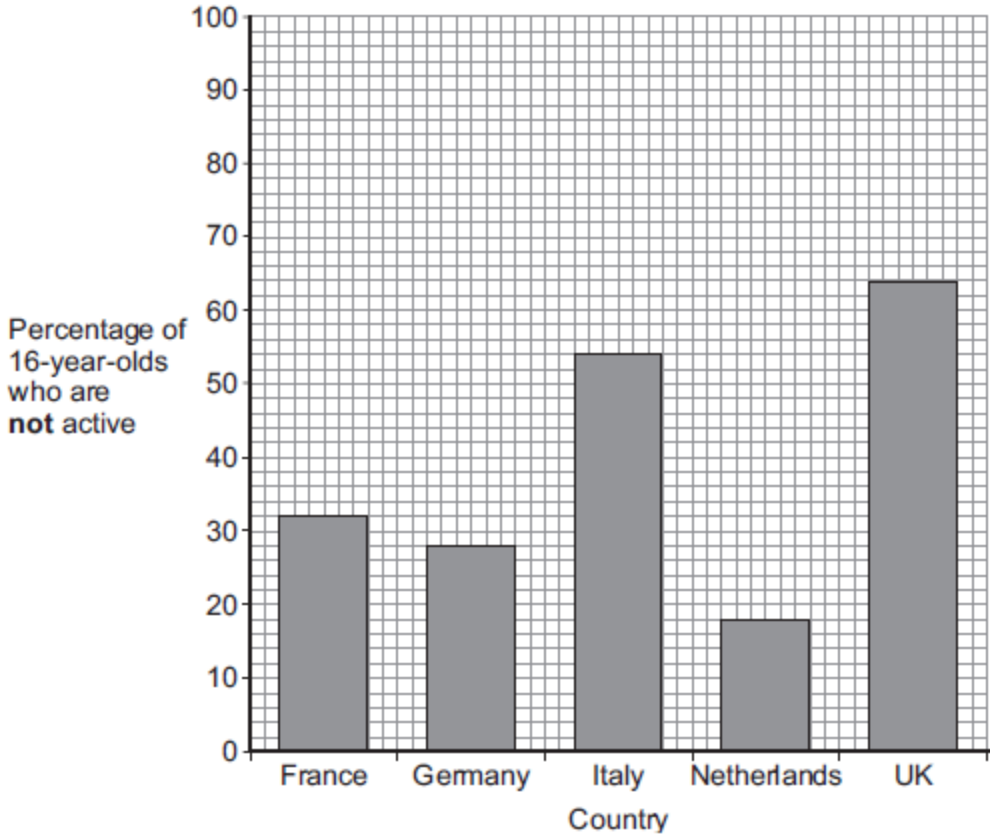
1. Scientists investigated the effect of different factors on health.

(a) People who are **not** active may have health problems.

The graph shows the percentage of 16-year-olds in some countries who are **not** active.



(i) What percentage of 16-year-olds in the UK are **not** active?

_____ %

(1)

(ii) What percentage of 16-year-olds in the UK are **active**?

_____ %

(1)

(iii) A newspaper headline states:

People in the UK are the laziest in the world.

Information in **Figure 1** does **not** support the newspaper headline.

Suggest **one** reason why the newspaper headline may be wrong.

_____

_____

(1)

(b) Doctors gave a percentage rating to the health of 16-year-olds.
100% is perfect health.

The table shows the amount of exercise 16-year-olds do and their health rating.

Amount of exercise done in minutes every week	**Health rating as %**
Less than 30	72
90	76
180	82
300	92

What conclusion can be made about the effect of exercise on health?

Use information from the table.

_____

_____

(1)

(c) Inherited factors can also affect health.

Give **one** health problem that may be affected by the genes someone inherits.

Draw a ring around the correct answer.

being malnourished **having a high cholesterol level** **having a deficiency disease**

(1)

(d) White blood cells are part of the immune system.

Use the correct answer from the box to complete each sentence.

antibiotics	antibodies	pathogens	vaccines

(i) When we are ill, white blood cells produce _____ to kill microorganisms.

(1)

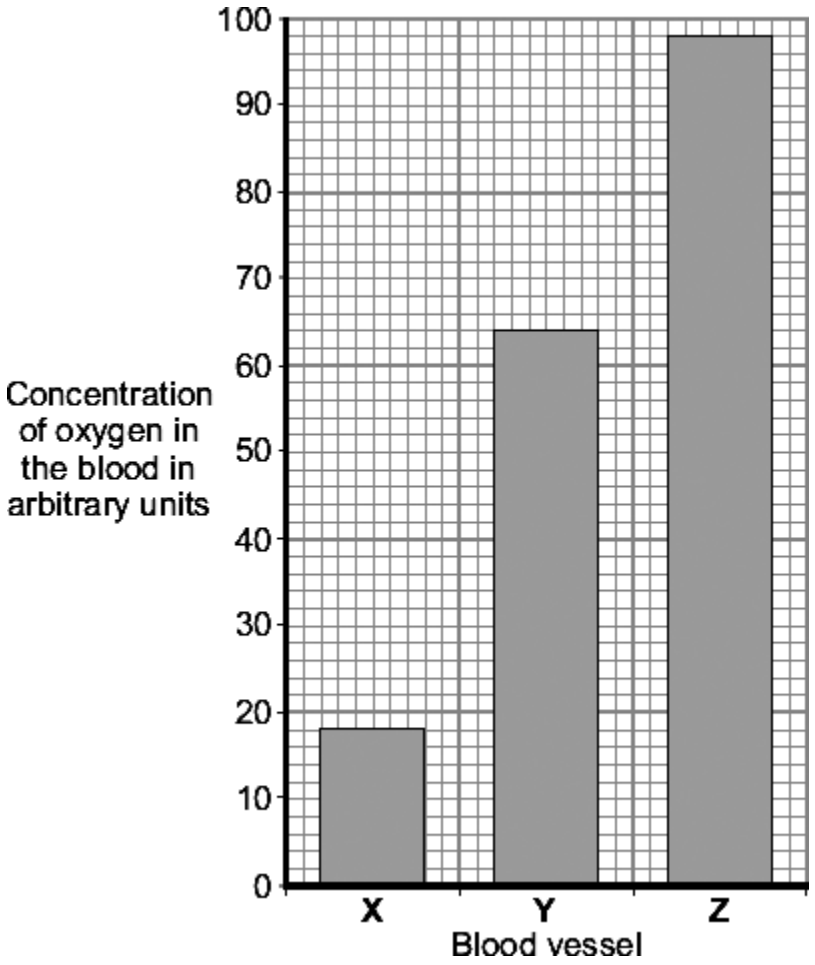
(ii) Many strains of bacteria, including MRSA, have developed resistance to drugs called

_____

(1)

(Total 7 marks)

2. The bar chart shows the concentration of oxygen in the blood in three different blood vessels, **X**, **Y** and **Z**.



(a) (i) What is the concentration of oxygen in blood vessel **X**?

Answer _____ arbitrary units.

(1)

(ii) Which blood vessel, **X**, **Y** or **Z**, carries blood from the lungs to the heart?

(1)

(b) Draw a ring around the correct answer to complete each sentence.

(i) Most of the oxygen in the blood is carried by the

plasma.

red blood cells.

white blood cells.

(1)

(ii) Oxygen combines with a coloured pigment in the blood.

This coloured pigment is called

alveoli.

haemoglobin.

lactic acid.

(1)

(Total 4 marks)

3. Oxygen is transported round the body by the blood.

Blood leaving the human lung can carry about 250 milligrams of oxygen per litre.
However, only 7 milligrams of oxygen will dissolve in one litre of water at body temperature.

(a) Suggest an explanation for the difference.

_____

_____

_____

_____

(2)

(b) Blood leaving the skeletal muscles during exercise may contain only 30 milligrams of oxygen per litre.

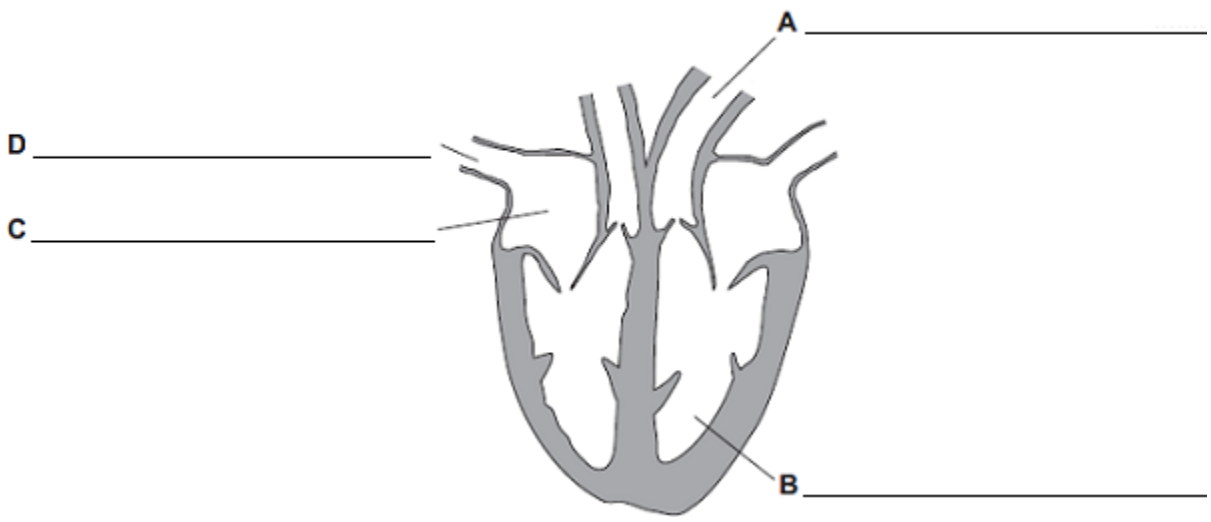
Explain what causes the difference in oxygen concentration between the blood leaving the lungs and the blood leaving the skeletal muscles.

