

## 2.4 Water

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 11 marks

**KEY WORDS** solvent • latent heat of vaporisation • specific heat capacity  
 • hydrogen bonding • polar

### Objective

Build the skills to answer exam questions on **water** – how **hydrogen bonding** arises, and how it explains water's roles as a **solvent**, its high **specific heat capacity**, and its **latent heat of vaporisation**.

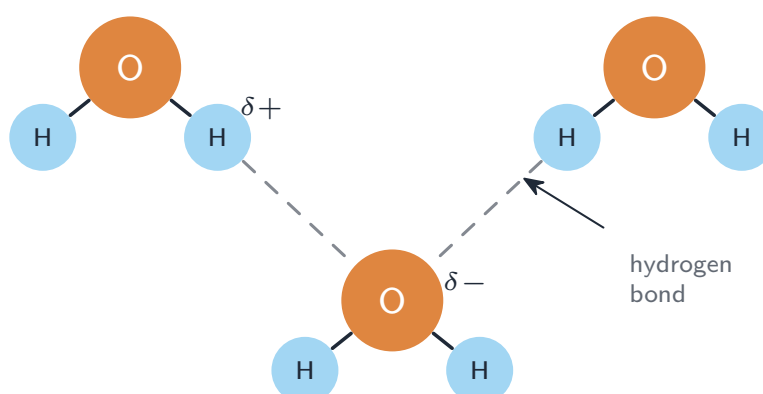
**You must be able to:**

- explain how hydrogen bonds form between water molecules
- relate hydrogen bonding to solvent action, high specific heat capacity and latent heat of vaporisation

### 1 Key knowledge and worked examples

#### ■ Why water is polar and forms hydrogen bonds

Water's O–H bonds are **polar**: the oxygen is slightly negative ( $\delta-$ ) and the hydrogens slightly positive ( $\delta+$ ). So the  $\delta+$  hydrogen of one molecule attracts the  $\delta-$  oxygen of its neighbour – a weak **hydrogen bond**. Each molecule can bond to several others.



*Water is polar ( $\delta-$  oxygen,  $\delta+$  hydrogens), so its molecules attract each other by hydrogen bonds*

### ■ Relating the property to the role

Always link the property back to **hydrogen bonding** and then to a use in living things:

- **solvent action** – polar water surrounds and dissolves other polar/charged molecules, so reactions can happen and substances can be transported (e.g. in blood).
- **high specific heat capacity** – many hydrogen bonds must gain energy before the temperature rises, so water (and organisms) stays at a steady temperature.
- **latent heat of vaporisation** – much energy is needed to break enough hydrogen bonds to evaporate water, so sweating/transpiration removes a lot of heat and cools the organism.

## 2 Practice

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**2.1** State which atom in a water molecule is slightly negative, and which is slightly positive. [2]

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**2.2** Name the property of water that allows it to act as a transport medium in blood. [1]

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## 3 Exam-style questions

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**3.1** Explain how a hydrogen bond forms between two water molecules. [2]

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**3.2** Water has a high specific heat capacity.

(a) Explain, in terms of hydrogen bonds, why water's temperature changes only slowly. [2]

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(b) Explain why this property is useful to living organisms. [1]

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**3.3** When an animal sweats, water evaporates from its skin and the animal cools down. Use the idea of **latent heat of vaporisation** and hydrogen bonds to explain why evaporation has a strong cooling effect. [3]

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