Cambridge (CIE) IGCSE Biology

Your notes

Biological Molecules

Contents

Your notes

Chemical Elements

- Most of the molecules in living organisms fall into three categories: **carbohydrates, proteins and lipids**
- These **all contain carbon** and so are described as organic molecules

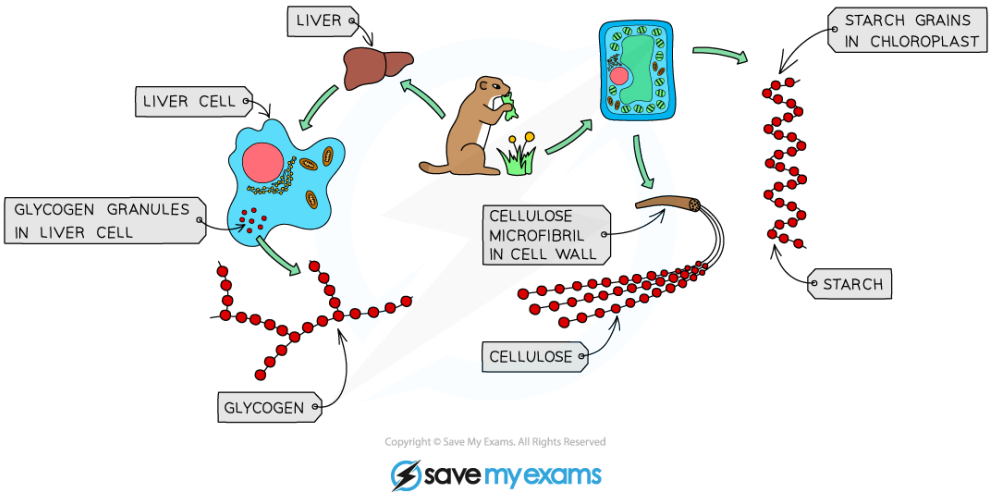
Chemical Elements Table

MOLECULE	CHEMICAL ELEMENTS
CARBOHYDRATE	CARBON, OXYGEN AND HYDROGEN
PROTEIN	ALL CONTAIN CARBON, OXYGEN, HYDROGEN AND NITROGEN AND SOME CONTAIN SMALL AMOUNTS OF OTHER ELEMENTS SUCH AS SULPHUR
LIPID	CARBON, OXYGEN AND HYDROGEN

Large Molecules are Made from Smaller Molecules

Carbohydrates

- Long chains of **simple sugars**
- **Glucose** is a simple sugar (a monosaccharide)
- When **2 glucose molecules join together maltose is formed** (a disaccharide)
- When **lots** of glucose molecules join together **starch, glycogen or cellulose** can form (a polysaccharide)

