information given in the table. Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to A*** **Indicative scientific points may include:** **Similarities and differences in properties.** • both have similar formulae / two oxygen atoms • neither conduct electricity. • carbon dioxide has a low MPT / BPT and silicon dioxide has a high MPT / BPT • carbon dioxide has a lowER MPT/BPT / less heat or energy to melt/boil ora • carbon dioxide is a gas and silicon dioxide is a solid **Ignore** 'MPT and/or BPT are different' **Structure and bonding** • bonding (in both) is covalent / no electrons or ions available to conduct electricity • carbon dioxide has a simple structure / carbon dioxide molecule contains a small number of atoms / is a small molecule • silicon dioxide has a giant structure / structure of silicon dioxide contains many atoms bonded together / 3D / lattice • (all) atoms in silicon dioxide held together by strong bonds / bonds require large amounts of energy/heat to break • weak forces between molecules in carbon dioxide / forces do not require large amounts of energy/heat to break • carbon dioxide has double bonds • silicon dioxide had only single bonds • each silicon atom is bonded to four oxygen atoms in silicon dioxide / is a tetrahedral structure • each carbon atom is bonded to two oxygen atoms in carbon dioxide **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	(b)		carbon dioxide is found in the atmosphere, silicon dioxide is found in the lithosphere	1	
			Total	**7**	

Question			Answer	Marks	Guidance
6	(a)		positively charged metal ions	1	
	(b)		Al^{3+} / Al^{+3} $2(O^{2-})$ 4e / $4e^{-}$	2	all correct = 2 1/2 correct = 1
	(c)		**any 3 from:** idea that in the metal/Al conduction due to <u>electrons</u> ; idea that in molten Al_2O_3 conduction due to <u>ions</u> ; <u>both</u> ions and electrons move ; idea that ionic compounds are broken down when they conduct / changes happen at the electrodes / chemical change / oxygen is made / metals are not changed when they conduct	3	**Allow** alternative wording for 'move'.
			Total	**6**	

Question			Answer	Marks	Guidance
7	(a)		copper oxide (1) copper carbonate (1)	2	
	(b)		$CuCl_2$ SO_4^{2-} / SO_4^{-2} OH^- / OH^{-1} / allow $2OH^-$	2	**Ignore** the use of brackets all correct (2) 1 or 2 correct (1)
	(c)		Correct answer = 12 g (2) *If answer is not fully correct allow (1) mark for* relative formula mass(RFM)=120 OR incorrect RFM ÷10	2	 Check equation for RFM written with $MgSO_4$
			Total	**6**	

Question			Answer	Marks	Guidance
8	(a)		**Level 3 (5–6 marks)** Links all three diagrams to correct energy changes and correctly predicts direction and/or relative size of temperature changes. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Links all three diagrams to correct energy changes or direction of temperature change. Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** Links at least one diagram to a correct energy change or to a correct direction of temperature change. Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to A** **Indicative scientific points may include:** **Energy changes** (during dissolving) • lithium chloride gives out energy/gives out heat/is exothermic • sodium chloride and potassium chloride both take in energy/take in heat/are endothermic **Ignore** 'energy goes down' / 'energy goes up' **Temperature change** • when lithium chloride dissolves temperature increases • when sodium chloride and potassium chloride dissolve temperature decreases • the temperature decrease/change is greater for potassium chloride than for sodium chloride. • the value of the temperature change is greatest when lithium chloride dissolves. **Level 3:** If direction of temperature change is given, it must be correct to allow L3. **Ignore** discussion of rate of dissolving **Ignore** references to bond making/breaking even if incorrect **Allow Level 1** (1-2 marks) for Error Carried Forward if all energy changes are given the wrong way round but then correctly linked to temperature changes. **Ignore** incorrect use of terms 'endothermic' and 'exothermic' when marking science but consider quality of written communication impeded (award lower mark of the level). **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer	Marks	Guidance
8	(b)		input variable – compound output variable – temperature	1	
	(c)		energy changes in reactions affect the rate (1) containers for reactions may be damaged by extreme temperatures (1)	2	
			Total	**9**	

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