Q1.

(a) Give two differences between whole blood and plasma.

(2)

1 .....
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2 .....
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(b) Ebola is an infectious disease. One symptom of Ebola is blood loss. The World Health Organisation (WHO) has a procedure for treating Ebola. This is the WHO's procedure.

- find a person who has recovered from Ebola
- observe this person to make sure that they are disease free for 28 days
- take blood from this person and test the blood for other diseases
- separate the plasma from the blood
- transfer this plasma to another person who has Ebola

Explain how the WHO procedure helps to treat a person who has Ebola.

(6)

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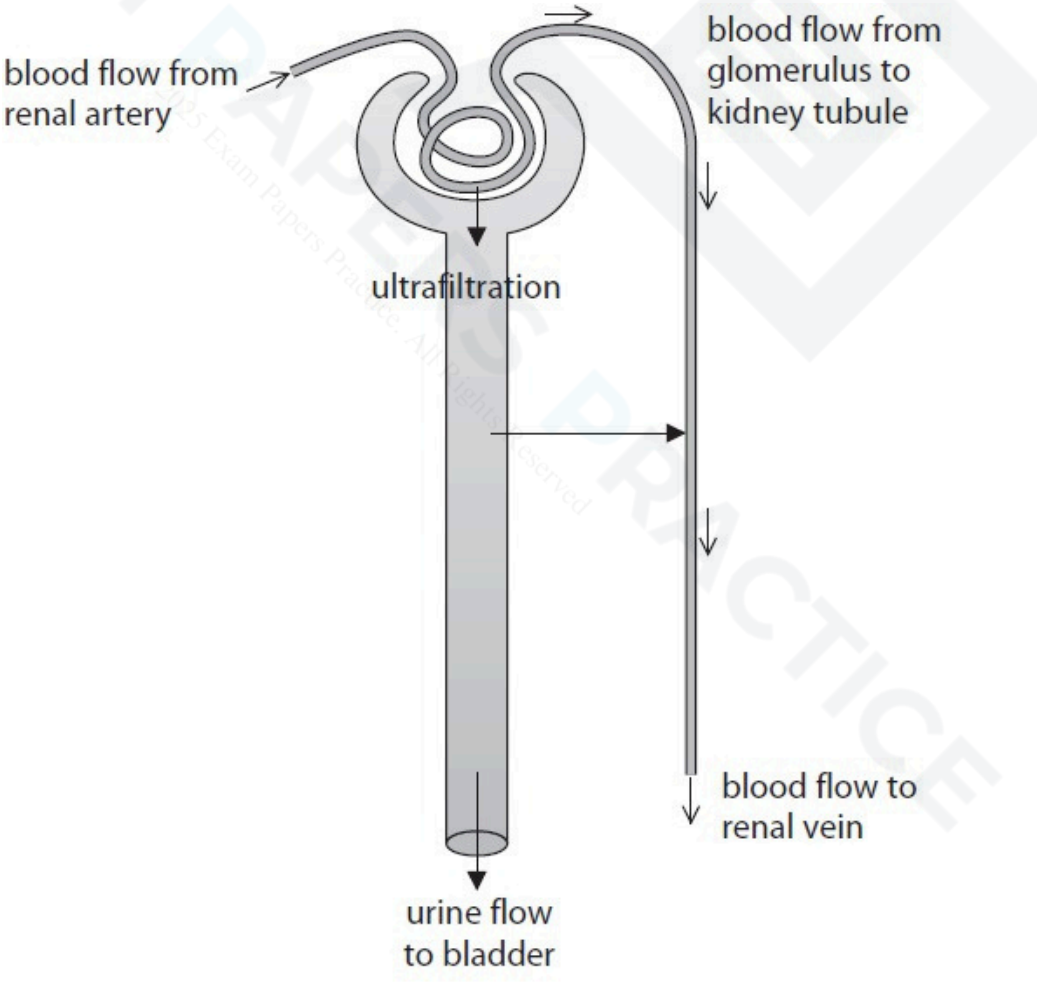
(Total for question = 8 marks)

Q2.

(a) The diagram shows part of a nephron in the human excretory system.



(Source: adapted from © Alila Medical Images/Alamy)

(i) Explain how ultrafiltration occurs in the Bowman's capsule.

(2)

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..... (ii)

Explain the differences in the composition of the blood flowing through the renal artery and through the renal vein.

(4)

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(b) The quantity of salt in the diet affects the concentration of urine produced. An investigation is set up to test this statement. This is the method used.

- ten people are each given a different food
- each food contains a different quantity of salt
- the volume of urine produced by each person is recorded each hour for six hours after eating the food

(i) State the independent variable in this investigation.

(1)

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(ii) Explain why this investigation is unlikely to produce valid results.

(2)

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(iii) State one change to the method that would make the results more valid.

(1)

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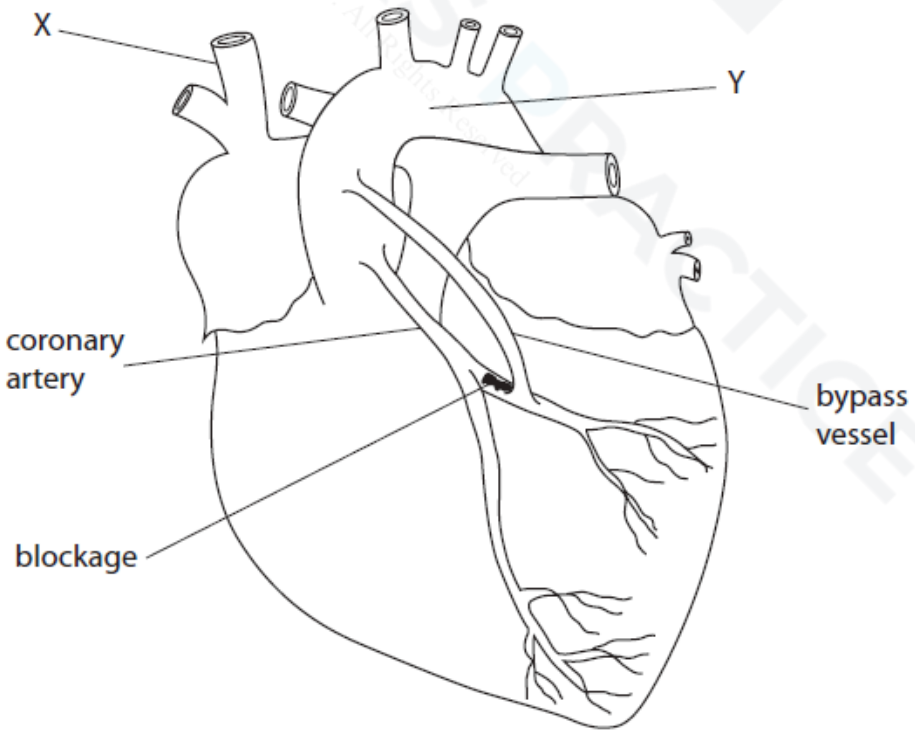
(Total for question = 10 marks)

Q3.
The diagram shows a person's heart. The person has had a heart bypass operation because a coronary artery had become partly blocked.



