



General Certificate of Secondary Education
2012

Science: Chemistry

Paper 1
Higher Tier

[G1403]

TUESDAY 12 JUNE, MORNING

MARK SCHEME

1	(a)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; padding: 5px;">Element</th><th style="text-align: center; padding: 5px;">metal or non-metal or semi-metal</th></tr> </thead> <tbody> <tr> <td style="padding: 5px;">Carbon</td><td style="text-align: center; padding: 5px;">non-metal [1]</td></tr> <tr> <td style="padding: 5px;">Silicon</td><td style="text-align: center; padding: 5px;">semi-metal [1]</td></tr> <tr> <td style="padding: 5px;">Germanium</td><td style="text-align: center; padding: 5px;">semi-metal [1]</td></tr> <tr> <td style="padding: 5px;">Tin</td><td style="text-align: center; padding: 5px;">metal [1]</td></tr> </tbody> </table>	Element	metal or non-metal or semi-metal	Carbon	non-metal [1]	Silicon	semi-metal [1]	Germanium	semi-metal [1]	Tin	metal [1]	AVAILABLE MARKS						
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Isotope	Number of protons	Number of electrons	Number of neutrons																
¹² C	6	6	6																
¹³ C	6	6	7																
¹⁴ C	6	6	8																
	(ii)	atoms of the same element/same atomic number/same number of protons [1] different number of neutrons/different mass number [1]	[2]																
	(c) (i)	different forms/structures of the same element [1] in the same (physical) state [1]	[2]																
	(ii)	A and B	[1]																
	(iii)	covalent	[1]																
	(iv)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; padding: 5px;">Substance</th><th style="text-align: center; padding: 5px;">Type of structure</th></tr> </thead> <tbody> <tr> <td style="padding: 5px;">A (diamond)</td><td style="text-align: center; padding: 5px;">giant (covalent)/macromolecular [1]</td></tr> <tr> <td style="padding: 5px;">B (graphite)</td><td style="text-align: center; padding: 5px;">giant (covalent)/macromolecular [1]</td></tr> <tr> <td style="padding: 5px;">C (silicon dioxide)</td><td style="text-align: center; padding: 5px;">giant (covalent)/macromolecular [1]</td></tr> <tr> <td style="padding: 5px;">D (carbon dioxide)</td><td style="text-align: center; padding: 5px;">molecular/simple (covalent) [1]</td></tr> </tbody> </table>	Substance	Type of structure	A (diamond)	giant (covalent)/macromolecular [1]	B (graphite)	giant (covalent)/macromolecular [1]	C (silicon dioxide)	giant (covalent)/macromolecular [1]	D (carbon dioxide)	molecular/simple (covalent) [1]	[4]						
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C (silicon dioxide)	giant (covalent)/macromolecular [1]																		
D (carbon dioxide)	molecular/simple (covalent) [1]																		
	(d) (i)	weak forces between layers [1] layers slide off [1]	[2]																
	(ii)	2,8,1 [1] 2,8,7 [1] Na ⁺ [1] 2,8 [1] Cl ⁻ [1] 2,8,8 [1] idea that ions held by attraction between opposite charges [1]	Maximum [6]																

		AVAILABLE MARKS
(e) (i)	regular arrangement [1] or evident in diagram of positive ions [1] or labelled in diagram sea of delocalised electrons [1] or labelled in diagram attraction between ions and electrons is the metallic bond [1]	Maximum [3]
(ii)	conducts electricity/malleable/ductile or other correct	[1]
(iii)	conducts electricity/soft/reference to colour/or other correct	[1]
2 (a) (i)	$2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$	[3]
(ii)	any two from: high melting point/high boiling point soluble (in water) does not conduct electricity when solid conducts electricity when molten/dissolved (in water)/aqueous/as a liquid crystalline/brittle	[2]
(iii)	shiny/grey/lustrous	[1]
(iv)	goes dull/tarnishes	[1]
(v)	under/in oil	[1]
(b) (i)	lower density than water	[1]
(ii)	(the sodium) melts	[1]
(iii)	alkaline [1] solution sodium hydroxide/ OH^- /hydroxide ions produced [1]	[2]
(iv)	$2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$	[3]
(c) (i)	sodium chloride [1] sodium aluminate [1]	[2]
(ii)	$2\text{NaOH} + \text{CO}_2 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O}$	[3]
(iii)	amphoteric	[1]
		21

