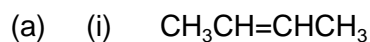


Mark schemes

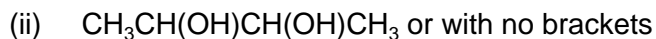
1



1

Addition or radical (**QoL**)

1



1

butan(e)-2,3-diol or 2,3-butan(e)diol

1



1

2,3-dimethylbutan(e)dioic acid

2,3-dimethylbutan(e)dioyl chloride

ignore -1,4-

1

condensation (**QoL**)

1

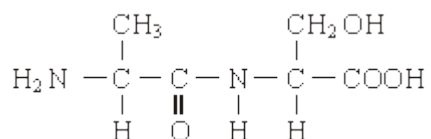


Allow conc sulphuric/nitric

NOT water nor acidified water nor weak acids

1

(b) Structure 1



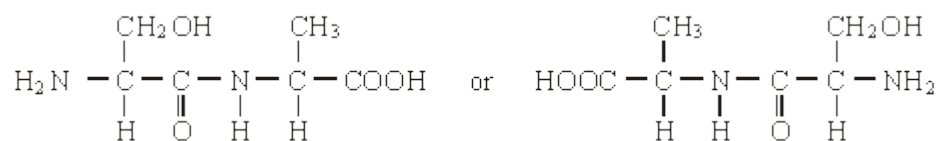
Allow -CONH- and -COHN-

Allow zwitterions

NOT polypeptides/repeating units

1

Structure 2 either of



1

- (c) (i) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$
allow -Cl, -I 1
- (ii) $\text{CH}_3\text{CH}_2\text{CN}$ 1
- (iii) (nucleophilic) substitution or from $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$
if reduction written here, no further marks 1
- further substitution/reaction occurs or other products are formed
Allow reduction forms only one product 1
- one of
 $(\text{CH}_3\text{CH}_2\text{CH}_2)_2\text{NH}$
 $(\text{CH}_3\text{CH}_2\text{CH}_2)_3\text{N}$
 $(\text{CH}_3\text{CH}_2\text{CH}_2)_4\text{N}^+ \text{Br}^-$
Allow salts including NH_4Br
Allow HBr 1

[15]

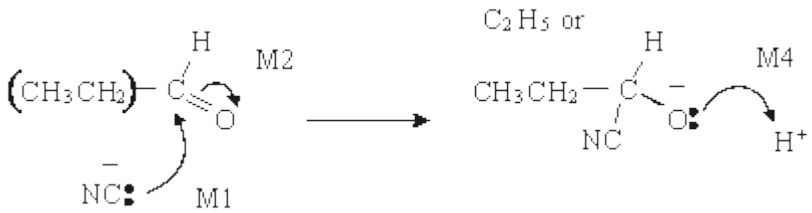
2

- (a) polyamide or nylon (2,4)
(allow nylon without numbers but if numbers are present they must be correct) 1
- condensation 1
- (b) $\text{H}_3\text{N}^+ - \text{CH}_2 - \text{COO}^-$ 1
- (c) ionic bonding in aminoethanoic acid
(can only score if includes that aminoethanoic is ionic) 1
- stronger attractions than Hydrogen bonding in hydroxyethanoic acid
(e.g. stronger Hydrogen bonding in aminoethanoic acid scores 0)
(mention of electrostatic forces between molecules scores 0) 1

[5]

3

(a) nucleophilic addition;



1

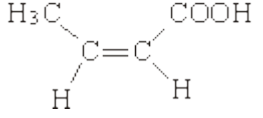
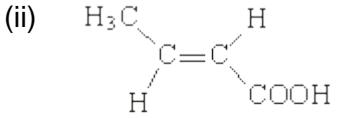
M3 structure;

(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

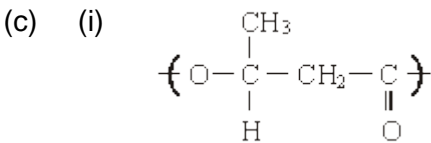
1



1

geometric(al) or cis-trans

1



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

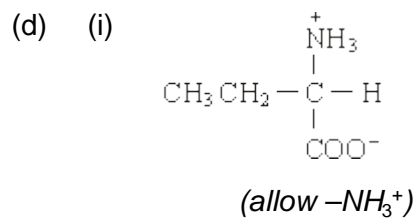
1

(ii) can be hydrolysed

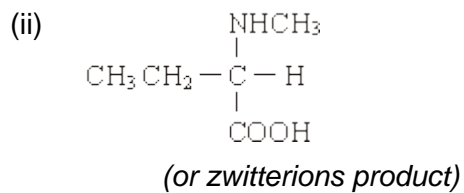
OR

can be reacted with/attacked by acid/base/nucleophiles/H₂O/OH⁻;

