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Level: HL IB in Biology  
Subject: Biology  
Topic: IB HL Biology  
Type: Mark Scheme

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All International Baccalaureate IB Topic Questions HL Biology

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**BIOLOGY**

**HL - IB**

Key skills

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### Answer 1

The correct answer is C because carbon has the ability to form covalent bonds with hydrogen, oxygen, nitrogen and sulfur, and can bond to form straight chains, branched chains or rings. This means that the number of possible carbon compounds is almost infinite.

A is incorrect, because graphite and diamond are forms of carbon as an element, not as compounds. Whilst B is partly true (it bonds covalently), the number of bonds does not vary; there are always 4 covalent bonds for each carbon atom. D is incorrect because carbon tends to form covalent bonds thanks to its 4 outer shell electrons, rather than forming ionic compounds.

### Answer 2

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. By contrast, in molecule 2 (a phospholipid) we 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'; glycosidic bonds are found in carbohydrates, not lipids. 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.

D is incorrect as molecule 1 is non-polar whereas molecule 2 is polar.

### Answer 3

The correct answer is D because polysaccharides are generally insoluble in cold water.

Amylose and amylopectin (30% and 70% of starch) are both polymers of  $\alpha$ -glucose.  $\alpha$ -glucose dissolves readily in water, so if it accumulated in cells it would decrease the osmolarity (making the cell more concentrated) which would seriously affect the osmotic properties of the cell.

Answer A and B are incorrect as hydrolysis reactions result in the breakdown of amylose and amylopectin, condensation results in their formation.

Answer C is incorrect as amylose has a coiled, unbranched structure whereas amylopectin is branched (due to the presence of 1,6-glycosidic bonds).

### Answer 4

The correct answer is B because the only polysaccharide with  $\beta$ -1,4 glycosidic bonds is cellulose. This is formed from  $\beta$ -glucose molecules where every alternate glucose is rotated about  $180^\circ$  relative to its neighbours. The  $-\text{CH}_2\text{OH}$  group that is attached to  $5\text{C}$  projects in an alternating pattern on each side of the polysaccharide chain.

A, C and D are all polysaccharides of  $\alpha$ -glucose, where the  $\text{CH}_2\text{OH}$  always projects upwards relative to  $5\text{C}$ . Amylose is unbranched, like cellulose, but its structure is coiled unlike cellulose and it contains  $\alpha$ -1, 4 glycosidic bonds.



### Answer 5

The correct answer is B.

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

### Answer 6

The correct answer is C because a triglyceride is not classified as a polymer; it is not made from many smaller repeating subunits. In comparison, a polysaccharide such as cellulose is a biological polymer as it is formed from chains of thousands of glucose molecules joined together by covalent bonds. Triglycerides are made from three fatty acid chains joined to a glycerol molecule, so they are composed of smaller subunits

A is incorrect as glycosidic bonds form during condensation reactions, not hydrolysis reactions.

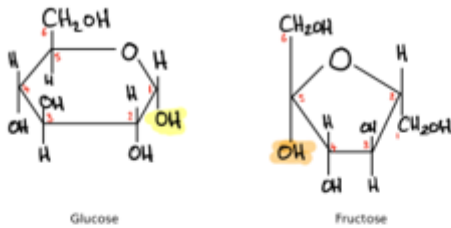
B is incorrect as a triglyceride is formed from smaller subunits joined together.

D is incorrect as glycosidic bonds join monosaccharides together to form disaccharides and polysaccharides.

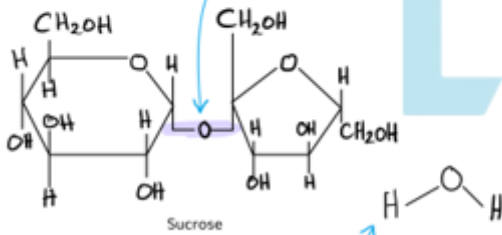


### Answer 7

The correct answer is C because sucrose is a disaccharide that forms when two monosaccharides, glucose and fructose, are chemically bonded together.



The hydroxyl group on glucose's C<sub>1</sub> atom reacts with the hydroxyl group on fructose's C<sub>5</sub> atom. This releases a water molecule (CONDENSATION). A glycosidic bond is formed.



Water is a by-product. [1 mark]

B and D are incorrect because glucose and galactose combine to form a different disaccharide, lactose.

### Answer 8

The correct answer is D because a small number of fatty acids (but not whole lipids) play a role in regulation of gene expression. The question asks specifically about whole lipids.

A is not correct because a layer of protective fat forms around many vulnerable internal organs eg. visceral fat around the heart.

B is not correct because seals and other marine creatures use fat for insulation and flotation (fat is generally less dense than water).

C is not correct because many fats carry fat-soluble nutrients (eg. certain vitamins) through the digestive system.

### Answer 9

The correct answer is B because it contains hydrogen in an atom ratio of 2:1 with oxygen. 32 hydrogen atoms and 16 oxygen atoms = 2:1 ratio.

A and C are incorrect because they contain a lot fewer oxygen atoms in relation to hydrogen atoms (these are in fact lipids).

D is incorrect because it does not contain hydrogen to oxygen in a 2:1 ratio either (this is in fact glycerol).

**Answer 10**

The correct answer is A; the specific enzyme required to break down cellulose is not produced by the human body.

B is incorrect; cellulose is required to provide fibre for healthy gut function.

Despite C being a correct feature of cellulose, it does not give the reason that cellulose cannot be digested.

D is incorrect because without the correct specific enzyme, more time for digestion of cellulose would make no difference.



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