Ionic Bonding

Mark Scheme 2

Level	IGCSE(9-1)
Subject	Chemistry
Exam Board	Edexcel IGCSE
Module	Single Award (Paper 2C)
Topic	Principles of Chemistry
Sub-Topic	Ionic Bonding
Booklet	Mark Scheme 2

Time Allowed: **38 minutes**

Score: **/31**

Percentage: **/100**

Grade Boundaries:

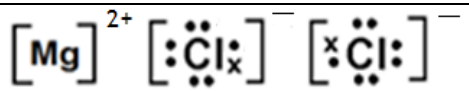
9	8	7	6	5	4	3	2	1
>90%	80%	70%	60%	50%	40%	30%	20%	10%

Question number	Answer	Accept	Reject	Marks
1 (a)	(giant) ionic **IGNORE** three-dimensional / lattice		any other answer	1
(b)	M1 and M3 can be scored from labelled diagrams **sodium:** **M1** – positive ions/cations/Na^+ and (delocalised/sea of) electrons **IGNORE** metal ions **M2** – (electrostatic) forces/attraction between positive ions/cations/Na^+ and (delocalised) electrons **IGNORE** references to metallic bonding **sodium chloride**: **M3** – positive and negative ions/cations and anions / Na^+ and Cl^- (ions) **M4** – electrostatic forces/attraction between (oppositely charged/positive and negative) ions / cations and anions / Na^+ and Cl^- **IGNORE** references to ionic bonding **comparison:** **M5** - forces in Na are weaker (than forces in NaCl) can be awarded even if an incorrect description of the forces has been given. [standalone]	Sodium / metal ions oppositely charged ions chlorine ions if stated as being negative less energy required to overcome forces in Na bonds / lattice for forces ORA	atoms/molecules nuclei intermolecular forces atoms/molecules nuclei intermolecular forces reference to covalent loses M4	1 1 1 1 1

Question number	Answer	Accept	Reject	Marks
1 (c)	**M1** - $n(Na) = \frac{0.138}{23}$ or 0.006 **M2** - $n(H_2)$ = ½ x **M1** or 0.003 **M3** - vol. H_2 = 24 000 x **M2** or 72 (cm^3) [Mark consequentially. $n(Na)$ and $n(H_2)$ need not be evaluated.] correct final answer on its own without working scores 3	0.072 $\underline{dm^3}$		1 1 1

Question number	Answer	Accept	Reject	Marks
1 (d) (i)	**M1** - (add dilute) <u>nitric</u> acid	addition of silver nitrate before nitric acid for both M1 and M2		1
	M2 - (add aqueous) silver nitrate	correct formulae throughout		1
	M3 - <u>white</u> precipitate / solid / suspension			1
	M3 dependent on **M2**			
(ii)	**Reason** – it fizzed / a gas was evolved **OR** sodium hydroxide would not fizz / produce a gas **IGNORE** incorrect identification of gas	sodium hydroxide is soluble		1
	X = <u>sodium</u> carbonate / <u>sodium</u> hydrogencarbonate			1
(e)	**M1** - 8 electrons around Na	any combination of dots and crosses 0 electrons		1
	M2 - 8 electrons around Cl. **IGNORE** inner shells even if incorrect **IGNORE** starting diagrams showing atoms either with or without arrow to show movement of electron			1
	M3 - correct charge on <u>both</u> Na and Cl [standalone]			1
(f)	**M1** - potassium is more reactive than sodium	reactivity increases down Group 1 ORA		1
	M2 - (but) bromine is less reactive than chlorine	reactivity decreases down Group 7 ORA	-ide endings	1
			Total	**19**

Question number	Answer	Notes	Marks
2 (a)		Ignore name and formula of compound	1
(i)	Na / sodium / Mg / magnesium	Accept aluminium	
(ii)	Si / silicon / P / phosphorus / S / sulfur / Cl / chlorine	If both name and formula given both must be correct If both name and formula given both must be correct	1

(b) (i)	 **M1** correct electronic configuration for magnesium ion and correct charge on ion **M2** correct electronic configuration for both chloride ions **M3** correct charges on both chloride ions	Allow electrons on brackets Allow any combination of dots and crosses Allow 0 or 8 electrons in outer shell M3 indep	3
(ii)	**M1** electrostatic attraction/forces between ions **M2** of opposite charge	accept positive	2

(iii)	**M1** attraction (between ions) is strong **M2** lots of ions (in structure) / giant structure / lattice / lots of/many bonds **M3** (therefore) lot of (thermal/heat) <u>energy</u> required to overcome attraction / to break down the lattice	and negative ions accept cations and anions M2 dep on M1 Accept attraction/forces between oppositely charged ions for 1 mark only Reject references to atoms/molecules/IMF for M1 and M2 Accept strong (ionic) bonding/strong (ionic) bonds	3

		Accept lot of (thermal/heat) energy required to break (ionic) bonds If any reference to attraction between atoms/molecules/electrons scores 0/3 If any reference to covalent bonding/covalent structure/IMF scores 0/3	
(c)		Correct answer with or without working scores 2 marks	2

	M1 mol Al = 20/3 (= 6.67) **M2** mass Al = (answer to M1 x 27) = 180 (g) **OR** **M1** 3 faradays give 1 mol **OR** 27 g / 30 faradays give 10 mol OR 270 g **M2** 20 faradays gives 180 (g)	M2 CQ on M1 eg 540 scores 1 mark 6.67 gives 180(.09) scores 2 marks 6.7 gives 180.9 = 181 scores 2 marks 6.66 gives 179.82 scores M2 only Accept any number of sig fig except 1	