



*Rewarding Learning*

**General Certificate of Secondary Education  
2011**

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**Science: Double Award (Non-Modular)**

Paper 2  
Higher Tier

**[G8405]**

**FRIDAY 27 MAY, MORNING**

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**MARK  
SCHEME**

		AVAILABLE MARKS																															
1	(a) C	[1]	4																														
	(b) E	[1]																															
	(c) F	[1]																															
	(d) B	[1]																															
2	Any three of: it has a wide range of uses OR specific named bulk use idea that it is not expensive idea of being easy to make availability of raw materials <b>NOT</b> availability of iron <b>NOT</b> iron readily available accept idea that it can last a long time strength only one mark may be linked to use (3 × [1])	[3]	3																														
3	<table border="1"> <thead> <tr> <th>Symbol</th> <th>Number of protons</th> <th>Number of neutrons</th> <th>Number of electrons</th> <th>Mass number</th> <th>Electron arrangement</th> </tr> </thead> <tbody> <tr> <td>Na</td> <td>11 [1]</td> <td>12</td> <td>11</td> <td>23</td> <td>2,8,1</td> </tr> <tr> <td>O</td> <td>8</td> <td>8</td> <td>8 [1]</td> <td>16</td> <td>2,6 [1]</td> </tr> <tr> <td>Ca</td> <td>20</td> <td>20</td> <td>20</td> <td>40 [1]</td> <td>2,8,8,2</td> </tr> <tr> <td>Al</td> <td>13</td> <td>14 [1]</td> <td>13</td> <td>27</td> <td>2,8,3 [1]</td> </tr> </tbody> </table>	Symbol	Number of protons	Number of neutrons	Number of electrons	Mass number	Electron arrangement	Na	11 [1]	12	11	23	2,8,1	O	8	8	8 [1]	16	2,6 [1]	Ca	20	20	20	40 [1]	2,8,8,2	Al	13	14 [1]	13	27	2,8,3 [1]	[6]	6
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Na	11 [1]	12	11	23	2,8,1																												
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Al	13	14 [1]	13	27	2,8,3 [1]																												
4	(a) correct 2,8,2 representation for magnesium [1] correct 2,7 representation for fluorine [1]	[2]	5																														
	(b) loss of 2 electrons by magnesium [1] gain of 1 electron by fluorine [1] idea that 2 fluorine atoms are needed (for each magnesium) [1] reference to loss or gain of atoms loses 1 mark/sharing electrons negates first 2 marks	[3]																															
5	(a) diamond	[1]																															
	(b) idea that quartz does not have delocalised electrons [1]	[1]																															
	(c) clear idea of having strong (covalent) <b>bonds</b> which are difficult to break	[1] [1]	4																														

		AVAILABLE MARKS
6	(a) $^{238}_{92}\text{U} \rightarrow ^{234}_{90}\text{Th} + ^4_2\text{He}$ there are six marking points: 6 correct = [4]; 5 correct = 3; 3 or 4 correct = [2]; 2 correct = [1]; 0 or 1 correct = [0]; accept the alpha symbol for He	[4]
	(b) $1.35 \times 10^{10}$ years [2] incorrect answer with 3 half-lives gains 1 method mark accept $13.5 \times 10^9$ for [2]	[2] 6
7	(a) Carbon dioxide dissolves in water (forming carbonic acid) [1] idea that carbonic acid reacts with calcium carbonate/limestone (forming calcium hydrogen carbonate) [1] OR $\text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2 \rightarrow \text{Ca}(\text{HCO}_3)_2$ [1] [1]	[2]
	(b) idea that $\text{Ca}^{2+}$ (calcium ions) react [1] with $\text{CO}_3^{2-}$ (carbonate ions) [1] and that an <b>insoluble</b> calcium compound is formed/calcium ions removed from solution [1] (idea of $\text{Ca}^{2+}$ ions being precipitated as calcium carbonate is worth [2]) OR $\text{Ca}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{CaCO}_3(\text{s})$ [1] [1] correct state symbols [1]	[3] 5
8	(a) (i) 160	[1]
	(ii) 0.625 moles i.e. $100 \div$ (a)(i) answer – apply CM	[1]
	(iii) 1.25 moles i.e. $2 \times$ (a)(ii) answer – apply CM	[1]
	(iv) 70 g i.e. $56 \times$ (a)(iii) answer – apply CM	[1]
	(v) 1.875 moles i.e. (a)(ii) answer $\times 3$ – apply CM	[1]
	(vi) 52.5 g [2] up to 1 method mark i.e. (a)(v) answer $\times 28$ – apply CM	[2] 7
9	(a) (i) Any two of: colourless/odourless/low density/insoluble in water/or other correct ( $2 \times [1]$ ) no marks relating to mp or bp	[2]
	(ii) meteorological balloons/rocket engines/(clean) fuel or other correct, e.g. Haber Process or hydrogenation of fats	[1]
	(iii) $\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$ LHS [1] RHS [1]	[2]

