EXAM PAPERS PRACTICE

Mass Transport Pack

These practice questions can be used by students and teachers and is

Suitable for AQA A Level 7402 Biology Topic Question

Level: AQA A LEVEL 7402

Subject: Biology

Exam Board: AQA A Level 7402

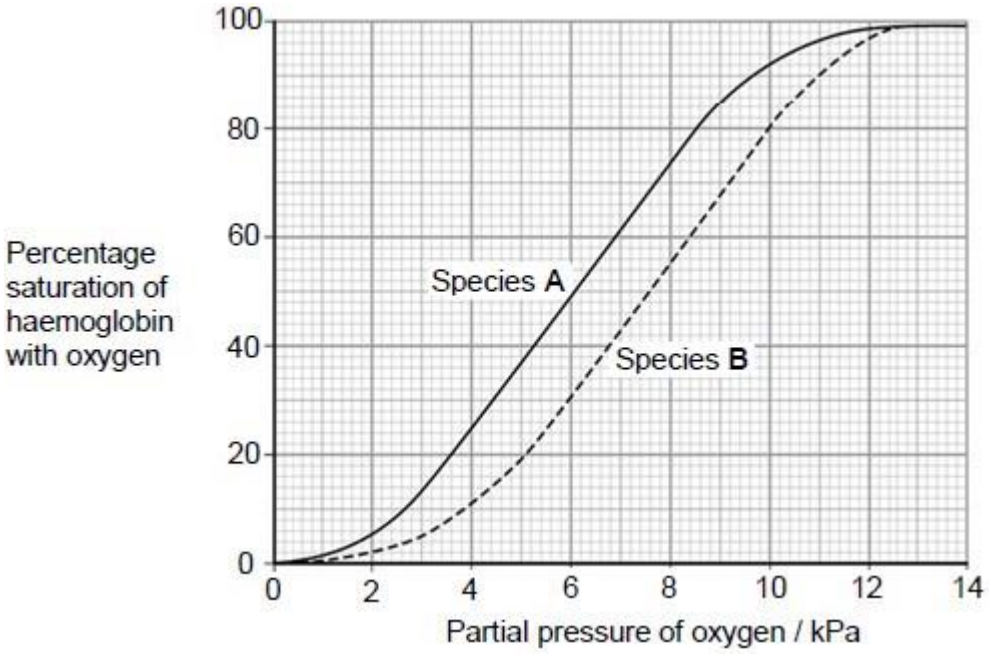
Topic: Mass Transport Pack

1 (a) Explain **four** ways in which the structure of the aorta is related to its function.

(4)

Figure 1 shows the oxyhaemoglobin dissociation curves for two different species, **A** and **B**.

Figure 1

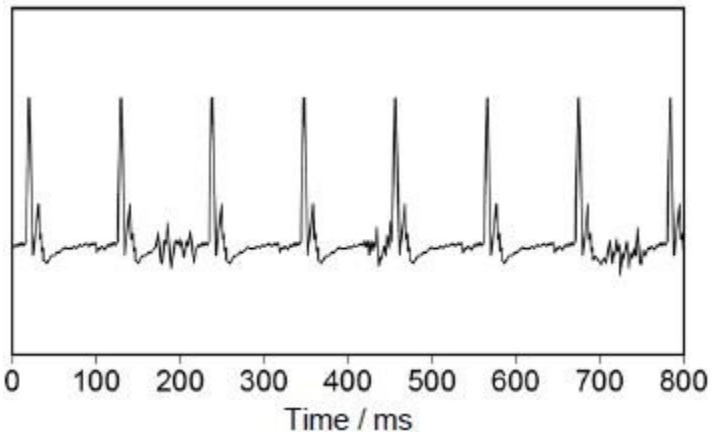


(b) Species **B** is more active than species **A**. Use **Figure 1** to explain how the haemoglobin of species **B** allows a greater level of activity.

(4)

(c) An electrocardiogram (ECG) shows the electrical activity of the heart. **Figure 2** shows an ECG for an animal of species **B** at rest. Each large spike represents a contraction of the ventricles.

Figure 2



For species **B**, the mean volume of blood leaving the left ventricle during each contraction is 0.03 cm^3.

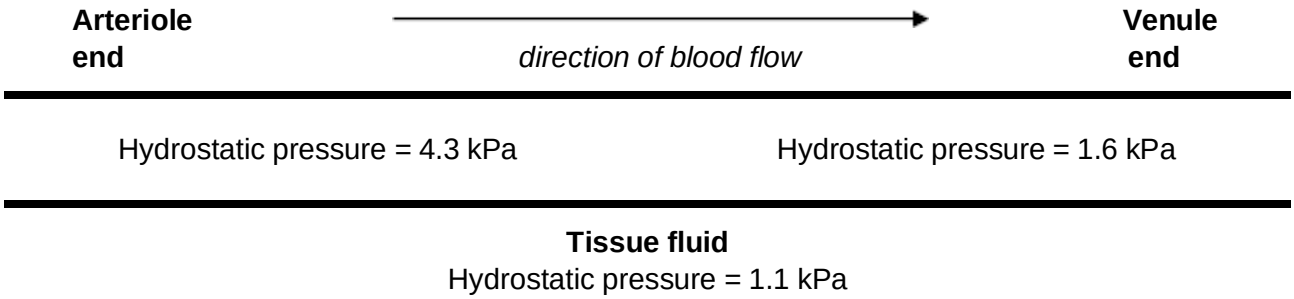
Calculate the mean volume of blood leaving the left ventricle per minute.

Volume of blood = _____ cm^3 $minute^{-1}$

(2)

(Total 10 marks)

2 The figure below represents a capillary surrounded by tissue fluid.
The values of the hydrostatic pressure are shown.



(a) Use the information in the figure above to explain how tissue fluid is formed.

_____

_____

_____

_____

(2)

(b) The hydrostatic pressure falls from the arteriole end of the capillary to the venule end of the capillary. Explain why.

_____

_____

(1)

(c) High blood pressure leads to an accumulation of tissue fluid. Explain how.

(Extra space)

(3)

(d) The water potential of the blood plasma is more negative at the venule end of the capillary than at the arteriole end of the capillary. Explain why.

(Extra space)

(3)

(Total 9 marks)

3 A student investigated the effect of body position on pulse rate.
The table below shows her processed results.

Body position	Pulse rate / beats per minute			
	Reading 1	Reading 2	Reading 3	Mean
Sitting	80	76	76	77
Standing	84	88	92	88
Lying down	68	72	68	69

The way the student recorded her pulse produced pulse rates per minute with even numbers.
Other than by chance, suggest why.

_____

_____

_____

(Total 1 mark)

4 A student determined their pulse rate when sitting down. Describe how they could have investigated whether their results were typical of all students of their age.

_____

_____

_____

_____

_____

_____

_____

[Extra Space] _____

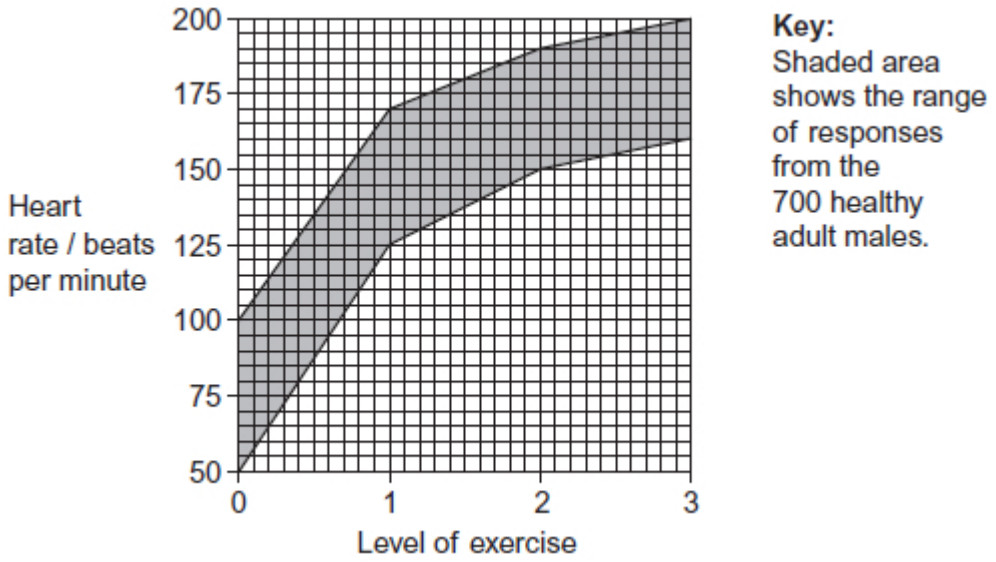
_____

_____

(Total 3 marks)

5 It is possible to test for signs of heart disease using an exercise test. This involves the patient doing a controlled period of exercise whilst their heart rate is monitored.

Scientists measured the heart rates of 700 healthy adult males aged between 25 and 54 before, during and after an exercise test. The test involved running on a treadmill at different speeds. Their results are shown in the graph below in the form in which they were presented.



(a) Suggest **two** variables the scientists would have controlled during the exercise test.

1 _____

2. _____

(2)

(b) Calculate the ratio of the range of heart rates at exercise level 3 and exercise level 1.

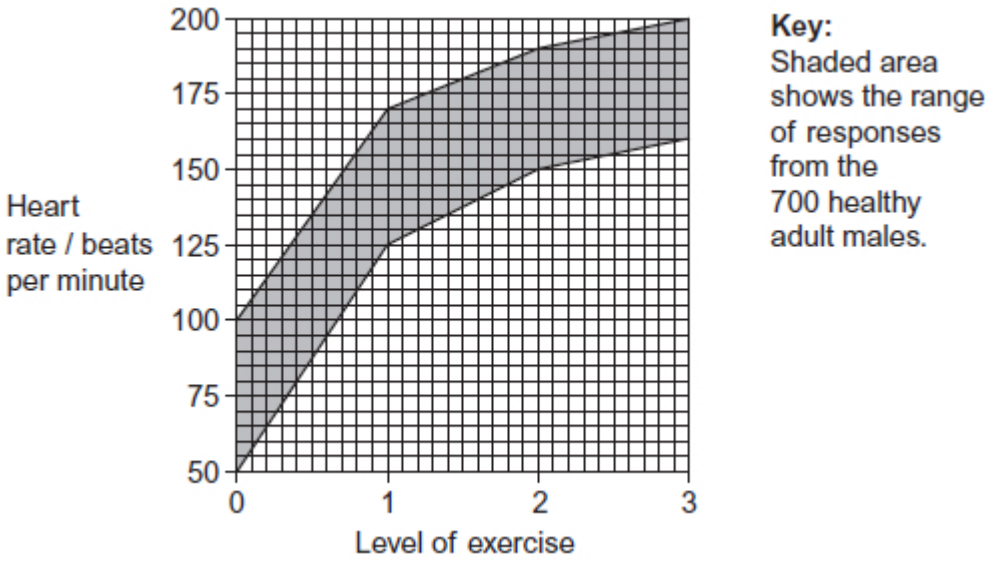
Answer = _____ : 1

(2)

(Total 4 marks)

6 It is possible to test for signs of heart disease using an exercise test. This involves the patient doing a controlled period of exercise whilst their heart rate is monitored.

Scientists measured the heart rates of 700 healthy adult males aged between 25 and 54 before, during and after an exercise test. The test involved running on a treadmill at different speeds. Their results are shown in the graph below in the form in which they were presented.



The data in the graph above can be used as a reference for doctors when assessing a patient for heart disease.

(a) The data in the graph above do not provide helpful information for all groups of patients. Give **two** groups of patients to which these data could **not** be applied.

1 _____

_____

2. _____

_____

(1)

(b) The guidelines for using an exercise test for assessment contain the following statements.

1. Ideally, patients should stop taking any medications for a period of time before the test.
2. In reality, most patients will need to continue taking their medications.

Suggest an explanation for each of these statements.

Statement 1 _____

_____

_____

Statement 2 _____

_____

_____

(2)

(Total 3 marks)

7 The artery leaving the left ventricle is the aorta. One form of heart disease is aortic valve disease (AVD). In this disease, the valve (the aortic valve) between the left ventricle and the aorta opens normally but only partly closes. This means that when the ventricle relaxes some blood flows back into the ventricle from the aorta.

Severe AVD can be treated by replacing the aortic valve.

A surgeon investigated the effect of this treatment,

- He replaced the aortic valves of 19 patients with valves removed from donors who had recently died.
- The valves from donors were stored in an isotonic antibiotic solution before use.
- He recorded the maximum pressure reached in an artery (as the ventricles contract) and minimum pressure in the artery (as the ventricles relax) in each patient before and after valve replacement surgery.

