

Subject: CHEMISTRY (SALTERS) Code: 2849

Session: January Year: 2006

Mark Scheme

MAXIMUM MARK

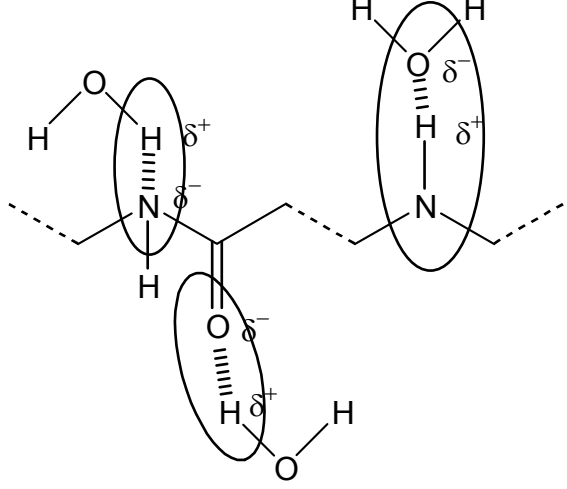
90

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

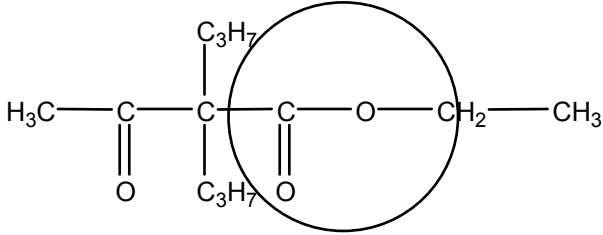
1. Please ensure that you use the **final** version of the Mark Scheme.
You are advised to destroy all draft versions.
2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point 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 ($\frac{1}{2}$) 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.

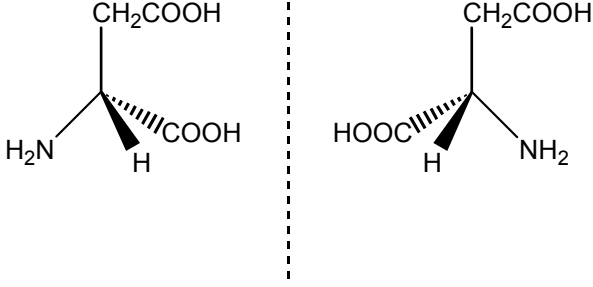
Mark Scheme	Unit Code	Session	Year	Version
<i>Abbreviations, annotations and conventions used in the Mark Scheme</i>	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit () = words which are not essential to gain credit <u> </u> = (underlining) key words which must be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument			

Mark Scheme Pages 1 of 7	Unit Code 2849	Session Jan	Year 2006	FINAL
Question	Expected answers			Marks
1 (a)	Improve properties / demand greater than nature can supply / reduce cost (1).			1
1 (b)	$\begin{array}{c} \text{H} & & \text{O} \\ & & \\ \text{H}-\text{N} & -(\text{CH}_2)_5- & \text{C}-\text{OH} \end{array}$ -COOH <i>allow</i> -COCl (1); -NH ₂ (1) ONE of the groups must have the (CH ₂) ₅ for the second mark.			2
1 (c) (i)	1,4-diaminobutane diaminobutane <i>allow butyl/butan(e)diamine</i> (1); 1,4 (1). <i>ecf</i> , 1,6-diaminohexane for 1 mark			2
1 (c) (ii)	Any two from the following four points: lower <i>T_g</i> / <i>T_m</i> / strength/ rigidity <i>ora</i> (2). NOT b.p. nor density.			2
1 (d) (i)	3 x 10 ⁴ / 198 (1); 150–152 (1) <i>ecf for M_r</i> .			2
1 (d) (ii)	(Secondary) amide (1) NOT peptide.			1
1 (d) (iii)	There will be greater number of hydrogen bonds (1); between chains (1); greater energy needed (to enable chains to move/flow) (1).			3
1 (e) (i)	$^+\text{H}_3\text{N}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{NH}_3^+$ <i>may not be skeletal</i> (1); $\text{HO}-\text{C}(=\text{O})-(\text{CH}_2)_4-\text{C}(=\text{O})-\text{OH}$ (1). <i>ecf for C chain from (b)</i> .			2
1 (e) (ii)	 Any one of the three atom arrangements above (1); Correct partial charges (1).			2
Total mark				17