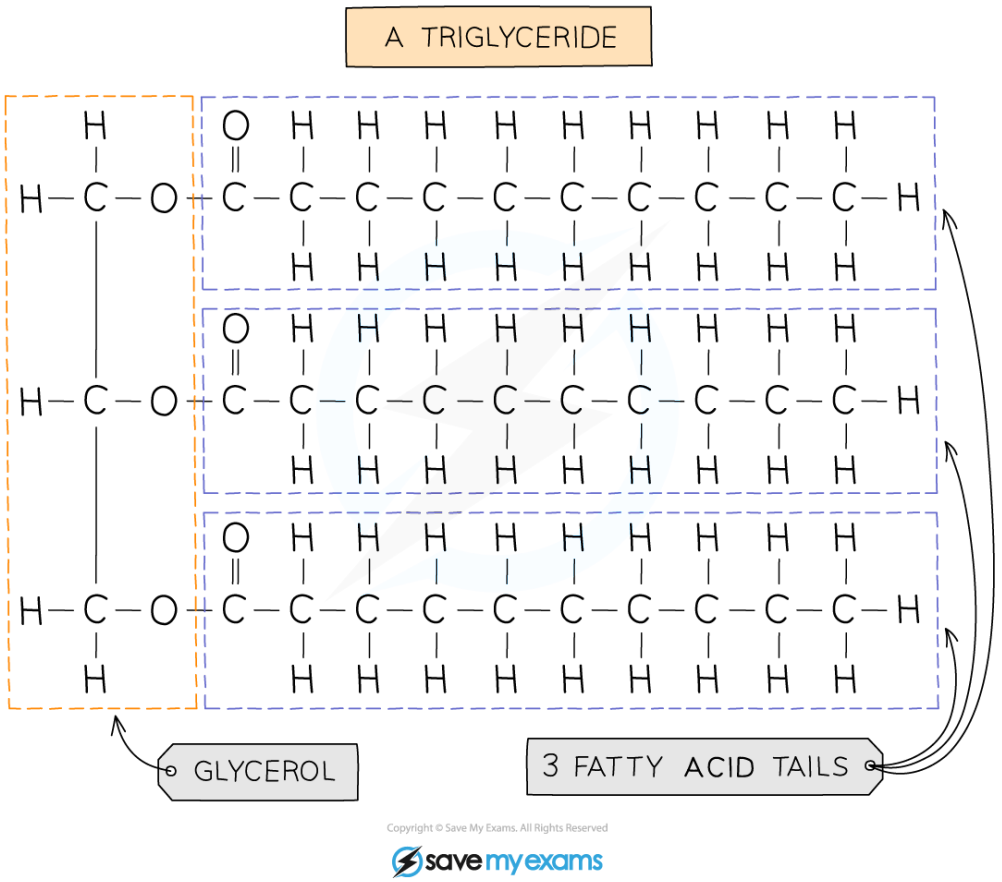


Glycogen, cellulose and starch are all made from glucose molecules

Fats

- Most fats (lipids) in the body are made up of **triglycerides**
- Their basic unit is **1 glycerol molecule chemically bonded to 3 fatty acid chains**
- The fatty acids vary in size and structure
- Lipids are divided into **fats** (solids at room temperature) and **oils** (liquids at room temperature)

Your notes



Structure of a triglyceride

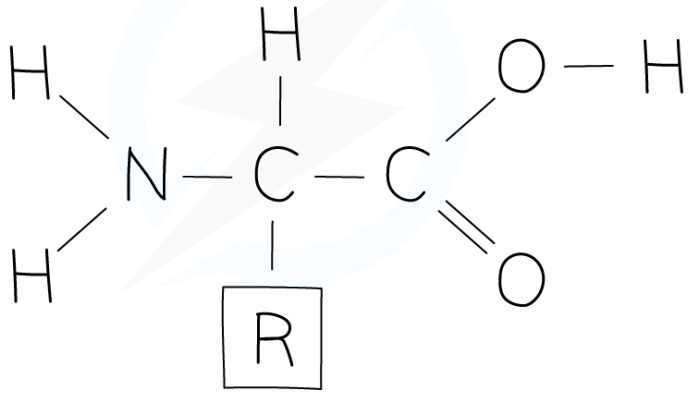
Proteins

- Long chains of **amino acids**
- There are about 20 different amino acids
- They all contain the **same basic structure** but the **'R' group is different for each one**
- When amino acids are joined together a protein is formed
- The amino acids can be arranged in any order, resulting in hundreds of thousands of different proteins
- Even a small difference in the order of the amino acids results in a different protein being formed