His results are shown in **Table 1**.

Table 1

	Mean maximum pressure reached in the artery / kPa (± standard deviation)	**Mean minimum pressure reached in the artery / kPa (± standard deviation)**
Before surgery	21.7 (±3.5)	4.8 (±2.5)
After surgery	18.2 (±2.2)	11.0 (±1.1)

This investigation involved 19 patients.

- The mean age was 36 years (standard deviation ±17 years).
- The mean time after surgery that pressure readings were taken was 7 months (standard deviation ±5 months).

Table 2 shows the normal range of values of pressure in this artery in the UK.

Table 2

Pressure	Range of pressures / kPa
Maximum	12.0 to 18.5
Minimum	8.0 to 11.9

Aortic valves removed from donors were stored in isotonic solution containing an antibiotic before being used in valve replacement surgery.

(a) Explain why the valves were stored in an **isotonic** solution.

_____

_____

_____

_____

_____

(2)

(b) Explain why the valves were stored in a solution containing an antibiotic.

_____

_____

_____

(1)

(c) There was a significant increase in the minimum blood pressure in the artery after valve replacement surgery.
Explain why the valve replacement surgery had this effect.

_____

_____

(1)

(d) The surgeon concluded that there was sufficient evidence for him to continue using this treatment.

How does the information above support his conclusion?

[Extra Space]

(3)

(e) How does the information above **not** support his conclusion?

(2)

(f) From the data in **Table 1** it is **not** possible to determine the highest pressure measured. Explain why.

(1)

(Total 10 marks)

8 In a healthy person, blood moves in one direction as it passes through the heart. Give **two** ways in which this is achieved.

1. _____

_____

_____

2. _____

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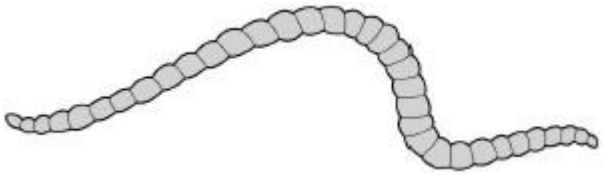
_____

(Total 2 marks)

9 Tubifex worms are small, thin animals that live in water. They have no specialised gas exchange or circulatory system.

The figure below shows a tubifex worm.



(a) Name the process by which oxygen reaches the cells inside the body of a tubifex worm.

_____

(1)

(b) Using the information provided, explain how **two** features of the body of the tubifex worm allow efficient gas exchange.

1. _____

_____

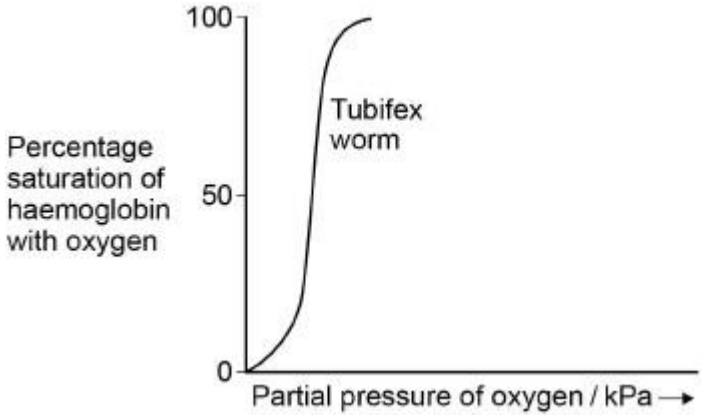
2. _____

_____

(2)

(c) Most species of tubifex worms live at the bottom of ponds, lakes and rivers where the partial pressure of oxygen is low. Pollution of water by sewage can cause the partial pressure of oxygen to fall below 0.2 kPa.

The graph shows the oxyhaemoglobin dissociation curve for a species of tubifex worm found in a river polluted with sewage.



The species of tubifex worm in the graph has 50% saturation of their haemoglobin with oxygen at 0.08 kPa.

Explain how this enables this species to survive in water polluted with sewage.

_____

_____

_____

_____

_____

(2)

(d) Species of tubifex worm that live in ponds, lakes and rivers **cannot** survive in seawater.

Use your knowledge of water potential to explain why they cannot survive in seawater.

_____

_____

_____

_____

(2)

(Total 7 marks)

10 The table shows the volume of blood in a woman's left ventricle at different times during **one** second.

Time / seconds	Volume of blood in left ventricle / cm^3
0.0	112
0.1	120
0.2	95
0.3	65
0.4	50
0.5	55
0.6	82
0.7	90
0.8	100
0.9	112
1.0	120

(a) Use the data in the table to calculate the heart rate in beats per minute.

Tick (✓) **one** box next to the correct answer.

60 ☐

66.7 ☐

75 ☐

85.7 ☐

(1)

(b) The stroke volume is the volume of blood pumped out of the left ventricle during one cardiac cycle.

Use the table above to determine the stroke volume.

Stroke volume = _____ cm^3

(1)

(c) Some people produce a much higher ventricular blood pressure than normal. This can cause tissue fluid to build up outside the blood capillaries of these people.

Explain why.

_____

_____

_____

_____

_____

(2)

(d) Some drugs used to reduce high ventricular blood pressure cause widening of blood vessels.

Suggest how widening of blood vessels can reduce ventricular blood pressure.

_____

_____

_____

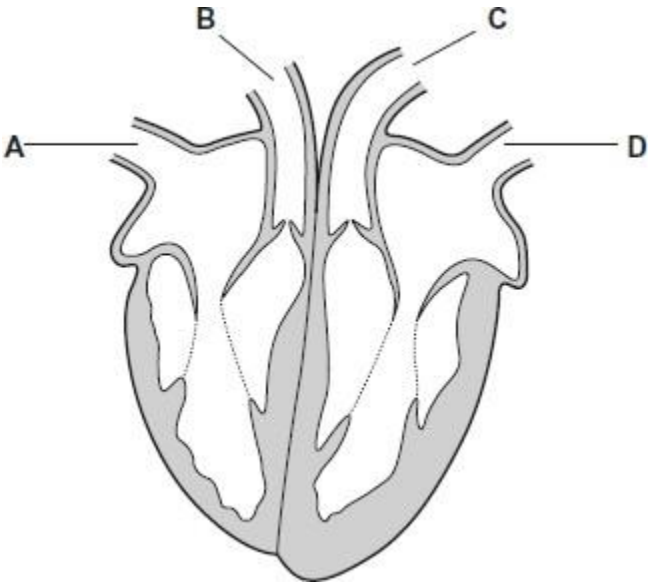
_____

_____

(2)

(Total 6 marks)

11 The diagram shows a section through the heart. The main blood vessels are labelled **A**, **B**, **C** and **D**.



(a) Write a letter, **A**, **B**, **C** or **D**, in the box to represent the correct blood vessel.

(i) Which blood vessel carries oxygenated blood away from the heart?

(1)

(i) Which blood vessel carries deoxygenated blood to the heart?

(1)

(b) Explain how the highest blood pressure is produced in the left ventricle.

(1)

(c) Some babies are born with a hole between the right and the left ventricles.

These babies are unable to get enough oxygen to their tissues.
Suggest why.

_____

_____

_____

_____

_____

(2)

(Total 5 marks)

12 Haemoglobin is a protein. It is made of two alpha polypeptides and two beta polypeptides. Each alpha polypeptide has 141 amino acids and each beta polypeptide has 146 amino acids.

(a) What term is used to describe the structure of a protein made of two or more polypeptides?

_____

(1)

(b) Calculate the minimum number of DNA bases needed to code for the number of amino acids in one alpha polypeptide.

Answer = _____

(1)

(c) Describe the role of haemoglobin in supplying oxygen to the tissues of the body.

_____

_____

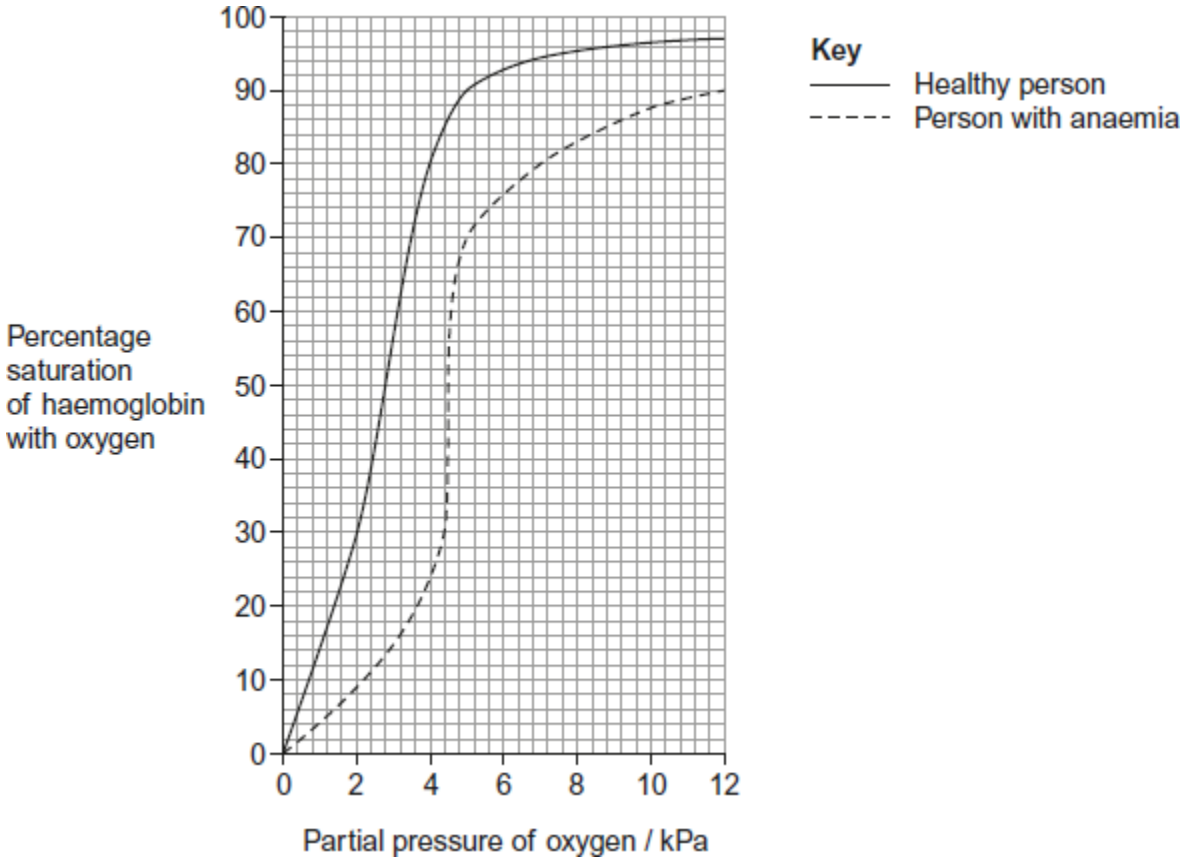
_____

_____

(2)

Anaemia is a condition in which there is a decrease in the concentration of haemoglobin in blood. In some people with anaemia, substances are produced which change the oxygen dissociation curve of haemoglobin.

The graph shows the effect of these substances on the oxygen dissociation curve of haemoglobin.



(d) (i) Use information in the graph to find the difference in the percentage saturation of haemoglobin with oxygen between a healthy person and a person with anaemia at a partial pressure of oxygen of 4 kPa.

Answer = _____

(1)

(ii) Explain the advantage to a person with anaemia of the change shown in the oxygen dissociation curve.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 8 marks)

13 In mammals, the mesenteric artery connects the aorta to blood vessels of the small intestine.

Sport scientists recorded increases in blood flow in the mesenteric artery after different types of meal. The types of meal were:

- carbohydrate only
- fat only
- protein only.

Typical results are shown in the table.

Type of meal	**Maximum percentage increase in blood flow in mesenteric artery**	**Time taken to reach maximum increase in blood flow in mesenteric artery / minutes**
Carbohydrate only	64	15
Fat only	60	30
Protein only	57	45

(a) The sport scientists concluded that the three types of meal had no major effect on maximum percentage increase in blood flow in the mesenteric artery.

What else can be concluded from their results?

