AP BIOLOGY • EXERCISE SHEET

2.7 Tonicity, Water Potential, and Osmoregulation

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

Objective

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

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

Now apply the methods above.

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

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

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

3 Exam-style questions

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

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 (osmoregulation). [2]

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **2.7 Tonicity, Water Potential, and Osmoregulation** lesson on the **Learn** page;
- read the **Tonicity, Water Potential, and Osmoregulation** section of the AP Biology handout on the **Know** page.

Solutions

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.