Your notes

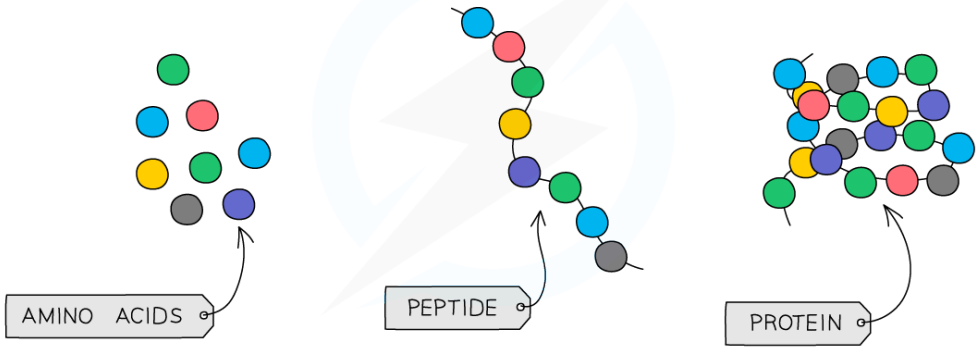
Your notes

GENERAL STRUCTURE OF AMINO ACIDS



General amino acid structure

HOW YOUR BODY USES AMINO ACIDS AS BUILDING BLOCKS



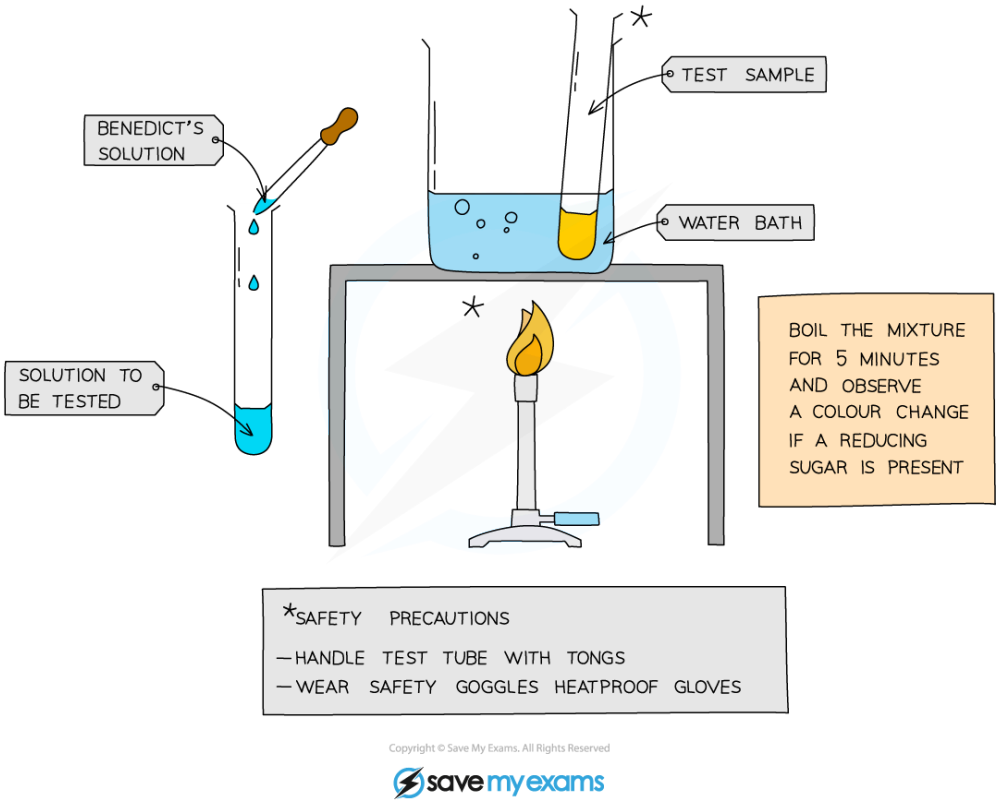
Amino acids join together to form proteins

Your notes

Food tests

Food test for glucose (a reducing sugar)

- Add **Benedict's solution** into sample solution in test tube
- **Heat** at 60 - 70 °c in water bath for **5 minutes**
- Take test tube out of water bath and observe the colour
- A positive test will show a colour change from **blue to orange or brick red**

