InkBiology

ANSWER BOOK

Diffusion and osmosis: movement that costs nothing

Membranes and transport across cells · Unit B04

AQA 3.2.3 · OCR A 2.1.5 (d)-(f) · Edexcel A Topic 4.6 · CAIE 4.2

6 questions · 20 marks

NAVY EDITION

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SECTION A · Short, 1 to 2 marks

A1 **B1** pure water at atmospheric pressure has a water potential of 0 kPa. **B1** any solution therefore has a negative water potential, because adding solute can only lower it. [2]

SECTION B · Standard, 3 to 5 marks

B1 **M1** change in mass = 3.78 − 4.20 = −0.42 g. **M1** percentage change = change in mass divided by initial mass, multiplied by one hundred: (−0.42 ÷ 4.20) × 100. **A1** −10.0 per cent, that is a loss of a tenth of the initial mass. **B1** water moved out of the cylinder into the solution, so the solution had the lower, more negative, water potential. [4]

B2 **B1** distilled water has a water potential of 0 kPa, which is higher, that is less negative, than the roughly −800 kPa of the cell contents. **B1** water therefore enters by osmosis through the partially permeable cell surface membrane, and with no cell wall to resist the pressure the cell bursts, which is haemolysis. **B1** the concentrated sodium chloride solution has a lower, more negative, water potential than the cell contents, so water leaves the cell by osmosis. **B1** the cell shrinks and puckers into a spiky shape, which is crenation. [4]

B3 **B1** glucose is a large polar molecule and cannot cross the hydrophobic core unaided, so it enters by facilitated diffusion through carrier proteins. **B1** the rate levels off once every carrier protein is occupied, so a steeper concentration gradient cannot raise it any further. **B1** oxygen is small and non-polar, so it dissolves in the bilayer and crosses by simple diffusion between the phospholipids. **B1** simple diffusion uses no proteins, so there is nothing to become saturated and the rate keeps rising with the concentration difference. [4]

B4 **M1** rearranges the relationship to give solute potential = water potential − pressure potential. **M1** substitutes correctly: −1150 − (+450). **A1** −1600 kPa, negative as a solute potential must always be. [3]

B5 **B1** the alveoli give an enormous total surface area, about 70 m² in a human lung, and rate is proportional to surface area. **B1** the barrier is only about 0.3 µm thick, one flattened epithelial cell and one capillary endothelial cell, and rate is inversely proportional to thickness. **B1** ventilation and continuous blood flow keep replacing the air and the blood, which maintains a steep concentration difference that would otherwise even out. [3]