Q18.

(a) The compound $H_2C=CHCN$ is used in the formation of acrylic polymers.

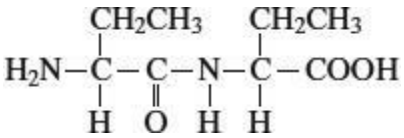
(i) Draw the repeating unit of the polymer formed from this compound.

(ii) Name the type of polymerisation involved in the formation of this polymer.

_____

(2)

(b) When the dipeptide shown below is heated under acidic conditions, a single amino acid is produced.



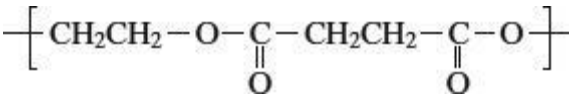
(i) Name this amino acid.

_____

(ii) Draw the structure of the amino acid species present in the acidic solution.

(2)

(c) The repeating unit of a polyester is shown below.



(i) Deduce the empirical formula of the repeating unit of this polyester.

_____

(ii) Draw the structure of the acid which could be used in the preparation of this

polyester and give the name of this acid.

Structure _____

Name _____

(iii) Give **one** reason why the polyester is biodegradable.

_____

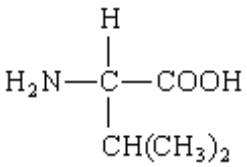
_____

(4)

(Total 8 marks)

Q19.

(a) Consider the following amino acid.



(i) Draw the structure of the amino acid species present in a solution at pH 12.

(ii) Draw the structure of the dipeptide formed from two molecules of this amino acid.

(iii) Protein chains are often arranged in the shape of a helix. Name the type of interaction that is responsible for holding the protein chain in this shape.

_____

(3)

(b) Consider the hydrocarbon **G**, $(CH_3)_2C=CHCH_3$, which can be polymerised.

(i) Name the type of polymerisation involved and draw the repeating unit of the polymer.

Type of polymerisation _____

Repeating unit

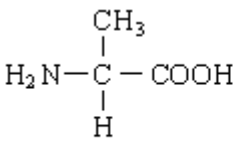
(ii) Draw the structure of an isomer of **G** which shows geometrical isomerism.

(iii) Draw the structure of an isomer of **G** which does not react with bromine water.

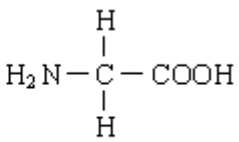
(4)
(Total 7 marks)

Q20.

The structures of the amino acids *alanine* and *glycine* are shown below.



alanine



glycine

(a) Give the systematic name for *alanine.*

_____

(1)

(b) *Alanine* exists as a pair of stereoisomers.

(i) Explain the meaning of the term *stereoisomers.*

_____

_____

_____

(ii) State how you could distinguish between the stereoisomers.

_____

_____

_____

(4)

(c) Give the structural formula of the species formed by *glycine* at pH 14.

(1)

(d) When two amino acids react together, a dipeptide is formed. Give the structural formulae of the **two** dipeptides which are formed when *alanine* and *glycine* react together.

Dipeptide 1

Dipeptide 2

(2)

(e) Give the structural formula of the organic compound formed when *glycine* reacts with methanol in the presence of a small amount of concentrated sulphuric acid.

(1)
(Total 9 marks)

Q21.

(a) Synthetic polyamides are produced by the reaction of dicarboxylic acids with compounds such as $H_2N(CH_2)_6NH_2$

(i) Name the compound $H_2N(CH_2)_6NH_2$

_____

(ii) Give the repeating unit in the polyamide nylon 6,6.

_____

(2)

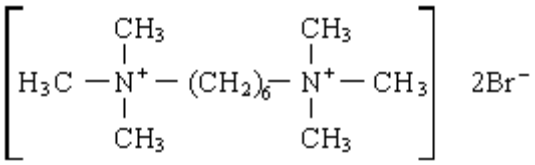
(b) Synthetic polyamides have structures similar to those found in proteins.

(i) Draw the structure of 2-aminopropanoic acid.

(ii) Draw the organic product formed by the condensation of two molecules of 2-aminopropanoic acid.

(2)

(c) Compounds like $H_2N(CH_2)_6NH_2$ are also used to make ionic compounds such as **X**, shown below.



Compound **X**

(i) **X** belongs to the same type of compound as $(CH_3)_4N^+Br^-$
Name this **type** of compound.

_____

(ii) State a reagent which could produce **X** from $H_2N(CH_2)_6NH_2$ and give a necessary condition to ensure that **X** is the major product.

Reagent _____

Condition _____

(iii) Name the mechanism involved in this reaction to form **X**.

_____

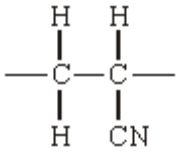
(4)

(Total 8 marks)

Mark Scheme

Q18.