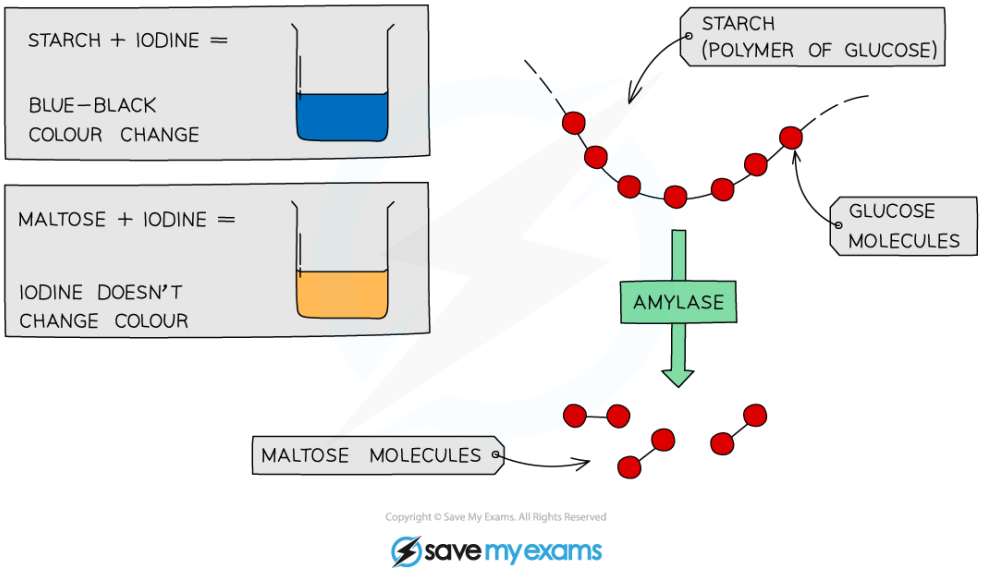


A positive test for glucose will show a colour change from blue to orange or brick red

Use this image

Food test for starch

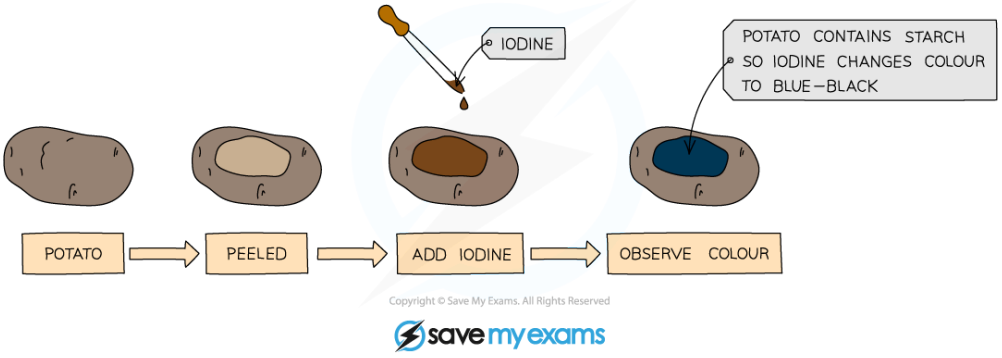
- We can use **iodine** to test for the presence or absence of starch in a food sample.



We can use iodine to test for the presence or absence of starch in a food sample

Use this image

- Add drops of **iodine solution** to the food sample
- A positive test will show a colour change from **orange-brown to blue-black**