_____

_____

_____

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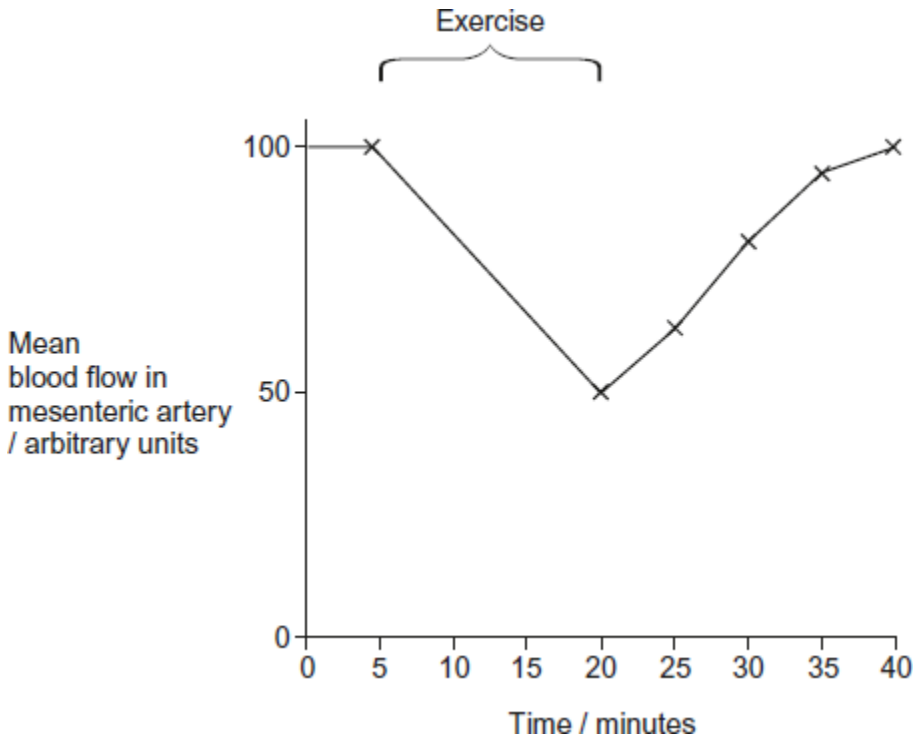
_____

(2)

In another investigation, the sport scientists recorded blood flow in the mesenteric artery before and after vigorous exercise.

The graph shows their results for a large group of volunteers.



(b) Suggest the advantage of the change in blood flow in the mesenteric artery during exercise.

(3)

(c) The sport scientists concluded people should **not** do vigorous exercise after a meal. Does the information from the table and the graph support this conclusion?

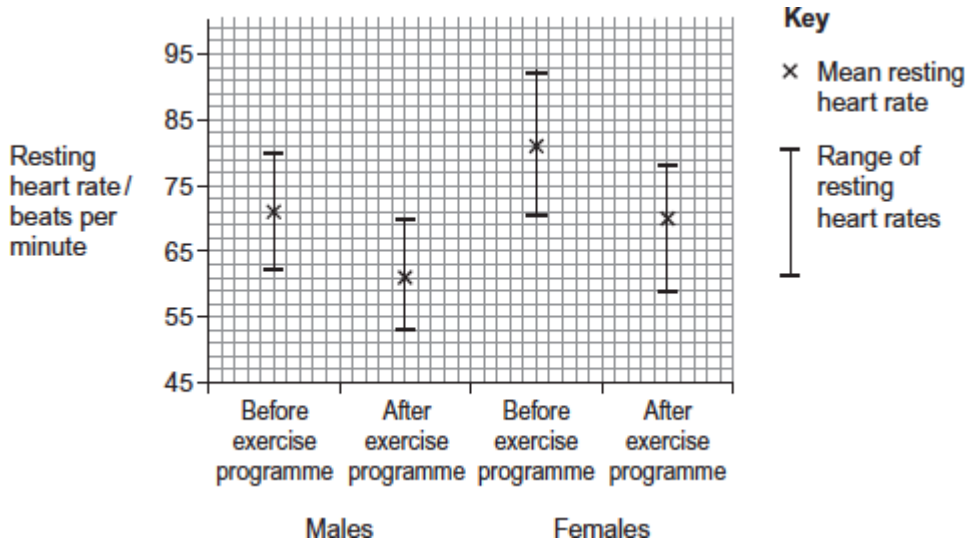
(4)

(Total 9 marks)

14 Scientists investigated the effect of a 6-week exercise programme on the resting heart rate of males and females.

The scientists recruited a large group of male volunteers and a large group of female volunteers. They measured the resting heart rate of each volunteer before the exercise programme. Both groups took part in the same exercise programme. The scientists measured the resting heart rate of each volunteer after the exercise programme.

The scientists determined the mean resting heart rate and the range of resting heart rates for each group before and after the exercise programme. The graph shows their results.



(a) What was the range of the resting heart rates in males after the exercise programme?

_____

(1)

(b) Calculate the percentage decrease in the mean resting heart rate of females after the exercise programme. Show your working.

Answer = _____ %

(2)

(c) The scientists used the percentage change in the mean resting heart rate after the exercise programme to compare the results for males and females.

Explain why they used percentage change in the resting heart rate.

(2)

(d) The scientists calculated the cardiac output of the volunteers before and after the exercise programme. In some volunteers, their cardiac output stayed the same, even though their resting heart rate decreased.

Explain how their cardiac output could stay the same even when their resting heart rate had decreased.

(2)

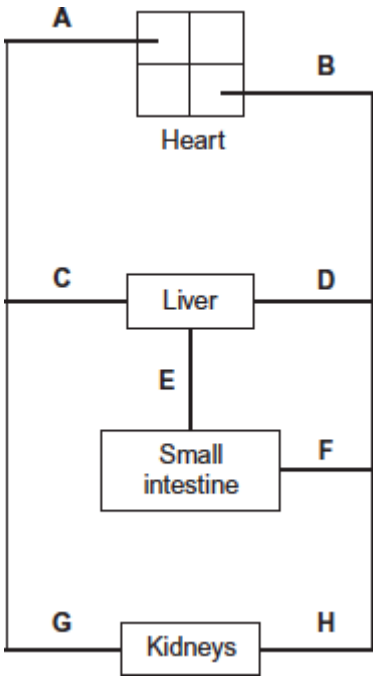
(Total 7 marks)

15 (a) What is the function of the coronary arteries?

(2)

(b) **Figure 1** shows some of the large blood vessels in a mammal.

Figure 1



(i) Which of the blood vessels **A** to **H** is the vena cava?

☐

(1)

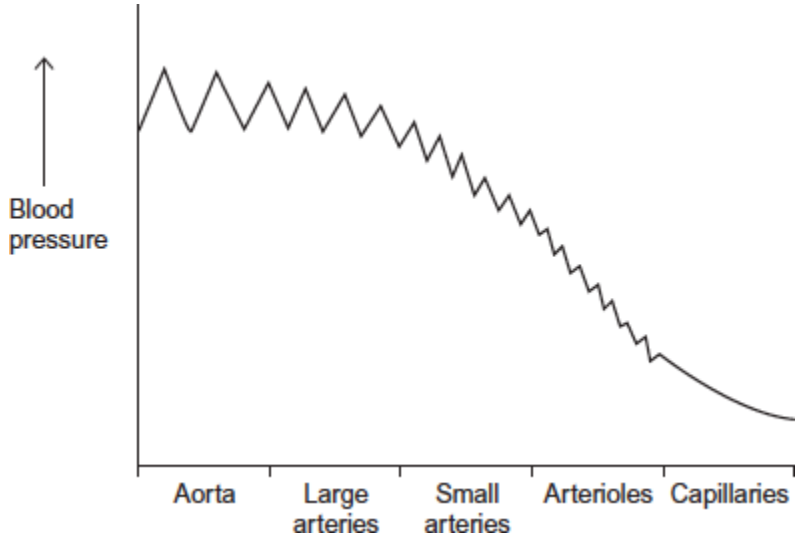
(ii) Which of the blood vessels **A** to **H** is the renal artery?

☐

(1)

(c) **Figure 2** shows how the blood pressure changes as blood travels from the aorta to the capillaries.

Figure 2



The rise and fall in blood pressure in the aorta is greater than in the small arteries.Suggest why.

[Extra space]

(3)

(Total 7 marks)

16 The mean internal diameter and the mean speed of blood flow for different human blood vessels are shown below in the table.

Blood vessel	Mean internal diameter / mm	Mean speed of blood flow / mm s^{-1}
Aorta	35	470
Coronary artery	4	380
Arteriole	0.03	110
Capillary	0.001	15
Vena cava	20	270

(a) Although the speed of blood flow in an arteriole is greater than speed of blood flow in a capillary, blood does **not** accumulate in the arterioles.

Explain why.

_____

_____

_____

(1)

(b) Other than causing slow blood flow, explain **one** advantage of capillaries being narrow.

_____

_____

_____

_____

(2)

(c) What factor limits the minimum internal diameter of the lumen of a capillary?

_____

_____

_____

(1)

(d) The volume of blood leaving the capillary network into the veins is less than the volume of blood entering from the arteries.

Explain why.

_____

_____

_____

(1)

(Total 5 marks)

17 A principle of homeostasis is the maintenance of a constant internal environment. An increase in the concentration of carbon dioxide would change the internal environment and blood pH. Explain the importance of maintaining a constant blood pH.

_____

_____

_____

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_____

[Extra space] _____

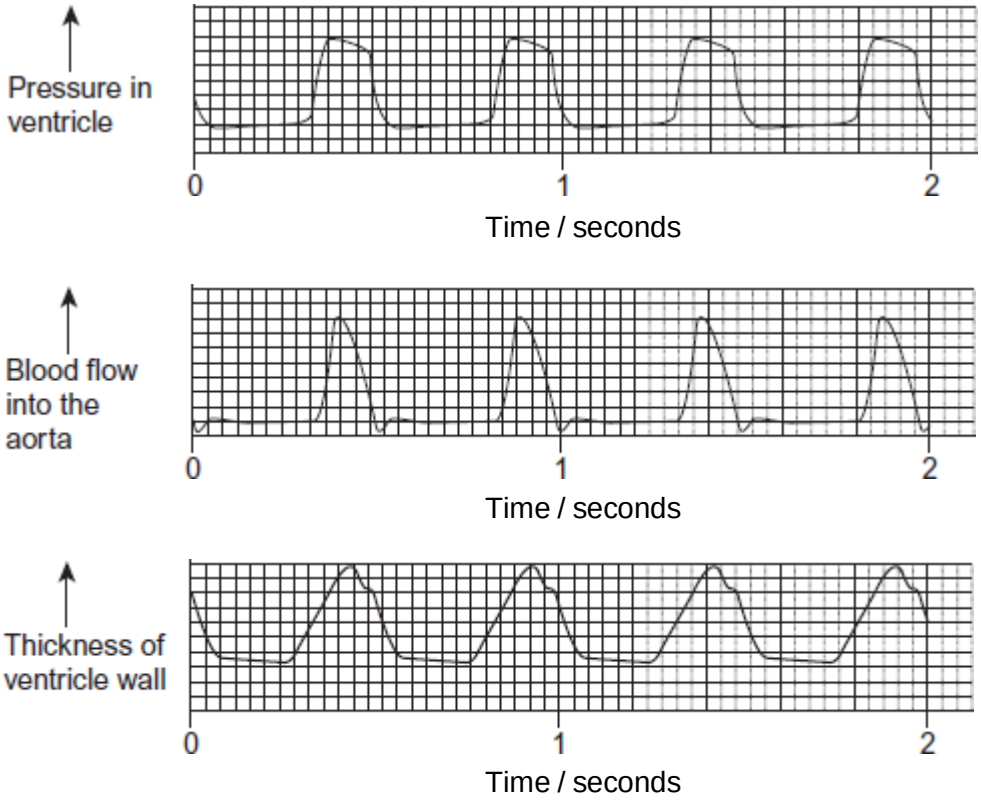
_____

_____

_____

(Total 3 marks)

18 The figure below shows recordings made from the heart of a dog.



(a) Use information from the figure to explain how the pressure in the dog's ventricle is related to blood flow into the aorta.

_____

_____

_____

_____

*(Extra space)*_____

_____

(2)

(b) Use information from the figure to explain how the pressure in the dog's ventricle is related to the thickness of the ventricle wall.

_____

_____

_____

_____

(Extra space) _____

_____

(2)

(c) Use the figure to calculate the heart rate of the dog in beats per minute.
Show your working.

Heart rate _____ beats per minute

(2)

(Total 6 marks)

19 (a) The oxygen dissociation curve for haemoglobin shifts to the right during vigorous exercise.
Explain the advantage of this shift.

_____

_____

_____

_____

_____

_____

(3)

(b) Weddell seals are diving mammals that live in cold environments. A Weddell seal is shown in **Figure 1**.

Figure 1

By Jerzystrzelecki (own work)
[CC BY 3.0] via Wikimedia Commons

(i) Explain how the body shape of a Weddell seal is an adaptation to living in a cold environment.

