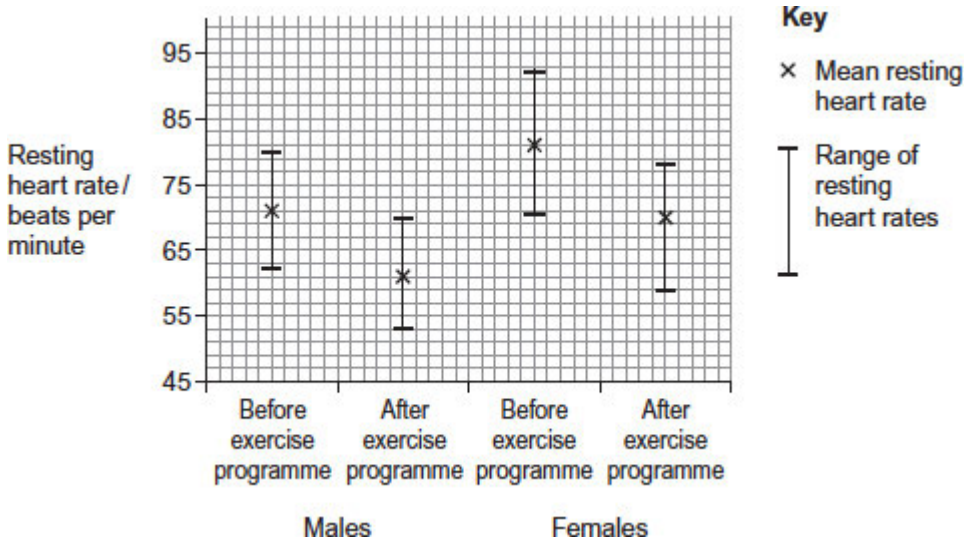
Q1. Scientists investigated the effect of a 6-week exercise programme on the resting heart rate of males and females.

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?

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(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.

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(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.

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(2)
(Total 7 marks)

Q2.(a) What is the function of the coronary arteries?

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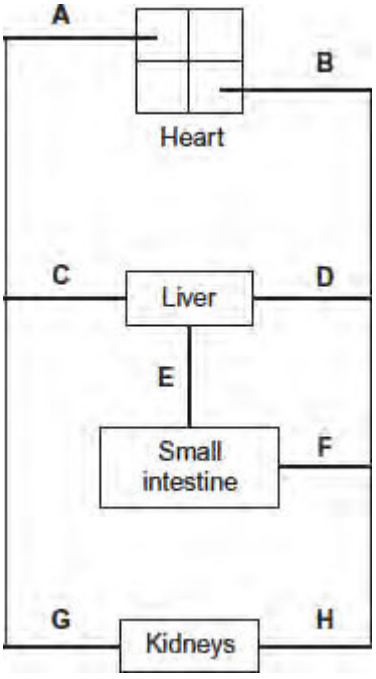
(2)

(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?

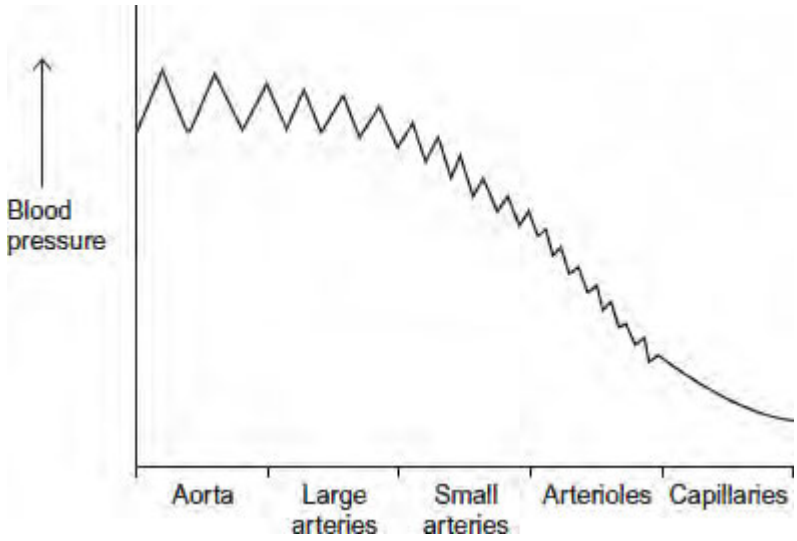
(1)

(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.

