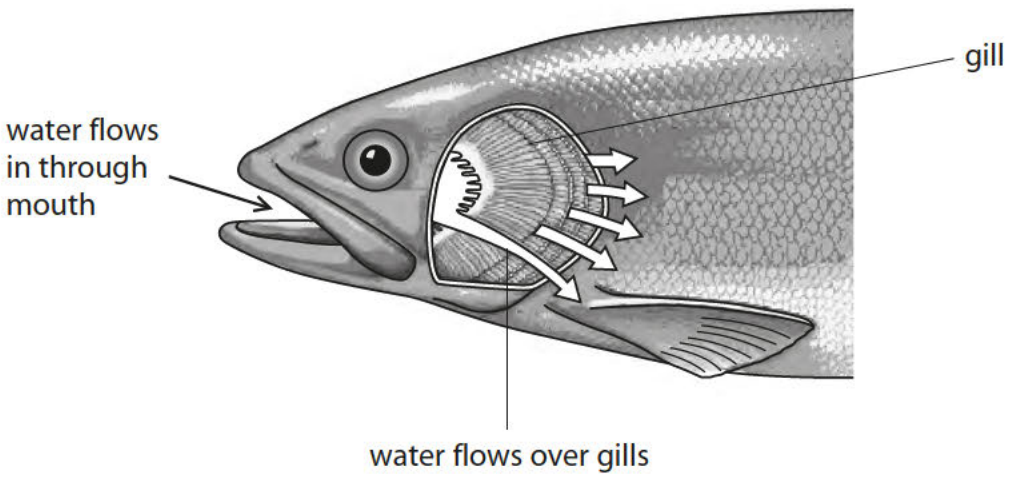
1 Fish breathe by opening their mouths to allow water containing oxygen to pass over their gills. This is shown in the diagram.



(a) (i) Gas exchange takes place in the gills.

What is meant by the term gas exchange?

(1)

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(ii) Fish use their gills as a gas exchange surface.

Suggest three ways in which fish gills are adapted for efficient gas exchange.

(3)

1 .....

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2 .....

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3 .....

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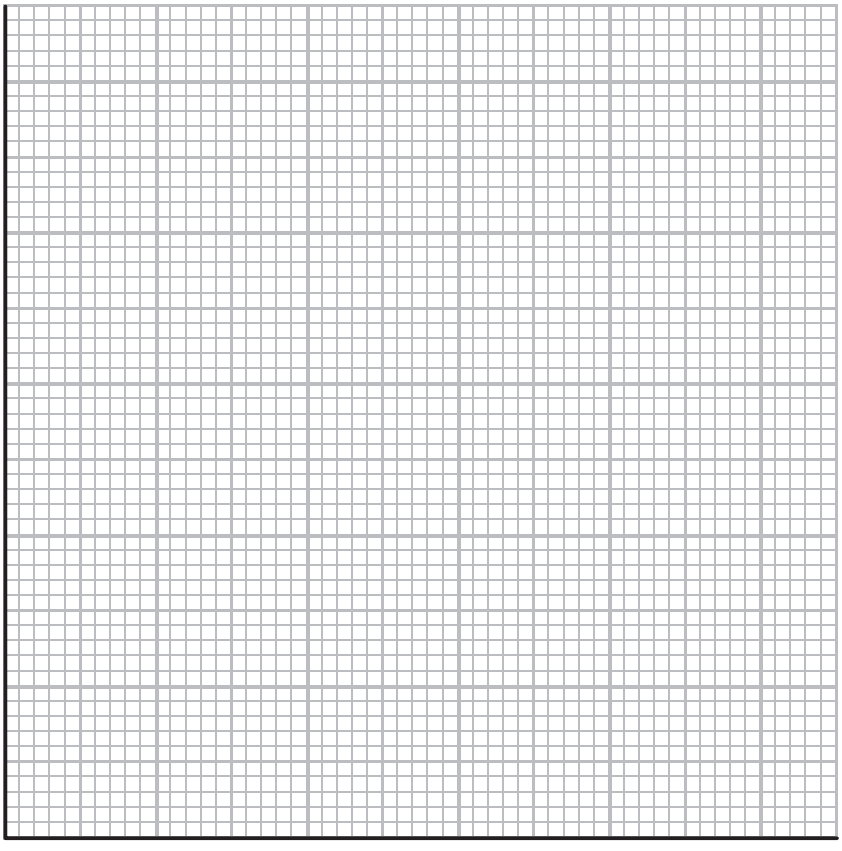
(b) Students investigated the effect of temperature on the breathing rate of fish. They put fish of the same size in tanks of water at different temperatures. They measured the breathing rate by counting the number of times the fish opened their mouths in a minute.

The results are shown in the table.

Water temperature in °C	Breathing rate in breaths per minute				
	Trial 1	Trial 2	Trial 3	Trial 4	Average
2	2	3	3	4	3
8	30	33	27	30	30
14	54	52	53	53	53
20	80	75	81	84	80
26	101	98	102	101	101

(i) Plot a line graph to show the effect of water temperature on the **average** breathing rate of the fish. Join the points with straight lines.

