



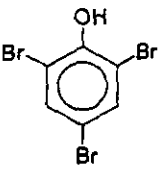
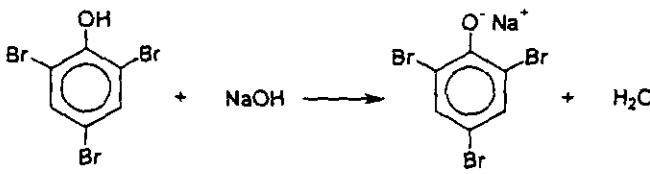
CHAINS, RINGS

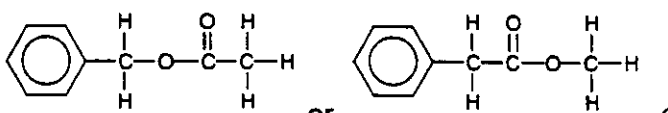
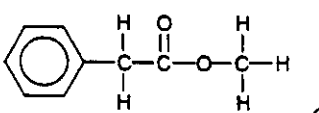
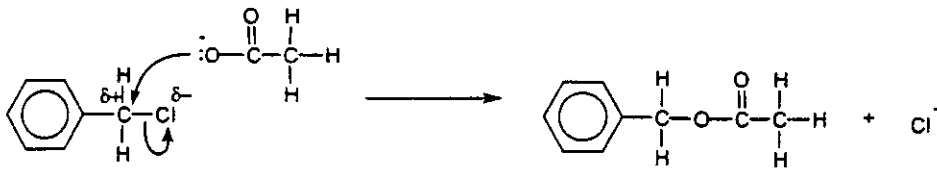
+ SPECTROSCOPY

Mark Scheme 2814

June 2002

Qu.	Expected answers:	Marks
1 (a)	propanone ✓ $\begin{array}{c} \text{H} \quad \text{O} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$ ✓	[2]
(b) (i)	propan-2-ol ✓ $\begin{array}{c} \text{H} \quad \text{OH} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$ ✓	[2]
(ii)	NaBH_4 ✓	[1]
(iii)	$\text{C}_3\text{H}_6\text{O} + 2[\text{H}] \longrightarrow \text{C}_3\text{H}_8\text{O} / \text{C}_3\text{H}_7\text{OH}$ ✓	[1]
(c)	2,4-dinitrophenylhydrazine ✓ yellow / orange/red ... crystals / solid / ppt. etc ✓ (re)crystallise / purify ✓ measure melting point/m.p. (of product) ✓ compare with known compounds ✓	max [4]
ANY 4 out of 5		[Total: 10]

Qu.	Expected answers:	Marks
2 (a) (i)	$\text{C}_6\text{H}_6 + \text{Br}_2 \longrightarrow \text{C}_6\text{H}_5\text{Br} + \text{HBr}$ organic product ✓ rest of the equation also correct ✓	[2]
(ii)	FeBr_3 / AlBr_3 / iron(III)bromide / aluminium bromide	[1]
(b) (i)	 ✓✓	[2]
(ii)	 organic product ✓ (allow ecf from (i) but must be a ring with OH) rest of the equation <u>also</u> correct ✓	[2]
(iii)	(benzene) ring is <u>activated</u> ✓ lone pair on oxygen is delocalised / interacts with the π electrons ✓ more (π) electron density (around ring) ✓ attracts bromine / electrophiles more / polarises Br_2 molecule more ✓	ANY 3 marks from 4 max [3]
(iv)	antiseptics / disinfectants	[1]
		[Total: 11]

