Mark Scheme 2811
January 2006

FOUNDATION
CHEMISTRY

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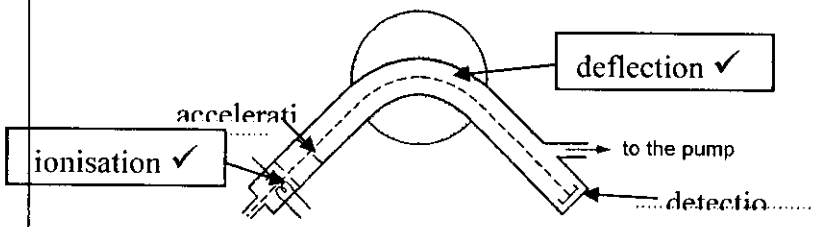
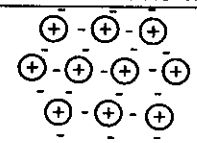
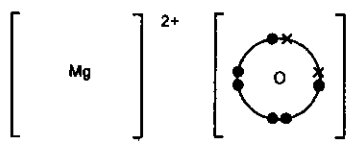
Question			Expected Answers	Marks
1	(a)	(i)		[2]
		(ii)	protons 12, neutrons 13, electrons 12 ✓ (^{25}Mg) protons 12, neutrons 14, electrons 12 ✓ (^{26}Mg)	[2]
		(iii)	$1s^2 2s^2 2p^6 3s^2$ ✓	[1]
		(iv)	24 x 78.60/100 + 25 x 10.11/100 + 26 x 11.29/100 ✓ = 24.33 ✓ (calc value: 24.3269. This scores one mark) 24.32 with no working, award 1 mark only. 24.3 with no working, no marks (Periodic Table value)	[2]
	(b)	(i)	 positive ions ✓ electrons ✓ (must be labelled) *If Mg^{2+} shown then must be correct: Mg^{+} not worthy*	[2]
		(ii)	electrons move ✓	[1]
	(c)	(i)	Oxidation state goes from 0 in O_2 ✓ ⟶ –2 in MgO ✓	[2]
		(ii)	 or with Mg full shell. correct dot and cross ✓; correct charges ✓	[2]
	(d)	(i)	MgO has reacted with CO_2 ✓	[1]
		(ii)	Solid dissolves / disappears ✓ Fizzing / bubbles ✓ $MgO + 2HCl \longrightarrow MgCl_2 + H_2O$ ✓ $MgCO_3 + 2HCl \longrightarrow MgCl_2 + CO_2 + H_2O$ ✓ both reactions form magnesium chloride/$MgCl_2$ ✓	[2] [3]
				Total: 20

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Question	**Expected Answers**	**Marks**
2 (a) (i)	mark vertically: H_2O NH_3 2 3 2 1 ✓ ✓	[2]
(ii)	3D Diagram required or diagram with name labelled bond angle required NH_3 pyramidal molecule shown ✓ 107 ° ✓ (106-108°) SO_2 non-linear molecule shown ✓ 110 - 130 ° ✓	[4]
(b) (i)	oxygen/ nitrogen is more electronegative/ molecule has atoms with different electronegativities /oxygen/more electronegative atom ... attracts bonded electron pair more ✓	[1]
(ii)	H bonding from N of 1 NH_3 molecule to H of another NH_3 molecule with a $H^{\delta+}$ shown and a $N^{\delta-}$ shown ✓ with lone pair involved in bond ✓ 2nd mark is available from water molecule(s)	[2]
(c)	ice is less dense than water ✓ hydrogen bonds hold H_2O molecules apart in ice / hydrogen bonds cause an open lattice structure ✓	[2]
(d) (i)	ratio N : H : S : O = $\frac{24.12}{14} : \frac{6.94}{1} : \frac{27.61}{32.1} : \frac{41.33}{16}$:✓ = 2 : 8 : 1 : 3 Empirical formula = $N_2H_8SO_3$ ✓ $N_2H_4SO_3$ is worth 1 mark from consistent use of at nos.	[2]
(ii)	$H_2O + 2NH_3 + SO_2 \longrightarrow (NH_4)_2SO_3$ ✓ *(Award mark for $N_2H_8SO_3$)*	[1]
		Total: 14

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Question	**Expected Answers**	**Marks**
3 (a) (i)	goes yellow/orange/brown ✓	[1]
(ii)	$Cl_2 + 2Br^- \longrightarrow Br_2 + 2Cl^-$ ✓✓ *OR* $Cl_2 + 2KBr \longrightarrow Br_2 + 2KCl$ 1 mark for species. 1 mark for balancing	[2]
(iii)	An electron is being gained ✓ Cl atoms are smaller/less shells (ora) ✓ In Cl, attraction for electrons is greater ✓	[3]
(b) (i)	Amount of substance that has the same number of particles as there are atoms in 12 g of ^{12}C/ 6×10^{23}/ Avogadro's Number ✓	[1]
(ii)	moles = $\frac{0.275 \times 120}{1000}$ = 0.0330 mol ✓	[1]
(iii)	moles Cl_2 = $\frac{0.0330}{2}$ = 0.0165 mol ✓ volume Cl_2 = 0.0165 x 24000 = 396 cm^3 ✓ / 0.396 dm^3 792 cm^3 worth 1 mark (no molar ratio) 1584 cm^3 worth 1 mark (x 2) units needed.	[2]
(iv)	bleach / disinfectant /sterilising /killing germs ✓	[1]
(c)	$NaClO_3$ ✓	[1]
		Total: 12

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Question	**Expected Answers**	**Marks**
4 (a)	Energy change when **each atom in 1 mole** ✓ of gaseous **atoms** ✓ **loses an electron** ✓ (to form 1 mole of gaseous 1+ ions).	[3]
(b)	From Li → N, ionisation energy increases ✓ number of protons/nuclear charge increases ✓ nuclear attraction increases / shell drawn in by increased nuclear charge/ atomic radius decreases ✓ across period, electrons added to same shell ✓ *Not same subshell* From Be → B, ionisation energy decreases ✓ for B, electron is removed from a p sub-shell/p orbital/different sub-shell ✓ which has a higher energy ✓ *watch for distinction between nuclear **attraction** and nuclear **charge** in candidates' scripts.* *Also watch for confusion between shell and subshell.* Al ✓ Sharp rise in successive ionisation energy between 3rd and 4th IE ✓ marking a change to a new or different shell / there are 3 electrons in the outer shell✓ *mention **of** 'orbital' or 'sub-shell cancels 'shell mark'* *Each marking point for Al is independent*	[7] [3]
	QoWC: links together two pieces of information correctly within **two** of the sections below: 1. General trend across period 2. Be to B 3. Successive ionisation energies ✓	[1]
		Total: 14