Q1.

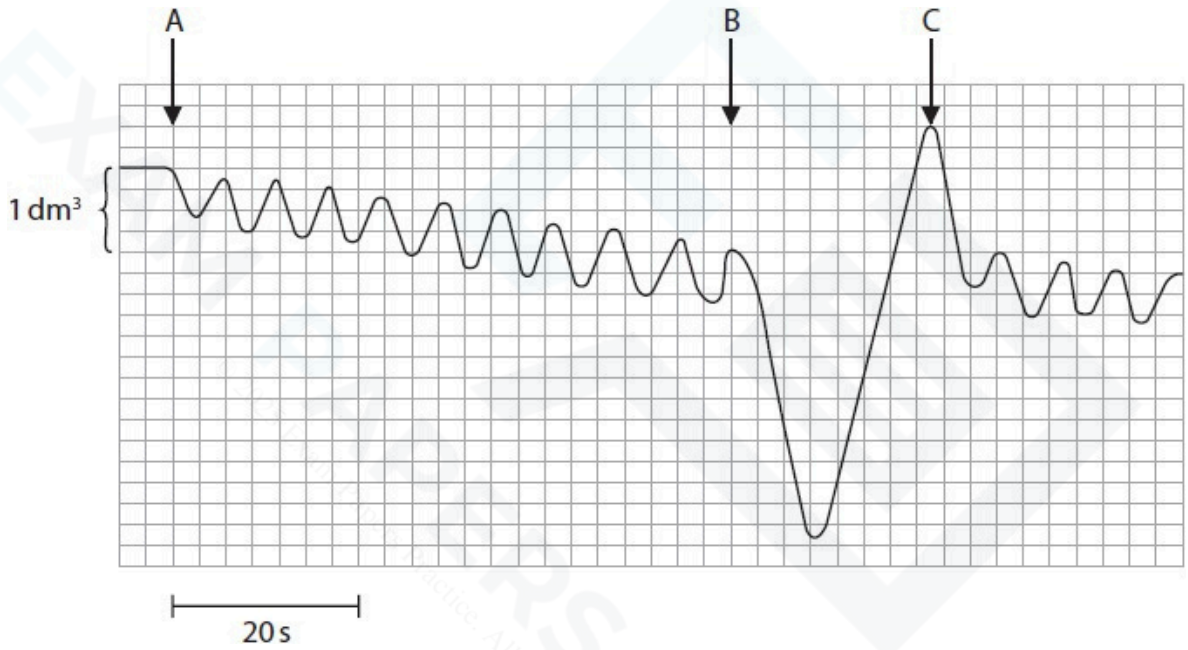
Aerobic respiration is the process that releases energy for use in the body.

(a) Give the word equation for the process of aerobic respiration.

(4)

..... + ... → ..... +
..... + energy

(b) A spirometer is used to measure the volumes of air breathed in and the volumes of air breathed out.
The spirometer trace shows the readings taken of a person at rest.



(i) Calculate the rate of breathing between points A and B shown on the trace.

(2)

rate = ... breaths per minute

(ii) Calculate the difference in the volume of air breathed in and the volume of air breathed out between points
B and C.

(3)

difference in volume = ... dm3

(c) Describe the differences that would be seen in the trace between points A and B if the person had been exercising
vigorously before the readings were taken.

(2)