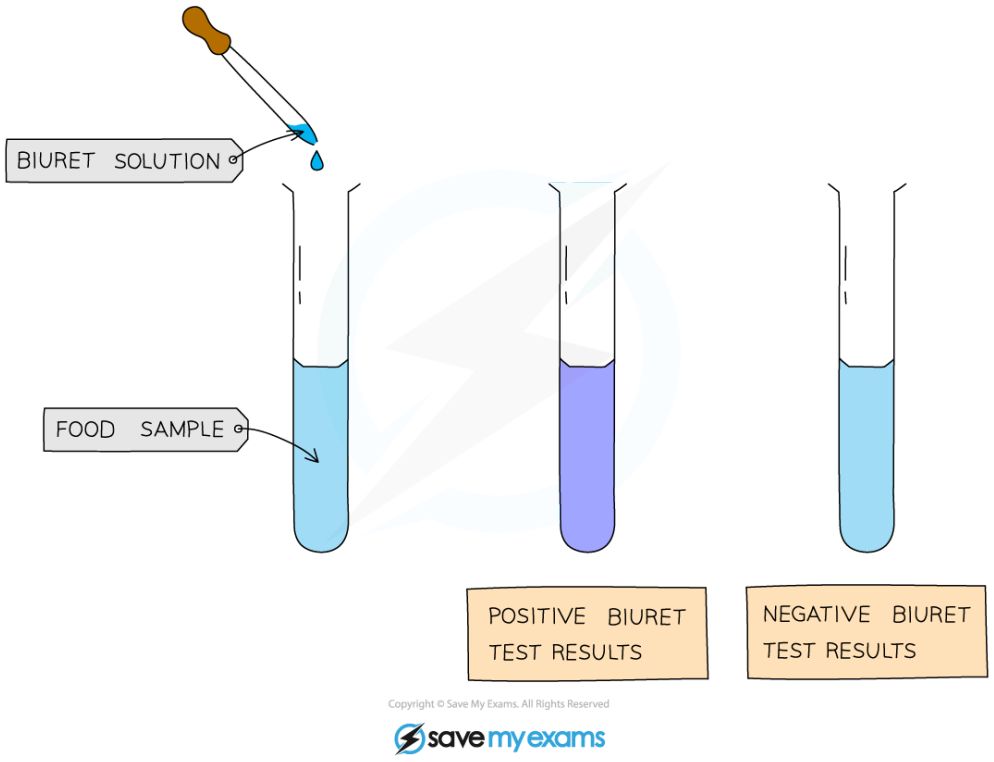
A positive test for starch will show a colour change from orange-brown to blue-black

Use this image

Food test for protein

- Add drops of **Biuret solution** to the food sample
- A positive test will show a colour change from **blue to violet / purple**

Your notes



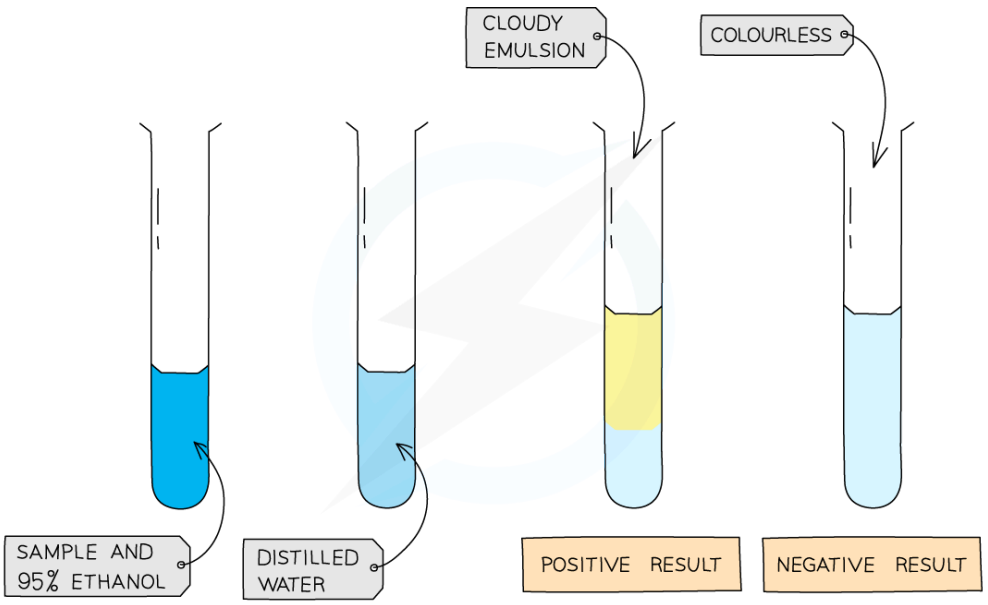
A positive test for protein will show a colour change from blue to violet / purple

