11. Gas exchange in humans

11.1 Gas exchange in humans

Paper 3 and 4

Question Paper

Paper 3

Questions are applicable for both core and extended candidates

1 Fig. 5.1 shows part of the human gas exchange system.

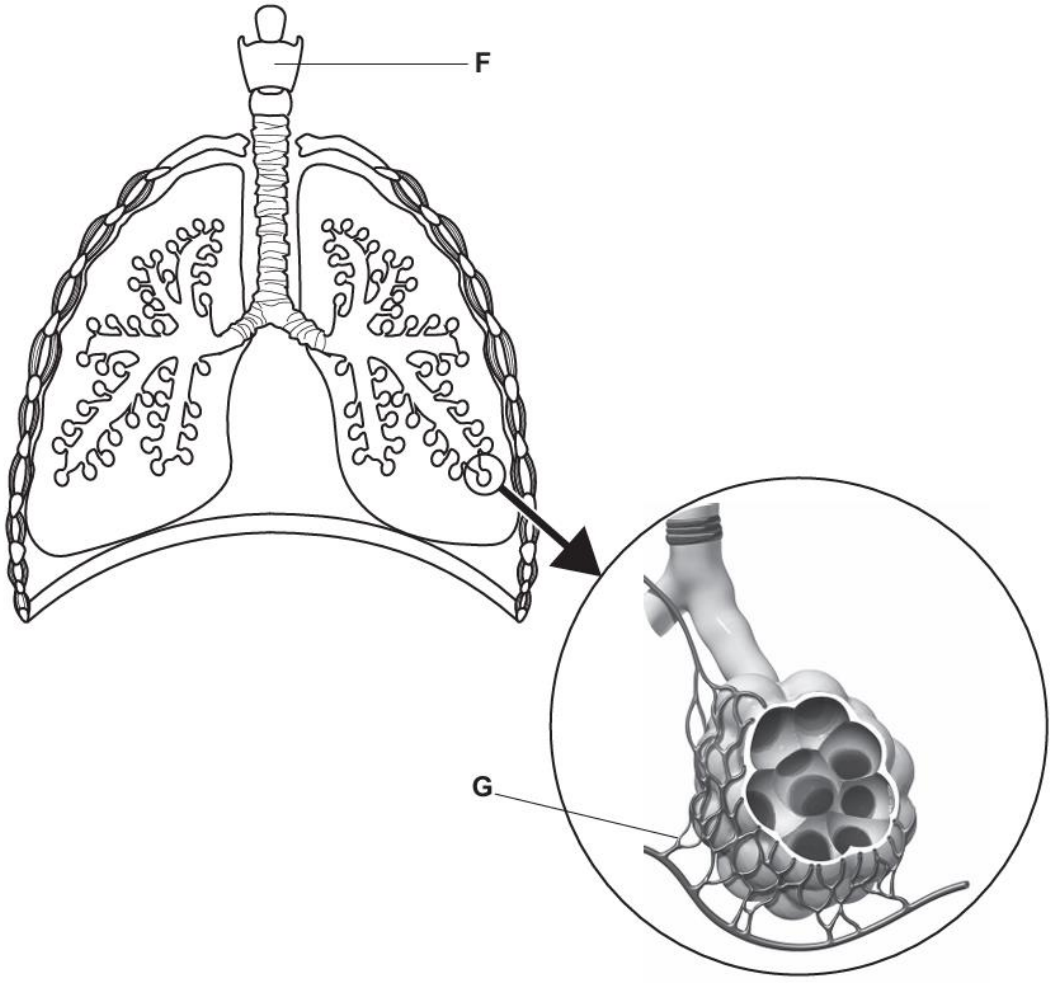

Fig. 5.1

(a) Identify the structures labelled **F** and **G** on Fig. 5.1.

F .....

G .....

[2]

(b) Write the words in the correct order in the boxes to show the structures inspired gases move through to get from outside the body to the blood.

alveoli **bronchiole** **bronchus** **trachea**

nose					blood

[2]

(c) The composition of air changes between inspiration and expiration.

(i) Complete the table about how expired air differs from inspired air.

Choose the word or phrase from the list.

Each word or phrase may be used once, more than once or not at all.

higher **lower** **the same**

gas	concentration in expired air compared to inspired air
carbon dioxide	
oxygen	
water vapour	

[3]

(ii) State the name of the substance used to test for the presence of carbon dioxide gas.

..... [1]

2 **(a)** Alveoli are the gas exchange surfaces in humans.

(i) State **two** features of gas exchange surfaces in humans.

1 .....

2 .....

[2]

(ii) State the name of the organ system alveoli belong to.

..... [1]

3 **(b)** A student breathed into a machine while they were at rest.

The machine recorded the volume of air as they breathed in and out.

The results are shown in Fig. 5.1.