(a) (i) What is the name of blood vessel Y?

(1)

☒ **A** aorta

☒ **B** pulmonary artery

☒ **C** pulmonary vein

☒ **D** vena cava

(ii) To which part of the heart is blood vessel X connected?

(1)

☒ **A** left atrium

☒ **B** left ventricle

☒ **C** right atrium

☒ **D** right ventricle

(b) (i) Before the bypass operation, the coronary artery was becoming blocked at the point shown on the diagram.
Draw a circle on the diagram to show the area of the heart that was affected by the blockage before the bypass operation.

(1)

(ii) Describe what effect this blockage would have on the heart tissue if the bypass vessel was not inserted.

(3)

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(iii) Suggest how the bypass vessel allows the heart to work more effectively.

(2)

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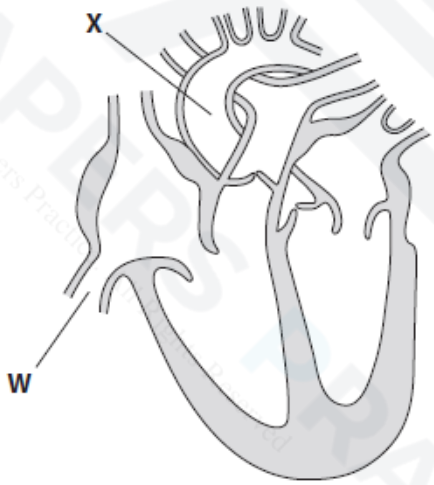
(Total for question = 8 marks)

Q4.

Figure 1 shows a human heart.

Figure 1



(a) (i) Which part of the heart pumps blood to the lungs?

(1)

☒ **A** left atrium

☒ **B** left ventricle

☒ **C** right atrium

☒ **D** right ventricle

(ii) Name blood vessels **W** and **X**.

(2)

Blood vessel **W**

.....

Blood vessel **X**

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(iii) Describe the differences in the composition of the blood carried by blood vessels **W** and **X**.

(2)

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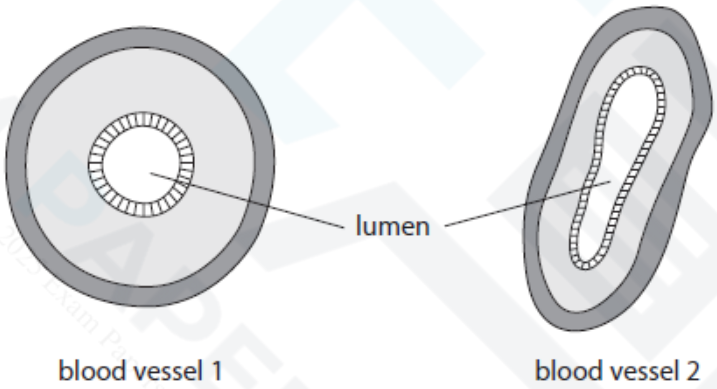
(b) The diagram shows two blood vessels that are connected to the heart.



(i) Give a reason why blood vessel 1 represents **X** in Figure 1.

(1)

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(ii) The diameter of the lumen in blood vessel 1 is 10 mm. The diagram has been drawn 50 times larger than the actual size of the blood vessel.
Calculate the actual size of the lumen of this blood vessel.
Give your answer in micrometres (µm).

(2)

actual size = ... µm

(iii) Explain how the structure of blood vessel 1 is adapted to help the blood flow through the vessel.

(2)

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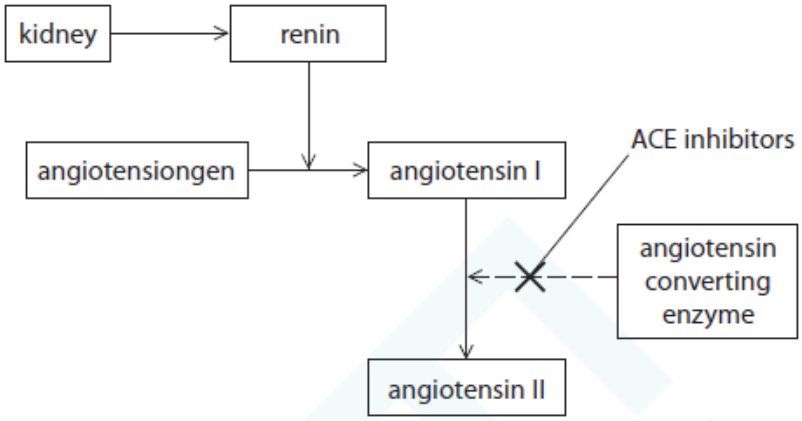
(c) The diagram shows the interaction of an ACE inhibitor in the renin-angiotensin pathway. This pathway is used by the body to control blood pressure.



(i) Explain how ACE inhibitors are used in the treatment of high blood pressure.

Use the diagram to help with your answer. **(4)**

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(ii) Suggest why it is important that people with high blood pressure take medication to reduce it.

(1)

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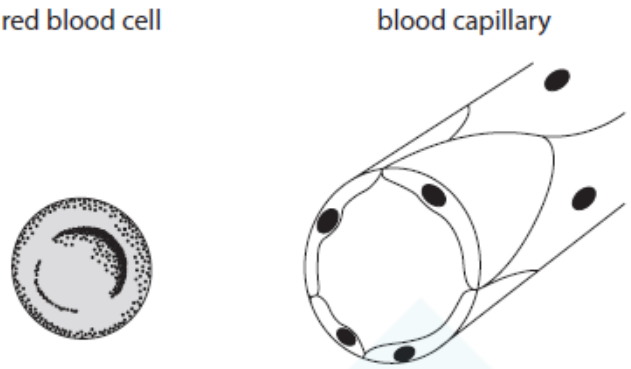
(Total for question = 15 marks)

Q5.

