A-Level Chemistry

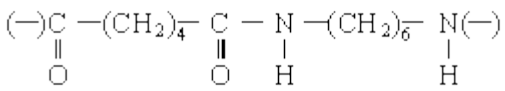
Condensation Polymers

Mark Scheme

Time available: 60 minutes
Marks available: 59 marks

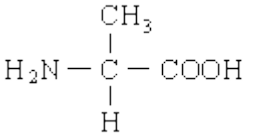
1.

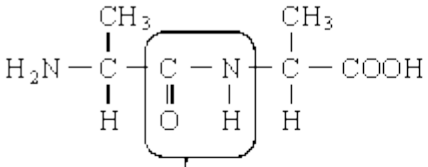
(a) (i) hexane-1,6-diamine or 1,6-diaminohexane **(allow ammine)**
or 1,6 hexan(e)diamine **(1)**

(ii)  **(1)**

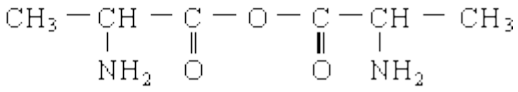
Allow –CONH–

2

(b) (i)  **(1)**

(ii)  **(1)**

peptide link essential : the rest is consequential on b(i)
(allow CONH)

allow anhydride 

2

(c) (i) <u>quaternary ammonium bromide salt</u> **(1)**

(not ion, not compound)

Allow quarternery

(ii) *Reagent*: CH_3Br or bromomethane **(1)**

penalise CH_3Cl but allow excess for any halo<u>methane</u>

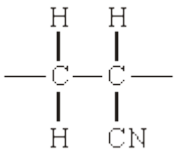
Condition: excess (CH_3Br) **(1)**

(iii) nucleophilic substitution **(1)**

4

[8]

2.

(a) (i) 

(Ignore n or brackets, but trailing bonds are essential)

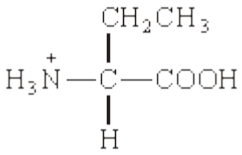
1

(ii) Addition or radical

1

(b) (i) 2-aminobutanoic (acid)

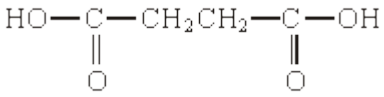
1

(ii) 

1

(c) (i) $C_3H_4O_2$

1

(ii) 

1

(1,4-)butan(e)dioic (acid)

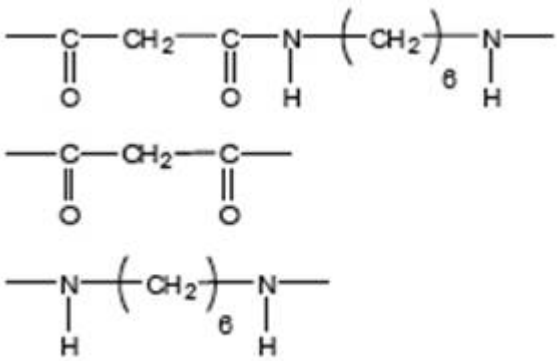
(allow succinic, but not dibutanoic nor butanedicarboxylic acid)

1

(iii) Can be hydrolysed / can react with acid or base or water /
can react with nucleophiles

1

[8]

3. (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

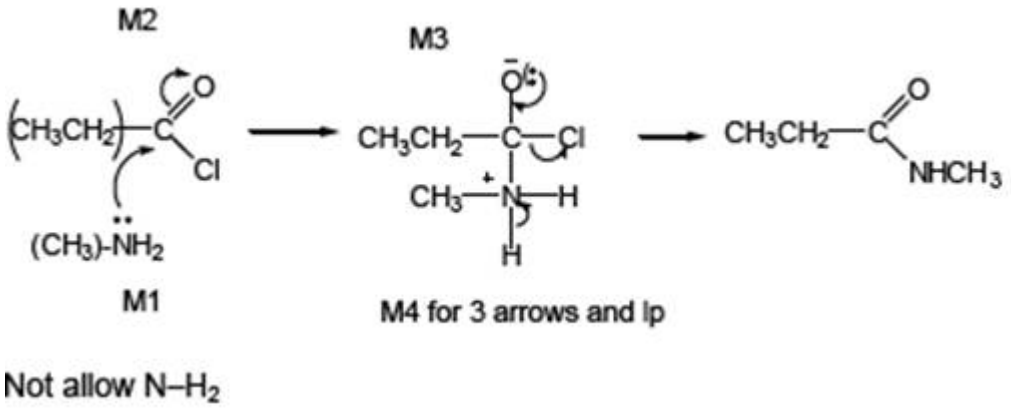
1

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



*Minus sign on NH_2 loses **M1***

1

*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, max 1 for **M1***

***M3** for correct structure <u>with charges</u> 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

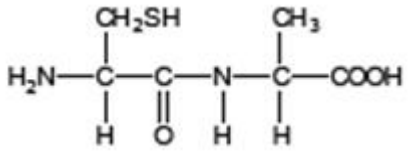
4

(ii) <u>N-methylpropanamide</u>

Not N-methylpropaneamide

1

(c)