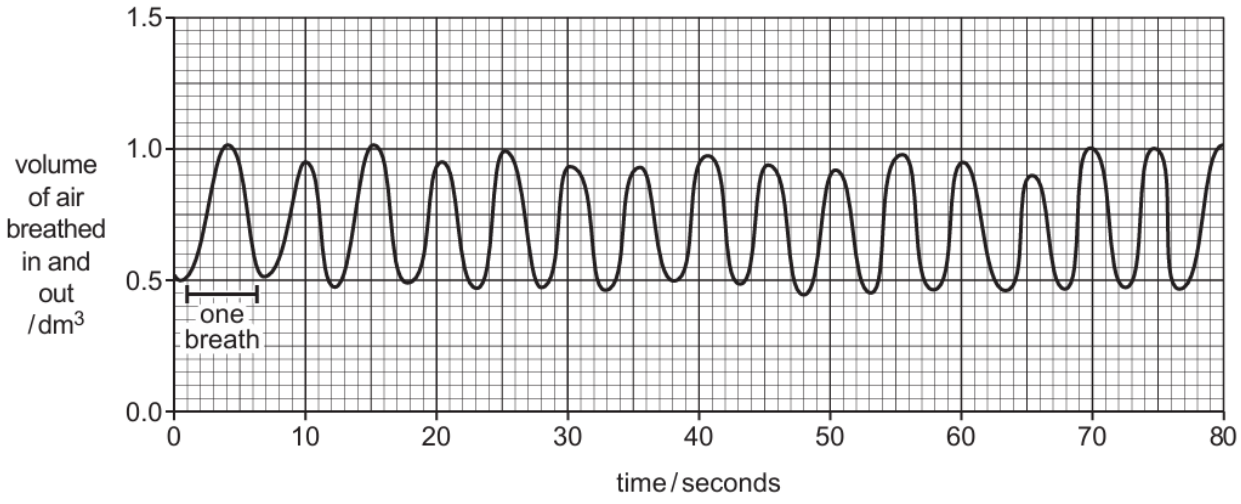

Fig. 5.1

(i) Estimate the number of breaths per minute the student took at rest.

..... breaths per minute [1]

(ii) State the volume of air breathed in during the first breath shown in Fig. 5.1.

..... dm^3 [1]

(iii) The rate and depth of breathing increases during physical activity.

Sketch another line **on Fig. 5.1** between 60 and 80 seconds to show this. [2]

4 **(a)** Fig. 5.1 is a diagram of the human gas exchange system.

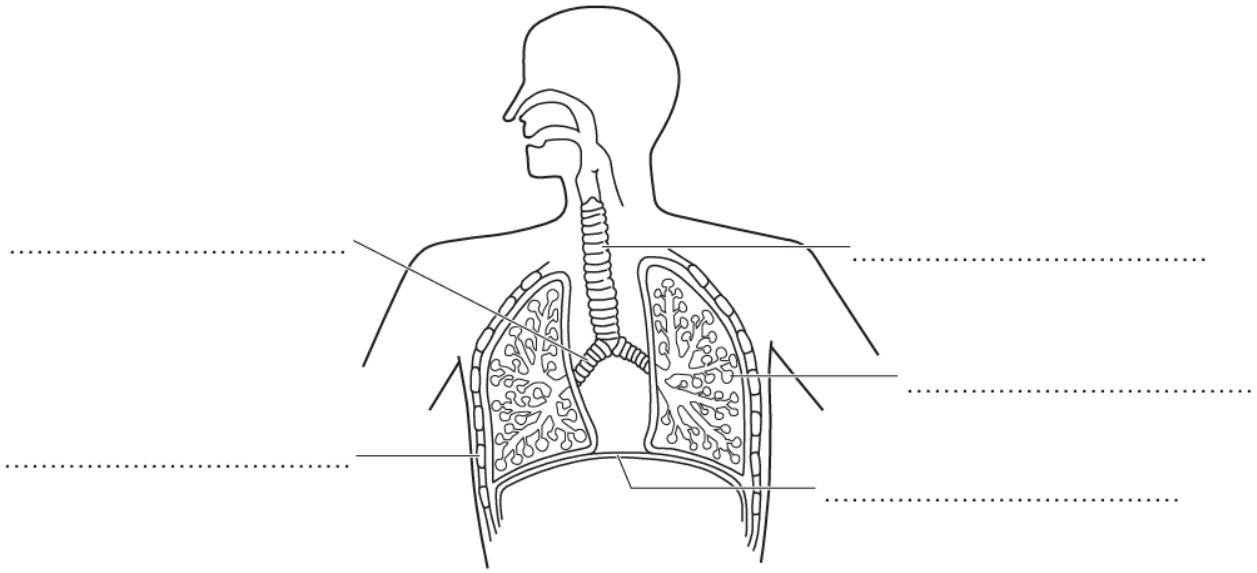

Fig. 5.1

The list shows the names of some of the parts of the human gas exchange system.

alveolus **bronchiole** **bronchus** **diaphragm**

larynx **rib** **trachea**

Use the words from the list to label Fig. 5.1.

You do not need to use every word.

Write your answers on the answer lines provided in Fig. 5.1. [5]

(b) State the name of the part of the body through which air enters and leaves.

..... [1]

(c) Complete the sentences about the differences between inspired and expired air.

Inspired air contains ..... oxygen than expired air.

Inspired air contains ..... carbon dioxide than expired air.

The concentration of water ..... in inspired and expired air varies.

[3]

(d) Carbon dioxide is one of the components of inspired and expired air.

State the name of the chemical used to test for the presence of carbon dioxide.

..... [1]

[Total: 10]

5 **(a)** Table 2.1 shows the breathing rate of different organisms.

Table 2.1

name of organism	breathing rate /average number of breaths per minute
buffalo	17
camel	8
cat	20
chicken	18
elephant	12
goat	21
horse	10
human	16
sheep	20

(i) State the name of the organism with the lowest breathing rate.

..... [1]

(ii) State the name of **two** organisms with the same breathing rate.

