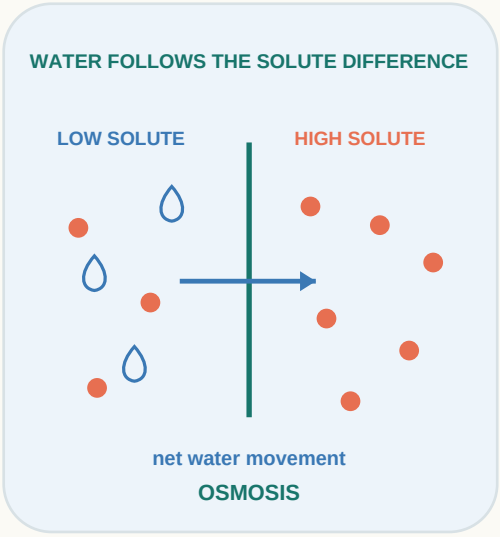
AP BIOLOGY | UNIT 2

TOPIC 2.7

Tonicity and Osmoregulation

Water movement changes cell volume, so cells and organisms must regulate water and solute balance.



THE CORE CAUSAL CHAIN

SOLUTE unequal concentration → **OSMOSIS** net water movement → **VOLUME** cell gains or loses water → **BALANCE** osmoregulation

BY THE END, YOU SHOULD BE ABLE TO...

1. Predict net water movement from tonicity.
2. Compare animal and plant cell responses.
3. Connect osmoregulation to stable internal conditions.

BIG IDEA

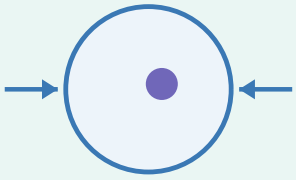
Tonicity predicts how an external solution changes cell volume. Osmoregulation keeps water gain and loss within survivable limits.

1 Predict water movement

Tonicity describes the effect of an external solution relative to the cell, not a property of the solution by itself.

HYPOTONIC

OUTSIDE SOLUTE **LOWER**



water moves into cell

The cell gains water and swells.

ISOTONIC

OUTSIDE SOLUTE **EQUAL**



water moves equally both ways

No net water movement; volume stays stable.

HYPERTONIC

OUTSIDE SOLUTE **HIGHER**



water moves out of cell

The cell loses water and shrivels.

THE OSMOSIS RULE

NET WATER MOVEMENT → **toward higher effective solute**

Water moves both ways; net movement is the difference.

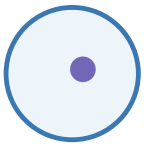
RELATIVE LANGUAGE

Always name the reference: a solution is hypotonic, isotonic, or hypertonic relative to the cell or another solution.

2 Cell responses and osmoregulation

Animal and plant cells respond differently because plant cell walls resist expansion and help maintain turgor pressure.

ANIMAL VS. PLANT CELLS

	HYPOTONIC	ISOTONIC	HYPERTONIC
ANIMAL	 swells / may lyse	 normal volume	 shrivels
PLANT	 turgid	 flaccid	 plasmolyzed

OSMOREGULATION STRATEGIES

V — CONTRACTILE VACUOLE

Freshwater protists pump excess water out of the cell.

K — KIDNEYS AND EPITHELIA

Animals adjust water and ion retention or loss across tissues.

S — COMPATIBLE SOLUTES

Cells alter internal solute levels without disrupting proteins.

PREDICTION METHOD

1. **Compare solute concentrations**
2. **Draw net water movement**
3. **Apply animal or plant structure**

COMMON ERROR

Solute does not 'pull' water by intention. Random water movement produces net osmosis because the two sides differ.