



Rewarding Learning

**General Certificate of Secondary Education
2012**

Science: Chemistry

Paper 1
Higher Tier

[G1403]

TUESDAY 12 JUNE, MORNING

**MARK
SCHEME**

1 (a)

Element	metal or non-metal or semi-metal
Carbon	non-metal [1]
Silicon	semi-metal [1]
Germanium	semi-metal [1]
Tin	metal [1]

[4]

(b) (i)

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

[1] each column [3]

(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)

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]

(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]	30
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

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]

- 4 (a) (i) does not break/lighter [1]
- (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_2H_4 [1]
Structural formula (showing all bonds)	$\begin{array}{c} H & & H \\ & \diagdown & / \\ & C = C & \\ & / & \diagdown \\ H & & H \end{array}$ [1]
Physical state at room temperature	gas [1]

- (ii) $\left[\begin{array}{cc} H & H \\ | & | \\ -C & -C- \\ | & | \\ H & H \end{array} \right]_n$ 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_2H_5OH [1]
Structural formula (showing all bonds)	$\begin{array}{ccccccc} & H & & H & & & \\ & & & & & & \\ H & -C & - & C & -O & -H & \\ & & & & & & \\ & H & & H & & & \end{array}$ if —OH shown award [1] [2]
Physical state at room temperature	liquid [1]

(ii) yeast [1]

(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)	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{C} \\ \quad // \\ \text{H} \quad \text{O} \\ \quad \quad \\ \quad \quad \text{O}-\text{H} \end{array}$ <p>if —OH shown award [1]</p>	[2]
Physical state at room temperature	liquid	[1]

(ii) $\text{CaCO}_3 + 2\text{CH}_3\text{COOH} \rightarrow (\text{CH}_3\text{COO})_2\text{Ca} + \text{H}_2\text{O} + \text{CO}_2$ [3]

(iii) bubbles/effervescence [1]

heat released [1]

calcium carbonate/solid disappears [1]

solution remains colourless [1]

Maximum [2]

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26

- 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)

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]

Total

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13

120