



Water: practice questions

6 questions • 17 marks • mark scheme at the back

For IB Diploma Biology SL undefined. **HL only** is additional higher level content, for HL students only.

Name

Total / 17

1 PAPER 1A STYLE [1 mark]

What causes hydrogen bonds to form between water molecules?

- A. ☐ Unequal sharing of electrons in O-H covalent bonds makes the molecules polar
- B. ☐ Water molecules lose and gain electrons to form H^+ and OH^- ions
- C. ☐ Electrons are shared equally between the oxygen and hydrogen atoms
- D. ☐ Hydrogen atoms of neighbouring molecules form covalent bonds with each other

2 PAPER 1A STYLE [1 mark]

Which property of water is mainly responsible for water being drawn through the cellulose cell walls of leaf mesophyll cells?

- A. ☐ High specific heat capacity
- B. ☐ Adhesion to hydrophilic cellulose
- C. ☐ Buoyancy
- D. ☐ Low viscosity

3 PAPER 1A STYLE [1 mark]

Which substance is transported in blood plasma combined with proteins, because it does not dissolve well in water?

- A. ☐ Glucose
- B. ☐ Sodium ions
- C. ☐ Amino acids
- D. ☐ Cholesterol

[5 marks]

Physical properties of water and air at 20 °C		
Property	Water	Air
Density / kg m ⁻³	998	1.2
Viscosity / mPa s	1.00	0.018
Thermal conductivity / W m ⁻¹ K ⁻¹	0.60	0.026
Specific heat capacity / J g ⁻¹ °C ⁻¹	4.18	1.01

[illegible]

[3 marks]

[illegible]

Explain how the polarity of water molecules makes water a suitable medium for metabolism and for transport in organisms.

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Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

A A [1]

2. [1]

B B [1]

3. [1]

D D [1]

4. [5]

- (a) $0.60 \div 0.026 = 23$ (times) / accept 23.1 [1]
- (b) water conducts heat (about 23 times) faster than air / has a higher thermal conductivity [1]
- (b) so heat is lost from the seal's body much faster in water [1]
- (b) blubber is an insulator that reduces heat loss / helps maintain body temperature [1]
- (c) water is much more viscous than air / about 55 times more viscous [1]
- (c) so there is more drag / resistance to movement through water [1]
- (c) streamlining reduces drag so the loon can swim fast enough to catch fish / uses less energy [1]
- [max 5]: max 1 for (a), max 2 for (b), max 2 for (c)

5. [3]

- cohesion is attraction between water molecules due to hydrogen bonds [1]
- evaporation of water from leaves / transpiration pulls water up the xylem [1]
- water in the xylem is under tension / negative pressure [1]
- cohesion keeps the water column continuous / stops the column breaking under tension [1]
- adhesion of water to xylem walls helps support the column [1]
- [max 3]

6. [6]

- electrons are shared unequally in the O-H covalent bonds / oxygen is more electronegative [1]
- oxygen is δ^- and hydrogens are δ^+ , so water molecules are polar [1]
- hydrogen bonds form between water molecules / between water and other polar molecules [1]
- polar molecules and ions are hydrophilic / attracted to water molecules [1]
- water molecules surround ions / polar molecules so they dissolve OWTTE [1]
- named examples of hydrophilic solutes: glucose / amino acids / mineral ions [1]
- dissolved substances can move and collide, so reactions can happen [1]
- most enzymes catalyse reactions in aqueous solution / cytoplasm is mostly water [1]
- water is a reactant in hydrolysis / is used or released in metabolic reactions [1]
- blood plasma transports dissolved glucose / amino acids / urea / hormones [1]
- xylem transports dissolved mineral ions / phloem transports dissolved sucrose [1]
- first cells originated in water / water remains the medium for most life processes [1]
- [max 6]