InkBiology

ANSWER BOOK

Carbohydrates: from one sugar to a store of thousands

Biological molecules, water and inorganic ions · Unit B02

AQA 3.1.1, 3.1.2 · OCR A 2.1.2 · CAIE 2.1, 2.2

8 questions · 25 marks

NAVY EDITION

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SECTION A · Short, 1 to 2 marks

A1 **B1** a monosaccharide is a single sugar unit, the monomer from which disaccharides and polysaccharides are built. **B1** the formula of glucose is $C_6H_{12}O_6$. [2]

A2 **A1** a glycosidic bond, formed by condensation. **A1** glucose and fructose. [2]

SECTION B · Standard, 3 to 5 marks

B1 **B1** a polysaccharide made of many α-glucose monomers joined by glycosidic bonds. **B1** it is a mixture of two polysaccharides, amylose and amylopectin. **B1** amylose has 1,4 glycosidic bonds only and coils into a helix. **B1** amylopectin has 1,4 glycosidic bonds along the chain and 1,6 glycosidic bonds at the branch points. [4]

B2 **B1** cellulose is made of β-glucose, so every other glucose molecule is rotated through 180°. **B1** this makes the chains straight rather than coiled, so they lie parallel to one another. **B1** hydrogen bonds form between hydroxyl groups on neighbouring chains, holding them together as microfibrils. **B1** the many hydrogen bonds give high tensile strength, so the wall resists the pressure of a cell taking in water and the cell does not burst. [4]

B3 **B1** make up a series of glucose solutions of known concentration. **B1** add the same volume of Benedict's solution to each, in excess, and heat all the tubes in a water bath at the same temperature for the same time. **B1** filter off the precipitate and measure the absorbance of each filtrate in the colorimeter, then plot absorbance against known concentration as a calibration curve. **B1** treat the fruit juice in exactly the same way and read its concentration from the curve, diluting the sample and repeating if its reading falls outside the range of the standards. [4]

B4 **M1** number of glycosidic bonds = 2400 − 1 = 2399. **M1** one molecule of water is released per bond formed, so 2399 molecules of water are released. **A1** 2399 × 18 = 43 182. [3]

B5 **B1** both are polysaccharides of α-glucose joined by 1,4 glycosidic bonds, whereas only glycogen also has 1,6 glycosidic bonds. **B1** glycogen is branched, whereas amylose is unbranched. **B1** amylose coils into a helix, whereas glycogen has shorter chains between its branch points and is more compact. [3]

B6 **B1** Benedict's solution detects reducing sugars only, and the carbohydrate may be a non-reducing sugar such as sucrose, or a polysaccharide such as starch. **B1** boil a fresh sample with dilute hydrochloric acid to hydrolyse the glycosidic bonds, then neutralise it with sodium hydrogencarbonate. **B1** add Benedict's solution and heat again; a brick-red precipitate would now show that a non-reducing sugar was present. Testing a separate sample with iodine in potassium iodide solution would detect starch. [3]