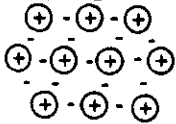




AS FOUNDATION CHEMISTRY
Mark Scheme 2811
June 2004

Question	Expected Answers	Marks																				
1 (a)	<table border="0"> <tr> <td>isotope</td> <td>protons</td> <td>neutrons</td> <td>electrons</td> </tr> <tr> <td>nickel-58</td> <td>28</td> <td>30</td> <td>28</td> </tr> <tr> <td>nickel-60</td> <td>28</td> <td>32</td> <td>28</td> </tr> <tr> <td>nickel-62</td> <td>28</td> <td>34</td> <td>28</td> </tr> <tr> <td></td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> </table> <p>For ecf, 3rd column same as first column.</p>	isotope	protons	neutrons	electrons	nickel-58	28	30	28	nickel-60	28	32	28	nickel-62	28	34	28		✓	✓	✓	[3]
isotope	protons	neutrons	electrons																			
nickel-58	28	30	28																			
nickel-60	28	32	28																			
nickel-62	28	34	28																			
	✓	✓	✓																			
(b)	<p>(i) mass spectrometry ✓ mass spec... /mass spectrometer should also be credited</p> <p>(ii) average mass/weighted mean mass of an atom ✓ compared with carbon-12 ✓ 1/12th of mass of carbon-12/on a scale where carbon-12 is 12 ✓ <i>mass of 1 mole of atoms (of an element) mass of 1 mole of carbon-12 is equivalent to first two marks</i> <i>"mass of the element that contains the same number of atoms as are in 1 mole of carbon-12" → 2 marks (mark lost because of mass units)</i></p> <p>(iii) $63.0 \times 77.2/100 + 65.0 \times 22.8/100 / 63.456$ ✓ = 63.5 (mark for significant figures) ✓</p> <p>(iv) copper/ Cu ✓</p>	[1] [3] [2] [1]																				
(c)	<p>(i) mass of Ni = 2.0.g ✓ moles of Ni = $2.0/58.7 \text{ mol} = 0.0341/0.034 \text{ mol}$ ✓ (1 mark would typically result from no use of 25% → 0.136 mol) 2nd mark is for the mass of Ni divided by 58.7</p> <p>(ii) number of atoms of Ni = $6.02 \times 10^{23} \times 0.0341$ = $2.05 \times 10^{22} / 2.1 \times 10^{22} \text{ atoms}$ ✓ Can be rounded down to 2.1 or 2.0 or 2 (if 2.0) From 8 g, ans = $8.18/8.2 \times 10^{22}$ (and other consequential responses)</p>	[2] [1]																				
		Total: 13																				

Question	Expected Answers	Marks
2 (a) (i)	 <p>positive ions/cations ✓ and negative electrons ✓ Can be described in words only for both marks</p>	[2]
(ii)	contain free/mobile/delocalised electrons ✓	[1]
(b) (i)	shared pair of ✓ electrons ✓ <i>i.e. 'shared electrons' is worth 1 mark. pair of electrons for second marks</i>	[2]
(ii)	correct dot-and cross diagram ✓	[1]
(c) (i)	electrostatic attraction ✓ between oppositely charged ions ✓ (charged or electrostatic for 1st mark)	[2]
(ii)	correct dot-and cross diagram ✓ correct charges ✓	[2]
(iii)	$\text{Mg} \longrightarrow \text{Mg}^{2+} + 2\text{e}^- \checkmark$ $\text{F}_2 + 2\text{e}^- \longrightarrow 2\text{F}^- \checkmark$ <p>– sign not required with electron</p>	[2]
(iv)	solid: ions cannot move /in fixed positions in lattice ✓ solution: ions are free to move ✓	[2]
		Total: 14