Mark Scheme Page 2 of 7	Unit Code 2849	Session Jan	Year 2006	FINAL												
Question	Expected answers			Marks												
2 (a) (i)	+5 (1) <i>accept</i> 5+.			1												
2 (a) (ii)	hydrogen electrode (1); detailed drawing not required but should have H ₂ gas and H ⁺ (aq). a half cell made from Pt (or C) dipping into a solution VO ₂ ⁺ and VO ²⁺ ions (1); conditions given as 1 mol dm ⁻³ /1M concentrations, 1 atmosphere pressure and 298 K (1); salt bridge dipping in solutions(1); voltmeter correctly connected (1).			5												
2 (b) (i)	0.74 V (1).			1												
2 (b) (ii)	B <i>V</i> ²⁺ / <i>V</i> ³⁺ (<i>may give more detail of half-cells</i>) because it has the more negative/less positive electrode potential AW in terms of reducing agent/oxidizing agent or electron transfer (1).			1												
2 (c) (i)	$V^{3+} + e^{-} \rightleftharpoons V^{2+}$ (1).			1												
2 (c) (ii)	$V^{2+} + VO_2^{+} + 2H^{+} \rightarrow V^{3+} + VO^{2+} + H_2O$ Correct vanadium species in both reactants and products (1); equation given balanced correctly (1).			2												
2 (d) (i)	$\left[\begin{array}{c} \text{OH}_2 \\ \text{H}_2\text{O} \diagdown \quad \diagup \text{OH}_2 \\ \text{V} \\ \text{H}_2\text{O} \diagup \quad \diagdown \text{OH}_2 \\ \text{OH}_2 \end{array} \right]^{3+}$ <p>Octahedral arrangement of ligands (1); O in H₂O bonded to V for all ligands (1). <i>Ignore charge on ion.</i></p>			2												
2 (d) (ii)	<p style="text-align: center;">3d 4s</p> <p>v <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>↑</td><td>↑</td><td>↑</td><td> </td><td> </td></tr></table> <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>↑↓</td></tr></table></p> <p>v³⁺ <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>↑</td><td>↑</td><td> </td><td> </td><td> </td></tr></table> <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td></tr></table></p> <p>Correct arrangement for V (1); correct arrangement for V³⁺ (1).</p>			↑	↑	↑			↑↓	↑	↑					2
↑	↑	↑														
↑↓																
↑	↑															
2 (d) (iii)	Ligands cause/interact with d orbital/energy levels AW (1); to split into two groups / $E = h\nu$ or in words (1); visible light/frequencies absorbed to excite electrons (1); rest of visible light transmitted as colour AW (1).			4												
Total mark				19												

Mark Scheme Page 3 of 7	Unit Code 2849	Session Jan	Year 2006	FINAL															
Question	Expected answers			Marks															
3 (a)	2-propylpentanoic acid <i>pentanoic acid</i> (1) <i>2-propyl</i> (1) <i>allow</i> 2-propan(e) or propyl-2- <i>l</i> ; <i>Dipropylethanoic/dipropanethanoic acid gains 1 mark.</i>			2															
3 (b)	 <p><i>Allow if only COO/both attached C atoms is/are circled.</i></p>			1															
3 (c) (i)	Prevent loss of product D /volatile reactants/gases (1).			1															
3 (c) (ii)	(Fractional) distillation (1).			1															
3 (c) (iii)	Add dilute hydrochloric/sulphuric/ acid (1). NOT conc.			1															
3 (c) (iv)	(Potassium) ethanoate/ CH ₃ COO ⁻ (K ⁺) (1).			1															
3 (d)	C ₂ H ₅ OH (1); Any two from three : relative molar mass = 46 (1); since peak furthest right is due to molecular ion(<i>may be shown on diagram</i>) (1); any one use of fragmentation pattern e.g. peak at 29, due to ethyl group /difference between peaks at 29 and 45 = 16, suggests O present (1).			3															
3 (e)	<table border="1"> <thead> <tr> <th>chemical shift from spectrum</th> <th>type of proton</th> <th>relative intensity</th> </tr> </thead> <tbody> <tr> <td>1.0</td> <td>CH₃</td> <td>9</td> </tr> <tr> <td>1.4</td> <td>CH₂</td> <td>8</td> </tr> <tr> <td>2.2</td> <td>O=CCH₃</td> <td>3</td> </tr> <tr> <td>3.7</td> <td>CH₂OC=O/ CH₃OC=O</td> <td>2</td> </tr> </tbody> </table>	chemical shift from spectrum	type of proton	relative intensity	1.0	CH ₃	9	1.4	CH ₂	8	2.2	O=CCH ₃	3	3.7	CH ₂ OC=O/ CH ₃ OC=O	2			3
chemical shift from spectrum	type of proton	relative intensity																	
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	two types of proton correctly identified (1); all four correct gains second mark (1); correct relative intensities (1).																		
3 (f)	(Broad) peak around 2500-3200 cm ⁻¹ (1) indicates OH (in carboxylic acid) (1); (Strong) peak around 1700-1725 cm ⁻¹ (1) indicates C=O (in carboxylic acid) (1).			4															