1



1



1

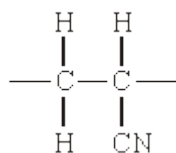
(iii) nucleophilic substitution;

1

[14]

4

(a) (i)



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

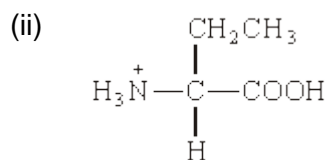
1

(ii) Addition or radical

1

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

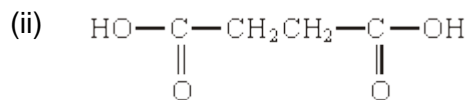
1



1

(c) (i) $C_3H_4O_2$

1



1

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

(allow succinic, but not dibutanoic nor butanedicarboxylic acid)

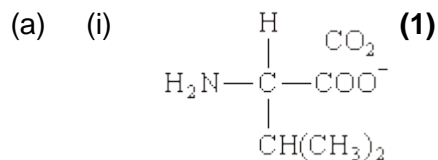
1

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

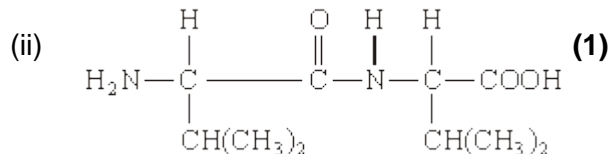
1

[8]

5



ignore Na^+ unless covalently bonded



must be dipeptide, not polymer nor anhydride

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

allow zwitterion

(iii) hydrogen bonding (1)

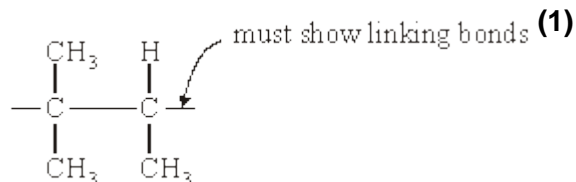
QL

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

3

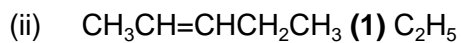
(b) (i) *Type of polymerisation: addition(al)* (1)

Repeating unit:

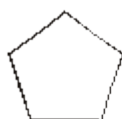


not multiples

allow n

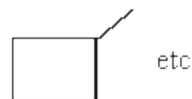


(iii)

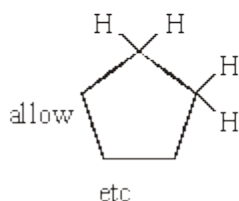


(1)

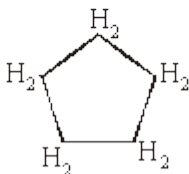
or



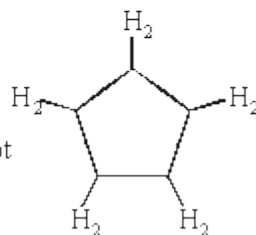
etc



or



but not



4

[7]

6

(a) 2-amino(e) propanoic acid (1)

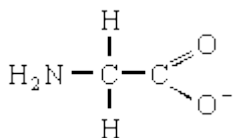
1

(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

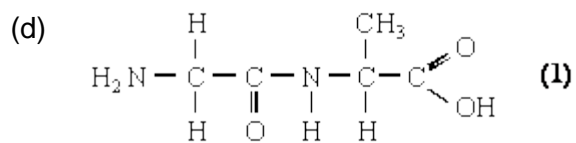
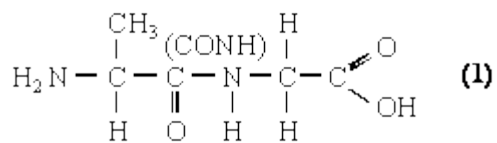
(c) (1)



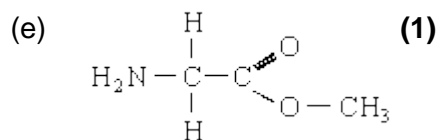
allow $\text{H}_2\text{NCH}_2\text{COO}^-$

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

1



Not anhydrides; not repeating units



or H₂NCH₂COOCH₃

2

1

[9]