(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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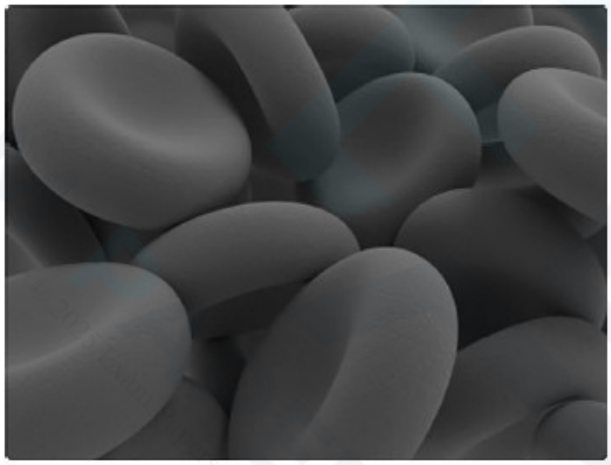
(Total for question = 7 marks)

Q6.

(a) The photograph shows a group of red blood cells.



(Source: RomanenkoAlexey/Shutterstock)

(i) Describe the function of red blood cells.

(3)

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(ii) Explain how the structure of the red blood cell is adapted to its function.

(4)

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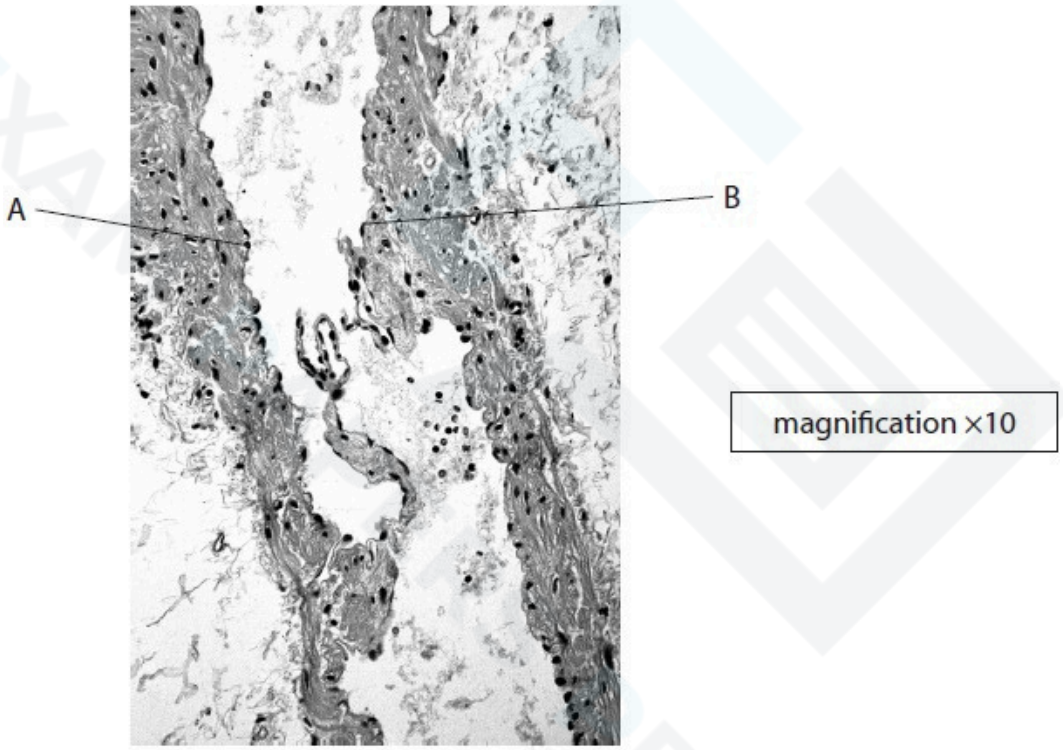
(b) The photograph shows a section through a blood vessel in a leg.



(Source: © DR. GLADDEN WILLIS, VISUALS UNLIMITED/SCIENCE PHOTO LIBRARY)

(i) State the type of blood vessel shown in the photograph.

(1)

.....

(ii) Explain your choice of blood vessel.

(2)

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(iii) Calculate the actual distance between points A and B.

(2)

distance = ... mm

(Total for question = 12 marks)

Q7.
Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Treatment of Ebola

Ebola is caused by an RNA virus. There is no proven treatment available for Ebola. However, whole blood collected from someone who has recovered from infection has been used as a treatment. The results have been promising in a small group of Ebola patients.

Guidance for national health authorities and blood transfusion services describes the stages needed to collect whole blood (CWB) or plasma (CP) from Ebola-recovered patients. This can be used for transfusion to patients as a treatment for early Ebola.

The guidance states how to

- identify people who have recovered from Ebola as potential blood donors
- screen donors' blood for A, B, O and Rhesus groupings
- screen donors' blood for transfusion-transmissible infections
- collect blood and care for donors
- obtain agreement of Ebola patients for the treatment
- identify patient's blood grouping
- store and transport CWB and CP to the places where transfusions are to be given
- select Ebola patients for transfusion
- transfuse the blood into the patient

Donated CWB should never be frozen and should be stored between 2 °C and 6 °C.

CWB and CP donations should be transfused to the Ebola patients using standard transfusion procedures.

(a) (i) Explain what is meant by an RNA virus (line 1).

(2)

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.....

(ii) The table lists five diseases. Put a tick (✓) next to the diseases that should be tested for in the donors' blood.

(2)

Disease	Blood tested (✓)
anaemia	
cystic fibrosis	
gonorrhoea	
HIV	
scurvy	

(iii) Explain why it is necessary to identify the blood group of the blood collected from donors who have recovered
from Ebola (line 9).

(3)

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(iv) Suggest why donated CWB should never be frozen (line 17).

(2)

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(v) Explain how the blood of people who have recovered from Ebola is likely to be effective in treating the disease.

(2)

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(b) The nitrogenous base composition of another virus was found to be adenine 13%, guanine 26%, uracil 20% and

cytosine 41%.

Explain how these figures prove that this is a virus with a single strand of RNA.

