# 6.4 Gas Exchange

## Question Paper

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|---|---|
| Course | DP IB Biology |
| Section | 6. Human Physiology |
| Topic | 6.4 Gas Exchange |
| Difficulty | Medium |

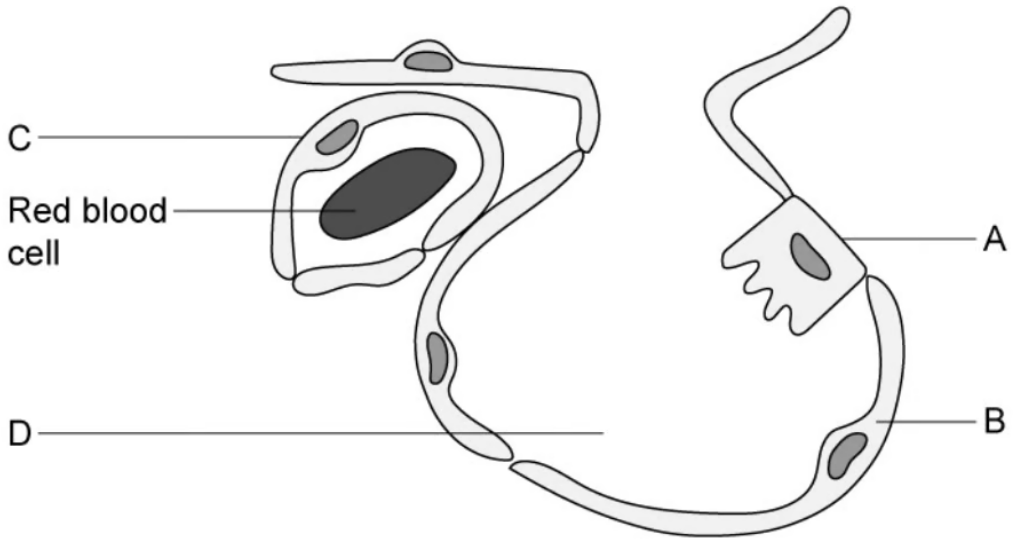
**Time allowed:** 60

**Score:** /49

**Percentage:** /100

## Question 1a

a) The diagram below shows a cross section of an alveolus and associated structures.




i) Label the structures **A- D**

ii) Give an adaptation of structures **A** and **B**

**[2 marks]**

## Question 1b

b) Describe the route taken by an oxygen molecule from an alveolus to the blood.

**[2 marks]**

## Question 1c

c) Explain how the fluid secreted by the epithelial cells of the alveolus helps to reduce surface tension and prevent adhesion of the alveolar surface.

**[4 marks]**

## Question 1d

d) State the mode of molecular transport by which oxygen from air in the alveoli enters the blood in capillaries.

**[1 mark]**

## Question 2a

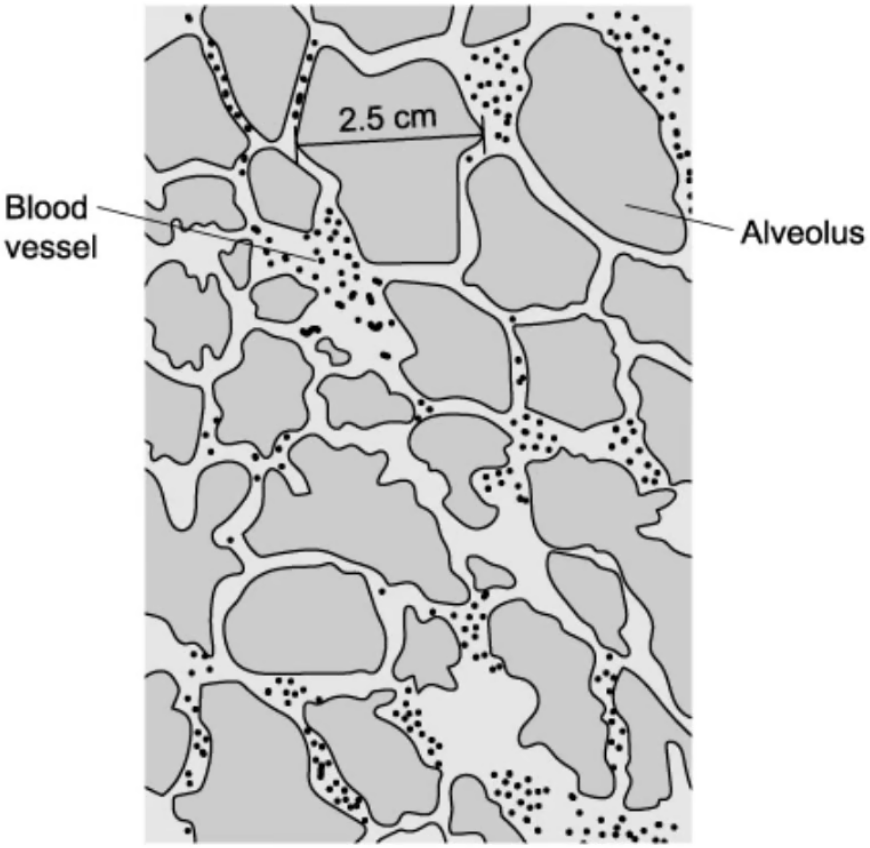
a) Explain how the volume of the thorax increases during inspiration.