			AVAILABLE MARKS
(b) (i)	sulphur dioxide	[1]	20
(ii)	3	[1]	
(iii)	kills fish/corrodes or damages stonework or buildings ( <b>NOT</b> erodes)/destroys or damages or kills vegetation/leaches nutrients from the soil or other correct, e.g. corrodes metal	[1]	
(iv)	idea of scrubbers/filters/use low sulphur fuels/desulphonation <b>NOT</b> use of alternative energy sources	[1]	
(c)	Advantages (allow up to four of): use of lignite as a fuel/providing jobs/e.g. cheap (fuel)/helping local economy/allow improved transport links/or other correct Disadvantages (allow up to four of): loss of habitat/eyesore/noise pollution/dust pollution/using up natural resource or other correct (max 6 × [1]) QWC mark for clear articulation – <b>NOT</b> just list [1]	[7]	
(d) (i)	fertilisers/slurry	[1]	
(ii)	fertilisers/detergents	[1]	
(iii)	soluble or dissolved allow bacteria	[1]	
(iv)	idea of killing bacteria/germs <b>NOT</b> cleaning accept sterilises	[1]	
10 (a) (i)	carbon/graphite	[1]	
(ii)	anode – oxygen, cathode – aluminium      both needed	[1]	
(iii)	anode [1] idea that it reacts with oxygen [1] forming carbon dioxide [1] <b>NOT</b> wears away/erodes	[3]	
(b) (i)	alkali metals <b>NOT</b> alkaline	[1]	
(ii)	Any four of: bubbles/effervescence/fizzing <b>NOT</b> just “gas”/hissing or similar sound metal floating/on surface forming a ball/melting or similar metal getting smaller/disappearing/dissolving moving around idea of catching fire/sparks/yellow-orange flame exothermic reaction idea of alkaline solution remaining/turns purple with indicator idea of very vigorous reaction (4 × [1])	[4]	

			AVAILABLE MARKS	
	(iii)	idea of reactivity of sodium	[1]	20
	(iv)	sodium + water → sodium hydroxide [1] + hydrogen [1]	[2]	
	(v)	slower or similar [1] lithium is less reactive [1] correct reference to position in Group 1 [1] any 2 points of 3	[2]	
(c)	(i)	calcium hydroxide or slaked lime	[1]	
	(ii)	$\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ <div style="display: flex; justify-content: center; gap: 100px;"> <span>[1]</span> <span>[1]</span> </div>	[2]	
	(iii)	Any two of: hard/brittle/crystalline/doesn't conduct electricity when solid/or other correct allow idea of soluble in water (2 × [1])	[2]	
11	(a)	(i) solubility of potassium chlorate (g/100 g H <sub>2</sub> O) [1] 6 correct points [2] (for 4 or 5 correct award [1]) correct curve [1]	[4]	
		(ii) 33.5 °C ± 0.5 °C	[1]	
		(iii) 6 ± 0.3 [1]      22.5 ± 0.5 [1]	[2]	
		(iv) (answer (iii) 2 – answer (iii) 1)/2 [2] award up to 1 method mark i.e. 8.25 g ± 0.4 – apply CM	[2]	
	(b)	(i) temperature – 250 °C–500 °C range [1] pressure – 150 atm–400 atm range [1] catalyst – iron [1]	[3]	
		(ii) $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ <div style="display: flex; justify-content: center; gap: 50px;"> <span>LHS [1]</span> <span>RHS [1]</span> </div> balancing mark (if other 2 marks gained) [1]	[3]	
		(iii) idea that pressure needed cannot be easily obtained/lack of appropriate apparatus [1] accept qualified danger or qualified cost	[1]	
	(c)	(i) hydrated [1] iron(III) oxide [1]	[2]	
		(ii) clear idea that zinc is more reactive than iron [1] idea that zinc reacts first (NOT faster) [1]	[2]	
				20

12 (a) (i)  $C_nH_{2n}$  [1]

(ii) a compound/substance of carbon and hydrogen [1] only (implied)  
[1] which has a (at least one) double (C=C) bond [1] [3]

hydrocarbon	molecular formula	structural formula	physical state at room temperature
(iii) propene:	$C_3H_6$ [1]	$\begin{array}{c} H & H & H \\   &   &   \\ C = C - C - H \\   & &   \\ H & & H \end{array}$ [1]	gas [1]

(b) addition **NOT** additional [1] polymerisation [1] [2]

(c) (i)  $C_2H_4 + H_2O \rightarrow C_2H_5OH$   
LHS [1] RHS [1] [2]

(ii) fermentation/anaerobic respiration by yeast [1]

(iii)  $\begin{array}{c} H & H \\ | & | \\ H - C - C - OH \\ | & | \\ H & H \end{array}$  [1]

(iv) solvent, fuel, idea of (alcoholic) beverages or other correct  
accept alcohol or antiseptic [1]

(d) (i)  $CH_3COOH$  [1]

(ii) Any two of:  
bubbling or fizzing or gas given off/magnesium metal disappears  
or dissolves/colourless solution formed  
exothermic reaction  
idea of steady, or slow (not very vigorous) reaction  
(2 × [1]) [2]

(e) (i) ethyl ethanoate [1]

(ii) colourless/sweet smelling/oily [1] liquid [1] [2]

**Total**

AVAILABLE  
MARKS

20

**120**