_____

_____

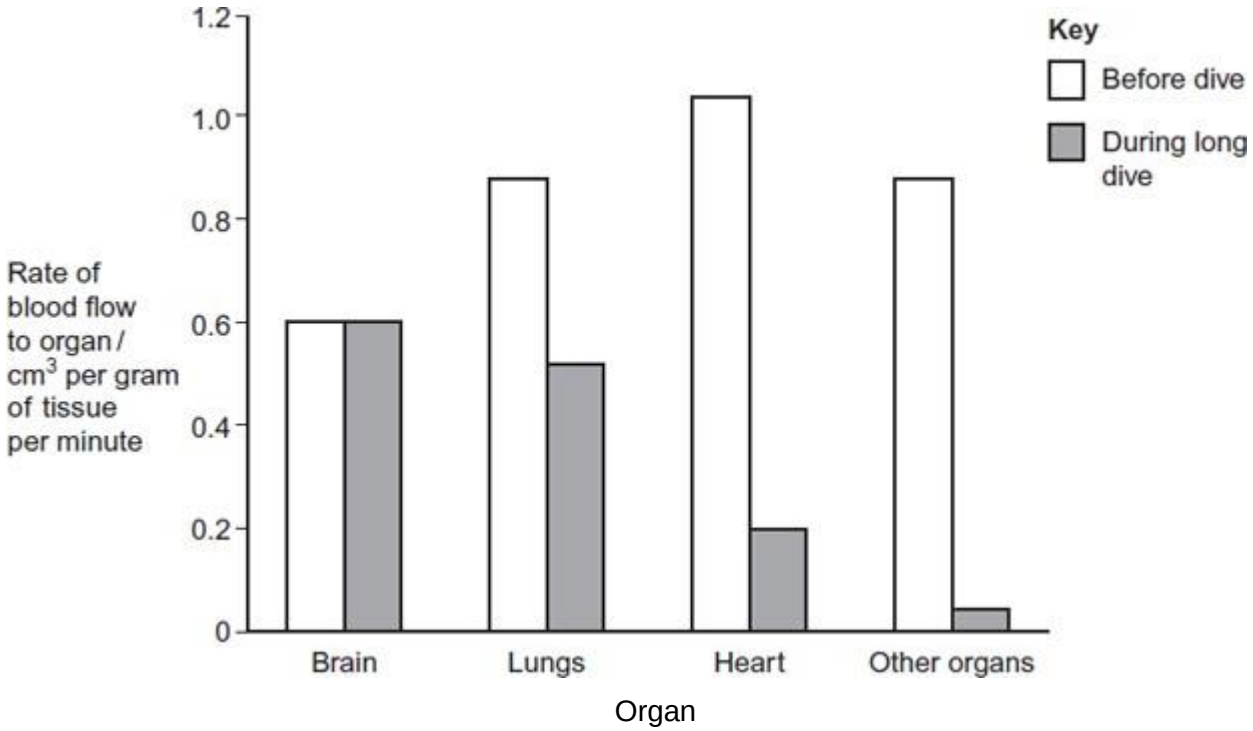
_____

_____

(2)

(ii) Weddell seals can remain underwater for long periods of time. **Figure 2** shows the rate of blood flow to different organs of a Weddell seal before a dive and during a long dive.

Figure 2



Describe and explain the changes in the rate of blood flow to the different organs during a long dive.

_____

_____

_____

_____

_____

_____

(Extra space) _____

_____

_____

(3)

(Total 8 marks)

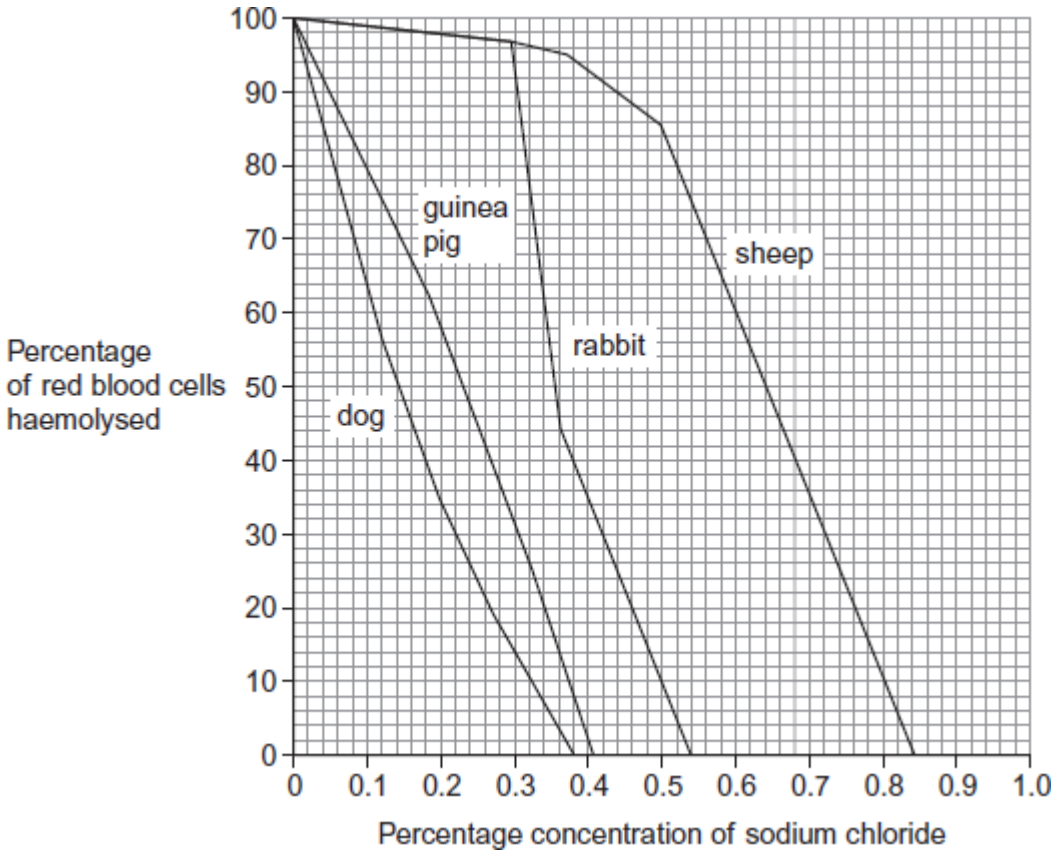
20 If red blood cells are placed in pure water, water enters the cells by osmosis and they burst. This is called haemolysis. As red blood cells burst they release pigment.

Scientists placed samples of red blood cells in different concentrations of sodium chloride solution for the same period of time. They used red blood cells from four different mammals: dog, guinea pig, rabbit and sheep.

If haemolysis had taken place, the solution turned red. The scientists measured the intensity of the red colour using a colorimeter. The more intense the red colour, the greater the amount of haemolysis.

The scientists calculated the percentage of red blood cells that were haemolysed in each sodium chloride solution.

The following figure shows the scientists' results.



(a) Use the figure to give **two** differences between the results for dog and sheep.

Difference 1 _____

_____

Difference 2 _____

_____

(2)

(b) Calculate the difference in the percentage of haemolysed cells between sheep and rabbit at a sodium chloride concentration of 0.5%.

_____

(1)

(c) Explain the relationship between the depth of the red colour of the solution and how much haemolysis has taken place.

_____

_____

_____

_____

_____

(2)

(d) During treatment in a veterinary surgery, any of the mammals in the figure above may be given an infusion of sodium chloride solution directly into a vein. The concentration of sodium chloride solution used is 0.9%, rather than 0.5%, regardless of the species of mammal.

Explain the advantage to the vet of using this concentration.

_____

_____

_____

_____

(Extra space) _____

_____

_____

(2)

(Total 7 marks)

21 (a) Describe how a heartbeat is initiated and coordinated.

(5)

(b) Explain how the heart muscle and the heart valves maintain a one-way flow of blood from the left atrium to the aorta.

(5)

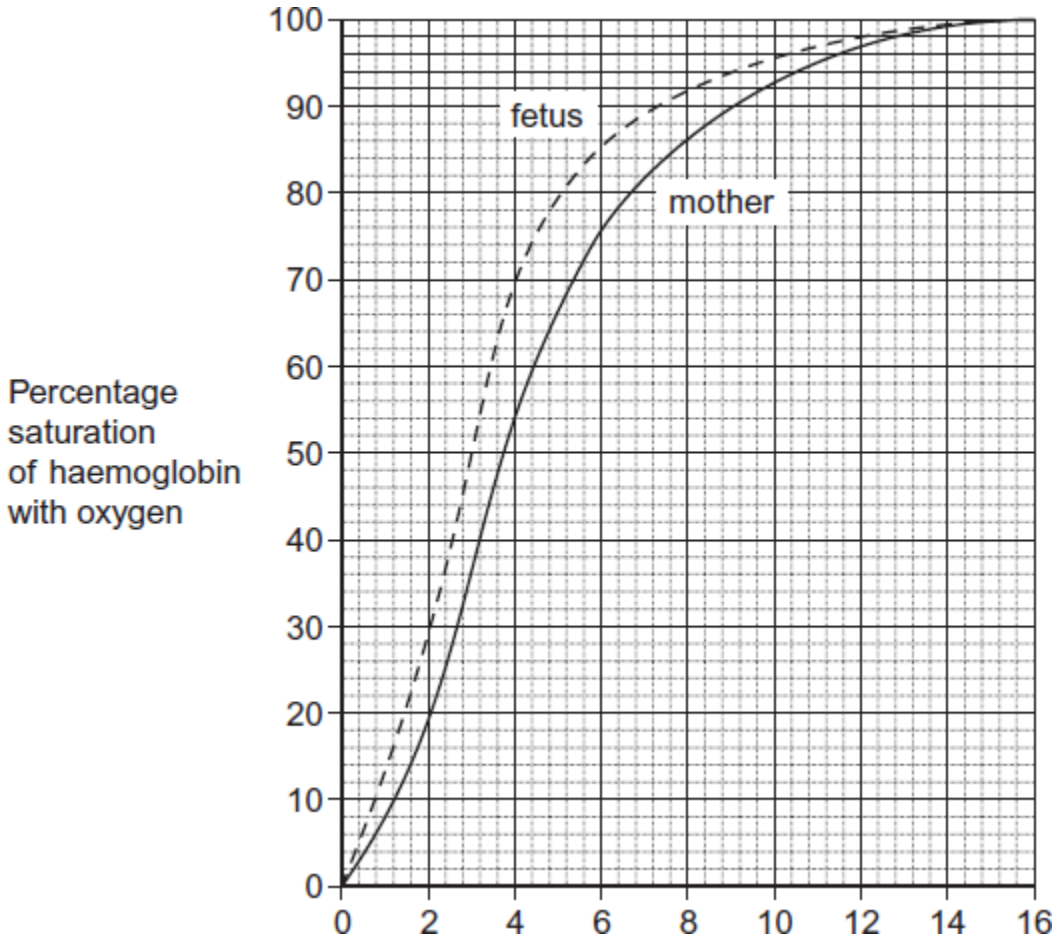
(Total 10 marks)

22 (a) The table shows three statements about some biological molecules. Complete the table with a tick in each box if the statement is true for haemoglobin, cellulose or starch.

Statement	Haemoglobin	Cellulose	Starch
Has a quaternary structure			
Formed by condensation reactions			
Contains nitrogen			

(3)

The graph shows oxygen dissociation curves for the haemoglobin of a mother and her fetus.



(b) What is the difference in percentage saturation between the haemoglobin of the mother and her fetus at a partial pressure of oxygen (pO_2) of 4 kPa?

(1)

(c) The oxygen dissociation curve of the fetus is to the left of that for its mother. Explain the advantage of this for the fetus.

(2)

(d) After birth, fetal haemoglobin is replaced with adult haemoglobin. Use the graph to suggest the advantage of this to the baby.

_____

_____

_____

_____

_____

_____

(2)

(e) Hereditary persistence of fetal haemoglobin (HPFH) is a condition in which production of fetal haemoglobin continues into adulthood. Adult haemoglobin is also produced.

People with HPFH do not usually show symptoms. Suggest why.