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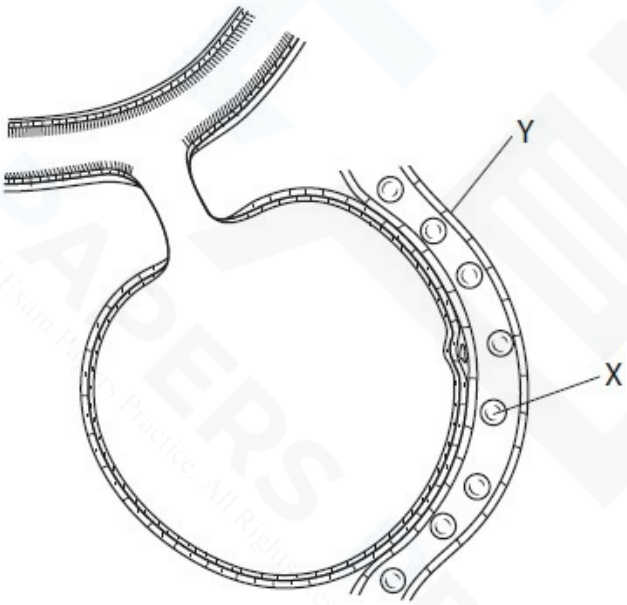
(Total for question = 11 marks)

Q2.

The diagram shows an alveolus and its blood supply.



(a) (i) What is the name of blood component X?

(1)

☒ **A** plasma

☒ **B** platelet

☒ **C** red blood cell

☒ **D** white blood cell

(ii) State three ways in which air in the alveolus differs from air in the atmosphere.

(3)

1 .....

.....

2 .....

.....

3 .....

.....

(iii) Give three features of alveoli that allow efficient gas exchange.

(3)

1 .....

.....

2 .....

.....

3 .....

.....

(b) Structure Y is a capillary. Give two features in the diagram which show that structure Y is a capillary.

(2)

1 .....
..... 2
.....
..... (c)

Some people have a condition known as emphysema. One symptom of emphysema is the breakdown of elastic fibres in the lung tissue.

Suggest the effects that loss of elastic fibres have on a person's ability to breathe.

(2)

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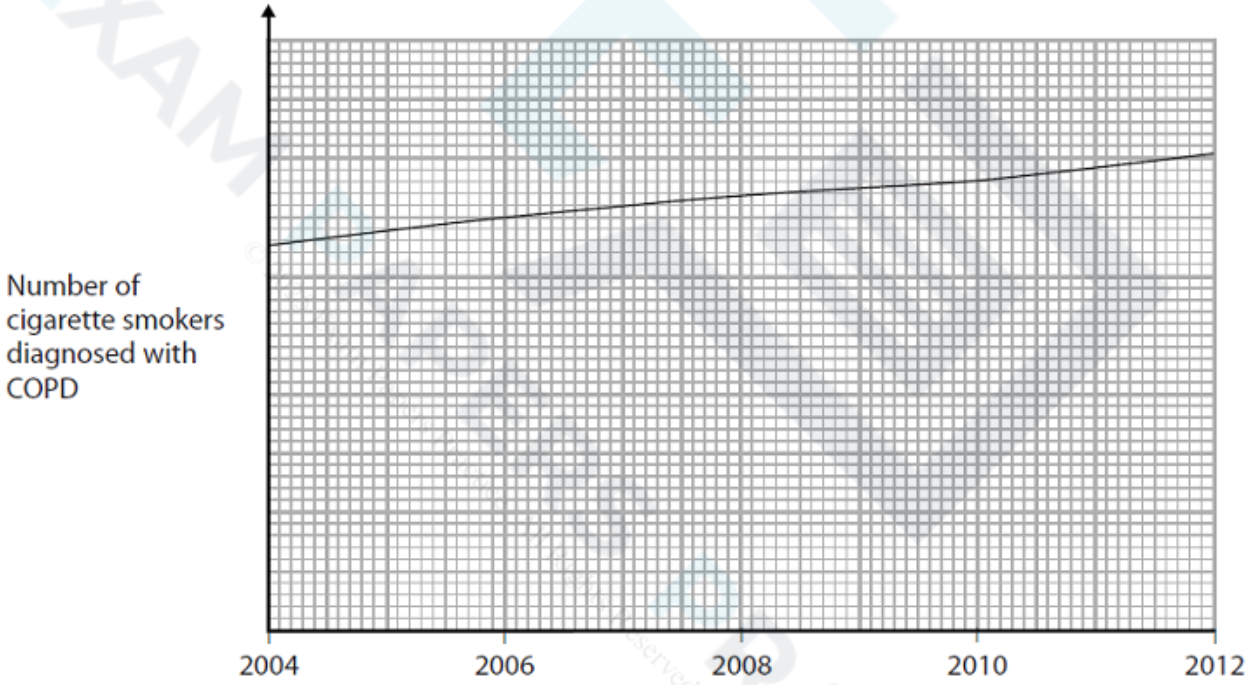
(Total for question = 11 marks)

