



EXAM PAPERS PRACTICE

Boost your performance and confidence with these topic-based exam questions

Practice questions created by actual examiners and assessment experts

Detailed mark scheme

Suitable for all boards

Designed to test your ability and thoroughly prepare you

2002

XVIII

1583

Time allowed
70 Minutes

Score

/59

Percentage

%

CHEMISTRY

**AQA
AS & A LEVEL**

Mark Scheme

3.3 Organic chemistry

1

(a) (i)

Reagent	Tollens	Fehlings or Benedicts	$K_2Cr_2O_7/H^+$ or acidified	$KMnO_4/H^+$	$I_2/NaOH$
Propanal	silver (mirror)	red ppt or goes red (<i>not red solution</i>)	goes green	goes colourless	No reaction
Propanone	no reaction	no reaction	no reaction	no reaction	Yellow (ppt)

(penalise incomplete reagent e.g. $K_2Cr_2O_7$ or $Cr_2O_7^{2-}/H^+$ then mark on)

3

(ii) propanal 3 peaks
ignore splitting even if wrong

1

propanone 1 peak

1

(b) **X** is CH_3CH_2COOH or propanoic acid if both name and formula given,
both must be correct, but

1

Y is $CH_3CH(OH)CH_3$ or propan-2-ol allow propanol with correct formula

1

Mark the type of reaction and reagent/condition independently.
The reagent must be correct or close to score condition

Step 1 Oxidation

$K_2Cr_2O_7/H^+$ or other oxidation methods as above
 allow $Cr_2O_7^{2-}/H^+$ if penalised above (ecf)
 reflux (not Tollens/Fehlings) or heat or warm

1

Step 2

reduction or nucleophilic addition	reduction or nucleophilic addition	reduction or hydrogenation
NaBH_4	LiAlH_4	H_2
in (m)ethanol or water or ether	ether or dry	Ni / Pt etc
or dry		

1

1

1

Step 3 esterification or (nucleophilic) addition-elimination or condensation

1

(conc) H_2SO_4 or HCl

1

warm (allow without acid reagent if **X** and **Y** given as reagents)

1

or reflux or heat

1

[15]

2

X is CH_3CN or ethanenitrile or ethanonitrile or methyl cyanide or cyanomethane or ethyl nitrile or methanecarbonitrile

Not ethanitrile

but contradicton of name and structure lose marks

1

Y is $\text{CH}_3\text{CH}_2\text{NH}_2$ or ethylamine or aminoethane or ethanamine

1

Step 1: reagent KCN not HCN/HCl
 condition (aq)/alcohol - only allow condition if reagent
 correct or incomplete

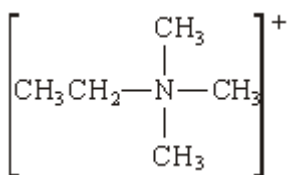
2

Step 2: reagent H_2 LiAlH_4 Na Zn/Fe/Sn Not NaBH_4
 condition Ni/Pt/Pd ether ethanol HCl

2

Z is an amine or aminoalkane or named amine even if incorrect name for **Z**
 secondary (only award if amine correct)

1



(Br)⁻ + can be on N or outside brackets as shown

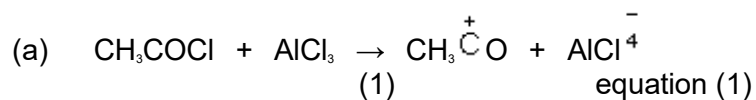
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nucleophilic substitution

1

[9]

3



2

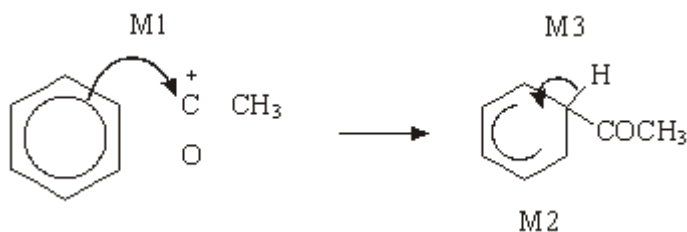
penalise wrong alkyl group once at first error
 position of + on electrophile can be on O or C or outside []