_____

_____

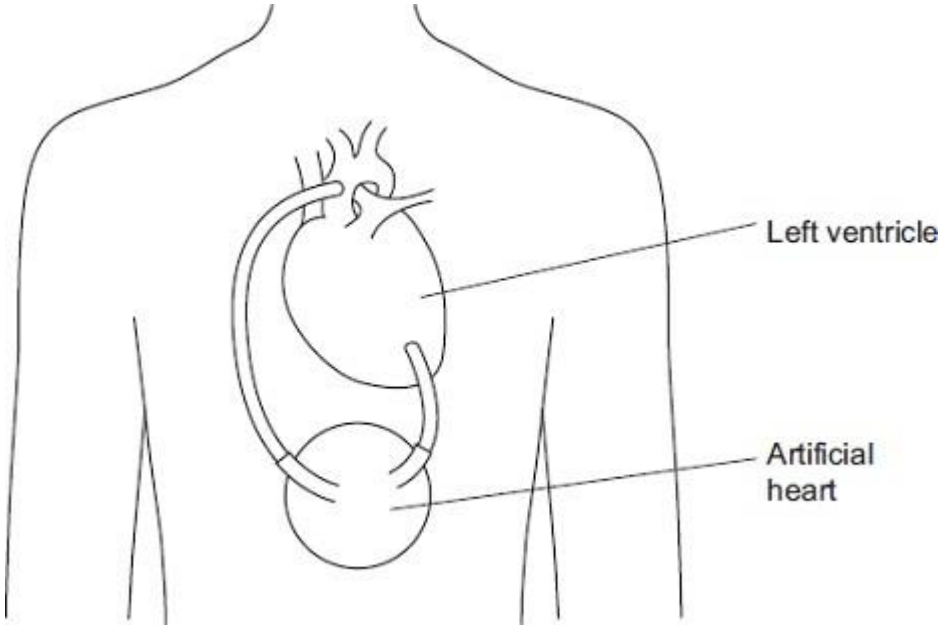
_____

(1)

(Total 9 marks)

23 Some people have a form of *heart failure* where their heart is not pumping blood as well as it used to. Some people with heart failure are given an artificial heart to improve circulation of blood from the left ventricle.
Figure 1 shows where this type of artificial heart is connected.

Figure 1



(a) Name the blood vessel to which the artificial heart is connected.

_____

(1)

(b) In these patients, the right ventricle still produces sufficient blood flow to keep the patient alive.

Suggest why the left ventricle requires the help of the artificial heart but the right ventricle does not.

_____

_____

_____

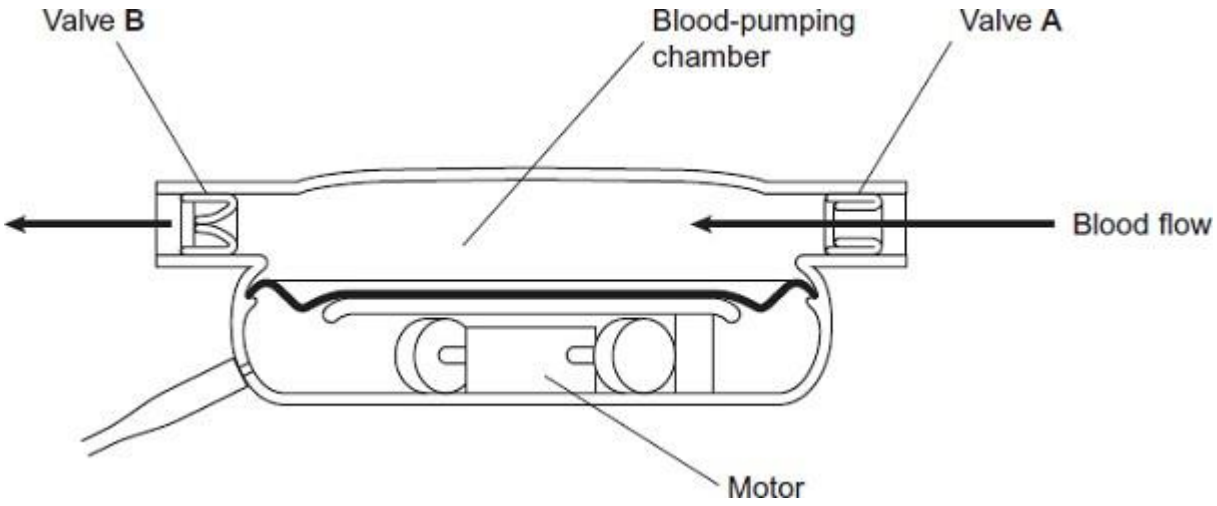
_____

_____

(2)

(c) **Figure 2** shows the internal structure of this type of artificial heart.

Figure 2



Valves **A** and **B** have the same functions as heart valves involved in the cardiac cycle. Name the heart valve that has the same function as:

valve **A** _____

valve **B** _____

(2)

(d) There are different designs of artificial heart. Doctors compared results for patients who received two different types of artificial heart, **X** and **Y.**

They recorded information 2 years after the artificial hearts were implanted. Their results are **shown in Figure 3**.

Figure 3

	Information recorded 2 years after artificial heart implanted		
Type of artificial heart	**Number of patients surviving without replacement of artificial heart**	**Number of patients surviving but who required repair or replacement of artificial heart**	**Number of patients who died**
X (119 patients)	62	13	44
Y (58 patients)	7	24	27

Which type of artificial heart was the more successful? Use calculations to support your answer.

(Extra space)

(3)

(Total 8 marks)

24 Some people have a condition called *white-coat hypertension*. People with this condition develop a higher than normal heart rate and blood pressure when they are in a doctor's surgery. High heart rate is correlated with high blood pressure.

Doctors investigated differences in heart rate between men *with white-coat hypertension* and those without the condition. They measured the men's mean heart rates:

- in the doctor's surgery, by recording the pulse in the wrist for 1 minute, when the men were lying down
- at home, using a portable heart rate monitor when the men were walking around
- at home, using a portable heart rate monitor when the men were sleeping.

(a) The groups of men selected for this investigation were matched.

Other than being men, suggest **one** factor for which they should have been matched.

_____

(1)

(b) Explain why the pulse recordings in the doctor's surgery were taken when the men were lying down.

_____

_____

_____

(1)

(c) The pulse felt in the artery in the wrist can be recorded and used to measure heart rate.

Suggest why the pulse felt can be used to measure heart rate.

_____

_____

_____

_____

_____

(2)

(d) The portable heart rate monitor recorded the men's heart rates continuously. This gave more reliable mean heart rates than those obtained by recording the pulse in the wrist for 1 minute.

Suggest why it is more reliable.

(2)

(e) The table shows the doctors' results.

Where and how heart rate was measured	Mean heart rate / beats per minute	
	Men with white-coat hypertension	Men without white-coat hypertension
Doctor's surgery, recording pulse when lying down	67	63
At home, walking around, using heart monitor	76	73
At home, sleeping, using heart monitor	63	60

A journalist, who saw these results, stated that they showed there is no such thing as *white-coat hypertension*.

Do these data support this statement? Give reasons for your answer.

(2)

(Total 8 marks)

25 Some substances can cross the cell-surface membrane of a cell by simple diffusion through the phospholipid bilayer. Describe other ways by which substances cross this membrane.

(Total 5 marks)

26 (a) (i) An arteriole is described as an organ. Explain why.

_____

_____

_____

(1)

(ii) An arteriole contains muscle fibres. Explain how these muscle fibres reduce blood flow to capillaries.

_____

_____

_____

_____

_____

(2)

(b) (i) A capillary has a thin wall. This leads to rapid exchange of substances between the blood and tissue fluid. Explain why.

_____

_____

_____

(1)

(ii) Blood flow in capillaries is slow. Give the advantage of this.

_____

_____

_____

(1)

(c) Kwashiorkor is a disease caused by a lack of protein in the blood. This leads to a swollen abdomen due to a build up of tissue fluid.

Explain why a lack of protein in the blood causes a build up of tissue fluid.

(Extra space)

(3)

(Total 8 marks)

27 Scientists compared the results of three investigations, **A**, **B** and **C**. These investigations were into the effect of drinking different amounts of alcohol on the risk of developing heart disease.

The graph shows the results of these investigations.

(a) Describe the relationship between increasing the number of alcoholic drinks per day and the risk of heart disease in investigation **A**.

(2)

(b) All the volunteers who took part in investigation **C** were aged between 40 and 50 years old. Explain how choosing volunteers of a similar age improved this investigation.

(1)

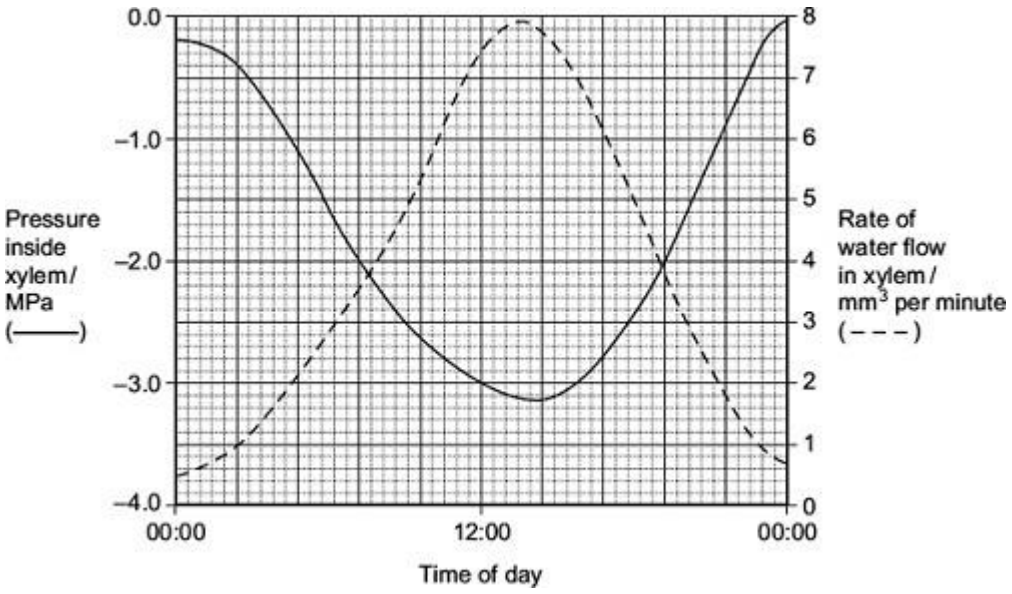
(c) A newspaper headline used the information in the graph to claim 'Alcohol is good for you.' Evaluate this claim.

(Extra space)

(3)

(Total 6 marks)

28 (a) Scientists measured the rate of water flow and the pressure in the xylem in a small branch. Their results are shown in the graph.



(i) Use your knowledge of transpiration to explain the changes in the rate of flow in the xylem shown in the graph.

(Extra space)

(3)

(ii) Explain why the values for the pressure in the xylem are negative.

(1)

(b) Doctors measured the thickness of the walls of three blood vessels in a large group of people. Their results are given in the table.

Name of vessel	Mean wall thickness /mm (± standard deviation)
Aorta	5.7 ± 1.2
Pulmonary artery	1.0 ± 0.2
Pulmonary vein	0.5 ± 0.2

(i) Explain the difference in thickness between the pulmonary artery and the pulmonary vein.

(1)

(ii) The thickness of the aorta wall changes all the time during each cardiac cycle. Explain why

(Extra space)

(3)

(iii) Which of the three blood vessels shows the greatest variation in wall thickness? Explain your answer.

(1)

(c) Describe how tissue fluid is formed **and** how it is returned to the circulatory system.

(Extra space)

(6)

(Total 15 marks)

29 Ivabradine is a drug that slows heart rate. It is taken as a pill. Doctors investigated its value in reducing the resting heart rate of patients with coronary heart disease.

- They described their investigation as a large-scale, controlled trial. It was also carried out on people living in different areas.
- The results of the trial showed that ivabradine slowed heart rate.
- Angina is a pain in the chest. It results when insufficient oxygen is brought to the heart muscle during exercise. The doctors found that ivabradine reduced angina.

(a) The results of the ivabradine trial were reliable.

(i) Explain the importance of the ivabradine investigation being a large-scale trial.

_____

_____

_____

(1)

(ii) Explain the importance of the ivabradine investigation being carried out on people living in different areas.

_____

_____

_____

(1)

(b) The ivabradine investigation was a controlled trial. Suggest how the control group would have been treated.

_____

_____

_____

_____

_____

(2)

(c) An electrocardiogram is made by attaching recording electrodes to a person's chest. It shows the electrical changes that take place in a person's heart each time it beats. A sports physiologist produced electrocardiograms for a fit adult male.

Chart **X** shows an electrocardiogram from this man after 10 minutes of complete rest.
A cardiac cycle consists of the filling time and the contraction time. The filling time and the contraction time for one cardiac cycle are shown on this chart.