3 (g)	<p><i>Any two of the following points:</i></p> <p>Solids are easier to administer; taste/smell reduced; not acidic; not corrosive; easier to make sure correct dosage, more soluble in water <i>(1 mark for each point).</i></p>	2
Total mark		19

Mark Scheme Page 5 of 7	Unit Code 2849	Session Jan	Year 2006	FINAL
Question	Expected answers			Marks
4 (a) (i)	Stereoisomerism/optical (isomerism) (1).			1
4 (a) (ii)	<p>(Molecule has) an asymmetric carbon atom / chiral centre / carbon bonded to 4 different atoms/groups / mirror image is non-superimposable (1);</p>  <p>Correct 3D structural formula for one enantiomer(1); mirror image (1).</p>			3
4 (b) (i)	<p>850 ± 25 (1) years for 1st reading; 850 ± 25 years for 2nd reading & 3rd reading not greater than 925 (1) <i>units need to be present for at least one of the readings to gain both marks;</i> suitable construction on graph to show calculation of half-life (1).</p>			3
4 (b) (ii)	Half-life is constant (1).			1
4 (b) (iii)	<p>Rate = k x [L-aspartic acid]; [L-aspartic acid] (1); Rate = k (1).</p>			2
4 (b) (iv)	s ⁻¹ /yr ⁻¹ /time ⁻¹ (1).			1
4 (b) (v)	k is the rate of reaction (1).			1
4 (c)	Zwitterion (1).			1
4 (d) (i)	$K_c = \frac{[\text{ion F}] \cdot [\text{H}^+]}{[\text{ion E}]}$ 'ion' not necessary for mark (1).			1
4 (d) (ii)	<p>[H⁺]² = 1.38 x 10⁻⁴ x 0.50 (1); [H⁺] = 8.30 or 8.31 x 10⁻³ mol dm⁻³ (1); 2 or 3 sig figs (1).</p>			3

4 (e)	<p>Order/sequence of amino acids (in protein chain) (1); shape taken up by protein chain e.g. folding of chains AW (1);</p> <p>the (extra) COOH/COO⁻ in aspartic acid (1) ; forms/increases the hydrogen bonding/ ion- dipole forces/interactions with water (molecules) (1);</p> <p>charged groups on side/R groups of substrates (may give example -NH₃⁺ / COO⁻ groups) (1); can attract charged groups/(may give example -NH₃⁺ / COO⁻ groups) in the active sites/AW of enzymes (1). <i>Accept polar side chains for charged groups but 1 mark not 2.</i></p> <p>QWC <i>See separate sheet (1).</i></p>	7
Total mark		24

Mark Scheme Page 7 of 7		Unit Code 2849	Session Jan	Year 2006	FINAL
Question	Expected answers				Marks
5 (a)	Any answer relating to railway tracks, points, frogs etc.(1).				1
5 (b) (i)	To remove sulphur (1).				1
5 (b) (ii)	Blowing oxygen through (1); turns the carbon to carbon dioxide <i>accept</i> carbon monoxide (1).				2
5 (c) (i)	Acidic (oxide) (1).				1
5 (c) (ii)	$6\text{CaO} + \text{P}_4\text{O}_{10} \rightarrow 2\text{Ca}_3(\text{PO}_4)_2$ correct formula for P_4O_{10} / P_2O_5 (1); correct formula for CaO rest correct (1).				3
5 (c) (iii)	Correct amount of P added later AW (1).				1
5 (d)	To remove (dissolved) oxygen (1).				1
5 (e)	Analysing mixtures of steels/ sorting out different steels/ removing non steel materials/rust from the scrap/cleaning steel/contains unwanted elements (1).				1
Total mark					11