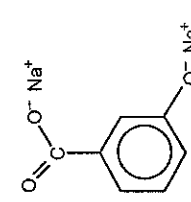
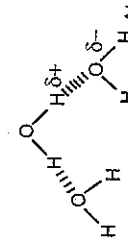

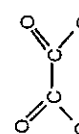
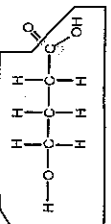


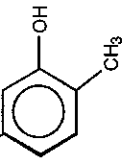
**Mark Scheme 2854  
June 2005**

Abbreviations, annotations and conventions used in the Mark Scheme		Unit Code 2854			Version Final
Mark Scheme Page 1 of 5	Year 2005	Session June	Year 2005	Version Final	
1 a i	0 (1); -3 (1) NOT 3-				2
1 a ii	gain of electrons/ oxidation state (of nitrogen) goes down (1) Mark separately from 1 a i IGNORE "gains hydrogen".				1
1 a iii	$\left[ \begin{array}{c} \text{H} \\ \cdot\cdot \\ \cdot\cdot \\ \text{H} \end{array} \right]^+$ allow four pairs however displayed. detail inside brackets (1); plus charge shown somewhere (1) Mark separately and credit if NH <sub>4</sub> shown Brackets not essential				2
1 b i	A 106 – 110 (1); B 118 – 122 (1)				2
1 b ii	CO(NH <sub>2</sub> ) <sub>2</sub> + H <sub>2</sub> O → CO <sub>2</sub> + 2NH <sub>3</sub> / CO(NH <sub>2</sub> ) <sub>2</sub> + H <sub>2</sub> O → H <sub>2</sub> NCOOH + NH <sub>3</sub> right-hand side (1); left hand side (1)				2
1 c i	rate constant				1
1 c ii	increases				1
1 d	acidic (1); nitrogen on right of Periodic Table (AW)/in p-block/ non-metal/ Group V(1) Second mark depends on first.				2
1 e i	phenol				1
1 e ii	$\text{O}=\text{C}-\text{O}^- \text{Na}^+$  salt formed with COOH and with phenol (1) O <sup>-</sup> Na <sup>+</sup> shown at least once (1) NOT with covalent bond Wrong isomer scores max. (1)				2
					16

2 a	M <sub>r</sub> methanol 32 (1); M <sub>r</sub> ethanediol 62 (1) (1) if A <sub>r</sub> values correct but not added, max (1) masses 256(g), 496(g) (subsumes previous marks) (can be rounded to 1 or 2 sf)/ ratio stated of 1:2 or close(1) (Accept 1:2)	3
2 b	 At least two hydrogen bonds between H and O in two different molecules (1); Correct delta+ and delta- across one hydrogen bond (1); at least two O-H-O straight (1);	4
2 c i		1
2 c ii	oxidation/ redox	1
2 c iii	NaBH <sub>4</sub> allow sodium tetrahydridoborate(II)	1
2 d	 H-O-C=O One COOH group as part of a molecule (1); Completely correct (1); Allow OH but not ambiguous attachments	2
2 e i	$K_{sp} = [\text{Ca}^{2+}][\text{C}_2\text{O}_4^{2-}]$ one. $K_{sp} = [\text{Ca}^{2+}][\text{C}_2\text{H}_2\text{O}_4^{2-}]$ scores (1)	2
2 e ii	$[\text{Ca}^{2+}] = [\text{C}_2\text{O}_4^{2-}]$ stated or implied (1); $[\text{Ca}^{2+}] = \sqrt{K_{sp}}$ (1); $[\text{Ca}^{2+}] = 4.8 \times 10^{-5}$ (1) Five from: A gas, liquid, solid; B instantaneous dipole (- induced dipole)/i.d.-i.d./Van der Waals forces in ethane/ ethane non-polar; C hydrogen bonding in ethanediol/ethanedioic acid; D more/stronger hydrogen bonding in ethanedioic acid; ignore attempts to quantify E diagram of this; F relative strengths of imfs; G stronger imf mean higher mp/bpt (ora)	3
2 f		5
		22

Question	Expected Answers	Marks
3 a i	alcohol/hydroxyl(1); carboxylic acid/ carboxyl(1) NOT carboxy	2
3 a ii	4 - hydroxy (1); butanoic acid (1) ignore commas, dashes, spaces. ALLOW other material between but-anoic or butan-oiс	2
3 b i	ester/lactone	1
3 b ii	hydrolysis	1
3 c i		1
3 c ii	-OH groups (1); hydrogen bond (1) indication that both groups have same shape/fit receptor site	3
3 c iii	computer (modelling)/ molecular modelling	1
3 c iv	(potassium/sodium) dichromate (1); (sulphuric) acid (1); or correct formulae (heat under) reflux, if any other marks scored (1)	3
3 d	Infrared: C=O (1); and no O-H/identify C=O as ester (1); therefore GBL (1) ALLOW GHB/GBH as conclusion IF first mark scored and O-H (incorrectly) identified ALLOW nmr marks as follows for any of these by ecf GBL GHB GHB alcohol idea of different environments having different shifts (1) allow for other substances idea of heights or areas in ratio. (as right or justified) allow 1H, 2H etc. 1:1:1 1:2:2:2:1 or 1:6:1 Correct shifts (± 0.2) 1.4, 3.7, 2.49-1.5, 3.6, 1.4, 2.4, 0.5-4.50.5-4.5, 3.6, 1.4 QWC logical, three terms from list used correctly (2) two terms from list used correctly (1) absorption/absorbance, wavenumber/cm <sup>-1</sup> , bond, proton (NOT in "proton nmr"), environment, shift, peak, (relative) intensity (nmr context)	6
3 e i	HA ⇌ H <sup>+</sup> + A <sup>-</sup> (or reaction with water forming H <sub>3</sub> O <sup>+</sup> ) products (1); equilibrium (1) mark separately	2
3 e ii	[H <sup>+</sup> ][A <sup>-</sup> ]/[HA] (2) wrong way up or no square brackets scores (1)	2
3 e iii	[H <sup>+</sup> ] = 1.26 x 10 <sup>-3</sup> mol dm <sup>-3</sup> stated or implied, units not essential (1); allow rounded to 1.3 [A <sup>-</sup> ] = [H <sup>+</sup> ] stated or implied (1); K <sub>a</sub> = (1.26 x 10 <sup>-3</sup> ) <sup>2</sup> /10 <sup>-1</sup> = 1.59/1.58/ 1.6/1.69 (rounded) x 10 <sup>-5</sup> (1); mol dm <sup>-3</sup> mark separately (1) ALLOW ecf on K <sub>a</sub> if it is less than 0.1	4
3 f i	minimises/ resists change in (allow maintains) pH/pH stays approximately constant (1); when small amounts (1) of acid and alkali added (1) need to maintain pH in the body (1); e.g. for enzyme reactions/blood (1) QWC: Two sentences; spelling, punctuation and grammar correct (1 error allowed)(1)	5 1

