Chapter 5
Amino acids and chirality

Print out and complete this worksheet to generate a summary for Chapter 5.

The data in the table of amino acids are required to answer some of the questions that follow.

Amino acid		Side chain	pH at the isoelectric point
Alanine	Ala	$-CH_3$	6.0
Asparagine	Asn	$-CH_2CONH_2$	
Aspartic acid	Asp	$-CH_2COOH$	
Glutamic acid	Glu	$-CH_2CH_2COOH$	3.1
Glycine	Gly	$-H$	5.8
Leucine	Leu	$-CH_2CH(CH_3)_2$	6.0
Lysine	Lys	$-(CH_2)_4NH_2$	9.7
Phenylalanine	Phe	$-CH_2C_6H_5$	5.5
Valine	Val	$-CH(CH_3)_2$	

1 State the general formula of an amino acid.

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2 Refer to the table and draw the structures of the following amino acids:

a alanine

b valine

c aspartic acid

d asparagine

3 Explain what is meant by the term *α-amino acid*.

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4 a Explain what is meant by the term *stereoisomer*.

b Explain what is meant by the term *chiral centre*.

c Refer to the table of amino acids. Identify the R group in phenylalanine and draw the two stereoisomers of phenylalanine.

d Explain why the two stereoisomers of phenylalanine are called *optical* isomers.

5 a State the general formula of a zwitterion.

b Explain how a zwitterion is formed from an amino acid.

c Explain what is meant by the term *isoelectric point*.

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d The isoelectric point of glycine is at pH 5.8. Draw the structure of glycine at the following pH values:

(i) pH = 2.0

(ii) pH = 5.8

(iii) pH = 10.0

e Refer to the table of amino acids and draw the structures of the following:

(i) glutamic acid at pH 12.0

(ii) lysine at pH 2.0

6 Write a balanced equation for the following reactions.

a glycine + NaOH ⟶

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b aspartic acid + NaOH ⟶

c alanine + HCl ⟶

d asparagine + HCl ⟶

7 a Draw a peptide link.

b Explain how the two amino acids alanine and glycine could form four different dipeptides.

c Draw the structures of the following dipeptides:

(i) Phe–Val

(ii) Val–Phe

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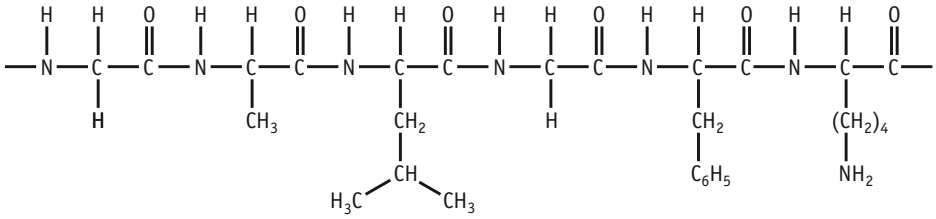
d Identify the amino acid sequence in the polypeptide below:



e Explain how peptides and proteins can be hydrolysed. Include the reagents and conditions in your answer.