..... and ..... [1]

(iii) State the name of the organism with the most **similar** breathing rate to humans.

..... [1]

(b) A person goes from resting to exercising.

Describe how their breathing changes.

.....

.....

.....

.....

..... [2]

(c) There is more carbon dioxide in expired air than in inspired air.

(i) State **two other** ways the composition of expired air is different from inspired air.

1 .....

.....

2 .....

.....

[2]

(ii) State the chemical used to test for the presence of carbon dioxide gas and the positive test result.

chemical .....

positive test result .....

[2]

(d) Fig. 2.1 is a diagram of the human gas exchange system.

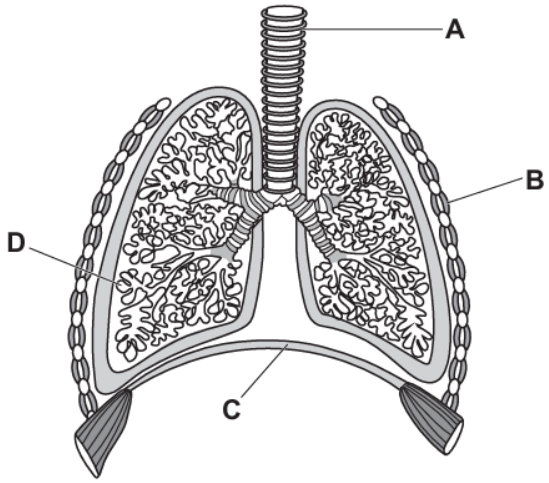

Fig. 2.1

Identify the parts labelled **A**, **B**, **C** and **D** in Fig. 2.1.

A .....

B .....

C .....

D .....

[4]

[Total: 13]

6 Fig. 1.1 is a diagram of the human gas exchange system.

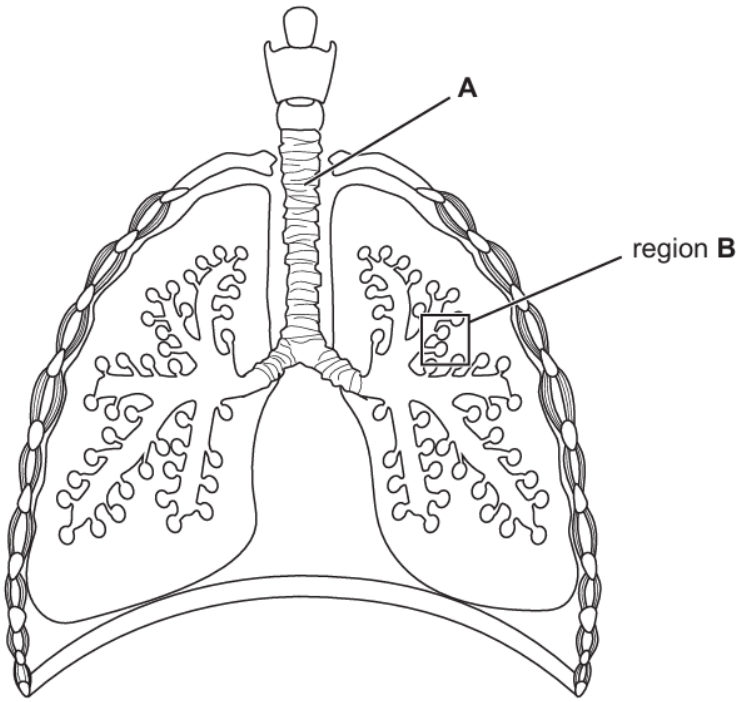

Fig. 1.1

(a) (i) Identify using a label line and a label **on Fig. 1.1**:

- a lung
- the diaphragm. [2]

(ii) State the name of structure **A** in Fig. 1.1.

..... [1]

(iii) Oxygen molecules pass through structure **A** on their way to the red blood cells.

State the names of **three** other structures in the gas exchange system that oxygen molecules must pass through on their way to the red blood cells.

1 .....

2 .....

3 .....
[3]

(iv) State the name of the process that moves oxygen into the red blood cells.

..... [1]

(b) Fig. 1.2 is a magnified image of the exchange surface shown in region **B** in Fig. 1.1.

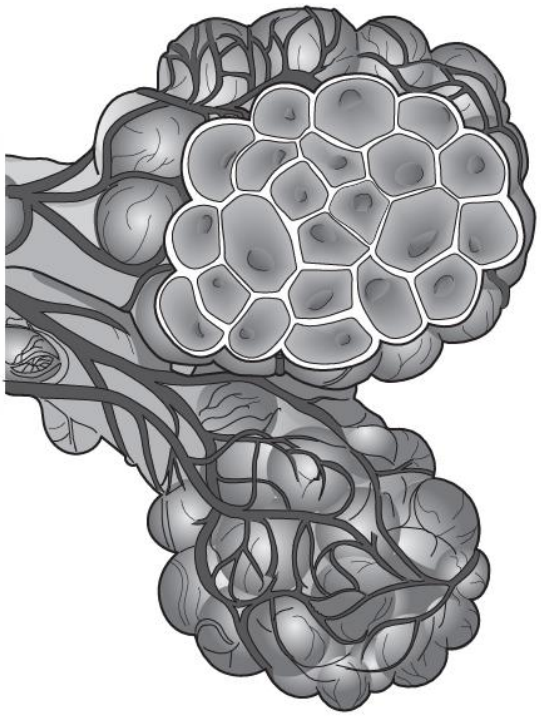

Fig. 1.2

(i) State the name of the main blood vessel that delivers blood to the lungs.