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[Extra space] .....

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(3)
(Total 7 marks)

Q3. 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.

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(1)

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

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(2)

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

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(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.

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(1)

(Total 5 marks)

Q4. 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] .....

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(Total 3 marks)

Q5. The figure below represents a capillary surrounded by tissue fluid.
The values of the hydrostatic pressure are shown.

Arteriole end ⟶ *direction of blood flow* ⟶ **Venule end**

Hydrostatic pressure = 4.3 kPa

Hydrostatic pressure = 1.6 kPa

Tissue fluid

Hydrostatic pressure = 1.1 kPa

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

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(2)

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

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(1)

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

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(Extra space) .....

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(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.

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(Extra space) .....

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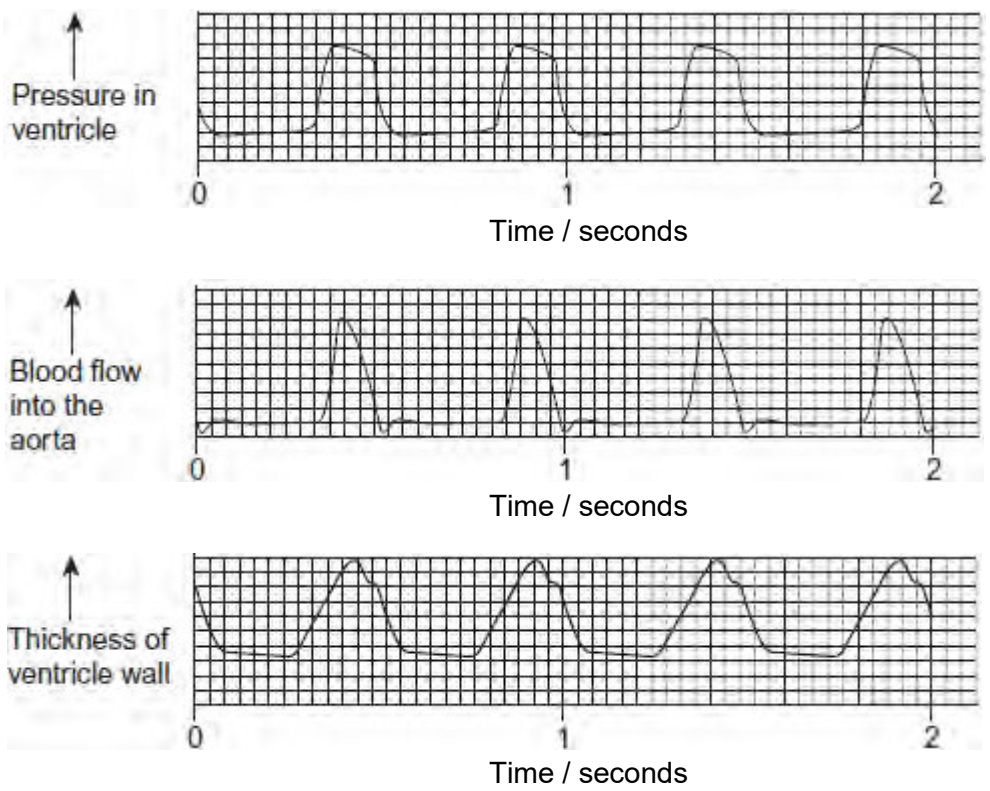
(3)
(Total 9 marks)

Q6. 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.

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(Extra space) .....

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(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.

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(Extra space) .....

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(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)