

7

Respiration in Humans

Structured Questions▶▶

Level 2

1. Figure 7.1 shows part of the respiratory system of a human.

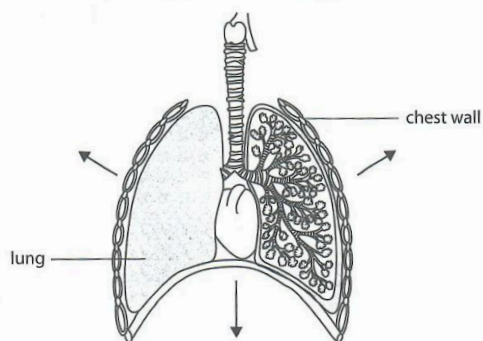


Figure 7.1

- (a) On Figure 7.1, label the following regions correctly:
- (i) trachea; [1]
 - (ii) bronchi; [1]
 - (iii) diaphragm. [1]
- (b) Describe the effect of tobacco smoke on the airways in the lungs over many years of heavy smoking. [3]
- (c) An investigation was conducted to observe the changes in volume of air breathed during three different activities in a person. The results are illustrated in Figure 7.2.

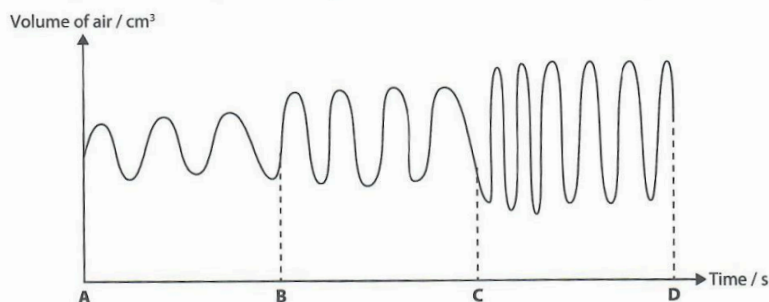


Figure 7.2

- (i) Complete Table 7.1 by matching the periods **A** to **B**, **B** to **C** and **C** to **D** to the respective activities.

[3]

Table 7.1

Activity	Period
jogging	
sitting	
running	

- (ii) With reference to your answers in (c)(i), suggest why the volume and rate of air inhaled needs to increase when a person shifts from period **A** to **B** to period **B** to **C**.

[2]

Level 3

2. Figure 7.3 shows the gaseous exchange surfaces, also known as the alveoli, in a lung.

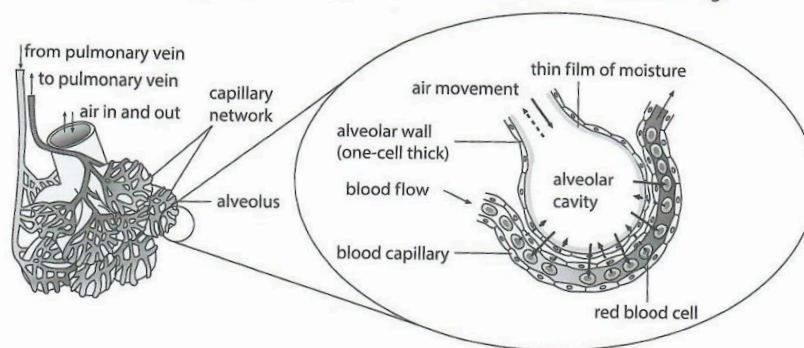


Figure 7.3

- (a) With reference to Figure 7.3, describe the structures of the alveoli that facilitate the rapid transfer of oxygen during gaseous exchange. [3]
- (b) Tobacco smoke in cigarettes can have serious effects on health. State **three** major toxic substances in tobacco smoke. [3]
- (c) It was known that a person who smokes has a higher risk of lung infections than a person who does not smoke. Explain why this is so. [2]
3. Figure 7.4 shows the alveoli from the lungs taken from two different people.

