OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry A

General Certificate of Secondary Education

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

Mark Scheme for June 2011

Oxford Cambridge and RSA Examinations

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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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<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>2 and 2</td><td>1</td><td>both needed</td></tr>
<tr><td></td><td>b</td><td></td><td>
<table>
<tr><th></th><th>true</th><th>false</th></tr>
<tr><td>each chlorine atom gains seven electrons</td><td></td><td>✓</td></tr>
<tr><td>each chloride ion has a positive charge</td><td></td><td>✓</td></tr>
<tr><td>chlorine atoms have fewer electrons than chloride ions</td><td>✓</td><td></td></tr>
<tr><td>chloride ions join together to form Cl_2 molecules</td><td></td><td>✓</td></tr>
<tr><td>chlorine atoms gain electrons from sodium atoms</td><td>✓</td><td></td></tr>
</table>
</td><td>2</td><td>all 5 correct = 2 marks
4/3 correct = 1 mark
1/2 correct = 0 marks</td></tr>
<tr><td></td><td>c</td><td></td><td>
<table>
<tr><th></th><th>...increases.</th><th>...decreases.</th><th>...stays the same.</th></tr>
<tr><td>… movement of the ....</td><td>✓</td><td></td><td></td></tr>
<tr><td>The charge on each ion ...</td><td></td><td></td><td>✓</td></tr>
<tr><td>The number of ions ...</td><td></td><td></td><td>✓</td></tr>
<tr><td>The distance between the ions...</td><td>✓</td><td></td><td></td></tr>
<tr><td>The electrical conductivity</td><td>✓</td><td></td><td></td></tr>
</table>
</td><td>3</td><td>all 5 correct = 3 marks
4 correct = 2 marks
3 correct = 1 mark
1/2 correct = 0 marks</td></tr>
</table>

Question			Answer		Mark	Guidance
	d		The colour of the halogen at the beginning of the reaction is different.	✓	1	**both needed** for (1)
			The rate of the reaction is different.	✓		
			The same compound is made at the end of the reaction.			
			The product of the reaction is purple.			
			Total		**[7]**	

Question			Answer	Mark	Guidance
2	a		**any four from:** lithium has a lower (relative) atomic mass / lithium has an atomic mass of 7, potassium 39; lithium has fewer protons than potassium / lithium has 3 protons, potassium has 19 protons ; lithium has fewer electrons than potassium / lithium has 3 electrons, potassium has 19 electrons; lithium has fewer neutrons than potassium / lithium has 4 neutrons, potassium contains 20 neutrons; lithium has fewer electron shells / lithium has 2 shells, potassium has 4 / lithium is 2,1 and potassium is 2,8,8,1; both have 1 electron <u>in outer shell</u> / same number of electrons <u>in the outer shell</u>;	4	**ignore** lithium has a lower atomic/proton number (in the question) if numbers for protons, electrons, neutrons or shells are given, they must be correct **allow** correct 'dot and cross' diagrams for both atoms **if no other marks are scored**, allow (1) only for… they contain different numbers of protons / electrons / neutrons / atomic masses;

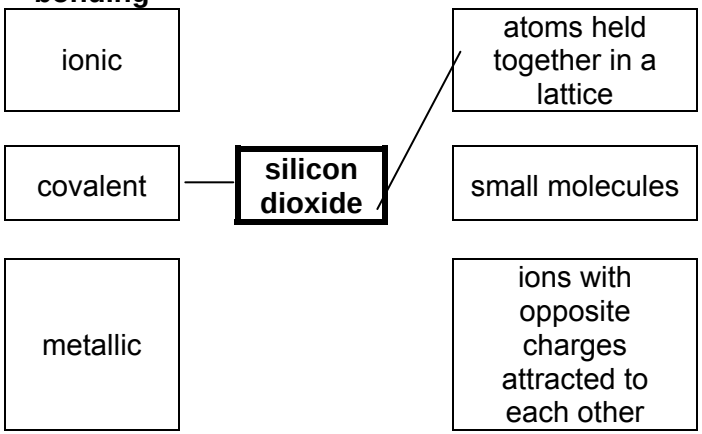
Question			Answer	Mark	Guidance
	b		Heat the compounds in a hot flame. ☐ ✓ (1) Look at the spectrum given off ☐ ✓ (1) ☐ ☐	2	
			Total	**[6]**	