Use this image

Food test for lipids

- Food sample is mixed with **2cm^3 of ethanol** and shaken
- The ethanol is added to an equal volume of **cold water**
- A positive test will show a **cloudy emulsion** forming

Your notes

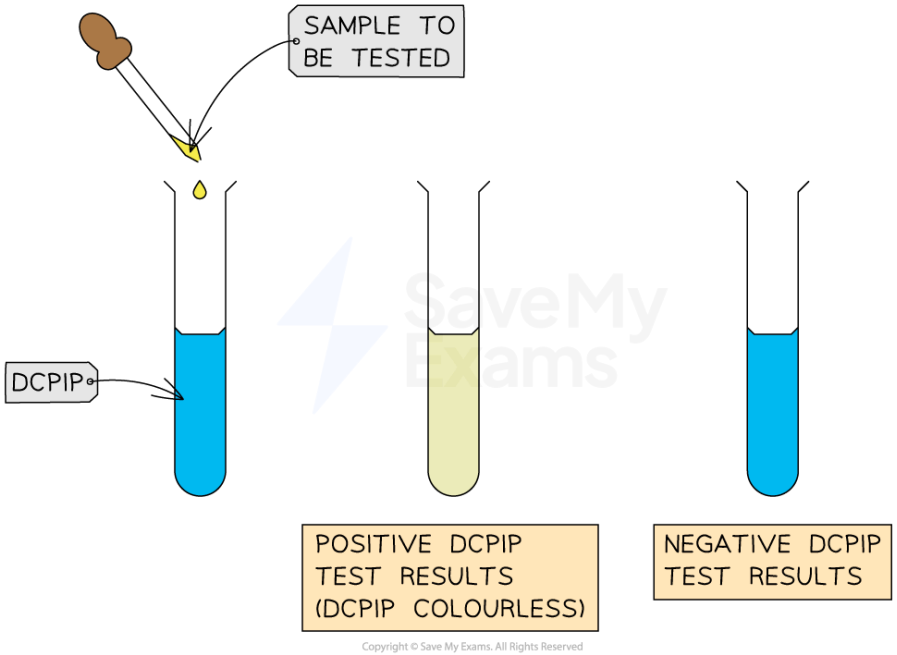


A positive test for lipids will show a cloudy emulsion forming

Use this image

Food test for vitamin C

- Add **1cm^3 of DCPIP solution** to a test tube
- Add a small amount of food sample (as a solution)
- A positive test will show the **blue colour of the dye disappearing**



Your notes

A positive test for vitamin C will show the blue colour of the dye disappearing

Use this image

Your notes

Examiner Tips and Tricks

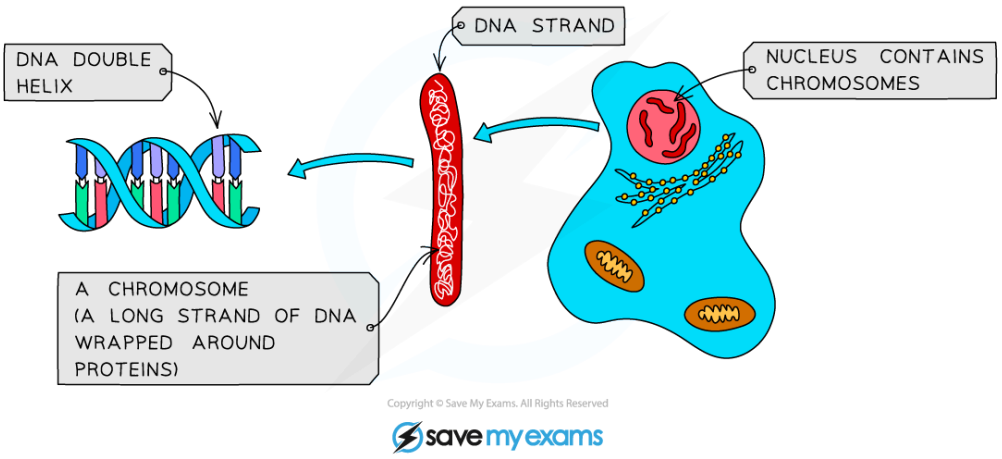
When describing food tests in exam answers, make sure you give the **starting colour** of the solution and **the colour it changes to** for a positive result.

