

Week 14

IGCSE Biology

Homework bundle for this week

本周作业合集

exercises.lol

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11. Gas exchange in humans

Starter Quiz · 课前小测

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Name: _____ Score: _____

1. Which are features of a good gas exchange surface? (Select all that apply.)

- ☐ large surface area
- ☐ thin (short diffusion distance)
- ☐ good blood supply
- ☐ thick and dry

Tick every correct option.

2. When you breathe in, the diaphragm:

- ☐ flattens (contracts)
- ☐ domes up (relaxes)
- ☐ disappears
- ☐ makes oxygen

3. Gas exchange in the lungs happens in the:

- ☐ alveoli
- ☐ trachea
- ☐ ribs
- ☐ diaphragm

4. Air rushes into the lungs when the pressure inside the chest:

- ☐ falls below the outside air pressure
- ☐ rises above the outside
- ☐ stays the same
- ☐ becomes zero

5. At the alveoli, oxygen diffuses:

- ☐ from the air into the blood
- ☐ from the blood into the air
- ☐ in both directions equally
- ☐ not at all

6. Compared with inhaled air, exhaled air has:

- ☐ less oxygen and more carbon dioxide

- ☐ more oxygen
- ☐ no carbon dioxide
- ☐ the same composition

7. Gas exchange occurs by diffusion, which is different from breathing.

- ☐ True ☐ False

8. During inhaling, the rib muscles lift the ribs up and out.

- ☐ True ☐ False

9. A large _____ area speeds up the diffusion of gases.

10. The movement of air in and out of the lungs is called _____ (breathing).

11. Gas exchange in humans

Answers · 答案

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1. **large surface area; thin (short diffusion distance); good blood supply**

A thick, dry surface would slow diffusion.

2. **flattens (contracts)**

The diaphragm flattens to increase chest volume.

3. **alveoli**

Alveoli are the tiny air sacs where gases exchange.

4. **falls below the outside air pressure**

Lower internal pressure draws air in.

5. **from the air into the blood**

Oxygen moves down its gradient into the blood.

6. **less oxygen and more carbon dioxide**

Oxygen is used and carbon dioxide added.

7. **True**

Breathing ventilates; gas exchange is diffusion across the surface.

8. **True**

This expands the chest, lowering pressure.

9. **surface**

More surface area means faster gas exchange.

10. **ventilation**

Ventilation keeps the gas-exchange gradient steep.

11.1 Gas exchange in humans

Name: _____ Class: _____ Date: _____ Total: 9 marks

KEY WORDS gas exchange 气体交换 • rate 速率 • thorax 胸腔 • diaphragm 膈肌
• carbon dioxide 二氧化碳

Objective

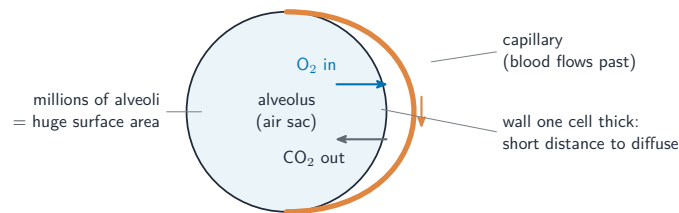
Build the skills to answer exam questions on **gas exchange in humans** 人体气体交换 — features of a gas exchange surface, the **alveoli** 肺泡, the breathing mechanism, and inspired vs expired air.

You must be able to:

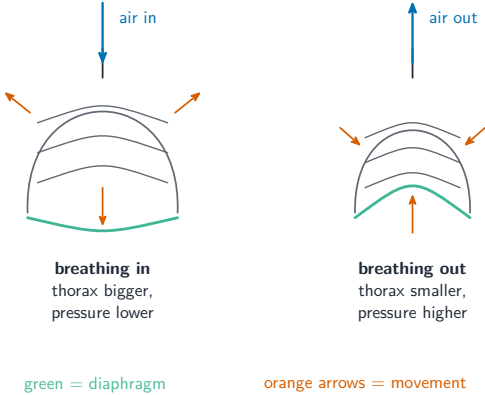
- give the four features of a gas exchange surface
- explain how the alveoli are adapted
- describe breathing in/out and compare inspired and expired air

1 Worked examples

■ Alveoli and breathing



Alveoli: huge surface area, thin (one cell), good blood supply, well ventilated



Breathing in: muscles contract → thorax bigger → pressure lower → air in

- expired air: less O₂, more CO₂, more water vapour. Limewater tests for CO₂.

2 Practice

2.1 State two features of a good gas exchange surface. [2]

2.2 State how expired air differs from inspired air in carbon dioxide. [1]

3 Exam-style questions

3.1 During breathing in, the diaphragm: [1]

- A relaxes and domes up
- B contracts and flattens
- C stays still
- D moves sideways

3.2 Oxygen passes from the alveoli into the blood.

(a) Name the process. [1]

(b) Explain two ways the alveoli are adapted for fast gas exchange. [2]

3.3 Describe how you could use limewater to show that expired air contains more carbon dioxide. [2]

Solutions

2.1 any two of: large surface area; thin surface; good blood supply; good ventilation.

2.2 expired air contains more carbon dioxide.

3.1 B. The diaphragm contracts and flattens when breathing in.

3.2 (a) diffusion.

(b) millions of alveoli give a large surface area; each wall is one cell thick / has a good blood supply, so exchange is fast.

