

Exercise walk-through

1.1

Water, carbohydrates and food tests (statements 1.1–1.4, core practical 1)

Sugars join and split

Condensation : two monosaccharides lose one water molecule and bond



Glycosidic bond : the C-O-C link between the sugars



Hydrolysis : digestive enzymes add water back and separate them

Read a health study like an examiner

Your turn

Gum disease correlates with endothelial damage. List three checks before claiming causation.

- A. Who was sampled, how selected, how many?
- B. Were confounders like smoking, age, diet controlled?
- C. Is there a mechanism and a dose-response pattern?

Four routes across a membrane

Route	Gradient	Protein	ATP
Diffusion	down	none	no
Facilitated	down	channel or carrier	no
Active transport	against	carrier pump	yes
Osmosis	water, down water potential	partially permeable membrane	no

Exercises 2.1·2.3

2.1 Explain, in terms of its dipole nature, why water dissolves sodium chloride but hexane does not. [3]

2.2 Name the bond formed when two glucose molecules join, state the molecule removed, and name the disaccharide produced. [3]

2.3 Explain one way in which the structure of glycogen suits its role as an animal energy store. [2]

Exercises 2.1·2.3

2.1 Explain, in terms of its dipole nature, why water dissolves sodium chloride but hexane does not. [3]

2.1 Water is polar: oxygen pulls shared electrons, giving each O–H bond a negative and a positive end. Water molecules cluster around Na^+ with their negative ends and around Cl^- with their positive ends, so the lattice separates and dissolves. Hexane is non-polar, so it cannot surround ions and exerts no attractive forces comparable with the ionic lattice.

2.2 Name the bond formed when two glucose molecules join, state the molecule removed, and name the disaccharide produced. [3]

2.2 Glycosidic bond; a molecule of water is removed; maltose.

2.3 Explain one way in which the structure of glycogen suits its role as an animal energy store. [2]

2.3 Any one: many 1,6-branch points give many chain ends, so glucose is released rapidly when energy is needed; or the polymer is insoluble, so it stores energy without changing cell water potential.

Exercises 3.1·3.2

3.1 A student heats equal volumes of Benedict's reagent with five glucose standards and a fruit-juice sample. The juice's colour matches the 2 % standard exactly, but the juice was diluted 1 part juice to 4 parts water before testing. Calculate the glucose concentration of the undiluted juice, showing your working, and state one reason why colour matching against standards is described as semi-quantitative. [4]

3.2 Amylose and cellulose are both polymers of glucose, yet only amylose serves as an energy store for the plant. Describe two structural differences between amylose and cellulose and explain why each difference makes cellulose unsuitable as an energy store.[4]

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3.1 The diluted juice is 2 %. Dilution was 1 in 5 total (1 part juice + 4 parts water), so the original is $2\% \times 5 = 10\%$. Semi-quantitative because colour is judged by eye against a limited set of standards, giving a range rather than an exact value; or because the reaction's colour depends on heating time and volume, which vary between tubes.

3.2 Amylose and cellulose are both polymers of glucose, yet only amylose serves as an energy store for the plant. Describe two structural differences between amylose and cellulose and explain why each difference makes cellulose unsuitable as an energy store.[4]

3.2 Amylose has only 1,4-glycosidic bonds and coils into a compact helix; cellulose has 1,4-bonds with alternate glucose units inverted, giving straight, unbranched chains. Amylose's helix packs densely for storage; cellulose's straight chains hydrogen-bond into microfibrils, so hydrolytic enzymes (which the plant targets at starch) cannot rapidly attack it. Amylose is made of α -glucose, which the plant's amylases hydrolyse; cellulose's β -linkage needs different enzymes the plant does not use for mobilising store.

Exercise 3.3

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3.3 Glucose and galactose. The 1,4-glycosidic bond. Undigested lactose passes to the colon, where bacteria ferment it, producing gas and osmotically active products that draw water into the gut, causing bloating and diarrhoea.