Your notes

Structure of a DNA Molecule: Extended

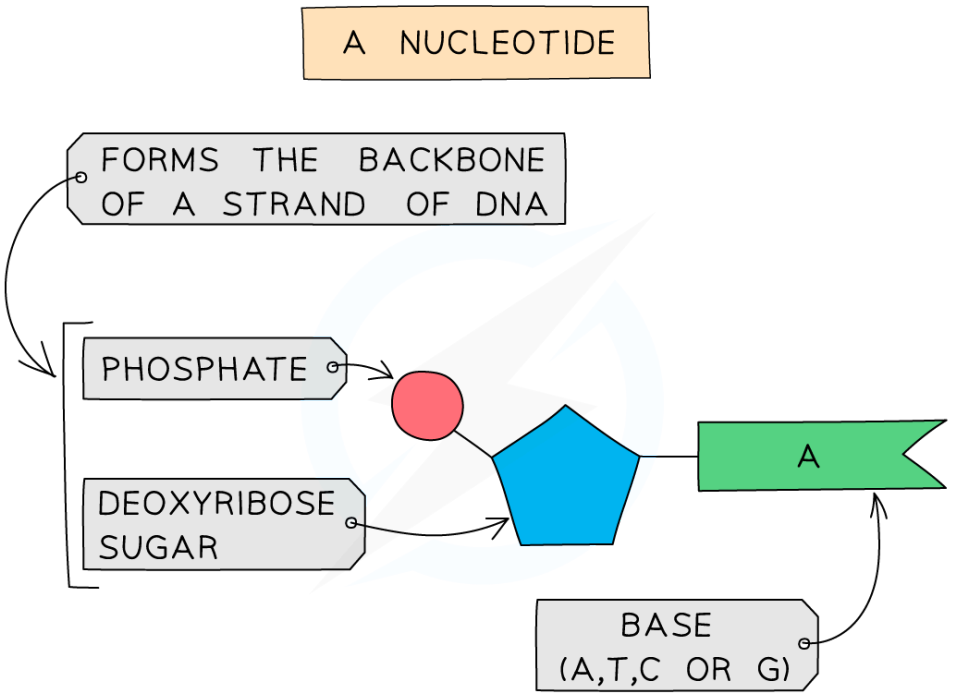
Extended Tier Only

- DNA, or deoxyribonucleic acid, is the molecule that contains the instructions for the growth and development of all organisms
- It consists of two strands of DNA wound around each other in what is called a **double helix**



DNA, chromosomes and the nucleus

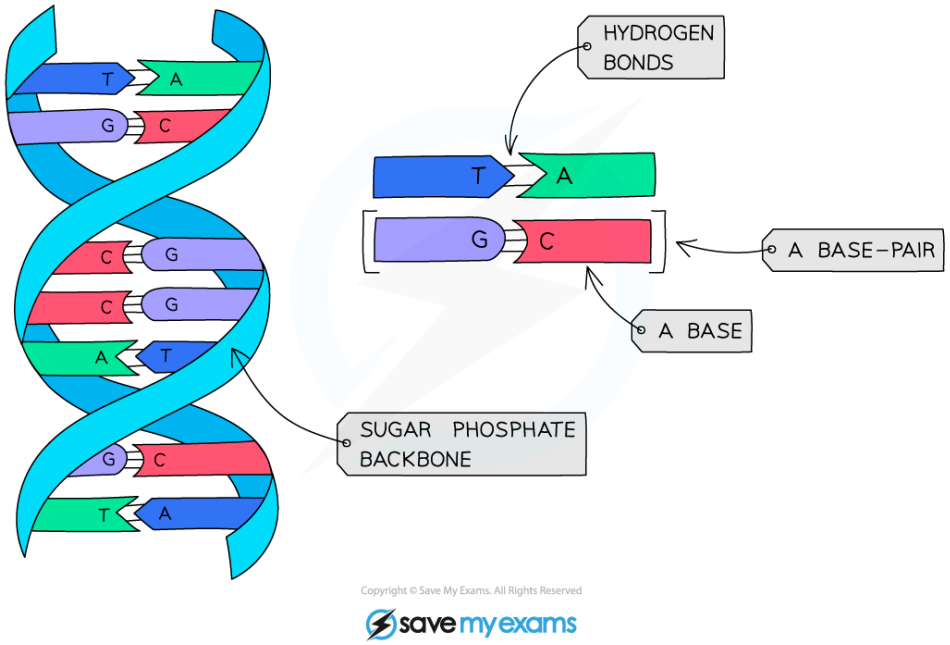
- The individual units of DNA are called **nucleotides**