(3)

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(Total for question = 14 marks)

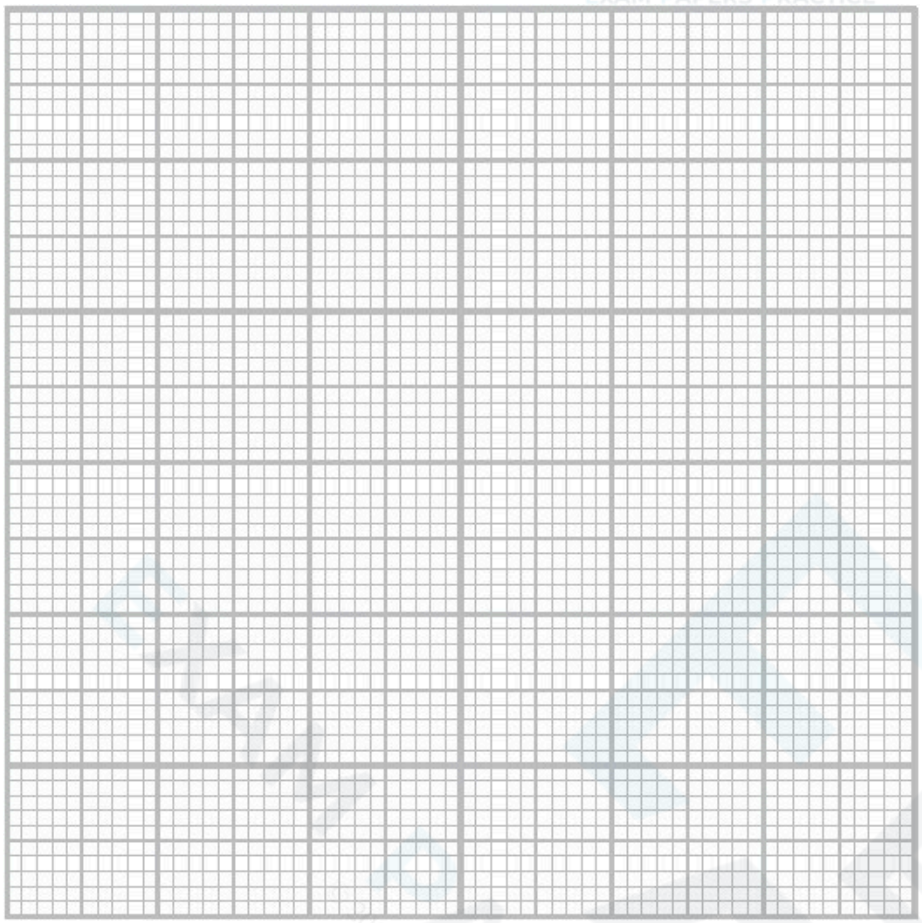
Q8.
A scientist investigates how the drug, atropine, affects the heart rate in humans.
Atropine paralyses the vagus nerve which carries impulses from the brain to the heart.
The heart rates of ten people are measured at intervals of two minutes for eight minutes, after which, atropine is injected.
The scientist continues to measure the heart rates.
The scientist's results are shown in the table.

Time in minutes	Heart rate in beats per minute
0	90
2	81
4	78
6	80
8	82
9	100
10	120
11	148
12	160
13	138
15	128
17	120
19	116
21	109
23	100

atropine injected →

(6)

(a) (i) Plot the scientist's results on the grid. Draw a curve of best fit.



(ii) Explain why ten people are injected with atropine rather than just one person.

(2)

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(b) (i) Calculate the percentage change in the heart rate at 12 minutes compared to the heart rate at the start of

the investigation.

(2)

percentage change = ... %

(ii) Explain why this percentage change is not achieved as soon as atropine is injected.

(2)

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(c) Suggest the function of the vagus nerve.

(2)

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(Total for question = 14 marks)

Q9.

(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)

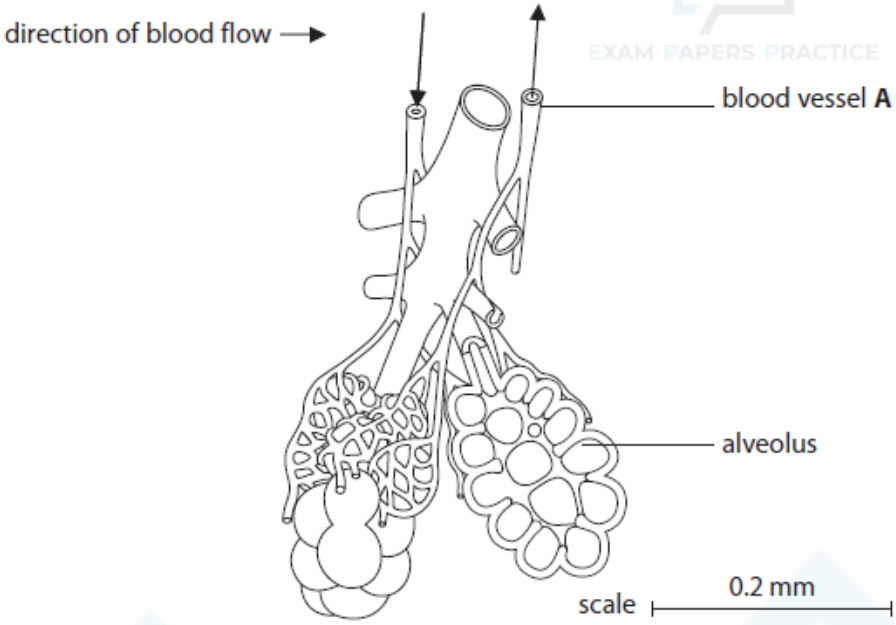
During the process of breathing in, ... in the thorax is reduced.

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)

Q10.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Inheritance of blood group involves codominant inheritance.

(a) (i) Which statement describes codominant inheritance in ABO blood groups?

(1)

☒ **A** the inheritance of two different alleles, both of which are expressed

☒ **B** the inheritance of two different alleles, only one of which is expressed

☒ **C** the inheritance of multiple alleles, only two of which are expressed

☒ **D** the inheritance of multiple alleles, only one of which is expressed

(ii) State the possible genotypes of a person with blood group A.

(1)

.....

(b) (i) A person's blood group is determined by antigens.
These antigens are carbohydrate and protein molecules on the surface of red blood cells.
In 2007, a team of scientists used enzymes to convert blood groups A, B and AB into blood group O for transfusions.
Suggest how enzymes can convert blood groups A, B and AB into blood group O.

(3)

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(ii) Suggest an advantage of producing blood group O using enzymes, compared with other methods of obtaining blood group O.

(1)

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(c) Haemophilia is a sex-linked blood disorder that reduces the ability of the blood to clot.

These are the genotypes of four offspring, P, Q, R and S.

P	Q	R	S
X^HX^h	X^hY	X^HX^H	X^HY

(i) Draw a genetic diagram to show how these offspring are produced from one set of parents.

(2)

(ii) These parents are expecting another baby.