Chart **X**

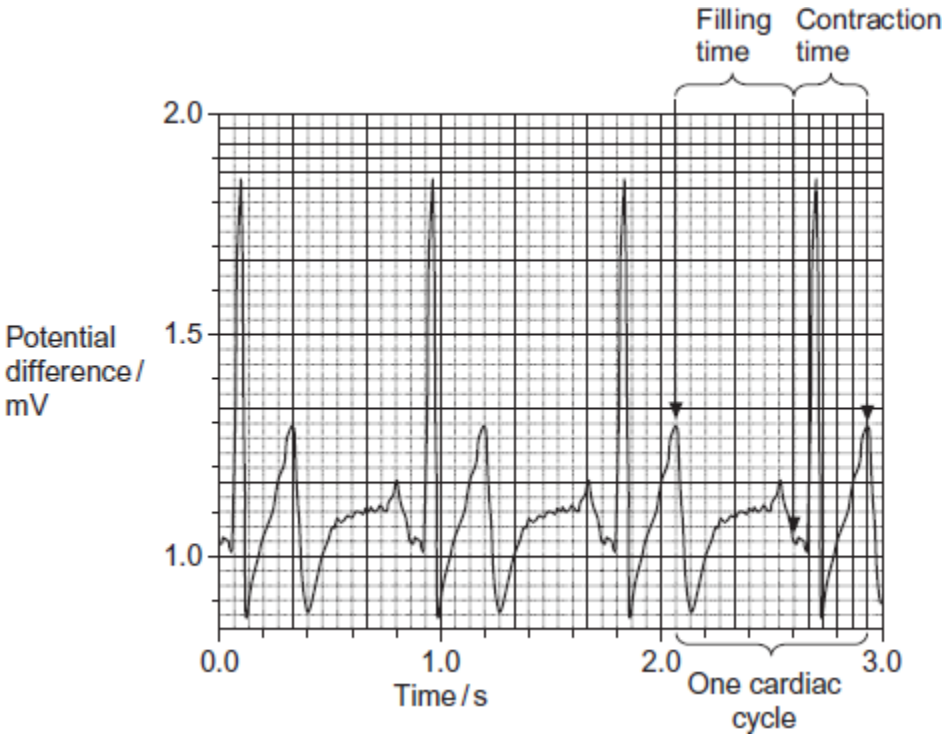
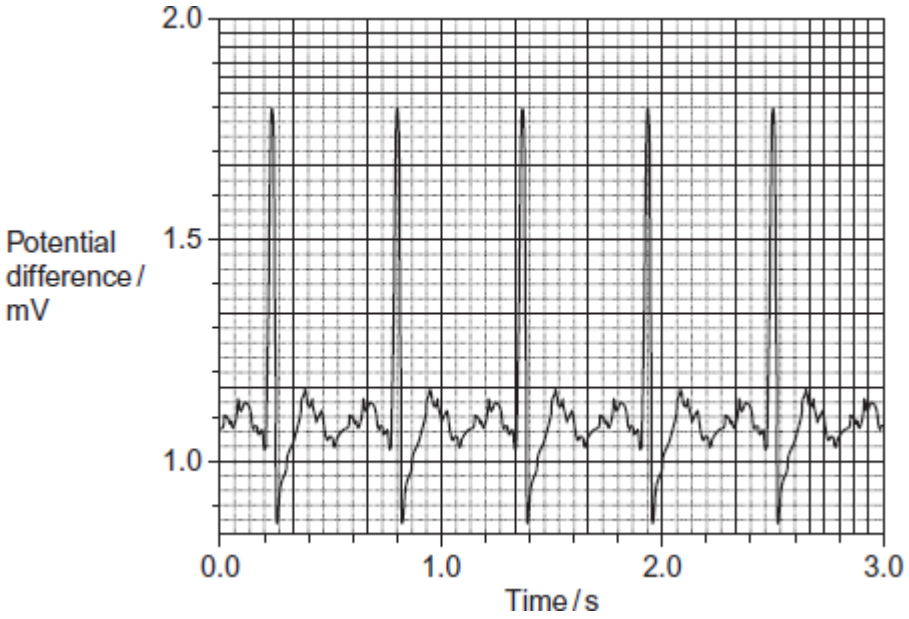


Chart **Y** shows an electrocardiogram from the same man immediately after a period of exercise.

Chart **Y**



Ivabradine slows heart rate.

(i) Use information from the charts above to explain why ivabradine increases the volume of blood entering the heart during a cardiac cycle.

_____

_____

(1)

(ii) Ivabradine reduces angina. Suggest how an increase in the volume of blood entering the heart reduces angina.

(Extra space)

(3)

(Total 8 marks)

30 An electrocardiogram is made by attaching recording electrodes to a person's chest. It shows the electrical changes that take place in a person's heart each time it beats. A sports physiologist produced electrocardiograms for a fit adult male.

Chart **X** shows an electrocardiogram from this man after 10 minutes of complete rest.
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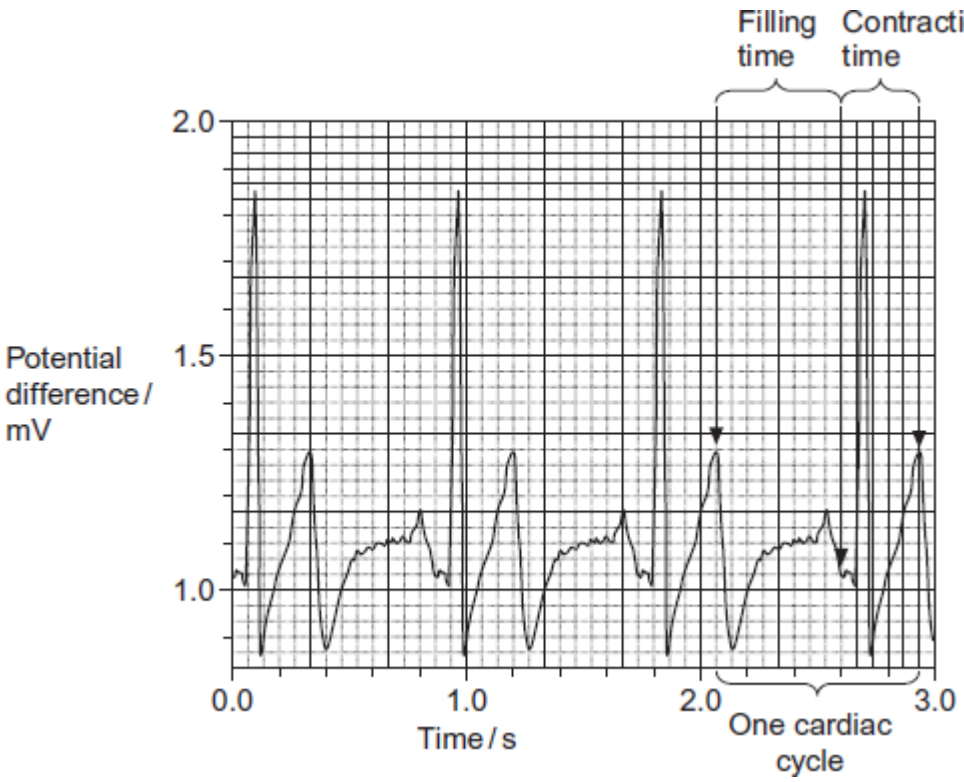
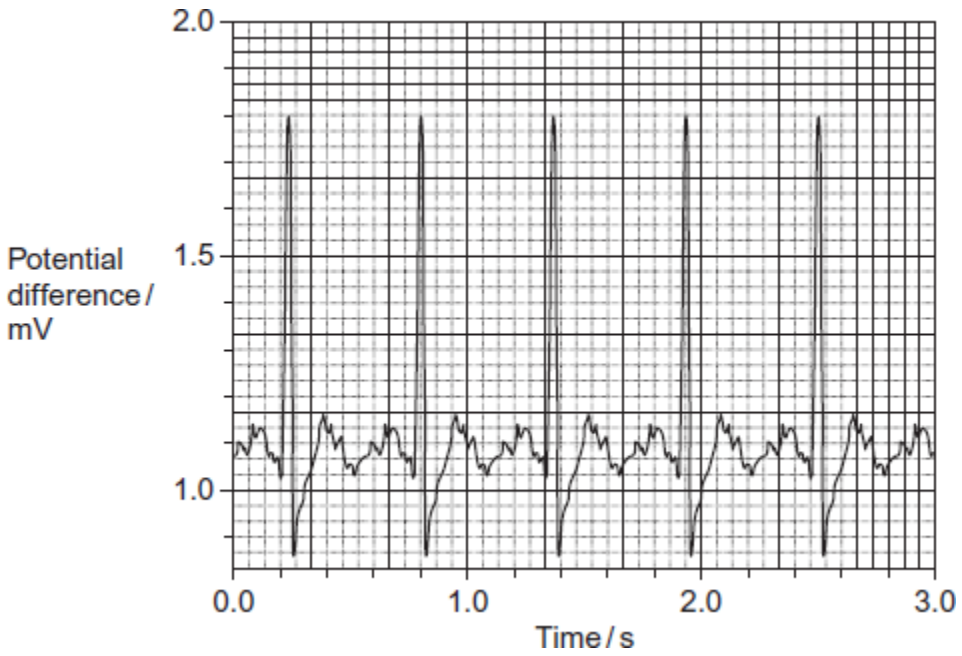


Chart **Y** shows an electrocardiogram from the same man immediately after a period of exercise.

Chart **Y**



(a) Give **one** way in which an electrocardiogram could have produced more reliable results than counting the pulse.

_____

_____

_____

(1)

(b) (i) Chart **X** shows that the man's resting heart rate was 67 beats per minute. What was his pulse rate? Explain your answer.

_____

_____

_____

(2)

(ii) Use chart **Y** to calculate the man's heart rate after the period of exercise.
Show your working.

Answer _____ beats per minute

(2)

(c) Use charts **X** and **Y** to describe how exercise affected filling time.

_____

_____

_____

_____

_____

(2)

(d) The physiologist used electrocardiograms to investigate the effect of increasing heart rate on filling time.
Describe how she could have modified the method of exercising you used to produce a range of increases in heart rate.

_____

_____

_____

_____

_____

(2)

(Total 9 marks)

Mark schemes

1

(a) 1. Elastic tissue to allow stretching / recoil / smoothes out flow of blood / maintains pressure;

2. (Elastic tissue) stretches when ventricles contract
OR
Recoils when ventricle relaxes;

3. Muscle for contraction / vasoconstriction;

4. Thick wall withstands pressure **OR** stop bursting;

5. Smooth endothelium reduces friction;

6. Aortic valve / semi-lunar valve prevents backflow.

4 max

(b) 1. Curve to the right so lower affinity / % saturation (of haemoglobin);

2. Haemoglobin unloads / dissociates more readily;

3. More oxygen to cells / tissues / muscles;

4. For greater / more / faster respiration;
Idea of a higher rate of respiration

4

(c) 16.5–18 (cm^3 $minute^{-1}$);
Allow 1 mark if heart rate wrongly calculated but then multiplied by 0.03

2

[10]

2

(a) 1. (Overall) outward pressure of 3.2 kPa;
2. Forces small molecules out of capillary.

2

(b) Loss of water / loss of fluid / friction (against capillary lining).

1

(c) 1. High blood pressure = high hydrostatic pressure;
2. Increases outward pressure from (arterial) end of capillary / reduces inward pressure at (venule) end of capillary;
3. (So) more tissue fluid formed / less tissue fluid is reabsorbed.
Allow lymph system not able to drain tissues fast enough

3

(d) 1. Water has left the capillary;
2. Proteins (in blood) too large to leave capillary;
3. Increasing / giving higher concentration of blood proteins (and thus wp).

3

[9]

3

1. Pulse counted for 15/30 seconds;
2. Beats counted were multiplied by 2 or 4;

1 max

4

1. Obtain pulse rates for a large number of students;

   Accept this idea for carrying out the investigation or for collecting data from other scientists work / published data

2. (belonging to) a range of different sexes / ethnic groups/from different parts of the country / employment groups;

   Accept suitable alternative variables but the idea of a range must be included

   Reject generic references to controlling these variables

3. Calculate mean and standard deviation (of students their age);

   Allow 'calculate standard error / 95% confidence limits / t test / statistical test'

4. See if their mean lies within the standard deviation;

   Accept 'see if my mean lies within the 95% confidence limits'

   If statistical test used, accept 'see if there is a significant difference between means'

[3 max]

5

(a) 1. Length of time of exercise;

2. Difficulty of exercise;

3. An environmental factor;

   Answers about variables relating to the subjects themselves are not valid.

