

Exercise walk-through

2.1

Testing for biological molecules

A-Level Biology

The properties of water that matter to life

solvent	action	many substances dissolve in it – which lets reactions happen and lets substances be transported
high specific heat capacity		so cells and habitats change temperature slowly
latent heat of vaporisation		a lot of energy is needed to evaporate water, so evaporation cools effectively – sweating, transpiration
cohesion		water molecules stick together, giving the unbroken column in xylem and surface tension
density of ice		ice is less dense , so it floats and insulates the water beneath
a metabolite		water is a reactant in hydrolysis and in photosynthesis, not only a medium

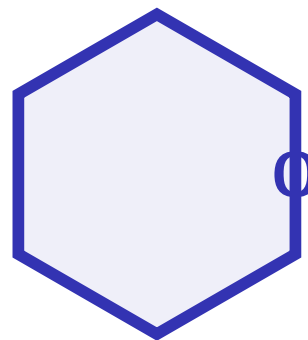
Every one of these follows from **hydrogen bonding** between polar molecules. Name the cause before listing the consequences.

Exam tips

- Learn each **food test** as reagent + positive result + colour change (Benedict's → brick-red; iodine → blue-black; biuret → purple; emulsion → white).
- Benedict's detects **reducing** sugars; for a non-reducing sugar you must **hydrolyse with acid first**, then re-test.
- Name the bond precisely: **glycosidic** (carbohydrates), **ester** (lipids), **peptide** (proteins) – all made by **condensation** (water removed).
- Link structure to function: cellulose (straight chains, H-bonds → strong), glycogen/starch (branched/coiled → compact store).
- For proteins, name the bond at each level: primary (peptide), secondary (hydrogen), tertiary (R-group interactions), quaternary.

Check yourself

- 1 Which test detects protein, and its colour?
- 2 Which bond joins two monosaccharides?
- 3 Cellulose is made of which glucose form?
- 4 Which part of a phospholipid is hydrophilic?



Answers 1. biuret → purple 2. a glycosidic bond 3. β -glucose 4. the phosphate head

Exercises 2.1·2.2

2.1 State the reagent and the positive result for each test.

[4]

test	reagent	positive result
starch		
protein		

2.2 A student wants to compare the reducing-sugar concentration of three drinks. Describe how the Benedict's test can be made **semi-quantitative** to do this.

[3]

Exercises 2.1·2.2

2.1 State the reagent and the positive result for each test.

[4]

test	reagent	positive result
starch		
protein		

2.1

- starch – iodine (solution); turns blue-black. protein – biuret solution; turns purple/lilac

2.2 A student wants to compare the reducing-sugar concentration of three drinks. Describe how the Benedict's test can be made **semi-quantitative** to do this.

[3]

2.2

- standardise the test using solutions of **known concentration**; record the time to first colour change *or* the final colour for each; estimate the unknown by comparing its time/colour to these standards

Exercise 3.1

3.1 Which test and result correctly identifies a protein?

[1]

☐

A biuret solution, stays blue

B biuret solution, turns purple

C Benedict's solution, turns brick-red

D iodine solution, turns blue-black

Exercise 3.1

3.1 Which test and result correctly identifies a protein?

[1]

☐

A biuret solution, stays blue

B biuret solution, turns purple

C Benedict's solution, turns brick-red

D iodine solution, turns blue-black

3.1 B

- Biuret turns from blue to purple with protein; no heating is needed

Exercise 3.2

3.2 A solution gives a negative Benedict's test. After boiling it with hydrochloric acid, neutralising, and re-testing, it turns brick-red. The solution contained: [1]

☐

A a lipid

B a non-reducing sugar

C a protein

D starch

Exercise 3.2

3.2 A solution gives a negative Benedict's test. After boiling it with hydrochloric acid, neutralising, and re-testing, it turns brick-red. The solution contained: [1]

☐

A a lipid

B a non-reducing sugar

C a protein

D starch

3.2 B

- A non-reducing sugar (e.g. sucrose) is negative until acid hydrolysis breaks it into reducing sugars

Exercise 3.3 (a)

3.3 A student is given an unknown solution X and asked to find out whether it contains reducing sugar, starch and protein.

(a) Describe the tests the student should carry out and the result that would show each substance is present. [4]

Exercise 3.3 (a)

3.3 A student is given an unknown solution X and asked to find out whether it contains reducing sugar, starch and protein.

(a) Describe the tests the student should carry out and the result that would show each substance is present. [4]

(a)

- Benedict's solution + heat
- brick-red shows reducing sugar; iodine solution
- blue-black shows starch; biuret solution
- purple shows protein

Exercise 3.3 (b)

3.3 A student is given an unknown solution X and asked to find out whether it contains reducing sugar, starch and protein.

(b) The student finds that X contains a non-reducing sugar but no reducing sugar. Describe how the student could have shown this. [3]

Exercise 3.3 (b)

3.3 A student is given an unknown solution X and asked to find out whether it contains reducing sugar, starch and protein.

(b) The student finds that X contains a non-reducing sugar but no reducing sugar. Describe how the student could have shown this. [3]

(b)

- do a Benedict's test (stays blue); then boil a fresh sample with hydrochloric acid and neutralise; Benedict's now gives brick-red
- non-reducing sugar present

Exercise 3.3 (c)

3.3 A student is given an unknown solution X and asked to find out whether it contains reducing sugar, starch and protein.

(c) State **one** variable the student should keep the same when comparing the colour from different samples.

[1]

Exercise 3.3 (c)

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(c) State **one** variable the student should keep the same when comparing the colour from different samples. [1]

(c)

- e.g. volume of sample / volume of Benedict's / temperature / time of heating