3.3 bubble inspired and expired air through separate tubes of limewater; the limewater with expired air turns cloudy faster (more CO₂).

17 Which muscles in the breathing system contract during inspiration?

- A external intercostal and diaphragm only
- B external intercostal and internal intercostal only
- C external intercostal, internal intercostal and diaphragm
- D internal intercostal and diaphragm only

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16 Which row describes what happens when breathing in?

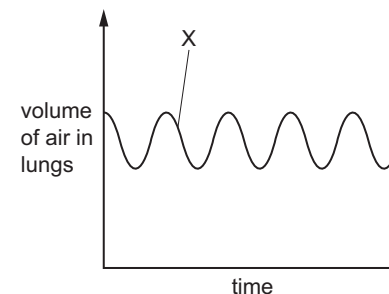
	diaphragm	external intercostal muscles
A	contracts	contract
B	contracts	relax
C	relaxes	contract
D	relaxes	relax

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18 Which changes cause expiration?

	external intercostal muscles	diaphragm
A	contract	relaxes and moves down
B	contract	relaxes and moves up
C	relax	relaxes and moves down
D	relax	relaxes and moves up

18 The graph shows how the volume of air in lungs changes when a person is breathing at rest.



Which processes are occurring to change the volume at the point marked X?

- A The diaphragm is relaxing and the external intercostal muscles are relaxing.
- B The diaphragm is contracting and the internal intercostal muscles are contracting.
- C The diaphragm is contracting and the internal intercostal muscles are relaxing.
- D The diaphragm is relaxing and the external intercostal muscles are contracting.

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6 Which row shows the conditions when diffusion of oxygen into the blood is fastest?

	alveolar surface area	concentration gradient	diffusion path distance
A	high	high	short
B	high	low	short
C	low	high	long
D	low	low	long

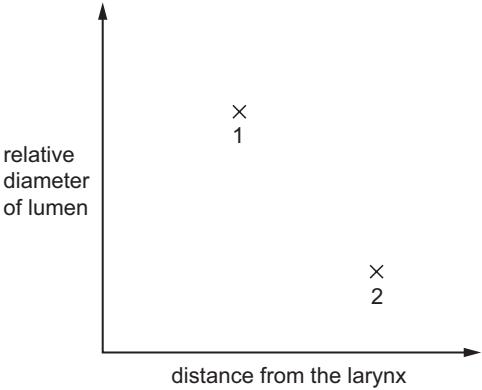
20 The table shows the breathing rate and the average total volume of air breathed by a student when exercising for 20 minutes.

time / minutes	breathing rate / breaths per minute	average total volume of air breathed / cm ³ per minute
0	12	5 000
5	12	9 000
10	12	15 000
15	18	20 000
20	22	25 000

Which conclusion can be made from the data in the table about the effect of exercise on breathing?

- A Between 0 minutes and 10 minutes, there is no change to the depth of breathing.
- B Between 0 minutes and 10 minutes, the depth of breathing increases.
- C Between 10 minutes and 20 minutes, there is no change to the rate of breathing.
- D Between 15 minutes and 20 minutes, the depth of breathing decreases.

18 The plotted points, 1 and 2, on the graph show two different types of structure in the breathing system of a human.



Which row identifies a structure attached to alveoli and a structure containing cartilage?

	a structure attached to alveoli	a structure containing cartilage
A	1	1
B	1	2
C	2	1
D	2	2

1 (a) Fig. 1.1 shows part of the human gas exchange system.

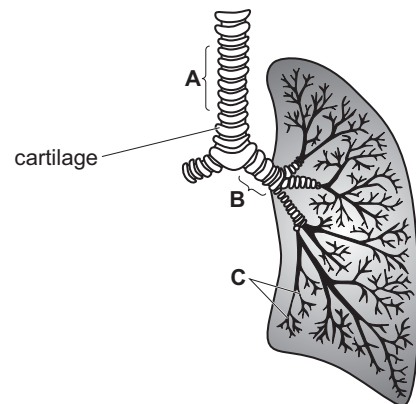


Fig. 1.1

- (i) Identify structures **A**, **B** and **C** shown in Fig. 1.1.

A

B

C

[3]

- (ii) State the function of the cartilage shown in Fig. 1.1.

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..... [1]

- (iii) Explain how inspiration occurs.

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- (b)** Cystic fibrosis is a condition that affects the lungs. People with cystic fibrosis have mucus in the airways of their lungs that is thicker and stickier than usual.

- (i) Two types of cells that line the airways protect the body against pathogens and particles.

State the names of these **two** types of cell **and** describe how they protect the body.

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..... [3]

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- (ii) Suggest how having thicker and stickier mucus in the airways affects the ability of a person to do exercise.

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..... [4]

. [4]

(c) Cystic fibrosis is an inherited condition in humans caused by a recessive allele of a gene.

There are two alleles for this gene:

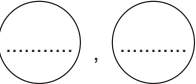
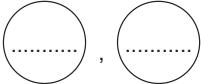
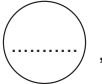
- the allele for no cystic fibrosis is represented by the letter **F**
- the allele for cystic fibrosis is represented by the letter **f**.

Two heterozygous parents wanted to have a child.

Complete the genetic diagram to predict the probability of these parents having a child with cystic fibrosis.

parental phenotypes no cystic fibrosis x no cystic fibrosis

parental genotypes x

gametes  ,  x  , 

offspring genotypes

offspring phenotypes

probability of having a child with cystic fibrosis

[5]

[Total: 20]