

Exercise walk-through

Tonicity and Osmoregulation ■ 2.7

eXercise

You must be able to

- classify a solution as **hypertonic** 高渗, **hypotonic** 低渗, or **isotonic** 等渗
- predict the direction of **osmosis** 渗透 and the effect on a cell
- use the idea of **water potential** 水势

Method — Tonicity

Compared with the cell:

- **Hypertonic** solution — more solute outside → water **leaves** the cell (shrinks).
- **Hypotonic** solution — less solute outside → water **enters** the cell (swells, may burst).
- **Isotonic** — equal solute → no net movement.

Method — Osmosis direction

Water moves by **osmosis** from **high water potential** (dilute) to **low water potential** (concentrated) — toward the side with more solute.

Method — Water potential

Water potential measures the tendency of water to move. Adding solute **lowers** water potential; water moves from higher to lower water potential.

Method — A worked prediction

A red blood cell in a hypotonic solution: water enters (the outside has higher water potential), so the cell swells and may lyse (burst).

Practice 2.1 ■ 1 mark

In a hypertonic solution, which way does water move relative to the cell?

Solution 2.1

Method: Tonicity

Worked steps

Water leaves the cell **B1**.

Practice 2.2 ■ 1 mark

Does adding solute raise or lower water potential?

Solution 2.2

Method: Water potential

Worked steps

Lower **B1**.

Practice 2.3 ■ 1 mark

What happens to an animal cell in a hypotonic solution?

Solution 2.3

Worked steps

It swells and may burst (lyse) **B1**.

Exam-style 3.1 ■ 1 mark

Water moves by osmosis from a region of

- A** low to high water potential
- B** high to low water potential
- C** high to high water potential
- D** it does not move

Solution 3.1

Method: Osmosis direction

A low to high water potential

B high to low water potential 

C high to high water potential

D it does not move

Worked steps

B — high to low water potential.

Exam-style 3.2 ■ 1 mark

A plant cell is placed in a very concentrated salt solution.

- (a) State whether the solution is hypertonic or hypotonic.
- (b) Predict the direction of water movement and the effect on the cell.

Solution 3.2

Method: Tonicity

Worked steps

(a) Hypertonic **B1**. (b) Water leaves the cell by osmosis (toward the lower water potential outside), so the cell loses water and the membrane pulls away from the wall (plasmolysis) **M1 M1 A1**.

Exam-style 3.3 ■ 2 marks

Explain why a freshwater organism must actively remove excess water (osmoregulation).

Solution 3.3

Worked steps

Its surroundings are hypotonic (higher water potential), so water constantly enters by osmosis; it must actively remove the excess to avoid swelling and bursting **M1** **A1**.