Q3.
(a) Chronic obstructive pulmonary disease (COPD) is the name given to a group of diseases that affect the breathing system.
These diseases include chronic bronchitis and emphysema.
Cigarette smoking is the main cause of COPD.
The graph shows the number of cigarette smokers diagnosed with COPD in the UK over a period of eight years.



(i) Describe the overall trend in cigarette smokers diagnosed with COPD.

(1)

.....

.....

(ii) Describe what further information is required to help form the conclusion that cigarette smoking is the only cause of COPD.

(2)

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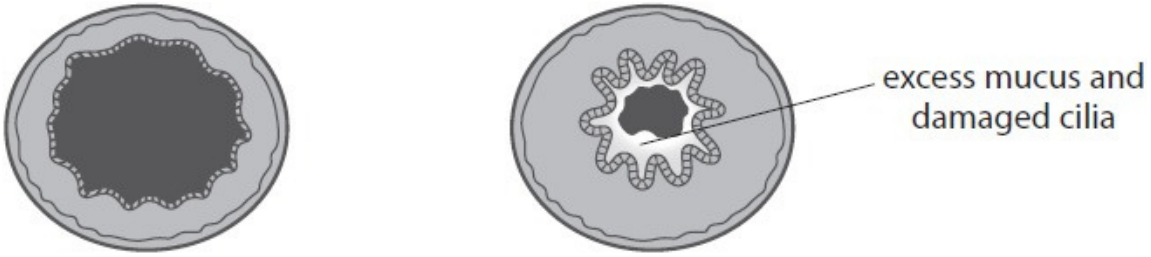
..... (b)

The diagram shows how chronic bronchitis affects the airways in the breathing system.



healthy airway chronic bronchitis

Explain how excess mucus and damaged cilia affect the breathing system of a person with chronic bronchitis.

(2)

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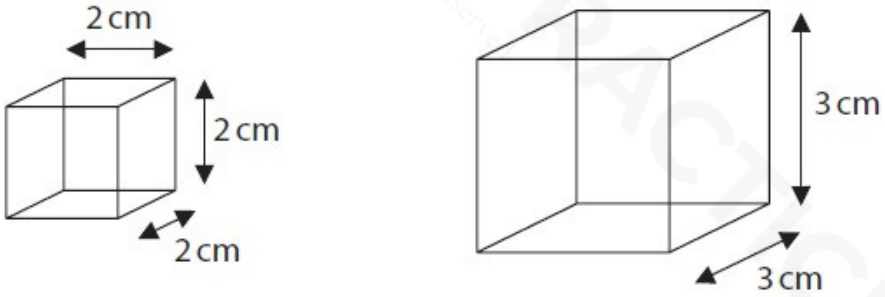
(c) The diagram shows models of two alveoli. One model represents an alveolus from a person with healthy lungs. The other model represents an alveolus from a person with emphysema.



Healthy **Emphysema**

The table shows the surface area to volume ratio for a healthy alveolus.

	Surface area in cm^2	Volume in cm^3	Surface area to volume ratio
Healthy	24	8	3:1
Emphysema			

(i) Complete the table by giving the missing information.

(3)

(ii) Explain how the surface area to volume ratio of alveoli in the lungs of a person with emphysema will affect the normal function of body cells.

