



# FIRM FOUNDATION COUNTRY SCHOOL

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CANDIDATE  
NAME

CANDIDATE  
CLASS

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**Biology**

**0610**

**TERM 1 2026**

**Form 2**

STUDY PACK

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## INSTRUCTIONS

- Read and understand all the notes.
- Print out all the notes and come with the handout to school next term.
- Write the exercise in your exercise book.
- Submit work during the first Biology lesson 2<sup>nd</sup> term.

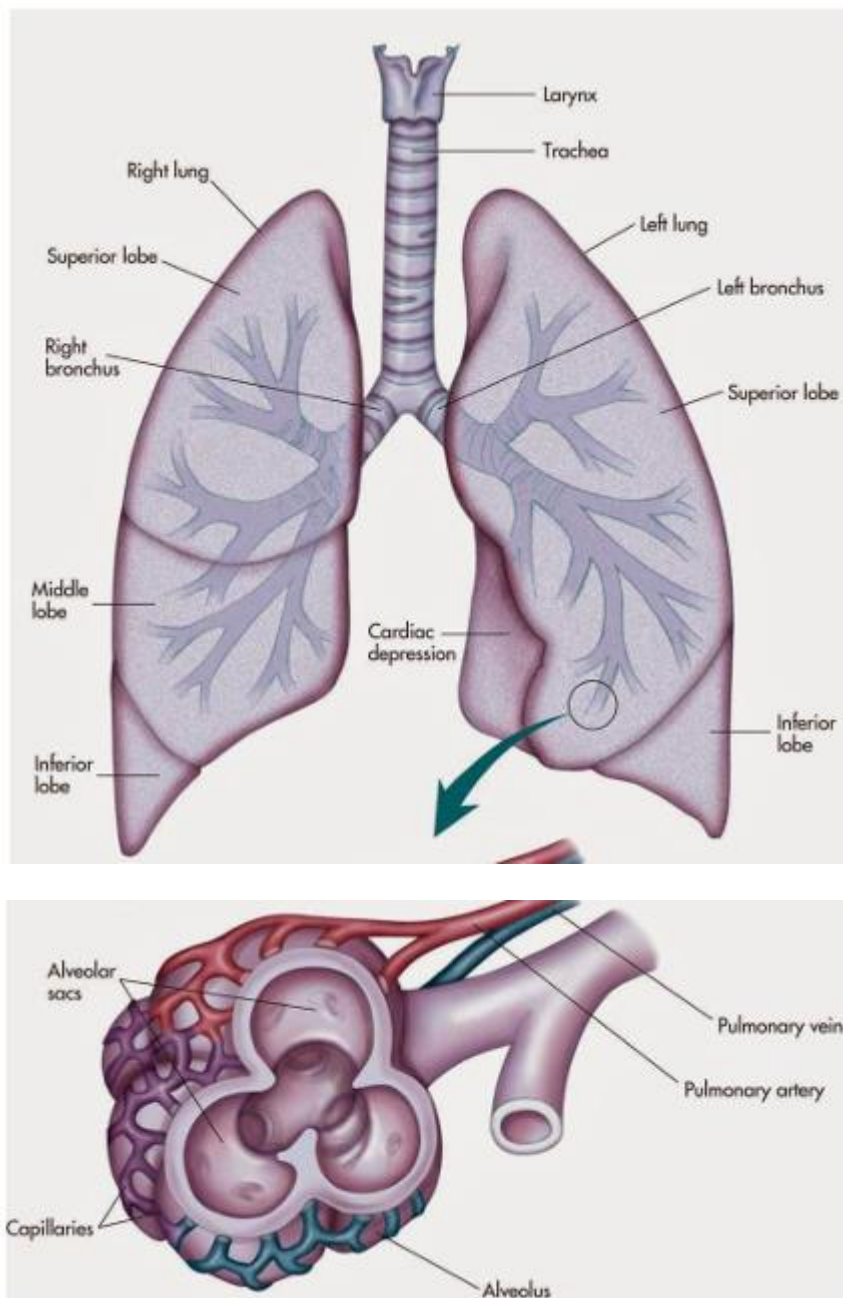
## INFORMATION

- The total mark for this paper is 35.
- The number of marks for each question or part question is shown in brackets [ ].
- This document has **7** pages. Any blank pages are indicated.