(4)

(Total 6 marks)

4. **Diagram 1** shows a section through the heart.

Diagram 1



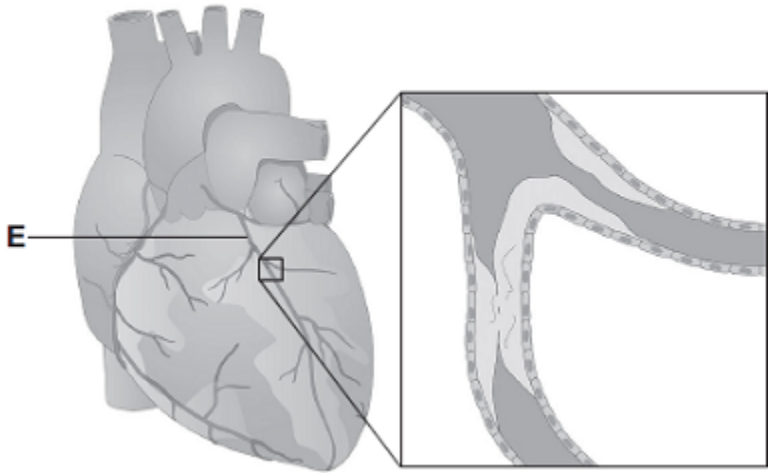
(a) On the diagram, name the parts labelled **A**, **B**, **C** and **D**.

(4)

(b) **Diagram 2** shows the blood vessels that supply the heart muscle.

Part of one of the blood vessels has become narrower.

Diagram 2



(i) Name blood vessel **E**.

_____

(1)

(ii) Give **one** method of treating the narrowed part of blood vessel **E**.

_____

(1)

(iii) Explain how the method of treatment works.

_____

_____

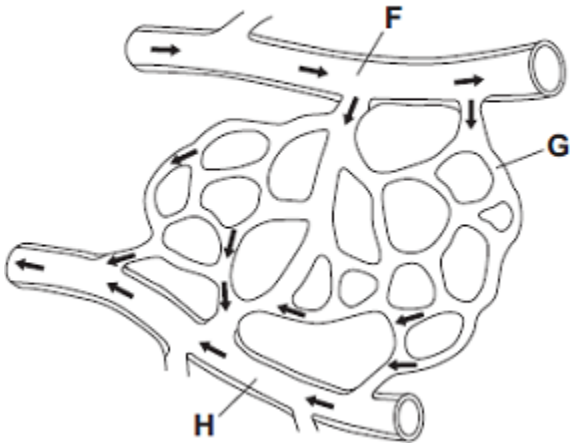
_____

_____

(2)

(c) **Diagram 3** shows part of the blood supply in the lungs.

Diagram 3



(i) Name the types of blood vessel labelled **F**, **G** and **H**.

F _____

G _____

H _____

(3)

(ii) Give **one** way in which the composition of the blood in vessel **F** is different from the composition of the blood in vessel **H**.

_____

_____

(1)

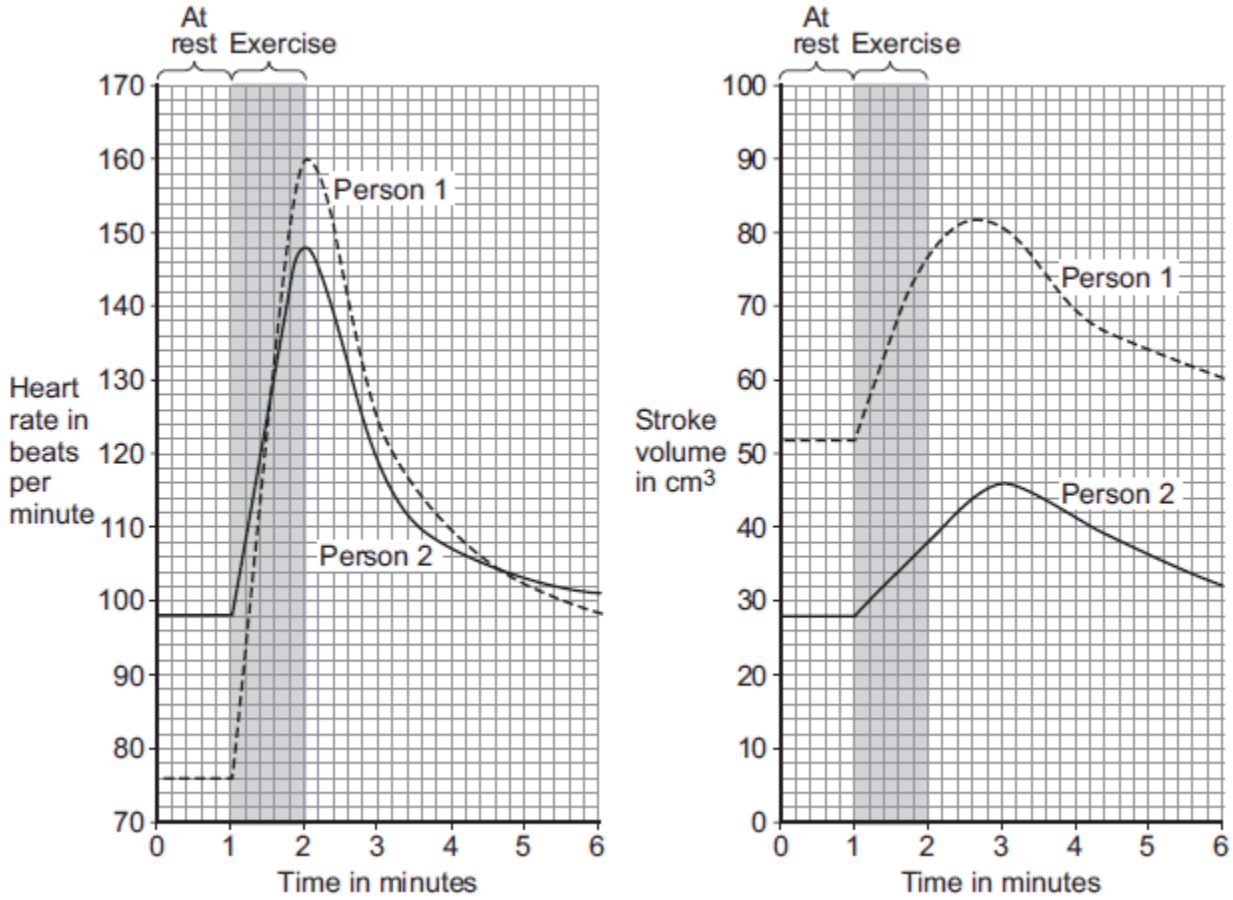
(Total 12 marks)

5. During exercise, the heart beats faster and with greater force.

The 'heart rate' is the number of times the heart beats each minute.The volume of blood that travels out of the heart each time the heart beats is called the 'stroke volume'.

In an investigation, **Person 1** and **Person 2** ran as fast as they could for 1 minute. Scientists measured the heart rates and stroke volumes of **Person 1** and **Person 2** at rest, during the exercise and after the exercise.

The graph below shows the scientists' results.



(a) The 'cardiac output' is the volume of blood sent from the heart to the muscles each minute.

Cardiac output = Heart rate × Stroke volume

At the end of the exercise, **Person 1**'s cardiac output = 160 × 77 = 12 320 cm^3 per minute.

Use information from the figure above to complete the following calculation of **Person 2**'s cardiac output at the end of the exercise.

At the end of the exercise:

Person 2's heart rate = _____ beats per minute

Person 2's stroke volume = _____ cm^3

Person 2's cardiac output = _____ cm^3 per minute

(3)

(b) **Person 2** had a much lower cardiac output than **Person 1.**

(i) Use information from the figure above to suggest the **main** reason for the lower cardiac output of **Person 2**.

_____

_____

(1)

(ii) **Person 1** was able to run much faster than **Person 2**.

Use information from the figure above and your own knowledge to explain why.

_____

_____

_____

_____

_____

_____

_____

_____

_____

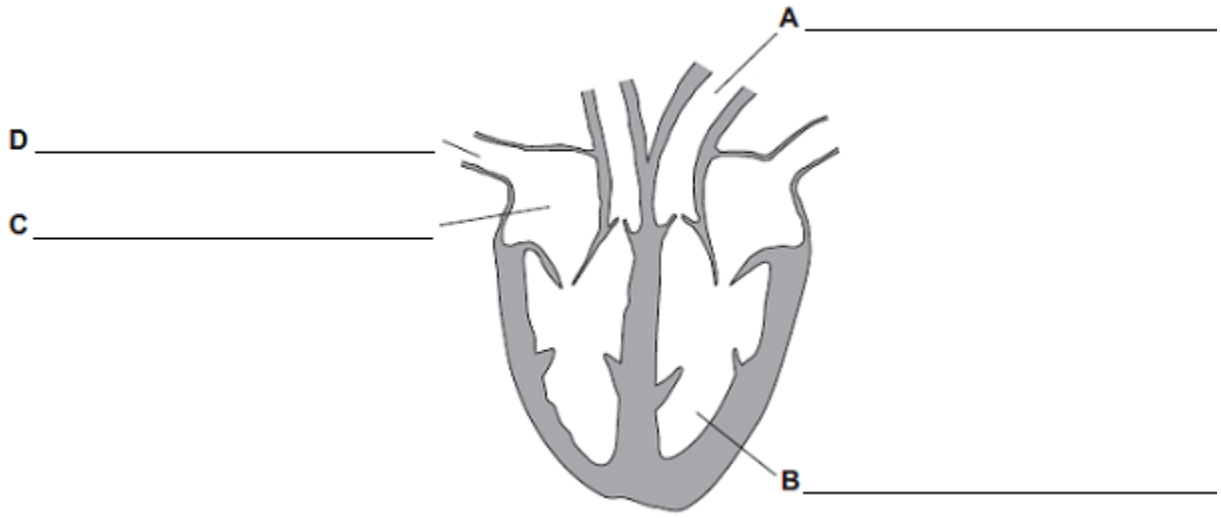
_____

(5)

(Total 9 marks)

6. **Diagram 1** shows a section through the heart.

