

## Mark schemes

1

Test

silver nitrate (solution) **(M1)**

*Allow an alternative soluble silver salt eg fluoride, sulfate.*

*Do not allow 'silver ions' but can access second mark.*

*Incorrect formula loses this mark but can access second mark.*

*Do not allow 'silver' or an insoluble silver salt and **cannot** access second mark.*

*Ignore references to acidification of the silver nitrate.*

*If an acid is specified it should be nitric acid, but allow sulfuric acid in this case as there are no metal ions present.*

*If hydrochloric acid is used, CE = 0 / 2.*

*Do not allow 'add water'.*

1

Observation white precipitate **(M2)**

*Ignore 'cloudy'.*

*Do not allow 'white fumes' or 'effervescence'.*

*Do not allow this mark if test reagent is incorrect or missing.*

*Allow named indicator paper or named indicator solution for **M1**.*

*Allow correct colour change for **M2**.*

1

[2]

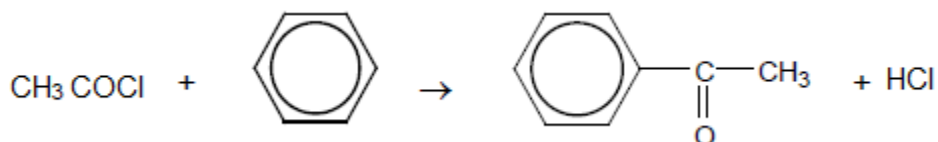
2

(a) (i)  $\text{CH}_3\text{COCl} + \text{C}_6\text{H}_6 \rightarrow \text{C}_6\text{H}_5\text{COCH}_3 + \text{HCl}$

*Not molecular formulae Not allow  $\text{C}_6\text{H}_5\text{CH}_3\text{CO}$*

1

**OR**



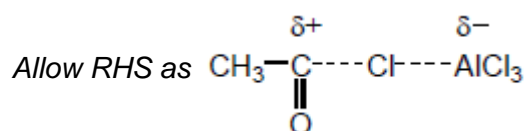
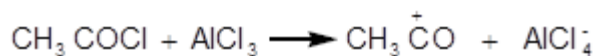
phenylethanone

*Ignore number 1 in name but penalise other numbers*

1

$\text{AlCl}_3$  can be scored in equation

1



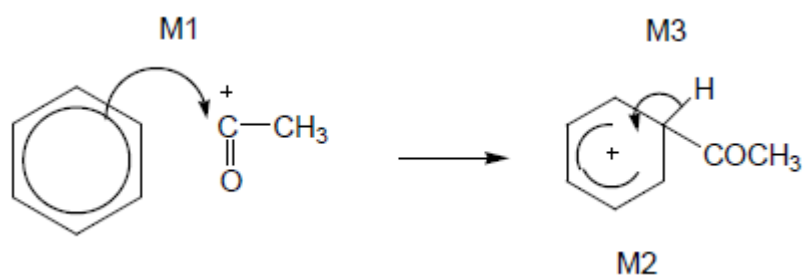
Allow + on C or O in equation but + must be on C in mechanism below

Ignore curly arrows in balanced equation even if wrong

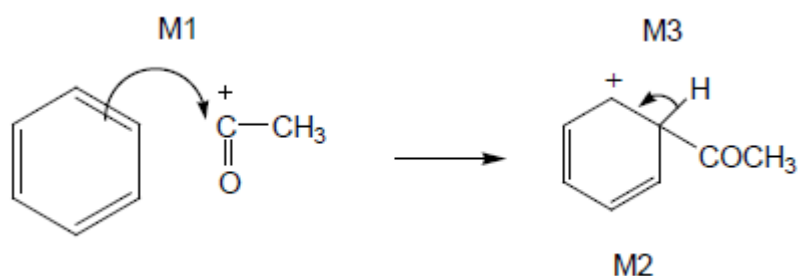
1

(ii) Electrophilic substitution

1



OR



- M1 arrow from within hexagon to C or to + on C
- + must be on C of  $\text{CH}_3\text{CO}$  in mechanism
- + in intermediate not too close to C1
- Gap in horseshoe must be centred approximately around C1
- M3 arrow into hexagon unless Kekulé
- Allow M3 arrow independent of M2 structure,
- ie + on H in intermediate loses M2 not M3
- Ignore base removing H for M3

