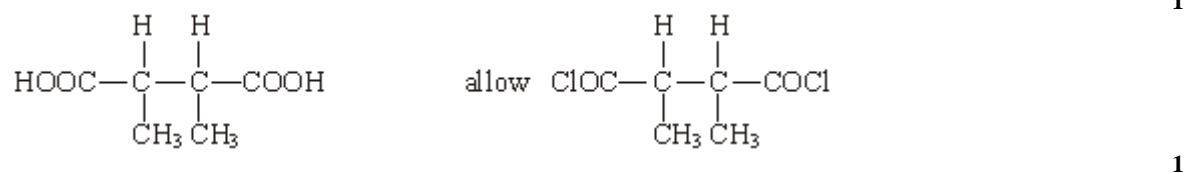


M1. (a) (i) $\text{CH}_3\text{CH}=\text{CHCH}_3$ 1

Addition or radical (**QoL**) 1

(ii) $\text{CH}_3\text{CH}(\text{OH})\text{CH}(\text{OH})\text{CH}_3$ or with no brackets 1

butan(e)-2,3-diol or 2,3-butan(e)diol 1

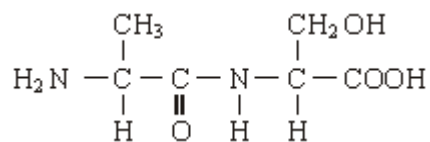


2,3-dimethylbutan(e)dioic acid 2,3-dimethylbutan(e)dioyl chloride
ignore -1,4-

condensation (**QoL**) 1

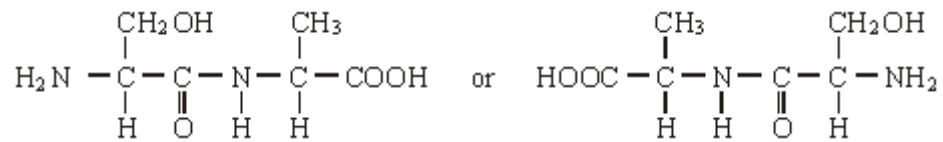
(iii) NaOH or HCl etc or Na_2CO_3 1
Allow conc sulphuric/nitric
NOT water nor acidified water nor weak acids

(b) Structure 1

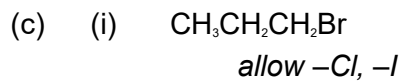


Allow -CONH- and -COHN-
Allow zwitterions
NOT polypeptides/repeating units

Structure 2 either of



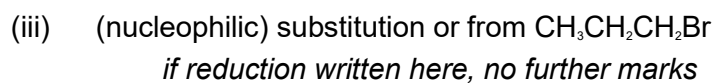
1



1



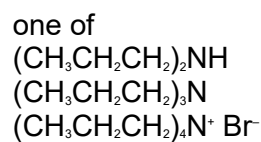
1



1

further substitution/reaction occurs or other products are formed
Allow reduction forms only one product

1



Allow salts including NH_4Br

Allow HBr

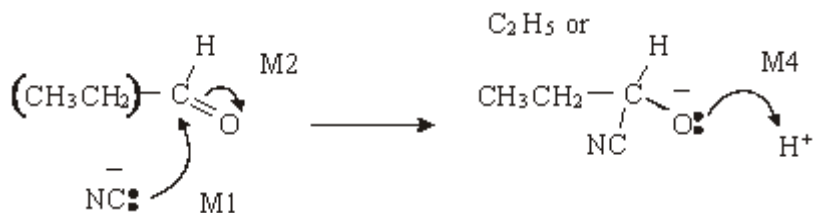
1

[15]

M2.C

[1]

M3. (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)

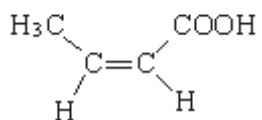
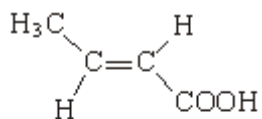
(M4 for arrow and lone pair (only allow for correct M3 or close))

4

(b) (i) 2-hydroxybutanoic acid

1

(ii)

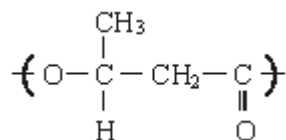


1

geometric(al) or cis-trans

1

(c) (i)



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

1

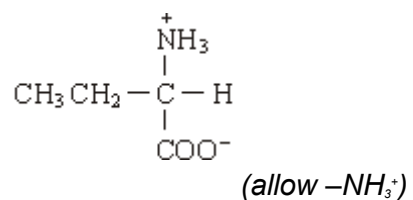
(ii) can be hydrolysed

OR

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

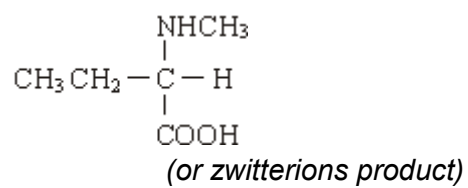
1

(d) (i)



1

(ii)



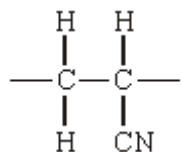
1

(iii) nucleophilic substitution;

1

[14]

M4. (a) (i)



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

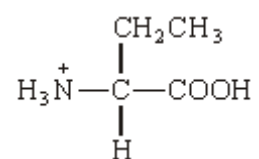
1

(ii) Addition or radical

1

(b) (i) 2-aminobutanoic (acid) 1

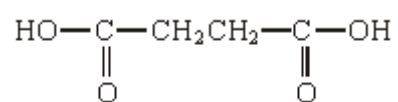
(ii)



1

(c) (i) $\text{C}_3\text{H}_4\text{O}_2$ 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]

M5.B

[1]