Diagram 1



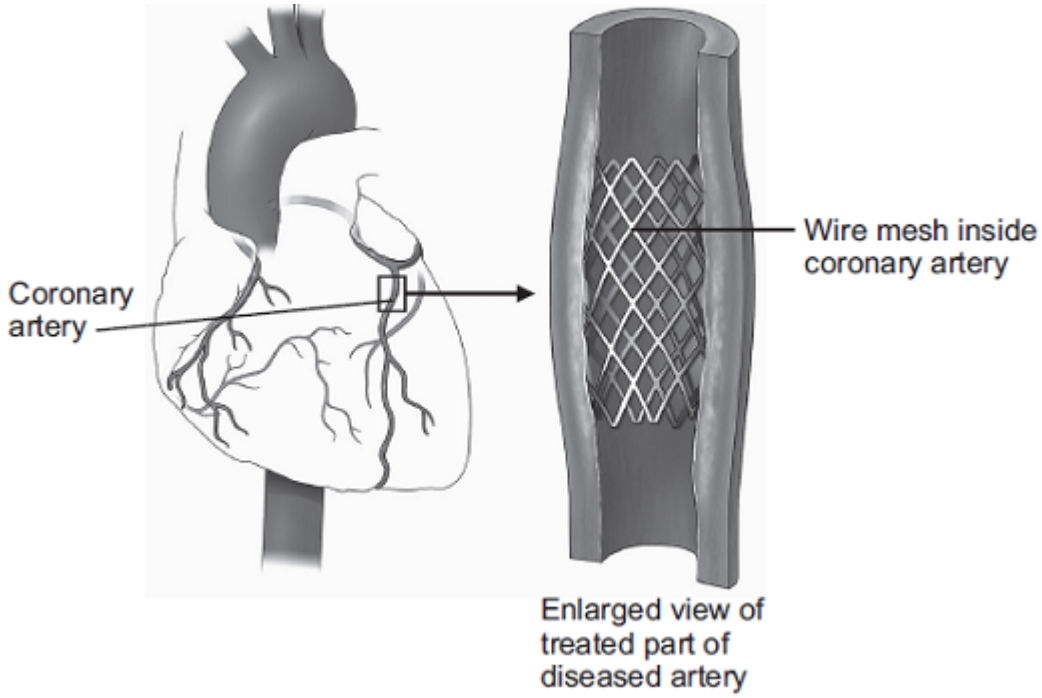
(a) Use words from the box to label parts **A**, **B**, **C** and **D**.

artery	**atrium**	**capillary**	**platelet**	**vein**	**ventricle**

(4)

(b) **Diagram 2** shows one treatment for a diseased coronary artery.

Diagram 2



(i) Name the treatment shown in **Diagram 2**.

_____

(1)

(ii) Explain how the treatment works.

_____

_____

_____

_____

(2)

(Total 7 marks)

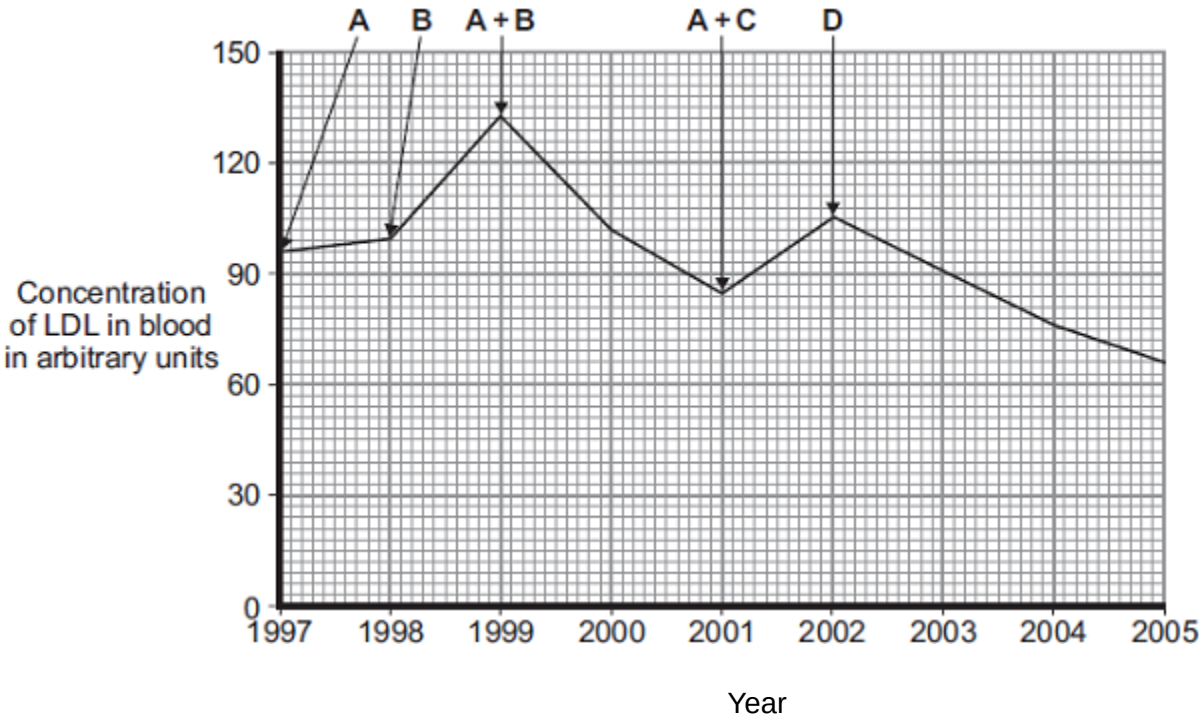
7. LDL is one form of cholesterol found in the blood.

People with a high concentration of LDL in their blood may be treated with drugs called statins.

A high concentration of LDL cholesterol in the blood may result in an increased risk of heart and circulatory diseases.

The graph shows the effects of the treatment of one person with four different statins, **A**, **B**, **C** and **D**, over a period of 8 years. The arrows show when each new treatment was started.

Each treatment was continued until the next treatment was started.

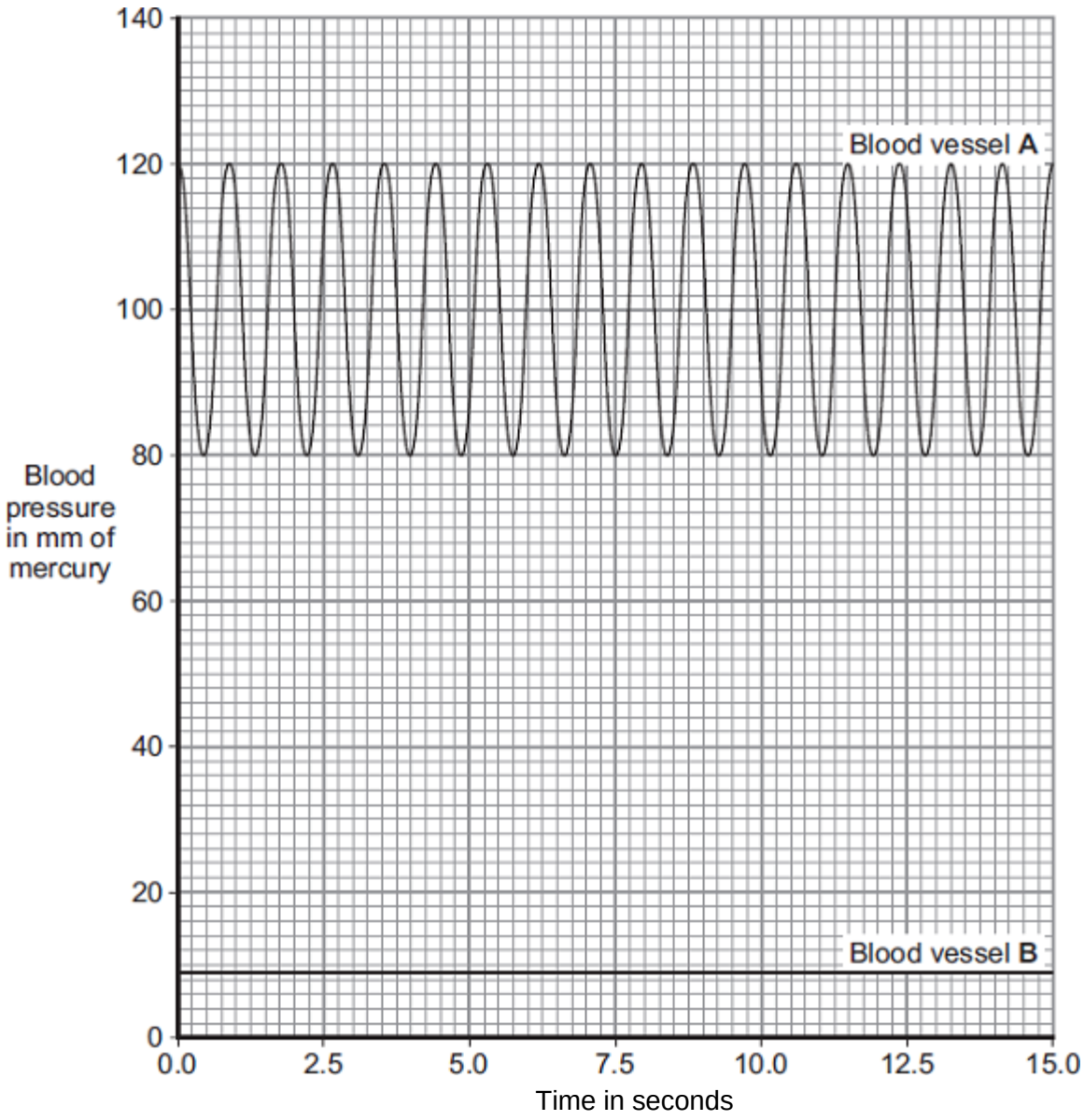


Compare the effectiveness of the five treatments in reducing the risk of heart and circulatory diseases for this person.

