RECOGNISING ACHIEVEMENT

Subject: Foundation Chemistry Code: 2811

Session: June Year: 2004

Final Mark Scheme

MAXIMUM MARK	60

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.
   You are advised to destroy all draft versions.

2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks (½) should never be used.

3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.

   x = incorrect response (errors may also be underlined)
   ^ = omission mark
   bod = benefit of the doubt (where professional judgement has been used)
   ecf = error carried forward (in consequential marking)
   con = contradiction (in cases where candidates contradict themselves in the same response)
   sf = error in the number of significant figures

4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.

5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.

6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)

7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit ( ) = words which are not essential to gain credit ____ = (underlining) key words which **must** be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument			
Question	**Expected Answers**			**Marks**
1 (a)	isotope / protons / neutrons / electrons nickel-58 / 28 / 30 / 28 nickel-60 / 28 / 32 / 28 nickel-62 / 28 / 34 / 28 ✓ ✓ ✓ For ecf, 3rd column same as first column.			**[3]**
(b) (i)	mass spectrometry ✓ mass spec… /mass spectrometer should also be credited			**[1]**
(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 ✓ *mass of 1 mole **of atoms** (of an element) mass of 1 mole of carbon-12 is equivalent to first two marks* *"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)*			**[3]**
(iii)	63.0 x 77.2/100 + 65.0 x 22.8/100 / 63.456 ✓ = 63.5 (mark for significant figures) ✓			**[2]**
(iv)	copper/ Cu ✓			**[1]**
(c) (i)	mass of Ni = 2.0 g ✓ moles of Ni = 2.0/58.7 mol = 0.0341/0.034 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			**[2]**
(ii)	number of atoms of Ni = $6.02 \times 10^{23} \times 0.0341$ = 2.05×10^{22} / 2.1×10^{22} 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)			**[1]**
				Total: 13

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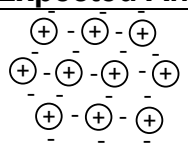
Question	**Expected Answers**	**Marks**
2 (a) (i)	 positive ions/cations ✓ and negative electrons ✓ Can be described in words only for both marks	**[2]**
(ii)	contain free/mobile/delocalised electrons ✓	**[1]**
(b) (i)	shared **pair of** ✓electrons ✓ *i.e. 'shared electrons' is worth 1 mark. pair of electrons for second marks*	**[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)	$Mg \longrightarrow Mg^{2+} + 2e^-$ ✓ $F_2 + 2e^- \longrightarrow 2F^-$ ✓ *– sign not required with electron*	**[2]**
(iv)	solid: ions cannot move /in fixed positions in lattice ✓ solution: ions are free to move ✓	**[2]**
		Total: 14

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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 x 10^{-3} mol ✓	**[1]**
(ii)	3.5 x 10^{-3} mol ✓ *ans to (i)*	**[1]**
(iii)	3.5 x 10^{-3} x 1000/5 = 0.70 mol dm^{-3} ✓ *ans to (ii) x 1000/5*	**[1]**
(c)	molar mass of NaClO = 23 + 16 + 35.5 = 74.5 (g mol^{-1}) ✓ concentration = 0.70 x 74.5 = 52.15 g (dm^{-3}) ✓ *ans to (iii) x 74.5* bleach is 5.215 g per 100 cm^3 and the information is correct (as this value exceeds 4.5%) ✓ *response depends upon answer to (b)(iii). Could be opposite argument if ans < 4.5%* *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 x 0.0604 = 0.604 mol dm^{-3} which is less than answer to (b)(iii) and therefore label is correct. ✓ *response depends upon answer to (b)(iii). Could be opposite argument if ans 0.604*	**[3]**
(d)	$2HCl + NaClO \longrightarrow Cl_2 + NaCl + H_2O$ ✓✓ *Award one mark for:* $HCl + NaClO \longrightarrow Cl_2 + NaOH$	**[2]**
		Total: 10

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Question	**Expected Answers**	**Marks**
4 (a) (i)	Answer is inclusive of 9 – 14 inclusive ✓	**[1]**
(ii)	Ca(s): $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ ✓ $Ca(OH)_2(aq)$: $1s^2 2s^2 2p^6 3s^2 3p^6$ ✓	**[2]**
(b) (i)	Identity of precipitate A: calcium carbonate / $CaCO_3$ ✓ Equation: $Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$ ✓ *equation alone would score 2 marks unless contradicted by identity*	**[2]**
(ii)	Formula of solution B: $Ca(HCO_3)_2$ ✓ Equation: $CaCO_3 + H_2O + CO_2 \longrightarrow Ca(HCO_3)_2$ ✓ *equation alone would score 2 marks unless contradicted by identity*	**[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

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Question	**Expected Answers**	**Marks**
5 (a)	H_2O H bonding from O of 1 molecule to H of another ✓ dipoles shown or described ✓ with lone pair of O involved in the bond ✓ CH_4 van der Waals' forces from oscillating dipoles/ temporary dipoles/ transient dipoles/ instantaneous dipoles ✓ leading to induced dipoles ✓ caused by uneven distribution of electrons ✓	**[3]** **[3]** **sub-total: 6**
(b)	Two properties from: Ice is less dense/lighter than water/floats on water/ max density at 4°C ✓ *explanation:* H bonds hold H_2O molecules apart / open lattice in ice / H-bonds are longer ✓ Higher melting/boiling point than expected ✓ *Not just high* *Accept: 'unusually high/strangely high/relatively high'* *explanation*: H bonds need to be broken ✓ *must imply that intermolecular bonds are broken* High surface tension ✓ *explanation* strength of H bonds across surface ✓	**[2]** **[2]** **[2]** **mark 2 properties only ⟶ 4 max**
	QoWC over whole question – legible text with accurate spelling, punctuation and grammar ✓	**[1]**
		Total: 11