



Water potential: practice questions

4 questions · 14 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 / 14

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 2A STYLE [3 marks]

Explain how sodium chloride and glucose dissolve in water.

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 =

.....

.....

.....

.....

.....

.....

.....

.....

.....

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.

.....

.....

.....

.....

.....

.....

.....

.....

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. [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

3. [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]

4. [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