

The gas exchange system and Smoking

Question Paper 6

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Gas exchange and smoking
Sub Topic	The gas exchange system and Smoking
Booklet	Theory
Paper Type	Question Paper 6

Time Allowed : 53 minutes

Score : / 44

Percentage : /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

2 Asthma is a disease of the respiratory system.

- During an asthma attack the membranes lining the airways release mucus and become inflamed.
- This causes the muscles of the airways to contract and narrow the lumen of the airways, making breathing difficult.
- Most asthma attacks are triggered by allergens.
- Allergens are harmless substances that, in some people, stimulate an immune response that leads to an allergic reaction.
- There has been a large increase in cases of asthma over the last 40 years.

(a) Many allergens that can trigger an asthma attack are inhaled during normal breathing.

Suggest **two** examples of these allergens.

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..... [2]

(b) Over the past 20 years a study has been carried out on the 261 inhabitants of a remote island in the South Atlantic called Tristan da Cunha.

- There are only seven different family names on the island.
- Half of the islanders displayed symptoms of asthma.
- A gene, *ESE3*, is responsible for the normal deposition of collagen in the walls of the airways.
- When the gene is faulty, too much collagen is produced and this can lead to asthma-like symptoms, making breathing difficult.
- This faulty gene has been found among the inhabitants of Tristan da Cunha.

(i) Collagen is also found in the walls of blood vessels.

State **one** property of collagen that enables it to carry out its main function in the walls of blood vessels and airways.

..... [1]

(ii) Suggest why this form of asthma was very common amongst the population of Tristan da Cunha.

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..... [3]

- 3 (a)** Table 2.1 shows some of the structures in different parts of the gas exchange system.

Complete Table 2.1 by indicating with a tick (✓) if the structure is present in each part of the gas exchange system or a cross (X) if it is not.

Table 2.1

structure	trachea	bronchus	bronchiole	alveolus
ciliated epithelium				
goblet cells				
cartilage				
smooth muscle				

[4]

- (b)** An exercise physiologist investigated aspects of breathing in an athlete.

The minute volume is the volume of air breathed in during one minute.

The data recorded is in Table 2.2.

Table 2.2

vital capacity /dm ³	breathing rate at rest /breaths min ⁻¹	minute volume /dm ³
5.8	11	5.5

- (i)** Explain how the physiologist would determine the vital capacity of the athlete.

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..... [2]

- (ii)** Calculate the athlete's tidal volume.

Answer = [1]

- (c) Fig. 2.1 shows a cross section of a coronary artery partially blocked by plaque causing atherosclerosis.

