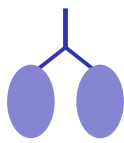


Gas Exchange in Humans

IGCSE Biology ■ Topic 11

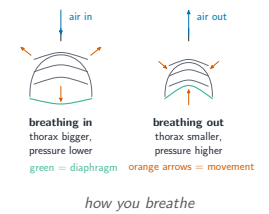
IGCSE Biology



Gas Exchange in Humans

What we will cover

- 1 A good gas-exchange surface
- 2 The breathing system
- 3 The alveolus
- 4 How you breathe
- 5 Inspired vs expired air
- 6 Exercise & clean airways



1 Surfaces and airways

Gas Exchange in Humans

Surfaces and airways

A good gas-exchange surface

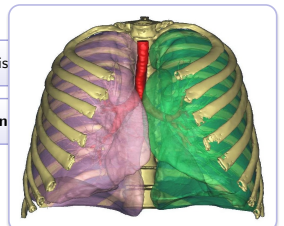
large surface area

thin – a short distance

good blood supply

good ventilation

Gas exchange 气体交换: O_2 in, CO_2 out, by **diffusion** 扩散. A steep concentration difference keeps it fast.

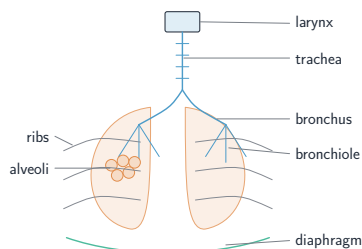


Gas exchange needs a large surface area

Gas Exchange in Humans

Surfaces and airways

The breathing system



The air path:

trachea 气管 → **bronchi** 支气管 → **bronchioles** 细支气管

The **ribs** 肋骨, **intercostal muscles** 肋间肌 & **diaphragm** 膈肌 move the air.

Gas Exchange in Humans

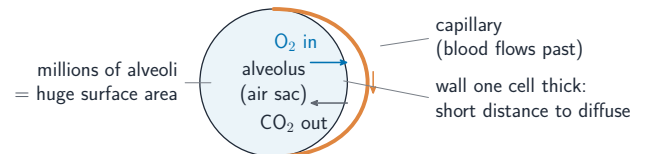
Surfaces and airways

The alveolus

Millions of **alveoli** 肺泡 are perfect surfaces:

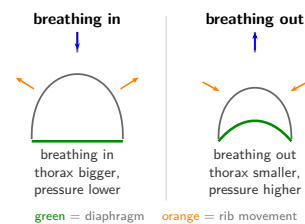
- huge surface area
- wall one cell thick
- wrapped in **capillaries** 毛细血管

O_2 diffuses in; CO_2 diffuses out.



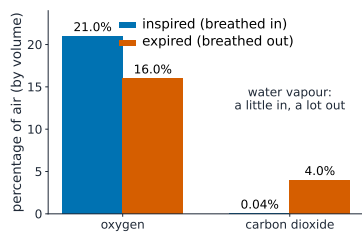
2 Breathing

How you breathe



Breathing in 吸气: intercostals & diaphragm **contract** → thorax 胸腔 bigger → pressure drops → air in. Breathing out is the reverse.

Inspired vs expired air



Expired air has **less** O_2 (21%→16%), **more** CO_2 (0.04%→4%) & more water vapour.

Limewater 石灰水 turns cloudy faster with expired air – it has more CO_2 .

Exercise and clean airways

exercise

more CO_2 in blood → brain → faster, deeper breathing

clean airways

goblet cells 杯状细胞 make **mucus** 黏液; **ciliated cells** 纤毛细胞 sweep it up

3 Recap

Worked example – inspired vs expired air

Expired air has more CO_2 and water vapour, and is warmer. Explain each.

- Body cells **respire**, making CO_2 ; blood carries it to the alveoli and it **diffuses out**.
- So expired CO_2 ($\approx 4\%$) > inspired ($\approx 0.04\%$).
- The alveoli are **moist**; water **evaporates** from that film into the air.
- The air is warmed to **body temperature** inside the lungs.
- Oxygen falls (21% → 16%) – but **not to zero**: only some diffuses out.

Expired air still holds plenty of oxygen – that is exactly why **rescue breathing works**. Nitrogen is unchanged; the body does not use it.

Topic 11 – key takeaways

1 Surface

large, thin, blood supply, ventilation

2 Alveoli

millions; one-cell wall; capillaries

3 Breathing

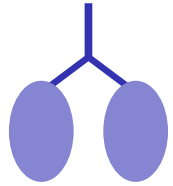
contract → bigger thorax → air in

4 Expired air

less O₂, more CO₂ & water

Check yourself

- 1 Name two features of a good gas-exchange surface.
- 2 Where does gas exchange happen in the lungs?
- 3 What happens to the diaphragm when you breathe in?
- 4 Which gas is higher in expired air?



Answers 1. e.g. large surface area & thin 2. the alveoli 3. it contracts and flattens
4. carbon dioxide