(5)



(ii) Suggest how the results support the hypothesis that warm water contains less oxygen than cold water.

(1)

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(iii) The students controlled the size of fish. Explain why this is needed to make it a valid investigation.

(1)

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(iv) Give two other factors the students should have controlled.

(2)

1 .....

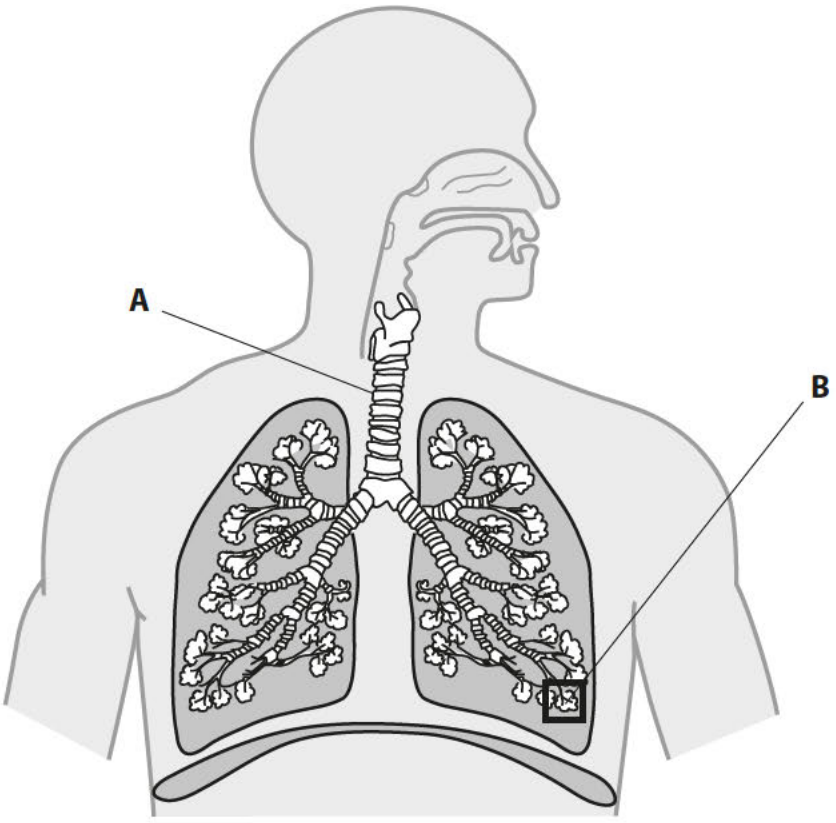
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2 .....

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(Total for Question = 13 marks)

2 The diagram shows some structures in the human breathing system.



(a) Name structures **A** and **B**.

(2)

A .....

B .....

(b) The table shows the level of two gases, **X** and **Y**, in blood entering and leaving the lungs during the process of gas exchange.

Gas	Level of gas in cm^3 per 100 cm^3 of blood	
	Blood entering lungs	**Blood leaving lungs**
X	10.6	19.0
Y	58.0	50.0

(i) Name the two gases.

(2)

gas **X** .....

gas **Y** .....

(ii) How much of gas **X** enters 100 cm^3 of blood, before the blood leaves the lungs?

(1)

..... cm^3

(iii) What term is used to describe how the process of gas exchange takes place?

Put a cross ☒ in the box to indicate your answer.

(1)

☒ **A** active transport

☒ **B** diffusion

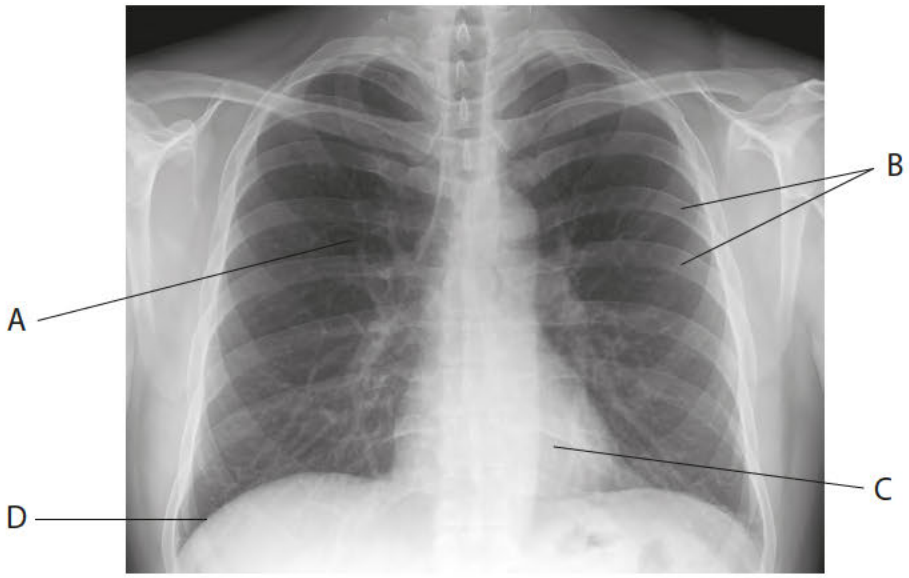
☒ **C** transpiration

☒ **D** osmosis

(Total for Question = 6 marks)

3 Doctors use X-rays to produce images of structures inside the body.

The image shows an X-ray of a normal human thorax.