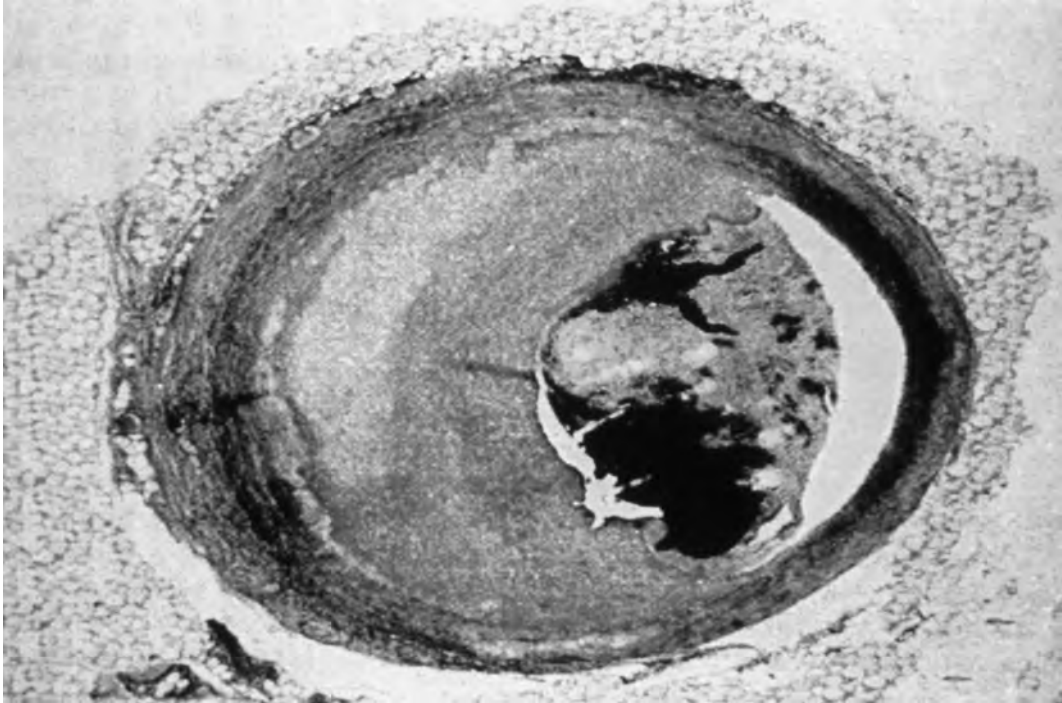


Fig. 2.1

Explain why atherosclerosis in coronary arteries may limit the ability of people to take vigorous exercise.

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..... [3]

- (d) Describe the effects of nicotine and carbon monoxide in cigarette smoke on the cardiovascular system.

nicotine

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carbon monoxide

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..... [3]

[Total: 13]

4 Fig. 6.1 is a section through lung tissue showing an alveolus and its blood supply.

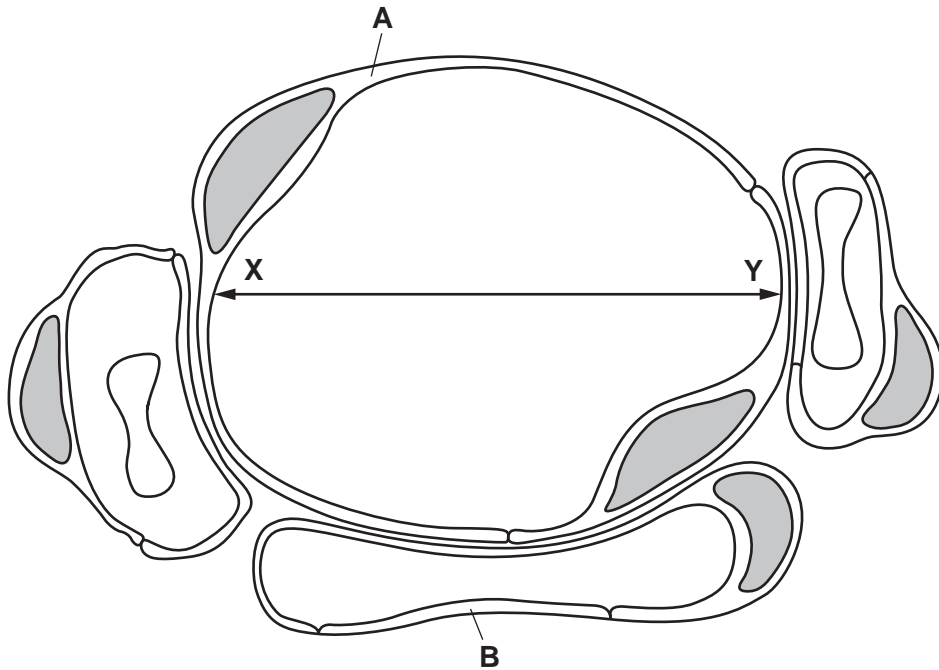


Fig. 6.1

(a) (i) Name the type of epithelial cell shown by label lines **A** and **B**.

..... [1]

(ii) Describe how the elastic fibres of the alveoli contribute to the healthy functioning of the lungs.

.....

 [2]

(b) The actual diameter of the alveolus along the line **X–Y** is 220 micrometres (μm). Calculate the magnification of Fig. 6.1.

Show your working and give your answer to the nearest whole number.