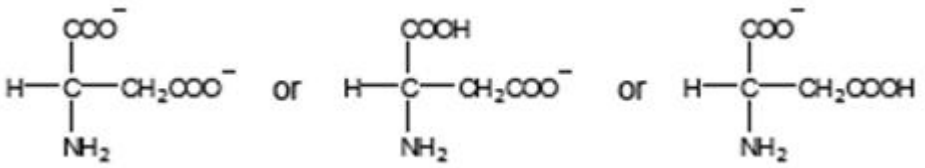
Allow –CONH– or –COHN–

1

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

1

(ii)



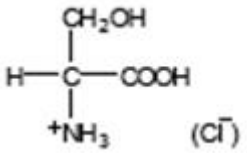
Must be salts of aspartic acid

allow $–CO_2^-$

allow NH_2–

1

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



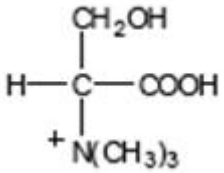
allow $–CO_2H$

allow $^+NH_3$–

don't penalize position of + on NH_3

1

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



(Br^-)

allow $–CO_2^-$

must show C-N bond

don't penalize position of + on $N(CH_3)_3$

1

[16]

4. (a) (i) (As a) soap

Allow washing, cleaning, degreasing, detergents

1

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

Allow <u>to make</u> 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

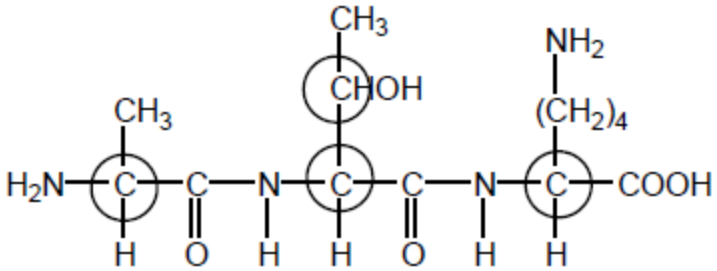
OR

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

1

[9]

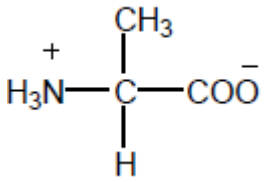
5. (a) (i)



These four only

1

(ii)



Allow − NH_3^+ and $^+NH_3^-$

1

(iii) 2-amino-3-hydroxybutanoic acid

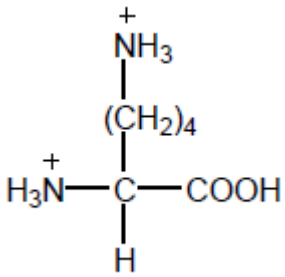
Ignore 1 in butan-1-oic acid

Do not penalise commas or missing hyphens

Penalise other numbers

1

(iv)



Allow $-NH_3^+$ and $^+NH_3^-$

1

(b) (i) Condensation

Allow polyester

1

(ii) propan**e**-1,3-diol

Must have e

*Allow 1,3-propan**e**diol*

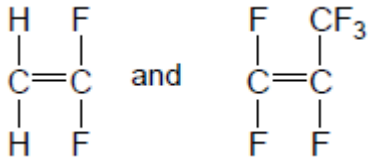
1

(c) (i) Addition

Not additional

1

(ii)

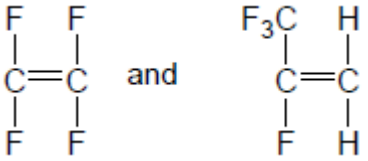


Allow monomers drawn either way round

Allow bond to F in CF_3

1

OR



1 for each structure within each pair

1

(d) c

If wrong, CE = 0

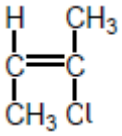
1

C-C or C-F bonds too strong

1

[11]

6. (a)

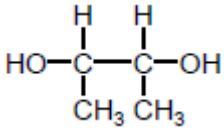


1

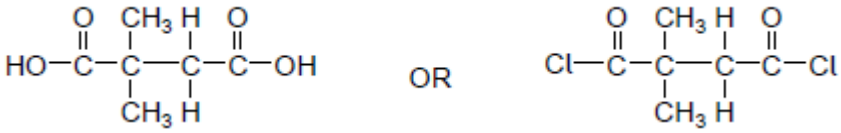
Addition

1

(b)



1



1

(c) **Q** is biodegradable

1

Polar C=O group or δ+ C in **Q** (but not in **P**)

1

Therefore, can be attacked by nucleophiles (leading to breakdown)

1

[7]