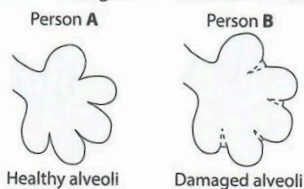


Figure 7.4

- (a) (i) Name the respiratory disease in person **B**. [1]
- (ii) Explain how the condition in (a)(i) would affect gaseous exchange. [2]

(b) Figure 7.5 shows the lining of the bronchus of the same two people.

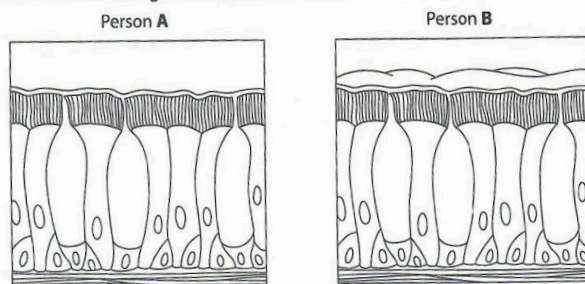


Figure 7.5

With reference to Figure 7.5, explain how the condition in person B will lead to the respiratory disease named in (a)(i).

[3]

4. Instead of lungs, flying insects have the tracheal system, which is made up of air tubes that branch throughout every region of the body, even into the legs. Air enters the tracheal system through valve-like openings (spiracles).

Figure 7.6 shows how oxygen and carbon dioxide diffuse through spiracles. Alternating contraction and relaxation of the flight muscles then pump air rapidly through the tracheal system. This system is capable of transporting oxygen and carbon dioxide directly to all body cells without the need of the animal's open circulatory system.

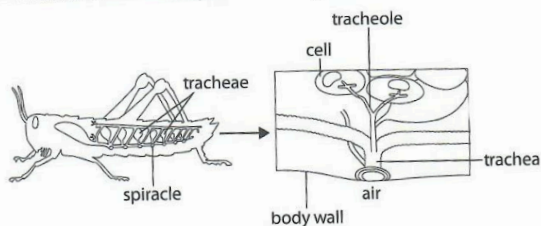


Figure 7.6

- (a) Compare and contrast the gaseous exchange in the human respiratory system and the tracheal system of flying insects.
- (b) Suggest which organ the flight muscles in the insects resemble in humans to transport oxygen and carbon dioxide around the body.

[3]

[1]

5. A student conducted a study to investigate the effect of inhaled carbon dioxide concentration on breathing. Table 7.2 shows the changes in the volume and breathing rate of a person inhaling different concentrations of carbon dioxide.

Table 7.2

Concentration of Carbon Dioxide in Inhaled Air / %	Volume of a Single Breath / cm ³	Breathing Rate / Breaths Per Min
0.03	520	14
0.10	590	16
1.00	760	19
3.00	1280	25
5.00	2250	30

- (a) Calculate the difference in the total volume of air entering the lungs per minute when the concentration of carbon dioxide in the inhaled air changes from 1.00% to 5.00%. Show your working. [3]
- (b) A student claimed that the stimulus for breathing is a high concentration of carbon dioxide in the blood. With reference to the data in Table 7.2, explain if the student's claim is true. [3]
6. Figure 7.7 shows a model used to study the inhalation and exhalation that take place in the human thorax.

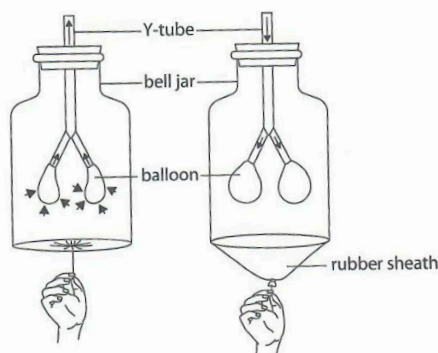


Figure 7.7

- (a) Complete Table 7.3 for the corresponding structures in the human thorax represented by structures in Figure 7.7. [4]

Table 7.3

Structure in Model	Part in Human Thorax
Y-tube	
bell jar	
balloons	
rubber sheath	

- (b) State **two** reasons why the model in Figure 7.7 does **not** accurately represent breathing in the human respiratory system. [2]
- (c) Suggest what would happen if a hole was made on the bell jar. Explain your answer. [3]

7. In the human gaseous exchange system, various structures are adapted in different ways to perform their respective functions.

