

**“All chained up”**

**Y13 UNIT 4 TEST 5**

**4.8 AMINO ACIDS  
4.9 POLYMERS**

**Answer all questions**

**SA SRECOM!**

Answer all questions  
Total 50 marks

**Name:.....**

**Mark for Section A...../36**

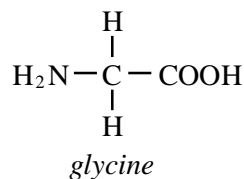
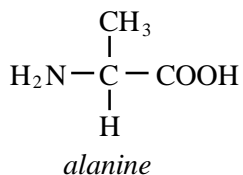
**Mark for section B..... /14**

**Total: ..... /50**

**Grade.....**

## SECTION A

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



- (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*

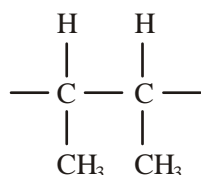
*Dipeptide 2*

(2)

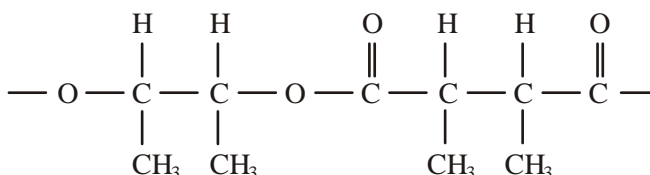
- (e) Give the structural formula of the organic compound formed when *glycine* reacts with methanol in the presence of a small amount of concentrated sulphuric acid.

(1)  
(Total 9 marks)

2. (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* .....

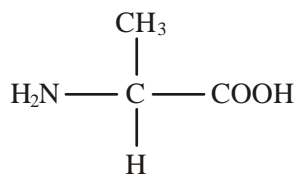
*Type of polymerisation* .....

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

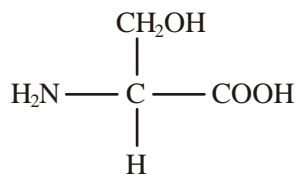
.....

(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* .....

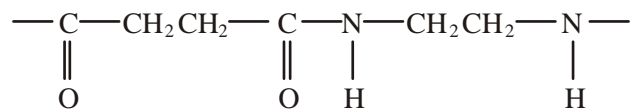
.....

*Structure of an impurity*

(5)

(Total 15 marks)

3. (a) The structure below shows the repeating unit of a polymer.



By considering the functional group formed during polymerisation, name this type of polymer and the type of polymerisation involved in its formation.

Type of polymer .....

Type of polymerisation .....

(2)

- (b) Draw the structure of the species present in solid aminoethanoic acid,  $\text{H}_2\text{NCH}_2\text{COOH}$

(1)

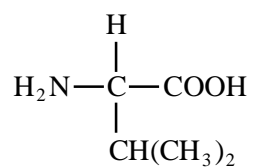
- (c) Explain why the melting point of aminoethanoic acid is much higher than that of hydroxyethanoic acid,  $\text{HOCH}_2\text{COOH}$

.....  
 .....  
 .....

(2)

(Total 5 marks)

4. (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**,  $(\text{CH}_3)_2\text{C}=\text{CHCH}_3$ , which can be polymerised.

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

*Type of polymerisation* .....

*Repeating unit*

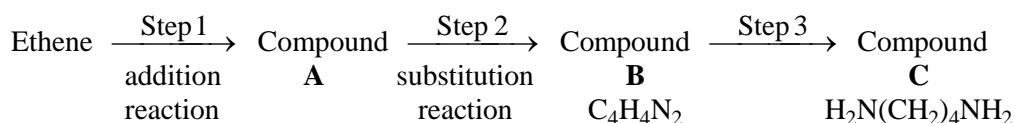
- (ii) Draw the structure of an isomer of **G** which shows geometrical isomerism.

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

(4)  
(Total 7 marks)

## SECTION B

5. (a) Compound C,  $\text{H}_2\text{N}(\text{CH}_2)_4\text{NH}_2$ , can be synthesised from ethene in three steps as shown below.



Name compound **C** and draw a structure for each of compounds **A** and **B**.  
State the reagent(s) required for each step and name the type of reaction involved in the conversion of **B** into **C**.

(7)

- (b) Draw the repeating unit of the polyamide formed when **C** reacts with hexanedioic acid. Discuss the interactions between the chains of the polyamide.

(4)

- (c) Explain why polyamides are degraded by sodium hydroxide whereas polymers such as poly(ethene) are not.

**(3)**

**(Total 14 marks)**

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



This image shows a full page of white paper with horizontal dotted lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

This image shows a full page of primary-ruled paper. It features approximately 20 horizontal rows, each defined by two parallel dotted lines. The paper is otherwise blank, with no margins, text, or other markings.