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TOPIC 17 TEST

1. (a) (i) propyl methanoate **(1)**

not propanyl

- *A wrong reagent or no reagent scores zero*
- *An incomplete reagent such as silver nitrate for Tollens, or potassium dichromate loses the reagent mark, but can get both observation marks*
- *penalise observations which just say colour change occurs or only state starting colour*

(ii) *Reagent*: $NaHCO_3$ **(1)**
Observation with ***C***: no reaction **(1)**
Observation with ***D***: effervescence **(1)**
for ***C*** *and* ***D*** *NOT Tollens*

Test	an identified (hydrogen) carbonate	acidified $K_2Cr_2O_7$	acidified $KMnO_4$	correct metal	UI or stated indicator	PCl_5
Observation with C	no reaction	goes green	goes colourless	no reaction	no change	no reaction
observation with D	bubbles or CO_2	no change	no change	bubbles or H_2	red or correct colour pH 3 – 6.9	(misty) fumes

4

[4]

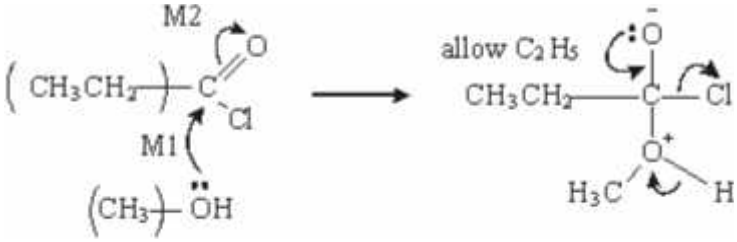
→

2. (a) $CH_3OH + CH_3CH_2COOH \rightarrow CH_3CH_2COOCH_3 + H_2O$

1

(b) (nucleophilic) addition–elimination NOT acylation

1



ignore use of Cl^- to remove H^+

M3 for structure

1

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M4 for 3 arrows and lone pair

4

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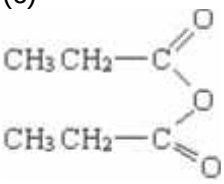
(c)



allow C_2H_5 and $–CO_2–$
allow $CH_3CH_2COOCOCH_2CH_3$
or *$(CH_3CH_2CO)_2O$*

1

(d) (i) faster/not reversible/bigger yield/purer product/no(acid) (catalyst) required

1

(ii) anhydride less easily hydrolysed or reaction less violent/exothermic
no (corrosive) (HCl) fumes formed or safer or less toxic/dangerous
expense of acid chloride or anhydride cheaper
any one

1

[9]

3. **X** is CH_3CH_2COOH or propanoic acid

1

Y is $CH_3CH(OH)CH_3$ or propan-2-ol

1

if both name and formula given, both must be correct, but allow propanol with correct formula

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**

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in (m)ethanol or water or ether or dry	ether or dry	Ni / Pt etc	1

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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

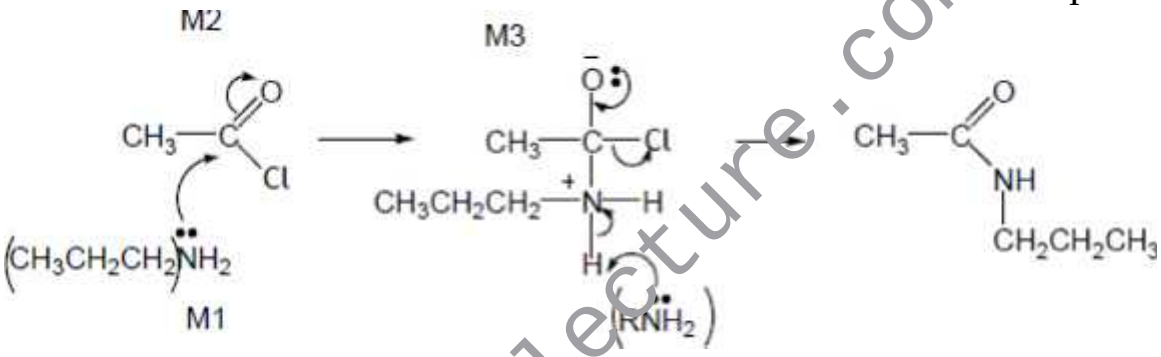
or reflux or heat

1

[10]

4. (a) (nucleophilic) addition-elimination

1



M4 for 3 arrows and lp

Allow wrong amine in M1 but penalise in M3

Allow C_3H_7 in M3

Minus sign on NH_3 loses M1 (but not M4 if NH_3 also shown here)

Allow attack by: $NH_2CH_2CH_2CH_3$

- *M2 not allowed independent of M1, but allow M1 for correct attack on C^+*
- *+ rather than δ+ on C=O loses M2*
- *If Cl lost with C=O breaking, max 1 for M1*
- *M3 for correct structure with charges but lone pair on O is part of M4*
- *3 arrows in M4 can be shown in two separate steps.*
- *If M3 drawn twice, mark first answer eg ignore missing + if missed off second structure*
- *Only allow M4 after correct / very close M3*
- *For M4, ignore RNH_2 removing H^+ but lose*

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M4 for Cl^- removing H^+ in mechanism,

• but ignore HCl shown as a product.

