Exam Papers Practice

2.1 Metabolism & Water

Mark Schemes

Course	DP IB Biology
Section	2. Molecular Biology
Topic	2.1 Metabolism & Water
Difficulty	Medium

To be used by all students preparing for DP IB Biology SL
Students of other boards may also find this useful

1

The correct answer is **A** because oxygen (O) is 65% of body mass, carbon (C) is 18%, hydrogen (H) is 10%, nitrogen (N) is 3%, Sulfur and phosphorus are important elements in polypeptides and nucleic acids/phospholipids respectively.

Whilst sodium (Na) and potassium (K) are both important elements for human function, they only account for a small fraction of one percent of biomass. Oxygen is the most abundant by mass because of its relatively high atomic mass of 16, versus 1 for hydrogen.

2

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.

3

The correct answer is **B** because it is the only anabolic reaction. This is the formation of the disaccharide sucrose by condensing two monosaccharides together. A large molecule is built from smaller ones, hence is an example of anabolism.

A, **C** and **D** are all catabolic.

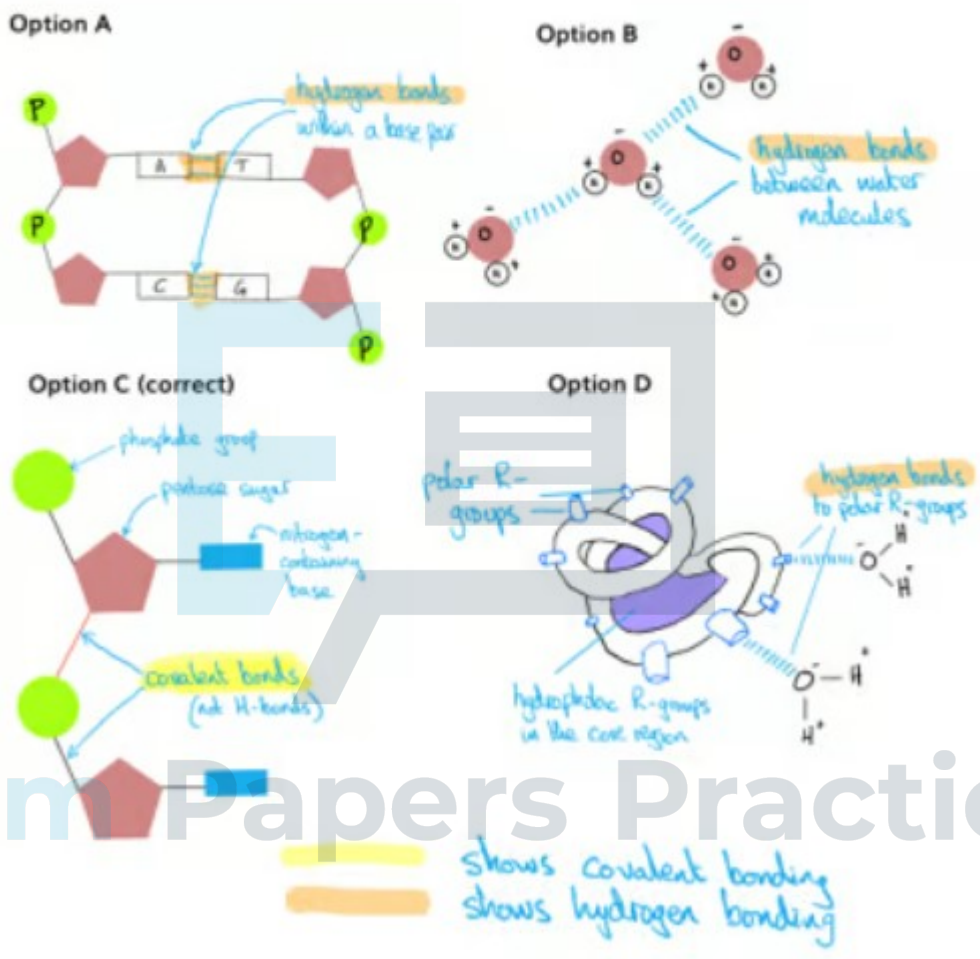
A is a breakdown of excess polypeptide to form urea, the main nitrogen-containing waste product excreted from the body.

