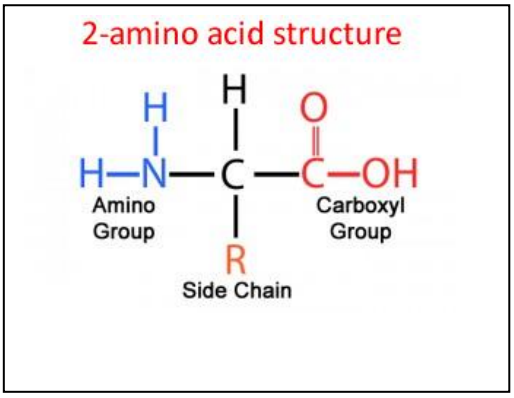
Lesson 1 – amino acids and proteins

Click to revise amino acids and protein structure.

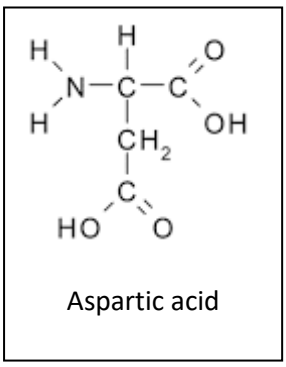
There are 20 different amino acids that the body uses to form the countless diverse number of proteins.

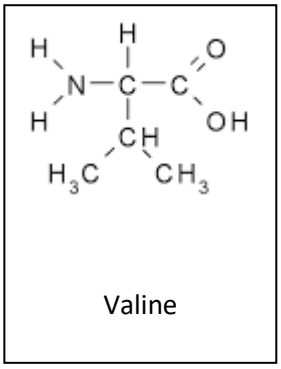
The general structure of an 2-amino acid is shown on the right. One 2-amino acid will differ from the next by having a different R group.



The R groups include:
- Non-polar side chains such as (-CH_3 or –$CH(CH_3)_2$)

- Polar side chains such as (CH_2COOH)


Aspartic acid


Valine

Some amino acids, 9 in fact, cannot be synthesised by the body and are known as essential amino acids that must be present in the diet.

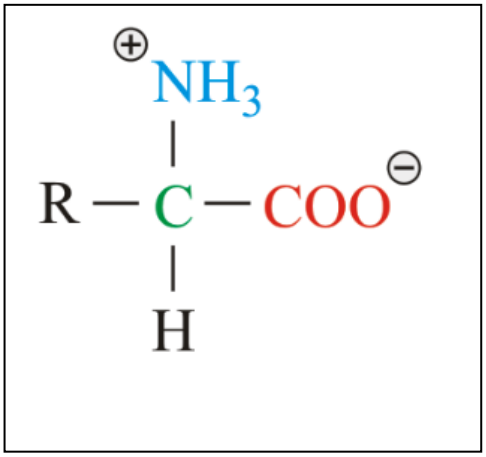
Since amino acids contain an amino (NH_2) and a carboxyl (COOH) group they can act as both an acid and a base. This makes them perfect biological pH buffers.

At low pH - $H_2N\text{-}CHR\text{-}COOH + H^+ \rightarrow {}^+H_3N\text{-}CHR\text{-}COOH$

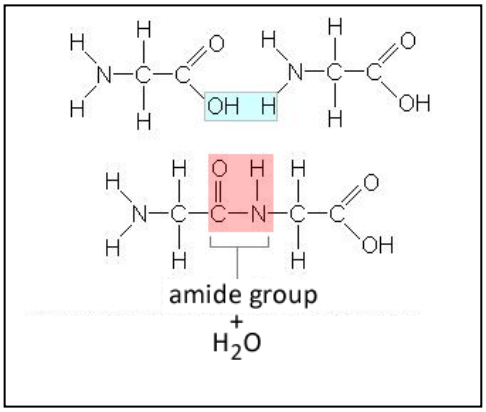
At high pH- $H_2N\text{-}CHR\text{-}COOH + OH^- \rightarrow H_2N\text{-}CHR\text{-}COO^- + H_2O$

At some intermediate pH the amino acid exists as a zwiterion.

A zwitterion is a neutral dipolar ion as shown on the right.

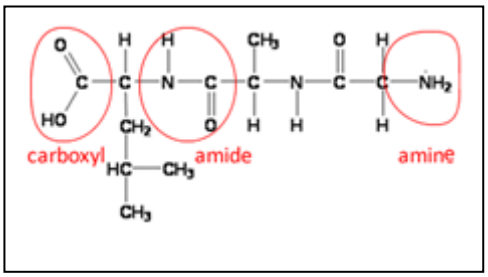


Amino acids undergo condensation polymerisation to form polypeptides (proteins). The amine and carboxyl functional groups react to form an amide group, commonly referred to as a peptide link, as shown on the right.

