

SOLUTIONS

Unit 9: Gas exchange

9.1: The gas exchange system

- B**
To reach the alveolar air space, carbon dioxide must cross the red blood cell membrane, the capillary endothelial cell membrane, and the alveolar epithelial cell membrane, resulting in a minimum of three membrane crossings.
- D**
The steep concentration gradient is maintained as blood entering the lungs has low oxygen and high carbon dioxide levels (statement 2), and constant blood flow brings fresh red blood cells to the lungs (statement 3). Airflow direction in the alveoli (statement 1) is not a key factor in maintaining this gradient.
- D**
Cartilage tissue is found in both the trachea and bronchi, providing structural support to keep these airways open during breathing. It is not found in bronchioles.
- A**
Alveoli are lined with squamous epithelium to reduce diffusion distance, facilitating efficient gas exchange between the alveoli and the blood.
- D**
Increasing the oxygen concentration inside the alveolus (X) and decreasing the thickness of the alveolar wall (Y) both enhance the diffusion rate by steepening the concentration gradient and reducing the diffusion distance.
- A**
The bronchi contain cartilage for support, ciliated epithelium for removing mucus, and smooth muscle to regulate airflow.
- A**
Elastic fibres help alveoli recoil during exhalation, and a continual supply of deoxygenated blood maintains the concentration gradient for efficient gas exchange.
- D**
The bronchi always contain cartilage, which provides support and prevents collapse. Other structures like alveoli and bronchioles lack cartilage.
- B**
Gas exchange occurs when CO₂ moves from high concentration in the blood (6.0 kPa) to lower concentration in the alveoli (5.3 kPa), and oxygen moves from high concentration in the alveoli (13.9 kPa) to lower concentration in the blood (5.3 kPa).
- C**
Both bronchi and trachea have cartilage for support and cilia to move mucus. Bronchioles typically lack cartilage but may have cilia, making only bronchi and trachea suitable for both features.
- C**
Oxygen diffuses through the squamous epithelium of the alveolus and the endothelium of the alveolar capillary, which are thin layers that facilitate efficient gas exchange.