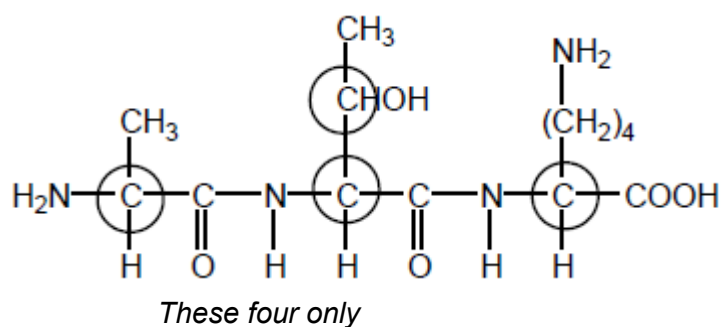
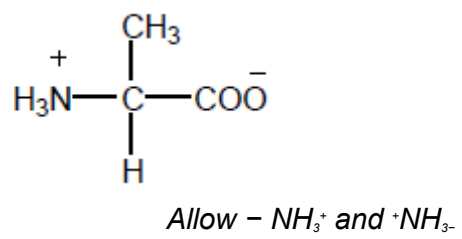


M1.(a) (i)



1

(ii)



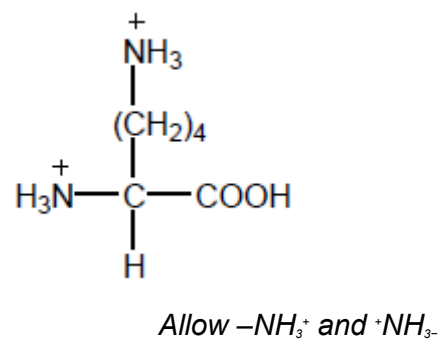
1

(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)



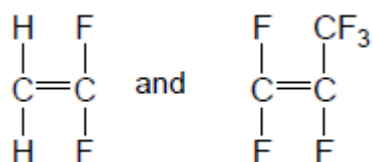
1

(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

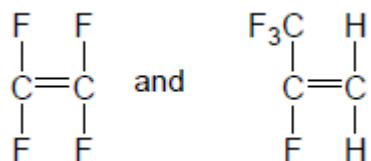
(ii)



*Allow monomers drawn either way round*  
*Allow bond to F in CF<sub>3</sub>*

1

**OR**



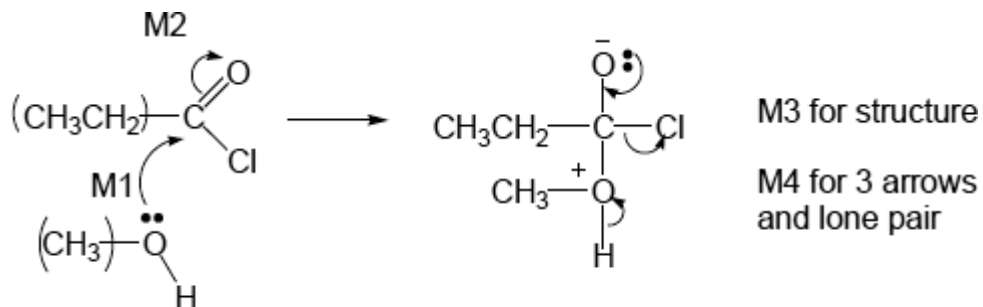
*1 for each structure within each pair*

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-

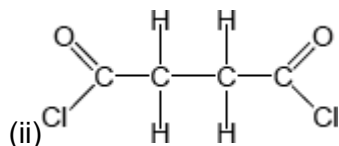
4

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  $\delta^+$  C in polyester

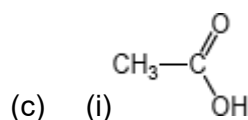
1

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

1

*Not reacts with NaOH*

1



*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*

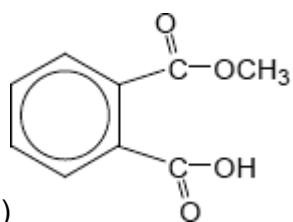
1

(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

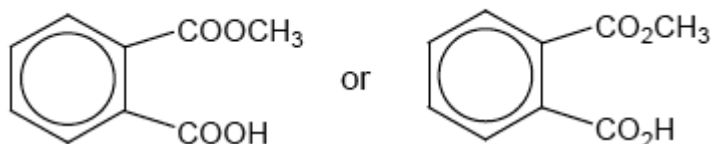
**NOT COST**

*List principle beyond two answers*



(d)

