Model Answers: Medium

1

The correct answer is **C** because **Molecule 1** is a triglyceride and the skeletal formula of the fatty acid chains shows no double bonds within the fatty acid chains, whereas in **Molecule 2** (a phospholipid) you can clearly see a double bond in the fatty acid chain on the right.

A is incorrect as	The statement about **Molecule 1** is correct but the statement about **Molecule 2** is incorrect – the phospholipid has one unsaturated fatty acid.
B is incorrect as	**Molecule 1** has three ester bonds linking the fatty acid chains to the glycerol 'head', whereas **Molecule 2** has two fatty acid chains attached via ester bonds to a glycerol molecule, and a phosphate ester bond between the glycerol and phosphate group. Phosphodiester bonds are found in the backbone of DNA and RNA molecules (between the sugars deoxyribose/ribose and phosphate groups)
D is incorrect as	**Molecule 1** is non-polar whereas Molecule 2 is polar.

2

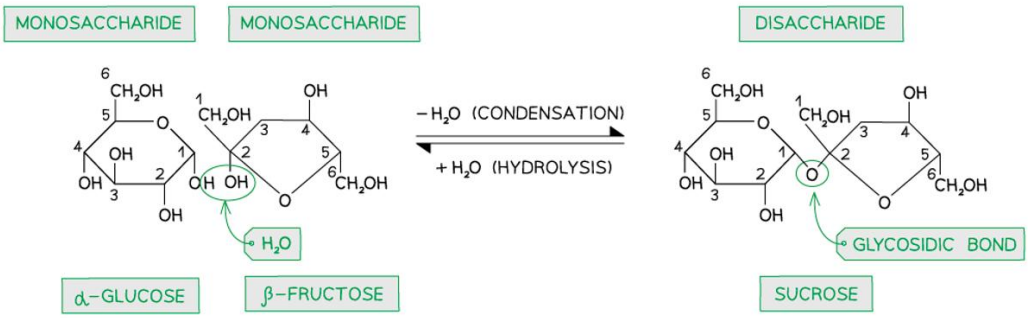
The correct answer is **D** because:

- Amylopectin, like glycogen, contains **1,4** and **1,6-glycosidic bonds** and therefore has a branched structure
- For the **1,4-glycosidic bond** this means the functional groups of ^{1}C (represented by k and n) and ^{4}C (represented by h and p) are involved in the formation of a glycosidic bond (accompanied by the loss of an H and OH to form water as a waste product)
- For the **1,6-glycosidic bond** to form a branched chain, there needs to be the loss of a water molecule between the functional groups of ^{1}C (represented by k and n) and ^{6}C (represented by i and m)

3

The correct answer is **C** because:

- Sucrose is a non-reducing sugar that forms when two reducing sugars, glucose and fructose, are chemically bonded together
- This is an example of a condensation reaction, where a molecule of water formed from two adjacent -OH groups, forming a glycosidic bond:



4

The correct answer is **D** because:

- Polysaccharides are generally insoluble in cold water (the solubility of starch increases as the temperature of water increases)
- Amylose and amylopectin (30% and 70% of starch) are both polymers of α-glucose
- α-glucose dissolves readily in water, so if it accumulated in cells it would decrease the water potential (making the cell more concentrated) which would seriously affect the osmotic properties of the cell
- The formation of the polysaccharides amylose and amylopectin allows a source of readily available glucose to be available in the cell (the breakdown by hydrolysis is easily enzyme-catalysed) without affecting the water potential

Options **A** and **B** are incorrect as hydrolysis reactions result in the breakdown of amylose and amylopectin, condensation result in their formation. Option **C** is incorrect as amylose has a coiled, unbranched structure whereas amylopectin is branched (due to the presence of **1,6-glycosidic bonds**).

5

The correct answer is **B** because:

- The only polysaccharide with by **β-1, 4 glycosidic bonds** is cellulose, formed from **β-glucose** molecules where every second glucose is rotated about 180˚ relative to its neighbours, the results in the CH_2OH group attached to ^5C projecting in an alternating pattern on each side of the polysaccharide chain

Options **A, C** and **D** are all polysaccharides of α-glucose, where the CH_2OH always projects up relative to ^5C. Amylose is unbranched, like cellulose, but its structure is coiled unlike cellulose and it contains **α -1, 4 glycosidic bonds**.

6

The correct answer is **B** because:

- The only difference between the structure of **α-glucose** and **β-glucose** is the arrangement of the OH and H groups attached to the first carbon on the glucose molecule
- For **β-glucose**, the rule for the OH group placement from ^1C to ^4C is 'up-down-up-down', whereas for **α-glucose** is the rule 'down-down-up-down'.

7

The correct answer is **C** because:

- A disaccharide is formed from two monosaccharides held together by a glycosidic (which is a covalent) bond
- This bond forms when a water molecule from two adjacent -OH groups is lost, this is an example of a condensation reaction which allows smaller molecules to join together to form larger molecules

8

The correct answer is **B** because:

- Statement 1 applies to amylose, amylopectin and cellulose (all polysaccharides are generally insoluble in water)
- Statement 2 only applies to cellulose, as the glucose molecules in amylose form a highly coiled helical structure, unlike the straight chains in cellulose caused by the rotation of one glucose molecule 180º relative to its neighbours
- Statement 3 applies to both amylose and cellulose, in amylose these bonds form between an oxygen bound to ^{2}**C** of one subunit and the oxygen bound to ^{3}**C** of the next glucose molecule. In cellulose, many hydrogen bonds are able to form between the OH groups on adjacent chains

You must know the structures of the main polysaccharides (starch: amylose and amylopectin, cellulose and glycogen) and how their structures relate to their function, as well as how they differ from each other.