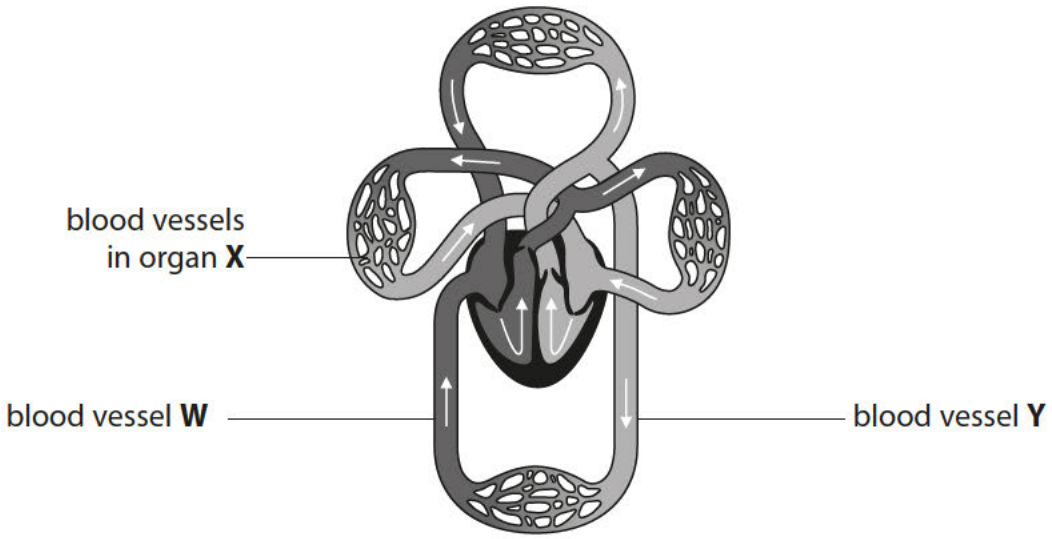
1 The diagram shows the human circulatory system.



(a) (i) Name organ **X**.

(1)

.....

(ii) Explain how the heart causes blood to move to organ **X**.

(2)

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.....

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.....

(iii) Which row shows the names of blood vessels **W** and **Y**?

Place a cross (☒) in the box next to your answer.

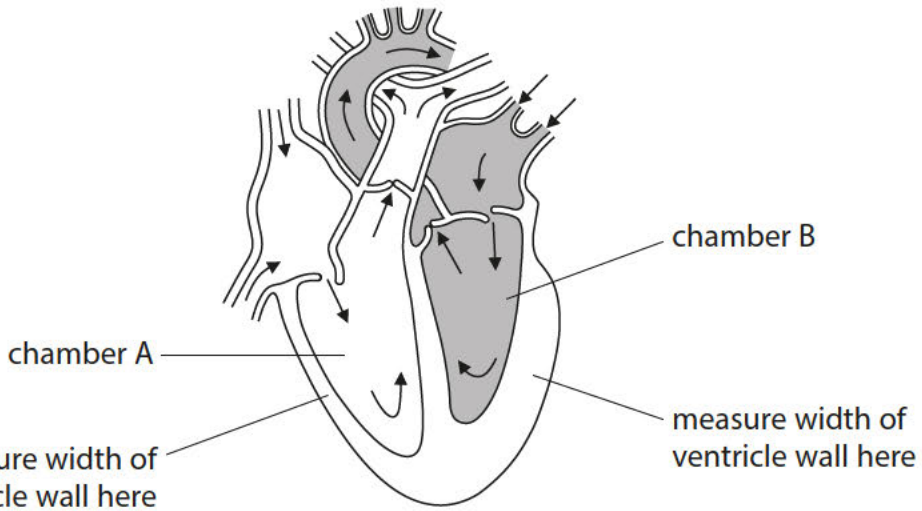
(1)

	blood vessel W	**blood vessel Y**
☐ **A**	pulmonary vein	aorta
☐ **B**	vena cava	pulmonary artery
☐ **C**	pulmonary artery	vena cava
☐ **D**	vena cava	aorta

(iv) Describe how the blood in vessel **W** is different from the blood in vessel **Y**.