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

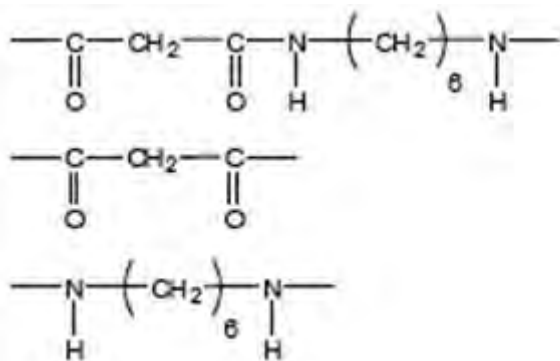
*Allow 'red' OR 'purple' OR 'magenta' instead of 'pink'*

*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

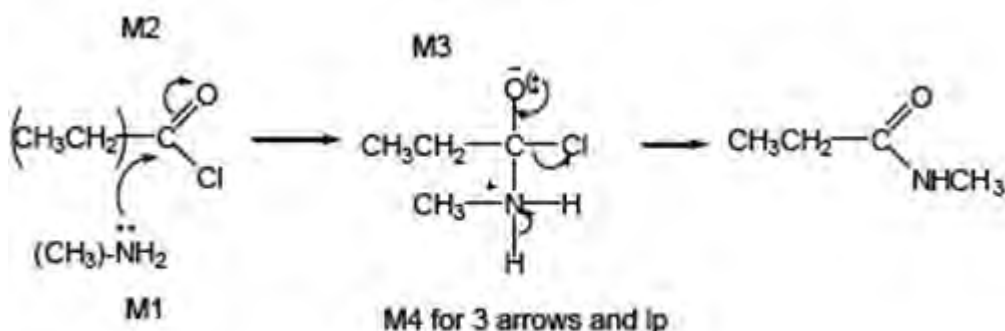
Or H bonding is stronger

(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-H<sub>2</sub>

Minus sign on  $\text{NH}_2$  loses **M1**

1

**M2** not allowed independent of **M1**, but allow **M1** for correct attack on  $\text{C}^+$

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

If  $\text{Cl}$  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  $\text{NH}_3$  removing  $\text{H}^+$  but lose

**M4** for  $\text{Cl}$  removing  $\text{H}^+$  in mechanism,

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

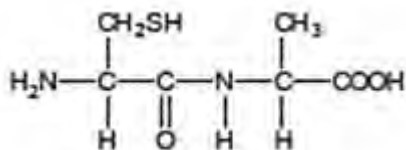
4

(ii) N-methylpropanamide

Not N-methylpropanamide

1

(c)



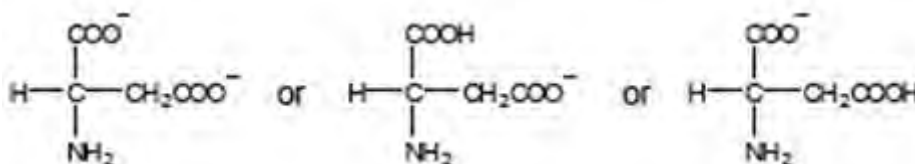
Allow  $-\text{CONH}-$  or  $-\text{COHN}-$

1

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

1

(ii)



Must be salts of aspartic acid

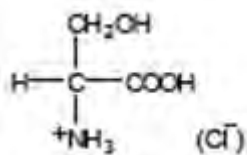
allow  $-\text{CO}_2^-$

allow  $\text{NH}_2-$

1

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





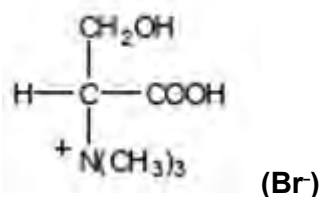
allow  $-\text{CO}_2\text{H}$

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

don't penalize position of + on  $\text{NH}_3$

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]**