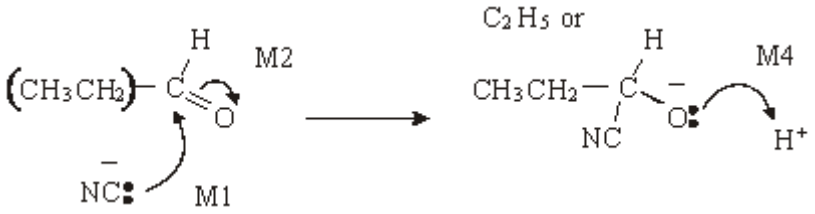
M1. (a) necleophilic addition;



1

M3 structure;

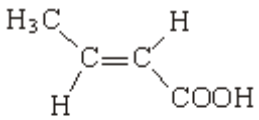
(be lenient on position of charge on CN–)
(M2 not allowed independent of M1,
but allow M1 for correct attack on C+
if M2 show as independent first.)
(+on C of C=O loses M2 but ignore δ+ if correct)
(M4 for arrow and lone pair (only allow for correct M3 or close))

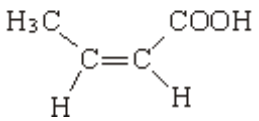
4

(b) (i) 2-hydroxybutanoic acid

1

(ii)



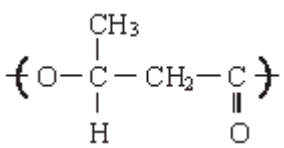


1

geometric(al) or cis-trans

1

(c) (i)



(one unit only) (ignore brackets or n) (trailing bonds are

needed)

1

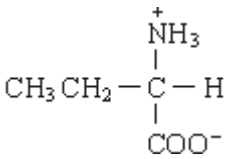
(ii) can be hydrolysed

OR

can be reacted with/attacked by acid/base/nucleophiles/H_2O/OH^-;

1

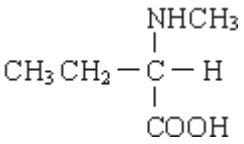
(d) (i)



(allow $-NH_3^+$)

1

(ii)



(or zwitterions product)

1

(iii) nucleophilic substitution;

1

[14]

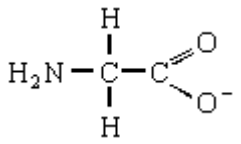
M2. (a) 2-amino(e) propanoic acid **(1)**

1

(b) (i) molecules with same structure / structural formula **(1)**
but with bonds **(atoms or groups)** arranged differently in space (3D) **(1)**

(ii) Plane polarised light **(1)**
Rotated (equally) in opposite directions **(1)**

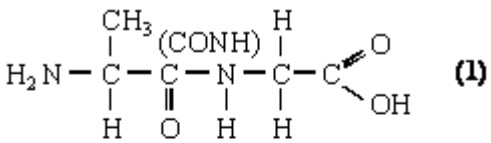
4

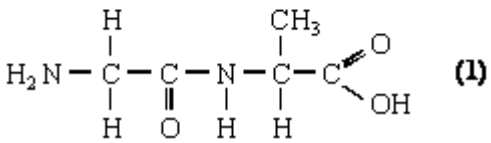
(c)  **(1)**

allow $H_2NCH_2COO^-$

Penalise NH_2^- and OH^- once per paper but CH_3- is allowed

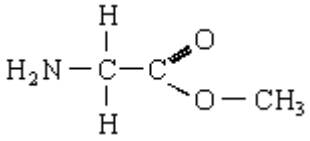
1

 **(1)**

(d)  **(1)**

Not anhydrides; not repeating units

2

(e)  **(1)**

or $H_2NCH_2COOCH_3$

1

[9]

M3. (a) 2-chloropropanoic acid **(1)**

1

(b) δ 1.72 Doublet ∴ next to CH **(1)**

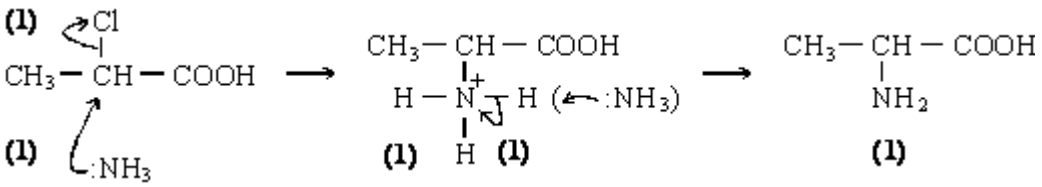
δ 4.44 Quartet ∴ next to CH_3 **(1)**

2

(c) Two triplets **(1)**

1

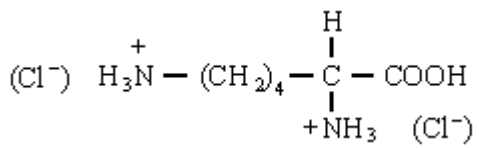
(d)



Allow S_N1

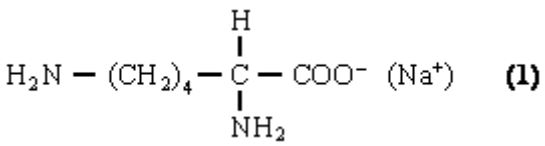
5

(e) (i)



