# 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*	Α	В	С	D	E	U
>85%	′77.5%	70%	62.5%	57.5%	45%	<45%

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1 In 1954, an article was published in the British Medical Journal entitled, *The mortality of doctors in relation to their smoking habits.* 

One aspect of the investigation studied a very large number of male doctors in the UK aged 35 years and older. A survey established the quantity of tobacco smoked per day.

Twenty-nine months later, the cause of any deaths in the study group was recorded.

Table 5.1 summarises the results obtained.

Table 5.1

	number of	death rate per year per 1000 men in the study			
cause of death	deaths	non- smokers	smokers, tobacco smoked / g day <sup>-1</sup>		
			1–14	15–24	25 and above
coronary thrombosis (heart attack)	235	3.89	3.91	4.71	5.15
other cardiovascular diseases	126	2.23	2.07	1.58	2.78
lung cancer	36	0.00	0.48	0.67	1.14
other diseases of the gas exchange system	54	0.86	0.88	1.01	0.77

(a)	State which group in the study is most at risk from dying of lung cancer.
	[1]
(b)	Using information from Table 5.1 to support your answer, discuss the evidence linking tobacco smoking to disease and early death.

[Total: 5]

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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)	Mar	ny allergens that can trigger an asthma attack are inhaled during normal breathing.
	Sug	gest two examples of these allergens.
		[2]
(b)		er the past 20 years a study has been carried out on the 261 inhabitants of a remote and in the South Atlantic called Tristan da Cunha.
		<ul> <li>There are only seven different family names on the island.</li> <li>Half of the islanders displayed symptoms of asthma.</li> <li>A gene, ESE3, is responsible for the normal deposition of collagen in the walls of the airways.</li> <li>When the gene is faulty, too much collagen is produced and this can lead to asthma-like symptoms, making breathing difficult.</li> </ul>
		This faulty gene has been found among the inhabitants of Tristan de Cunha.
	(i)	Collagen is also found in the walls of blood vessels.
		State <b>one</b> 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.
		হৈ ৷

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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  $(\checkmark)$  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	breathing rate at rest	minute volume
/dm <sup>3</sup>	/breaths min <sup>-1</sup>	/dm <sup>3</sup>
5.8	11	5.5

(i)	Explain how the physiologist would determine the vital capacity of the athlete.
	[2
ii)	Calculate the athlete's tidal volume.

Answer = .....[1]

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(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.
[3]

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(d)	Describe the effects of nicotine and carbon monoxide in cigarette smoke on the cardiovascular system.
	nicotine
	carbon monoxide
	Carbon monoxide
	[3]
	[Total: 13]

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

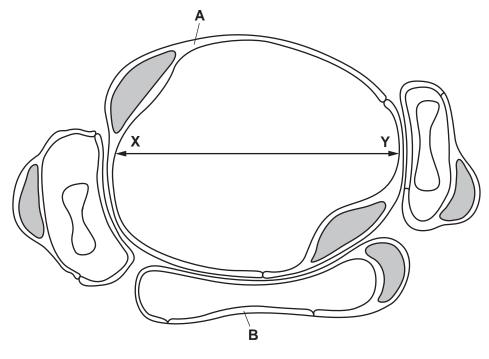
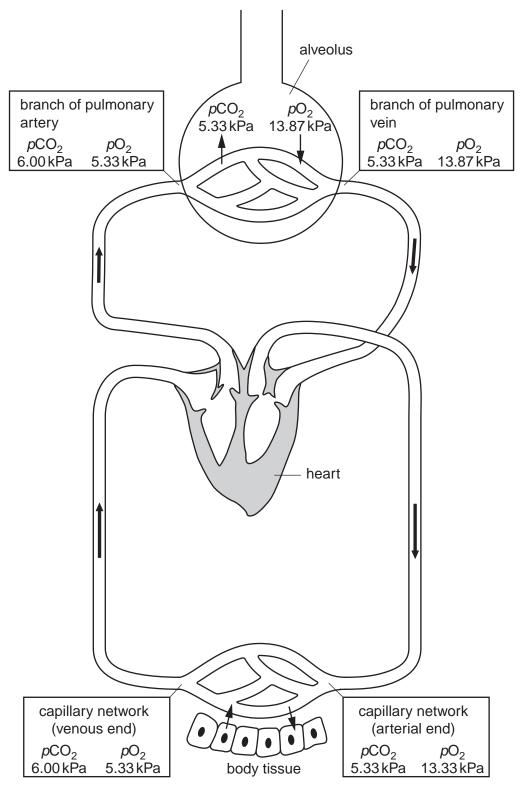


Fig. 6.1

(a)	(i)	Name the type of epithelial cell shown by label lines <b>A</b> and <b>B</b> .
	(ii)	Describe how the elastic fibres of the alveoli contribute to the healthy functioning of
	( )	the lungs.
		[2]
(b)		e actual diameter of the alveolus along the line $X-Y$ is 220 micrometres ( $\mu$ m) culate the magnification of Fig. 6.1.
	Sho	ow your working and give your answer to the nearest whole number.
		answer ×[2]
(c)	Out	line two features of a gas exchange surface that are shown on Fig. 6.1.
	1	
	2	
		ro

(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

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With reference to Fig. 6.2, explain how the differences in $pO2$ and $pCO_2$ in the alveolus and in blood enable gas exchange in the lungs <b>and</b> respiring tissue.
[4
[4
[Total: 11

[Total: 11]

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**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 cm<sup>3</sup> 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 cm<sup>3</sup> 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

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

#### key

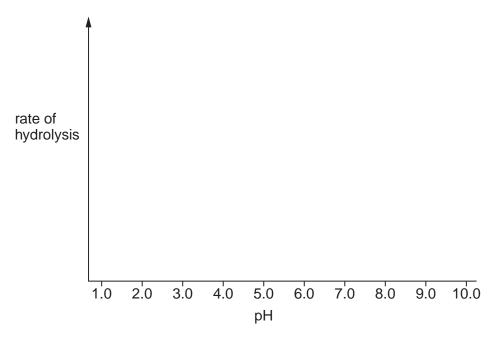
✓ = starch present

X = starch absent

(a)	Describe how the student would test for the presence of starch.										
	[2]										

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**(b)** Use the axes below to sketch a graph to show the effect of pH on the **rate of hydrolysis** of starch by amylase.



(c) With reference to the student's results, describe and explain the effect of pH on the rate of hydrolysis of starch by amylase.

[2]

[Total: 9]