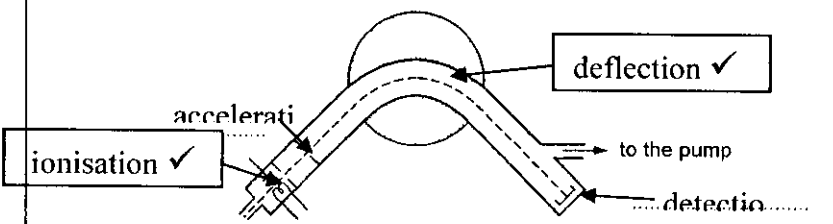
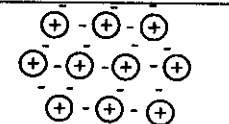


**Mark Scheme 2811**  
**January 2006**

FOUNDATION  
CHEMISTRY

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Question	Expected Answers	Marks															
1 (a) (i)	 <p>ionisation ✓    acceleration    deflection ✓    to the pump    .....detection.....</p> <table border="1" data-bbox="422 784 1218 896"> <thead> <tr> <th></th> <th>protons</th> <th>neutrons</th> <th>electrons</th> <th></th> </tr> </thead> <tbody> <tr> <td><math>^{25}\text{Mg}</math></td> <td>12</td> <td>13</td> <td>12</td> <td>✓</td> </tr> <tr> <td><math>^{26}\text{Mg}</math></td> <td>12</td> <td>14</td> <td>12</td> <td>✓</td> </tr> </tbody> </table> <p>(ii) <math>1s^2 2s^2 2p^6 3s^2</math> ✓</p> <p>(iii) <math>24 \times 78.60/100 + 25 \times 10.11/100 + 26 \times 11.29/100</math> ✓  <math>= 24.33</math> ✓ (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)</p>		protons	neutrons	electrons		$^{25}\text{Mg}$	12	13	12	✓	$^{26}\text{Mg}$	12	14	12	✓	[2] [2] [1] [2]
	protons	neutrons	electrons														
$^{25}\text{Mg}$	12	13	12	✓													
$^{26}\text{Mg}$	12	14	12	✓													
(b) (i)	 <p>positive ions ✓    electrons ✓ (must be labelled)  <i>If <math>\text{Mg}^{2+}</math> shown then must be correct: <math>\text{Mg}^+</math> not worthy</i>            electrons move ✓</p>	[2] [1]															
(c) (i)	Oxidation state goes from 0 in $\text{O}_2$ ✓ $\rightarrow -2$ in $\text{MgO}$ ✓	[2]															
(ii)	<p>or with Mg full shell.            correct dot and cross ✓; correct charges ✓</p>	[2]															
(d) (i)	$\text{MgO}$ has reacted with $\text{CO}_2$ ✓	[1]															
(ii)	Solid dissolves / disappears ✓ Fizzing / bubbles ✓ $\text{MgO} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2\text{O}$ ✓ $\text{MgCO}_3 + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$ ✓ both reactions form magnesium chloride/ $\text{MgCl}_2$ ✓	[2] [3]															
		<b>Total: 20</b>															

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Question	Expected Answers	Marks
2 (a) (i)	mark vertically: $\begin{array}{cc} \text{H}_2\text{O} & \text{NH}_3 \\ 2 & 3 \\ 2 & 1 \\ \checkmark & \checkmark \end{array}$	[2]
(ii)	3D Diagram required or diagram with name labelled bond angle required NH <sub>3</sub> pyramidal molecule shown ✓ 107° ✓ (106-108°) SO <sub>2</sub> 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 <sub>3</sub> molecule to H of another NH <sub>3</sub> molecule with a H <sup>δ+</sup> shown and a N <sup>δ-</sup> 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 <sub>2</sub> O molecules apart in ice / hydrogen bonds cause an open lattice structure ✓	[2]
(d) (i)	ratio N : H : S : O = $\frac{24.12}{14} : \frac{6.94}{1} : \frac{27.61}{32.1} : \frac{41.33}{16} : \checkmark$ = 2 : 8 : 1 : 3 Empirical formula = N <sub>2</sub> H <sub>8</sub> SO <sub>3</sub> ✓ N <sub>2</sub> H <sub>4</sub> SO <sub>3</sub> is worth 1 mark from consistent use of at nos.	[2]
(ii)	$\text{H}_2\text{O} + 2\text{NH}_3 + \text{SO}_2 \longrightarrow (\text{NH}_4)_2\text{SO}_3 \checkmark$ (Award mark for N <sub>2</sub> H <sub>8</sub> SO <sub>3</sub> )	[1]
		Total: 14

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Question	Expected Answers	Marks
3 (a) (i)	goes yellow/orange/brown ✓	[1]
(ii)	$\text{Cl}_2 + 2\text{Br}^- \longrightarrow \text{Br}_2 + 2\text{Cl}^-$ ✓ ✓ <i>OR</i> $\text{Cl}_2 + 2\text{KBr} \longrightarrow \text{Br}_2 + 2\text{KCl}$ 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 $^{12}\text{C}$ / $6 \times 10^{23}$ / Avogadro's Number ✓	[1]
(ii)	$\text{moles} = \frac{0.275 \times 120}{1000} = 0.0330 \text{ mol}$ ✓	[1]
(iii)	$\text{moles Cl}_2 = \frac{0.0330}{2} = 0.0165 \text{ mol}$ ✓ $\text{volume Cl}_2 = 0.0165 \times 24000 = 396 \text{ cm}^3$ ✓ / $0.396 \text{ dm}^3$ $792 \text{ cm}^3$ worth 1 mark (no molar ratio) $1584 \text{ cm}^3$ worth 1 mark (x 2) units needed.	[2]
(iv)	bleach / disinfectant /sterilising /killing germs ✓	[1]
(c)	$\text{NaClO}_3$ ✓	[1]
		<b>Total: 12</b>

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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)	<p>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 ✓ <i>Not same subshell</i></p> <p>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 ✓</p> <p><i>watch for distinction between nuclear attraction and nuclear charge in candidates' scripts. Also watch for confusion between shell and subshell.</i></p> <p>AI ✓ 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 ✓</p> <p><i>mention of 'orbital' or 'sub-shell' cancels 'shell mark' Each marking point for AI is independent</i></p>	[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