

This is the **Higher Separate** version — includes all Higher Tier content (marked ★) and all Separate Science content.

Diffusion is the movement of particles from an area of high concentration to an area of low concentration. It is a passive process — no energy is needed.

- Diffusion is the NET movement of particles (not all particles) from HIGH concentration to LOW concentration — down the concentration gradient.
- It is PASSIVE — no energy (ATP) is required.
- Examples: O<sub>2</sub> diffuses from alveoli into blood; CO<sub>2</sub> diffuses from blood into alveoli; glucose diffuses from small intestine into blood; urea diffuses from cells into blood.
- Rate of diffusion increases with: steeper concentration gradient, higher temperature, larger surface area, thinner membrane.
- ★ HT Fick's Law:  $\text{rate of diffusion} \propto (\text{surface area} \times \text{concentration difference}) \div \text{thickness of membrane}$ .
- Cells/organisms are adapted to maximise diffusion: alveoli (large SA, thin walls, moist, good blood supply), villi in small intestine (large SA, thin walls, capillaries).
- Simple organisms (e.g. amoeba) rely entirely on diffusion — their small size gives a large surface area : volume ratio.
- ★ HT As organisms get larger, SA:V ratio decreases — specialised exchange surfaces needed.

### Key Terms

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| <b>Diffusion</b>                    | Net movement of particles from HIGH to LOW concentration — passive, no energy  |
| <b>Concentration gradient</b>       | Difference in concentration between two areas — steeper = faster diffusion   |
| <b>Surface area to volume ratio</b> | Ratio that determines how efficiently an organism can exchange substances by diffusion                                   |
| <b>Fick's Law</b>                   | $\text{Rate of diffusion} = (\text{surface area} \times \text{concentration difference}) \div \text{membrane thickness}$ |

■ **Exam Tip:** Diffusion is always from HIGH to LOW — particles move "downhill". Common exam error: stating diffusion requires energy — it does NOT. Only active transport requires energy.