Question			Answer	Mark	Guidance
3	a		potassium sulfate / potassium sulphate (1)	1	
	b		**$NaNO_3$** and **K_3PO_4** (1)	1	**both** required for one mark
	c	i	**H^+** (1)	1	
		ii	**$Ca(OH)_2$** (1)	1	
	d	i	**PO_4^{3-}** (1)	1	
		ii	**KNO_3** (1)	1	**accept** $K^+NO_3^-$
	e		potassium carbonate (1) potassium hydroxide (1)	2	
			Total	**[8]**	

Question			Answer	Mark	Guidance
4	a		**any two from:** starts fast / fastest at the start; slows down; then stops;	2	look for a description of changes to the **rate** **ignore** references to volume of gas e.g. gas volume increases / stays the same / levels out **maximum (1) mark** if answer includes incorrect description of rate i.e. rate increases / rate becomes constant / rate stays the same
	b		lower concentration of acid (1) slower rate / less gas made / less product made / reaction ends sooner; (1)	2	**ignore** lower temperature / use less acid **accept** dilute the acid mark independently
	c	i	111 (1)	1	
		ii	☐ 2.2 g ☑ (1) ☐ ☐ ☐	1	

Question			Answer	Mark	Guidance
		iii	The acid is used up before … ☑ ☐ ☐ ☐ ☐ (1)	1	
			Total	[7]	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>5</td><td>a</td><td></td><td>
<table>
<tr><th></th><th>found only in air</th><th>found only in the Earth's crust</th><th>found in both</th></tr>
<tr><td>metals</td><td></td><td>✓</td><td></td></tr>
<tr><td>non-metals</td><td></td><td></td><td>✓</td></tr>
</table>
</td><td>1</td><td>both ticks required for one mark</td></tr>
<tr><td></td><td>b</td><td>i</td><td>
<table>
<tr><th>type of bonding</th><th></th><th>structure</th></tr>
<tr><td>ionic</td><td></td><td>atoms held together in a lattice</td></tr>
<tr><td>covalent</td><td>oxygen</td><td>small molecules</td></tr>
<tr><td>metallic</td><td></td><td>ions with opposite charges attracted to each other</td></tr>
</table>
</td><td>1</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
		ii		1	
		iii	High Hard Poor Does not dissolve	2	all four correct = 2 marks 2/ 3 correct = 1 mark 1 correct = 0 marks
	c		gives example of one element <u>and</u> one compound (1) elements contain only one type of atom (1) compounds contain more than one element which are joined together / bonded / combined / reacted together / in a molecule (1)	3	**elements given in Q:** oxygen, nitrogen, silicon, aluminium **compounds given in Q**: carbon dioxide, silicon dioxide **allow** other examples of elements and compounds if no names are given, accept <u>correct</u> formulae only (accept Co_2) ignore incorrect formulae if correct names are given **allow** elements cannot be split / are shown on the Periodic Table **ignore** a compound contains elements mixed together **ignore** incorrect references to <u>type</u> of bonding e.g. ionic / covalent
			Total	[8]	

<table>
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<tr><td>6</td><td>a</td><td>i</td><td>
<table>
<tr><th></th><th>true</th><th>false</th></tr>
<tr><td>the ore contains over 60% aluminium oxide</td><td>✓</td><td></td></tr>
<tr><td>aluminium oxide is not soluble in sodium hydroxide</td><td></td><td>✓</td></tr>
<tr><td>the impurities dissolve because sodium hydroxide is acidic</td><td></td><td>✓</td></tr>
<tr><td>the process does not need any energy input</td><td></td><td>✓</td></tr>
</table>
</td><td>2</td><td>all correct = 2 marks
2/3 correct = 1 mark
1 correct = 0 marks</td></tr>
<tr><td></td><td></td><td>ii</td><td>waste product: sodium hydroxide / red mud

AND

effect: enters soil/land/water / damages plants / harms animals / damages ecosystems / damages habitats / damages landscape</td><td>1</td><td>need to identify a waste product and an effect

accept iron oxide / silicon dioxide / titanium dioxide as alternatives to ‘red mud’

ignore causes pollution / damages the environment

do not allow sodium hydroxide is acidic</td></tr>
<tr><td></td><td>b</td><td></td><td>Al^{3+} + 3 e^- → Al

$2O^{2-}$ → O_2 + 4 e^-</td><td>3</td><td>3 and Al (1)
do not allow any extra numbers or charges given with Al e.g. Al^+ / 3Al etc

O_2 (1)
4e (1)

do not allow O^2 ,O2 or 2O</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[6]</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Paper Total</td><td>[42]</td><td></td></tr>
</table>

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