(Total 4 marks)

8. The heart pumps the blood around the body. This causes blood to leave the heart at high pressure.

The graph shows blood pressure measurements for a person at rest.
The blood pressure was measured in an artery and in a vein.



(a) Which blood vessel, **A** or **B**, is the artery?

Blood vessel _____

Give **two** reasons for your answer.

Reason 1 _____

_____

Reason 2 _____

_____

(2)

(b) Use information from the graph to answer these questions.

(i) How many times did the heart beat in 15 seconds? _____

(1)

(ii) Use your answer from part (b)(i) to calculate the person's heart rate per minute.

_____

_____

Heart rate = _____ beats per minute

(1)

(c) During exercise, the heart rate increases.

The increased heart rate supplies useful substances to the muscles at a faster rate.

Name **two** useful substances that must be supplied to the muscles at a faster rate during exercise.

1. _____

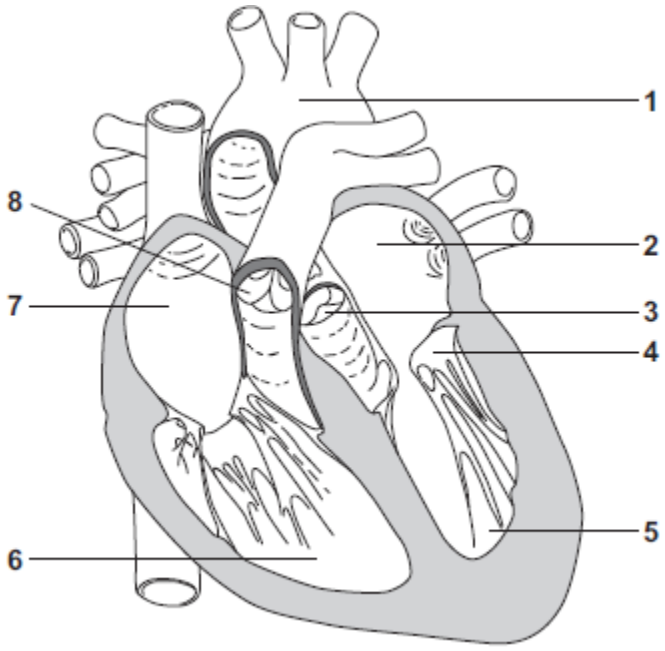
2. _____

(2)

(Total 6 marks)

9. The diagram in **Figure 1** shows a section through the human heart, seen from the front.

Figure 1



(a) Draw a ring around the correct answer to complete each sentence.

(i) The wall of the heart is made mostly of

epithelial
glandular
muscular

tissue.

(1)

(ii) The resting heart rate is controlled by the pacemaker.

The pacemaker is located at position

1.
6.
7.

(1)

(iii) If a person's heart rate is irregular, the person may be fitted with an artificial pacemaker.

The artificial pacemaker is

an electrical device.
a pump.
a valve.

(1)

(b) (i) Write a number, **2**, **5**, **6** or **7**, in **each** of the three boxes to answer this question.

Which chamber of the heart:

pumps oxygenated blood to the head and body ☐

receives deoxygenated blood from the head and body ☐

receives oxygenated blood from the lungs? ☐

(3)

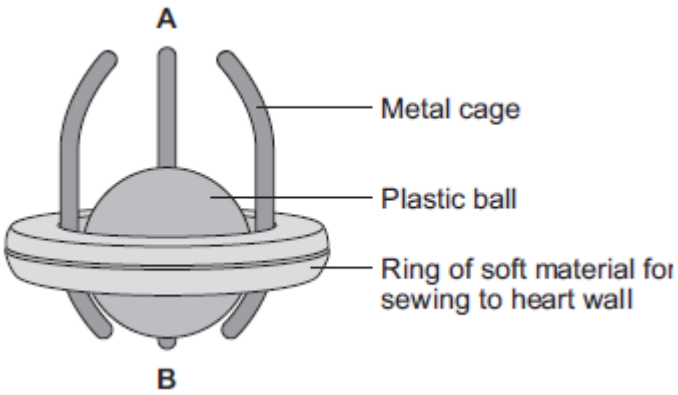
(ii) Give the number, **3**, 4 or **8**, of the valve that closes when the blood pressure in the aorta is greater than the blood pressure in the left ventricle.

Write the correct answer in the box. ☐

(1)

(c) The diagram in **Figure 2** shows one type of artificial heart valve. The plastic ball is in the closed position.

Figure 2



This type of artificial valve could be used to replace a faulty valve in the heart.

(i) What is the function of valves in the heart?

_____

_____

(1)

(ii) The artificial valve could be used to replace valve **4** shown in **Figure 1**.

The artificial valve opens to let blood through when the ball is moved towards **A**.

Which end of the valve, **A** or **B**, should point towards chamber **5**?

Explain your answer.

_____

_____

_____

_____

_____

_____

_____

(3)

(d) (i) The artificial heart valve may cause blood clots to form on its surface.

Describe what happens during blood clotting.

_____

_____

_____

_____

(2)

(ii) Read the information in the passage.

> Replacing a damaged heart valve can dramatically improve the blood circulation and the supply of oxygen to the body's tissues. The operation to replace a heart valve is a long one during which the patient's blood goes through a bypass machine. Sometimes the artificial valve can fail to work. If the surface of the valve becomes rough, small blood clots can form on its surface then break away and be carried around the body by the blood.

Evaluate the advantages and disadvantages of artificial heart valves.

(4)

(Total 17 marks)

10. Blood is part of the circulatory system.

(a) (i) Give **one** function of white blood cells.

(1)

(ii) Which of the following is a feature of platelets?

Tick (✓) **one** box.

They have a nucleus. ☐

They contain haemoglobin. ☐

They are small fragments of cells. ☐

(1)

(b) Urea is transported by the blood plasma from where it is made to where the urea is excreted.

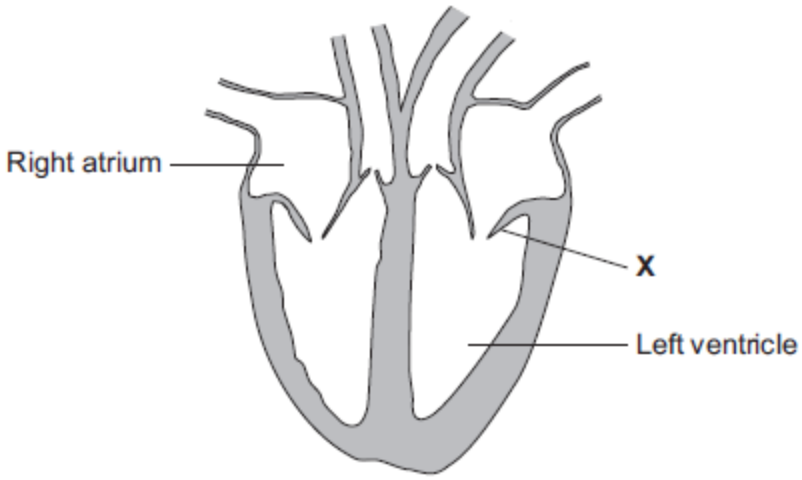
Complete the following sentence.

Blood plasma carries urea from where it is made in the _____

to the _____ where the urea is removed from the blood.

(2)

(c) The illustration shows a section through the human heart.



Structure **X** is a valve. If valve **X** stops working, it may need to be replaced.

A scientist is designing a new heart valve. The scientist knows that the valve must be the correct size to fit in the heart.

Suggest **two** other factors the scientist needs to consider so that the newly designed valve works effectively in the heart.

_____

_____

_____

_____

(2)

(Total 6 marks)

11. The circulatory system transports substances such as glucose and oxygen around the body.

(a) Name **two** other substances that the circulatory system transports around the body.

1. _____

2. _____

(2)

(b) (i) Blood is a tissue. Blood contains red blood cells and white blood cells.

Name **two** other components of blood.

1. _____

2. _____

(2)

(ii) The heart is part of the circulatory system.

What type of tissue is the wall of the heart made of?

_____

(1)

(c) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Every year, many patients need to have heart valve replacements.

The table gives information about two types of heart valve.

Living human heart valve	Cow tissue heart valve
• It has been used for transplants for more than 12 years. • It can take many years to find a suitable human donor. • It is transplanted during an operation after a donor has been found. • During the operation, the patient's chest is opened and the old valve is removed before the new valve is transplanted.	• It has been used since 2011. • It is made from the artery tissue of a cow. • It is attached to a stent and inserted inside the existing faulty valve. • A doctor inserts the stent into a blood vessel in the leg and pushes it through the blood vessel to the heart.

A patient needs a heart valve replacement. A doctor recommends the use of a cow tissue heart valve.

Give the advantages and disadvantages of using a cow tissue heart valve compared with using a living human heart valve.

Use information from the table and your own knowledge in your answer.