C is when fats are hydrolysed to form fatty acids and glycerol and are in turn respired to release energy.

D is catabolic because anaerobic respiration is still a form of respiration, which is exergonic (releases energy).

4

The correct answer is **C** because nucleotides are joined to each other in a strand by strong, covalent bonds. The rest are examples of hydrogen bonding.



5

The correct answer is **B** because the lack of polarity means that hydrogen bonds do not form between methane molecules, as they do in water. Therefore very less energy is required to separate molecules from the liquid state to the gaseous state, hence methane's low boiling point (-162°C).

A is incorrect because a lot of compounds have a low molecular weight, and this is not related to their polarity.

C is incorrect because flammability is linked to the energy content of the covalent bonds within the molecule.

D is incorrect because many gases, of varying polarity, contribute to the greenhouse effect and climate change, notably CO_2, water vapour and methane, which have different levels of polarity.

6

The correct answer is **A** because ice crystals form in a way that makes them less densely packed than in liquid water. This is not caused by water's high latent heat of vaporisation or specific heat capacity.

B is incorrect because water's high latent heat of vaporisation causes its boiling point to be 100°C, so at temperatures that exist naturally on Earth, water can form, ice, liquid water or steam (water vapour).

C is incorrect because it is this feature that allows a lot of cooling effect by secreting a small volume of water, in sweating (animals) or transpiration (plants).

D is a definition of water's high specific heat capacity.

7

The correct answer is **C** because polypeptide synthesis is anabolic, therefore involves condensation reactions as amino acids are joined together in sequence. This takes place in the cytoplasm (on ribosomes).

This type of question is best answered by elimination of the wrong answers.

Polypeptide synthesis is a metabolic reaction to **build up** new biomass, so is by definition, **anabolic** - eliminate **D**.

Polypeptide synthesis is a condensation reaction - eliminate **B**.

The energy carried ATP is required to build up new biomass - eliminate **A.**

The final column is a confirmation that polypeptide synthesis takes place in the cytoplasm, not the mitochondria.

8

The correct answer is **D** because sodium chloride (salt) is the most soluble, and cholesterol is insoluble in water. A single molecule of an amino acid is still more soluble than oxygen, as oxygen requires the assistance of haemoglobin to transport to cells and tissues.

Cholesterol is the least soluble - eliminate **A**

Sodium chloride (salt) is the most soluble - eliminate **C**

Oxygen is less soluble than all amino acids - eliminate **B**

9

The correct answer is **D** because all the properties are caused by forces that act between molecules of water. These are **hydrogen bonds**.

Surface tension relies on hydrogen bonds that pull water molecules together and create a 'skin' on the surface. Hydrogen bonds make water a **good solvent** by bonding with polar solutes, surrounding the individual solute particles. Water has strong **cohesive** properties because it attracts other water molecules strongly through hydrogen bonds. A large amount of heat is required to break the strong hydrogen bonds in water, explaining water's **high specific heat capacity**.

10

The correct answer is **D** because, as water has a high specific heat capacity, a lot of heat is required to raise its temperature. This helps stabilise the temperature that enzymes work in, minimising denaturation by exposure to heat.

(i) is incorrect because water does retain a lot of heat, but this would lead to the temperature in the leaves increasing which could cause enzymes to denature.

(ii) is incorrect as water does not form hydrogen bonds with nonpolar molecules. Even with polar ones, this property of water does not prevent denaturation of enzymes at extremes of temperature or pH.

(iv) is incorrect because while water molecules are cohesive (they stick together), that doesn't prevent denaturation of enzymes at extremes of temperature or pH.