3 f ii	[HA] = [A <sup>-</sup> ] Thus [H <sup>+</sup> ] = K <sub>a</sub> (1) pH = -lg 1.59 x 10 <sup>-5</sup> = 4.8 (1) ignore sf. K <sub>a</sub> = 1 x 10 <sup>-5</sup> gives 5.0 as pH. ecf from K <sub>a</sub> < 0.1 in 3eii	2
4 a	fertilizers/ to make explosives/nitric acid/azo dyes	1
4 b	nitrogen ALLOW N <sub>2</sub> but NOT N	1
4 c i	p <sub>CO</sub> p <sub>H<sub>2</sub></sub> /p <sub>CH<sub>4</sub></sub> p <sub>H<sub>2</sub>O</sub> (2); all correct except for ONE of the following, scores (1) • hydrogen not cubed • concentrations shown ALLOW square brackets with "p". • wrong way up NO CREDIT if + signs	2
4 c ii	p <sub>CO</sub> = K <sub>p</sub> p <sub>CH<sub>4</sub></sub> p <sub>H<sub>2</sub>O</sub> /p <sub>H<sub>2</sub></sub> <sup>3</sup> (1) stated or implied p <sub>CO</sub> = 4.22 atm (1); 3 sf mark separately provided some working if answer incorrect(1) ALLOW ecf from wrong expression in 4c(i) or first marking point.	3
4 d i	more (gas) molecules on right-hand side (1); decreasing pressure moves equilibrium (position) in direction of more molecules/to increase pressure(1); ALLOW "moves to right" IF first marking point scored. more hydrogen produced (1)	3
4 d ii	speed up reaction/ get flow through plant/compromise or optimum between speed and yield (1)	1
4 e i	CO + H <sub>2</sub> O → CO <sub>2</sub> + H <sub>2</sub> left-hand side (1); right hand side (1) equim or arrow two from: toxic /poisonous/harmful to life; causes photochemical smog can be burnt as a fuel; makes CO <sub>2</sub> /H <sub>2</sub> which are useful; NOT greenhouse gas	2
4 e ii	positive must be present to score, but only scores if qualified by at least one of: more ways of arranging/more disorder (1); more molecules on right (1); products - reactants (1); (198 + 393) - (186 + 189) = 591 - 375 3 x 131 (1); correct answer (+216) or other correctly worked out answer with sign(1)	3
4 f i	positive must be present to score, but only scores if qualified by at least one of: more ways of arranging/more disorder (1); more molecules on right (1); products - reactants (1); (198 + 393) - (186 + 189) = 591 - 375 3 x 131 (1); correct answer (+216) or other correctly worked out answer with sign(1)	3

5 a	C, 19 (1); H, 16 (1)	2
5 b	reflects/does not absorb/ transmits (NOT emits) yellow (1); absorbs all other/complementary colours/wavelengths (1) "reflects only yellow" scores both.	2
5 c i	(electrons are) not associated with one bond/pair of atoms (1); spread over several atoms NOT whole molecule(1)	2
5 c ii	(all) benzene rings (1); N=N (1); (O atoms of) -OH (1) AW in all parts.	3
5 c iii	lower excitation energy (NOT "easier to excite")/ first energy level lower (1); $E = hv$ /frequency decreases with decreasing distance between energy levels (ora)(1)	2
5 d i	CH <sub>3</sub> Cl (1); AlCl <sub>3</sub> (1); anhydrous/reflux (1) formulae must be correct. Names permitted. Award last only if some other mark scored.	3
5 d ii	H (on a benzene ring) (1); is replaced/substituted by CH <sub>3</sub> (1) mark separately	2
5 d iii	electrophilic	1
5 e i	diazonium (salt)	1
5 e ii	HO  OH nothing on crucial carbon (1); rest of structure (1) depends on first allow sodium salt	2
5 f	four from hydrogen bonding in connection with cotton; dye cannot break cotton-water bonds/water breaks dye-cotton bonds; permanent dipole-permanent dipole in connection with polyester; instantaneous dipole-induced dipole in dye; imf of polyester and dye match better/more imf between dye and polyester (AW)(1)	4
		24