Your notes

GCSE Biology: revision notes

Diffusion, osmosis and active transport

Contents

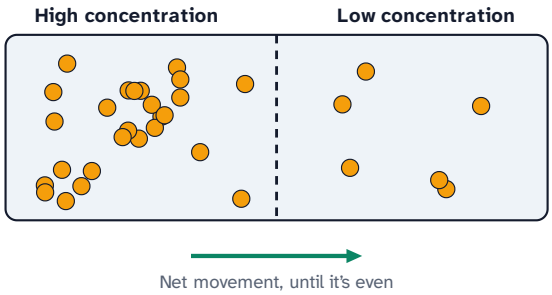
1. Start here: how things get in and out of cells
2. Diffusion
3. Surface area and exchange surfaces
4. Osmosis
5. Required practical: osmosis in plant tissue
6. Active transport
7. Exam tip
8. Common mistakes
9. Worked examples
10. Key terms
11. Quick questions
12. What to do next

Start here: how things get in and out of cells

- Cells need things to come in (oxygen, glucose, water) and waste to go out (carbon dioxide, urea).
- There are three ways across the cell membrane: **diffusion** (particles spreading out), **osmosis** (water spreading across a membrane) and **active transport** (pumping).
- **Diffusion** and **osmosis** happen by themselves, from where there is more to where there is less. **Active transport** goes the other way, so it needs energy from respiration.

Diffusion

- **Diffusion** is the spreading out of particles, resulting in a net movement from an area of higher concentration to an area of lower concentration.
- It is passive: it does not need energy from respiration.
- Examples: oxygen and carbon dioxide diffuse in gas exchange; urea diffuses from cells into the blood plasma to be taken to the kidneys.
- The rate of **diffusion** increases with a bigger **concentration gradient**, a higher temperature and a larger membrane surface area.

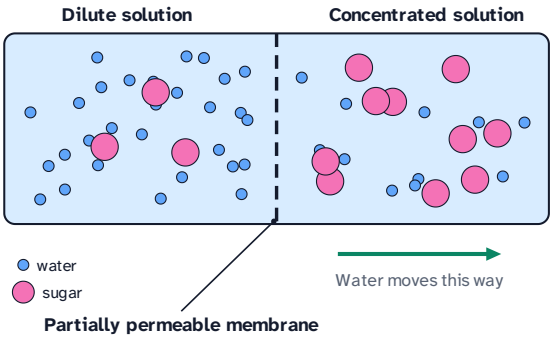


Surface area and exchange surfaces

- Single-celled organisms have a large **surface area to volume ratio**, so **diffusion** across their surface meets their needs.
- Larger organisms have a smaller **surface area to volume ratio**, so they need specialised exchange surfaces and transport systems.
- Good exchange surfaces have a large surface area, a thin membrane (short **diffusion** path), an efficient blood supply in animals and ventilation for gas exchange.
- Examples: **alveoli** in the lungs, villi in the small intestine, gills in fish, and roots and leaves in plants.

Osmosis

- **Osmosis** is the **diffusion** of water from a dilute solution to a more concentrated solution through a **partially permeable membrane**.
- If the solution outside a cell is more dilute than inside, water moves in; animal cells may burst, but plant cells become **turgid** because of the cell wall.
- If the solution outside is more concentrated, water moves out; animal cells shrivel and plant cells become **flaccid** (and may become plasmolysed).



Required practical: osmosis in plant tissue

- Cut equal cylinders of potato, blot them dry and measure the mass of each.
- Place them in sugar or salt solutions of different concentrations, and one in distilled water, for the same time at the same temperature.
- Blot and reweigh, then calculate percentage change in mass = (change in mass ÷ starting mass) × 100.

Your notes

- Plot percentage change against concentration; where the line crosses zero, the solution has the same concentration as the potato cells.

Active transport

- **Active transport** moves substances from a more dilute solution to a more concentrated solution, against a **concentration gradient**.
- It needs energy from respiration, so cells that do it have many mitochondria.
- Root hair cells use **active transport** to absorb mineral ions from very dilute solutions in the soil.
- In the gut, **active transport** absorbs sugar molecules into the blood when the sugar concentration in the gut is lower.

Exam tip

- Use the exact phrases: 'down a **concentration gradient**', '**partially permeable membrane**' and, for **active transport**, 'against a concentration gradient, using energy from respiration'.
- In **osmosis** questions, say water moves from a dilute solution to a more concentrated one.

Common mistakes

- Writing 'from high to low concentration' for **osmosis** without saying it's the concentration of water.
- Saying **active transport** doesn't need energy.
- Saying plant cells burst in water: the cell wall stops them.

Worked examples

A potato cylinder goes from 2.50 g to 2.20 g in a sugar solution. Calculate the percentage change in mass.

Work out the change: new mass – starting mass. **2.20 – 2.50 = –0.30 g**

Divide by the starting mass and multiply by 100. **–0.30 ÷ 2.50 × 100 = –12**

The mass went down, so water left the potato cells by osmosis: the solution was more concentrated than the cells.

Answer: –12% (a 12% decrease)

Find the surface area to volume ratio of a cube with 2 cm sides.

Surface area: 6 faces, each 2 cm × 2 cm. **6 × 4 = 24 cm²**

Volume: length × width × height. **2 × 2 × 2 = 8 cm³**

Write it as surface area : volume and simplify. **24 : 8 = 3 : 1**

Answer: 3 : 1 (smaller cubes have bigger ratios, which is why single cells can rely on diffusion)

Your notes

Key terms

Diffusion	The net movement of particles from an area of higher concentration to an area of lower concentration.
Concentration gradient	The difference in concentration between two areas.
Osmosis	The diffusion of water from a dilute solution to a more concentrated solution through a partially permeable membrane.
Partially permeable membrane	A membrane that lets small molecules such as water through but not larger ones.
Active transport	The movement of substances against a concentration gradient, using energy from respiration.
Surface area to volume ratio	The surface area of an object divided by its volume.
Turgid	Describes a plant cell that is swollen and firm because it has taken in water.
Flaccid	Describes a plant cell that is soft because it has lost water.
Plasmolysis	When the cytoplasm of a plant cell pulls away from the cell wall because it has lost a lot of water.
Alveoli	Tiny air sacs in the lungs where gas exchange happens.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What is diffusion?
2. Which of these increases the rate of diffusion?
3. What does osmosis move?
4. What happens to a plant cell placed in pure water?
5. What happens to a red blood cell placed in a very concentrated salt solution?
6. Why does active transport need energy?
7. Which cells use active transport to absorb mineral ions from the soil?
8. Why do cells that carry out active transport have many mitochondria?

Answers

1. The net movement of particles from higher to lower concentration
2. A larger surface area
3. Water
4. It becomes turgid
5. It shrivels as water leaves
6. It moves substances against a concentration gradient
7. Root hair cells
8. To release energy from respiration

Your notes

What to do next

Practise 12 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

Free revision for GCSE and KS3 at lycolearn.co.uk. Some notes are for one exam board only, and say so in brackets.

Your notes