

## 2.7 Tonicity, Water Potential, and Osmoregulation

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Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Total: 10 marks**

**KEY WORDS** hypotonic 低渗 • water potential 水势 • osmosis 渗透 • hypertonic 高渗 • isotonic 等渗

### Objective

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Build the skills to answer exam questions on **tonicity, water potential, and osmoregulation**.

**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

### 1 Worked examples

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Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

#### ■ 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.

#### ■ Osmosis direction

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

#### ■ Water potential

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

### ■ 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).

## 2 Practice

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Now apply the methods above.

**2.1** In a hypertonic solution, which way does water move relative to the cell? [1]

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**2.2** Does adding solute raise or lower water potential? [1]

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**2.3** What happens to an animal cell in a hypotonic solution? [1]

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## 3 Exam-style questions

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**3.1** Water moves by osmosis from a region of [1]

- **A** low to high water potential
  - **B** high to low water potential
  - **C** high to high water potential
  - **D** it does not move
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**3.2** A plant cell is placed in a very concentrated salt solution.

(a) State whether the solution is hypertonic or hypotonic. [1]

(b) Predict the direction of water movement and the effect on the cell. [3]

**3.3** Explain why a freshwater organism must actively remove excess water (osmoregula-

tion).

[2]



## Solutions

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**2.1** Water leaves the cell.

**2.2** Lower.

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

**3.1 B** — high to low water potential.

**3.2** (a) Hypertonic. (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).

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