



IB • SL • Biology

🕒 35 mins ❓ 4 questions

Structured Questions

Water

Hydrogen Bonds / Physical & Chemical Properties of Water

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Total Marks

/35

1 (a) Which property or properties (**A**, **B**, **C**) explain the ability of water to dissolve solutes?

Property A: Polarity of water molecules

Property B: High specific heat capacity of water

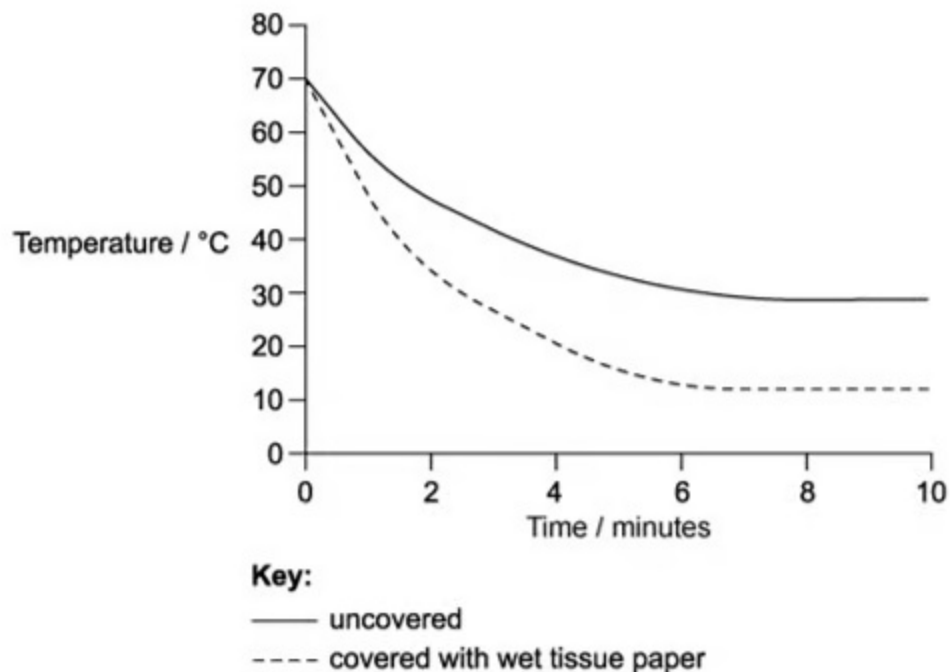
Property C: Hydrogen bonding

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.....
(1 mark)

(b) Describe the properties of carbon that make it an ideal element as the basis of living systems.

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.....
(3 marks)

(c) A group of students investigated the thermal properties of water. To do this, they poured hot water at 70°C into two thin plastic cups and measured the rate of cooling of each cup. The sides of one cup were covered with tissue paper soaked in hot water. The sides of the other cup were left uncovered. The temperature of the water in each cup was recorded with a thermometer every 2 minutes for 10 minutes. The results are shown in the graph below.



Other than the starting temperature of the water (70°C), give **two** conditions that must be kept the same for each cup throughout the experiment.

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(2 marks)

(d) With reference to a thermal property of water, explain how the experiment in part **c**) can demonstrate the response of the human body to prevent overheating.

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(2 marks)

2 (a) Water plays a very important role within the cytoplasm of cells. Two properties of water that make it an important part of the cytoplasm of cells are its **polarity** and its ability to act as a **universal solvent**.

For each of these **two** properties, explain why this makes water important for the cytoplasm.

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(2 marks)

(b) The relatively high specific heat capacity of water is of great biological significance to organisms.

State **one** example of how this property is biologically important.

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(1 mark)

(c) With reference to bonding, explain how the relatively high specific heat capacity of water enables it to buffer temperature changes.