..... [1]

(ii) The gas exchange surface shown in Fig. 1.2 is permeable to make gas exchange efficient.

List **two** other features of gas exchange surfaces.

1 .....

2 .....

[2]

(c) Oxygen concentration is higher in inspired air than in expired air.

State **one** other way the composition of inspired air differs from the composition of expired air.

..... [1]

[Total: 11]

7 Fig. 6.1 shows part of the human gas exchange system.

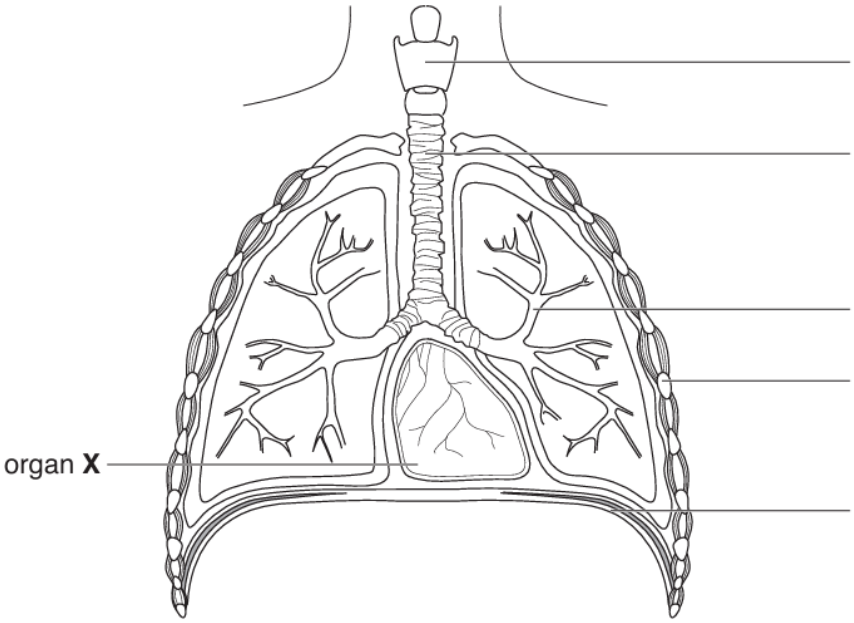

Fig. 6.1

(a) **(i)** Label the structures on Fig. 6.1 using words from the list:

- **bronchiole**
- **diaphragm**
- **larynx**
- **rib**
- **trachea.**

[5]

(ii) Organ **X** on Fig. 6.1 is not part of the gas exchange system.

State the name of the organ system to which organ **X** belongs.

..... [1]

(b) State **three** features of an efficient gas exchange surface.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

8 **(c)** Describe the changes to a person's breathing during exercise.

.....

.....

.....[2]

9 Fig. 6.1 shows a diagram of the gas exchange system.

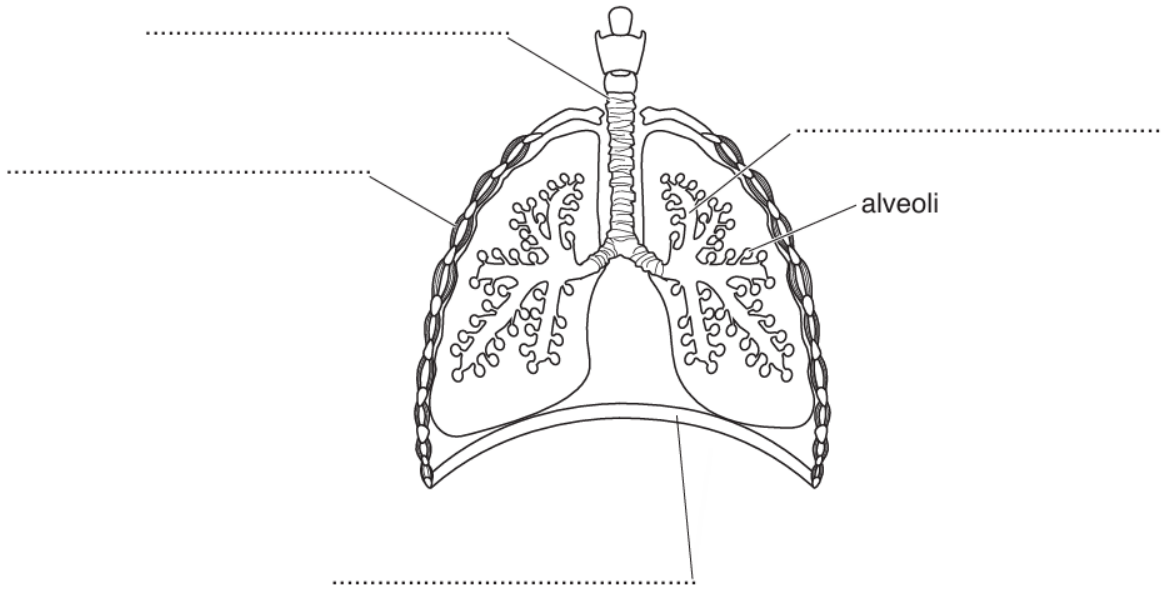

Fig. 6.1

(a) Complete the labelling of Fig. 6.1 using the words from the list.

bronchiole **diaphragm** **intercostal muscle** **trachea**

[4]

(b) Alveoli are gas exchange surfaces.