## GASEOUS EXCHANGE IN HUMANS

-Gas exchange usually involves **2** or more gases transferred in opposite directions across **a respiratory surface**.

**1. Structure of the breathing system:** the larynx, trachea, bronchi, bronchioles, alveoli and associated capillaries.



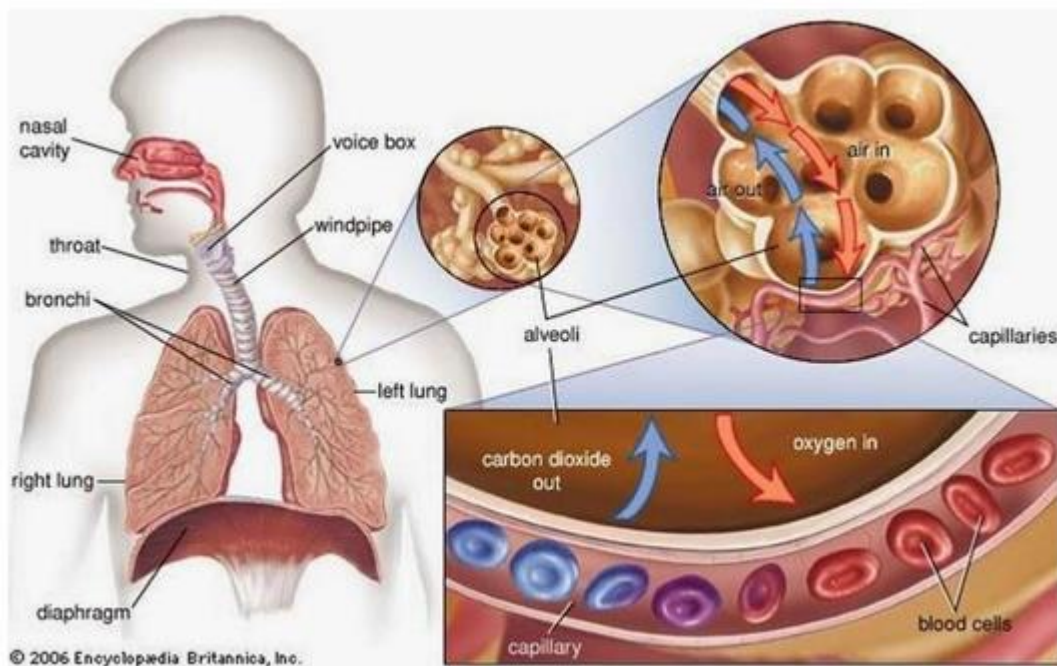
**2. Gaseous exchange relies on diffusion.**

To be efficient, the gaseous exchange surface must:

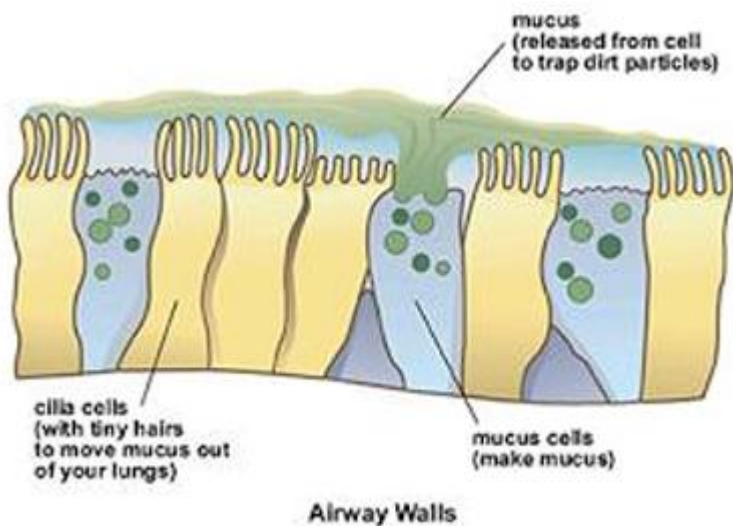
- thin – shorter distance to diffuse
- moist – allow gases to dissolve
- large surface area
- have a concentration gradient across surface