© Stillwaterising

(a) Identify the structures labelled A, B, C and D.

(4)

A .....

B .....

C .....

D .....

(b) Describe how structures B and D help a person to breathe in.

(5)

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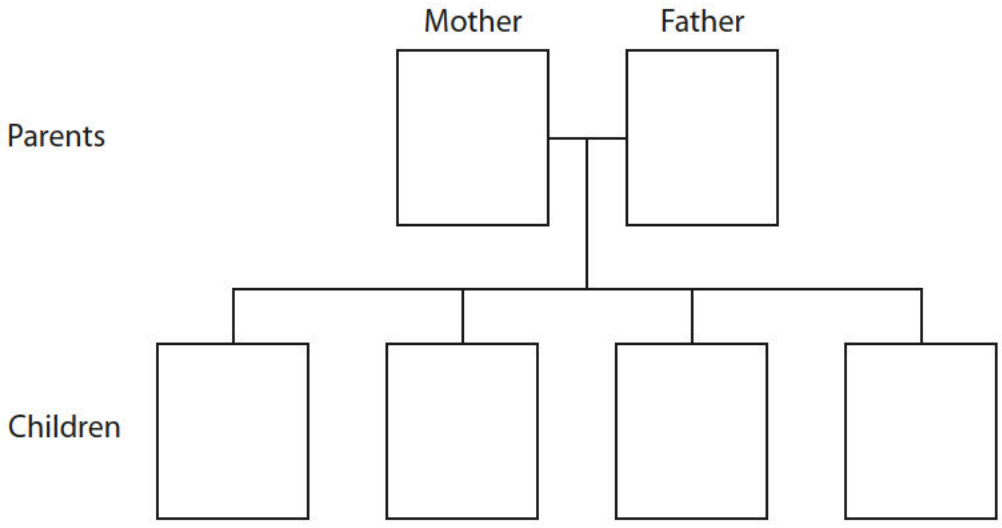
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(c) Some cells lining the bronchioles in the lung produce mucus. Cystic fibrosis is an inherited condition in which these cells produce very sticky mucus which blocks the bronchioles.

The allele for producing very sticky mucus, **f**, is recessive to the allele for producing normal mucus, **F**.

(i) In the boxes below give the genotypes of the parents, and all the possible children, for a cross between a heterozygous mother and a heterozygous father.

(2)



(ii) Suggest why people with cystic fibrosis often have lung infections.

(2)

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(iii) Suggest why gas exchange is reduced in someone with cystic fibrosis.

(2)

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(Total for Question = 15 marks)

4 The table shows the number of deaths in the United Kingdom in 2010 caused by cancer, lung diseases and circulatory diseases. The table also shows the number of these deaths caused by smoking.

Cause of death	Total number of deaths	Number of these deaths caused by smoking
cancer	66 000	38 000
lung diseases	46 000	22 000
circulatory diseases	138 000	20 000

(a) (i) What is the total number of deaths caused by all three diseases?

(1)

.....

(ii) Calculate the percentage of the total number of deaths that are caused by smoking.

Show your working.

(2)

percentage ..... %

(b) Chemicals in cigarette smoke cause mutations in cells which can lead to cancer.

What is meant by the term **mutation**?

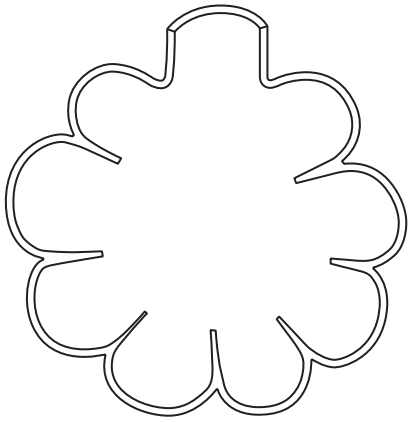
(2)

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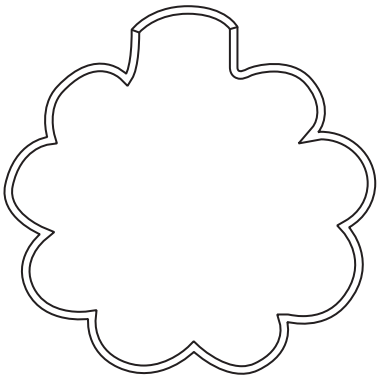
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(c) Emphysema is a lung disease that is usually caused by smoking. The diagram shows a cross section through two alveoli X and Y. Alveolus X is from a non-smoker and alveolus Y is from a smoker suffering from emphysema.



X



Y

Use the diagram to suggest and explain the effect of emphysema on gas exchange.

(2)

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(d) Smoking can increase the risk of developing coronary heart disease.

Explain how coronary heart disease can cause death.

(5)

(Total for Question = 12 marks)