(6)

(Total 11 marks)

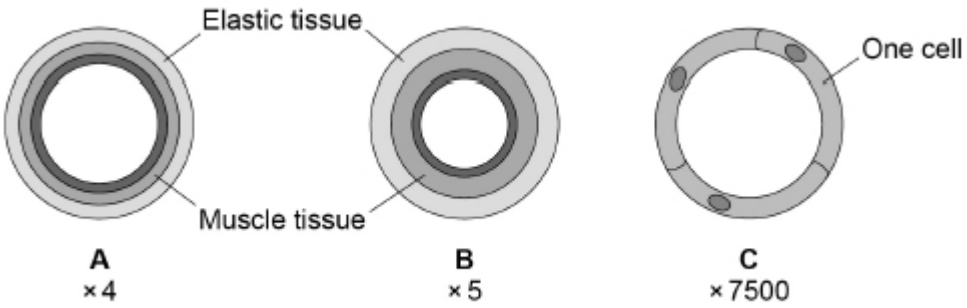
12. This question is about the circulatory system.

(a) Draw **one** line from each blood component to its function.

Blood Component	Function
	Destroys microorganisms
Platelet	Helps the blood to clot
Red blood cell	Transports glucose around the body
White blood cell	Transports oxygen around the body
	Transports urea

(3)

(b) The diagram below shows cross sections of the three main types of blood vessel found in the human body. Each blood vessel is drawn to the scale shown.



Which blood vessel has the smallest diameter?

Tick **one** box.

A		B		C	

(1)

(c) Which blood vessel in the figure above is an artery?

Give **one** reason for your answer.

Blood vessel: _____

Reason: _____

_____

(2)

Table 1 gives information about the blood flow in two people.

Table 1

Person	**Blood flow through the coronary arteries in cm^3 / minute**
A – does **not** have coronary heart disease	250
B – has coronary heart disease	155

(d) Calculate the difference in blood flow between person **A** and person **B**.

_____

_____

Difference = _____ cm^3 / minute

(1)

(e) Suggest why blood flow through the coronary arteries is lower in people with coronary heart disease.

_____

_____

(1)

(f) Calculate the volume of blood flowing through the coronary arteries of person **A** in 1 hour.

Give your answer in dm^3.

_____

_____

_____

_____

_____

Volume of blood in 1 hour = _____ dm^3

(2)

Coronary heart disease can be treated by:

- inserting a stent
- using a Coronary Artery Bypass Graft (CABG).

Table 2 gives information about each method.

Table 2

	Stent	CABG
Procedure	The patient is awake during the procedure. A small cut is made in the skin. A wire mesh is inserted into the coronary artery via a blood vessel in the arm or leg.	The patient is not awake during the procedure. The chest is cut open. A section of blood vessel from the arm or leg is removed. It is used to create a new channel for blood to bypass the blockage in the coronary artery.
When procedure is recommended	When only one blockage is present	When multiple blockages are present
Time spent in hospital after procedure	2-3 hours	at least 7 days
Recovery time after procedure	7 days	12 weeks
Risk of heart attack during procedure	1%	2%
Chance of failure within one year	40%	5%

(g) Give **two** advantages of using a stent instead of CABG.

1. _____

_____

2. _____

_____

(2)

(h) Give **two** advantages of using CABG instead of a stent.

1. _____

_____

2. _____

_____

(2)

(Total 14 marks)

13. The circulatory system contains arteries and veins.

(a) (i) Describe how the structure of an artery is different from the structure of a vein.

_____

_____

_____

_____

(2)

(ii) A comparison is made between blood taken from an artery in the leg and blood taken from a vein in the leg.

Give **two** differences in the composition of the blood.

1. _____

_____

2. _____

_____

(2)

(b) During operations patients can lose a lot of blood. Patients often need blood transfusions to keep them alive.

The text shows information about a new artificial blood product.

Sea worms give hope for people in need of blood transfusions

Scientists have carried out a five-year trial using a new artificial blood product. The scientists have used a protein from sea worms to create the new artificial blood and the results from the trial are very positive. Thousands of sea worms can be grown and collected.

During the trial, mice were given blood transfusions of the artificial blood. The bodies of the mice tolerated the artificial blood and the artificial blood did not cause any side effects.

Suggest **two** possible advantages of using the new artificial blood, instead of using human blood for a transfusion in humans.

1. _____

_____

2. _____

_____

(2)

(Total 6 marks)

14. The heart is part of the circulatory system.

(a) (i) Name **one** substance transported by the blood in the circulatory system.

_____

(1)

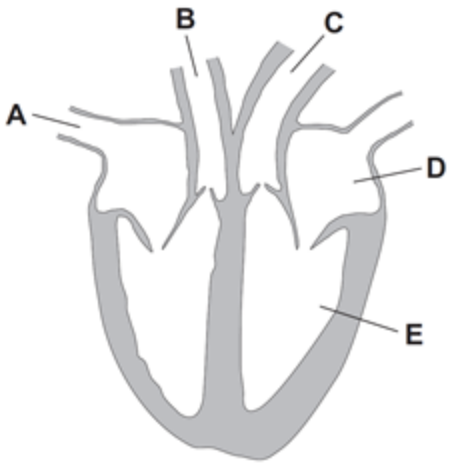
(ii) What is the main type of tissue in the heart wall?

_____

(1)

(b) **Figure 1** shows the human heart.

Figure 1



(i) Which blood vessel, **A**, **B** or **C**, takes blood to the lungs? ☐

(1)

(ii) Name parts **D** and **E** shown in **Figure 1**.

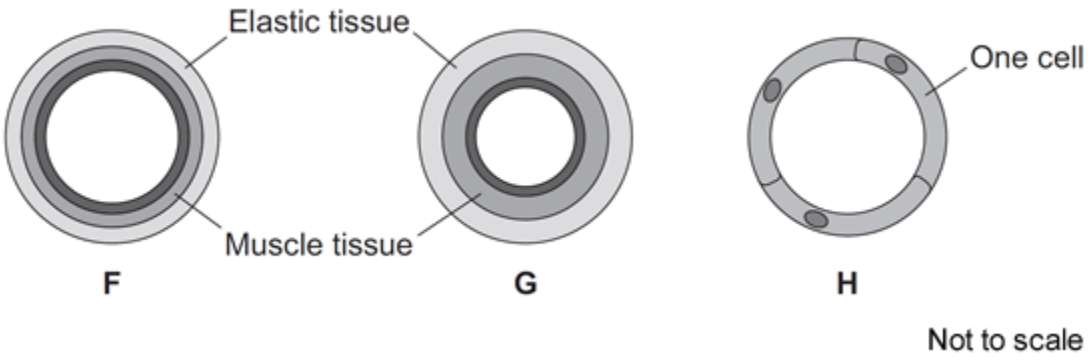
D _____

E _____

(2)

(c) **Figure 2** shows three types of blood vessel, **F**, **G** and **H**.

Figure 2



(i) What type of blood vessel is **F?**

Tick (✓) **one** box.

an artery ☐

a capillary ☐

a vein ☐

(1)

(ii) A man needs to have a stent fitted to prevent a heart attack.

In which type of blood vessel would the stent be placed?

Tick (✓) **one** box.

an artery ☐

a capillary ☐

a vein ☐

(1)

(iii) Explain how a stent helps to prevent a heart attack.

_____

_____

_____

_____

(2)

(Total 9 marks)

15. The heart pumps blood to the lungs and to the cells of the body.

(a) Name the blood vessel that transports blood from the body to the right atrium.

_____

(1)

(b) The aorta transports blood from the heart to the body.

In a person at rest:

- blood travels at a mean speed of 10 cm/s in the aorta
- blood travels at a mean speed of 0.5 mm/s in the capillaries
- the speed of blood decreases at a rate of 0.4 cm/s^2 as blood travels from the aorta to the capillaries.

Calculate the time it takes for blood to travel from the aorta to the capillaries.

Assume that the speed of blood decreases at a constant rate.

Use the equation:

$$\text{rate of decrease in speed} = \frac{\text{change in speed}}{\text{time}}$$

Give your answer to 2 significant figures.

Time = _____ s

(4)