- (a) Complete Table 7.4 using a tick (✓) or cross (×) in the appropriate box to show if the structure has the particular feature in a healthy individual.

Table 7.4

Structure	Trachea	Bronchus	Bronchiole	Alveoli
Lined with cilia				
Secretes mucus				
One-cell thick wall				
Reinforced with cartilage				

- (b) Describe how the concentration gradients of oxygen and carbon dioxide are maintained for gaseous exchange. [2]
- (c) Suggest what will happen to cells if gaseous exchange did not occur efficiently. [1]

8. Figure 7.8 shows a section of the bronchus from the lungs of a healthy non-smoker and a section of the bronchus from a heavy smoker. The two sections are obtained from the same relative positions of the lungs and drawn to the same scale.

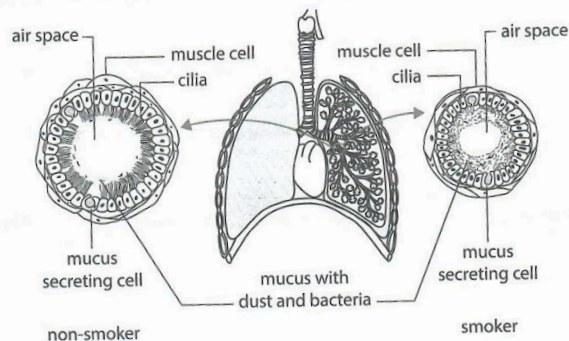


Figure 7.8

- (a) With reference to Figure 7.8, compare and contrast the difference between the bronchus of a non-smoker and a smoker. [3]
 (b) (i) Write the word equation for aerobic respiration. [1]
 (ii) Figure 7.9 shows the experiment conducted by a student to investigate the contents of air during inhalation and exhalation.

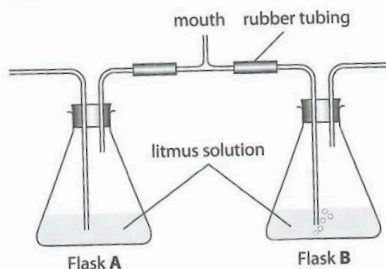


Figure 7.9

- When the healthy non-smoker inhaled and exhaled through the mouthpiece, state what would be observed in flasks A and B. [2]
 (iii) Suggest **one** difference in the observation when the heavy smoker inhaled and exhaled once through the mouthpiece. [1]

Free-response Questions▶▶**Level 3**

9. Table 7.5 shows the concentration of carbon dioxide in the air expelled by a man five minutes after he stopped running.

Table 7.5

Time / min	Percentage Concentration of Carbon Dioxide / %
0	6.0
1	5.6
2	4.8
3	4.4
4	4.3
5	4.3

- (a) (i) Plot the data shown in Table 7.5 on a graph. [3]
(ii) Describe and explain the results of the investigation after the run. [6]
(b) Aside from the decrease in carbon dioxide concentration, state another change in breathing of the man after the run. [1]

10. A student conducted an investigation on a large number of smokers. The study investigated the relationship between smoking habits on a group of individuals and the percentage of deaths due to lung cancer in smokers. The results are summarised in Table 7.6.

Table 7.6

Number of Cigarettes Smoked Per Day	Percentage of Deaths Due to Lung Cancer / %		
	Before 15 Years Old	15 – 25 Years Old	Above 25 Years Old
1 – 9	16	11	9
10 – 20	24	20	17
21 – 30	46	39	25

- (a) Draw a bar graph to represent the information given in Table 7.6. [3]
- (b) State and explain the relationship of the number of cigarettes smoked per day and the percentage of deaths due to lung cancer. [3]
- (c) Figure 7.10 shows a section of an alveolus and an adjacent blood capillary in a human lung.