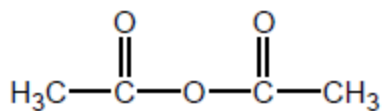
3

(b) Electron pair donor or lone pair donor

Allow donator

Allow lone pair used in description of (dative) bond formation

1



Allow  $(\text{CH}_3\text{CO})_2\text{O}$

1

(acid) anhydride

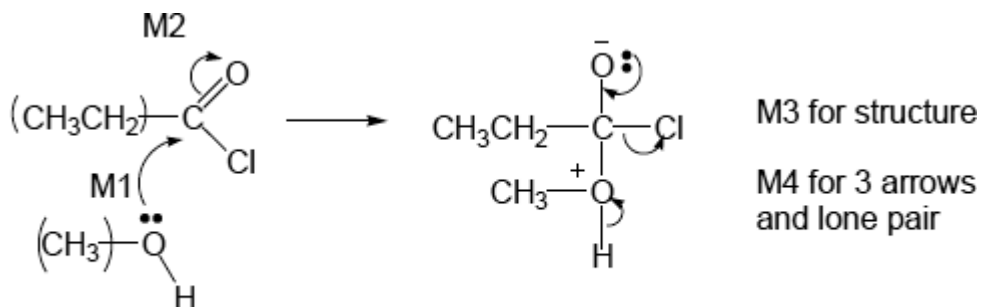
Allow ethanoic anhydride but not any other anhydride

1

[11]

3

(a)



methyl propanoate

(NO mark for name of mechanism)

- M2 not allowed independent of M1, but allow M1 for correct attack on C+
- + rather than  $\delta+$  on C=O loses M2
- If Cl lost with C=O breaking, max1 for M1
- M3 for correct structure with charges but lp on O is part of M4
- only allow M4 after correct/very close M3
- ignore  $\text{Cl}^-$  removing  $\text{H}^+$

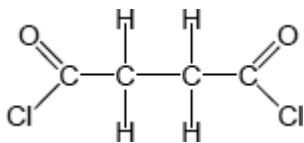
4

(b) (i) pentane-1,5-diol

Second 'e' and numbers needed

Allow 1,5-pentanediol but this is not IUPAC name

(ii)



Must show ALL bonds

1

(iii) All three marks are independent

M1 (base or alkaline) Hydrolysis (allow close spelling)

1

*Allow (nucleophilic) addition-elimination or saponification*

M2  $\delta^+$  C in polyester

1

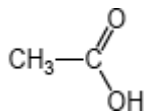
M3 reacts with  $\text{OH}^-$  or hydroxide ion

1

*Not reacts with NaOH*

1

(c) (i)



*Allow  $\text{CH}_3\text{COOH}$  or  $\text{CH}_3\text{CO}_2\text{H}$*

1

(ii) (nucleophilic) addition-elimination

*Both addition and elimination needed and in that order*

OR

(nucleophilic) addition followed by elimination

*Do **not** allow electrophilic addition-elimination / esterification*

*Ignore acylation*

1

(iii) any **two** from: ethanoic anhydride is

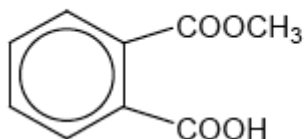
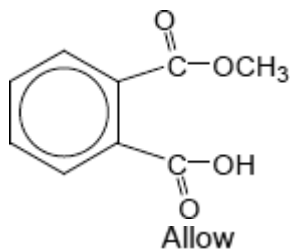
- less corrosive
- less vulnerable to hydrolysis
- less dangerous to use,
- less violent/exothermic/vigorous reaction OR more controllable rxn
- does not produce toxic/corrosive/harmful fumes (of HCl) OR does not produce HCl
- less volatile

**NOT COST**

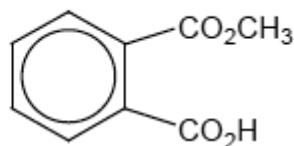
*List principle beyond two answers*

2

(d)



or



1

(e) (i) ester

*Do not allow ether*

*Ignore functional group/linkage/bond*

1

(ii) 12 or twelve (peaks)

1

(iii) 160 – 185

*Allow a number or range within these limits*

*Penalize extra ranges given*

*Ignore units*

1

(f) (i)

sulfuric acid	sodium hydroxide	✓
hydrochloric acid	ammonia	X or blank
ethanoic acid	potassium hydroxide	✓
nitric acid	methylamine	X or blank

*4 correct scores 2*

*3 correct scores 1*

*2 or 1 correct scores 0*

2

(ii) Pink to colourless

*Allow 'red' OR 'purple' OR 'magenta' instead of 'pink'*

*Do not allow 'clear' instead of 'colourless'*

1

[21]

4

Minimum volume and hot water:

*Note that this question is worth a total of 5 marks.*

Any **two** from:

to obtain saturated solution

to increase yield / reduce amount left in solution

enable crystallisation (on cooling)

*Do not allow 'because acid doesn't dissolve well in cold water'.*

Max 2

Filtered hot: to remove insoluble impurities / to prevent crystals forming during filtration