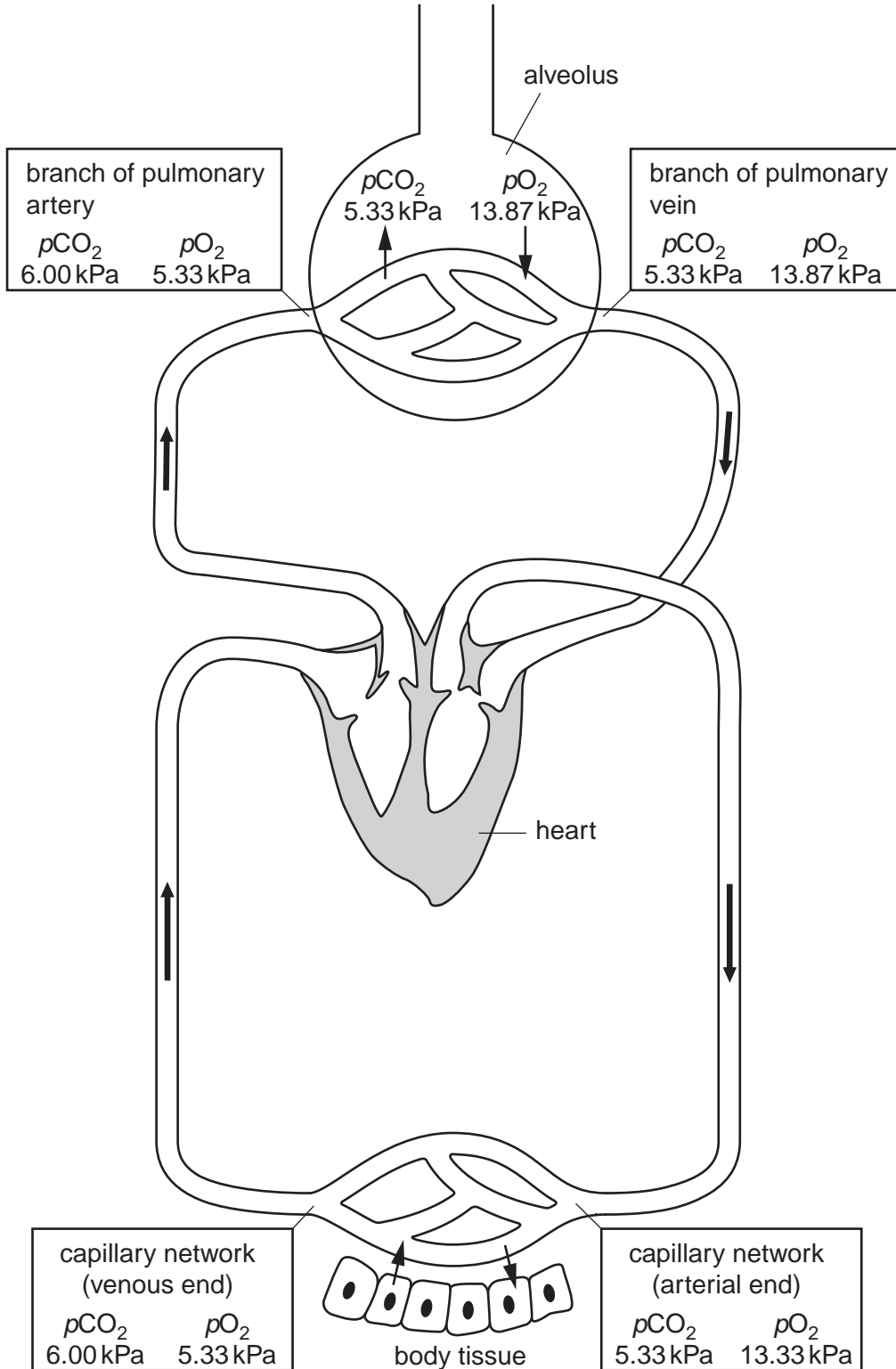
answer \times [2]

(c) Outline two features of a gas exchange surface **that are shown on Fig. 6.1**.

1.

 2.
 [2]

- (d) Fig. 6.2 is a simplified diagram of the circulatory system of a human, showing gas exchange in the lungs and in respiring tissue. The partial pressures of oxygen (pO_2) and carbon dioxide (pCO_2) at four locations are also shown.



not to scale

Fig. 6.2

- 5 Amylase is an enzyme that catalyses the hydrolysis of starch. A student investigated the effect of pH on the activity of the enzyme.

Eight test-tubes were set up each containing 5 cm³ of the same concentration of amylase solution but in buffer solutions of different pH values. The test-tubes were left in a water-bath at 30 °C for 10 minutes.

After 10 minutes, 5 cm³ of a starch suspension at 30 °C was added to each test-tube. Immediately, the student took a sample from each test-tube and tested the reaction mixture for the presence of starch. Samples were then taken every minute for 10 minutes and tested in the same way.

The student’s results are shown in Table 2.1.

Table 2.1

pH	time / min									
	0	1								10
2.0	✓	✓								
3.0	✓	✓							X	
4.0	✓	✓	✓	✓	✓	✓	X	X		
5.0	✓	✓	✓	✓	X	X				
6.0	✓	✓	✓	X	X					
7.0	✓	✓	✓	✓	X	X				
8.0	✓	✓							X	
9.0	✓	✓								

key

✓ = starch present

X = starch absent

- (a) Describe how the student would test for the presence of starch.

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..... [2]

