

4. Figure 4 shows part of the respiratory system of a human being.

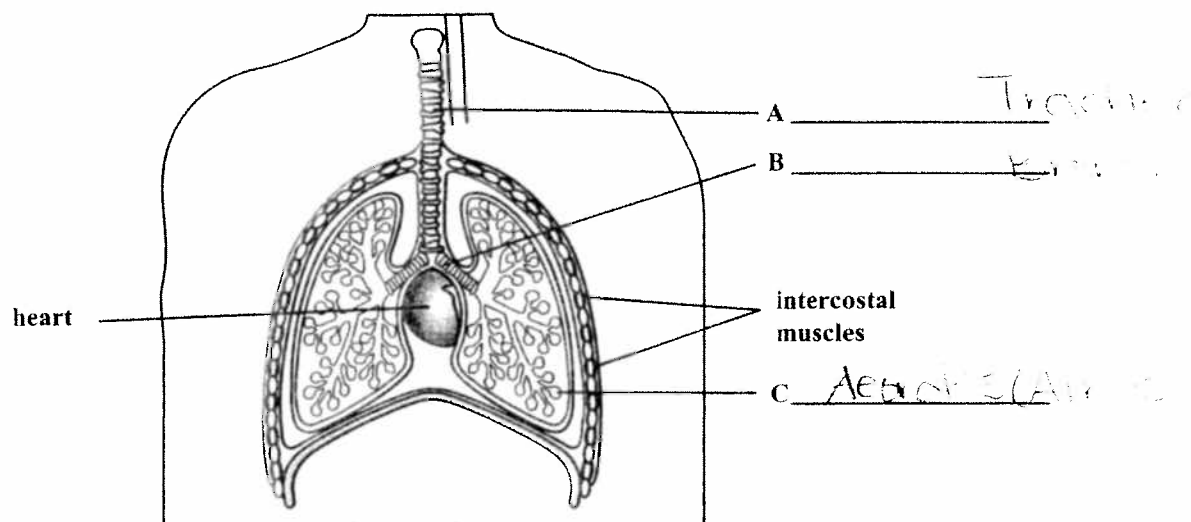


Figure 4. Part of the respiratory system of a human being

- (a) (i) Label the diagram at the points marked A, B and C. (3 marks)

- (ii) Fill in the blank spaces in the following sentence.

On breathing in, the ribcage moves up and out while the diaphragm flattens.

(3 marks)

- (b) Mr Speedy, a middle-aged man, decides to train for a sprint competition. Since retiring from sports, Mr Speedy has become a heavy smoker. He sets off on a 100 m sprint but by the halfway mark he experiences pain in his legs and sides. He cannot complete the sprint. He remains bent over, breathing through his mouth for several minutes.

- (i) Suggest how the changes in the process of respiration (aerobic and anaerobic) might be responsible for Mr Speedy being unable to complete the sprint.

During the sprint, the muscle cells were respiring aerobically but as the oxygen supply decreased, anaerobic respiration took place. Since anaerobic respiration produces less energy, this energy was quickly used up, leaving no more to complete the sprint.

(2 marks)

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For
Perfect
answer

- (ii) Explain why his heart rate increases during the sprint.

Since more oxygen was required for respiration, the heart beat faster to circulate blood (containing oxygen) to muscles. (2 marks)

- (iii) Account for the pain in his leg muscles.

This pain was caused by lactic acid, a product of anaerobic respiration. (2 marks)

- (iv) Explain why Mr Speedy has to breathe through his mouth.

Breathing through the mouth increases oxygen intake. This oxygen is needed to remove the lactic acid and CO_2 produced during anaerobic respiration. (2 marks)

- (v) How does Mr Speedy's smoking contribute to his inability to complete the sprint?

The cigarette contents have damaged his lungs and reduced his oxygen intake capacity. (1 mark)

Total 15 marks

Human and Social Biology

Paper 02

Question 4

This question is based on the topic “Life Processes”. Parts (a) (ii) and (iii) came from Objective 2.2 which relates the structures of the respiratory tract to their functions.

Parts (b) (i), (ii) (iii) and (iv) are based on Objective 2.8 which differentiates between aerobic and anaerobic respiration and (b) (v) is based on Objective 2.11 which explains the effects of cigarette smoking.

This response received full marks because in Parts (a) (i) and (ii), the candidate properly labelled the parts of the respiratory system and could identify the movements involved in breathing in.

In Part (b) (i), the candidate clearly differentiated between aerobic and anaerobic respiration and could identify the circumstances under which each took place.

In Part (b) (ii), the candidate associated the functions of the heart in relation to oxygen and energy supply.

Part (b) (iii) required that the candidate identify lactic acid which causes pain as a product of anaerobic respiration.

In Part (b) (iv), the candidate related a need for more oxygen to restore oxygen and lactic levels to normal.

Finally, in Part (b) (v), the candidate was able to link reduced lung capacity to the effects of cigarette smoking.