

1.1 Water, carbohydrates and food tests

Name: _____ Class: _____ Date: _____

Total: 21 marks

KEY WORDS condensation • hydrolysis • glycosidic bond • amylose
• glycogen • semi-quantitative

Objective

Practise the carbohydrate and water chemistry of Topic 1 statements 1.1–1.4: water as a polar solvent, condensation and hydrolysis of sugars, the storage polysaccharides, and Core Practical 1's semi-quantitative food tests. Original training tasks grounded in the specification.

1 Key knowledge and worked examples

■ Two reactions build and break every carbohydrate

Condensation joins two monosaccharides, removing a water molecule and forming a **glycosidic bond**. **Hydrolysis** adds water back across that bond. Maltose = glucose + glucose; sucrose = glucose + fructose; lactose = glucose + galactose.

■ Storage structure is release speed

Amylose: 1,4-linked straight chain that coils – compact. Amylopectin and glycogen add 1,6-branches every 24–30 residues – many chain ends, so hydrolases release glucose quickly. Glycogen is the animal store; starch (amylose + amylopectin) is the plant store.

■ Worked example: reading a Benedict's calibration

Colour standards of 0–4 % glucose are heated with equal volumes of Benedict's and read in a colourimeter (absorbance 0.02, 0.09, 0.18, 0.35, 0.64). The straight section runs to about 4 %; beyond it the reagent saturates. An unknown of absorbance 0.58 lies at $0.58/0.16 \approx 3.6\%$. Two working habits: compare like with like (equal volumes, same heating time), and read unknowns inside the calibrated range, not past it.

2 Practice

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]

3 Exam-style questions

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]

3.3 Lactose-intolerant people lack the enzyme that hydrolyses lactose. Name the products of lactose hydrolysis, name the bond broken, and explain why failing to hydrolyse lactose causes gut symptoms when gut bacteria ferment it instead. [5]