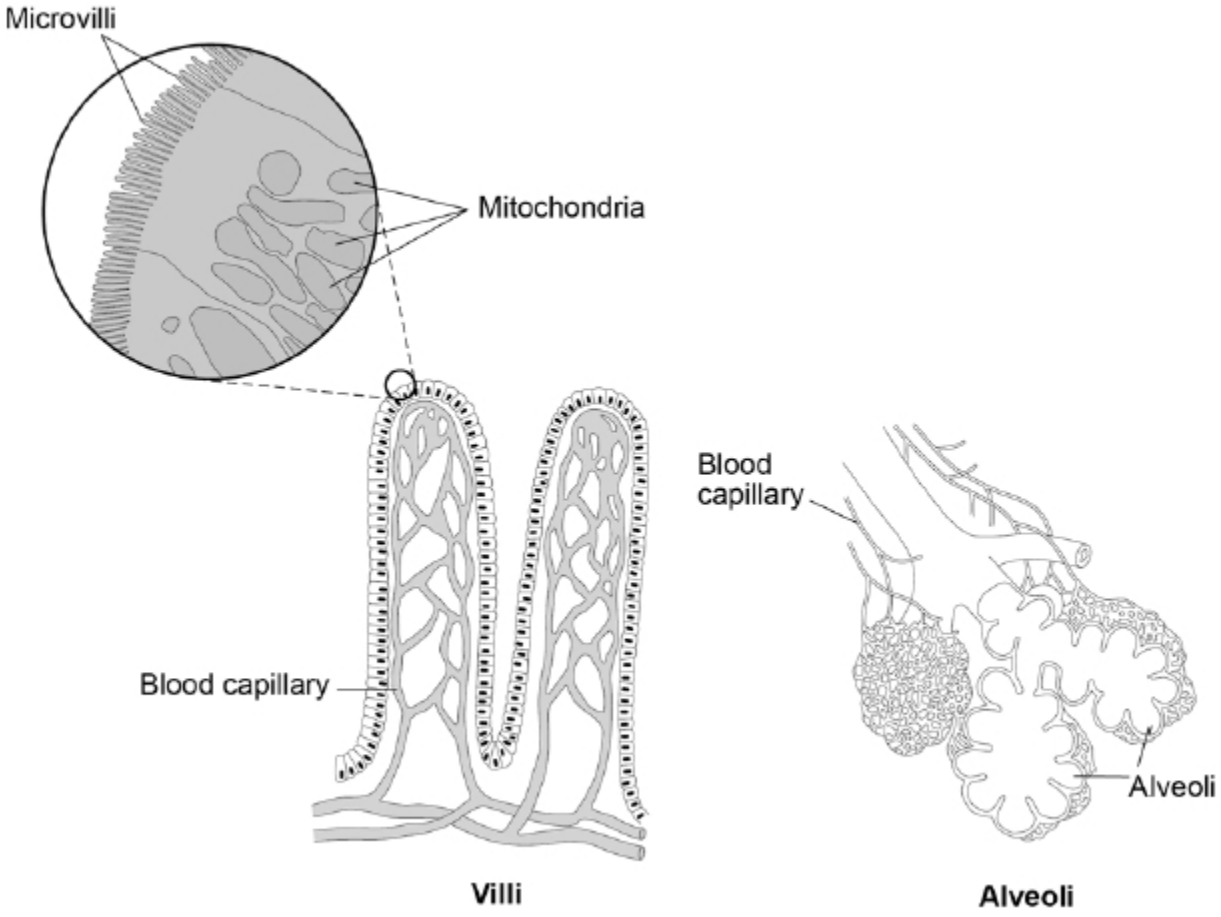
(c) Describe the route taken by oxygenated blood from the lungs to the body cells.

(4)

(d) The digestive system and the breathing system both contain specialised exchange surfaces.

- In the digestive system, digested food is absorbed into the blood stream in structures called villi.
- In the breathing system, gases are absorbed into the blood stream in the alveoli.

The diagram below shows the structure of villi and alveoli.



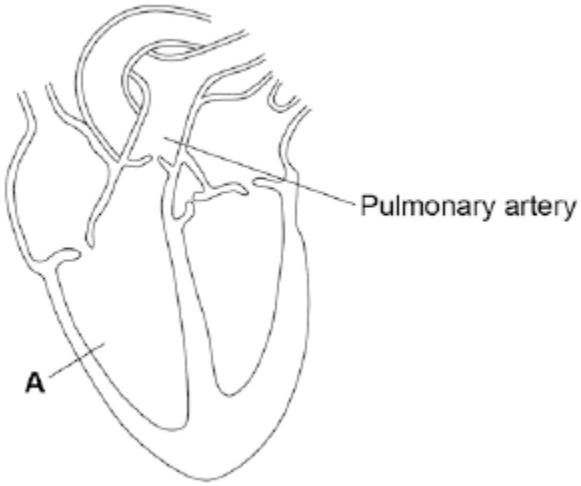
Explain how the villi and the alveoli are adapted to absorb molecules into the bloodstream.

(6)

(Total 15 marks)

16. **Figure 1** shows a diagram of the human heart.

Figure 1



(a) What part of the heart is labelled **A**?

Tick **one** box.

Aorta ☐

Atrium ☐

Valve ☐

Ventricle ☐

(1)

(b) Where does the pulmonary artery take blood to?

Tick **one** box.

Brain ☐

Liver ☐

Lungs ☐

Stomach ☐

(1)

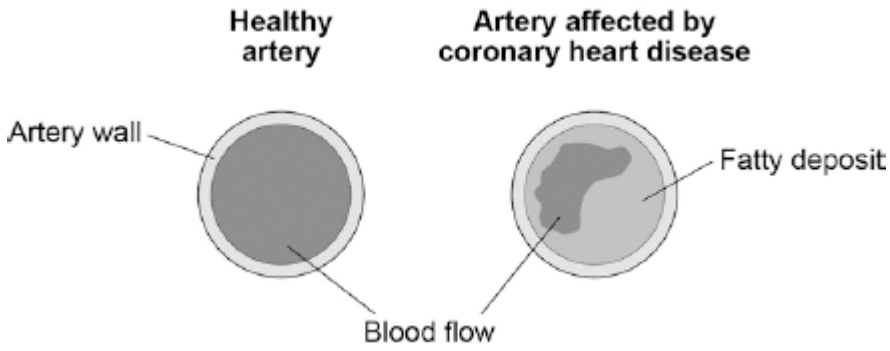
(c) Circle a valve on **Figure 1**.

(1)

(d) The coronary arteries supply blood to the heart.

Figure 2 shows two coronary arteries.

Figure 2



Describe **two** ways the healthy artery is different from the artery affected by coronary heart disease.

1. _____

_____

2. _____

_____

(2)

(e) What can be used to treat people with coronary heart disease?

Tick **two** boxes.

Antibiotics ☐

Hormones ☐

Statins ☐

Stent ☐

Vaccination ☐

(2)

(f) Suggest **two** risk factors for coronary heart disease.

1. _____

_____

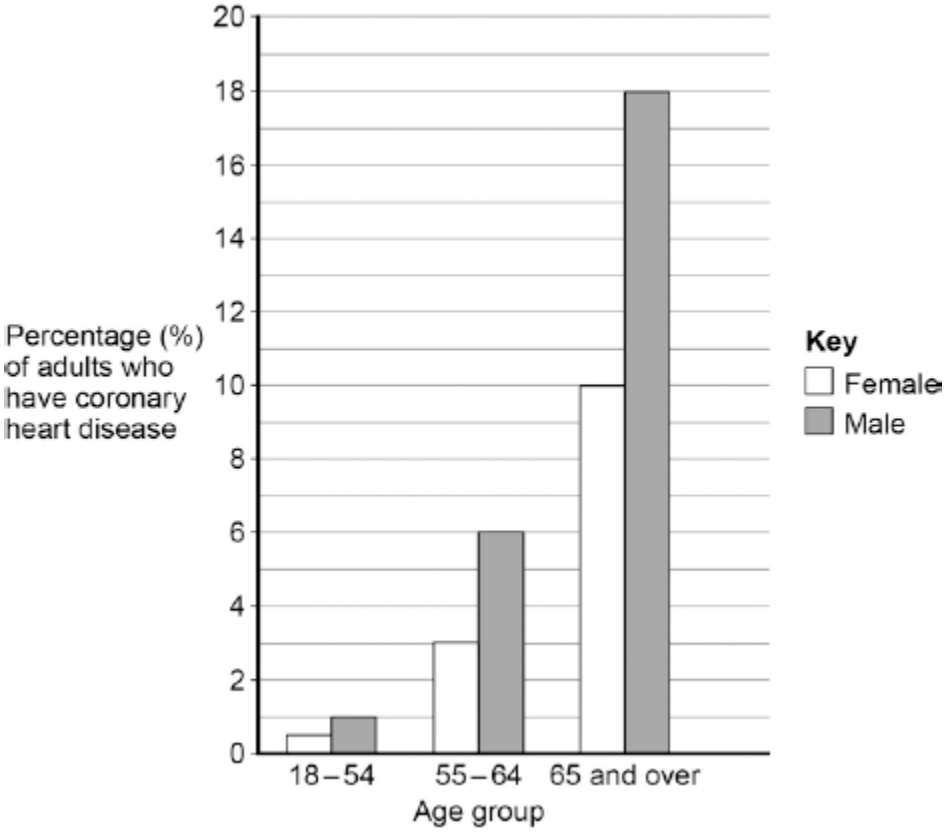
2. _____

_____

(2)

(g) **Figure 3** shows the percentages of adults in the UK who have coronary heart disease.

Figure 3



Calculate the difference in the percentage of male and female adults aged 65 and over who have coronary heart disease.

_____ %

(1)

(h) Which is the correct conclusion for the data in **Figure 3**?

Tick **one** box.

Children do **not** suffer from coronary heart disease ☐

More males suffer from coronary heart disease than females ☐

More younger people suffer from coronary heart disease than older people ☐

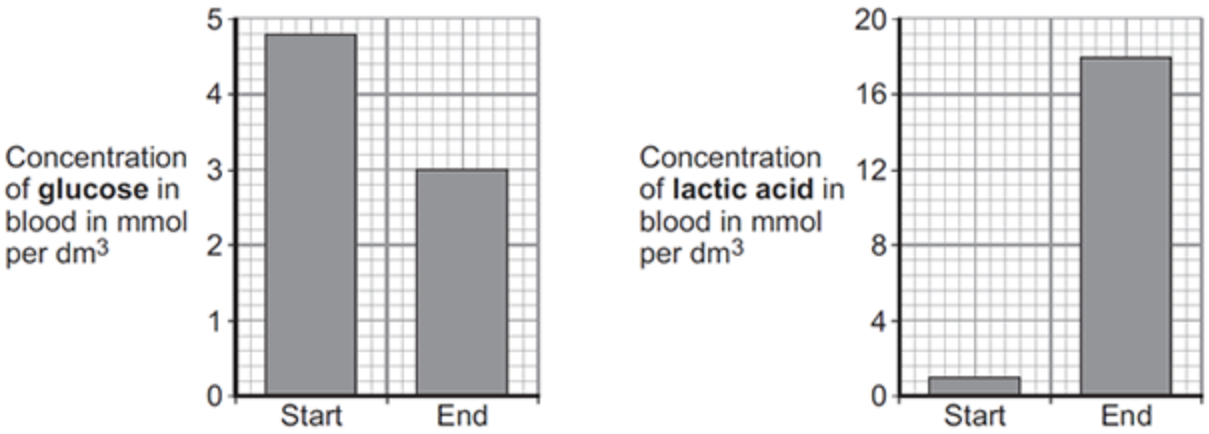
(1)

(Total 11 marks)

17. An athlete ran as fast as he could until he was exhausted.

(a) **Figure 1** shows the concentrations of glucose and of lactic acid in the athlete's blood at the start and at the end of the run.