(2)

(b) The diagram shows the chambers of the heart.



(i) Calculate how many times thicker the wall of chamber B is compared with the wall of chamber A.

(1)

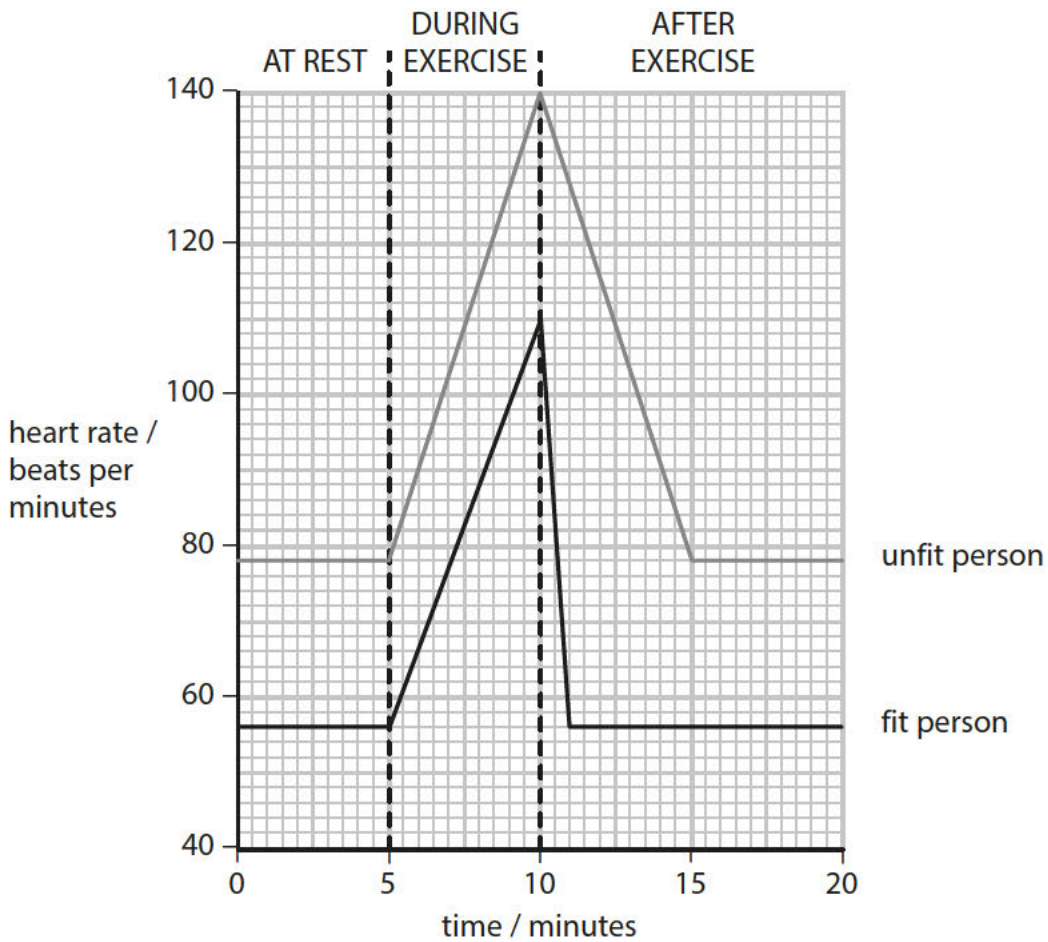
..... times thicker

(ii) Explain why the wall of chamber B is thicker than the wall of chamber A.

(2)

(Total for Question 1 = 9 marks)

2 The graph shows the heart rate of a fit person and of an unfit person at rest, during exercise and after exercise.



(a) (i) Compare the heart rate of the fit person with the heart rate of the unfit person from 5 to 15 minutes.