   2. E.g. speed of treadmill / running, incline on treadmill.

   3. E.g. temperature / humidity / clothing worn.

2 max

(b) 0.89;

Ranges correct – level 3 range of 40 and level 1 range of 45 = 1 mark;

If value of 1.125 (level 1: level 3) is calculated award 1 mark

Accept any number significant figures as long as rounding is correct

2

[4]

6 (a) Any **two** from:

- People outside age range
- Women
- Those unable to exercise;

__Two__ of these categories needed to gain __one__ mark.

Accept examples for outside age range e.g. those under 25 or those over 54

Accept examples of those unable to exercise (e.g. those in wheelchairs, those with non-heart related issues).

1

(b) 1. (Stop because) medication could affect heart rate;

Accept descriptions of how the heart rate may be affected e.g. stopping medication could cause the heart rate to speed up

2. (Continue because) stopping could put the patient at too great a risk;

Accept '(continue because) stopping could result in the patient dying'

2

[3]

7

(a) 1. (Because) same water potential (as valve);

2. (So) prevents loss or gain of water by osmosis / down water potential gradient;

Loss or gain and method of loss or gain must both be in the answer

3. (So) cells / tissues in the valves aren't damaged;

2 max

(b) 1. Kills / stops growth of bacteria that could cause infection / disease (in patient);

2. Kills / stops growth of bacteria that could damage the valve;

'Kill / stop growth of bacteria' is insufficient without further explanation.

1 max

(c) (After surgery) valve closes fully / correctly / works so preventing blood flowing back into the heart;

OR

(After surgery) valve closes fully / correctly / works so preventing blood flowing out of the artery;

Do not credit the converse here

1

(d) 1. (For maximum) mean decreases, to within the normal range;

2. (For minimum) mean increases to within normal range;

3. No overlap in the (means ±) standard deviation for <u>minimum</u> pressure so there is a real difference;

Ignore references to the differences in maximum pressure

Accept idea of significant difference for 'real difference'

4. Includes wide range of ages of patients;

3 max

(e) 1. Standard deviation shows that some of the patients will be outside normal pressure range (after surgery);

Accept this as a general statement or in relation to maximum or minimum pressures

2. Small group;

3. Short follow up times;

4. No comparison with other treatments;

(f) D o n , t k

now the range;

2 max

1

[10]

8

1. Pressure gradient / moves from high to low pressure;

2. Valves stop backflow;

Accept 'valves close when pressure gradient is 'the wrong way' for 2 marks

2. Accept 'one way valves'

2. 'Valves' on its own is insufficient

[2]

9

(a) (Simple) diffusion;

Reject: facilitated diffusion.

1

(b) 1. Thin/small **so** short diffusion pathway;

Reject: thin membrane/wall/cells.

2. Flat/long/small/thin **so** large surface area to volume ratio/surface area : volume;

Accept: small volume to surface area ratio.

2

(c) 1. High/50% saturation (with oxygen) below (pO_2 of) 0.2 kPa;

*Accept: fully saturated **or** above 50% saturation below 0.2kPa.*

Accept: any number between 0.08 and 0.2 kPa

2. (Oxygen) for respiration;

2

(d) 1. Water potential higher in worm

OR

Lower water potential in seawater;

Accept: correct reference to water potential gradient if direction of water movement is given.

Accept: ψ for water potential.

2. Water leaves by osmosis (and worm dies);

Reject: worm/cells burst.

2

[7]

10

(a) 66.7;

1

(b) 70;

1

(c) 1. More fluid forced/filtered out of capillary/blood (due to high pressure);

Accept: water for fluid.

Must convey idea of 'more'.

Reject: more tissue fluid is forced out.

Do not credit 'more plasma forced out'.

2. Less return of fluid (into capillary/blood) due to pressure

OR

Lymph(atic) (system) cannot drain away all excess fluid;

Accept: water for fluid.

2

(d) 1. Larger lumen/volume (of blood vessels);

Accept: more 'space' or more 'room' (in blood vessels).

Accept: more blood flow (in blood vessels).

Accept: reduces stroke volume or less blood in ventricle.

2. Reduces (blood) pressure (in blood vessels);
3. Less friction/resistance (in blood vessels);

2

[6]

11 (a) (i) C;

Ignore name of vessel

1

(ii) A;

Ignore name of vessel

1

(b) Strongest/stronger contractions;

Accept most muscle in wall / thickest/thicker muscular wall

A comparative statement is needed

Answer must be in context of producing force and not resisting it

1

(c) 1. Blood flows from left ventricle to right ventricle/ mixing of oxygenated and deoxygenated blood;

2. Lower volume of (oxygenated) blood leaves left ventricle/flows into aorta/C

OR

Lower pressure in blood leaving left ventricle/flowing into aorta/C

OR

Less oxygen in blood leaving left ventricle/aorta/C;

2

[5]

12

(a) Quaternary (structure);

Accept phonetic spelling eg quarternary/quarternery /4°

Award no mark for quaternary as part of a list

1

(b) 423;

1

(c) 1. Oxyhaemoglobin formed/ haemoglobin is loaded/ uptakes/associates/binds with oxygen in area of higher ppO_2 / in gas exchange surface/lungs/gills;

Reference to "react with" = max 1

Accept: reversible interaction with oxygen

Ignore: haemoglobin is carried / contained in red blood cells

2. (oxygen) unloaded/dissociates from/released (in area of lower ppO_2 / in capillaries/to cells/tissues);

2

(d) (i) 56(%);

Accept responses in the range 54-58(%)

1

(ii) 1. (Anaemia curve shifted to right) haemoglobin has lower affinity for oxygen / binds less tightly;

Assume reference is to haemoglobin of anaemia unless stated

2. releases more oxygen / oxygen is released quicker / oxygen dissociates/ unloads more readily to muscles/tissues/cells;

3. (For) respiration;

Accept: even with a lower haemoglobin concentration / meet demand for ATP/energy;

3

[8]

13

(a) 1. Time taken to reach maximum blood flow varied widely/significantly;

Must be emphasis on idea of 'widely'. Mention only of 'vary' is insufficient. Ignore use of numbers unless a comparison is given

Ignore any mention of a correlation between maximum percentage increase in blood flow and time taken to reach maximum increase in blood flow

2. Quickest after a carbohydrate-only meal;
OR
Slowest after a protein-only meal;

2

(b) 1. More blood flows to (skeletal) muscles (during exercise);

2. (supplying) more oxygen / glucose / removing more carbon dioxide/ lactic acid/ heat;

1 and 2. Idea of 'more' is needed

More blood to muscles delivering oxygen = 2 marks

3. For high (rate of) respiration / to meet increased demand for energy/ATP;
OR
Prevents anaerobic respiration/lactic acid build up;

Accept: reduces/delays for prevent

3

(c) **Immediate effect of exercise after meal**

1. Meal increases blood flow in (mesenteric) artery AND exercise decreases blood flow in (mesenteric) artery;

1. Will relate to information given in the tables

Overall effect on blood circulation

2. Insufficient blood (flow to small intestines / muscles);

2. Accept: blood diverted away/shunted

Ignore references to 'strain on heart', 'heart disease', 'cardiovascular diseases'

Ignore references to controlling variables and reliability

Effect on blood flow of type of meal

3. Carbohydrate meal quick(er) / during exercise;
OR
Protein/fat meal slow(er) / after exercise;

Effect of reduced blood flow on cells

4. (More) anaerobic (respiration) / lactic acid produced;
OR
less aerobic respiration;

Consequence for person of changed blood flow

5. Less absorption (of digested food) / faeces contains digested food;
6. Cramp / indigestion / discomfort / fatigue;

*Look for **ideas** in each of 5 areas*

MP1 might be spread throughout the answer

6. Ignore references to digestion

Max 4

(c)
1. (blood flows from kidney along) renal vein to vena cava;
2. (along) vena cava to right atrium/side of heart;
3. (along) pulmonary artery to lungs;
4. (along) capillaries to pulmonary vein;
5. (along) pulmonary vein to left atrium/side of heart;
6. (along) aorta to renal artery (to kidney);
7. Blood may pass through several complete circuits before returning to kidney;

Reject: 'blood vessel pumps' only once

Ignore references to valves

Ignore references to heart action/cardiac cycle

Accept labelled diagram must include directional arrows

Max 6

[15]

14 (a) 53−70 / 70-53 / 17 (beats per minute).

1

(b) 13.6 / 13.58 / 14;

If answer is incorrect, 1 mark for the principle of difference (11) divided by initial heart rate (81).

$\frac{70-81}{81}$ *or* $\frac{81-70}{81}$ *for 1 mark*

Ignore + or - signs

2

(c) 1. Allows comparison;
2. (Initial / resting) heart rates different (between males and females).

2

(d) 1. Cardiac output = stroke volume × heart rate

1. Accept CO = SV × HR

2. (So) stroke volume increases / increased size or volume of ventricles.

2. Neutral: more blood leaves heart

2. If the term stroke volume is not used, it must be defined

2 max

[7]

15 (a) 1. (Carry) oxygen / glucose;

Accept: oxygenated blood

Ignore references to removing waste products

Ignore references to arteries 'pumping' blood

2. (To) heart <u>muscle / tissue / cells / myocytes</u>.

Must be supply to heart or cardiac

2

(b) (i) **A**;

Accept: A on its own even if outside box

Reject if two (or more) letters given

1

(ii) **H**;

Accept: H on its own even if outside box

Reject if two (or more) letters given

1

(c) (Aorta)

1. (is) close / directly linked to the heart / ventricle / pressure is higher / is very high;

2. (Aorta has) elastic tissue;

Accept elasticity

Ignore reference to muscle

3. (Aorta has) stretch / recoil.

Q *Reject: contracts / relaxes / pumps*

Accept: for mp 2 and mp 3, converse for small arteries <u>if</u> qualified by little / less

3

[7]

16

(a) 1. Many / more capillaries (than arterioles);

2. (Cross-sectional) area of capillaries (much) greater (than of arterioles).

*Note: maximum of **1** mark for this question*

1 max

(b) 1. Short pathway / short distance between blood and outside of capillary;

Reference to blood and cells required

2. Large surface area (of blood) in contact with walls of capillaries;

Idea is per unit volume of blood but candidates need not say this

3. Fast exchange / fast diffusion / fast osmosis.

Must relate to increased speed

2 max

(c) Width / size / diameter of blood cell.

Accept named blood cell

Reject platelet

Accept idea that below a certain diameter friction becomes too great for blood to flow

1

(d) (Fluid) in tissue fluid / (fluid) in lymph.

1

[5]

17 (Maintaining constant pH to avoid)

1. Named protein / enzyme (in blood) sensitive to / affected by change in pH;

Accept converse for MP2 and MP3.

Named example should be a protein that might be affected (by change in pH) eg haemoglobin, carrier protein in plasma membrane.

Accept 'change in H^+ concentration' for 'change in pH'.

2. (Resultant) change of charge / shape / tertiary structure;

The change in charge idea relates to the enzyme / protein and not the blood (plasma) or red blood cells.

'Denaturation' alone is insufficient.

3. Described effect on named protein or enzyme.
e.g. less oxygen binds with haemoglobin / less transport across membranes / fewer substrates can fit active site / fewer enzyme-substrate complexes.

Idea of 'less' or 'fewer' required. Ignore suggestion of 'no' or 'none'.

