OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry A

General Certificate of Secondary Education

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

Mark Scheme for June 2012

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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.

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

Available in scoris to annotate scripts:

	indicate uncertainty or ambiguity
BOD	benefit of doubt
CON	contradiction
	incorrect response
ECF	error carried forward
	draw attention to particular part of candidate's response
NBOD	no benefit of doubt
R	reject
	correct response
	draw attention to particular part of candidate's response
^	information omitted

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 <u>and</u> 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.

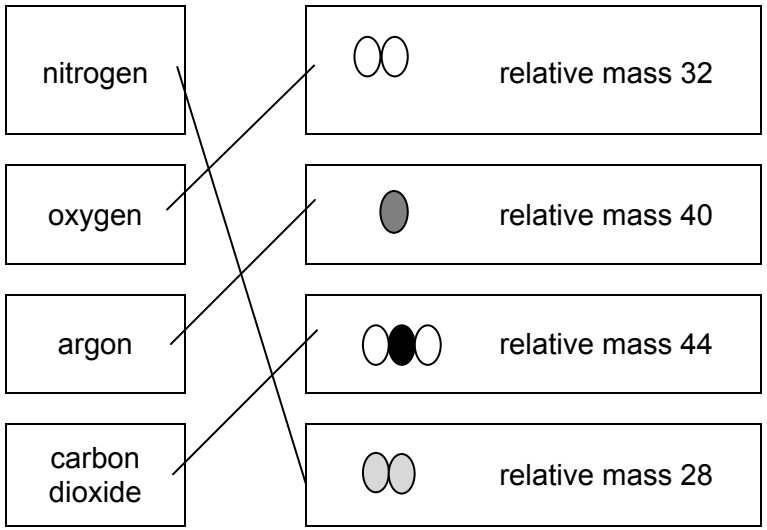
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>
<table>
<tr><th></th><th>true (✓)</th><th>false (✓)</th></tr>
<tr><td>Rubidium is more reactive than sodium.</td><td>✓</td><td></td></tr>
<tr><td>Rubidium is a non-metal.</td><td></td><td>✓</td></tr>
<tr><td>Rubidium has a lower proton number than lithium.</td><td></td><td>✓</td></tr>
<tr><td>Rubidium reacts with water to make hydrogen gas.</td><td>✓</td><td></td></tr>
</table>
</td><td>2</td><td>all correct = 2
2/3 correct = 1
1 correct = 0</td></tr>
<tr><td></td><td>(b)</td><td></td><td>RbOH</td><td>1</td><td>do not accept RBOH or R_BOH
O must be at least half height of H</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>3</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
2	(a)		**[Level 3]** Makes points about different properties of Gp1 and Gp 7 and identifies L3 points that do not support Mendeleev. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Makes points about <u>different</u> properties for Gp1 and Gp 7. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes points about the same property for Gp 1 and Gp 7 OR makes points about different properties for one group. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to C** **Indicative scientific points may include:** **Points about Gp 1** Group 1 / Li, Na, K….. • are all shiny / solids / similar appearance • all conduct electricity • MPts/BPts show a trend in Gp 1 / MPts/BPts decrease down Gp 1 / MPts/BPts for Gp 1 are generally high(er) / BPts have a large(r) range / (**ignore** references to MPt range) **Points about Gp 7** Group 7 / Cl, Br, I….. • do not conduct electricity • all coloured • states/colours/appearance of Gp 7 are different • MPts/BPts show a trend in Gp 7 / MPts/BPts increase down Gp 7 / MPts/BPts for Gp 7 are generally low(er)/ BPts have a small(er) range / (**ignore** references to MPt range) **L3 points that do not support Mendeleev** • iodine's MPt is …. high for Gp 7/higher than Na/K/ high compared to Gp 1/similar to Gp 1 / links iodine is a solid to Gp1 • Li has an unusually high BPt for Gp 1 **ignore** discussion of any properties not from the table e.g. atomic structure / reactivity (at rtp) **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer	Marks	Guidance
	(b)		both have one electron in the outer shell / same number of electrons in the outer shell; different number of shells of electrons / Na has 3 shells and K has 4 shells / Na has two full shells and K has 3 full shells;	2	**ignore** 'they both have 2 full shells' 'they both have 2 electrons in the first shell / 8 in the second' **ignore** references to the size of the atom / distance of outer electrons from nucleus / ease of losing electron / Na has 11 electrons and K has 19 **do not allow** 'Na has *more* shells than K / K has *fewer* shells than Na' **allow** Na is 2.8.1 and K is 2.8.8.1 **for (2) marks**
			Total	**8**	

Question			Answer	Mark	Guidance
3	(a)	(i)	**B** and **E**	1	both needed
		(ii)	**A** and **C**	1	both needed
		(iii)	**D**	1	
	(b)		+1 / 1+ / +	1	**ignore** '1' alone with no charge **ignore** positive **allow** C^+ or Li^+ but no other letter
			Total	**4**	

Question			Answer	Mark	Guidance
4	(a)		tarnish/goes dull/white/grey/darker/lighter / loses its shine; reacts; reference to oxygen/water/moisture/making sodium oxide;	3	**ignore** 'goes rusty' **allow** 'it corrodes' for MP1 **allow (2)** for 'oxidises' / 'oxidation' for MP2 and MP3 **ignore** 'oxidisation' 'reacts with air' = (1) for MP2 **ignore** references to CO_2
	(b)		$2Na + Cl_2 \rightarrow 2NaCl$ / $Na + \frac{1}{2}Cl_2 \rightarrow NaCl$	2	all three formulae correct (1) correct formulae and correct balancing (2) **ignore** state symbols
			Total	**5**	

