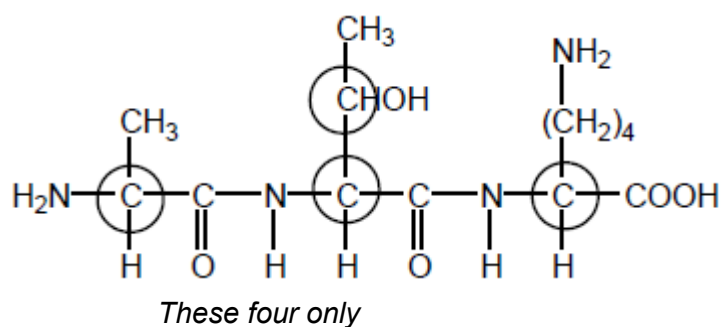
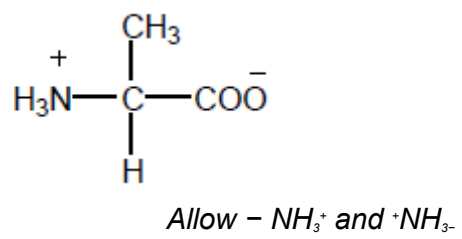


M1.(a) (i)



1

(ii)



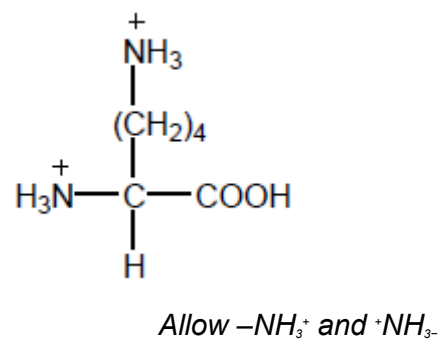
1

(iii) 2-amino-3-hydroxybutanoic acid
Ignore 1 in butan-1-oic acid

Do not penalise commas or missing hyphens
Penalise other numbers

1

(iv)



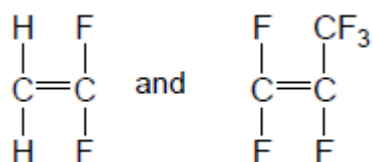
1

(b) (i) Condensation
Allow polyester 1

(ii) propane-1,3-diol
Must have e
Allow 1,3-propanediol 1

(c) (i) Addition
Not additional 1

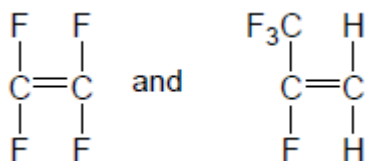
(ii)



Allow monomers drawn either way round
Allow bond to F in CF₃

1

OR



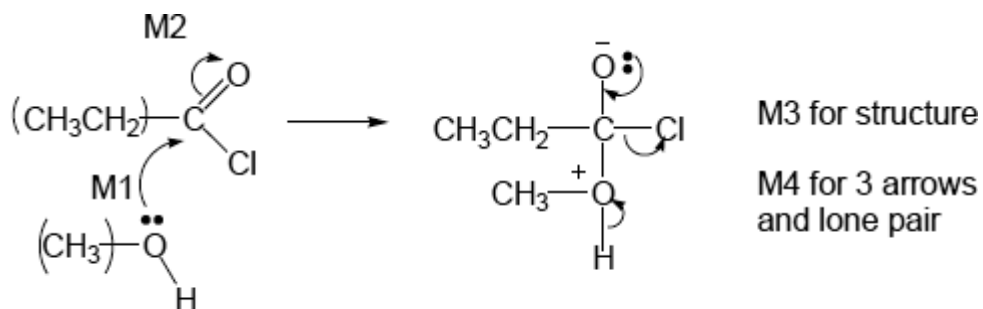
1 for each structure within each pair

1

(d) c
If wrong, CE = 0 1

C-C or C-F bonds too strong

1
[11]



M2.(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 Cl- removing H-

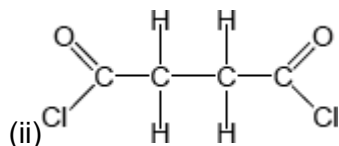
4

1

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

Second 'e' and numbers needed

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



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 δ^+ C in polyester

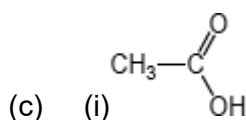
1

M3 reacts with OH^- or hydroxide ion

1

Not reacts with NaOH

1



Allow CH_3COOH 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

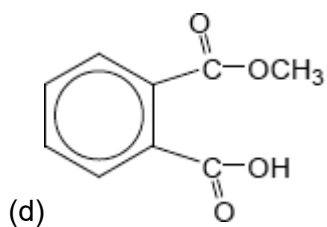
1

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

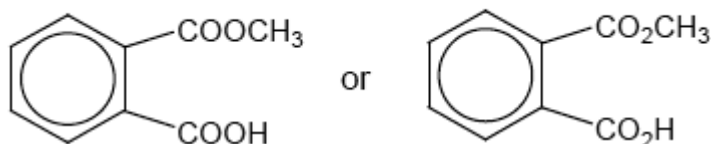
- less corrosive
- less vulnerable to hydrolysis
- less dangerous to use,
- less violent/exothermic/vigorous reaction OR more controllable rxn
- does not produce toxic/corrosive/harmful fumes (of HCl) OR does not produce HCl
- less volatile