State **two** features that make alveoli good gas exchange surfaces.

1 .....

2 .....

[2]

(c) There is less oxygen in expired air than in inspired air.

(i) Describe **two other** ways in which expired air is different from inspired air.

1 .....

2 .....

[2]

(ii) State the name of a process that uses oxygen in the body.

.....[1]

(d) State an example of a cell and an organ from the gas exchange system.

cell .....

organ .....
[2]

[Total: 11]

Paper 4

Questions are applicable for both core and extended candidates unless indicated in the question

10 **(a)** Fig. 2.1 is a diagram of the gas exchange system in humans.

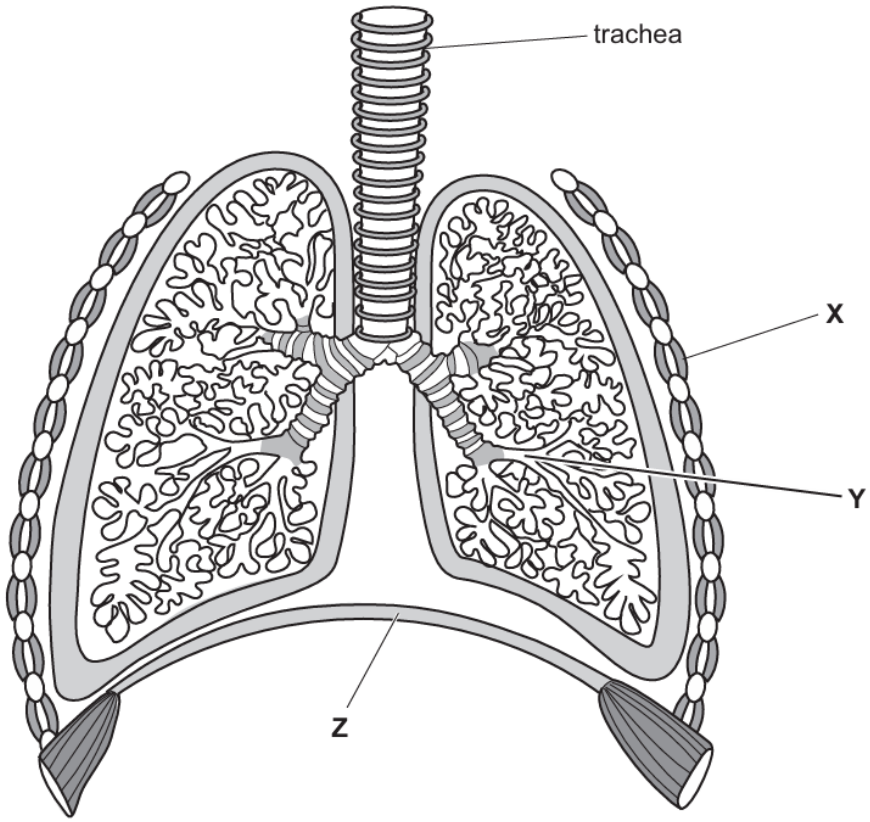

Fig. 2.1

(i) State the names of the parts labelled **X**, **Y** and **Z** in Fig. 2.1.

X .....

Y .....

Z .....

[3]

(ii) The wall of the trachea contains rings of tissue.

State the name of this tissue **and** describe its function. **(extended only)**

name .....

function .....

.....

[2]

(iii) State the names of **two** types of cells responsible for protecting the breathing system from particles. **(extended only)**

1 .....

2 .....

[2]

(b) A scientist estimated the pressure and volume in the thorax during one breath.

