

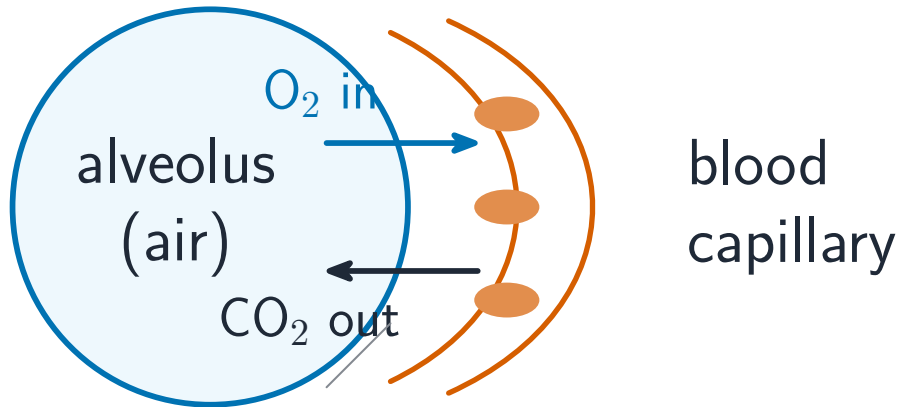
Exercise walk-through

9.1

The gas exchange system

A-Level Biology

Gas exchange in the alveoli



wall one cell thick;
moist; short distance

Alveoli are great exchange surfaces: huge area, walls one cell thick, rich blood supply, moist lining.

- O₂ diffuses air → blood
- CO₂ diffuses blood → air

Real lung tissue



The open spaces are alveoli; the thin pink walls are where gases cross.

Breathing renews the air and flowing blood carries gases away – keeping the **concentration gradients** steep, so exchange stays fast.

Exam tips

- Link each **alveolar** feature to fast diffusion: large surface area, thin (one-cell) walls, moist surface, good blood supply – a “surface area, short distance, steep gradient” answer.
- Match airway tissue to function: cartilage (holds airways open), ciliated + goblet cells (trap and sweep mucus), smooth muscle and elastic fibres.
- Frame answers with **Fick's law** ideas: $\text{rate} \propto \text{surface area} \times \text{concentration difference} \div \text{distance}$.

Exercises 2.1-2.2

2.1 State the function of (a) cartilage and (b) goblet cells in the airways. [2]

2.2 State **three** features that make the alveoli good for gas exchange. [3]

Exercises 2.1-2.2

2.1 State the function of (a) cartilage and (b) goblet cells in the airways. [2]

2.1

(a)

- cartilage holds the airway open / stops it collapsing

(b)

- goblet cells make mucus that traps dust and microbes

2.2 State **three** features that make the alveoli good for gas exchange. [3]

2.2

- any three: large surface area; thin (one-cell) walls / short diffusion distance; rich/good blood supply; moist surface

Exercises 3.1·3.2

3.1 Which tissue keeps the trachea open when air pressure inside falls?

[1]

☐

A cartilage

B ciliated epithelium

C goblet cells

D smooth muscle

3.2 Why do oxygen molecules diffuse from the alveolar air into the blood?

[1]

☐

A the blood is warmer than the air

B oxygen is at a higher concentration in the alveolar air than in the blood

C the alveolus wall is thick

D carbon dioxide pushes the oxygen across

Exercises 3.1·3.2

3.1 Which tissue keeps the trachea open when air pressure inside falls?

[1]

☐

- A cartilage
- B ciliated epithelium
- C goblet cells
- D smooth muscle

3.1 A

- Cartilage holds the trachea open

3.2 Why do oxygen molecules diffuse from the alveolar air into the blood?

[1]

☐

- A the blood is warmer than the air
- B oxygen is at a higher concentration in the alveolar air than in the blood
- C the alveolus wall is thick
- D carbon dioxide pushes the oxygen across

3.2 B

- Oxygen diffuses down its concentration gradient from high (air) to low (blood)

Exercise 3.3

3.3 Explain how the ciliated epithelium and goblet cells together keep the lungs healthy.[3]

Exercise 3.3

3.3 Explain how the ciliated epithelium and goblet cells together keep the lungs healthy.[3]

3.3

- goblet cells secrete mucus that traps dust and microbes; the cilia beat to sweep the mucus up towards the throat; it is swallowed, keeping the airways clear of pathogens

Exercise 3.4 (a)

3.4 An alveolus has a diameter of $250\text{ }\mu\text{m}$. In a photomicrograph it measures 20 mm across.

(a) Calculate the magnification of the photomicrograph.

[2]

Exercise 3.4 (a)

3.4 An alveolus has a diameter of 250 μm . In a photomicrograph it measures 20 mm across.

(a) Calculate the magnification of the photomicrograph.

[2]

(a)

- $20 \text{ mm} = 20\,000 \mu\text{m}$; magnification = $\frac{20\,000}{250} = \times 80$

Exercise 3.4 (b)

3.4 An alveolus has a diameter of 250 μm . In a photomicrograph it measures 20 mm across.

(b) Explain why a one-cell-thick alveolus wall speeds up gas exchange. [2]

Exercise 3.4 (b)

3.4 An alveolus has a diameter of 250 μm . In a photomicrograph it measures 20 mm across.

(b) Explain why a one-cell-thick alveolus wall speeds up gas exchange. [2]

(b)

- a thin wall gives a short diffusion distance, so gases cross faster