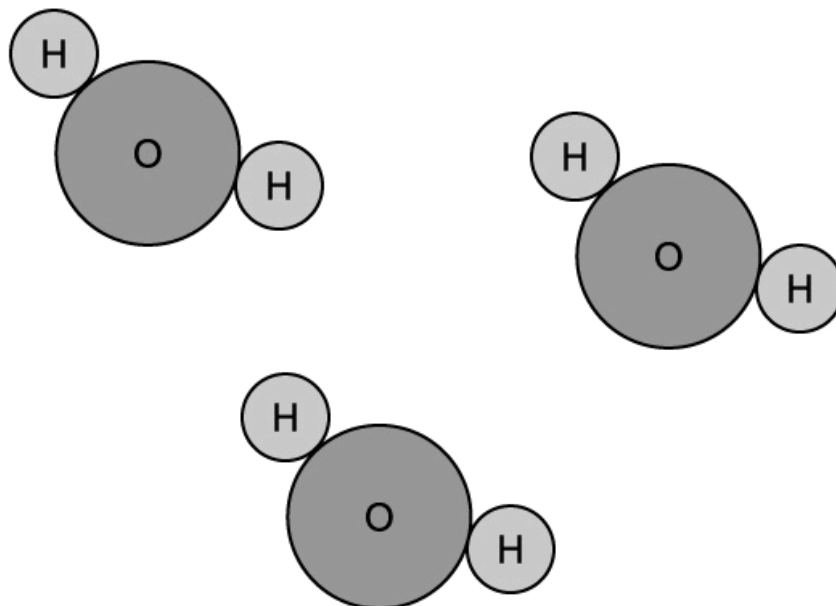
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(2 marks)

(d) The diagram below shows three water molecules in close proximity to each other. Using a dotted line, draw a hydrogen bond between water molecules. Also use the symbols δ^+ and δ^- to indicate small

electrostatic charges on the appropriate atoms.

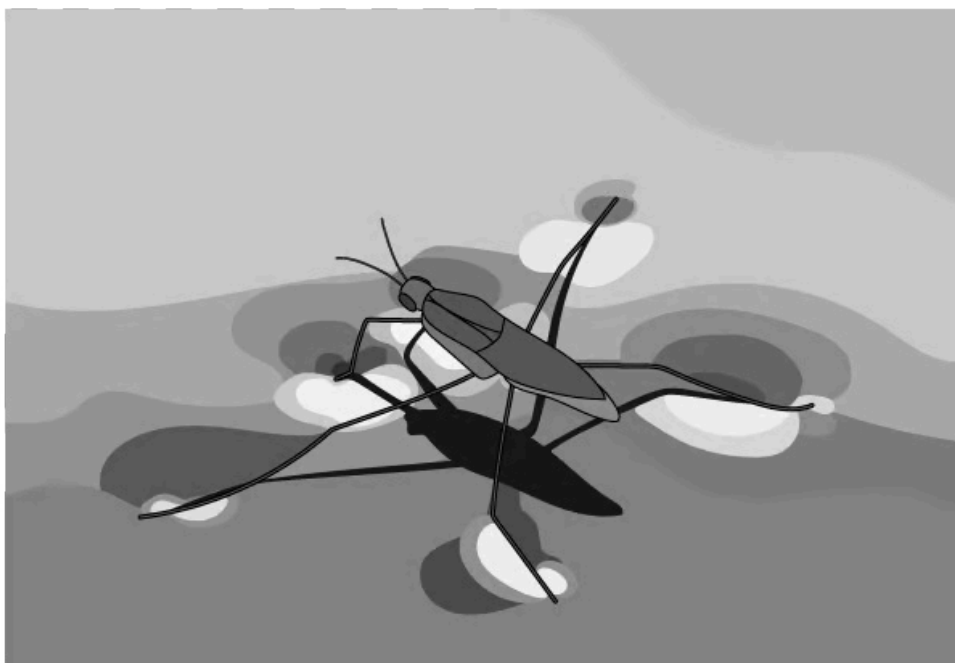


(3 marks)

3 (a) Compare and contrast the terms **adhesion** and **cohesion** in the context of water molecules in biological tissues.

(3 marks)

(b) The diagram shows a pond skater (or water strider).



Certain small animals such as pond skaters and fisher spiders can walk across bodies of water without breaking the surface.

Use your knowledge of water's properties to suggest how detergent pollution contaminating ponds and lakes can have a detrimental effect on these small animals.

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(3 marks)

(c) Outline how vasodilation affects the volume of water lost as sweat in humans.

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(2 marks)

4 (a) *One mark is available for clarity of communication throughout this question.*

Explain the importance of hydrogen bonding in biological molecules.

(7 marks)

(b) Explain how certain biological molecules are hydrophilic, some are hydrophobic and others are amphipathic. Use named molecules as examples in your answer.

(4 marks)