Question			Answer	Mark	Guidance
5	(a)			2	all correct = 2 2/3 correct = 1 1 correct = 0
	(b)		All the gases in the air are elements. ☐ Air contains only non-metal elements. ✓ There are weak attractions between molecules in air. ✓ All the gases have high melting points and boiling points. ☐ The gases are good conductors of electricity. ☐	2	

Question			Answer	Mark	Guidance
	(c)		A covalent bond is made by sharing electrons. ✓ The atoms gain positive or negative charges when the bond is made. ☐ The atoms are held together by the attraction between the nuclei of the atoms and the electrons between them. ✓ Each atom is surrounded by a sea of electrons that can move. ☐ The atoms are bonded covalently into large, three dimensional structures. ☐	2	
			Total	**6**	

Question	Answer	Mark	Guidance
6	**[Level 3]** Identifies all three ions present and links these to the correct test result. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Identifies some ions present in solution (with no incorrect ions) and EITHER links each ion to the correct test result OR identifies a test not carried out. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** States presence or absence of some ions in the solution but may have additional incorrect ions stated. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A*** **Indicative scientific points may include:** **Presence or absence of ions in the solution** • contains zinc (ions) • contains sulphate (ions) • contains chloride (ions) • does not contain calcium (ions) **allow** other ions not present e.g. carbonate, copper, iron **allow** ions if given in compounds e.g. 'contains calcium chloride' would be correct for 'contains chloride ions' but incorrect for 'no calcium ions' **Tests not carried out** • Zak had not tested for a sulfate / had not added (acidified) barium chloride/barium nitrate • Amy had not added enough/excess sodium hydroxide / did not test for zinc **Test Result** • (acidified) barium chloride/barium nitrate gives a white precipitate with a sulfate • sodium hydroxide gives a white precipitate with a zinc ion • sodium hydroxide added to excess redissolves for a zinc ion • sodium hydroxide gives a white precipitate with a calcium ion • silver nitrate gives a white precipitate with a chloride **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
		6	

Question			Answer	Mark	Guidance
7	(a)		relative formula mass PbO = 223 (1) answer = 414 = (2)	3	**ignore** units if given if 414 is not given as final answer, **allow (1)** for 207 used in second part of answer
	(b)	(i)	disadvantages: eyesore (from waste rock) / noise / traffic / possible toxicity / dust / subsidence; advantages: work / jobs / improved transport links / more facilities available;	2	**ignore** wildlife/habitat/environment/pollution/danger/hazard ideas
		(ii)	idea that it cannot be made completely safe / benefits outweigh risks; need lead for building materials / people need the jobs / boosts local economy;	2	**allow** other correct uses
			Total	**7**	

Question			Answer	Mark	Guidance
8	(a)		hydrochloric acid; water and H_2O;	2	**ignore** hydrogen chloride **do not allow** H^2O / H2O O must be at least half the height of H
	(b)		copper oxide <u>and</u> copper hydroxide;	1	need both
	(c)	(i)	*any two from:* starts low / gives pH 1-3; (1) increases; (1) goes to 7; (1) <u>acid</u> used up; (1)	2	 **ignore** references to colours **ignore** the pH is neutralised / the pH goes to neutral **ignore** 'acid is neutralised'
		(ii)	pH meter ✓ universal indicator ✓	1	need both 0 marks if more than two boxes are ticked
			Total	**6**	

Question			Answer	Mark	Guidance
9	(a)		**[Level 3]** Gives a logical sequence of method which leads to an endpoint and includes reference to some fine detail. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Gives a logical sequence of several points to give a method which leads to an endpoint. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes several points about the method used. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A*** **Indicative scientific points may include:** **Method** • use a burette • acid goes into the burette • add indicator to flask/potassium hydroxide / use a pH meter (**allow** idea of thermometric methods) • add acid to potassium hydroxide • add acid dropwise/slowly (near the end) / swirl • take a reading **Endpoint** • stop when colour (of indicator) changes / **allow** example of colour change (**allow** 'goes colourless' but **ignore** 'goes clear' **ignore** 'until neutral' if an indicator is used) • stop when pH meter shows solution shows neutral or sudden pH change • (for thermometric) stop when highest temperature reached **Fine detail** • pipette the KOH • repeat titrations • idea of ignoring the rough • calculation of averages • use a white tile • read from the meniscus • washing conical flask with water / burette rinsed with acid / pipette rinsed with potassium hydroxide consider the use of **universal/'pH'** indicator OR if adding an indicator is implied (e.g. by reference to colour change) but not clearly stated as impeding communication at level 2 and 3 **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer	Mark	Guidance
	(b)	(i)	5 g	1	
		(ii)	shows 3.5 in calculation; correct answer 70%	2	[answer (b) (i) shown for reference, correct answer 5g] 70 % gains both marks **allow** ecf from part **(b)(i)** for **both marks** if 4.05, 9, 10 or 45 are given as incorrect answer in (b) (i) 4.05 gives 86% / 86.4% 9 gives 39%/ 38.9% 10 gives 35% 45 gives 8% / 7.8% if 0.05 is given as answer in (b) (i), only MP1 for 3.5 can score **allow** 90 % for (1) (from 4.5 used in calculation)
	(c)	(i)	concentration (of the acid)	1	**ignore** references to 'dilution' / pH / acid strength **do not allow** 'concentration of potassium hydroxide'
		(ii)	it will be the same / no effect / no change; (no change because) he is using the same amount of potassium hydroxide / potassium hydroxide is the limiting factor / only changes the rate idea;	2	**accept** 'nothing' **ignore** 'only the acid concentration changes'
	(d)	(i)	40; 60;	2	**allow** 40.0 60.2
		(ii)	$H^+ + OH^- \rightarrow H_2O$	1	**ignore** state symbols (i.e. (aq) or (l) written after each formulae)
			Total	**15**	

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