Determine the probability that this baby will have haemophilia.

(1)

..... probability =

(Total for question = 9 marks)

Q11.

The table lists four features of blood. It also shows four main components of blood.

Put a tick (✓) in a box if the component shows the feature.

(4)

Feature	Components			
	Red blood cell	Plasma	Platelet	Phagocyte
transports oxygen				
has a nucleus				
consists of 90% water				
involved in blood clotting				

(Total for question = 4 marks)

Q12.

(a) Two types of nucleic acid are found in cells. These are DNA and RNA.

Describe **three** differences between DNA and RNA.

(3)

1 .....
..... 2
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..... 3
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.....

(b) The symbols shown can be used to represent the components of nucleotides that join together to make nucleic acid.

base phosphate sugar

Draw a section of RNA consisting of two nucleotides using the symbols given.

(3)

(c) A student investigates DNA taken from a human cheek cell. The student finds that 37% of the nucleotides contain adenine.

(i) Calculate the percentage of nucleotides in the sample that contain guanine.

Show your working.

(3)

percentage containing guanine = ... %

(ii) The student repeats the investigation twice using a muscle cell and then a red blood cell.

Explain the results that the student should expect for each investigation.

(5)

muscle cell
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.....

red blood cell
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.....
.....
.....

(d) The DNA of rice plants can be modified to produce Golden Rice. Golden Rice has been modified to have high levels of

(1)

☒ **A** insect resistance

☒ **B** iron

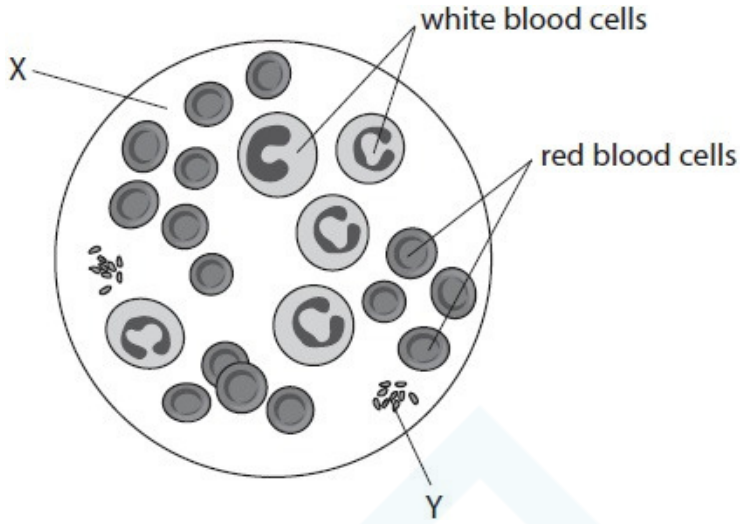
☒ **C** protein

☒ **D** vitamin A

(Total for question = 15 marks)

Q13.

The diagram shows a sample of human blood.



(a) State the function of red blood cells.

(1)

.....

.....

(b) Give the name of X and Y.

(2)

X .....

Y .....

(c) (i) Calculate the ratio of red blood cells to white blood cells.

Write the ratio in its simplest form.

(2)

ratio = ...

(ii) Suggest why this ratio will change if a person has a bacterial infection.

(2)

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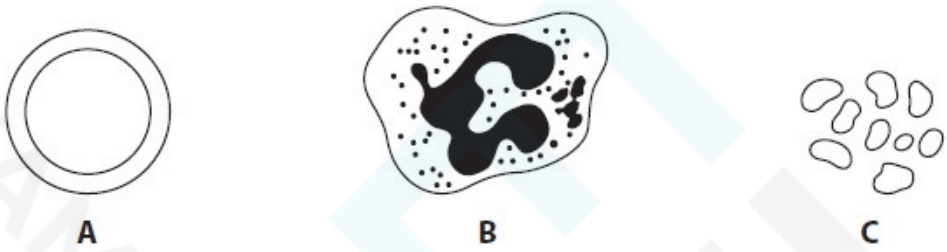
(Total for question = 7 marks)

Q14.

The diagram shows some of the components of blood.



(a) Complete the table by giving the name of the component and its function.

Component A has been completed as an example.

(4)

Component	Name	Function
A	red blood cell	transports oxygen
B		
C		

(b) (i) Describe the process of blood clotting.

(5)

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(ii) Explain why it is important that blood clots.

(3)

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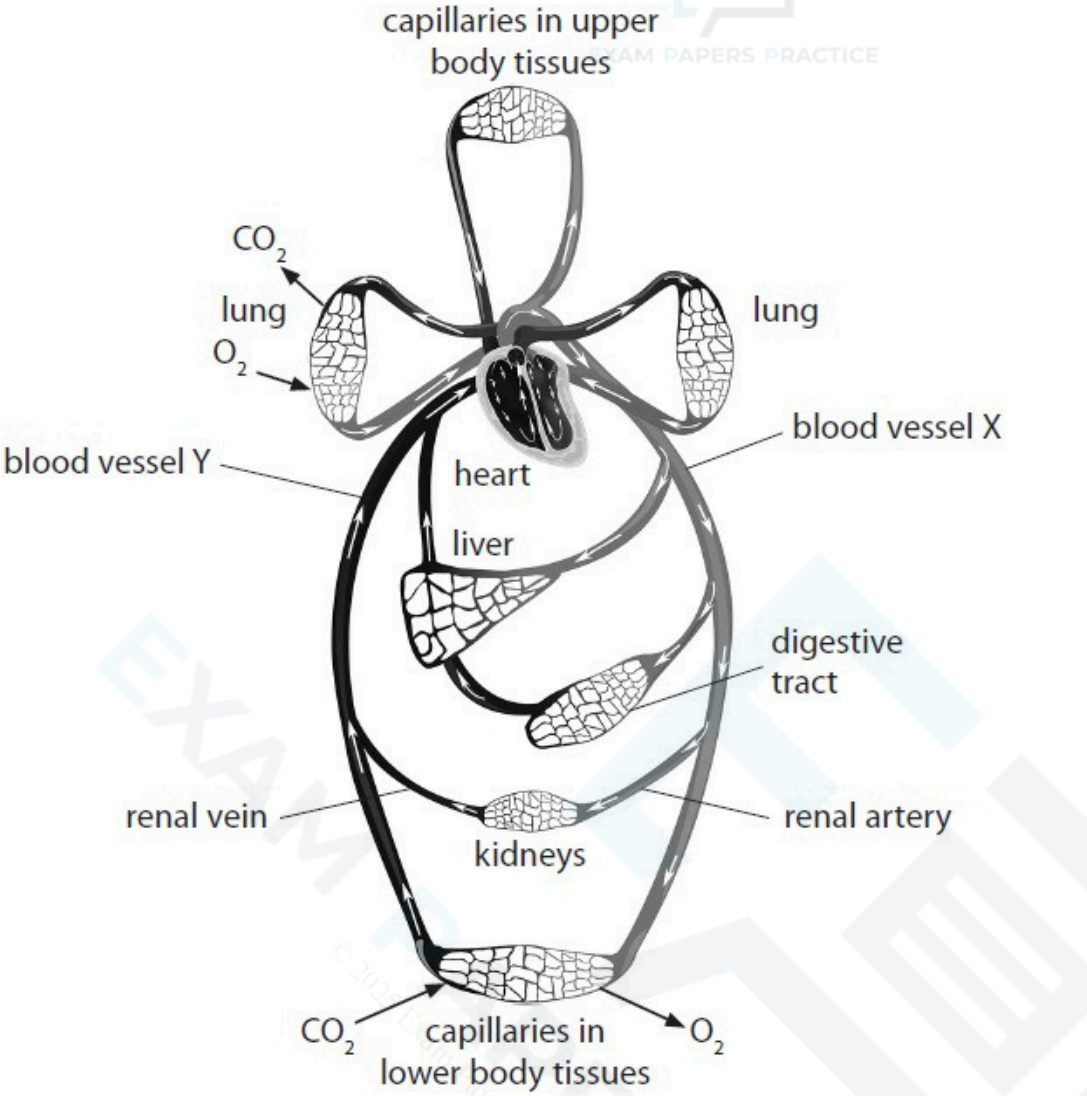
(Total for question = 12 marks)

