Question 35 **(11 marks)**

Cytochrome C is a protein found in the cells of many organisms. A biochemist analysed the Cytochrome C from a human and a grey whale to establish their respective α-amino acid sequences.

(a) What protein structure level does the α-amino acid sequence represent? (1 mark)

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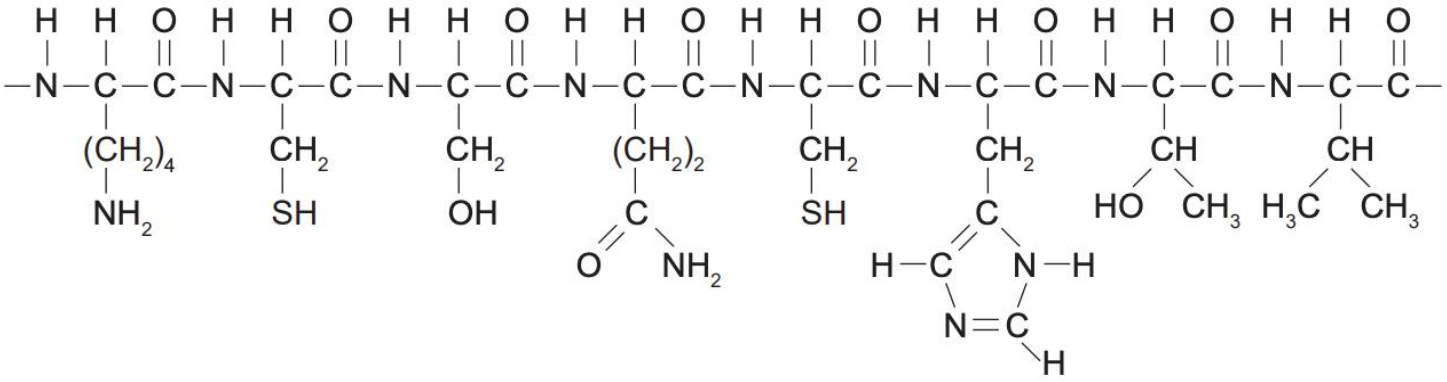
The structural formula of a small segment of human Cytochrome C, as written by the biochemist in her notebook, is shown below.



The biochemist wrote the sequence of α-amino acids in the corresponding grey whale Cytochrome C segment in an abbreviated form:

– Lys – Cys – Ala – Gln – Cys – His – Thr – Val –

(b) Identify **one** similarity and **one** difference between the given α-amino acid sequences of human and grey whale Cytochrome C. (2 marks)

Similarity: _____

_____

_____

Difference: _____

_____

_____

The biochemist examined the overall three-dimensional folded shape of grey whale Cytochrome C. The biochemist did this by identifying the predominant types of interactions occurring between the side chains of α-amino acids located near each other in grey whale Cytochrome C. Three of the α-amino acid pairs considered by the biochemist are shown in the following table.

(c) Complete the following table by identifying the predominant side chain interaction for each α-amino acid pair. (3 marks)

α-Amino acid pairs	**Predominant side chain interaction**
Ala and Val	
Gln and His	
Cys and Cys	

(d) The biochemist found that both human and grey whale Cytochrome C contain several alpha helices but no beta-pleated sheets. What protein structure level do alpha helices and beta-pleated sheets represent? (1 mark)

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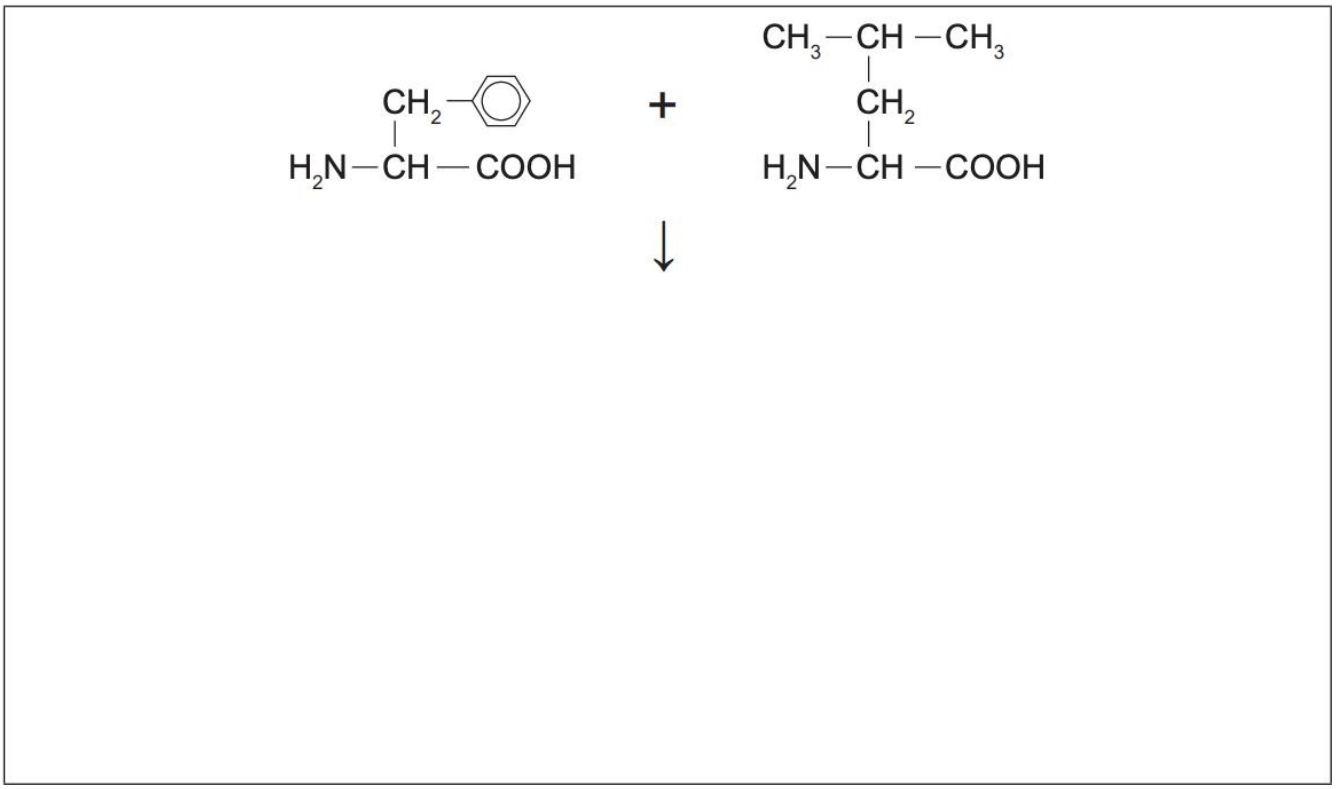
Further analysis of human Cytochrome C showed that there was a segment where two other α-amino acids (phenylalanine and leucine) were adjacent to each other. The biochemist obtained pure samples of each of these amino acids and set up an experiment to facilitate their reaction with each other.

(e) Write a balanced equation, using condensed structural formulae, for a reaction that occurs between phenylalanine and leucine. (2 marks)



(f) The biochemist decided to examine how the structure of leucine changes with solution pH. Complete the following table by drawing the structural formula of leucine at the indicated pH. (2 marks)

Structural formula of leucine	pH
	acidic
	alkaline