

Biological molecules

IGCSE Biology 0610 · Topic 4 revision notes

Everything from the 2 lessons of this topic on a few pages: the key idea of each lesson, the diagram to remember, the points to learn and the traps examiners set. Read it, cover it, test yourself.

1. Large molecules from small ones

2. Food tests and the structure of DNA

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1 Large molecules from small ones

Syllabus 4.1

Carbohydrates and fats contain carbon, hydrogen and oxygen only. Proteins contain carbon, hydrogen, oxygen and nitrogen (some also contain sulfur). Large biological molecules are made by joining many small molecules together: **starch, glycogen and cellulose** are made from glucose; proteins from amino acids; fats and oils from fatty acids and glycerol.

small molecules



large molecules



Fig. 1: three families of large molecule and the small molecules each is built from; the hexagons are glucose units, the coloured beads are amino acids

C, H, O for two; add N for proteins.

- ✓ **Carbohydrates and fats:** carbon, hydrogen and oxygen only.
- ✓ **Proteins:** carbon, hydrogen, oxygen and nitrogen; some contain sulfur as well.
- ✓ **From glucose:** starch, glycogen and cellulose. **From amino acids:** proteins. **From fatty acids and glycerol:** fats and oils.
- ✓ **Name both parts of a fat** and never say a large molecule is made from another large molecule.

Watch out!

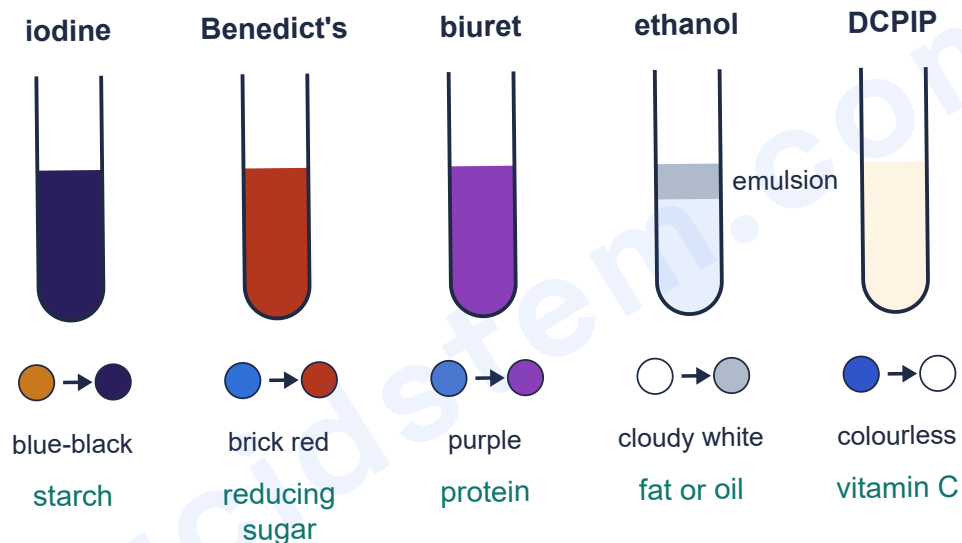
Nitrogen is the element that separates proteins from the other two groups. "Carbon, hydrogen and oxygen" is a correct answer for carbohydrates and for fats, but it loses the mark for proteins unless you add nitrogen.

"Fats are made from fatty acids" is only half an answer. Always name both parts: **fatty acids and glycerol**. Likewise, cellulose is made from glucose, not from starch.

2 Food tests and the structure of DNA

Syllabus 4.1

Iodine solution turns from orange-brown to **blue-black** with starch. **Benedict's solution**, heated in a water bath, turns from blue to green, yellow, orange or **brick red** with reducing sugars. **Biuret** turns from blue to **purple** with protein. Shaking a food with ethanol and pouring it into water gives a **cloudy white emulsion** if fat is present. Vitamin C turns blue **DCPIP colourless**. Extended: DNA is **two strands coiled into a double helix**; each strand carries bases, bonds between pairs of bases hold the strands together, and the bases always pair **A with T and C with G**.



Benedict's must be heated in a water bath; the other four tests work cold.

Fig. 1: the five food tests; each tube shows a positive result, and the circles show the colour change from the reagent to that result

Name the reagent, the method and both colours.

- ✓ **Starch:** iodine, orange-brown to blue-black. **Protein:** biuret, blue to purple.
- ✓ **Reducing sugar:** Benedict's, heat in a water bath, blue to green, yellow, orange or brick red.
- ✓ **Fat:** shake with ethanol, pour into water, cloudy white emulsion. **Vitamin C:** DCPIP, blue to colourless; fewer drops means more vitamin C.
- ✓ **Extended DNA:** two strands, double helix, bases, bonds between base pairs, A with T and C with G.

Watch out!

State both colours: the colour of the reagent at the start and the colour it turns. "Iodine turns blue" instead of blue-black, or a Benedict's result given without heating, are classic lost marks.

Do not read the number of drops as the amount of vitamin C. More drops means less vitamin C in each drop of juice.

Pair the bases A with T and C with G, never A with G or C with T. And it is the bonds between pairs of bases that hold the two strands together.