



Water potential: practice questions

7 questions • 23 marks • mark scheme at the back

For IB Diploma Biology, Standard Level and Higher Level (first assessment 2025). **HL only** is additional higher level content, for HL students only.

Name

Total / 23

1 PAPER 1A STYLE [1 mark]

A cell is placed in a solution that is isotonic to its cytoplasm. Which statement is correct?

- A. ☐ No water molecules cross the cell membrane
- B. ☐ Water moves into and out of the cell at equal rates
- C. ☐ Water moves into the cell faster than it leaves
- D. ☐ Water moves out of the cell faster than it enters

2 PAPER 1A STYLE [1 mark]

HL only

Where would a negative pressure potential be found?

- A. ☐ In a turgid leaf mesophyll cell
- B. ☐ In a plasmolysed epidermal cell
- C. ☐ In xylem vessels transporting sap under tension
- D. ☐ In a beaker of pure water at atmospheric pressure

3 PAPER 2A STYLE [3 marks]

Explain how sodium chloride and glucose dissolve in water.

4 PAPER 1B STYLE

[6 marks]

Potato cylinders were placed in sucrose solutions for 60 minutes. Five repeats were done at each concentration (the data are for practice). (a) Calculate the percentage change in mass of a cylinder that went from 1.60 g to 1.76 g. [1] (b) Using the means, estimate the isotonic sucrose concentration of the potato tissue, showing how you did this. [2] (c) State what the standard error indicates and deduce which concentration gave the least reliable mean. [2] (d) Suggest one variable that should be controlled. [1]

Percentage change in mass of potato cylinders		
Sucrose concentration / mol dm ⁻³	Mean percentage change in mass / %	Standard error / %
0.0	+18.0	1.1
0.2	+7.5	0.9
0.4	-3.0	2.6
0.6	-11.5	1.0
0.8	-17.0	1.2

Answer =

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5 PAPER 2A STYLE

[4 marks]

Compare and contrast the effects of a hypotonic medium on a red blood cell and on a plant cell, and explain why fluids given intravenously are isotonic.

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PAPER 2A STYLE

HL only

Answer =

[illegible]

PAPER 2B STYLE

HL only

[illegible]

Mark scheme

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

1. [1]

B B

2. [1] HL only

C C

3. [3]

- water molecules are polar / have $\delta+$ hydrogen and $\delta-$ oxygen [1]
- Na^+ ions are attracted to the $\delta-$ oxygen of water molecules [1]
- Cl^- ions are attracted to the $\delta+$ hydrogen of water molecules [1]
- glucose is polar and forms hydrogen bonds with water molecules [1]
- each solute particle becomes surrounded by water molecules / solvation [1]
- max 3

4. [6]

- (a) $(1.76 - 1.60) \div 1.60 \times 100 = +10\%$ [1]
- (b) isotonic point is where percentage change is zero / line crosses the x-axis [1]
- between 0.2 and 0.4 mol dm^{-3} , about 0.34 mol dm^{-3} [1] Accept 0.32–0.36
- (c) standard error shows how precisely the mean is known / how close the sample mean is likely to be to the true mean [1] Do not accept spread of the data alone (that is standard deviation)
- 0.4 mol dm^{-3} , as it has the largest standard error [1]
- (d) one of: temperature / size or surface area of cylinders / source of potato / time / volume of solution / blotting method [1]

5. [4]

- both: water enters the cell by osmosis [1]
- red blood cell swells and may burst / haemolysis, as it has no cell wall [1]
- plant cell becomes turgid / develops turgor pressure, but the cell wall prevents bursting [1]
- isotonic IV fluids cause no net water movement into or out of blood cells [1]
- so blood cells do not burst or crenate / shrink [1]
- max 4

6. [3] HL only

- (a) $\psi_w = -900 + 350 = -550 \text{ kPa}$ [1]
- (b) from X to Y [1] ECF from (a)
- water moves from higher (less negative) to lower water potential / to where it has lower potential energy [1]

7. [5] HL only

- $\psi_w = \psi_s + \psi_p$ [1]
- the solution has a lower / more negative water potential than the cells [1]
- water leaves the cells by osmosis (from higher to lower water potential) [1]
- solute potential of the cells becomes more negative as cell sap becomes more concentrated [1]
- pressure potential falls (to zero) as the protoplast stops pushing on the wall / cells become flaccid [1]
- plasmolysis: the membrane pulls away from the cell wall [1]
- net water loss stops when the water potential of the cells equals that of the solution [1]
- tissue loses mass / becomes shorter / softer [1]
- max 5