Qu.	Expected answers:	Marks
3 (a) (i)	NaOH / KOH / OH ⁻ / H ₂ O ✓	[1]
(ii)	nucleophilic ✓ substitution ✓	[2]
(iii)	$\text{C}_6\text{H}_5\text{CH}_2\text{Cl} + \text{NaOH} \longrightarrow \text{C}_6\text{H}_5\text{CH}_2\text{OH} + \text{NaCl}$ $/ \text{OH}^- \longrightarrow \text{Cl}^-$ if water in (i), then: $\text{H}_2\text{O} \longrightarrow \text{HCl}$	[1]
(b) (i)	allow either  or 	[1]
(ii)	$\text{C}_6\text{H}_5\text{CH}_2\text{OH} + \text{CH}_3\text{COOH} \longrightarrow \text{CH}_3\text{COOCH}_2\text{C}_6\text{H}_5 + \text{H}_2\text{O} \checkmark$ allow $\text{C}_6\text{H}_5\text{CH}_2\text{COOCH}_3$ as the ester	[1]
(iii)	perfumes / flavourings / solvents ✓	[1]
(iv)	suggested mechanisms could be S _N 1 or S _N 2 type (such as the example shown below)	
		
	look for diagram or words describing: nucleophilic ✓ substitution / ester + Cl ⁻ as products ✓ dipole on C-Cl bond ✓ curly arrow from COO ⁻ to C ✓ curly arrow from bond to Cl ✓	
	ANY 3 out of 5	max [3]
	(allow anything reasonable producing $\text{C}_6\text{H}_5\text{CH}_2\text{COOCH}_3$)	
		[Total: 10]

Qu.	Expected answers:	Marks
4	<p>(at a temperature) $< 10^\circ$ ✓</p> <p>(reagent is) nitrous acid / HNO_2 ✓</p> <p>(made by) sodium nitrite / NaNO_2 ... ✓</p> <p>... (with) hydrochloric acid / HCl ✓</p> <p>... (to give diazonium salt with formula) eg $\text{C}_6\text{H}_5\text{N}_2^+$ / $\text{C}_6\text{H}_5\text{N}_2\text{Cl}$ / $\text{C}_6\text{H}_5\text{N}^+\equiv\text{N Cl}$ ✓</p> <p>balanced equation - e.g. $\text{C}_6\text{H}_5\text{NH}_2 + \text{HNO}_2 + \text{H}^+ \longrightarrow \text{C}_6\text{H}_5\text{N}_2^+ + 2\text{H}_2\text{O}$ ✓</p> <p>(any of the other marks above may be awarded if they appear in an equation)</p> <p style="text-align: center;">MAX 4 from these 5</p> <p>(used to form) dyes / colourings / coloured compounds ✓</p>	<p>[1]</p> <p>max [4]</p> <p>[1]</p>
[Total: 6]		

Qu.	Expected answers:	Marks
5 (a) (i)		[1]
(ii)	CH ₂ ✓	[1]
(iii)		[1]
(b) (i)	peptide / amide ✓	[1]
		[1]
(ii)	condensation ✓	[1]
(iii)		[1]
		[1]
5 (b) (iv)	M_r glycine, C ₂ H ₅ NO ₂ = 75.(0) ✓ M_r C ₄ H ₈ N ₂ O ₃ = 132.(0) ✓	[2]
	use of 2:1 ratio to give 0.009333mol of dipeptide <i>H</i> expected / ecf ✓	(or use of 2:1 ratio to give mass ratio of 150:132 / ecf)
	answer in the range 89.2 - 89.4 with 3 sf / ecf ✓ (correct answer gets all 4 marks)	(answer in the range 44.6 - 44.7 (no 2:1) with 3 sf gets 3 marks overall)
(v)		[2]
	$H_3N^+CH_2COOH$ Cl ⁻ / NH ₃ ⁺ group ✓ rest of the molecule and Cl ⁻ ✓	[2]

[Total: 14]