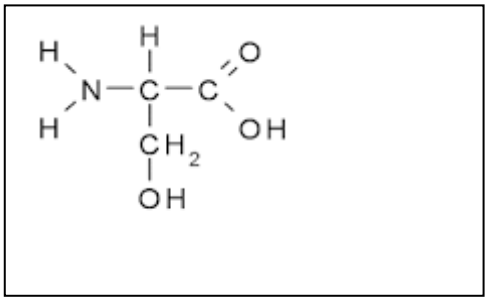


1) Consider the tri-peptide shown on the right.
a) Name the amino acids that formed the tri-peptide. Use the data sheet.

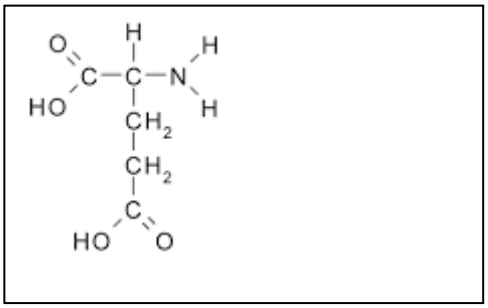
b) Circle and name three functional groups shown on the tri-peptide.



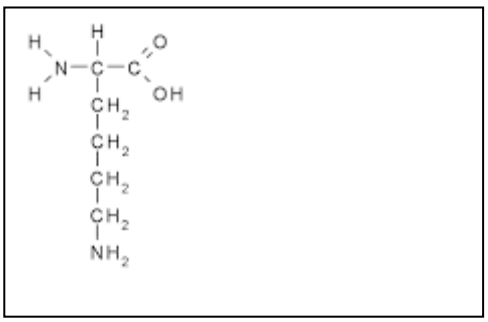
2) Give IUPAC names of the following amino acids.



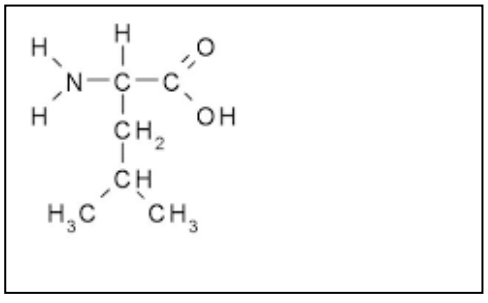
2-amino-3-hydroxy-propanoic acid



2-aminopentanedioic acid



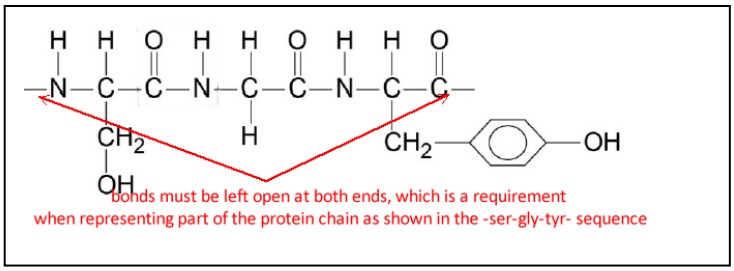
2,6-diaminohexanoic acid



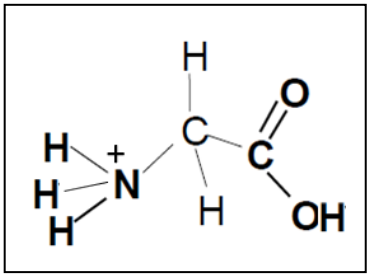
2-amino-4-methylpentanoic acid

3) A small protein fragment was isolated from the blood of a rare bird. After analysis it was concluded that the amino acid sequence of a small part of this protein was -ser-gly-tyr-.

a) Draw the structure of this section.



b) Glycine was removed and placed in 0.1 M HCl solution. Draw the structural formula of glycine under these conditions.



4) Consider the table on the right. It shows the side chains of 6 amino acids. Amino acids can be classified according to the nature of their side chains (Z or R groups). These may be polar, non-polar, acidic or basic.

Name of amino acid	Structure of side chain of pH 7
alanine (Ala)	$-CH_3$
asparagine (Asn)	$-CH_2-CO-NH_2$
aspartic acid (Asp)	$-CH_2COO^-$
cysteine (Cys)	-CH-SH
lysine (Lys)	$-CH_2-CH_2-CH_2-CH_2-NH_3^+$
serine (Ser)	$-CH_2OH$

a) name one polar amino acid
serine, or Asn or Asp

b) name one non-polar amino acid.
alanine

c) Which **two different** amino acids form hydrogen bonds between each other? *Ser and Asn*

d) Which **two different** amino acids form ionic bonds (salt bridges) between each other? *Lys and Asp*