

M1.B

[1]

M2. (a) X contains > C=O (1)

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

∴ X is CH₃CH₂COOH (1)

∴ Y is CH₃CH₂CH₂OH (1)

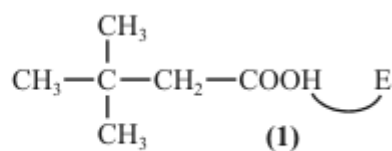
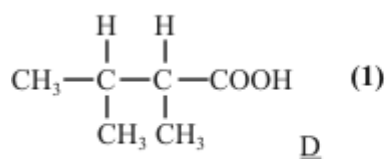
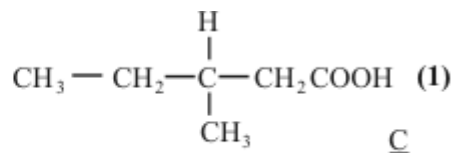
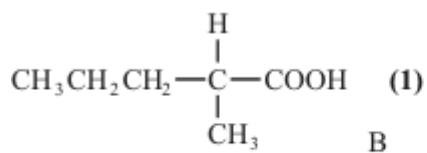
∴ A is $\text{CH}_3\text{CH}_2\overset{\text{O}}{\parallel}{\text{C}}\text{OCH}_2\text{CH}_2\text{CH}_3$ (1)

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

Conc H₂SO₄ : catalyst (1)

7

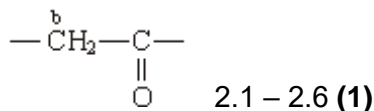
(b)



in any order

4


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

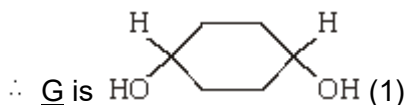


a: quartet (1)  3 adjacent H (1)

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

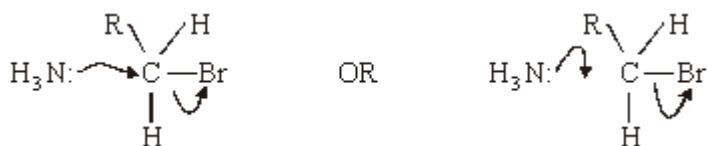
(d) allow (1) for any OH (alcohol) shown correctly in any structure – ignore extra functional groups. Structure must be completely correct to gain second mark

[19]

Organic points

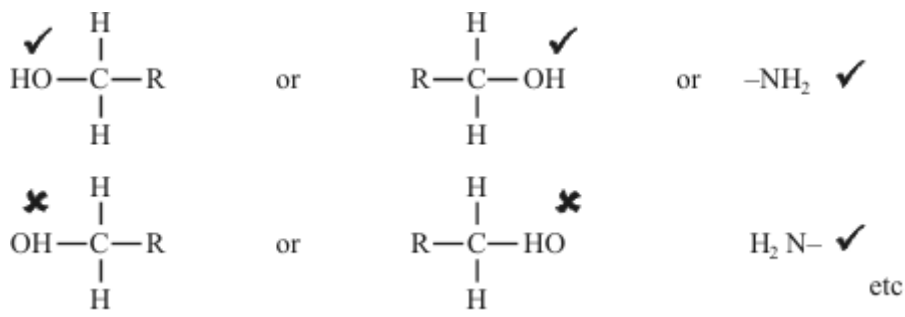
(1) Curly arrows: must show movement of a pair of electrons,
i.e. from bond to atom or from lp to atom / space

e.g.



(2) Structures

penalise sticks (i.e. $\begin{array}{c} | \\ -\text{C}- \\ | \end{array}$) once per paper

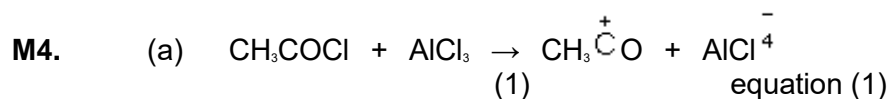


Penalise once per paper

allow CH_3- or $-\text{CH}_3$ or $\begin{array}{c} \text{CH}_3 \\ | \end{array}$ or CH_3
or $\text{H}_3\text{C}-$

M3.D

[1]



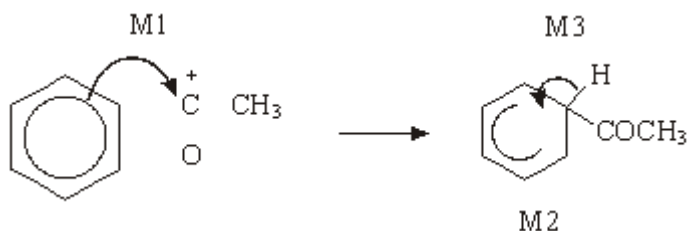
2

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 AlCl₃ 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

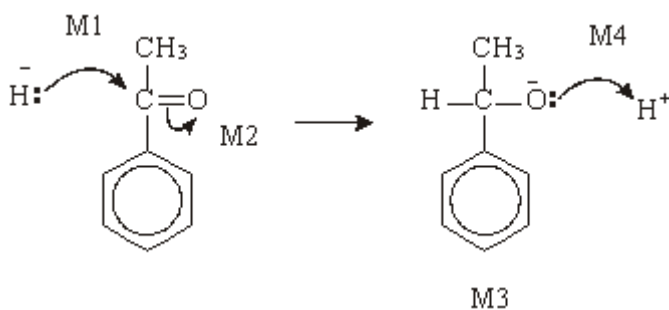
M1 arrow from within hexagon to C or to + on C

+
+ 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) H₂SO₄ or (conc) H₃PO₄
 allow dilute and Al₂O₃
 Do not allow iron oxides

1

[14]

M5. X is CH₃CN 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 CH₃CH₂NH₂ 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

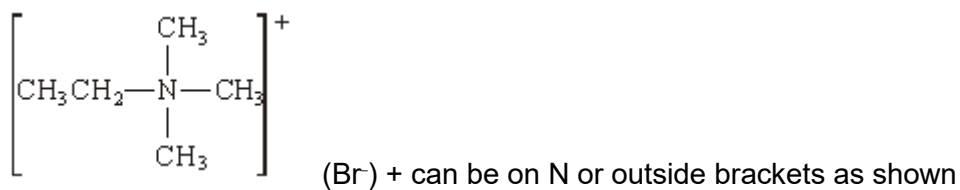
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Step 2: reagent H₂ LiAlH₄ Na Zn/Fe/Sn Not NaBH₄
 condition Ni/Pt/Pd ether ethanol HCl

2

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

1



1

nucleophilic substitution

1

[9]

M6. (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	1
	$NaBH_4$	$LiAlH_4$	H_2	1
	in (m)ethanol or water or ether	ether or dry	Ni / Pt etc	1

or dry

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]