penalise wrong curly arrow in the equation or lone pair on AlCl_3 else ignore

Electrophilic substitution

NOT F/C acylation

1



horseshoe must not extend beyond C2 to C6 but can be smaller

+ not too close to C1

M3 arrow into hexagon unless Kekule

allow M3 arrow independent of M2 structure

M1 arrow from within hexagon to C or to + on C

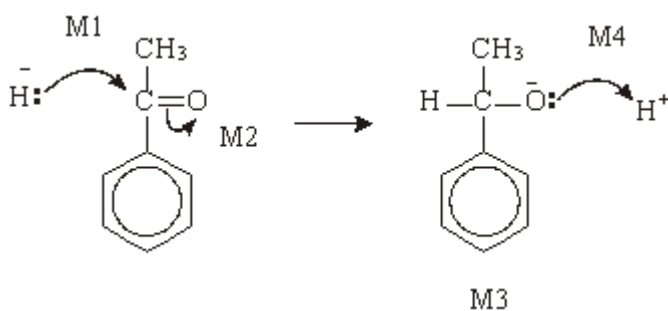
+
 + must be on C of RCO^+

3

(b) Nucleophilic addition

NOT reduction

1



M2 not allowed independent, but can allow M1 for attack of H^- on C^+ formed

4

1-phenylethan(-1-)-ol or (1-hydroxyethyl)benzene

1

(c) dehydration or elimination

1

(conc) H_2SO_4 or (conc) H_3PO_4

allow dilute and Al_2O_3

Do not allow iron oxides

1

[14]

5

(a) X contains $> \text{C}=\text{O}$ (1)

if X and Y reversed lose this mark but allow remaining max 6/7

\therefore X is $\text{CH}_3\text{CH}_2\text{COOH}$ (1)

\therefore Y is $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ (1)

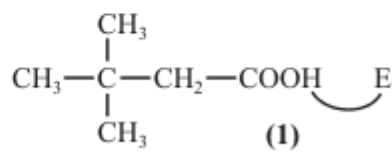
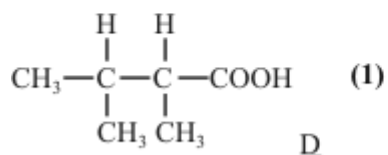
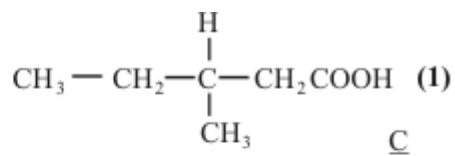
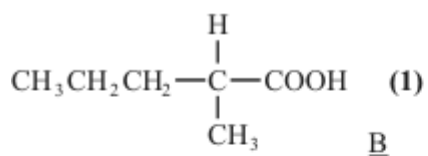
\therefore A is $\text{CH}_3\text{CH}_2\text{C}(=\text{O})\text{OCH}_2\text{CH}_2\text{CH}_3$ (1)

Propanol $\begin{cases} \text{X reagent: acidified } \text{K}_2\text{Cr}_2\text{O}_7 & (1) \\ \text{Y reagent: } \text{NaBH}_4 & (1) \end{cases}$

Conc H_2SO_4 : catalyst (1)

7

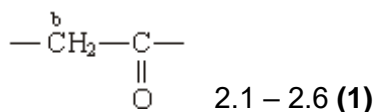
(b)




in any order

4

(c) $-\overset{\text{a}}{\text{OCH}_2}- \quad 3.1 - 3.9 \quad (1)$



a: quartet (1)  3 adjacent H (1)

b: triplet (1)  2 adjacent H (1)

6

(d) $3269 \text{ cm}^{-1} \therefore \text{OH}$  alcohol (1)



2

Notes

(a) first mark for C=O stated or shown in **X**

Ignore wrong names

Y $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

allow C_3H_7 in **A** if **Y** correct or vice versa

Allow (1) for **A** if correct conseq to wrong **X** and **Y**

other oxidising agents: acidified KMnO_4 ; Tollens; Fehlings

other reducing agents: LiAlH_4 ; Na/ethanol; Ni/H_2 ; Zn or Sn or Fe/HCl

(b) give (1) for carboxylic acid stated or COOH shown in each suggestion

(1) for correct **E**

any 2 out of 3 for **B**, **C** or **D**

allow C_3H_7 for either the **B** or **D** shown on the mark scheme

i.e. a correct structure labelled **B**, **C** or **D** or **E** will gain 2.

(c) protons a – *quartet* must be correct to score 3 *adjacent H* mark. Same for b

(d) allow (1) for any OH (alcohol) shown correctly in any structure – ignore extra functional groups. Structure must be completely correct to gain second mark

[19]

6.B

[1]