NOT COST

List principle beyond two answers



Allow



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

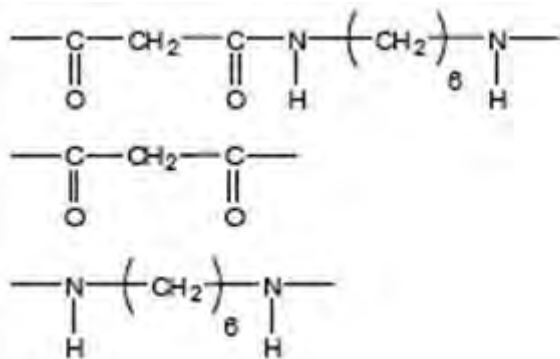
Allow 'red' OR 'purple' OR 'magenta' instead of 'pink'

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

1

[21]

M3. (a) (i)



Allow -CONH- or -COHN-

Mark two halves separately

lose 1 each for missing trailing bonds at one or both ends or error in peptide link or either or both of H or OH on ends

1

Not allow $-(C_6H_{12})-$

Ignore n

1

(ii) **M1** in polyamides - H bonding

1

M2 in polyalkenes - van der Waals forces

Penalise forces between atoms or van der Waals bonds

1

M3 Stronger forces (of attraction) in polyamides

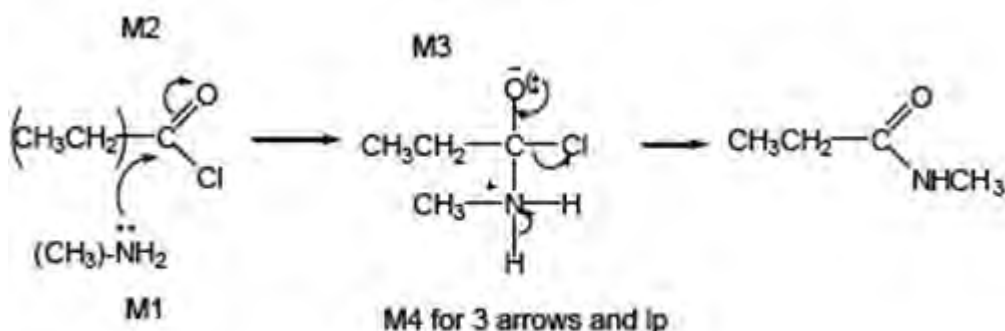
Or H bonding is stronger

(must be a comparison of correct forces to score M3)

Do not award if refer to stronger bonds

1

(b) (i) (nucleophilic) addition elimination



Not allow N-H₂

Minus sign on NH_2 loses **M1**

1

M2 not allowed independent of **M1**, but allow **M1** for correct attack on C^+

+ rather than δ^+ on $\text{C}=\text{O}$ loses **M2**

If Cl lost with $\text{C}=\text{O}$ breaking, max 1 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_3 removing H^+ but lose

M4 for Cl removing H^+ in mechanism,

but ignore HCl as a product

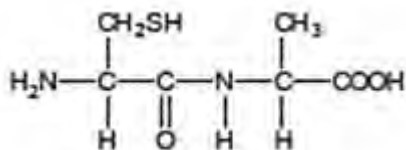
4

(ii) N-methylpropanamide

Not N-methylpropaneamide

1

(c)



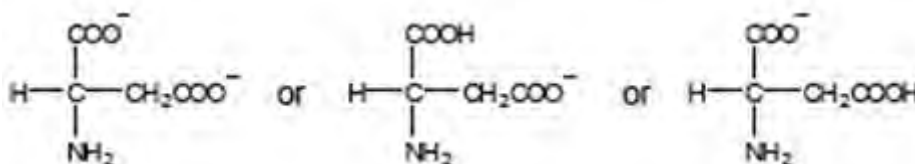
Allow $-\text{CONH}-$ or $-\text{COHN}-$

1

(d) (i) 2-amino-3-hydroxypropanoic acid

1

(ii)



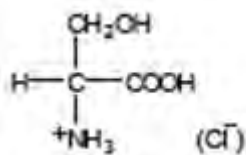
Must be salts of aspartic acid

allow $-\text{CO}_2^-$

allow NH_2^-

1

(iii) Penalise use of aspartic acid once in d(iii) and d(iv)



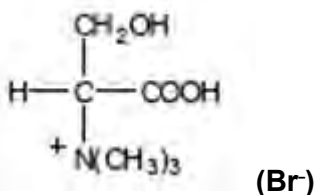
allow $-\text{CO}_2\text{H}$

allow $^+\text{NH}_3-$

don't penalize position of + on NH_3

1

- (iv) Penalise use of aspartic acid once in d(iii) and d(iv)



allow $-\text{CO}_2^-$

must show C-N bond

don't penalize position of + on $\text{N}(\text{CH}_3)_3$

1

[16]

- M4.(a)** (i) (As a) soap

Allow washing, cleaning, degreasing, detergents

1

- (ii) (Bio)diesel or biofuel or fuel for cars/lorries

Allow to make soap

1

- (iii) (Cationic) surfactant /detergent /fabric softener /germicide / shampoos /(hair) conditioners /spermicidal jelly

Allow cleaning

1

(b) (i) (Poly)ester

1

Terylene **OR** PET

Allow polyester

1

(ii) (Poly)amide

1

Kevlar **OR** nylons

Ignore numbers with nylons Allow polyamide(e)

1

(iii) (Independent marks)

CE = 0

Hydrogen bonding in b(ii)

1

Imfs in (b)(ii) are stronger

OR

H bonding stronger than dipole–dipole/van der Waals/ dispersion/London forces in b(i)

1

[9]