**[2 marks]**

## Question 2b

b) The diagram below shows a micrograph of thinly sliced lung tissue.

**Figure 1**

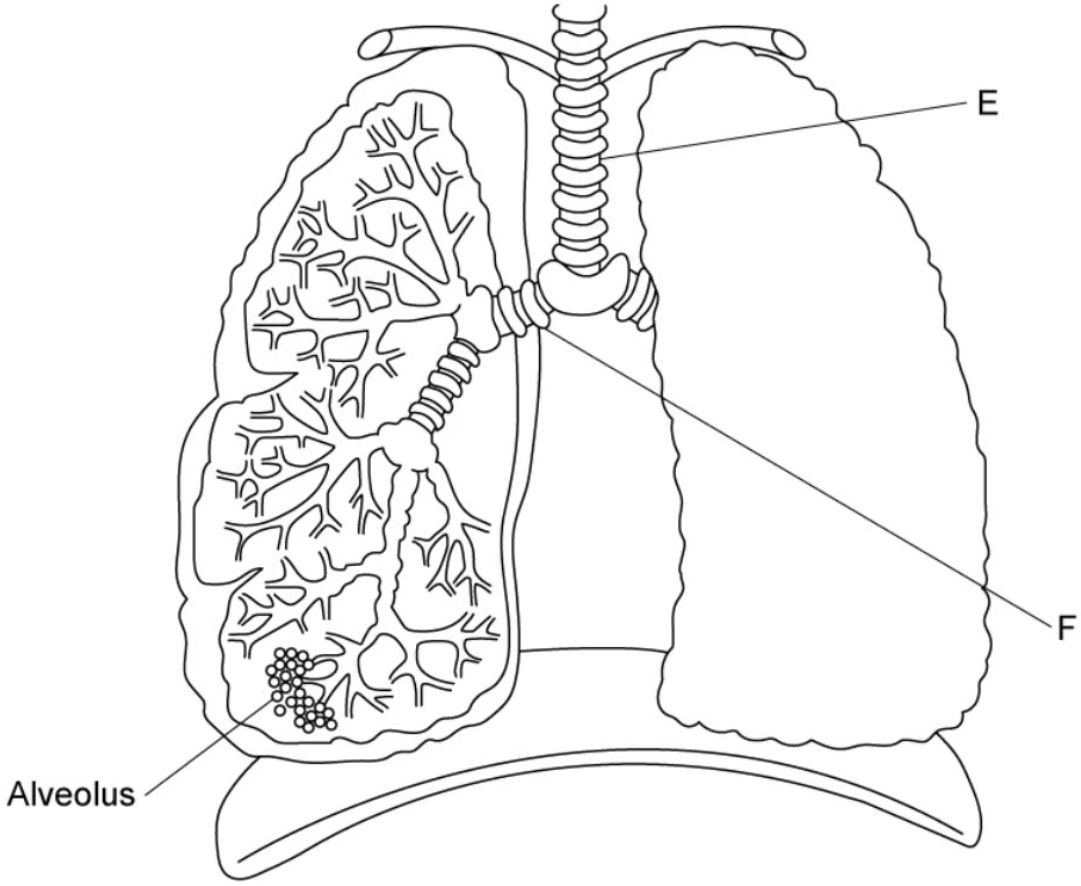



Calculate the actual size, in micrometres, of the alveolus diameter that has been measured in the diagram.