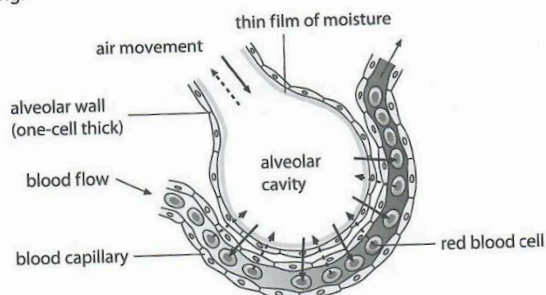


Figure 7.10

Suggest how the absorption and transport of oxygen will be affected by cigarette smoke. [2]

11. An investigation was carried out to find the relationship between the birth mass of babies and the number of cigarettes smoked per day by their mothers during pregnancy. The results are shown in Figure 7.11.

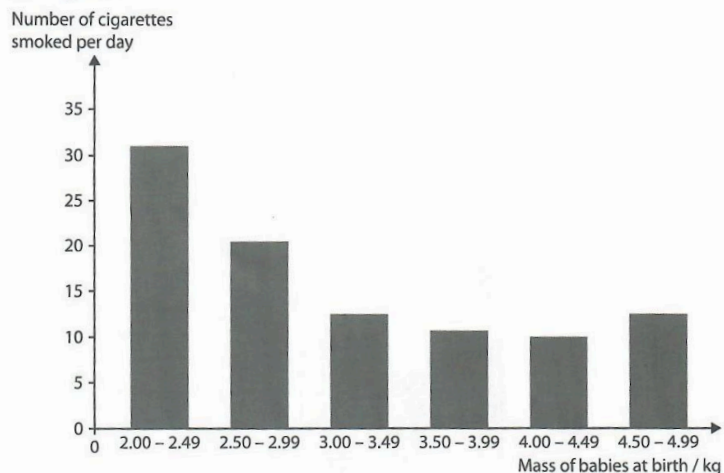


Figure 7.11

- Describe the relationship between the number of cigarettes smoked and the birth mass based on the data from Figure 7.11. [3]
- Explain how **two** named components of cigarette smoke may have caused the observation seen in (a). [6]
- One of the mothers was discovered to suffer from emphysema. State **one** symptom of emphysema experienced by smokers. [1]

12. Humans carry out aerobic and anaerobic respiration.

(a) Use word equations to explain the differences between aerobic and anaerobic respiration in humans. [4]

(b) Athletes compete in races of different distances.

Figure 7.12 shows the percentage of energy released by aerobic and anaerobic respiration during these races.

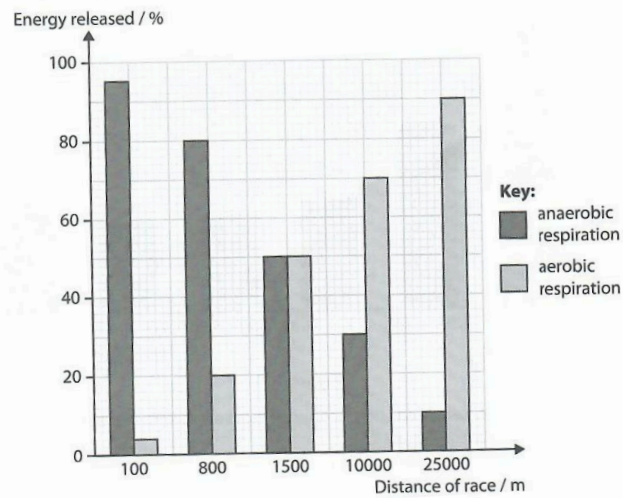


Figure 7.12

With reference to Figure 7.12, state **two** conclusions that can be made from the information provided. [4]