

Active transport

4.1.3.3 · Cell biology · revision notes

Active transport moves substances against a concentration gradient, using energy from respiration. Questions ask you to explain examples in root hair cells and the gut, and to compare active transport with diffusion and osmosis.

Key facts

- Active transport: from a more dilute to a more concentrated solution (against the concentration gradient)
- Root hair cells: absorb mineral ions from very dilute soil solutions
- Many mitochondria = lots of active transport
- Needs energy from respiration
- Small intestine: sugar absorbed from the gut (lower concentration) into the blood (higher concentration)
- Diffusion and osmosis are passive (no energy); active transport needs energy

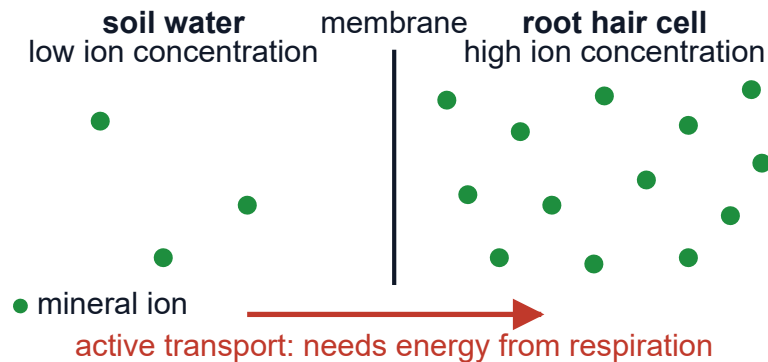
Notes

What active transport is

- Active transport** moves substances from a more dilute solution to a more concentrated solution: **against** the concentration gradient.
- It needs **energy from respiration**.
- Cells that carry out a lot of active transport have many mitochondria, to release the energy needed.

Examples

- **Root hair cells** absorb mineral ions from very dilute solutions in the soil. The concentration of ions is usually higher inside the root hair cell, so diffusion would not bring them in.



Active transport moves ions against the concentration gradient, using energy from respiration.

- Plants need mineral ions for healthy growth, e.g. nitrate ions to make proteins.
- In the **small intestine**, sugar molecules are absorbed from a lower concentration in the gut into the blood, which has a higher sugar concentration.
- The sugar is carried to cells and used for respiration.

Comparing the three processes

- **Diffusion:** particles of a gas or solute; from higher to lower concentration; no energy needed.
- **Osmosis:** water only; from a dilute to a concentrated solution, through a partially permeable membrane; no energy needed.
- **Active transport:** substances such as mineral ions and sugar; from a dilute to a more concentrated solution (against the gradient); energy from respiration needed.
- Water enters root hair cells by osmosis, while mineral ions enter by active transport.

How to answer each type of question

Give differences between active transport and diffusion

2 marks

Grade 4

1. Compare the direction: against or down the concentration gradient.
2. Compare the energy: needed or not needed.
3. Write each point as a comparison.

Example. Root hair cells absorb nitrate ions from the soil by active transport.
Give **two** ways in which active transport is different from diffusion.

Model answer. Active transport moves substances against the concentration gradient / from a dilute to a more concentrated solution, but diffusion moves them from higher to lower concentration (1).
Active transport needs energy from respiration, but diffusion does not (1).

Don't lose marks

- ✗ Forgetting to say 'against the concentration gradient' (or 'from dilute to more concentrated').
- ✗ Saying mitochondria 'make energy'. They release energy by respiration.
- ✗ Saying mineral ions are absorbed by osmosis. Water enters by osmosis; mineral ions enter by active transport.
- ✗ Getting the direction the wrong way round: in active transport, substances move to where they are more concentrated.

More tips

Memory tricks

- 'Active' = needs energy: like pushing a trolley uphill, against the gradient.
- Two examples to learn: 'roots and guts' (mineral ions into root hairs, sugar from the gut into the blood).
- See 'many mitochondria' in a question about absorbing something? Think active transport.

Exam technique

- In any 'explain' answer, use the phrases 'against the concentration gradient' and 'energy from respiration'.
- For comparison questions, cover what moves, the direction, whether energy is needed, and an example.
- In data questions, link anything that changes respiration (oxygen, temperature, a poison) to the energy for active transport.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

State what active transport is

The movement of substances from a more dilute solution to a more concentrated solution, against a concentration gradient.

Grade 4

State where the energy comes from

Active transport needs energy from respiration.

Grade 5

Describe two examples of active transport

Mineral ions from the soil into root hair cells; sugar from the gut into the blood.

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