[3]

18 (a) 1. Ventricle pressure rises **then** blood starts to flow into aorta because pressure causes (aortic / semilunar) valve to open;

Accept times, eg ventricle pressure rises at 0.3 (25) seconds,followed by blood flow into aorta at 0.35 / 0.4 seconds

Idea of sequence is essential

Accept times

2. Ventricle pressure starts to fall **so** blood flow falls;

Idea of sequence is essential

2

(b) 1. Thickness of wall increases **because** ventricle (wall) contracts;

Must be idea that increase in thickness is linked to contraction

Accept muscle for ventricle and systole for muscle contraction

2. Contraction **causes** the increase in pressure;

Accept <u>thickening</u> of wall

2

(c) *2 marks for correct answer*

1. Between 120 ± 5;;

Length of cycles varies slightly

2. Length of cardiac cycle correct but final answer wrong;

Length of cardiac cycle = 0.45 - 0.52

2

[6]

19

(a) 1. Lower affinity for oxygen / releases more oxygen / oxygen is released quicker / oxygen dissociates / unloads more readily;

Q Neutral: the organism / body has a lower affinity for oxygen / releases more oxygen

2. (To) muscles / tissues / cells

3. (For) high / rapid respiration;

Q Reject: 'produces more energy' on its own

Neutral: reference to partial pressure

Accept: (for) respiration to produce more energy in the form of ATP / release more energy

3

(b) (i) 1. Small SA:VOL;

Neutral: small limbs / small ears / extremities

Neutral: small SA

Accept: large VOL:SA

Neutral: reference to fat / blubber / insulation

2. (So) reduces heat loss / (more) heat retained;

Note: MP2 is independent of MP1

2

(ii) 1. Brain is the same, others fall;

Note: 1. might not be given in the same sentence

Assume that 'other organs fall' = all three organ categories fall

Accept: 'blood flow is reduced to all organs except for the brain'

2. Brain controls other organs / remains active / needs constant supply of oxygen;

Accept: 'seal would die' = brain remains active

3. Lungs not used / are used less / seal is not breathing / heart rate decreases / heart pumps less / blood diverted to muscles;

Reject: seal is not respiring

3

[8]

20

(a) 1. (Curve for) dog falls rapidly at the start but (curve for) sheep falls slowly at first;

*Do **not** allow curve for dog falls more steeply (since from 0.5% NaCl fall in sheep is just as steep as fall in dog)*

2. Sheep doesn't fall rapidly until 0.5 (but dog falls rapidly from 0);

3. (Trend shows that) for any concentration of sodium chloride haemolysis is lower in the dog;

The idea of a trend is required. Statement of individual values alone is insufficient, eg 'at 0.2, 34% in dog and 98% in sheep' is insufficient

Accept dog reaches 0 at lower concentration of sodium chloride than for sheep / dog reaches 0 at 0.38% compared to 0.84 % in sheep;

2 max

(b) 74 to 76;

Accept a value within this range

1

(c) 1. (Red) colour is due to haemoglobin;

Note: a correct response to marking point 2 also scores marking point 1

2. The more haemoglobin released the more red the solution;

Need idea of haemoglobin release before giving credit

2

(d) 1. (Use of 0.9%) will not cause haemolysis in any (of the mammals);

Full credit requires statement of marking point 1 and any approach from marking point 2

2. (So) will not kill any of the animals;

or

Only need to use / store / buy one concentration of sodium chloride solution / cheaper to have one concentration of sodium chloride solution / can buy in bulk;

or

Anyone can give it / no need to find out what concentration any animal requires;

Different approaches available for this marking point

2 max

[7]

21

(a) 1. SAN sends wave of electrical activity / impulses (across atria) causing atrial contraction;

Accept excitation

2. Non-conducting tissue prevents immediate contraction of ventricles / prevents impulses reaching the ventricles;

3. AVN delays (impulse) whilst blood leaves atria / ventricles fill;

4. (AVN) sends wave of electrical activity / impulses down Bundle of His;

4. Allow Purkyne fibres / tissue

5. Causing ventricles to contract from base up;

5

(b) 1. Atrium has higher pressure than ventricle (due to filling / contraction) causing atrioventricular valves to open;

Start anywhere in sequence, but events must be in the correct order.

1. Accept bicuspid, reject tricuspid

1. Allow: blood passes through the valve = valve open / blood stopped from passing through the valve = valve closed

2. Ventricle has higher pressure than atrium (due to filling / contraction) causing atrioventricular valves to close;

3. Ventricle has higher pressure than aorta causing semilunar valve to open;

Points 1, 2 and 3 must be comparative: eg higher 3. Allow aortic valve

4. Higher pressure in aorta than ventricle (as heart relaxes) causing semilunar valve to close;

4. Allow aortic valve

5. (Muscle / atrial / ventricular) contraction causes increase in pressure;

5

[10]

22 (a)

Statement	Haemo-globin	Cellulose	Starch
Has a quaternary structure	✓		
Formed by condensation reactions	✓	✓	✓
Contains nitrogen	✓		

One mark for each correct row

3

(b) 16;

1

(c) 1. Higher affinity / loads more oxygen at low / same / high partial pressure / pO_2;

2. (Therefore) oxygen moves from mother / to fetus;

2

(d) 1. Low affinity / oxygen dissociates;

Assume 'it' is adult haemoglobin

1. Accept: converse if 'fetal haemoglobin' is clearly stated

2. (Oxygen) to respiring tissues / muscles / cells;

*2. **Q**: Neutral 'respirate'*

2

(e) Enough adult Hb produced / enough oxygen released / idea that curves / affinities / Hb are similar / more red blood cells produced;

Neutral: 'adult Hb is also produced' as in the question stem

Reject: curves / affinities / Hb are the same

1

[9]

23 (a) Aorta;

1

(b) 1. Left ventricle pumps to whole body (except lungs) / pumps blood further;

Accept converse for right ventricle

Reject 'push'

2. Left ventricle does most work / produces a greater pressure / produces a greater force;

2

(c) 1. (Valve **A**) atrioventricular valve;

Accept bicuspid / mitral

2. Semi-lunar valve;

Accept aortic valve

Ignore references to left and right

2

(d) **X** because (no mark)

Accept other valid calculations - probabilities

1. 52.1% survived without replacement compared to 12.1% / difference of 40%;

If correct figures written in table, award marks

2. 10.9% required repair or replacement of artificial heart compared to 41.4% / difference of 30.5%;

Max 2 if incorrect rounding of values

3. 37% died compared to 46.6% / difference of 9.6%;

OR

(X / Y = 119 divided by 58 = 2.05)

14.4; 49.2; 55.4;

Note that this ratio could be reversed i.e. 58 divided by 119 multiplied by numbers in top row

Accept rounded to 14; 49; and 55;

3

[8]

24 (a) One suitable factor;

Not health or lifestyle

E.g. Age / no heart condition / not on medication;

Accept BMI / smokers / diet / fitness / race etc. – has to affect heart rate or blood pressure

1 max

(b) Patients were at rest / not moving / not using muscles / in standardised position / controlled conditions;

Accept same position as sleeping

Ignore relaxed

1

(c) 1. Caused by pressure / surge of blood;

Ignore pulse rate equals heart rate

2. From (one) contraction / beat of (left) ventricle / heart;

Reject right ventricle

Ignore pumps / pumping

2

(d) 1. Monitor records heart rate over long period of time / all the time / more data collected;

Ignore reference to continuously as in stem

Ignore anomalies can be discarded

2. Anomalies in recording have less effect;

Ignore more accurate / reliable mean

3. Recording pulse rate for <u>one minute only</u> may give an anomalous / atypical result;

4. Errors when trying to count pulse for one minute / human error;

5. Monitor records HR over a range of activities during the day / pulse rate only records for a single set of conditions;

2 max

(e) 1. Men with condition always have higher heart rates;

Accept blood pressure references for heart rate

2. But no direct measurements of blood pressure;

Accept – no stats analysis to show significance

3. Only one investigation / test / need more studies;

Ignore references to 'yes' and 'no' throughout

4. Using different recording methods / conditions (in each case so cannot compare results);

5. Men without condition also have increased / higher heart rate in doctor's surgery;

2 max

[8]

25

By osmosis (no mark)

No mark awarded for naming terms e.g. osmosis, facilitated diffusion, active transport, co-transport etc.

1. From a high water potential to a low water potential / down a water potential gradient;

2. Through aquaporins / water channels;

QWC ignore large / small WP

By facilitated diffusion (no mark)

QWC ignore reference to high / low concentrations of water or high / low concentration of solution

3. Channel / carrier protein;

4. Down concentration gradient;

By active transport (no mark)

*QWC ignore '**along**' concentration gradients*

5. Carrier protein / protein pumps;

6. Against concentration gradient;

7. Using ATP / energy (from respiration);

Co-transport subsumed into mark scheme for active transport and facilitated diffusion

By phagocytosis / endocytosis (no mark)

Can award MP2, 3, 5 for 3 marks with no context given

8. Engulfing by cell surface membrane to form vesicle / vacuole;

Ignore lipid diffusion as in stem of question

By exocytosis / role of Golgi vesicles (no mark)

9. Fusion of vesicle with cell surface membrane;

5 max **2**

26

(a) (i) Made of (different) tissues / more than one tissue; **1**

(ii) 1. (Muscle) contracts;

Assume that 'they' or 'it' = muscle

2. (Arteriole) narrows / constricts / reduces size of lumen / vessel / vasoconstriction;

Ignore: references to pressure

***Q** Correct context for muscle contracts, vessel constricts*

[5]

(b) (i) Short diffusion distance / pathway;

Accept: thin diffusion pathway

1

(ii) (More) time for exchange / diffusion (of substances);

Accept: example of more time for specific substance to be exchanged

1

(c) 1. Water potential (in capillary) not as low / is higher / less negative / water potential gradient is reduced;

Accept: 'blood or plasma' instead of 'capillary'

2. Less / no water removed (into capillary);

Accept converse: water remains in the tissue

3. By osmosis (into capillary);

***Q** Marking points 2. and 3. must be in the context of movement into the capillary*

Neutral: reference to more tissue fluid being formed as in the question stem

Neutral: reference to lymphatic drainage

3

[8]

27 (a) 1. (Risk) decreases, then increases;

2. (Risk) increases from 2 (drinks per day);

Accept increases risk above 3

2

(b) Age affects heart disease / age affects how alcohol affects the body;

Accept age affects results

Accept 'removes confounding variable'

Accept 'controlling a variable'

1

(c) *To gain 3 marks candidates must have mp1 and 2 from mps 2-5*

1. (True because) studies show decreased risk up to 3 drinks per day;

Accept any evidence from graph

1

2. (False because) eg all show an increased risk above 5 drinks / day, eg **A** and **B**, show increased risk (of heart disease) above 4 per day;
Accept any evidence from graph

3. Data only about heart disease / alcohol causes other diseases / social problems;

4. Amount of alcohol per drink may vary;

5. May be due to other factor

2 max

[6]

28

(a) (i) 1. Stomata open;
Allow converse

2. Transpiration highest around mid-day as middle of day warmer / lighter;
2. Allow 'Sun is at its hottest'

3. (Increased) tension / water potential gradient;
Ignore 'pull, suck'

3

(ii) (Inside xylem) lower than atmospheric pressure / (water is under) tension;
Accept cohesion tension. Ignore vacuum

1

(b) (i) High pressure / smoothes out blood flow / artery wall contains more collagen / muscle / elastic (fibres) / connective tissue;
Accept converse for pulmonary vein
Incorrect function of artery disqualifies mark

1

(ii) 1. (Aorta wall) stretches because ventricle / heart contracts / systole / pressure increases;
1. Allow expand

2. (Aorta wall) recoils because ventricle relaxes / heart relaxes / diastole / pressure falls;
2. Allow spring back
Reject any reference to contract / relax in MP1 and 2

3. Maintain smooth flow / pressure;

3

(iii) Aorta 1.2 / largest SD;
Allow pulmonary vein provided candidate relates standard deviation to mean

1

(c) Formation

1. High blood / hydrostatic pressure / pressure filtration;

2. Forces water / fluid out;

2. Reject plasma, ignore tissue

3. Large proteins remain in capillary;

Return

4. Low water potential in capillary / blood;

5. Due to (plasma) proteins;

6. Water enters capillary / blood;

7. (By) osmosis;

7. Osmosis must be in correct context

8. Correct reference to lymph;

6 max

[15]

29

(a) (i) Identifies anomalies / minimises effect of anomalies / unusual results / results more likely to be representative / more reliable mean;

Accept likely to see side effects

1

(ii) Minimises / avoids regional bias / effects;

This is the basic principle. Accept examples that make this basic point, e.g.

There may be factors that affect people living in different areas

1

(b) 1. Treated the same as those on ivabradine / experimental group;

2. Given dummy pill / placebo;

Do not accept: given no pill

2

(c) (i) Increases filling time;

1

(ii) 1. Maximum / large amount of blood leaves heart / ventricles / increases stroke volume / cardiac output;

Must be in context of blood leaving the heart

2. More blood / more oxygen to heart muscle / heart tissue;

Accept wall of heart

3. Via coronary arteries;

3 max

[8]

30

(a) Records every heart beat / does not miss heart beats / gives more precise / accurate measurements;

Qualified reference to human error e.g. in counting

1

(b) (i) 1. 67 / 69.2 / the same;

All that is required here is a connection to be established between heart rate and pulse rate

2. There is one surge in pressure / pulse each time the heart contracts / beats;

2

(ii) Two marks for correct answer in range 90.0 – 113.0;;

One mark for incorrect answer in which duration of one heart beat is clearly identified as between 0.53 and 0.66 seconds;

2

(c) Allow two marks for quantitative statement: e.g. filling time decreases from 0.55 ± 0.1 to 0.30 ± 0.1 s;;

Allow one mark for qualitative statement: e.g. Filling time decreases;

Accept other quantitative statements such as those based on proportion of cardiac cycle

2

(d) One mark for more general answer, e.g. increase exercise;

This is the general principle. Detail may vary if centre uses different exercise

Two marks for detailed answer, e.g. increase frequency / duration of exercise;;

Reject comments not related to method used

2

[9]