

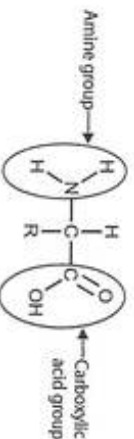
AMINO ACIDS AND PROTEINS

u13 - team 2

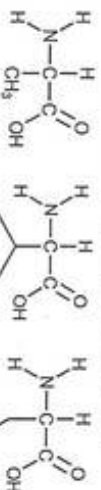
AMINO ACIDS

GENERAL FORMULA

Amino acids are compounds with the general formula $\text{RCH(NH}_2\text{)COOH}$. They are often drawn like this:



There are 20 different amino acids, each with a different 'R' group, or side chain. Here are some examples of different amino acids:

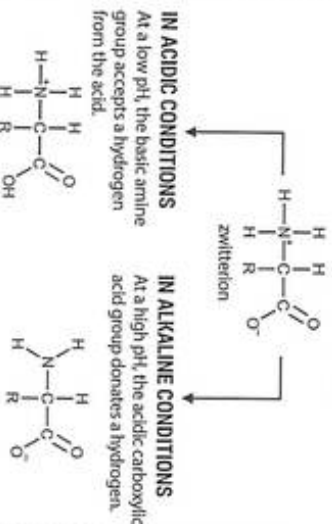


ZWITTERIONS

Zwitterion: an ion containing a positive and a negative charge.

Amino acids contain an acidic carboxylic acid group and a basic amine group, so they can react with both bases and acids.

At a pH called the 'isoelectric point', the amino acid forms a **zwitterion**. The acidic carboxylic acid has donated a hydrogen, and the basic amine group has accepted a hydrogen.



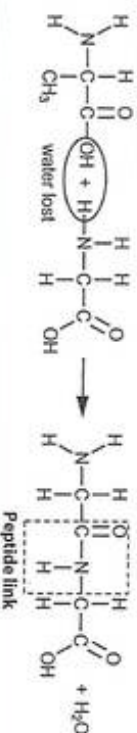
EXAM TIP

Some amino acids also have side chains which react with acids or bases, so watch out!

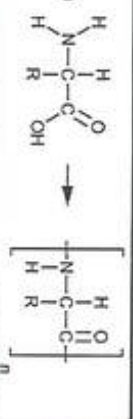
PROTEINS

PEPTIDE LINKS

Amino acids can react together to form polymer chains. The carboxylic acid group reacts with the amine group to form a peptide link.



Multiple amino acids can link together in a chain to form a polymer. When these chains have a biological function, they are called **proteins**.



PROTEIN STRUCTURE

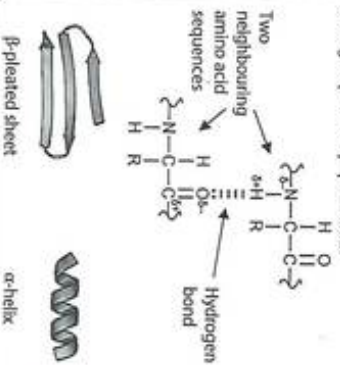
PRIMARY STRUCTURE

The **primary structure** of a protein is the order of the amino acids.



SECONDARY STRUCTURE

Two main structures form in amino acid chains: **α-helices** and **β-pleated sheets**. These are the result of hydrogen bonding between N-H and C=O groups in the peptide links.

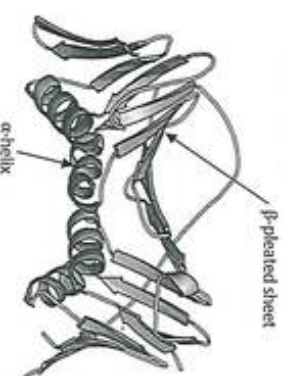


ENZYMES

Enzymes are proteins that act as catalysts in biological reactions using their active sites. Active sites are **stereospecific**, meaning that only one enantiomer of the correct molecule will bind to the active site. Many drugs have the same shape as a protein's active site, so can block them and inhibit the enzyme. Computers can be used to help design these drugs.

TERTIARY STRUCTURE

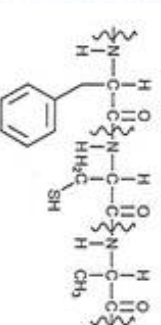
The tertiary structure describes how the α-helices and β-pleated sheets, and the rest of the amino acid chain, fold together in a complex 3D structure.



HYDROLYSIS

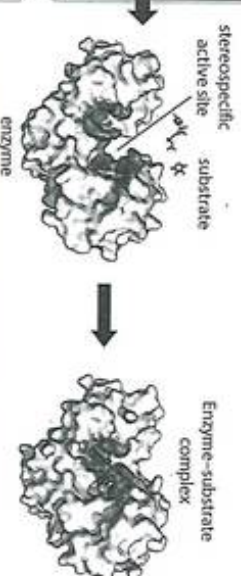
When a protein is hydrolysed, the peptide links break to reform the original amino acids.

Hydrolysing the following protein section at the bonds shown will give three different amino acid monomers:



EXAM TIP
Look for the peptide links and split them down the middle.

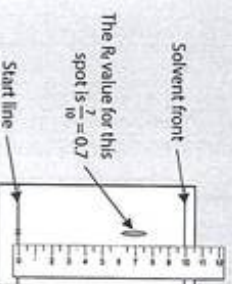
If the hydrolysis occurs in acid, the amine will form an ion and the carboxylic acid group will form a neutral protonated form.



CHROMATOGRAPHY

Chromatography can be used to identify the amino acids in a sample.

$$R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$



Amino acids are not coloured, so they are not normally visible. The chromatogram can be sprayed with a dye such as **ninhydrin**, which turns the amino acids purple.