2.2 Movement of substances

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

Objective

Build the skills to answer exam questions on **movement of substances in and out of cells** : diffusion, osmosis and active transport, the factors that affect them, and osmosis investigations with potato.

You must be able to:

- define diffusion, osmosis and active transport
- calculate surface area to volume ratio and percentage change in mass
- explain what happens to plant and animal cells in water and in strong solutions
- use results to find the concentration of cell contents

1 Key knowledge and worked examples

Moving substances

process	what moves	needs energy?
diffusion	particles, from a higher to a lower concentration	no
osmosis	water, from a dilute solution to a more concentrated solution, through a partially permeable membrane	no
active transport	particles, against a concentration gradient (low to high)	yes, from respiration
faster when	larger surface area to volume ratio, shorter distance, higher temperature, steeper gradient	
percentage change	(final − initial) ÷ initial ×100	

Worked example 1: percentage change. A potato piece goes from 2.50 g to 2.80 g. Find the percentage change.

1. Known: initial 2.50 g; final 2.80 g.
2. Rule: change ÷ initial ×100.
3. Numbers: $0.30 \div 2.50 \times 100$.
4. Result: +12%.

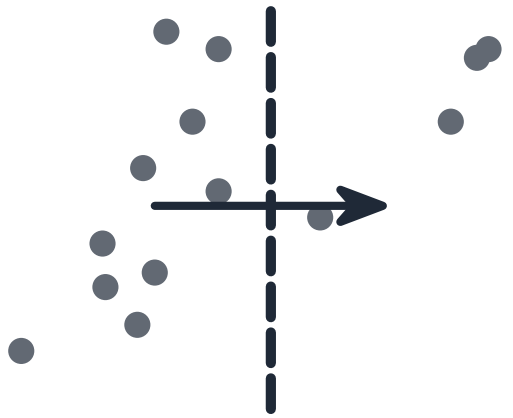
Worked example 2: surface area to volume. Find the ratio for a 2 cm cube.

1. Known: side 2 cm.
2. Rule: area $= 6\times$ side^2; volume $=$ side^3.
3. Numbers: 24 cm^2; 8 cm^3; $24 \div 8$.
4. Result: 3 : 1.

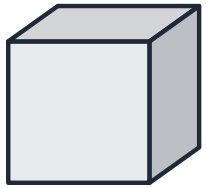
Answer shapes: in osmosis, say where the water is more concentrated (the dilute side) and which way it moves.

2 Practice

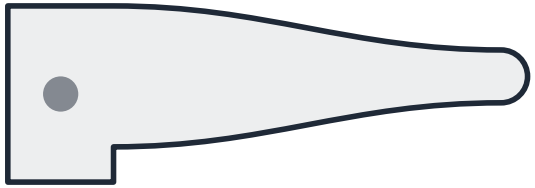
2.1 Define osmosis. [2]



2.2 Calculate the surface area to volume ratio of a 1 cm cube. [2]

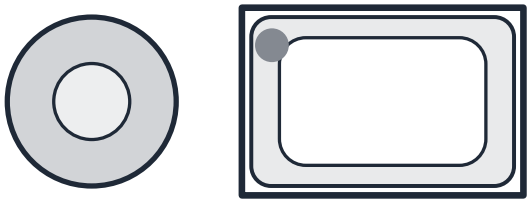


2.3 Explain why root hair cells take in mineral ions by active transport. [2]

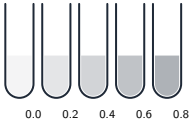


3 Exam-style questions

3.1 Explain why a red blood cell bursts in pure water, but a plant cell does not. [3]



3.2 A student puts potato cylinders, each 2.00 g, into sucrose solutions for 1 hour, then dries and weighs them. The results are shown.



sucrose / mol dm^{-3}	0.0	0.2	0.4	0.6	0.8
final mass / g	2.30	2.12	1.96	1.80	1.70

(a) Calculate the percentage change in mass at 0.0 mol/dm^3 and at 0.8 mol/dm^3. [2]

(b) Use the results to estimate the concentration of the solution inside the potato cells. Explain your answer. [3]

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(c) Explain the changes in mass at 0.0 and 0.8 mol/dm^3, and describe how the student could make the results more reliable. [6]