

Chemistry A

General Certificate of Secondary Education

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

Mark Scheme for June 2011

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

Question		Answer	Mark	Guidance
	d	The colour of the halogen at the beginning of the reaction is different. <input checked="" type="checkbox"/>	1	both needed for (1)
		The rate of the reaction is different. <input checked="" type="checkbox"/>		
		The same compound is made at the end of the reaction. <input type="checkbox"/>		
		The product of the reaction is purple. <input type="checkbox"/>		
Total			[7]	

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

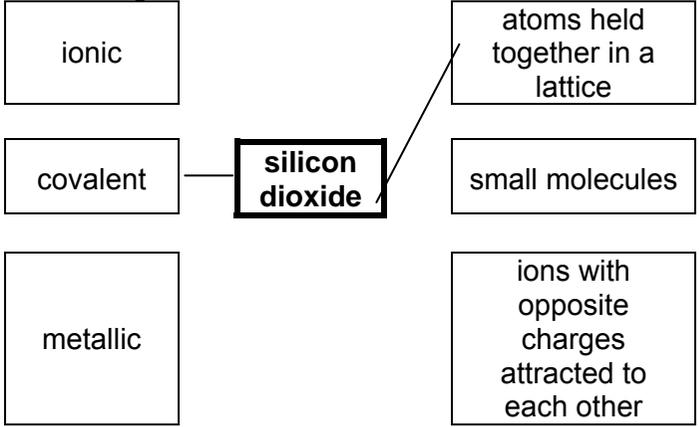
Question		Answer	Mark	Guidance
	b	<p><input type="checkbox"/></p> <p>Heat the compounds in a hot flame. <input checked="" type="checkbox"/> (1)</p> <p>Look at the spectrum given off <input checked="" type="checkbox"/> (1)</p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	2	
Total			[6]	

Question		Answer	Mark	Guidance
3	a	potassium sulfate / potassium sulphate (1)	1	
	b	NaNO_3 <u>and</u> 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	<p>any two from:</p> <p><u>starts</u> fast / fastest at the <u>start</u>;</p> <p>slows down;</p> <p>then stops;</p>	2	<p>look for a description of changes to the rate</p> <p>ignore references to volume of gas e.g. gas volume increases / stays the same / levels out</p> <p>maximum (1) mark if answer includes incorrect description of rate i.e. rate increases / rate becomes constant / rate stays the same</p>
	b	<p>lower concentration of acid (1)</p> <p>slower rate / less gas made / less product made / reaction ends sooner; (1)</p>	2	<p>ignore lower temperature / use less acid</p> <p>accept dilute the acid</p> <p>mark independently</p>
	c	i	111 (1)	1
		ii	<p>2.2 g <input type="checkbox"/></p> <p><input checked="" type="checkbox"/> (1)</p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	1

Question		Answer	Mark	Guidance
	iii	The acid is used up before ... <input checked="" type="checkbox"/> (1) <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	1	
Total			[7]	

Question			Answer				Mark	Guidance												
5	a			found only in air	found only in the Earth's crust	found in both	1	both ticks required for one mark												
		metals			✓															
		non-metals				✓														
	b	i	<table border="0"> <tr> <td>type of bonding</td> <td></td> <td>structure</td> </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>				type of bonding		structure	ionic		atoms held together in a lattice	covalent	oxygen	small molecules	metallic		ions with opposite charges attracted to each other	1	
type of bonding		structure																		
ionic		atoms held together in a lattice																		
covalent	oxygen	small molecules																		
metallic		ions with opposite charges attracted to each other																		

Question	Answer	Mark	Guidance
ii	<p>type of bonding</p> <p>ionic</p> <p>covalent</p> <p>metallic</p> <p>silicon dioxide</p> <p>structure</p> <p>atoms held together in a lattice</p> <p>small molecules</p> <p>ions with opposite charges attracted to each other</p> 	1	
iii	<p>High</p> <p>Hard</p> <p>Poor</p> <p>Does not dissolve</p>	2	<p>all four correct = 2 marks</p> <p>2/ 3 correct = 1 mark</p> <p>1 correct = 0 marks</p>
c	<p>gives example of one element <u>and</u> one compound (1)</p> <p>elements contain only one type of atom (1)</p> <p>compounds contain more than one element which are joined together / bonded / combined / reacted together / in a molecule (1)</p>	3	<p>elements given in Q: oxygen, nitrogen, silicon, aluminium</p> <p>compounds given in Q: carbon dioxide, silicon dioxide</p> <p>allow other examples of elements and compounds</p> <p>if no names are given, accept <u>correct</u> formulae only (accept Co₂) ignore incorrect formulae if correct names are given</p> <p>allow elements cannot be split / are shown on the Periodic Table</p> <p>ignore a compound contains elements mixed together ignore incorrect references to <u>type</u> of bonding e.g. ionic / covalent</p>
	Total	[8]	

Question			Answer		Mark	Guidance
6	a	i		true	false	2 all correct = 2 marks 2/3 correct = 1 mark 1 correct = 0 marks
			the ore contains over 60% aluminium oxide	✓		
			aluminium oxide is not soluble in sodium hydroxide		✓	
			the impurities dissolve because sodium hydroxide is acidic		✓	
			the process does not need any energy input		✓	
		ii	<p>waste product: sodium hydroxide / red mud</p> <p><u>AND</u></p> <p>effect: enters soil/land/water / damages plants / harms animals / damages ecosystems / damages habitats / damages landscape</p>		1	<p>need to identify a waste product and an effect</p> <p>accept iron oxide / silicon dioxide / titanium dioxide as alternatives to 'red mud'</p> <p>ignore causes pollution / damages the environment</p> <p>do not allow sodium hydroxide is acidic</p>
	b	$\text{Al}^{3+} + 3 \text{e}^{-} \rightarrow \text{Al}$ $2\text{O}^{2-} \rightarrow \text{O}_2 + 4 \text{e}^{-}$		3	<p>3 <u>and</u> Al (1)</p> <p>do not allow any extra numbers or charges given with Al e.g. Al⁺ / 3Al etc</p> <p>O₂ (1) 4e (1)</p> <p>do not allow O² ,O2 or 2O</p>	
Total					[6]	
Paper Total					[42]	

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