Qu.	Expected answers:	Marks
6 (a) (i)	C_7H_8O ✓	[1]
(ii)	$M_r = 108$ so m/e of molecular ion = 108 / ecf from (i) ✓	[1]
(iii)	$\%C = (84.0)/(108) \times 100\% = 77.8\%$ ✓ $\%H = (8.0)/(108) \times 100\% = 7.4\%$ ✓ / ecf from (i) or (ii)	[2]
(b)	K has OH group ✓ K has peak at 3230 - 3550 cm^{-1} ✓ L does not have OH group / peak at 3230 - 3550 cm^{-1} ✓	(ignore reference to any other bonds) [3]
(c) (i)	peak at $\delta = 7.3ppm$ / with area 5, is due to the benzene ring (protons) ✓ peak at $\delta = 4.5ppm$ / with area 2, is due to the $-CH_2-$ (protons) ✓ peak at $\delta = 3.2ppm$ / with area 1, is due to the OH (proton) ✓	[3]
(ii)	peak at $\delta = 3.2ppm$ / with area 1 disappears / ecf from (i) ✓	[1]
(iii)	expect peak at $\delta = 7.1-7.7 ppm$ ✓ 5 protons responsible / area = 5 ✓ expect peak at $\delta = 3.3-4.3ppm$ ✓ 3 protons responsible / area = 3 ✓	[4]
		[Total: 15]

Qu.	Expected answers:	Marks
7 (a)	CH ₃ CH ₂ COOH ✓	[1]
(b)	C ₆ H ₅ NO ₂ ✓	[1]
(c)	CH ₃ Cl / CH ₃ Br ✓ AlCl ₃ / FeCl ₃ / FeBr ₃ etc ✓	[2]
(d)	C ₆ H ₅ NH ₃ ⁺ / C ₆ H ₅ NH ₂ ✓	[1]
(e)	CH ₃ COOC ₂ H ₅ ✓	[1]
(f) (i)	(CH ₃) ₂ C(OH)CN etc ✓	[1]
(ii)	nucleophilic addition ✓	
	Look for the following in a diagram as above or description: (dipoles not required)	
	CN ⁻ /nucleophile attacks (δ) ⁺ carbonyl C / curly arrow from CN ⁻ to carbonyl C ✓	
	(curly arrow) breaking C=O ✓	
	correct structure of the intermediate ✓	
	curly arrow from O ⁻ to HCN / H ₂ O ✓	
	ANY 5 out of the 6 marks above	
	(curly arrows must be clearly from and to the correct bond / atom to gain the mark)	
		max [5]
		[Total: 12]

Qu.	Expected answers:	Marks
8	<p>(structural isomerism is) same molecular formula, different structural formulae ✓</p> <p>two correct structures of suitable example ✓</p> <p>stereoisomerism (is same structural) formula /order of bonds, different spatial arrangements of the atoms ✓</p> <p>(cis-trans / geometric isomerism is due to) non-rotation around a C=C double bond ✓</p> <p>two correct structures of suitable example ✓</p> <p>(optical isomerism is when) molecules are non-superimposable mirror images / asymmetric / contain a chiral centre ✓ (or polymers may be isotactic, atactic or syndiotactic)</p> <p>carbon atom is attached to four distinguishable / different groups / atoms /(or shown in diagram) ✓ (or polymer side chain on the same, random or alternate sides)</p> <p>two correct 3-d structures of suitable example ✓</p>	
	8 points on isomerism (3 MAX for optical isomerism / polymers)	
	<p>(synthesis of only one stereoisomer of a pharmaceutical is good because ...)</p> <p>... only one of the two stereoisomers may be active /the two isomers may have different activity in the body ✓</p> <p>... a smaller dose needed /saves cost of materials/separation ✓ (ora)</p> <p>... the other may have (harmful) side effects ✓</p> <p>good example of stereospecific drug e.g. Thalidomide / Dopa / Ibuprofen ✓</p>	
	4 points on chiral synthesis	max [10]
	Quality of Written Communication	
	<p>the answer is coherent, and at least two of the specialist terms: structural, cis-trans/geometric and optical isomerism are assigned correctly ✓</p>	
	<p>the text contains at least two legible sentences with reasonably accurate spelling, punctuation and grammar ✓</p>	[2]
		[Total: 12]