**[2 marks]**

## Question 2c

c) The diagram below shows the structure of the human gas exchange system




Identify structures **E** and **F**

**[1 mark]**

## Question 2d

d) Explain how the downward movement of the diaphragm leads to air entering the lungs

**[3 marks]**

## Question 3a

a) Describe and explain **two** adaptations of alveoli that enable rapid gas exchange.

**[2 marks]**

## Question 3b

b) Describe the route taken by a carbon dioxide molecule from the blood to the outside air.

**[4 marks]**

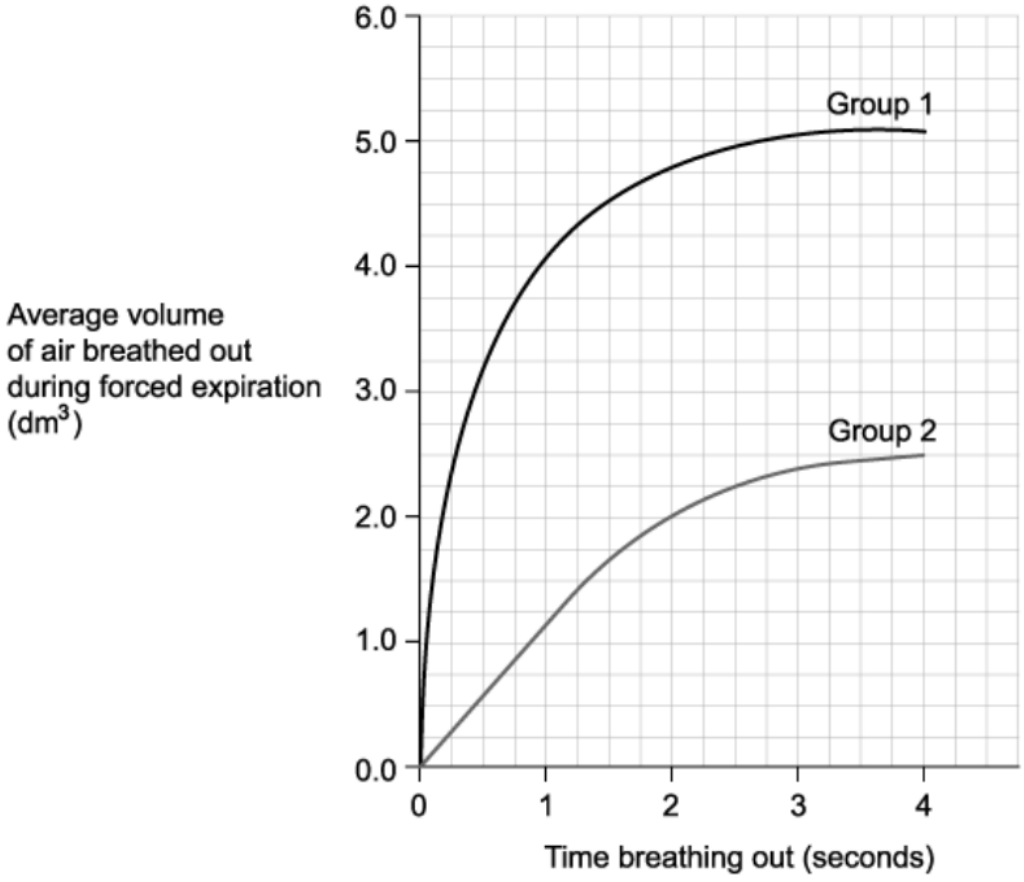
## Question 3c

c) Two groups of people were asked to take part in a study. The individuals in group **1** were healthy and the individuals in group **2** had recently recovered from an asthma attack.

In the experiment each individual was asked to breathe in as deeply as they could. They then breathed out via forced expiration.

A study coordinator measured the volume of air that each individual breathed out during forced expiration.

The graph below shows the results.




The FEV (forced expiration volume) is the volume of air that an individual can breathe out within a single second.