– maintained by movement of air and transport/ use of gas.

\*These features are present in gills (fish) and alveoli (lungs).



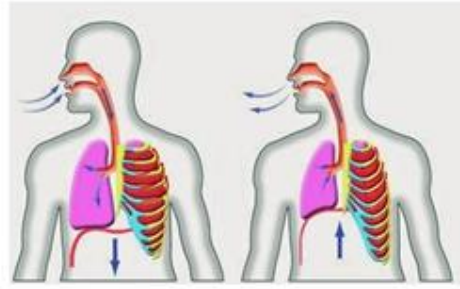
### 3. The role of mucus and cilia



- Inside the nose, thin turbinal bones are covered with a layer of cells. Some of which are goblet cells.
- **Goblet cells** produce a **liquid** (water + **mucus**) ---> evaporate ---> moisten nose.
- Cilia: tiny hair-like projections; constantly moving
- Bacteria + dust particles are **trapped** by cilia and mucus as to not move further inside the gas exchange system.

## Inspired and expired air, blood pH and breath rate

- \* inspired air: air we breath in
- \* expired air: air we breath out



### The composition of inspired and expired air

#### Testing for CO<sub>2</sub>

-To investigate the differences in composition between inspired and expired air, we use limewater because it change colour when the gas is bubbled through, from colourless to milky.

-There is more CO<sub>2</sub> present in expired air ---> it makes limewater change colour more quickly (than inspired air).

### Link between physical activity and rate and depth of breathing

- when you run, muscles in your legs use up a lot of energy.
- cells in the muscles need a lot of O<sub>2</sub> very quickly.
- they combine **O<sub>2</sub> + glucose** as fast as they can, to **release energy** for muscle construction ---> a lot of O<sub>2</sub> is needed
- you breath **deeper** and **faster** to get **more O<sub>2</sub>** into your blood.
- your heart beat faster to get O<sub>2</sub> to the leg muscles as quickly as possible.
- a **limit** is reached - the heart and the lung can not supply O<sub>2</sub> to the muscles any faster.
- some extra energy (not much) is produced by **anaerobic respiration**: some glucose is broken down without combing with O<sub>2</sub>:



**Glucose ---> lactic acid + energy.**

- **CO<sub>2</sub>** and **lactic acid** concentration in tissue and in the blood **↑** ---> blood **pH ↓**
- Brain sens the change ---> nerve impulses sent to the diaphragm and the intercostal **muscles**, stimulating them to **contract harder** and **more often** ---> **faster** and **deeper** breathing.

### Effects of tobacco smoke on the respiratory system

- Tobacco smoke contains irritants and carcinogens.
- Its 4 main toxic chemicals: carbon monoxide, nicotine, smoke particles and tar.

Carbon monoxide: - combines with haemoglobin in RBC ---> prevents them transporting O<sub>2</sub>.

Nicotine: - addictive ---> continual smoking

-Smoke particles: - irritate air passages ---> inflammation + increase mucus production ---> chronic bronchitis.