(a) *(i)*



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

1

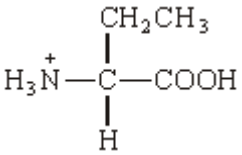
(ii) *Addition or radical*

1

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

1

(ii)

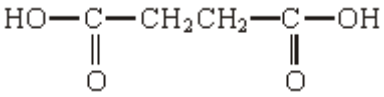


1

(c) *(i)* $C_3H_4O_2$

1

(ii)



1

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

(allow succinic, but not dibutanoic nor butanedicarboxylic acid)

1

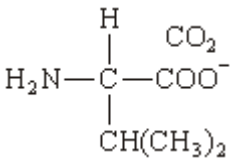
(iii) *Can be hydrolysed / can react with acid or base or water / can react with nucleophiles*

1

[8]

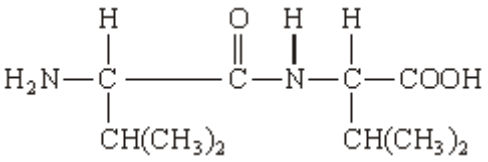
Q19.

(a) *(i)*



(1)

ignore Na^+ unless covalently bonded

(ii)  ***(1)***

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

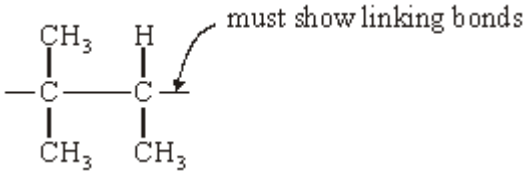
(iii) *hydrogen bonding* ***(1)***

QL

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

3

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

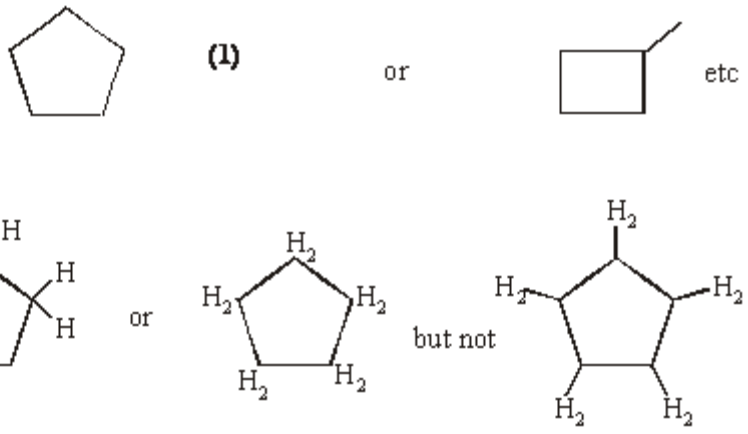


Repeating unit: ***(1)***

not multiples
allow n

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

(iii)



4

[7]

Q20.

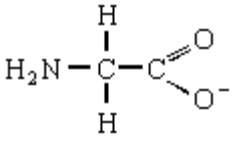
(a) *2-amino(e) propanoic acid* ***(1)***

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)***

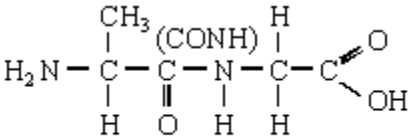
4

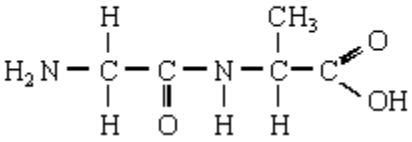
(c)  ***(1)***

allow $H_2NCH_2COO^-$

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

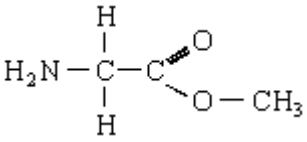
1

 **(1)**

(d)  **(1)**

Not anhydrides; not repeating units

2

(e)  ***(1)***

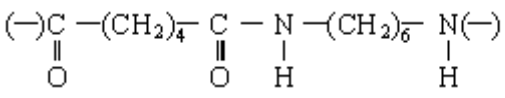
or $H_2NCH_2COOCH_3$

1

[9]

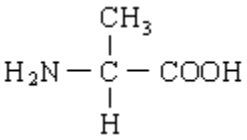
Q21.

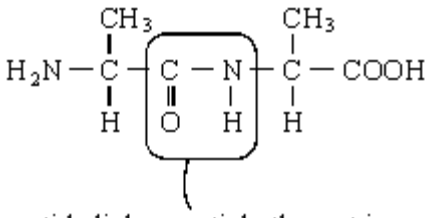
(a) (i) *hexane-1,6-diamine or 1,6-diaminohexane* ***(allow ammine)***
or 1,6 hexan(e)diamine ***(1)***

(ii)  **(1)**

Allow –CONH–

2

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

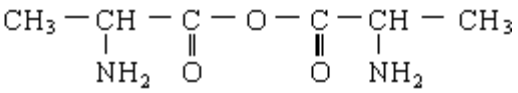


(1)

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]