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Level: SL IB in Biology  
Subject: Biology  
Topic: IB SL Biology  
Type: Topic Question

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All International Baccalaureate IB Topic Questions SL Biology

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**BIOLOGY**

**SL - IB**

Key skills

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### Question 1.

Sodium hydrogen carbonate ( $\text{NaHCO}_3$ ) dissociates into sodium ions ( $\text{Na}^+$ ) and bicarbonate ions ( $\text{HCO}_3^-$ ) when it is dissolved. The latter creates an alkaline environment suitable for certain enzymes and bicarbonate ions in the blood help to buffer lactic acid during exercise.

How does water help the production of bicarbonate ions?

- A. The oxygen atoms form ionic bonds with bicarbonate ions.
- B. The oxygen atoms in water attract bicarbonate ions.
- C. The hydrogen atoms form hydrogen bonds with bicarbonate ions.
- D. The hydrogen atoms in water attract bicarbonate ions.

[1 mark]

### Question 2.

Water ( $\text{H}_2\text{O}$ ) and methane ( $\text{CH}_4$ ) are simple compounds with covalent bonds and a similar molecular mass.

In theory, this should mean that they share similar physical and chemical properties however, this is not the case.

The table below compares some of the features of methane and water:

	Water	Methane
Molecular weight	18	16
Latent heat of vaporisation / $\text{kJ kg}^{-1}$	2260	510
Specific heat capacity / $\text{kJ kg}^{-1} \text{ }^\circ\text{C}^{-1}$	4.2	2.2
Melting point / $^\circ\text{C}$	0	-182
Boiling point / $^\circ\text{C}$	100	-162

Which of the statements below correctly describes the reason for these property differences?

- A. Water is able to form hydrogen bonds with adjacent water molecules.
- B. Methane forms a tetrahedral structure due to the fact carbon is able to form four covalent bonds.
- C. Methane has a higher energy content in its bonds than water.
- D. Water has a higher density than methane in a liquid state.

[1 mark]

### **Question 3.**

Which of the following does not rely on the specific heat capacity of water?

- A. Heat Loss through evaporation of sweat
- B. Enzyme function
- C. Aquatic ecosystems withstanding extreme temperature change
- D. Humans living in sub-zero temperatures

[1 mark]

### **Question 4.**

Which of the following explains why water has a high latent heat of vaporization?

- A. Water molecules are able to form ionic bonds in the liquid state.
- B. Hydrogen bonds between water molecules must be broken for evaporation to occur.
- C. Water has a low density in the gaseous state compared to the liquid state.
- D. Water molecules have a small molecular size, making them easier to evaporate.

[1 mark]

**Question 5.**

How does the structure of water contribute to its ability to act as a buffer in biological systems?

- A. The high density of water allows it to absorb and release hydrogen ions easily.
- B. The hydrogen bonding in water stabilizes the pH of solutions by resisting changes in hydrogen ion concentration.
- C. Water's ability to dissolve gases helps in the buffering process by maintaining constant gas levels.
- D. Water's low specific heat capacity allows for rapid changes in temperature and pH.

[1 mark]

**Question 6.**

In which way does the anomalous expansion of water upon freezing contribute to the environment?

- A. It reduces the overall volume of lakes and rivers during winter, making them more prone to freezing.
- B. It increases the density of ice, making it sink in water bodies.
- C. It allows ice to float, insulating aquatic life and preserving ecosystems in frozen water bodies.
- D. It prevents water from forming a solid state, thus inhibiting the freezing process.

[1 mark]

**Question 7.**

Which of the following statements about water's role in enzyme function is most accurate?

- A. Water directly participates in the catalytic activity of all enzymes by forming active sites.
- B. Water acts as a solvent for substrates and products, facilitating enzyme-substrate interactions and reaction conditions.
- C. Water molecules interfere with enzyme function by disrupting substrate binding through hydrogen bonding.
- D. Water's high viscosity creates a barrier that slows down enzyme-catalyzed reactions.

[1 mark]

**Question 8.**

What role does the polarity of water play in the formation of secondary and tertiary structures of proteins?

- A. Water molecules disrupt hydrogen bonds between amino acids, leading to random coil structures.
- B. Water molecules stabilize secondary and tertiary protein structures by forming hydrogen bonds with the peptide backbone.
- C. Water molecules cause denaturation of proteins by interacting with nonpolar side chains.
- D. Water molecules only affect primary protein structures and do not influence higher-order structures.

**[1 mark]**