(3)

(ii) Cardiac output = stroke volume × heart rate.

The stroke volume of the fit person at 10 minutes is 0.20 dm^3 per beat.

Calculate the cardiac output of the fit person at 10 minutes.

Use the graph to help you.

(2)

..... dm^3 per minute

(iii) The recovery period is the time it takes for the heart rate to return to its rate at rest after exercise.

Explain why the recovery period for the fit person was different from the recovery period for the unfit person.

(3)

(b) Which of the following shows the direction that blood flows towards, through and from the heart?

Place a cross (☒) in the box next to your answer.

(1)

☒ **A** vena cava → ventricle → atrium → pulmonary vein

☒ **B** pulmonary artery → atrium → ventricle → aorta

☒ **C** aorta → ventricle → atrium → pulmonary vein

☒ **D** pulmonary vein → atrium → ventricle → aorta

(c) More carbon dioxide is produced by cells during exercise.

Name the part of the blood that transports most of the carbon dioxide to the lungs.

(1)

.....

(Total for Question 2 = 10 marks)

3 The volume of blood that the heart pumps with every beat is known as the stroke volume.
Stroke volume can be used to indicate fitness level.

The table gives information about the stroke volume, heart rate and cardiac output of an athlete at rest and during exercise.

athlete	stroke volume / dm^3	heart rate / beats per minute	cardiac output / $dm^3\ min^{-1}$
at rest	0.1	53	5.3
during exercise		182	30.4

(a) Calculate the stroke volume of the athlete during exercise.

(2)

answer = ... dm^3

(b) Explain why it is important that the cardiac output of the athlete increases during exercise.

(3)

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(c) Describe how the circulatory system transports substances around the body.

(2)

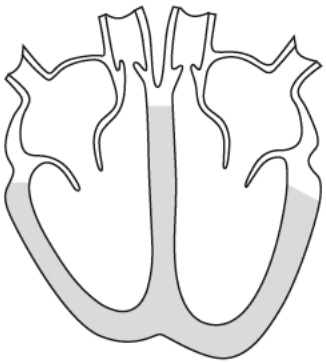
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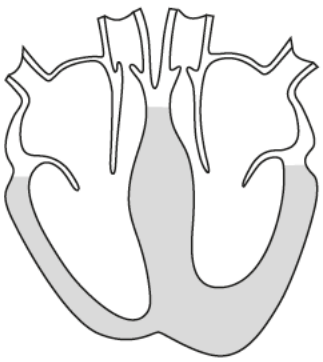
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(d) The diagrams below show a healthy heart and a heart with a condition known as hypertrophic cardiomyopathy (HCM).



healthy heart



hypertrophic cardiomyopathy

A symptom of HCM is that contraction of the heart muscle is more difficult.

Suggest the effects HCM may have on an athlete during competitive sport.

(2)

.....

.....

.....

.....

(e) Some athletes, such as sprinters, use energy from anaerobic respiration.

Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Anaerobic respiration produces

☒ **A** carbon dioxide

☒ **B** glucose

☒ **C** lactic acid

☒ **D** oxygen

(Total for Question 3 = 10 marks)

