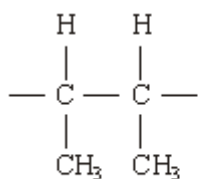
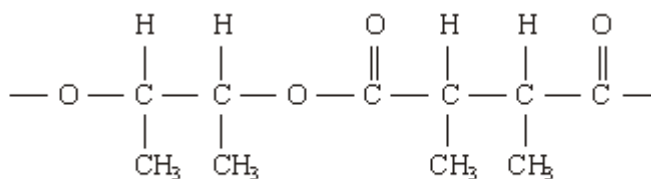


Q1. (a) The repeating units of two polymers, **P** and **Q**, are shown below.



P



Q

- (i) Draw the structure of the monomer used to form polymer **P**. Name the type of polymerisation involved.

Structure of monomer

Type of polymerisation

- (ii) Draw the structures of **two** compounds which react together to form polymer **Q**. Name these **two** compounds and name the type of polymerisation involved.

Structure of compound 1

Name of compound 1

Structure of compound 2

Name of compound 2

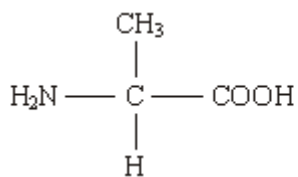
Type of polymerisation

- (iii) Identify a compound which, in aqueous solution, will break down polymer **Q** but not polymer **P**.

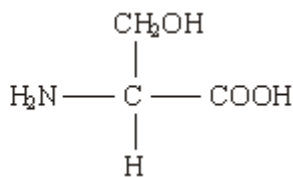
.....

(8)

- (b) Draw the structures of the **two** dipeptides which can form when one of the amino acids shown below reacts with the other.



Structure 1



Structure 2

(2)

- (c) Propylamine, $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$, can be formed either by nucleophilic substitution or by reduction.

- (i) Draw the structure of a compound which can undergo nucleophilic substitution to form propylamine.

- (ii) Draw the structure of the nitrile which can be reduced to form propylamine.

- (iii) State and explain which of the two routes to propylamine, by nucleophilic substitution or by reduction, gives the less pure product. Draw the structure of a compound formed as an impurity.

Route giving the less pure product

Explanation

.....

Structure of an impurity

(5)
(Total 15 marks)

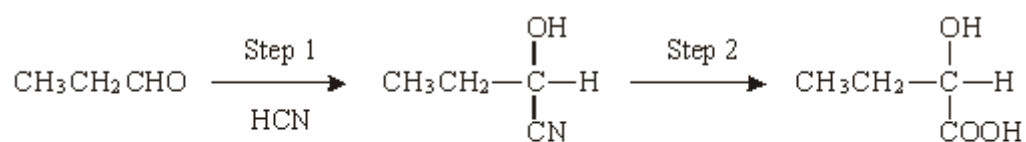
Q2. Terylene is made by reacting benzene-1,4-dicarboxylic acid and ethane-1,2-diol.

Terylene is

- A** an addition polymer.
- B** a polyamide.
- C** a polyester.
- D** a nylon.

(Total 1 mark)

Q3. Consider the reaction sequence shown below.



propanal

Q

- (a) Name and outline a mechanism for the reaction in Step 1.

Name of mechanism

Mechanism

(5)

(b) (i) Name compound **Q** formed in Step 2.

.....

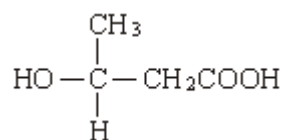
(ii) Two stereoisomers are formed by the dehydration of **Q**. Give the structures of these two isomers and name the type of stereoisomerism shown.

Structures of isomers

Type of stereoisomerism

(4)

(c) An isomer of **Q** which has the structure shown below is polymerised to form the biodegradable polymer known as PHB.



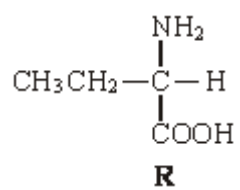
(i) Draw the repeating unit of the polymer PHB.

(ii) Suggest a reason why the polymer is biodegradable.

.....
.....

(2)

(d) The amino acid **R** is shown below.



(i) Draw the structure of the zwitterion formed by **R**.

(ii) Draw the structure of the major organic product formed when an excess of **R** is reacted with bromomethane.

- (iii) Name the mechanism of the reaction which results in the formation of the product given in part (ii).

.....

(3)
(Total 14 marks)

Q4. (a) The compound $\text{H}_2\text{C}=\text{CHCN}$ is used in the formation of acrylic polymers.

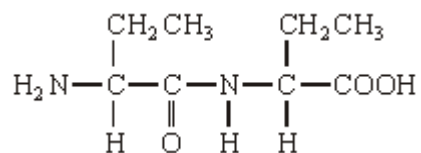
- (i) Draw the repeating unit of the polymer formed from this compound.

- (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.



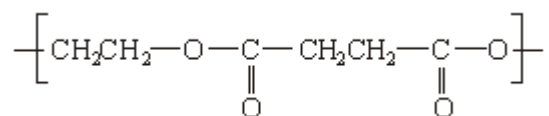
- (i) Name this amino acid.

.....

(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

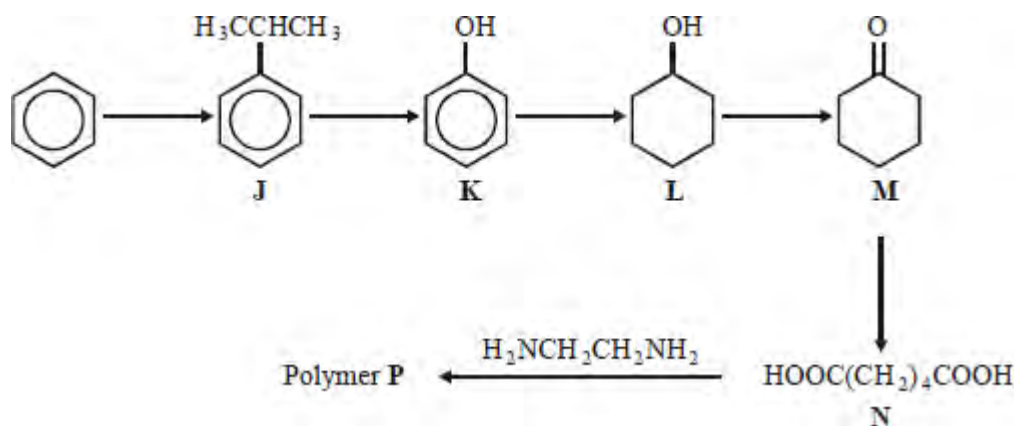
(iii) Give **one** reason why the polyester is biodegradable.

.....

.....

(4)
(Total 8 marks)

Q5. This question is about the following reaction scheme which shows the preparation of polymer **P**.



Polymer **P** is formed in a two-step reaction from **N**. The first stage is a neutralisation reaction. The volume, in cm^3 , of a 0.20 mol dm^{-3} solution of $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$ required to neutralise $6.8 \times 10^{-3} \text{ mol}$ of the acid **N** is

- A** 17
- B** 34
- C** 68
- D** 136

(Total 1 mark)