(3)

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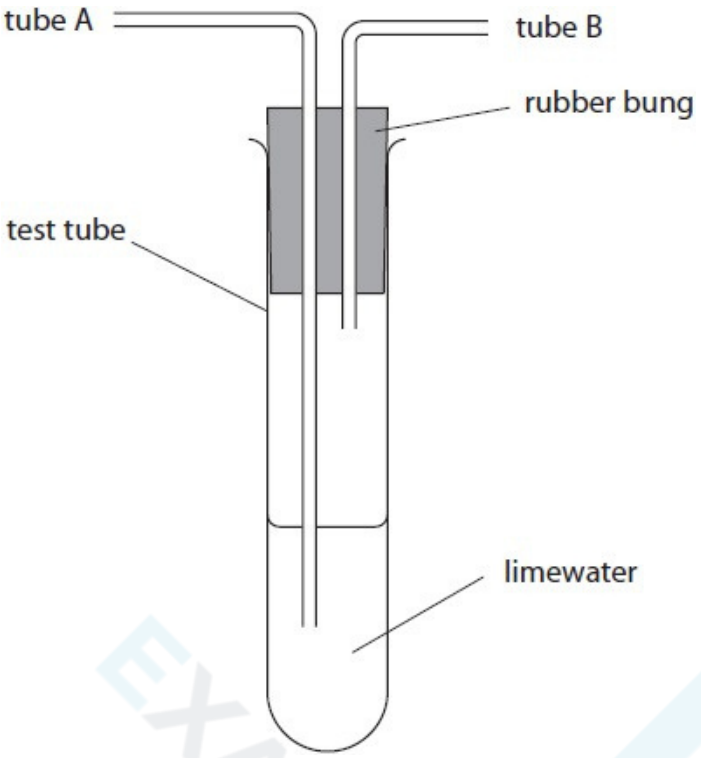
(Total for question = 11 marks)

Q4.
The amount of carbon dioxide in inhaled air is different from the amount of carbon dioxide in exhaled air.
The diagram shows a piece of apparatus that can be used to investigate this difference.



(a) (i) Describe how this apparatus should be used to compare the amount of carbon dioxide in inhaled and exhaled air.

(4)

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(ii) Explain the difference expected between the results.

(3)

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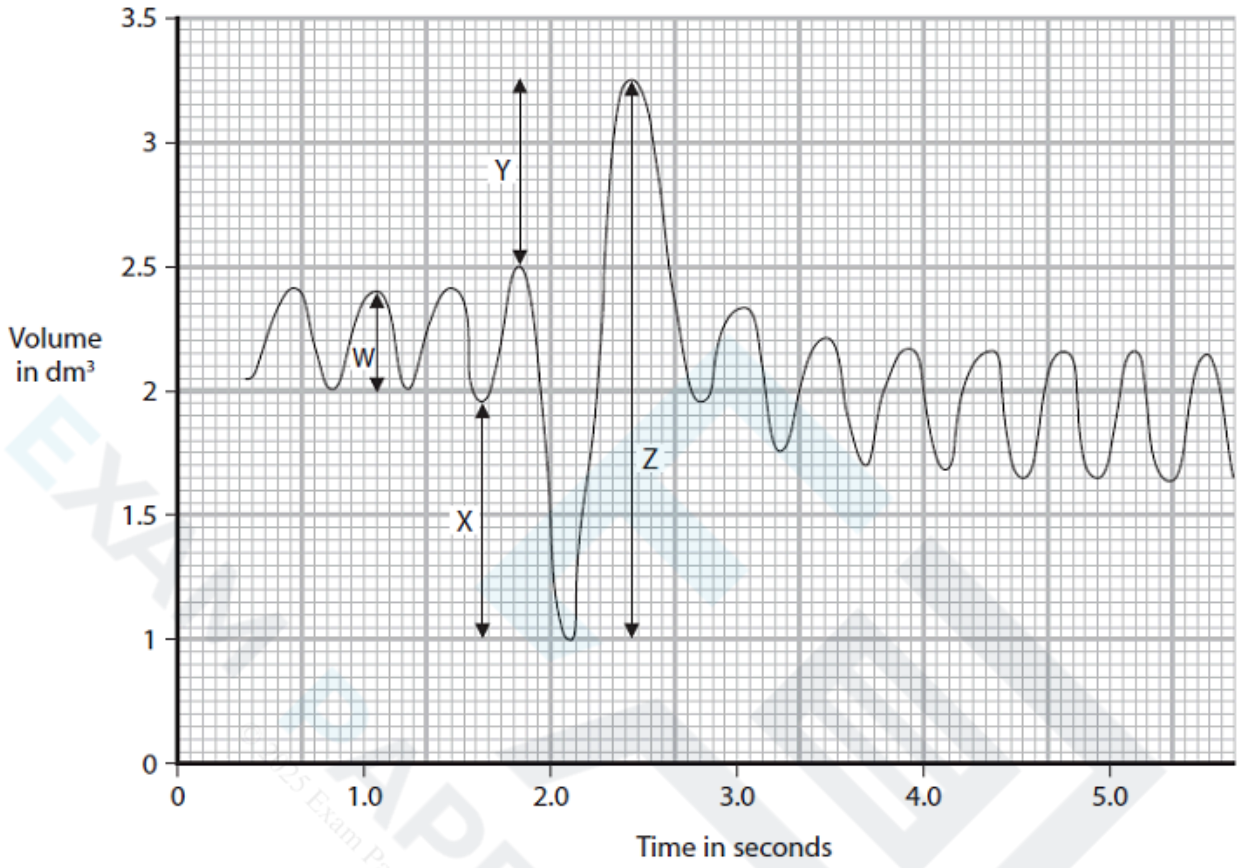
(b) The movement of air in and out of the lungs can be measured using a spirometer.