4 Figure 1 shows a diagram of the heart.

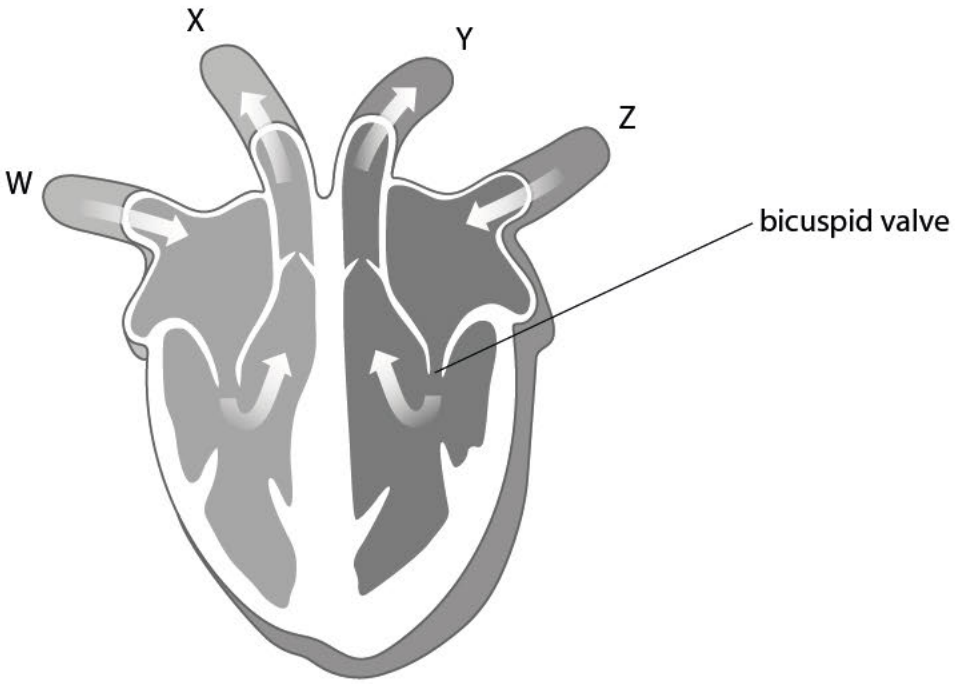


Figure 1

(a) (i) Vessel X takes

(1)

- ☒ **A** deoxygenated blood to the body
- ☒ **B** deoxygenated blood to the lungs
- ☒ **C** oxygenated blood to the body
- ☒ **D** oxygenated blood to the lungs

(ii) Give one reason why the wall of the left ventricle is thicker than the right.

(1)

.....

.....

Valves in the human heart may become damaged and no longer function.

(iii) Describe what would happen to the flow of blood in the left side of the heart if the bicuspid valve did not function effectively.

(2)

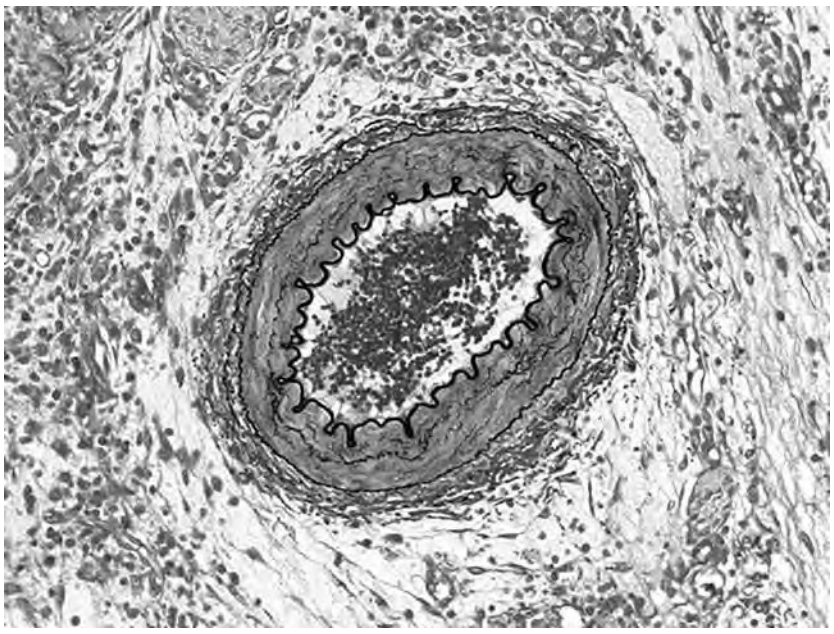
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Figure 2 shows a photomicrograph of a blood vessel.



(Source: Microscape/Science Photo Library)

Figure 2

(b) Explain how the structure of this blood vessel is related to its function.

(2)

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.....

.....