Fig. 2.2 shows a graph of the results. **(extended only)**

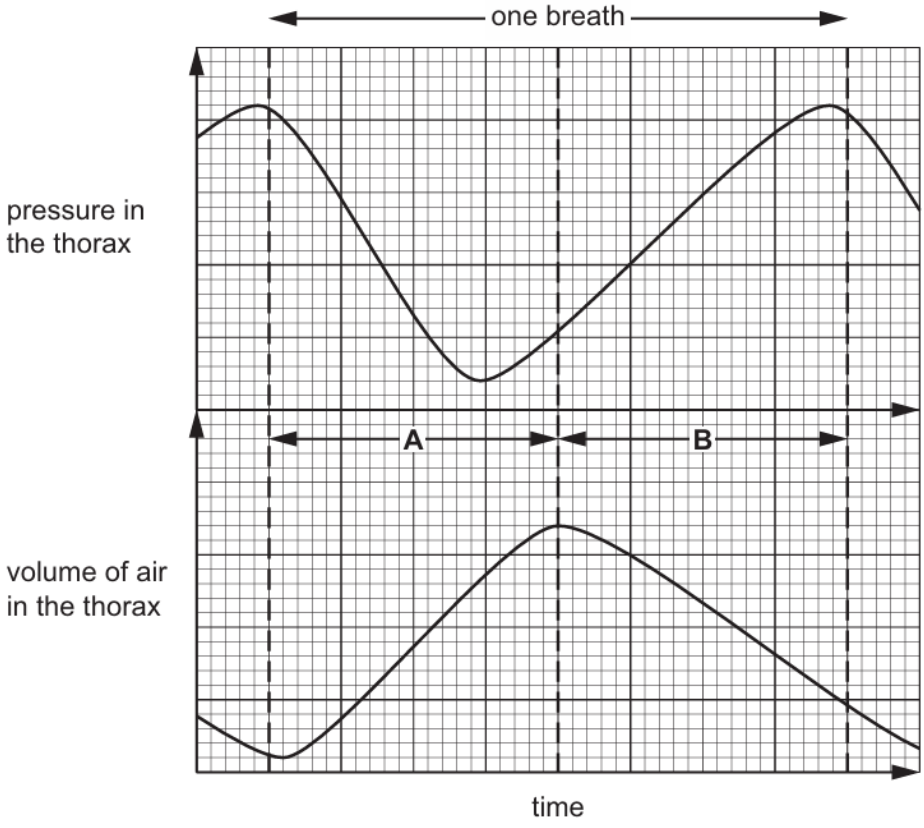

Fig. 2.2

Describe **and** explain the changes in the thorax that occur during section **A only** in Fig. 2.2.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(c) Complete the sentences to describe the effect of carbon dioxide concentration on breathing.

(extended only)

During physical activity, the carbon dioxide concentration of the blood

..... .

This is detected by the ..... .

This results in an increased rate and greater ..... of breathing.

[3]

11 **(a)** Fig. 3.1 is a photomicrograph of some cells lining the trachea.

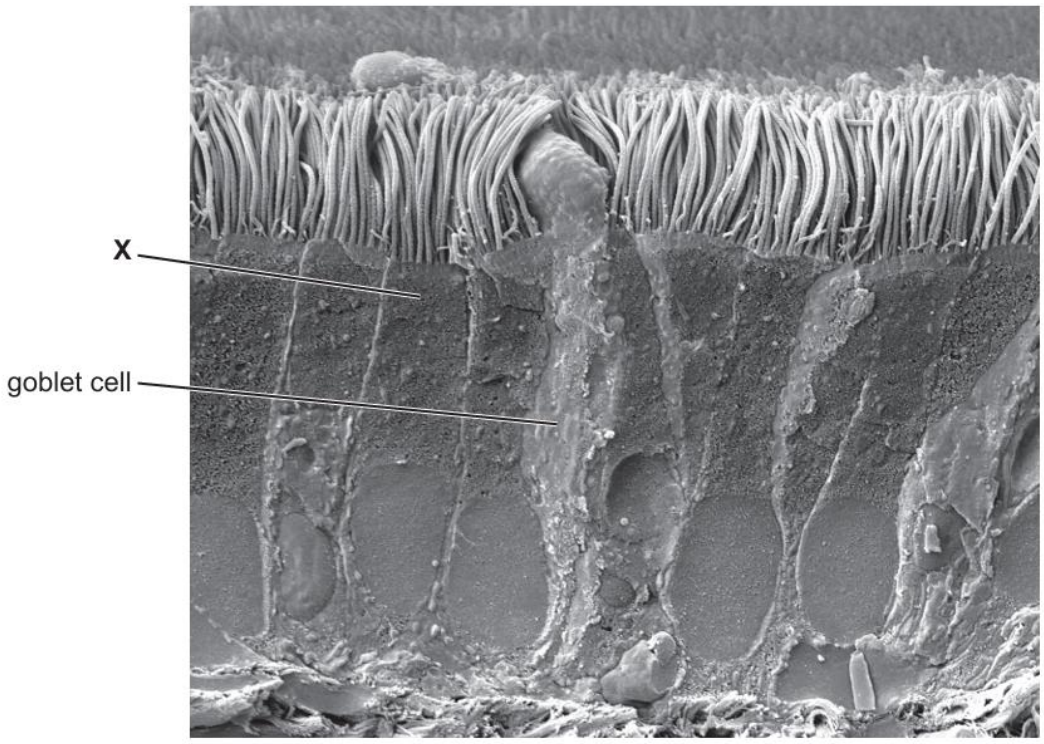

Fig. 3.1

(i) Describe the role of goblet cells. **(extended only)**

.....

.....

.....

.....

..... [2]

(ii) Explain how the cell labelled **X** in Fig. 3.1 is adapted for its function. **(extended only)**

.....

.....

.....

.....

..... [2]

(iii) State the name of **one other** part of the body where the type of cell labelled **X** in Fig. 3.1 is found. **(extended only)**

..... [1]

(b) Table 3.1 contains some features of the breathing system.

Complete Table 3.1 to show the actions of each feature of the breathing system that occur to cause inspiration. **(extended only)**

Table 3.1

feature of the breathing system	action that causes inspiration
diaphragm	.....
external intercostal muscles	.....
pressure in the thorax	.....
ribs	.....
volume of the thorax	.....

[5]

(c) State the name of the gas that is excreted by the breathing system.

..... [1]

(d) Good ventilation is one feature of gas exchange surfaces.

State **two other** features.

1 .....

2 .....

[2]

(e) State the name of the gas exchange surface in humans.

..... [1]

12 **(a)** Fig. 6.1 shows part of the human gas exchange system.

