

Movement into and out of cells

IGCSE Biology 0610 · Topic 3 revision notes

Everything from the 3 lessons of this topic on a few pages: the key idea of each lesson, the diagram to remember, the points to learn and the traps examiners set. Read it, cover it, test yourself.

1. Diffusion

2. Osmosis

3. Active transport

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1 Diffusion

Syllabus 3.1

Diffusion is the **net movement of particles from a region of their higher concentration to a region of their lower concentration**, down a concentration gradient, as a result of their random movement. The energy comes from the kinetic energy of the moving molecules and ions themselves, so the cell spends no energy. Some substances, such as oxygen, carbon dioxide and glucose, move into and out of cells by diffusion through the cell membrane.

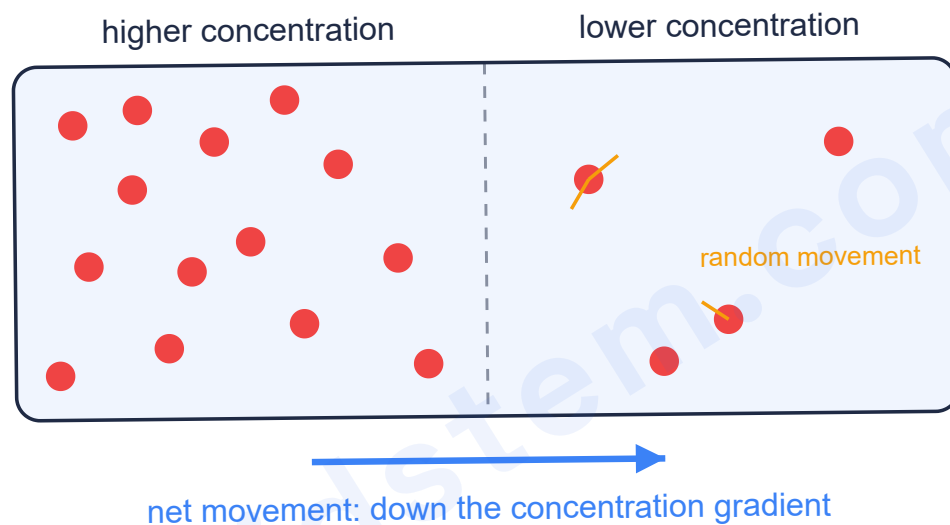


Fig. 1: every particle moves at random, but more move from the crowded side to the sparse side than back

Net, random, passive.

- ✓ **Definition:** net movement from higher to lower concentration, down a concentration gradient, by random movement.
- ✓ **Energy:** kinetic energy of the particles; no respiration needed.
- ✓ **Faster with:** larger surface area, higher temperature, steeper gradient, shorter distance.
- ✓ **In organisms:** say which side supplies the substance and which side removes it.

Watch out!

Do not say particles stop moving when diffusion is complete. They keep moving at random; it is the *net* movement that becomes zero because there is no longer a concentration gradient.

"Higher concentration" on its own is not a factor. The rate depends on the *difference* in concentration between the two regions, the concentration gradient.

2 Osmosis

Syllabus 3.2

Water diffuses through partially permeable membranes by **osmosis**, and moves into and out of cells this way through the cell membrane. Extended: osmosis is the **net movement of water molecules from a region of higher water potential (dilute solution) to a region of lower water potential (concentrated solution), through a partially permeable membrane**. Plants are supported by the pressure of water inside their cells pressing outwards on the cell wall.