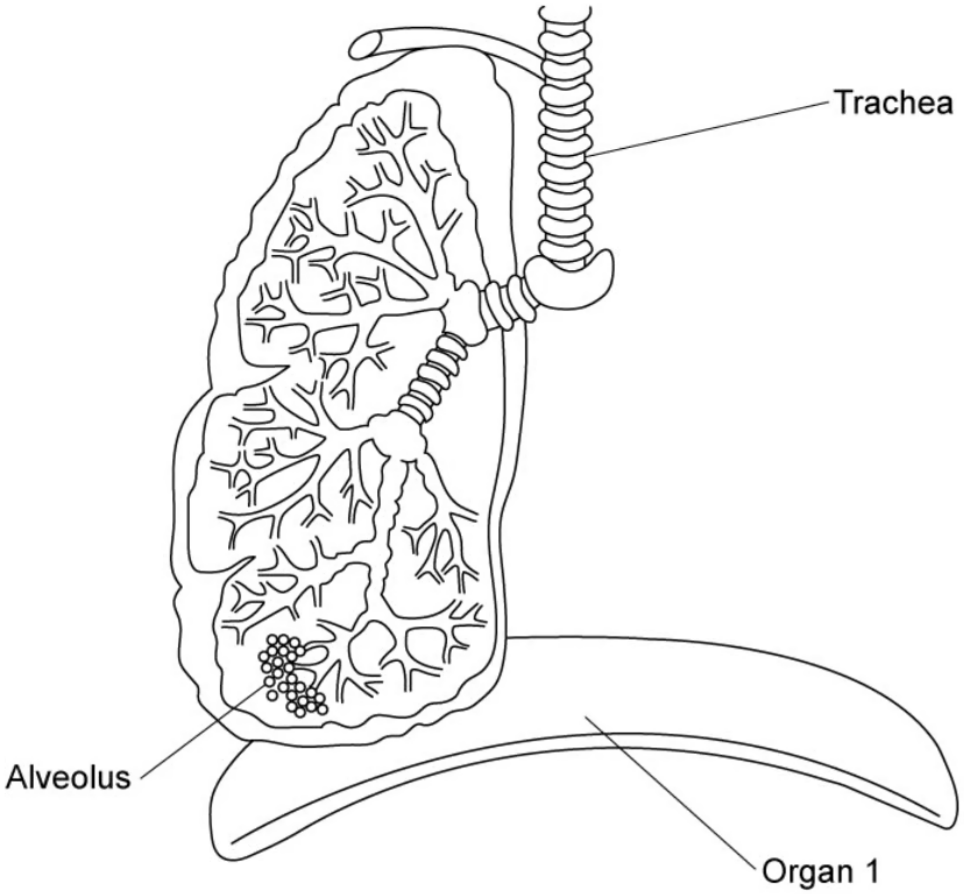
Using the graph, calculate the percentage difference in the FEV for group **2** compared with group **1**.

[2 marks]

## Question 4a

a) The diagram below depicts a section of the human gas exchange system.

**Figure 1**




State the name of **Organ 1** and describe its role in breathing out.

[3 marks]