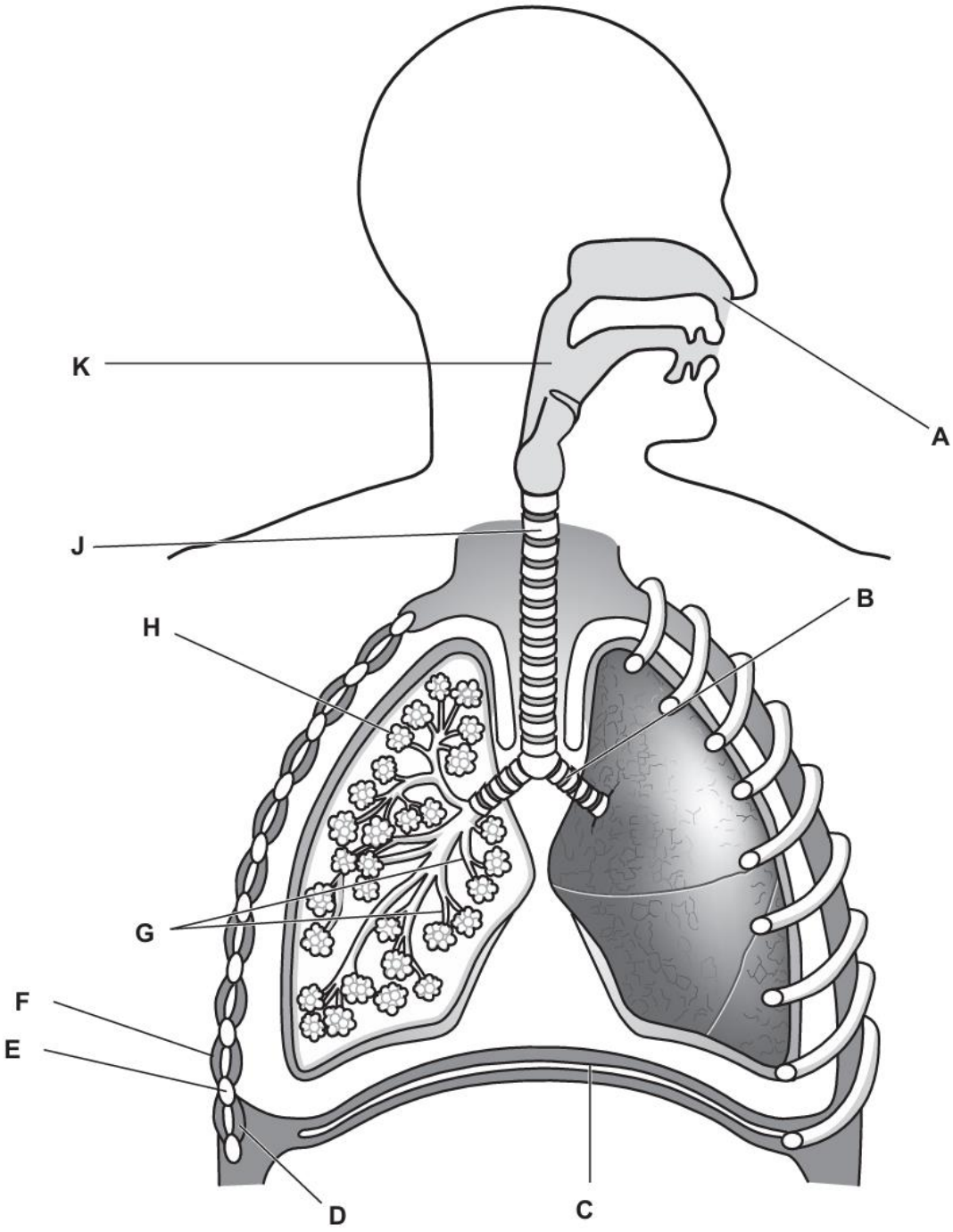

Fig. 6.1

(i) Table 6.1 shows the names of some parts of the human gas exchange system, their functions and the letters in Fig. 6.1 that identify the parts.

Complete Table 6.1. **(extended only)**

Table 6.1

function	name of the structure	letter in Fig. 6.1
	hairs in the nose	**A**
prevents collapse of the airway		
contracts to decrease the pressure in the thorax		**F**
	diaphragm	
protects the lungs from mechanical damage		
contains cilia to move mucus out of the airway		
site of gas exchange	alveoli	

[7]

(ii) Describe and explain how the alveoli are adapted for gas exchange.

.....

.....

.....

.....

.....

.....

..... [3]

13 Fig. 5.1 is a diagram of the human gas exchange system.

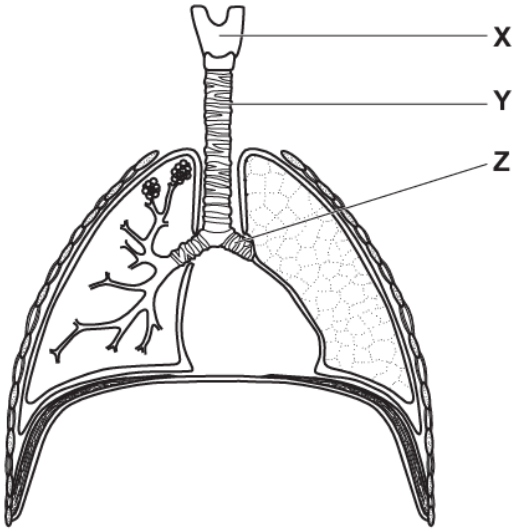

Fig. 5.1

(a) (i) Identify the parts of the gas exchange system labelled **X**, **Y** and **Z** in Fig. 5.1.

X .....

Y .....

Z .....

[3]

(ii) State the name of the tissue that prevents the collapse of **Y** and **Z** during breathing. **(extended only)**

..... [1]

(b) Breathing involves the movement of the ribs and the diaphragm.