The diagram shows a trace produced by a spirometer.



(i) Complete the table using the correct letters from the trace to show the tidal volume, the vital capacity and the volume of air in each case.

(4)

Lung volume	Letter	Volume in dm³
tidal volume		
vital capacity		

(ii) Explain the pattern of breathing occurring to give lung volume Z.

(2)

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(Total for question = 13 marks)

Q5.

The diagram shows a cell from the human breathing system.

(a) (i) Add these labels to the diagram.

- cilia
- cell membrane
- nucleus

(3)

(ii) Each of the cell structures has a particular function.

The boxes give a list of structures and functions.

Draw **one** straight line from each structure to its function.

(3)

Structure	Function
cilia	holds the genetic code
cell membrane	site where most chemical reactions occur
nucleus	controls the entry and exit of substances
	makes proteins
	moves mucus through the trachea

(b) (i) Cigarette smoking affects the function of the cell shown in the diagram.

Name a substance in cigarette smoke that causes damage to this cell.

(1)

.....

(ii) Describe how cigarette smoking affects the cell shown in the diagram.

(2)

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.....

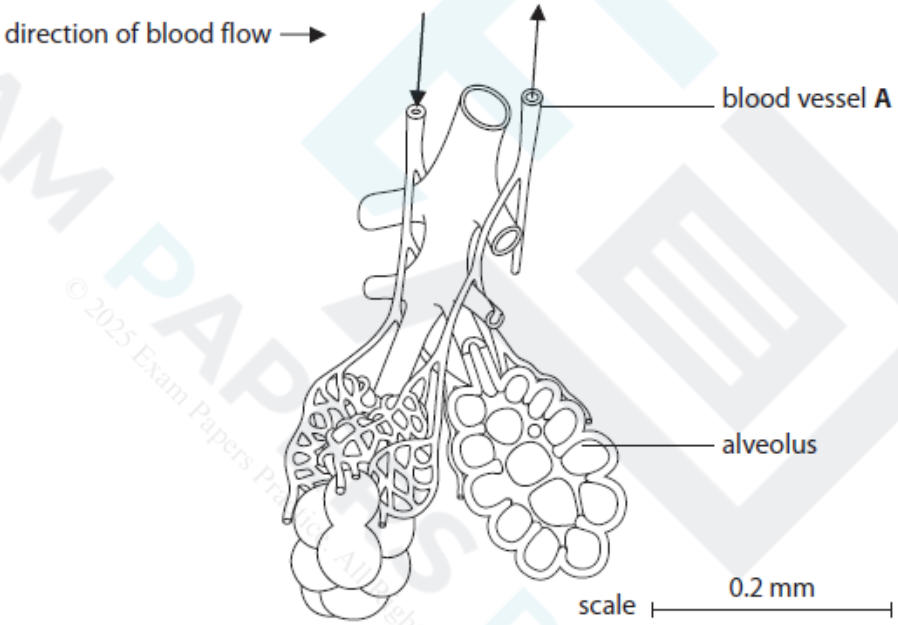
(Total for question = 9 marks)