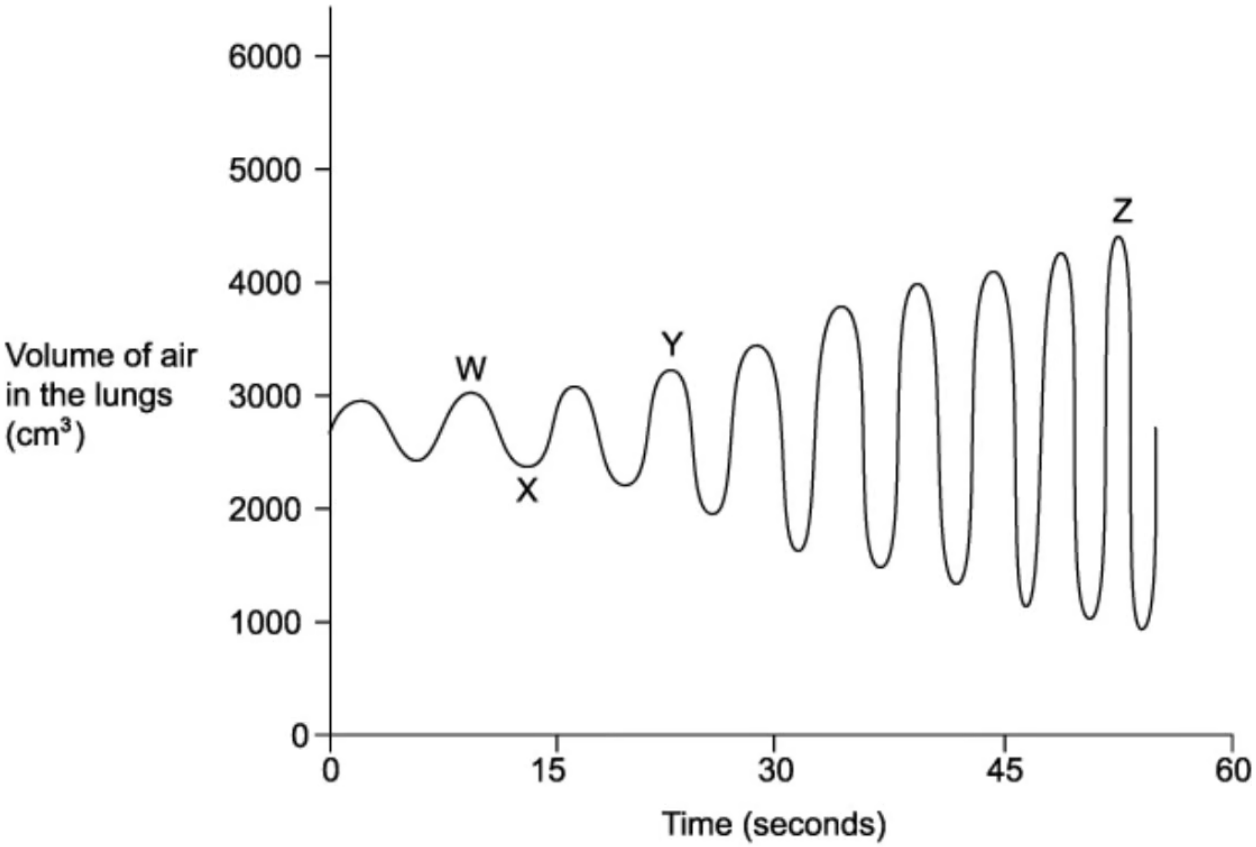
## Question 4b

b) In normal and healthy lungs, an oxygen concentration gradient is maintained between the alveoli and the lung capillaries. Describe and explain how this is maintained.

**[4 marks]**

## Question 4c

c) The graph below shows the changes in the volume of air in a woman's lungs while breathing.




Explain how the graph shows that the woman was breathing out between times **W** and **X**.

**[1 mark]**

## Question 4d

d) Muscle action during ventilation is described as antagonistic.

Outline what this means with reference to **one** example during ventilation.

[1 mark]

## Question 5a

a) Emphysema is an example of a Chronic Obstructive Pulmonary Disease (COPD).

Explain the consequences smoking has on lung tissue and the increase of symptoms of emphysema.

[5 marks]

## Question 5b

b) Lung cancer is another disease that affects the respiratory system. Many scientific studies have shown a link between smoking and lung cancer.

Describe other factors that may cause lung cancer.

[4 marks]

## Question 5c

c) Doctors investigated the effect of the smoking habits of men on their non-smoking partners.

The doctors recruited 640 non-smoking partners, all of which were women aged 30 or older. They divided these women into groups according to the smoking habits of their husbands. After 15 years, the doctors recorded how many of the partners had died and their cause of death.

They used these data to determine the relative risk of a partner dying from a particular disease according to her husband's smoking habit.

In this comparison, they gave the relative risk to the partner of a non-smoker as 1.00. A value greater than 1.00 shows an increased risk compared to the partner of a non-smoker.

The results are shown in the table below.

| Cause of death | Relative Risk of Partner Dying | | |
|---|---|---|---|
| | Husband is a non-smoker | Husband is a smoker (1-19 cigarettes/day) | Husband is a smoker (>19 cigarettes/day) |
| Lung cancer | 1.00 | 1.63 | 2.12 |
| Emphysema | 1.00 | 1.34 | 1.54 |
| Stomach cancer | 1.00 | 1.13 | 1.15 |
| Breast cancer | 1.00 | 1.10 | 1.18 |
| Heart disease | 1.00 | 0.86 | 0.87 |

The scientists concluded from these data that if a husband smoked, it greatly increased the risk of his partner dying of certain diseases.

Evaluate this statement.

**[6 marks]**