1. In this question, one mark is available for the quality of the use and organisation of scientific terms.

In all living organisms a large variety of polypeptides and proteins are formed naturally from α-amino acids.

State the general formula of an α-amino acid and use it to describe how amino acids can be combined to give a variety of polypeptides and proteins.

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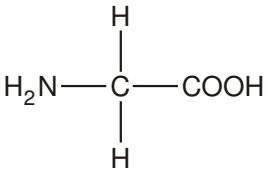
[6]

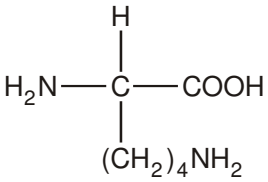
Quality of Written Communication [1]

[Total 7 marks]

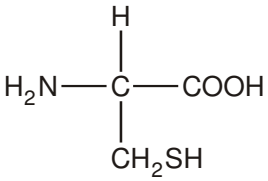
2. The four amino acids shown below are found in proteins and enzymes.



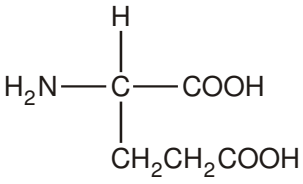
glycine



lysine



cysteine



glutamic acid

Write down the structural formula for a dipeptide formed from one molecule of glycine and one of lysine.

[Total 2 marks]

3. Leucine (2-amino-4-methylpentanoic acid) is a naturally occurring α-amino acid that is often used in protein supplements.

Leucine has a structural formula of $(CH_3)_2CHCH_2CH(NH_2)COOH$.

(a) (i) State the general formula of an α-amino acid.

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[1]

(ii) Draw a displayed formula of leucine.

[1]

(b) Leucine can exist as a zwitterion.

(i) State what is meant by the term *zwitterion*.

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[1]

(ii) Explain with the aid of a diagram how the zwitterion is formed from the functional groups in leucine.

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[2]

(c) Leucine can be obtained from a source of protein such as meat.

(i) State suitable reagents and conditions to break down a protein into amino acids.

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[2]

(ii) State the type of reaction occurring.

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[1]

[Total 8 marks]