Q15.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The diagram shows the human circulatory system.



(Source: © Designua/Shutterstock)

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

(1)

☒ **A** aorta

☒ **B** pulmonary artery

☒ **C** pulmonary vein

☒ **D** vena cava

(ii) What is the name of blood vessel Y?

(1)

☒ **A** aorta

☒ **B** pulmonary artery

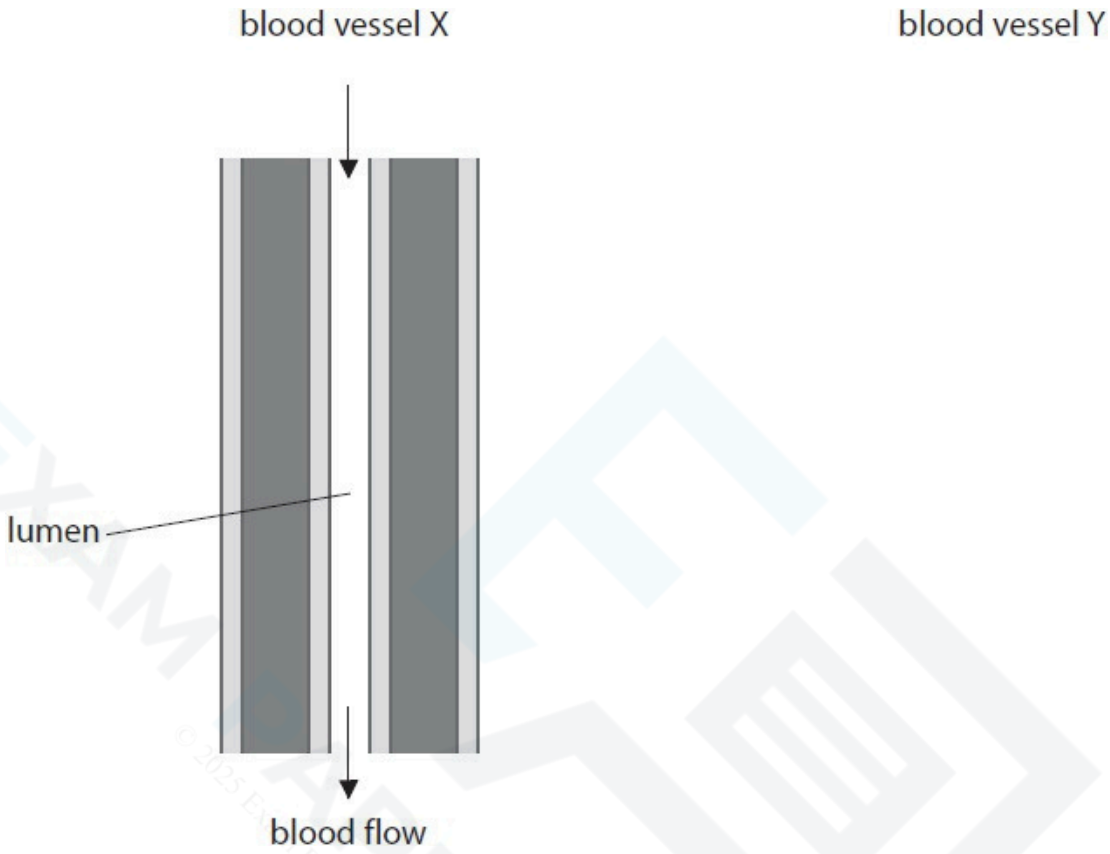
☒ **C** pulmonary vein

☒ **D** vena cava

(iii) The diagram shows a longitudinal section through blood vessel X.

Draw a diagram to show a longitudinal section through blood vessel Y.

(3)



(iv) Explain the differences in the structures of blood vessel X and blood vessel Y.

(3)

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(b) Explain two adaptations of capillaries that increase the rate of diffusion of substances into body tissues.

(4)

1 .....

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2 .....

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(Total for question = 12 marks)

Q16.
Aspirin is a painkiller, but can also be prescribed to people who are at risk of having a stroke or a heart attack.
Aspirin dissolves blood clots and is also an enzyme inhibitor, which reduces the risk of more blood clots
forming in blood vessels.
(a) (i) Describe how a blood clot forms in a blood vessel.

(3)

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(ii) Explain how a blood clot in the coronary artery increases the risk of a heart attack.

