

9.1 The gas exchange system

Name: _____ Class: _____ Date: _____

Total: 14 marks

KEY WORDS gas exchange 气体交换 • bronchi 支气管 • alveoli 肺泡 • bronchiole 细支气管
• trachea 气管

Objective

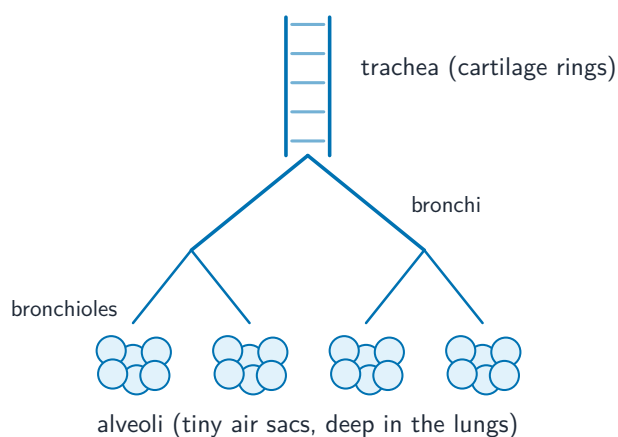
Build the skills to answer exam questions on **the gas exchange system** — its structure, the tissues of the airways, and **gas exchange** 气体交换 in the **alveoli** 肺泡.

You must be able to:

- describe the structure of the gas exchange system and the distribution of its tissues
- describe the functions of cartilage, ciliated epithelium, goblet cells, smooth muscle and squamous epithelium
- explain how the alveoli are adapted for gas exchange

1 Worked examples

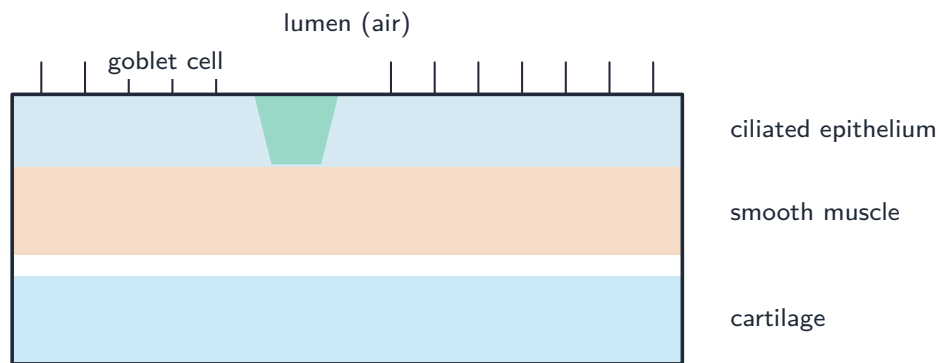
■ The airways



Air passes down the trachea, into the bronchi and bronchioles, to the alveoli

Air path: **trachea** 气管 → **bronchi** 支气管 → **bronchioles** 细支气管 → **alveoli**, each wrapped in **capillaries** 毛细血管.

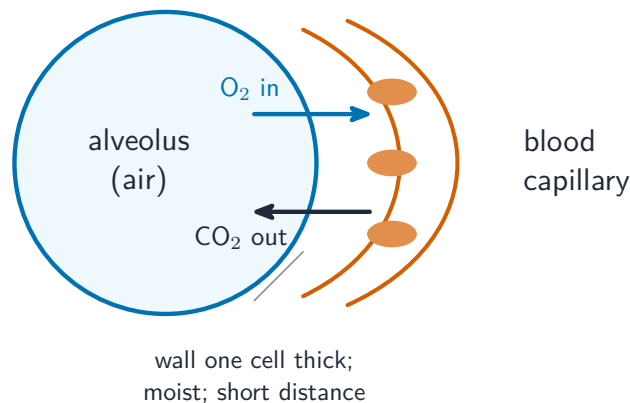
■ Tissues and their functions



Cilia and goblet cells line the lumen; smooth muscle and cartilage support the wall

- **cartilage** 软骨 — holds the airway open.
- **ciliated epithelium** 纤毛上皮 — cilia sweep **mucus** 黏液 up to the throat.
- **goblet cells** 杯状细胞 — make mucus that traps dust and microbes.
- **smooth muscle** 平滑肌 — narrows the airway; **elastic fibres** recoil to push air out.
- **squamous epithelium** 扁平上皮 — very thin alveolus lining → short diffusion distance.

■ Gas exchange in the alveoli



Across the thin, moist wall: oxygen diffuses into the blood, carbon dioxide diffuses out

Alveoli are adapted by: a **large surface area** (millions of sacs), a **thin wall** (one cell thick — short diffusion distance), a **rich blood supply**, and a **moist lining**. Breathing and blood flow keep the **concentration gradients** 浓度梯度 steep.

2 Practice

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]

3 Exam-style questions

3.1 Which tissue keeps the trachea open when air pressure inside falls? [1]

A	B
C	D

- 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	B
C	D

- 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

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

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]

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