7

(a) 2-chloropropanoic acid (1)

1

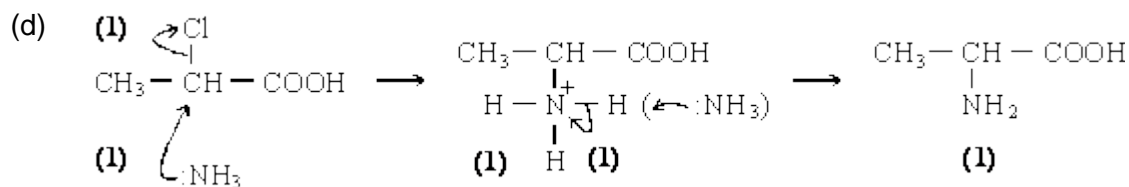
(b) δ 1.72 Doublet : next to CH (1)

δ 4.44 Quartet : next to CH₃ (1)

2

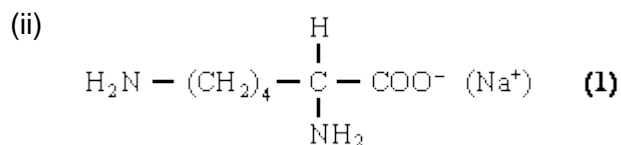
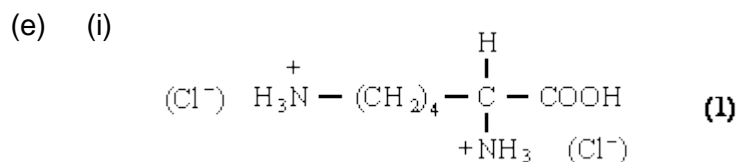
(c) Two triplets (1)

1

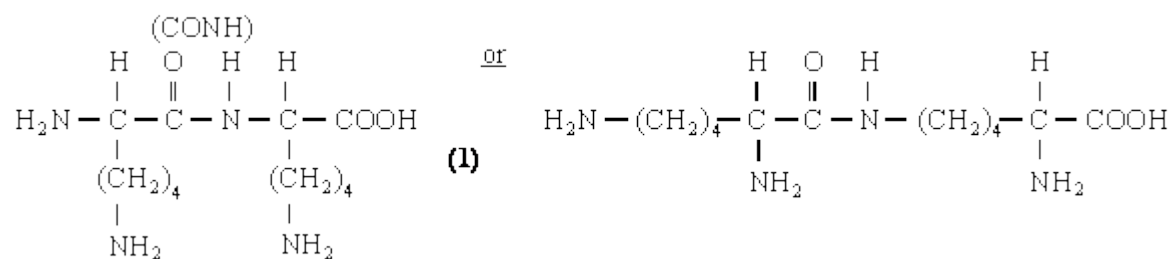


Allow S_N1

5



(iii)



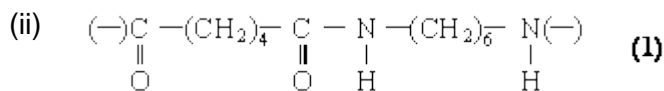
Or anhydride

3

[12]

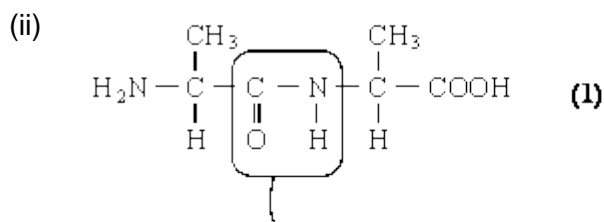
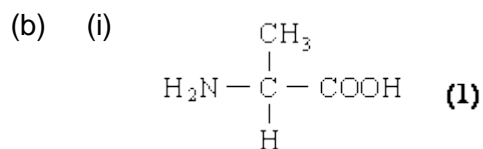
8

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



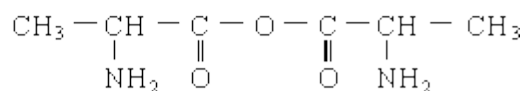
Allow -CONH-

2



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

allow anhydride



2

- (c) (i) quaternary ammonium bromide salt (1)
(not ion, not compound)
Allow quaternary
- (ii) *Reagent:* CH₃Br or bromomethane (1)
penalise CH₃Cl but allow excess for any halomethane
- Condition: excess (CH₃Br)* (1)
- (iii) nucleophilic substitution (1)

4

[8]