

Exercise walk-through

4.1

Biological molecules

IGCSE Biology

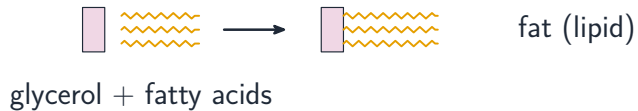
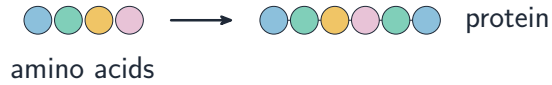
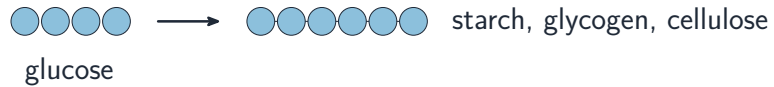
Elements in food

carbohydrates
and fats
C H O

proteins
C H O N

- **Carbohydrates** and **fats** contain three elements: **carbon** (C), **hydrogen** (H) and oxygen (O).
- **Proteins** contain carbon, hydrogen and oxygen too, plus **nitrogen** (N). (Some proteins also contain sulfur, S.)

Building large molecules



Large molecules are joined from many small ones, like beads on a string.

- **starch** , **glycogen** ,
cellulose – many
glucose units
- proteins – **amino acids** ,
about 20 kinds
- fats – three **fatty acids** to
one **glycerol**

Starch and glycogen *store* energy;
cellulose builds *cell walls*.

Small units, large molecules

Carbohydrates

Simple sugars join into starch, glycogen and cellulose.

Fats and oils

Built from **fatty acids** and **glycerol** – three fatty acids to each glycerol.

Proteins

Long chains of amino acids, folded into a shape that decides the job.

DNA

Two strands of nucleotides. **Bonds** between **pairs of bases** hold the strands together, and DNA is the **genetic material** – the instructions for building and running the organism.

Each family is one kind of small unit repeated. Name the unit and you have named the molecule.

Food tests

Food substance (test)	start	positive result
Starch (iodine)		 blue-black
Reducing sugar (Benedict's, heat)		 brick-red
Protein (biuret)		 purple
Fat (ethanol emulsion)		 cloudy white
Vitamin C (DCPIP)		 colourless

Add a test chemical & watch the colour (**biuret** for protein, an **emulsion** for fat).

Only **Bene-**
dict's needs
heat. DCPIP goes **colourless**;
the others gain a colour.

The five food tests, colour by colour

Starch

Add **iodine solution** : orange-brown → **blue-black**.

Reducing sugar

Add Benedict's solution and **heat**: blue → green → yellow → brick-red.

Protein

Biuret test: blue → **purple**.

Fats and oils

The **ethanol emulsion** test: dissolve in ethanol, then add water – a cloudy white layer forms.

Vitamin**C**

Add the food to blue DCPIP: blue → **colourless**. The only test whose colour is *lost*.

Only Benedict's needs heat, and only the ethanol test needs two liquids. Naming the reagent *and* both colours is what earns the marks.

Exercises 2.1·2.2

2.1 Name the elements found in a protein.

[1]

2.2 Name the small units that join to make a protein.

[1]

Exercises 2.1·2.2

2.1 Name the elements found in a protein.

[1]

2.1

- a protein contains **carbon, hydrogen, oxygen and nitrogen**
-

2.2 Name the small units that join to make a protein.

[1]

2.2

- proteins are made of **amino acids**

Exercise 3.1

3.1 The test for a reducing sugar uses Benedict's solution and:

[1]

☐

A cooling

B heat

C iodine

D no change

Exercise 3.1

3.1 The test for a reducing sugar uses Benedict's solution and:

[1]

☐

A cooling

B heat

C iodine

D no change

3.1 B

- Benedict's test needs **heat**
- A would slow it; C is starch; D is false

Exercise 3.2 (a)

3.2 A student tests a food sample.

(a) Describe the test for starch and its positive result.

[2]

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[2]

(a)

- add **iodine** solution
- orange-brown turns **blue-black**

Exercise 3.2 (b)

3.2 A student tests a food sample.

(b) Describe the test for protein and its positive result.

[2]

Exercise 3.2 (b)

3.2 A student tests a food sample.

(b) Describe the test for protein and its positive result.

[2]

(b)

- add **biuret** solution
- blue turns **purple**

Exercise 3.3

3.3 One strand of DNA has the base sequence A–C–G–T. Write the sequence of the matching strand. [2]

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3.3

- A pairs with T, C pairs with G
- matching strand: **T–G–C–A**

Exercise 3.4 (a)

3.4 A student tested a food sample for three nutrients.

(a) For **starch**, **reducing sugar** and **protein**, name the reagent used, describe the method, and give the positive result. [6]

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(a) For **starch**, **reducing sugar** and **protein**, name the reagent used, describe the method, and give the positive result. [6]

(a)

- **starch**: iodine; orange-brown → **blue-black**
- **reducing sugar**: Benedict's + heat; blue → **brick red**
- **protein**: biuret; blue → **purple/lilac**

Exercise 3.4 (b)

3.4 A student tested a food sample for three nutrients.

(b) The sample was positive for starch and protein but negative for reducing sugar. Name the small units that starch and protein are each built from. [2]

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(b) The sample was positive for starch and protein but negative for reducing sugar. Name the small units that starch and protein are each built from. [2]

(b)

- starch is built from **glucose**
- protein is built from **amino acids**

Exercise 3.4 (c)

3.4 A student tested a food sample for three nutrients.

(c) Explain why the reducing sugar test needs heating but the starch test does not. [2]

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3.4 A student tested a food sample for three nutrients.

(c) Explain why the reducing sugar test needs heating but the starch test does not. [2]

(c)

- Benedict's is a chemical reaction that needs **heat**
- iodine just **changes colour** when it meets starch

Exercise 3.4 (d)

3.4 A student tested a food sample for three nutrients.

(d) Name the three elements found in every carbohydrate, and the extra element always present in a protein. [2]

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(d) Name the three elements found in every carbohydrate, and the extra element always present in a protein. [2]

(d)

- carbohydrates: **C, H, O**
- proteins also always contain **nitrogen**