		AVAILABLE MARKS
3	(a) (i) carbon dioxide	[1]
	(ii) decreases	[1]
	(iii) citric acid/ascorbic acid/carbonated water	[1]
	(iv) Solubility = mass [1] of solid which saturates [1] 100 g water [1] at a particular temperature [1] allow idea of maximum mass for saturate	[4]
(b)	(i) water which does not lather with soap [1] water which does not lather readily with soap [2]	[2]
	(ii) B [1] contains largest calcium and/or magnesium ion concentration/mass [1] [2]	
	(iii) equal volumes of mineral water [1] add soap and shake [1] most soap/most scum/least lather = hardest water [1]	[3]
	Quality of written communication	[2]
	(iv) pH paper/Universal Indicator [1] compare to colour chart [1]	[2]
	(v) C [1] lowest pH [1]	[2]
	(vi) any compound containing one positive and one negative ion from the lists below: positive ions: calcium/magnesium/sodium/potassium negative ions: hydrogen carbonate/chloride/sulphate/nitrate [1] correct formula of named compound [1]	[2]
(c)	(i) calcium ions/ Ca^{2+} [1] in the hard water [1] replaced/swapped [1] with sodium ions/ Na^+ [1] from ion exchanger [1]	[4]
	(ii) hydrated [1] sodium carbonate [1]	[2]
	(iii) all nitrates are soluble/no insoluble nitrate	[1]
	(iv) fertilisers	[1]
		30

4 (a) (i) does not break/lighter [1]

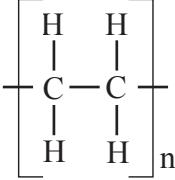
AVAILABLE MARKS

(ii) a long chain molecule [1] made from many repeating units/monomers [1] [2]

(iii) liver damage/poor coordination/other suitable [1]

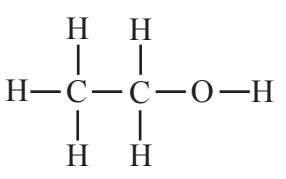
(b) (i)

Ethene		
Molecular formula	C ₂ H ₄	[1]
Structural formula (showing all bonds)		[1]
Physical state at room temperature	gas	[1]

(ii)  correct structure with no double C=C bond [1]
repeat indicated n or min 2 repeating units [1] [2]

(iii) any one from:
global warming
ice caps melt
flooding
rise in sea level
climate change [1]

(c) (i)

Ethanol		
Molecular formula	C ₂ H ₅ OH	[1]
Structural formula (showing all bonds)	 if —OH shown award [1]	[2]
Physical state at room temperature	liquid	[1]

(ii) yeast	[1]	AVAILABLE MARKS 30
(iii) carbon dioxide	[1]	
(iv) warm/absence of air	[1]	

(d) (i)	Ethanoic acid	
Molecular formula	CH ₃ COOH	[1]
Structural formula (showing all bonds)	$ \begin{array}{c} \text{H} & & \text{O} \\ & & // \\ \text{H}-\text{C} & -\text{C} & \text{O}-\text{H} \\ & & \backslash \\ \text{H} & & \text{O} \end{array} $	[2]
	if —OH shown award [1]	
Physical state at room temperature	liquid	[1]



(iii) bubbles/effervescence [1]
heat released [1]
calcium carbonate/solid disappears [1]
solution remains colourless [1]

Maximum [2]

26

			AVAILABLE MARKS								
5	(a) (i) halogens	[1]									
	(ii) solid	[1]									
	(iii) 7	[1]									
	(iv) astatide [1] 1 -- [1]	[2]									
(b)	(i) $\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2$	[3]									
	(ii) yellow-green gas dissolves [1] solution changes from colourless [1] to brown [1]	Maximum [2]									
(c)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Name of compound</th><th style="text-align: center;">Formula of compound</th></tr> </thead> <tbody> <tr> <td>aluminium chloride</td><td style="text-align: center;">AlCl_3 [1]</td></tr> <tr> <td>sodium hypochlorite</td><td style="text-align: center;">NaOCl [1]</td></tr> <tr> <td>{ iron(III) chloride [2] iron chloride = [1]</td><td style="text-align: center;">FeCl_3</td></tr> </tbody> </table>	Name of compound	Formula of compound	aluminium chloride	AlCl_3 [1]	sodium hypochlorite	NaOCl [1]	{ iron(III) chloride [2] iron chloride = [1]	FeCl_3	Maximum [3]	13
Name of compound	Formula of compound										
aluminium chloride	AlCl_3 [1]										
sodium hypochlorite	NaOCl [1]										
{ iron(III) chloride [2] iron chloride = [1]	FeCl_3										
		Total	120								