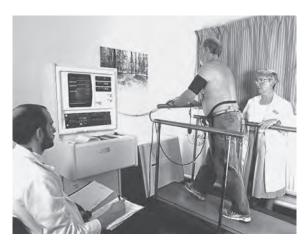1 A human heart can work effectively for over a hundred years but many people throughout the world have heart problems.

(a) Explain how the sinoatrial node (SAN) ensures that oxygenated blood enters the aorta.

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*(b) The treadmill test can be used to diagnose heart problems.

This test requires a person to walk on a treadmill whilst an electrocardiogram (ECG) is recorded.

The angle of the treadmill is raised to increase the level of exercise. The photograph below shows a person carrying out the treadmill test.

Explain how the heart rate of this person is controlled as the level of exercise increases during this test.

(6)

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(c) The ECG below was recorded at rest.

(i) This person had a resting heart rate of 74 beats per minute.

Calculate the time taken for this ECG. Show your working.

(2)

Answer ....

(ii) Suggest suitable units for the vertical axis (*y*-axis) of this ECG.

(1)

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(Total for Question 1 = 13 marks)

2 A number of drugs, including EPO, have been used by athletes.

EPO is a drug that stimulates the formation of red blood cells. EPO has been used to enhance the performance of certain types of athlete.

(a) Sprinters usually have more fast twitch fibres in their leg muscles than long distance runners.

Suggest why EPO may have less of an effect on the performance of a sprinter than on a long distance runner.

(3)

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(b) Suggest **two** ethical reasons why the use of drugs, such as EPO, should be banned from sport.

(2)

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(Total for Question 2 = 5 marks)

3 (a) Read through the following passage about the structure of the heart. Write on the dotted lines the most appropriate word or words to complete the passage.

(5)

The heart muscle in the walls of the heart is called .... muscle.

The .... valves control the flow of blood between the chambers of the heart.

The chamber of the heart that receives oxygenated blood from the lungs is named the

....

Deoxygenated blood is transported back to the lungs in the ....

Backflow of blood into the heart is prevented by .... valves.

(b) Arteries and capillaries are blood vessel adapted for specific roles in the circulatory system.

Give **two** differences between the structure of an artery and a capillary.

(2)

1 ....

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2 ....

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(c) Anticoagulants, such as warfarin, are used to treat cardiovascular disease (CVD).

(i) Explain how anticoagulants can help reduce the effects of CVD.

(2)

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(ii) State **one** risk associated with the use of anticoagulants.

(1)

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(Total for Question 3 = 10 marks)

4 Scientists investigated the BMI (Body Mass Index) of male office workers aged 40 and the type of breakfast they ate most regularly.

BMI is calculated using the formula below.

$$BMI = \frac{\text{mass in kilograms}}{(\text{height in metres})^2}$$

BMI can be used to indicate the category, shown in the table below, to which a person belongs.

Category	BMI range
underweight	less than 18.5
healthy weight	from 18.5 to 25
overweight	from 25 to 30
obese	over 30

The graph below shows the results of their investigation.

(a) Put a cross ⊠ in the box to complete each of the following statements.

(i) The graph shows that people who ate

(1)

⊠ **A** dairy products have a lower mean BMI than those people who ate bread.

⊠ **B** fruit and vegetables have the lowest mean BMI

⊠ **C** no breakfast have a higher mean BMI than those people who ate meat and eggs

⊠ **D** ready-to-eat cereal have a higher mean BMI than those people who ate cooked cereal

(ii) The graph shows that the mean BMI for

(1)

☒ **A** every group sampled in the investigation indicates that they were overweight

☒ **B** those who ate bread for breakfast indicates that they were a healthy weight

☒ **C** those who ate cooked cereals for breakfast indicates that they were underweight

☒ **D** those who ate dairy products for breakfast indicates that they were obese

(iii) The units for mean BMI are

(1)

☒ **A** $kg\ m^2$

☒ **B** $kg\ m^{-2}$

☒ **C** $m^2\ kg$

☒ **D** $m\ kg^{-2}$

(iv) The scientists ensured that their data were reliable by repeating the investigation with

(1)

☒ **A** a larger sample size

☒ **B** female office workers aged 40

☒ **C** more types of breakfast

☒ **D** male footballers

(b) Suggest how the scientists ensured that their investigation was valid.

(2)

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(c) Some people avoid eating breakfast in an attempt to lose weight.

Using information from the graph, suggest why eating no breakfast is unlikely to lead to weight loss.

(2)

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(d) Cooked cereal, such as porridge, contain a high proportion of dietary fibre. This helps to lower blood cholesterol levels.

Using the information in the graph and your knowledge of blood cholesterol, suggest why a breakfast of cooked cereal could reduce the chances of developing cardiovascular disease (CVD).

(3)

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(Total for Question 4 = 11 marks)