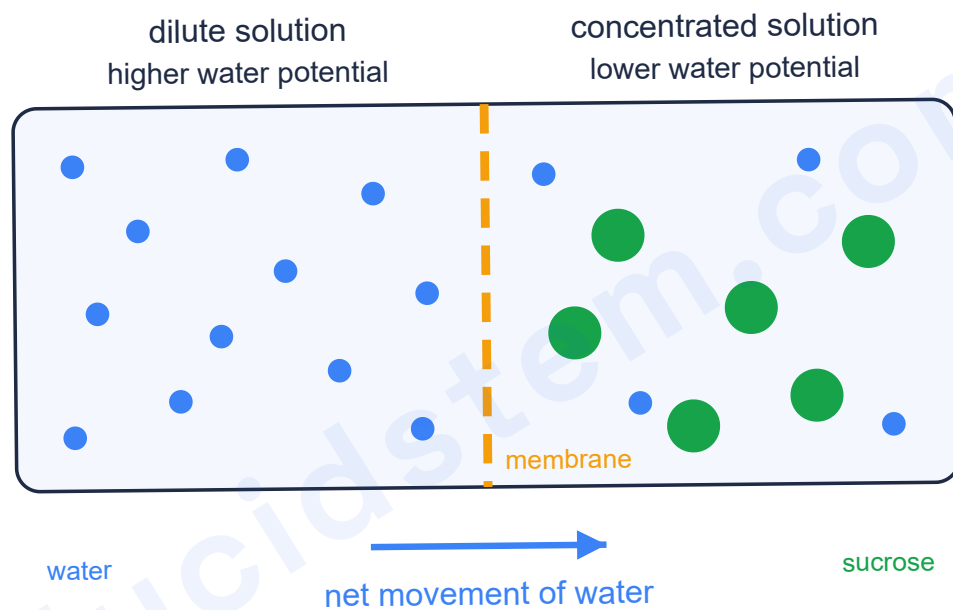


Fig. 1: water molecules cross the partially permeable membrane both ways; the large sucrose molecules cannot, so the net flow of water is towards the concentrated side

Water moves, solute stays.

- ✓ **Osmosis (Extended):** net movement of water from higher water potential (dilute) to lower water potential (concentrated) through a partially permeable membrane.
- ✓ **Percentage change** = $(\text{final} - \text{initial}) \div \text{initial} \times 100$; divide by the initial mass.
- ✓ **No change in mass** means the solution matches the concentration of the cell sap.
- ✓ **Plant cells:** turgid, flaccid, plasmolysed; the wall stops bursting. Animal cells can burst.

Watch out!

In osmosis it is the water that moves, not the solute. The sucrose molecules are too large to pass through the membrane. Never write that "sucrose moves out by osmosis".

"No change in mass" does not mean no water moved. Water still crosses both ways at the same rate; there is no net movement because the solution matches the concentration of the cell sap.

Plant cells do not burst in pure water: the cell wall resists the turgor pressure. Only cells without a wall, such as red blood cells, burst. A plasmolysed cell has lost so much water that its membrane has pulled away from the wall; a flaccid cell has only lost its turgor.

3 Active transport

Syllabus 3.3

Active transport is the movement of particles through a cell membrane from a region of lower concentration to a region of higher concentration (against a concentration gradient), using energy from respiration. Extended: protein carriers in the membrane move the molecules or ions across, which lets cells such as root hair cells take up mineral ions from very dilute soil water.

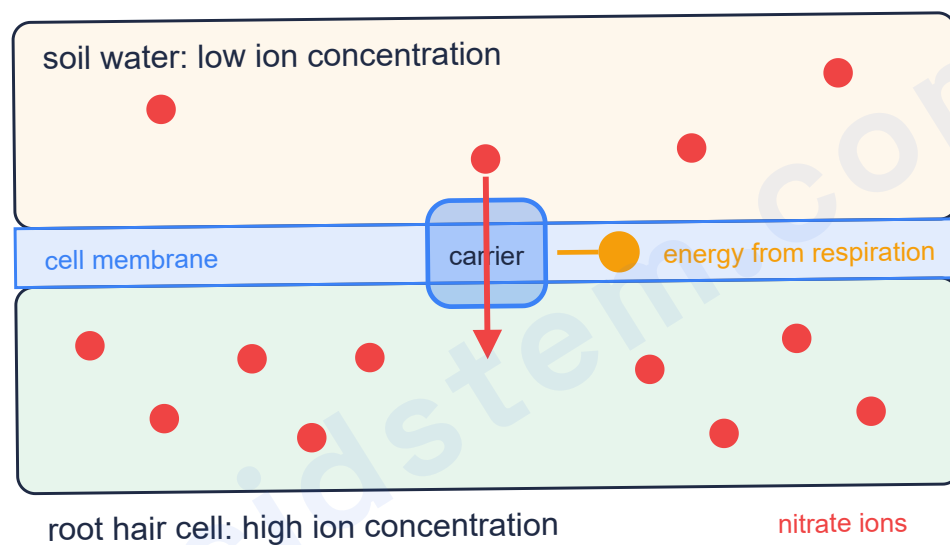


Fig. 1: a carrier protein moves a nitrate ion into a root hair cell, against the concentration gradient, using energy from respiration

Against the gradient, with energy.

- ✓ **Active transport:** lower to higher concentration, through a membrane, using energy from respiration.
- ✓ **Extended:** protein carriers move the molecules or ions across.
- ✓ **Root hairs:** water in by osmosis, mineral ions in by active transport.
- ✓ **Anything that stops respiration** (no oxygen, a poison, low temperature) slows active transport.

Watch out!

Active transport needs energy from respiration. Do not say the energy comes from the kinetic energy of particles (that is diffusion), and do not say active transport "makes" energy: it uses it.

Root hair cells take up water by osmosis but mineral ions by active transport. Keep the two processes separate in your answers.

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