- presence of smoke particles in alveoli + coughing = emphysema (breathlessness)
- Tar: - a carcinogen: increase risk of lung cancer ( cell division out of control)
- lines air passages: - increase mucus production - paralysing + damaging cilia ---> bronchitis

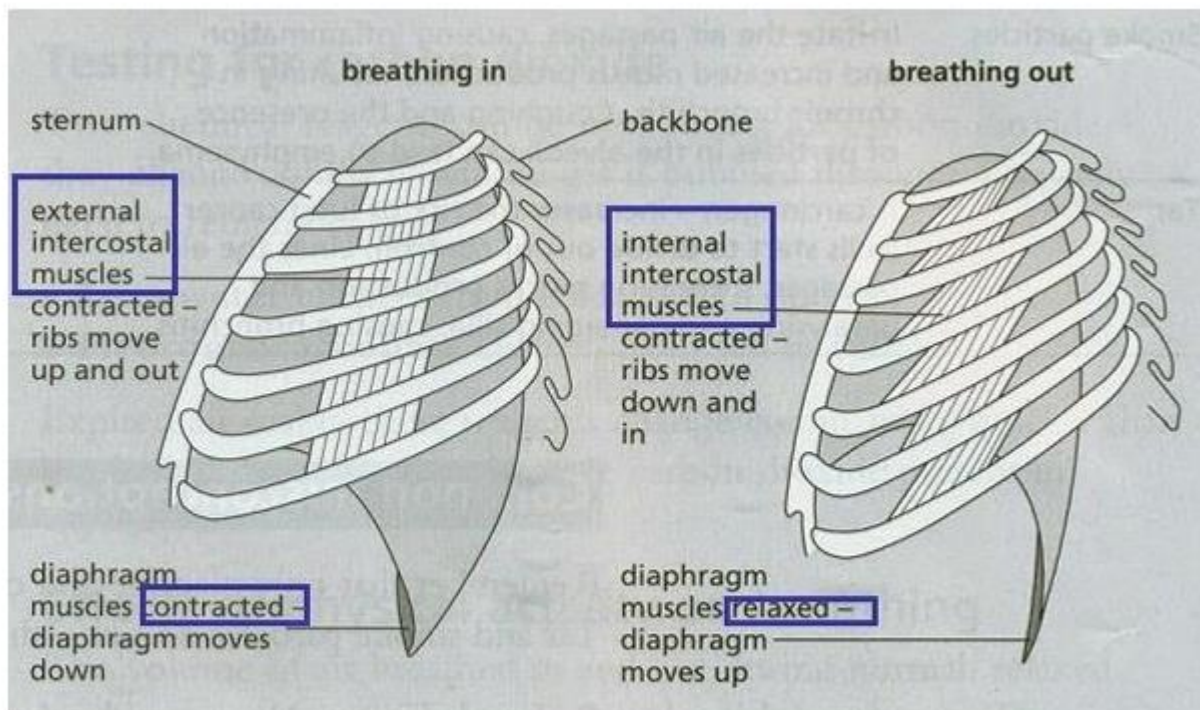
**Common misconceptions:**

*Remember that only nicotine and carbon monoxide enter the blood. Tar and smoke particles do not – they stay in the lungs.*

**Ventilation, role of intercostal muscles and diaphragm**

-There are 2 sets of muscles which help you to breath: - intercostal: between the ribs - diaphragm: a large sheet of muscle and elastic tissue, underneath the lungs and heart.

*Figure below shows the relationship between intercostal muscles, diaphragm and ribcage to achieve ventilation of the lungs.*



*Two set of intercostal muscles are attached to the ribes. They are antogonistic.*

1. Breathing in (inhaling)

- The external intercostal muscles contract, they move the ribcage upward and outward ---> ↑ volume of the thorax.
- The diaphragm muscles contracts ---> diaphragm moves down
- ↑ volume of the thorax
- ↓ air pressure in the thoracic cavity
- air rush into the lungs through the mouth or nose.

2. Breathing out (exhaling) The opposite happens: •

- The internal intercostal muscles contract
- The diaphragm muscles relax ---> diaphragm moves up
- ↓ volume of the thorax
- ↑ air pressure in the thoracic cavity air rush out of the lungs.