Question	Expected Answers	Marks
3 (a)	NaClO, oxidation state = +1 ✓ NaCl, oxidation state = -1 ✓ OR Oxidation number decreases from NaClO → NaCl ✓ by 2 ✓	[2]
(b) (i)	84/24000 = 3.5 × 10 ⁻³ mol ✓	[1]
(ii)	3.5 × 10 ⁻³ mol ✓ ans to (i)	[1]
(iii)	3.5 × 10 ⁻³ × 1000/5 = 0.70 mol dm ⁻³ ✓ ans to (ii) × 1000/5	[1]
(c)	molar mass of NaClO = 23 + 16 + 35.5 = 74.5 (g mol ⁻¹) ✓ concentration = 0.70 × 74.5 = 52.15 g (dm ⁻³) ✓ ans to (iii) × 74.5 bleach is 5.215 g per 100 cm ³ and the information is correct (as this value exceeds 4.5%) ✓ <i>response depends upon answer to (b)(iii). Could be opposite argument if ans < 4.5%</i> OR molar mass of NaClO = 23 + 16 + 35.5 = 74.5 (g mol ⁻¹) ✓ moles of NaOCl = 4.5/74.5 = 0.0604 mol (in 100 cm ³) ✓ bleach is 10 × 0.0604 = 0.604 mol dm ⁻³ which is less than answer to (b)(iii) and therefore label is correct. ✓ <i>response depends upon answer to (b)(iii). Could be opposite argument if ans 0.604</i>	[3]
(d)	2HCl + NaClO → Cl ₂ + NaCl + H ₂ O ✓✓ Award one mark for: HCl + NaClO → Cl ₂ + NaOH	[2]
		Total: 10

Question	Expected Answers	Marks
4 (a) (i)	Answer is inclusive of 9 – 14 inclusive ✓	[1]
(ii)	Ca(s): $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ ✓	[2]
	Ca(OH) ₂ (aq): $1s^2 2s^2 2p^6 3s^2 3p^6$ ✓	
(b) (i)	Identity of precipitate A: calcium carbonate / CaCO ₃ ✓	[2]
	Equation: $\text{Ca(OH)}_2 + \text{CO}_2 \longrightarrow \text{CaCO}_3 + \text{H}_2\text{O}$ ✓ <i>equation alone would score 2 marks unless contradicted by identity</i>	
(ii)	Formula of solution B: Ca(HCO ₃) ₂ ✓	
	Equation: $\text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2 \longrightarrow \text{Ca(HCO}_3)_2$ ✓ <i>equation alone would score 2 marks unless contradicted by identity</i>	[2]
(iii)	CaCl ₂ ✓	[1]
(c)	barium atoms are larger ✓ barium atoms have more shielding ✓ this outweighs the increase in nuclear charge ✓ barium electrons are lost more easily /less energy required /ionisation energy decreases ✓	[4]
		Total: 12

Question	Expected Answers	Marks
5 (a)	<p>H₂O H bonding from O of 1 molecule to H of another ✓ dipoles shown or described ✓ with lone pair of O involved in the bond ✓</p> <p>CH₄ van der Waals' forces from oscillating dipoles/ temporary dipoles/ transient dipoles/ instantaneous dipoles ✓</p> <p>leading to induced dipoles ✓ caused by uneven distribution of electrons ✓</p>	<p>[3]</p> <p>[3]</p> <p>sub-total: 6</p>
(b)	<p>Two properties from: Ice is less dense/lighter than water/floats on water/ max density at 4°C ✓ <i>explanation:</i> H bonds hold H₂O molecules apart / open lattice in ice / H-bonds are longer ✓</p> <p>Higher melting/boiling point than expected ✓ <i>Not just high</i> Accept: '<i>unusually high/strangely high/relatively high</i>' <i>explanation:</i> H bonds need to be broken ✓ <i>must imply that intermolecular bonds are broken</i></p> <p>High surface tension ✓ <i>explanation</i> strength of H bonds across surface ✓</p>	<p>[2]</p> <p>[2]</p> <p>[2]</p> <p>mark 2 properties only → 4 max</p>
	<p>QoWC over whole question – legible text with accurate spelling, punctuation and grammar ✓</p>	<p>[1]</p>
		<p>Total: 11</p>