Describe the process of **inspiration**. **(extended only)**

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) State the name of the gas exchange surface in the lungs.

..... [1]

14 The gas exchange system is one of the organ systems of the human body.

Fig. 1.1 shows parts of the gas exchange system during breathing in and breathing out.

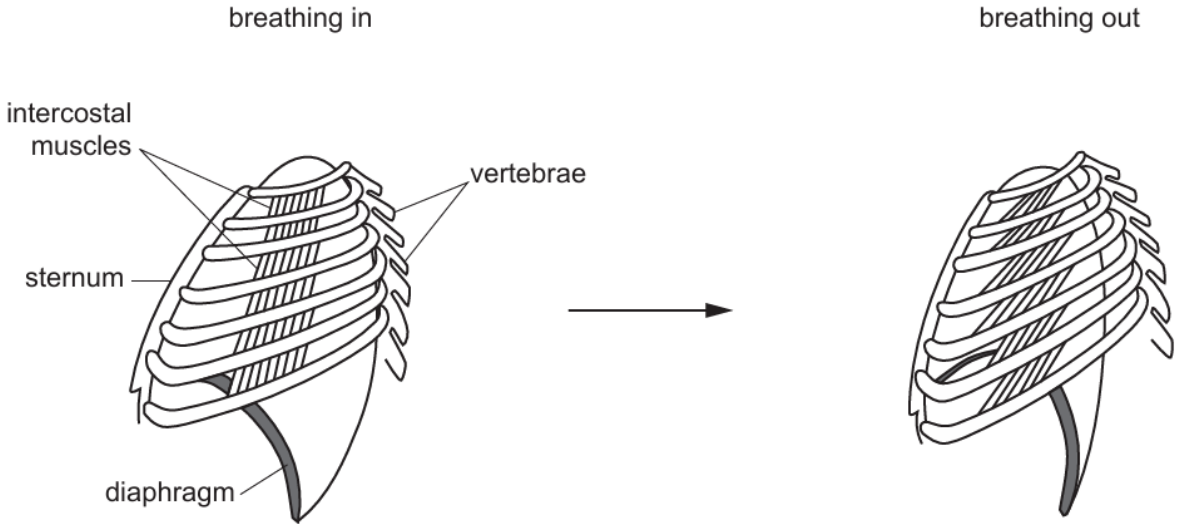

Fig. 1.1

(a) Complete Table 1.1 to show: **(extended only)**

- the functions of the diaphragm and the intercostal muscles during breathing in and breathing out
- the pressure changes in the thorax.

Use these words:

contract
relax
increases
decreases.

Table 1.1

	diaphragm	intercostal muscles		pressure change in the thorax
		internal	external	
breathing in				
breathing out				

[4]

Fig. 1.2 shows part of the gas exchange surface of a human.

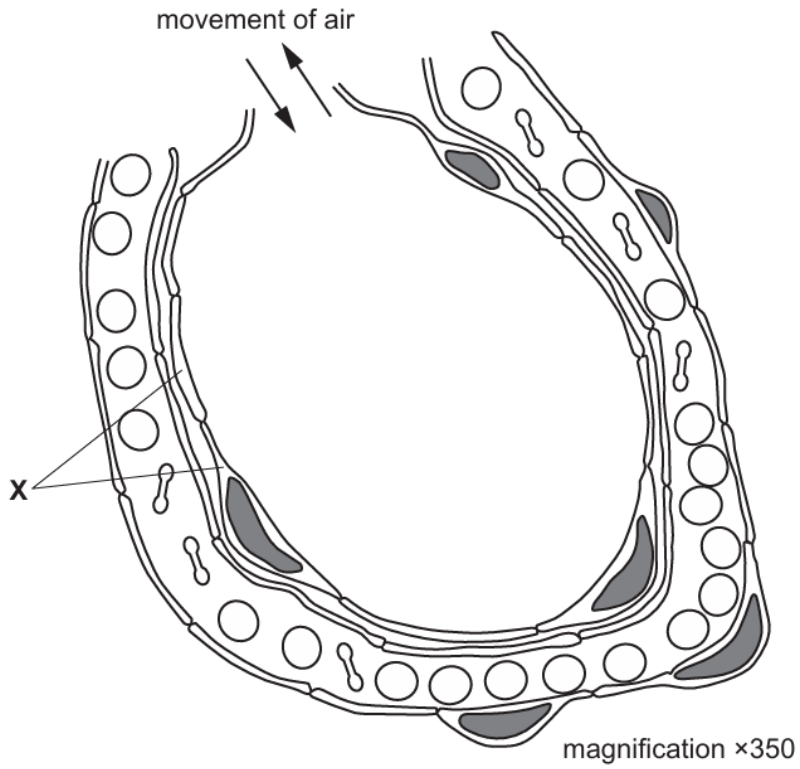

Fig. 1.2

(b) State **two** features of the gas exchange surface that are **visible** in Fig. 1.2.

1 .....

2 .....

[2]

(c) The cells labelled **X** on Fig. 1.2 form a tissue.

(i) Define the term *tissue*.

.....

.....

.....

.....

..... [2]

(ii) Cartilage is another tissue found in the gas exchange system.

State the functions of cartilage in the gas exchange system. **(extended only)**

.....

.....

.....

.....

..... [2]

15 **(a)** Explain how the human gas exchange system is protected against pathogens. **(extended only)**

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]