1

Cooled in ice: to increase amount of crystals that are formed

*Do not allow 'to cool quickly'.*

1

Washed with cold water: to remove soluble impurities

*Allow 'washing with hot water would dissolve some of the crystals'.*

1

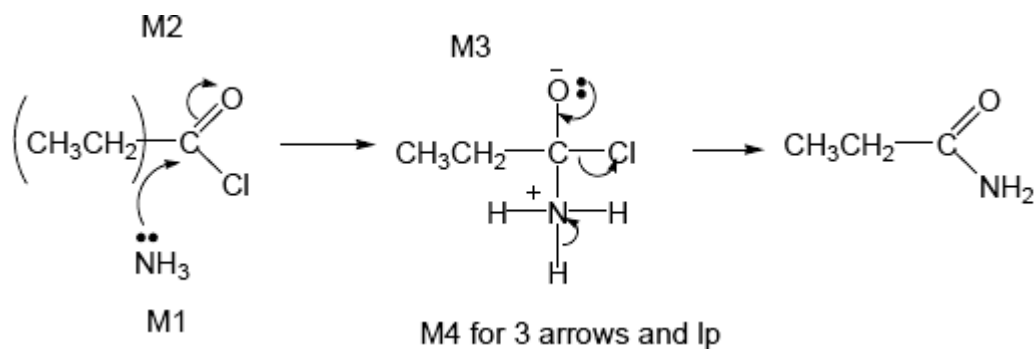
[5]

5

(a) (Nucleophilic) addition-elimination

- *Minus sign on NH<sub>3</sub> loses M1 (but not M4 also)*
- *M2 not allowed independent of M1, but*

1



- *allow M1 for correct attack on C+*
- *+ rather than δ+ on C=O loses M2*
- **If Cl lost with C=O breaking, max1 for M1**
- **M3** for correct structure with charges but lp on O is part of **M4**
- *only allow **M4** after correct/very close **M3***
- *For **M4**, ignore NH<sub>3</sub> removing H<sup>+</sup> but lose **M4** for Cl<sup>-</sup> removing H<sup>+</sup> in mechanism,*
- *but ignore HCl shown as a product*

4

propanamide (Ignore -1- )

penalise other numbers

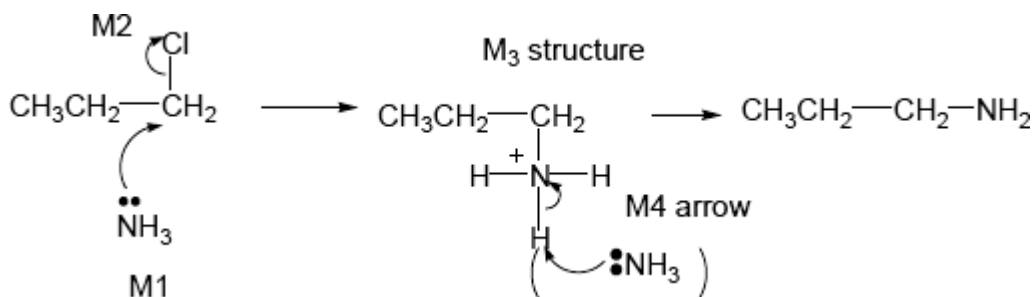
penalise propaneamide and N-propanamide

1

(b) Nucleophilic substitution

- Minus sign on  $\text{NH}_3$  loses M1 (not M4 also)
- + rather than  $\delta+$  on  $\text{C}=\text{O}$  loses M2

1



- ALLOW  $\text{SN}1$  so allow M2 for loss of  $\text{Cl}^-$  before attack of  $\text{NH}_3$  on  $\text{C}^+$  for M1
- only allow M4 after correct/very close M3
- For M4, ignore  $\text{NH}_3$  removing  $\text{H}^+$  but lose M4 for  $\text{Cl}^-$  removing  $\text{H}^+$  in mechanism,

Propylamine (ignore number 1)

- but ignore  $\text{HCl}$  shown as a product

4

or propan-1-amine or 1-aminopropane (number 1 needed)

penalise other numbers

allow 1-propanamine

1

(c) electron rich ring or benzene or pi cloud repels nucleophile/ammonia

Allow

- $\text{C}-\text{Cl}$  bond is short/stronger than in haloalkane
- $\text{C}-\text{Cl}$  is less polar than in haloalkane
- resonance stabilisation between ring and  $\text{Cl}$

1

[13]

6

1-chloropropane no visible change

Accept 'small amount of precipitate' or 'precipitate forms slowly'.

1

ethanoyl chloride      white precipitate

*Accept 'large amount of precipitate' or 'precipitate forms immediately'.*

1

[2]