A nucleotide

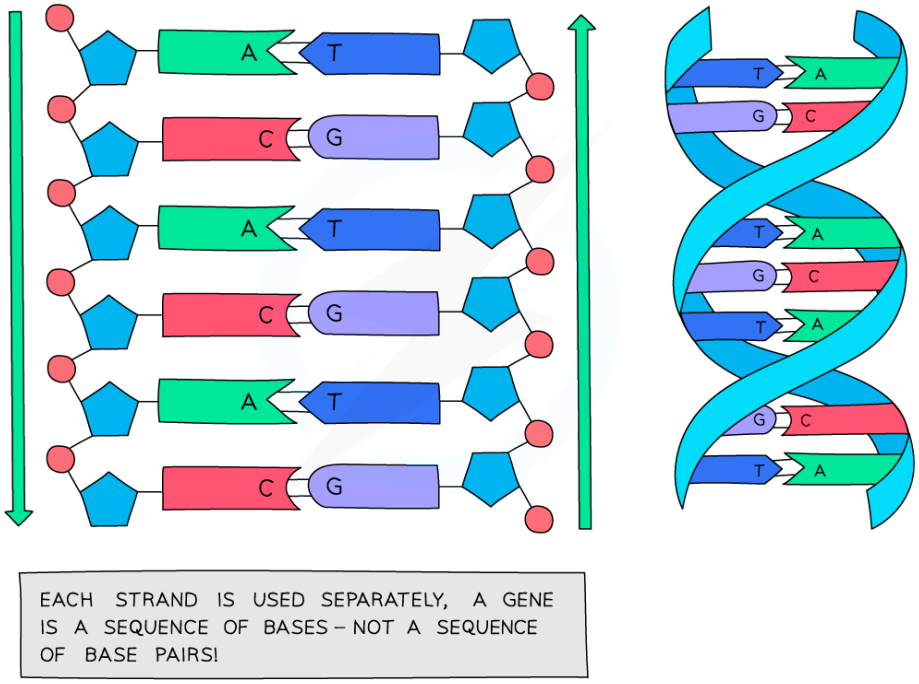
- All nucleotides contain the same phosphate and deoxyribose sugar, but differ from each other in the **base** attached
- There are four different bases, **Adenine (A), Cytosine (C), Thymine (T) and Guanine (G)**
- The bases on each strand pair up with each other, holding the two strands of DNA in the double helix
- The bases always pair up in the same way:
  - Adenine always pairs with Thymine **(A-T)**
  - Cytosine always pairs with Guanine **(C-G)**

Your notes



DNA base pairs

- The phosphate and sugar section of the nucleotides form the 'backbone' of the DNA strand (like the sides of a ladder) and the base pairs of each strand connect to form the rungs of the ladder



The DNA helix is made from two strands of DNA held together by hydrogen bonds

- It is this sequence of bases that holds the code for the formation of proteins

Your notes

Examiner Tips and Tricks

You do not need to learn the names of the bases, **just their letter**. Make sure you **know which bonds with which**, as this is the most commonly asked question about this topic.