Q6.
(a) Movement of air in and out of the lungs during breathing is achieved by various volume and pressure changes occurring in the lungs and thorax.
Complete the following passage using the most appropriate words.

(5)

During the process of breathing in, ... in the thorax is reduced.
This is brought about by an increase in the ..... of the thorax.
These changes are due to the ..... becoming flat and the ribs moving
out and up. This means that the external air pressure is greater. This causes air to travel ..... a pressure gradient. This results in the lungs ..... .

(b) The diagram shows a section through part of a lung.



(i) Blood vessel **A** labelled on the diagram is the pulmonary vein.
State why blood vessel **A** is the pulmonary vein.
Use information from the diagram to help you with your answer.

(1)

.....

(ii) Determine the actual thickness of the wall of the alveolus using a ruler and the scale shown on the diagram.
Show the stages in your calculation.

(4)

(iii) Explain the significance of the thickness of the wall of the alveolus to the efficiency of gas exchange.

(3)

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(Total for question = 13 marks)

Q7.

A group of four students investigate their pulse rates at rest and after two minutes of exercise.

The table shows their results.

Student	Pulse rate at rest / bpm	Pulse rate after two minutes of exercise / bpm
1	78	142
2	86	168
3	81	157
4	78	168

(a) Draw a bar chart to show the pulse rates of each student at rest and after two minutes of exercise.

(4)

(b) Calculate the mean increase in pulse rate after two minutes of exercise.

(2)

mean increase in pulse rate = ... bpm

(c) Suggest why the value obtained for the mean increase in pulse rate may be unreliable.

(1)

.....
.....

(d) Give **three** possible reasons why the increase in pulse rate after two minutes of exercise is different for each student.

(3)

1 .....

3 .....

3 .....

(e) Describe a method that the students could use to measure their pulse rates. **(2)**

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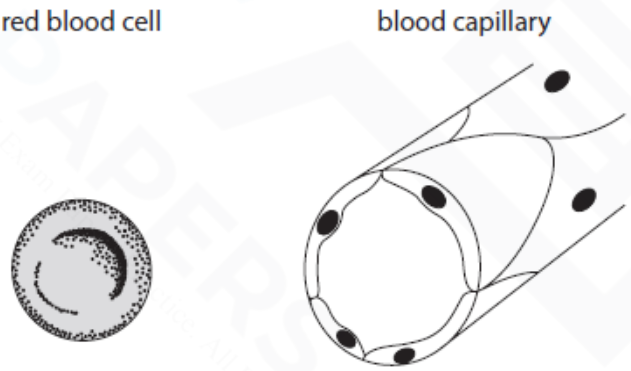
(Total for question = 12 marks)

Q8.

(a) The diagrams show a red blood cell and a blood capillary drawn to the same scale.



(i) State why only one red blood cell at a time can travel through blood capillaries.

(1)

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(ii) Explain the advantage of only one blood cell at a time travelling through a capillary.

(3)

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(b) Cigarette smoke affects the function of red blood cells.

Explain why the birth weights of babies born to mothers who smoke cigarettes tend to be lower than the mean birth weight.

(3)

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(Total for question = 7 marks)