Figure 1



(i) Lactic acid is made during anaerobic respiration.

What does anaerobic mean?

_____

_____

(1)

(ii) Give evidence from **Figure 1** that the athlete respired anaerobically during the run.

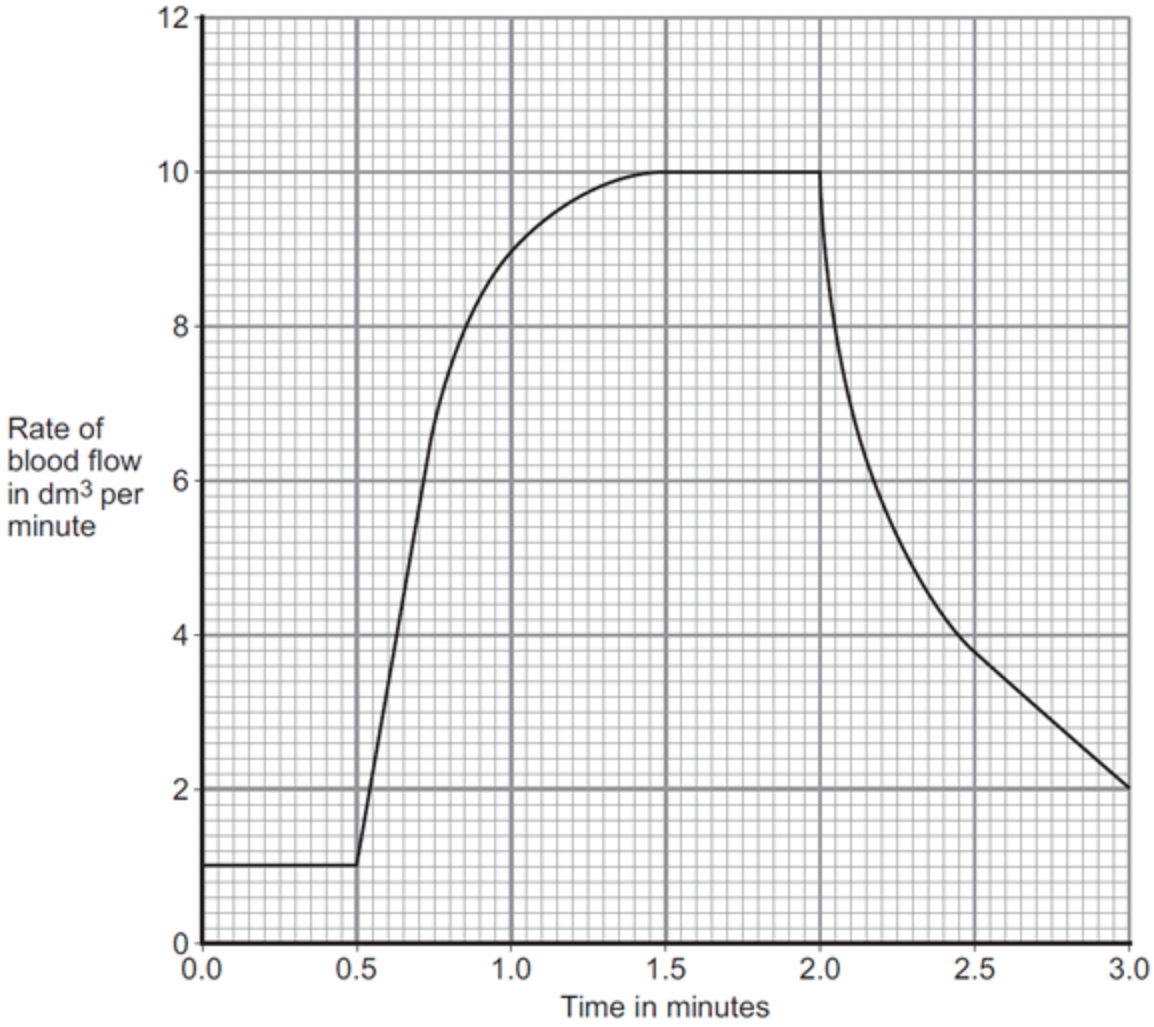
_____

_____

(1)

(b) **Figure 2** shows the effect of running on the rate of blood flow through the athlete's muscles.

Figure 2



(i) For how many minutes did the athlete run?

Time = _____ minutes

(1)

(ii) Describe what happens to the rate of blood flow through the athlete's muscles during the run.

Use data from **Figure 2** in your answer.

_____

_____

_____

_____

(2)

(iii) Explain how the change in blood flow to the athlete's muscles helps him to run.

(4)

(Total 9 marks)

1.

(a) (i) 64

1

(ii) 36

allow e.c.f from (i) i.e. 100 − answer given in (a)(i)

1

(iii) any **one** from:

- only considers 16-year-olds

  ignore lack of evidence

  allow does not refer to all ages
- only about some / 5 countries

  allow does not refer to all countries.

1

(b) the more exercise done the healthier a person is

allow the more exercise done the higher the health rating

allow the less exercise done the lower the health rating

1

(c) having a high cholesterol level

1

(d) (i) antibodies

1

(ii) antibiotics

1

[7]

2.

(a) (i) 18

1

(ii) Z

1

(b) (i) red blood cells

1

(ii) haemoglobin

1

[4]

3.

(a) blood has red (blood) cells / haemoglobin

1

<u>haemoglobin</u> combines with / carries oxygen

ignore 'mix'

***NB** Blood can form oxyhaemoglobin = **2** marks*

1

(b) blood gains oxygen / becomes oxygenated (in the lungs)

idea of acquiring oxygen must be unambiguous

1

blood loses oxygen to the muscles / cells

1

because muscles are respiring (aerobically)

1

to provide energy (for exercise)

1

[6]

4. (a) A aorta

ignore left and right

1

B ventricle

1

C atrium

allow atria

1

D vena cava

1

(b) (i) (coronary) artery

allow arteriole

1

(ii) stent / description

accept (coronary) by-pass operation

allow statins

allow diets low in cholesterol

allow balloon (angioplasty)

1

(iii) (stent) keeps artery open

must relate to (b)(ii)

1

or

ignore reference to capillary / vein

(by-pass) new blood vessel / vein connecting around narrowed region;

or

(statins / low cholesterol diet) remove some of the cholesterol blockage

or

(balloon) widens / opens the blood vessel

1

which allows (more) blood through or allows blood to go around the blockage

(c) (i) F artery

accept arteriole / branch of pulmonary artery

1

G capillary

1

H vein

H accept venule / branch of pulmonary vein;

1

(ii) F (Pulmonary artery) has <u>less</u> oxygen / <u>more</u> carbon dioxide / <u>more</u> glucose / sugar

accept F (Pulmonary artery) is deoxygenated

accept converse for H (Pulmonary vein)

'It' refers to F

1

[12]

5. (a) 5624

***allow 2 marks** for:*

- *correct HR = 148 **and** correct SV = 38 plus wrong answer / no answer*

or

- *only one value correct **and** ecf for answer*

***allow 1 mark** for:*

- *incorrect values **and** ecf for answer*

or

- *only one value correct*

3

(b) (i) **Person 2** has low(er) stroke volume / SV / described

*eg **Person 2** pumps out smaller volume each beat*

*do **not** allow **Person 2** has lower heart rate*

1

(ii) **Person 1** sends <u>more blood</u> (to muscles / body / lungs)

1

(which) supplies (more) oxygen

1

(and) supplies (more) glucose

1

(faster rate of) respiration **or** transfers (more) energy for use

ignore aerobic / anaerobic

allow (more) energy release

allow aerobic respiration transfers / releases more energy (than anaerobic)

*do **not** allow makes (more) energy*

1

removes (more) CO2 / lactic acid / heat

allow less oxygen debt

or less lactic acid made
or (more) muscle contraction / less muscle fatigue

if no other mark awarded,

allow person 1 is fitter (than person 2) for max 1 mark

1

[9]

6. (a) **A** artery

allow aorta

1

B ventricle

ignore references to left and right

1

C atrium

ignore references to left and right

allow atria

1

D vein

allow vena cava

1

(b) (i) stent

1

(ii) keeps (artery) open

1

so (more) blood can flow through

allow blood can flow (more) easily

ignore ref to blood clots

1

[7]

7.

A + B most effective (treatment)

ignore descriptions of LDL levels

1

D is (the most) effective (treatment)

D is the best single (treatment)

1

neither A nor B (alone) are effective

allow increase risk of heart disease instead of not effective

1

can't tell if C is effective

OR

A + C is not effective

1

[4]

8.