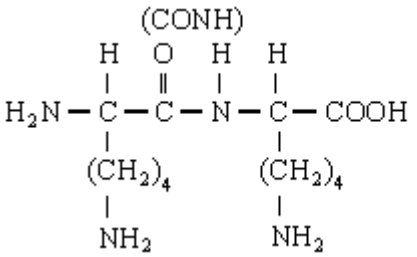
(1)

(ii)



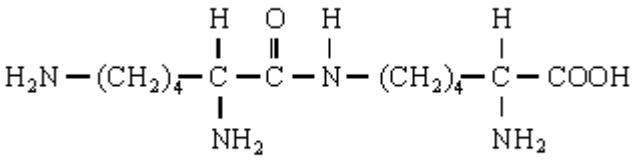
(1)

(iii)



(1)

<u>or</u>



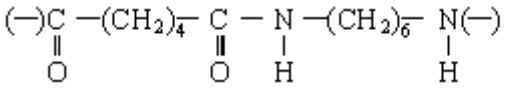
<u>Or</u> anhydride

3

[12]

M4. (a) (i) hexane-1,6-diamine or 1,6-diaminohexane **(allow ammine)** or 1,6 hexan(e)diamine **(1)**

(ii)

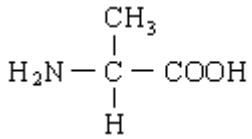


(1)

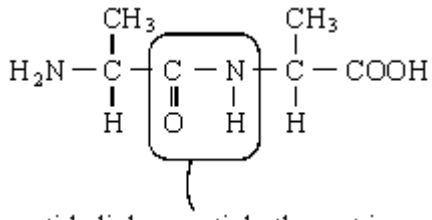
Allow –CONH–

2

(b) (i)



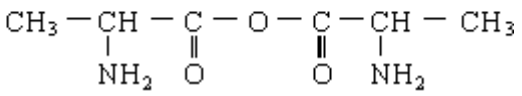
(1)



(1)

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

allow anhydride

(ii) 

2

(c) (i) quaternary ammonium bromide salt **(1)**

(not ion, not compound)

Allow quarternery

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

penalise CH_3Cl but allow excess for any halomethane

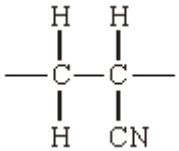
Condition: excess (CH_3Br) **(1)**

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

4

[8]

M5. (a) (i)



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

1

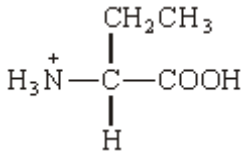
(ii) Addition or radical

1

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

1

(ii)

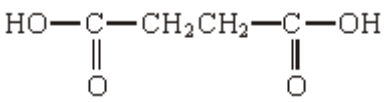


1

(c) (i) $C_3H_4O_2$

1

(ii)



1

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

(allow succinic, but not dibutanoic nor butanedicarboxylic acid)

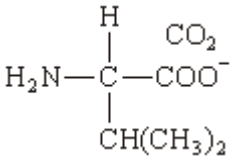
1

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

1

[8]

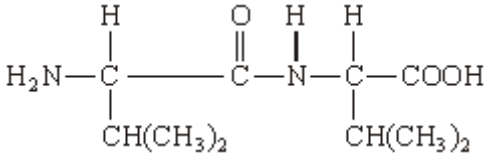
M6. (a) (i)



(1)

ignore Na^+ unless covalently bonded

(ii)



(1)

must be dipeptide, not polymer nor anhydride
allow –CONH– or –COHN–
allow zwitterion

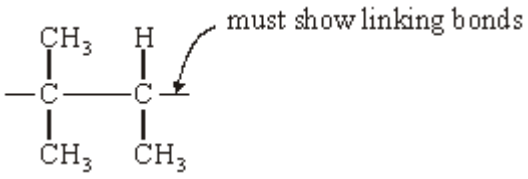
(iii) <u>hydrogen bonding</u> **(1)**

QL

Allow with dipole-dipole or v derWaals, but not dipole-dipole etc alone

3

(b) (i) *Type of polymerisation*: addition(al) **(1)**



Repeating unit: **(1)**

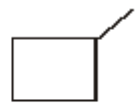
not multiples

allow n

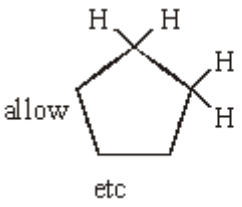
(ii) $CH_3CH=CHCH_2CH_3$ **(1)** C_2H_5

(iii)

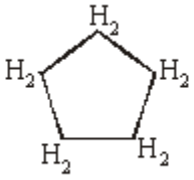
(1) or



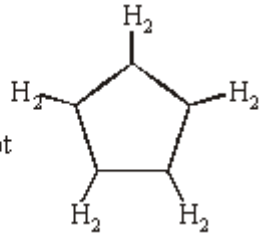
etc



or



but not



4

[7]