



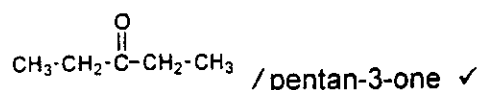
A2 CHAINS,
RINGS + SPECTROSCOPY
Mark Scheme 2814
January 2004

- 1 (a) (i) (relative) molecular mass / M_r ✓ [1]
- (ii) right / highest m/e / highest mass / second highest mass etc ✓ AW [1]
- (b)
-
- [4]
- (c) Tollens' reagent / ammoniacal silver nitrate ✓
 warm / heat ✓
 aldehyde: silver mirror ✓
 ketone: no reaction / change ✓
- allow use of warm acidified $K_2Cr_2O_7$ to give green or Fehlings/ Benedicts to give red ppt [4]
- (d)(i) yellow / orange / red ✓
 precipitate / solid / crystals ✓ [2]
- (ii) measure the melting point (of the solid / ppt) ✓
 (re)crystallise / purify / compare result with known compounds / data book ✓ [2]
- (e)(i) no peak at 9.5 - 10.0 / peak with area 1 ✓ [1]

Qu 1 continued overleaf

Q 1 continued

1 (e) (ii)



1 mark for identifying the correct structure

the peak at 1.1 ...

(is in the range 0.7-1.6 so) is due to CH_3 / R-CH_3 group(s) ✓

is a triplet / 1:2:1 as it is next to a CH_2 / two protons ✓

is due to six protons / two CH_3 (in the same environment) ✓

the peak at 2.4 ...

(is in the range 2.0 – 2.9 so) is due to the CH_2 / $\text{-CO-CH}_2\text{-R}$ group(s) ✓

is a quartet / 1:3:3:1 as it is next to a CH_3 / three protons ✓

is due to four protons / two CH_2 (in the same environment) ✓

the number of peaks ...

(two peaks, so only) two environments / two types of proton / H_a and H_b on structure / each $\text{CH}_3\text{CH}_2\text{-}$ is identical etc ✓

three environments for methylbutanone so would get 3 peaks / H_a , H_b , H_c shown on a structure ✓

four environments for for pentan-2-one so would get 4 peaks / H_a , H_b , H_c , H_d shown on a structure ✓

ANY 5 reasoning marks out of 9

max
[6]

[Total: 21]

- 2 (a) carbonyl / ketone ✓
phenol ✓

[2]

- (b)(i) $C_{14}H_8O_4$
1 for $C_{14}...$ ✓
1 for $...H_8O_4$ ✓

[2]

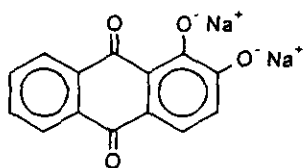
- (ii) moles dissolved = $0.800 \times 0.015 = 0.012$
/ conc in $gdm^{-3} = 0.015 \times 240 = 3.6(g)$ ✓

$$\text{mass dissolved} = 0.0120 \text{ mol} \times 240 / 3.6 \text{ gdm}^{-3} \times 0.800$$

$$= 2.88/2.9(g) \quad \checkmark \quad (\text{or ecf})$$

[2]

- (c)



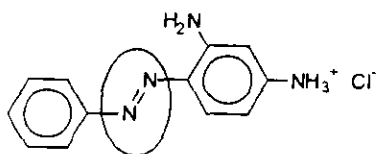
H_2O as product ✓
balanced equation ✓

[3]

- (d) $C=O$ / carbonyl ✓
1680 – 1750 ✓
 $O-H$ / hydroxy(l) ✓
3230 – 3550 ✓

[4]

- (e)

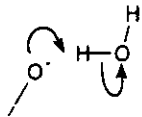


[1]

[Total: 14]

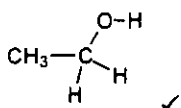
- 3 (a) $\text{CH}_3\text{CHO} + 2[\text{H}] \longrightarrow \text{C}_2\text{H}_5\text{OH}$
where $\text{CH}_3\text{CHO} \longrightarrow \text{C}_2\text{H}_5\text{OH}$ gets ✓
and also $2[\text{H}]$ to give a correct balanced equation ✓

(b)(i)



✓✓ one mark for each curly arrow

(ii)



(iii) electron/lone pair donor

(iv) nucleophile/hydride is attracted to a positive (charge) centre
 δ^+ carbon /area of electron deficiency ✓

(its lone pair of electrons) forms a (covalent/dative) bond ✓

the double/ π electron pair goes to the oxygen atom ... ✓

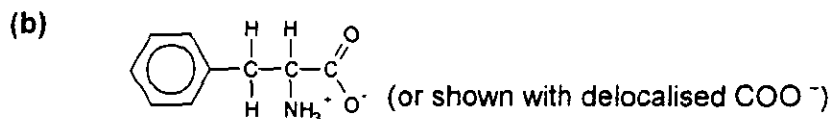
... (causing) the carbonyl/double/ π bond to break ✓

