

Gas exchange · supported focus

International Baccalaureate · IB Diploma · Biology · SL

Scope and prerequisites

Supported SL focus. First assessment 2025; current subject brief acquired; full Biology guide not acquired. Remaining guide, assessment and practical requirements retain their recorded holds.

Prerequisites: read the stated quantities and units, use arithmetic and the model conditions below. Each lesson develops its own method before independent transfer.

These are original or explicitly fictional teaching examples, not actual measurements or completed assessed learner investigations.

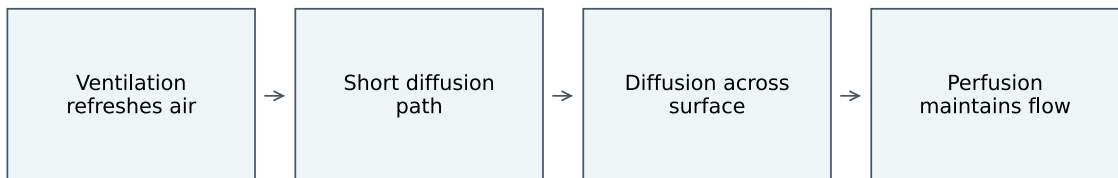
Gas exchange: maintaining diffusion gradients

■ What would explain this observation?

- An exchange surface can be very thin yet fail to deliver enough oxygen when **ventilation** or blood flow falls.
 - Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.
-

■ Build the model

- Gas exchange occurs by diffusion across a surface. Large area, short diffusion distance and maintained concentration gradients support transfer. Ventilation refreshes the external medium; **perfusion** carries gases to and from the exchange surface.
- ventilation: Movement of air or water over an exchange surface; perfusion: Blood flow through tissue or an exchange surface.



■ Choose evidence that can test it

- Distinguish movement of the whole medium from diffusion across the membrane. Ventilation and perfusion work together, while haemoglobin helps transport oxygen in blood. A change in breathing rate alone does not measure oxygen uptake.
- Use an approved model or published respiratory data. Compare exchange surface area, diffusion path and flow. For human demonstrations use voluntary resting measurements; do not induce breathlessness or hyperventilation.

■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: tidal volume is 0.50 L and breathing rate is 12 breaths/min. Minute ventilation = $0.50 \times 12 = 6.0$ L/min. This includes dead-space ventilation and is not identical to alveolar ventilation.

Example:

Tidal volume is 0.60 L and breathing rate is 10 breaths/min. Find minute ventilation. Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

■ Check the conclusion and its limits

- Air entering the lungs is not all exchanged with blood. Oxygen and carbon dioxide diffuse in opposite net directions because their own gradients differ.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

Minute ventilation directly equals oxygen uptake. This claim is false: Air entering the lungs is not all exchanged with blood. Oxygen and carbon dioxide diffuse in opposite net directions because their own gradients differ.

Key:

Gas exchange: maintaining diffusion gradients: Distinguish movement of the whole medium from diffusion across the membrane. Ventilation and perfusion work together, while haemoglobin helps transport oxygen in blood. A change in breathing rate alone does not measure oxygen uptake.