(a) A

no mark - can be specified in reason part

if B given - no marks throughout

if unspecified + 2 good reasons = 1 mark

high(er) pressure in A

allow opposite for B

*do **not** accept 'zero pressure' for B*

pulse / described in A

accept fluctuates / 'changes'

allow reference to beats / beating

ignore reference to artery pumping

2

(b) (i) 17

1

(ii) 68

accept correct answer from student's (b)(i) × 4

1

(c) oxygen / oxygenated blood

allow adrenaline

ignore air

glucose / sugar

extra wrong answer cancels - eg sucrose / starch / glycogen / glucagon / water

allow fructose

ignore energy

ignore food

2

[6]

9. (a) (i) muscular

1

(ii) **7**

1

(iii) an electrical device

1

(b) (i) in sequence:

5

1

7

1

2

1

(ii) **3**

1

(c) (i) prevent backflow (of blood) / allow flow in only one direction / in the correct direction

1

(ii) **A**

*no mark, but max **2** marks if incorrect*

2 / atrium contracts / pressure in **2** increases

1

<u>blood</u> <u>pushes</u> ball (down / towards ventricle / towards **5**)

allow this point even if valve in wrong part of heart

1

(opens valve which) allows blood into **5** / ventricle

***or** converse points re closing the valve*

1

(d) (i) involvement of <u>platelets</u> / eg <u>platelets</u> 'trigger' clotting process / release enzyme(s) / release 'clotting factors'

1

fibrinogen to fibrin
or
meshwork formed (which traps blood cells)

1

(ii) any **four** from:

*to gain **4** marks candidates should include at least:*

***one** advantage and **one** disadvantage*

Advantages

(improved circulation / O_2 supply) provides:

- <u>more</u> cell respiration
- <u>more</u> energy released
- (more) active life / not so tired / more physical activity

Disadvantages

- danger of surgery / operation
- infection from surgery / operation
- valve may need replacing
- clots may form and block blood vessels

  may need to take anti-coagulants – eg warfarin
- clots may cause heart attacks / strokes

4

[17]

10. (a) (i) defence against **or** destroy pathogens / bacteria / viruses / microorganisms

*do **not** allow 'destroy disease'*
accept engulf pathogen / bacteria / viruses / microorganism
accept phagocytosis
accept produce antibodies / antitoxins
allow immune response

1

(ii) they are small fragments of cells

1

(b) liver

in this order only

1

kidney(s)

1

(c) any **two** from:

- that it doesn't cause an immune response **or** isn't rejected / damaged by white blood cells
- whether it is a long lasting material / doesn't decompose / corrode / inert
- if it is strong (to withstand pressure)
- it will open at the right pressure
- that it doesn't cause clotting
- that it doesn't leak **or** it prevents backflow
- non toxic

ignore correct size

2

[6]

11. (a) any **two** from:

- carbon dioxide / CO_2
- urea
- protein
- water / H_2O
- hormones / insulin.

ignore food / waste / alcohol / drugs / enzymes

ignore glucose and oxygen

*allow **two** correct hormones for 2 marks*

*allow **two** correct food components for 2 marks*

allow antibodies

allow antitoxins

2

(b) (i) plasma

1

platelets

1

(ii) (cardiac) muscle

allow muscular

1

(c) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking Guidance and apply a 'best-fit' approach to the marking.

0 marks
No relevant content

Level 1 (1−2 marks)
There is a description of at least one advantage of the cow tissue valve
or
a description of at least one disadvantage of the cow tissue valve.

Level 2 (3−4 marks)
There is a description of at least one advantage of the cow tissue valve
and
at least one disadvantage of the cow tissue valve.

Level 3 (5−6 marks)
There is a description of the advantages and disadvantages of the cow tissue valve
or
a description of several advantages of the cow tissue valve and at least one disadvantage.

Examples of the points made in the response

Advantages of cow tissue valve:

- abundant supply of cows
- so shorter waiting time

  ignore can take many years to find a suitable human donor
- no need for tissue typing
- quicker operation
- less invasive **or** shorter recovery time
- cheaper operation costs
- less operation / anaesthetic risks.

Disadvantages of cow tissue valve:

- made from cow so possible objections on religious grounds

  ignore ethical arguments
- new procedure so could be unknown risks

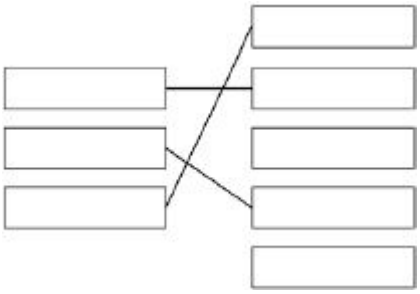
  allow possible transfer of disease from cow
- risks of using a stent eg. blood clots, stent breaking or valve tearing
- not proven as a long term treatment
- may be rejected

  ignore information copied directly from the table without value added.

6

[11]

12. (a)



additional line from a blood component negates the mark for that component

1
1
1

(b) C

1

(c) (vessel) B

thick walls **or** thick muscle / elastic tissue

*do **not** accept ref to 'cell walls'*

1

or
lumen is small / narrow

allow description of 'lumen'

1

(d) 95

1

(e) (because coronary) arteries / they are narrower

allow (because the coronary) arteries are blocked / clogged (with fat)

1

(f) 250 × 60 (= 15 000)

or
15 000

allow 0.25 × 60

1

15

$$\text{allow } \frac{\text{answer to marking point 1}}{1000}$$

an incorrect conversion to dm^3 in calculation does not negate marking point 1

1

*an answer of 15 scores **2** marks*

(g) any **two** from:

- no need to stay as long in hospital (after procedure) **or** can go home sooner / same day

  allow only need to stay 2–3 hours in hospital (after procedure)
  allow less scarring
  allow less chance of infection
  allow only a small cut needed

- not as / less invasive **or** no need for a major operation **or** no need for general anaesthetic
- shorter recovery time **or** can get back to normal lifestyle quicker **or** less time needed off work

  allow only 7 days recovery

- lower risk of a heart attack (during procedure)

  ignore reference to cost
  ignore idea that it takes less time overall

2

(h) lower chance of failure (within one year)

allow only a 5% chance of failure

1

only need one operation to treat multiple blockages **or** can treat multiple blockages at one time

ignore ref to anaesthetic or CABG being a long-term treatment

1

[14]

13. (a) (i) doesn't have valves

allow veins have valves

1

has a thicker wall **or** thicker layer of muscle

allow has a smaller lumen

ignore references to elastic (in walls)

1

(ii) any **two** from:

- (artery has) more oxygen
- (artery has) more glucose

  allow (artery has) more amino acids / fatty acids
- (artery has) less carbon dioxide
- (artery has) less lactic acid

  ignore urea

  ignore reference to pressure

  accept converse for veins if veins is clearly stated

2

(b) any **two** from:

- no rejection
  allow no tissue matching required
- abundant supply
- low risk of infection
  allow named example ie HIV, CJD
- longer shelf life
  allow less space needed for storage
  ignore side effects

2

[6]

14. (a) (i) any **one** from:

- glucose
- oxygen
- carbon dioxide
- urea
- water

allow hormones

allow named example of a product of digestion

1

(ii) (cardiac) muscle

allow muscular

1

(b) (i) **B**

1

(ii) **D** atrium / atria

ignore references to left or right

1

E ventricle(s)

ignore references to left or right

1

(c) (i) a vein

1

(ii) an artery

1

(iii) keeps artery open / wider

allow ecf from part cii

1

(so) blood / oxygen can pass through (to the heart muscle)

1

[9]

15. (a) vena cava

1

(b) 0.5 mm = 0.05 cm

1

time = $\frac{10.00 - 0.05}{0.4}$

allow alternative correct substitution

1

24.875

1

25 (s)

*an answer of 25 (s) scores **4** marks*

*allow 24 for **3** marks (no conversion of mm to cm)*

*allow 23.8 / 23.75 for **2** marks (no conversion of mm to cm and incorrect sf)*

1

(c) (blood) travels through (the) pulmonary vein

1

(blood) enters left atrium

1

(blood) enters (the) left ventricle

1

(blood) leaves the heart via / through (the) aorta

allow blood travels through arterioles

allow blood (travels round the body and) reaches the cells / tissues via / in capillaries

1

ignore ref to valves / systole / diastole throughout

(d) **Level 3 (5-6 marks):**
Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

Level 2 (3-4 marks):
Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

Level 1 (1-2 marks):
Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

No relevant content (0 marks)

Indicative content

S = structural F = functional

- (S) both have a large surface area
- (S) villi have many microvilli
- (S) alveolar walls are not flat / are folded

- (F) to maximise diffusion (of gases) / absorption of (food) molecules

- (S) both have many capillaries / good blood supply / capillaries near the surface
- (F) to maintain concentration / diffusion gradient

- (S) both have thin walls / walls that are one cell thick / one cell thick surface
- (F) to provide a short diffusion distance (for molecules to travel)

- (S) villi have many mitochondria
- (F) to provide energy for active transport (of food molecules)

- (S) cells of the villi have microvilli / more projections
- (F) to further increase the surface area / increase the number of proteins in the membrane / to allow more active transport to take place

[15]

16. (a) ventricle

1

(b) lungs

1

(c) valve circled on heart

1

(d) no fatty deposit

1

healthy artery is wider / bigger hole / has more blood flow

1

(e) statins

1

stent

1

(f) any **two** from:

- smoking
- high-fat diet
- lack of exercise

allow:

- *overweight / obese*
- *having high blood pressure*
- *having high cholesterol*

2

(g) 8 (%)

1

(h) more males have coronary heart disease than females

1

[11]

17. (a) (i) without <u>oxygen</u>

allow not enough oxygen

ignore air

ignore production of CO_2

ignore energy

1

(ii) more / high / increased lactic acid (at end)

allow approximate figures (to show increase)

ignore reference to glucose

1

(b) (i) 1.5

allow only 1.5 / 1½ / one and a half

1

(ii) increases at first **and** levels off

ignore subsequent decrease

1

suitable use of numbers eg

rises to 10 / by 9 (dm^3 per min)

or

increases up to 1.5 (min) / levels off after 1.5 (min) (of x axis timescale)

allow answer in range 1.4 to 1.5

or

after the first minute (of the run)

1

(iii) supplies (more) oxygen

1

supplies (more) glucose

1

need 'more/faster' once only for full marks

*allow removes (more) CO_2 / lactic acid / heat as an alternative for either marking point one **or** two, **once** only*

for (more) respiration

1

releases (more) energy (for muscle contraction)

*do **not** allow energy production or for respiration*

1

[9]