

Gas exchange · supported focus

Supported focus · SL

Supported scope

- 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.
- State model conditions and distinguish fictional data from measurements.

Exchange · 1.1

Reasoning

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.

Exchange · 2.1

Reasoning

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.

Exchange · 3.1

Reasoning

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.

Exchange · 4.1

Reasoning

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.

Exchange · 4.2

Reasoning

Tidal volume is 0.60 L and breathing rate is 10 breaths/min. Find minute ventilation.

Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

Exchange · 5.1

Reasoning

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.

Exchange · 5.2

Reasoning

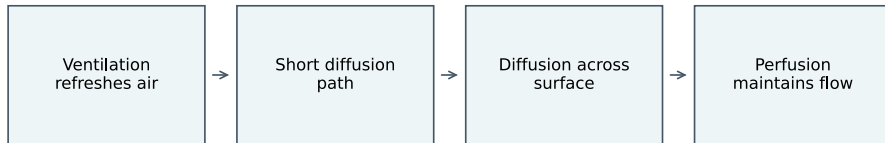
Minute ventilation directly equals oxygen uptake. This claim is false: Air entering the lungs is not all exchanged with blood. Oxygen and carbon dioxide diffuse in opposite net directions because their own gradients differ.

Exchange · 5.3

Reasoning

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.

Exchange · diagram



- Original teaching diagram: Gas exchange: maintaining diffusion gradients
- Use the labels and the stated model together.

Exchange · original transfer

Your turn

Fictional patterns use $0.50 \text{ L} \times 12/\text{min}$ and $0.30 \text{ L} \times 20/\text{min}$. Given dead space 0.15 L per breath, compare minute and alveolar ventilation in this simplified model.

Exchange · transfer reasoning

Method and interpretation

Both minute ventilations 6 L/min. Alveolar values = $(0.50 - 0.15) \times 12 = 4.2$ and $(0.30 - 0.15) \times 20 = 3.0$ L/min. This model illustrates the distinction and is not a clinical judgement.

Check yourself

- Explain ventilation using the stated model.
- Explain perfusion using the stated model.
- Change one value in the original transfer; explain which assumption still matters.