(3)

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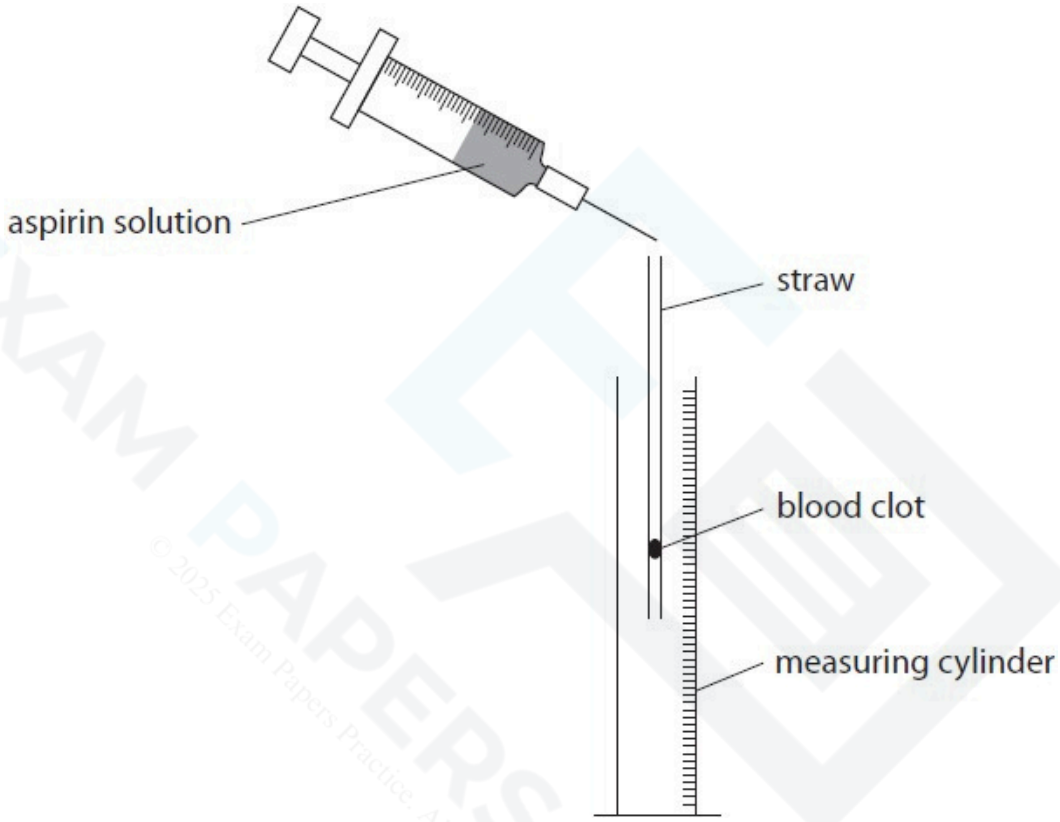
..... (b) A student uses this apparatus to investigate the effect of aspirin on the rate of blood flow through blood vessels.



The student uses this method.

- dissolve one aspirin tablet in water
- use a syringe to pass the aspirin solution through a straw containing a blood clot
- record the total volume of aspirin solution in the measuring cylinder every five minutes

The student repeats the method with solutions formed from two aspirin tablets and then from three aspirin tablets.
(i) Give a control variable for this investigation.

(1)

.....

(ii) Describe a suitable control test for this investigation.

(1)

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.....

The table shows the student's results.

Time in minutes	Total volume of aspirin solution in the measuring cylinder in cm^3		
	1 aspirin tablet	2 aspirin tablets	3 aspirin tablets
5	0	0	0
10	0	0	0
15	0	0	1
20	0	1	2
25	1	1	3
30	1	2	4
35	2	4	6
40	5	7	9
45	10	12	16
50	17	19	22
55	25	27	31
60	35	37	39

(iii) Explain the pattern shown by the results.

(3)

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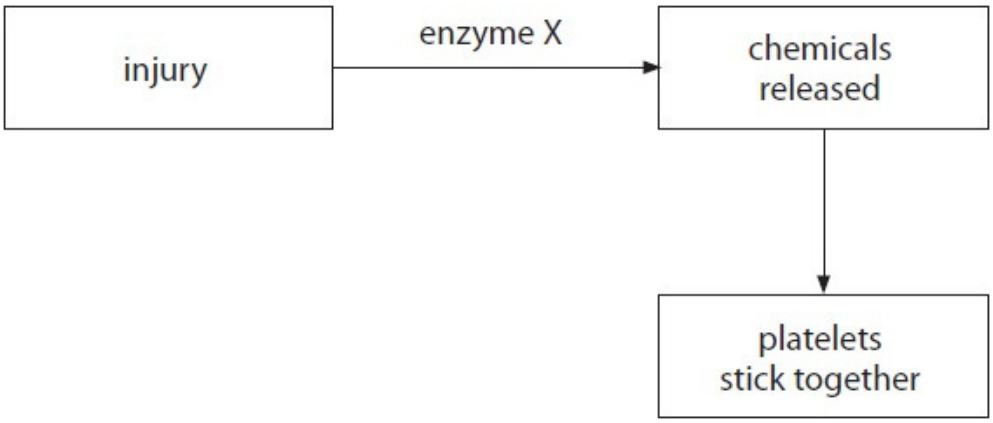
(c) The diagram shows a pathway involved in blood clotting.



Aspirin is an inhibitor of enzyme X.

Explain how the inhibition of enzyme X reduces the formation of blood clots. **(4)**

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(Total for question = 15 marks)

Q17.

Haemophilia is a condition in which blood does not clot. It is caused by a sex-linked allele.

(a) (i) Explain why the process of blood clotting is important.

(3)

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(ii) State what is meant by the term **sex-linked**.

(2)

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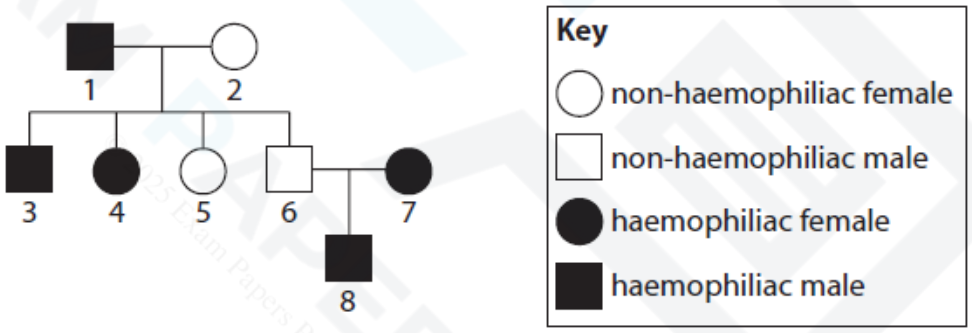
(b) The pedigree shows the pattern of inheritance of haemophilia in a family.



Xh is the allele for haemophilia and XH is the allele for clotting.