Figure 3 shows a diagram of the circulatory system of a fish.

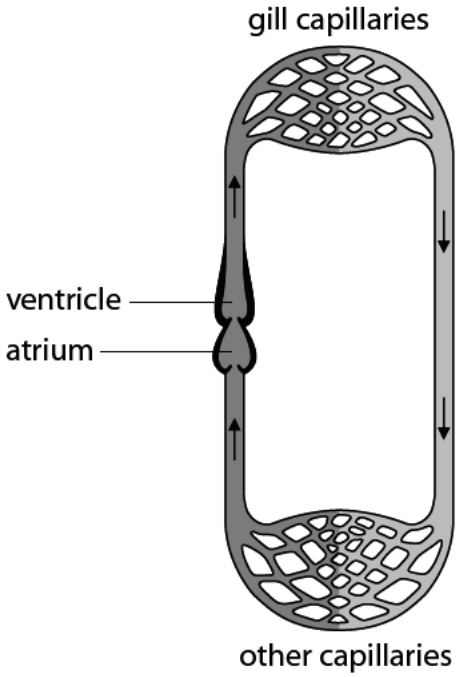


Figure 3

(c) Compare the differences between the structure of the circulatory system of a fish and the human circulatory system.

(4)

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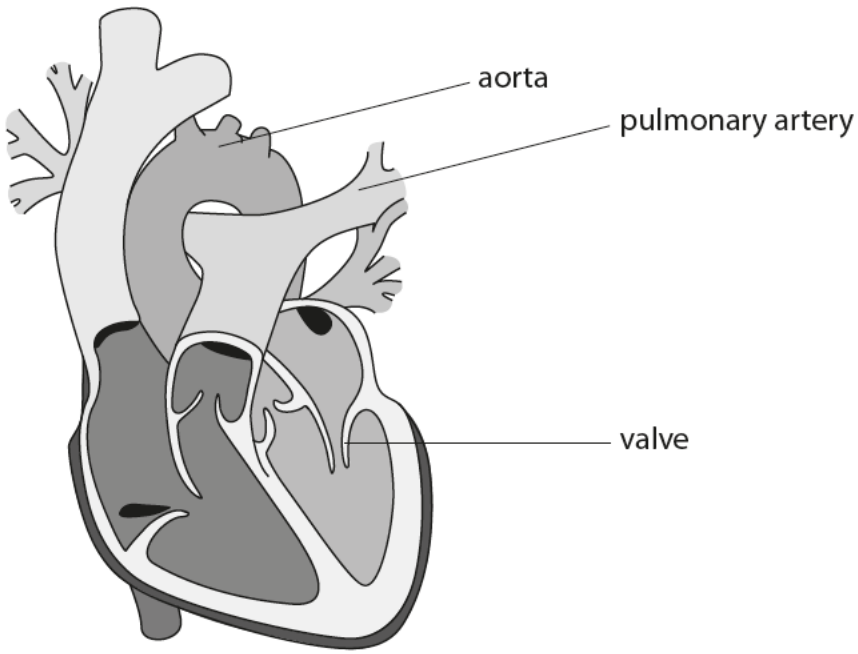
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(Total for Question 4 = 10 marks)

5 The diagram shows a human heart.



(a) (i) Draw an arrow onto the diagram to show where oxygenated blood enters the heart.

(1)

(ii) Suggest how the blood flowing through the pulmonary artery would be different from the blood flowing through the aorta.

(2)

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(iii) Describe the role of the valve labelled on the diagram.

(2)

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(b) Heart disease can significantly reduce cardiac output.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

Cardiac output is the volume of blood leaving the

(1)

☒ **A** atrium every heart beat

☒ **B** atrium every minute

☒ **C** ventricle every heart beat

☒ **D** ventricle every minute

*(ii) A reduced cardiac output would affect the performance of an athlete.

Explain the effects that a reduced cardiac output would have on the muscle cells of an athlete.

(6)

(Total for Question 5 = 12 marks)