Features	Inspiration	Expiration
<b>Intercostal muscles</b>	<b>external</b> muscles contract	<b>internal</b> muscles contract
<b>Ribcage moving</b>	<b>upward</b> outward	<b>downward</b>
<b>Diaphragm muscles</b>	<b>contract</b>	<b>relax</b>
<b>Diaphragm</b>	move ↓	move ↑
<b>Thorax volume</b>	↑	↓
<b>Air pressure in thorax cavity</b>	↓ lower than air pressure outside	↑ higher than air pressure outside
<b>air rushes</b>	<b>into</b> the lungs	<b>out</b> of the lungs

### **SUMMARY**

• All gas exchange surfaces need to be thin, have a large surface area, be kept moist, and have a good supply of O<sub>2</sub>. In larger animals, a transport system is needed to carry away the CO<sub>2</sub> and bring O<sub>2</sub>.

• The air we breathe in travels down the trachea and bronchi, through the bronchioles and into the alveoli.

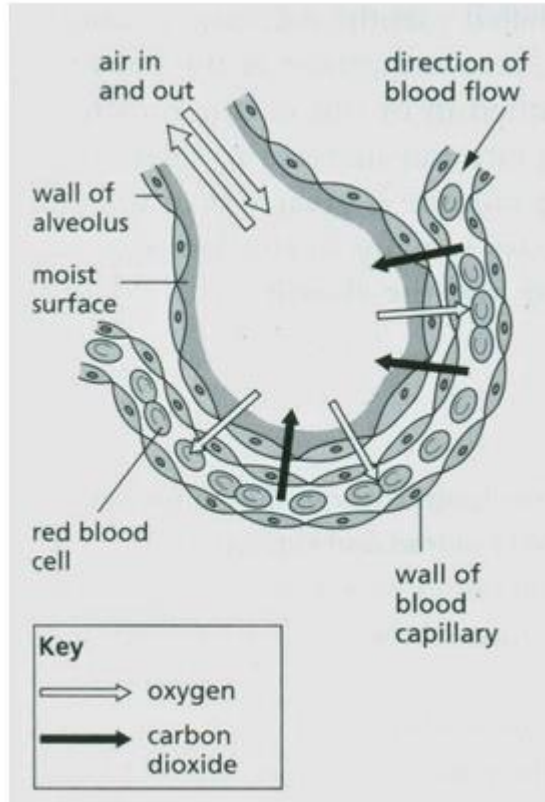
• Some of these tubes are lined with goblet cells which make mucus, and ciliated cells. The mucus traps dirt, bacteria and other particles and the cilia sweep the mucus up and away from the lungs.

• Air is drawn into the lungs by the contraction of the external intercostal muscles and the muscles in the diaphragm. These muscle contractions increase the volume of the thorax, which decreases the pressure. Air flows down the pressure gradient and into the lungs.

• Tobacco smoke contains many different substances that harm health. Nicotine is an addictive stimulant, and its intake increases the risk of developing heart diseases. Tar causes lung and other cancers. CO<sub>2</sub> reduces the ability of red blood cells to transport O<sub>2</sub>. Smoke particles irritate the lungs and can contribute to the development of emphysema.

**EXERCISE**

1. State how each feature labeled on the diagram of an alveolus makes the process of gaseous exchange efficient. [5 marks]



2. a) The composition of the air inside the lungs changes during breathing.

i) State three differences between inspired and expired air. [3 marks]

ii) Gaseous exchange in the alveoli causes some of the changes to the inspired air. Describe three features of the alveoli which assist gaseous exchange. [3 marks]

3a) i) State what is meant by anaerobic respiration [2 marks]

ii) Where does anaerobic respiration occur in human? [1mark]

4. Describe the effects of physical activities on the rate and depth of breathing.

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5. Design a nice model of the human gaseous exchange

[15]