(i) What is the genotype of person 3?

(1)

☒ **A** Xh

☒ **B** Xh

☒ **C** XH

☒ **D** Xh

XHY

(ii) What is the genotype of person 5?

XhY

(1)

☒ **A** Xh

☒ **B** Xh

☒ **C** XH

☒ **D** Xh

XHY

(iii) Parents 6 and 7 have another child.

Determine the probability that the child will be male with haemophilia.

(2)

probability = ...

(iv) Explain why people with genotypes shown by persons 4 and 7 are less likely to be present in a population.

(3)

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.....
.....
.....

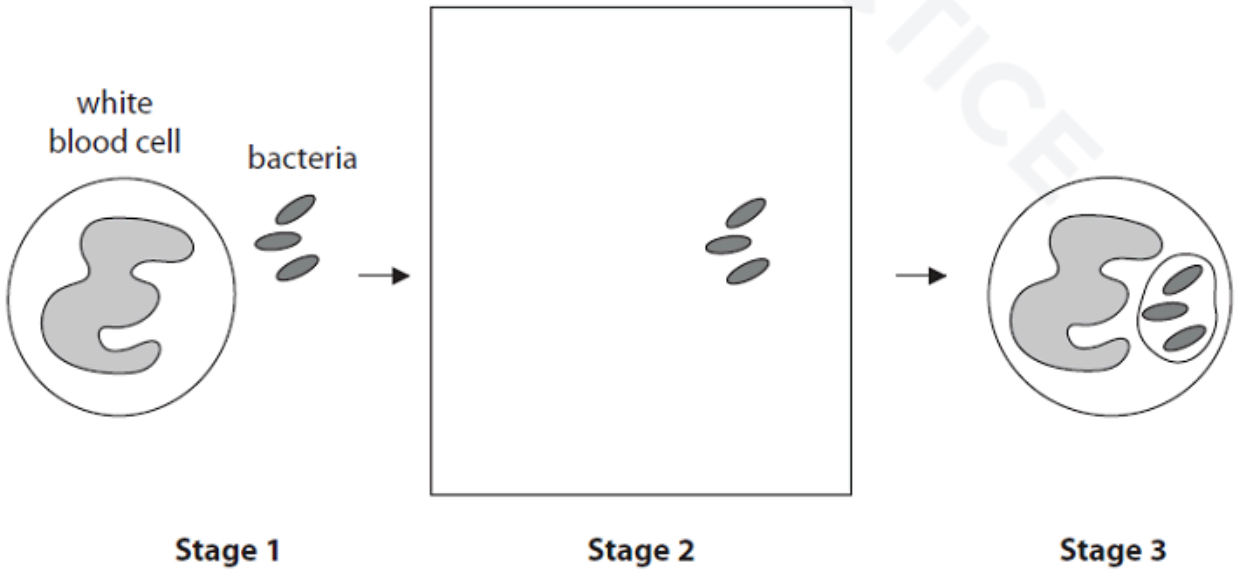
(Total for question = 12 marks)

Q18.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

(a) Bacteria can cause disease in humans.

The diagram shows how one type of white blood cell helps to defend the body against disease.



(i) Complete the diagram by drawing the shape of the white blood cell at stage 2.

(1)

(ii) The box lists words associated with bacteria and disease.

acids	enzymes	erythrocytes	lymphocytes	phagocytes	toxins

Use words from the box to complete the sentences.

(2)

White blood cells called ..... engulf bacteria.
These white blood cells contain ..... to digest bacteria.
(iii) One way that white blood cells defend the body from disease is shown in the diagram.
State another way in which white blood cells defend the body against disease.

(1)

.....
..... (b) The table lists structures found in some cells. Place ticks in boxes to show which structures are found in bacterial cells and which are found in human skin cells. One row has been completed for you.

(3)

Structures	Bacterial cell	Human skin cell
nucleus		
DNA		
cytoplasm	✓	✓
cell wall		

(c) Viruses can also cause diseases in humans.

Many viruses contain RNA as their genetic material.

Which statement describes the structure of RNA?

(1)

☒ **A** a double-stranded helix containing the bases ATGC

☒ **B** a double-stranded helix containing the bases AUGC

☒ **C** a single-stranded helix containing the bases ATGC

☒ **D** a single-stranded helix containing the bases AUGC

(Total for question = 8 marks)

Q19.
There are four different blood groups, A, B, AB and O.
The antigens on the surface of red blood cells determine a person's blood group.
There are two types of antigen, antigen A and antigen B.
(a) The table lists the four different blood groups.
Complete the table by giving the correct type of antigens for each blood group.

(2)

Blood group	A	B	AB	O
Antigen				

(b) If a person needs a blood transfusion, it is important that they receive a suitable blood group.
Explain the effects on a person who receives a blood group that is not suitable.

(3)

.....

.....

.....

.....

.....

.....

(c) Explain which blood group or groups can be given to people with each of the other blood groups during a transfusion.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

(d) The table shows the percentage of students with each type of blood group in a school.

Blood group	Percentage (%)
A	42
B	10
AB	4
O	44

There are 750 students in the school.

Calculate the number of students who can safely receive blood group B.

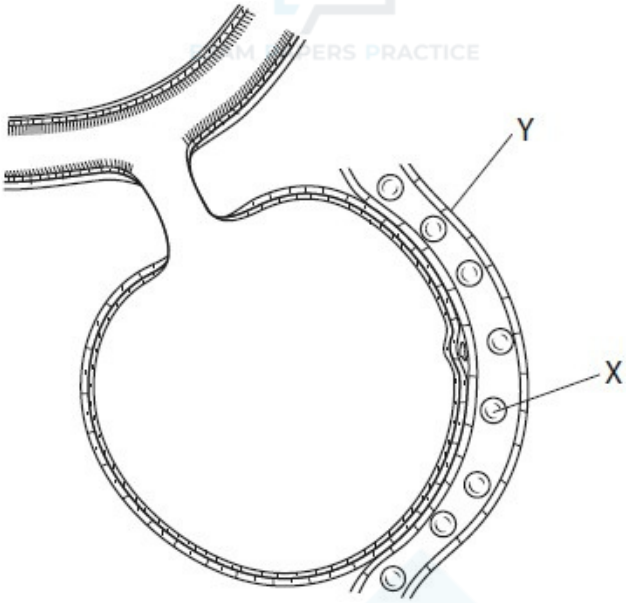
(3)

number of students = ...

(Total for question = 12 marks)

Q20.

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)

.....
.....
.....
.....

(Total for question = 11 marks)