ANY 3 out of 4 marks

(c) hydrogen has no lone pair

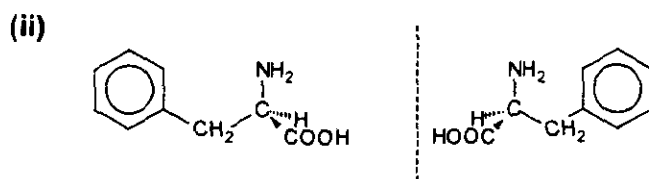
[Total: 10

4 (a) $\text{RCH}(\text{NH}_2)\text{COOH}$ ✓ [1]



either $-\text{NH}_3^+$ or $-\text{COO}^-$ shown in the right place ✓
rest of the structure correct ✓ [2]

(c) (i) optical (isomerism) [1]



(or shown as zwitterion, or with C_7H_7)

at least one structure correctly drawn ✓
a correct mirror image ✓ [2]

(d) difference in position of the NH_2 relative to the COOH ✓
an OH group (in G) ✓
extra carbon / longer chain (in G) ✓
extra chiral centre (in G) ✓

ANY 3 out of 4



(ii) for lengthening the carbon chain / increasing the number of carbon atoms ✓ [1]

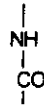
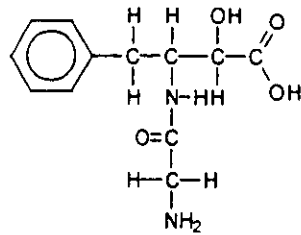


(ii) a mixture of stereoisomers ... because G is made synthetically / not naturally / in the laboratory / the HCN can add above or below etc ✓ [1]

Qu 4 continued overleaf

Q 4 continued

4 (g)



NH and CO ✓

all bonds displayed correctly ✓

[2]

(h) (only) one stereoisomer has the right shape / fits the active site
etc / is pharmacologically active ✓

the other stereoisomer may have (harmful) side-effects ✓

increased dose is needed ✓

valid reason for increased costs - eg testing of both isomers
(NOT just related to increased dosage) ✓

ANY 3 out of 4 marks

[3]

[Total 19 Marks]

- 5 (a) addition involves breaking a double bond ✓
- condensation involves loss of water / small molecule ✓
- correct PE repeat unit (either: $\{-\text{CH}_2-\text{CH}_2-\}$ or $\{-\text{CH}_2-\}$) ✓
- equation to form PE from ethene showing 'n' monomers to give a polymer using 'n' / with at least 4 carbons extending on ✓
- correct ester link displayed in PET ✓
- correct PET repeat unit indicated ✓
- equation to form a correct repeat of PET and H_2O , showing at least one of each monomer ✓

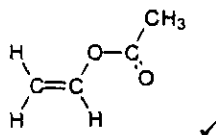
[7]

Quality of written communication

mark for good organisation and a logical response ... examples are linked to the relevant definitions / the response attempts or implies a comparison

[1]

(b)(i)



[1]

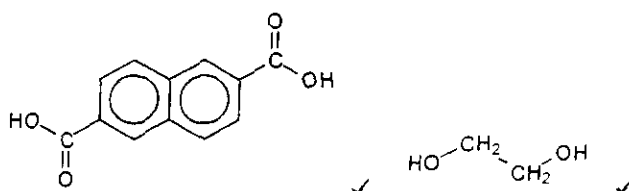
- (ii) dilute / aq / named concentration ✓
- acid / H^+ / alkali / OH^- / suitable named acid or alkali ✓
- heat / reflux ✓

[3]

- (iii) CH_3COOH (if acid hydrolysis in (ii)) / CH_3COO^- (from alkaline hydrolysis in (ii))

[1]

(c)



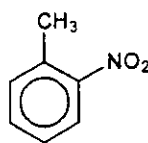
[2]

[Total: 15]

6 (a)(i) $\text{CH}_3\text{Cl} / \text{CH}_3\text{Br}$ ✓ [1]

(ii) $\text{AlCl}_3 / \text{FeBr}_3$ etc ✓ [1]

(b)



[1]

(c)

stage 2

H_2SO_4 ✓

HNO_3 ✓

60°C ✓

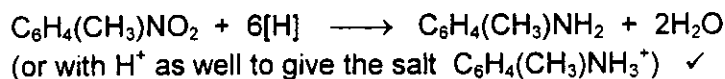


stage 3

tin ✓

HCl ✓

heat / reflux ✓



ANY 7 out of 8

max
[7]

Quality of Written Communication

mark for technical terms ... answer contains at least two of the following terms:

concentrated/conc (for any acid), nitration, nitrating mixture, electrophilic, substitution, reduction, catalyst (for H_2SO_4 or tin), 2-methylnitrobenzene ✓

[1]

[Total 11 Marks]