

AQA TRILOGY B1 part C – Cellular Transport

Key term	Definition
Concentration gradient	
Active	In this context, referring to a transport process which requires energy.
Passive	In this context, referring to a transport process which does not require energy.
Semi-permeable	Also termed partially permeable. A membrane with tiny holes in it, allowing some molecules through it but not others.
Flaccid	In this context, a state where plant cells have lost water and become wilted.
Turgid	A state where a plant cell is swollen and firm, due to water entering by osmosis, pushing the cell membrane against the rigid cell wall.
Plasmolysis	The process where the cell membrane and cytoplasm of a plant cell shrink away from the cell wall due to water loss, resulting in the cell becoming flaccid.
Surface area	The total area of all the surfaces of a three-dimensional object or living organism.
Volume	In this context, the amount of space that a living organism occupies

Diffusion

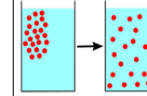
- Diffusion is the spreading of the particles of a gas or liquid, resulting in a net movement of particles from a region where they are of a **higher concentration to an area of lower concentration**.
- Some of the substances transported in and out of cells by diffusion are oxygen and carbon dioxide in gas exchange, and of the waste product urea from cells in the blood plasma for excretion in the kidney.
- In multicellular organisms, surfaces and organ systems are specialised for exchanging materials. The effectiveness of an exchange surface is increased by:
 - having a large surface area
 - having a membrane that is thin
 - having an efficient blood supply (in animals)
 - being ventilated (in animals).

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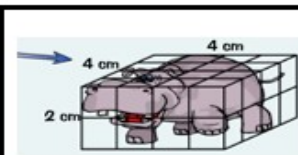
Factors which increase the rate of diffusion:

2

- A bigger difference in concentrations
- A higher temperature
- A bigger surface area (of the membrane).



A single-celled organism has a relatively large surface area to volume ratio. This allows sufficient transport of molecules into and out of the cell to meet the needs of the organism.

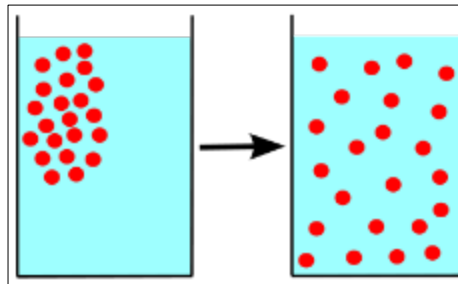


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$$\begin{aligned}\text{Surface area} &= \text{length} \times \text{width} \\ &= (4 \times 4) \times 2 \\ &\quad + (4 \times 2) \times 4 \\ &= 64 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Volume} &= \text{length} \times \text{width} \times \text{height} \\ &= 4 \times 4 \times 2 \\ &= 32 \text{ cm}^3\end{aligned}$$

$$\text{Surface area to volume ratio} = 64:32 \text{ (2:1)}$$

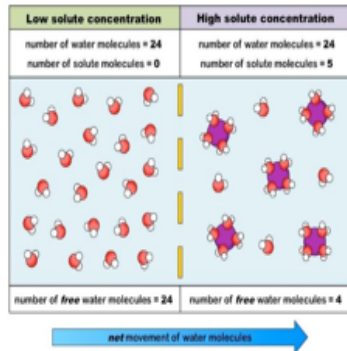


Part	Function	Adaptation
 Lungs (alveoli)	To exchange oxygen and carbon dioxide.	- Large surface area. - Moist lining. - Very thin walls. - Good blood supply.
 Small intestine (villi)	To pass digested food into the bloodstream.	- Single layer of surface cells. - Very good bloody supply.
 Leaves in plants	Exchange carbon dioxide and oxygen.	- Flattened shape (increased area). - Air spaces in leaf. - Guard cells to open and close stomata.
 Gills in fish	To exchange oxygen and carbon dioxide.	Gill filaments (big surface area). Lamellae on gill filaments. Lots of blood capillaries. Large concentration gradient (due to direction of blood flow).

QR Code/link to revision help



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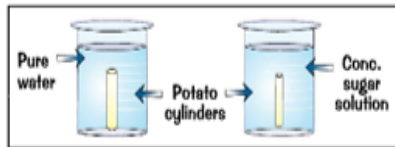


Osmosis

- Osmosis is the movement of water molecules across a partially permeable membrane from a region of higher water concentration to a region of lower water concentration.
- A partially permeable membrane has very small holes in it so only tiny molecules (e.g. water can pass through).
- The water molecules pass in both directions because they move randomly.
- Because there are more water molecules on one side than on the other, there is a steady net flow of water into the region with fewer water molecules (more concentration sugar solution).

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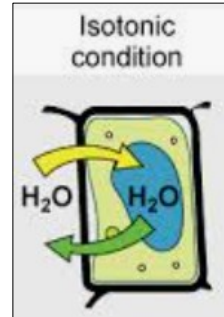
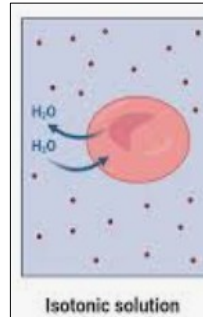
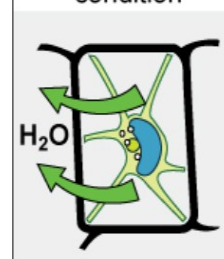
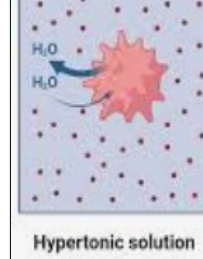
In biology, isotonic, hypertonic, and hypotonic describe the relative solute concentrations of two solutions, often a cell and its surrounding environment. Isotonic solutions have the same solute concentration as the reference, meaning water moves equally in and out. Hypertonic solutions have a higher solute concentration (and lower water concentration) than the reference, causing water to move out of the cell. Hypotonic solutions have a lower solute concentration (and higher water concentration), causing water to move into the cell.



IV – concentration of sugar solution.
DV – mass of potato
CV – volume of solution,
temperature, time, type of sugar
etc.

- You can place potato cylinders in different sugar solutions (one should be pure water and one very concentrated and some in between).
- You measure the mass of the potato cylinder, place it in the sugar solution for 24 hours and then measure the mass after (must be dry).
- If the mass has increased – water has moved in by osmosis. This means there was a higher water concentration outside.
- If the mass has decreased – water has moved out by osmosis. This means there was a higher water concentration inside.

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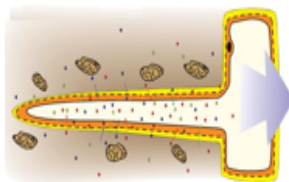


Active transport

- Active transport is the movement of particles against a concentration gradient (from low to high concentration).
- This process requires energy which is released through respiration in the mitochondria.

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Root hairs take in minerals using active transport



Active transport happens in the gut

- Active transport is used in the gut when there is a lower concentration of nutrients in the gut, but a higher concentration of nutrients in the blood.
- This happens when diffusion cannot occur.