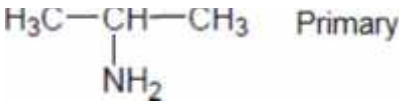
4

N-propylethanamide must be this name even if wrong amine used

NOT N-propylethaneamide

1

(b) (i)

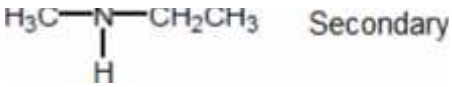


Not allow ambiguous $C_3H_7NH_2$

BEWARE No mark for the original amine $CH_3CH_2CH_2NH_2$

Label and structure must both be correct for each type to score the mark.

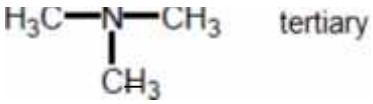
1



Allow C_2H_5

Penalize wrong number of carbons but otherwise correct, first time only.

1



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(ii) Absorption at 3300 3500 (cm^{-1}) in spectrum

Allow trough, peak, spike.

Ignore absorption at 750 1100 for C–C bond in secondary - this is within fingerprint region.

Allow any number in this range.

If range missing, no further marks.

If range linked to tertiary, no further marks.

1

N–H (bond) (only) present in secondary amine or not present in tertiary amine

OR

This peak or N–H absorption (only) present in spectrum of secondary amine or not present in spectrum of tertiary amine

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(c) (i) M1 Route **A**: stage 1 KCN

Apply list principle for extra reagents or catalysts
NOT HCN NOT KCN / acid Not KCN / HCN

1

M2 Aqueous or ethanolic

M2 only scores after correct M1
ignore warm; acid here loses M1 & M2

1

M3 Route **A** Intermediate CH_3CH_2CN or propanenitrile

If M3 intermediate wrong, max 2 for M1 & M2 ie no mark for stage 2

Name alone must be exactly correct to gain M1 but mark on if name close

But if M3 intermediate close, eg "nitrile" or wrong nitrile, can award marks in stage 2

correct formula gains M1 (ignore name if close)

If stage 1 correct and intermediate is missing, can award marks in stage 2

contradiction of name and formula loses mark

stage 1 wrong & intermediate missing, no marks.

1

M4 Route **A**: stage 2 H_2

H loses M4 but mark on

$LiAlH_4$

Apply list principle for extra reagents or catalysts.
M5 only scores after correct M4
Not $NaBH_4$ not Sn or Fe / HCl
Allow (dil) acid after but not with $LiAlH_4$
Penalise conc acid.

1

M5 Ni or Pt or Pd

ether

1

M6 Route **B** NH_3

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With acid loses M6 & M7

Apply list principle for extra reagents or catalysts.

1

M7 Excess NH_3

Ignore conc, ignore high P, ignore solvent.

1

(ii) Route **A** disadv Toxic / poisonous KCN or cyanide or CN or HCN

Expensive

$LiAlH_4$

Ignore

acidified

OR lower yield because 2 steps

Allow H_2 flammable / explosive etc.

Not just dangerous.

Ignore time reasons.

1

Route **B** disadv Further reaction / substitution likely

Allow impure product.

1

[20]

5. (a) (i) propan(e)-1,2,3-triol or 1,2,3- propan(e)triol

not propyl

ignore hyphen, commas

1

(ii) soaps

allow anionic surfactant

not cationic surfactant

not detergents, not shampoos

1

(b) (i) (bio)diesel

Allow fuel for diesel engines

not biofuel, not oils

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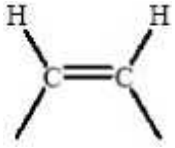
1

(ii)



ignore anything else attached except any more H atoms. →

1

(iii) $CH_3(CH_2)_{12}COOCH_3 + 21½O_2 \rightarrow 15CO_2 + 15\ H_2O$

OR

$C_{15}H_{30}O_2$ or 43/2

not *allow equation doubled*

1

[5]

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6. Sample in capillary / melting point tube

Accept alternative as long as small container used

1

Heat in melting point apparatus / heat gently / slowly near melting point

1

[2]

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