1 There are many venomous (poisonous) snakes in the world. Many of the venoms from these snakes affect the blood clotting process.

*(a) Describe the blood clotting process.

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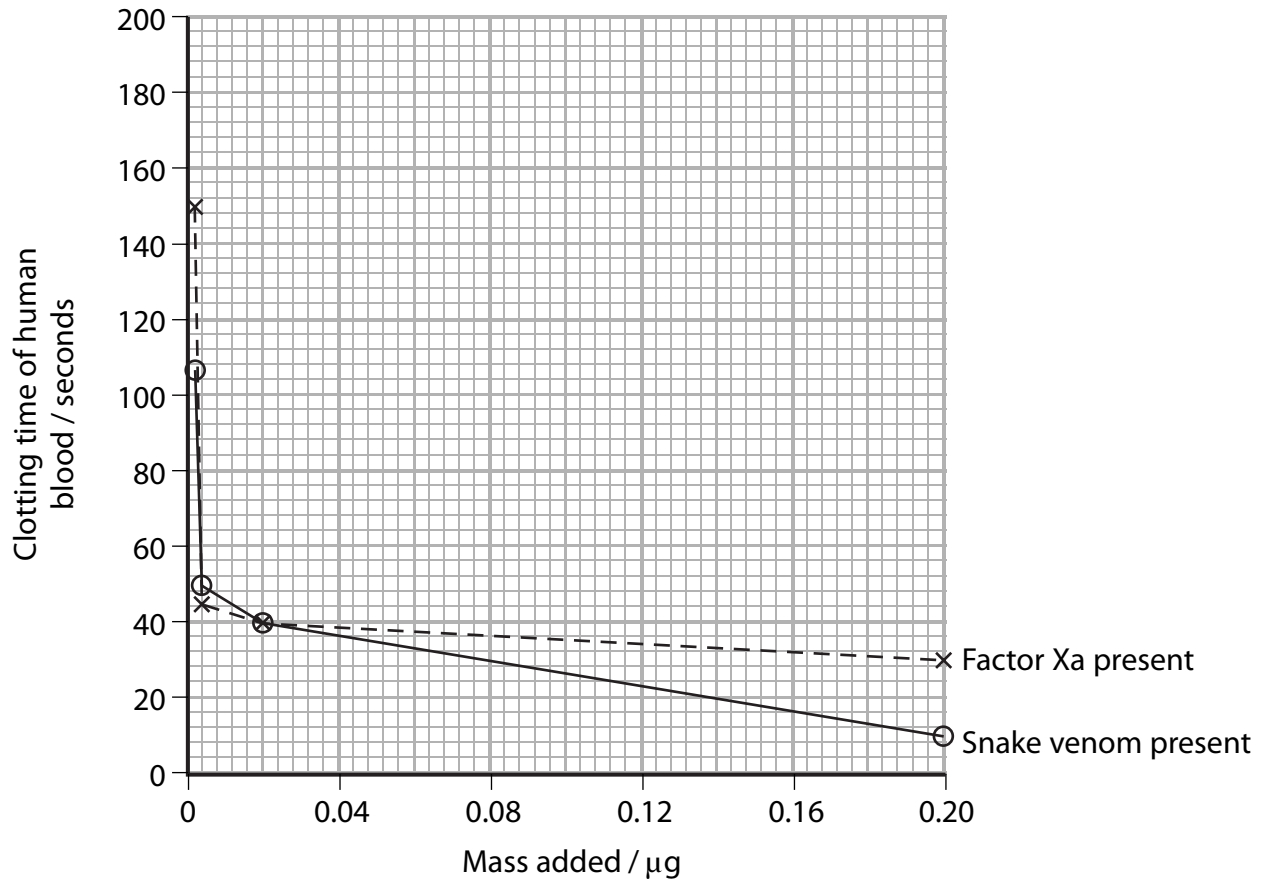
(b) Factor Xa is a clotting factor present in human blood.

An experiment was carried out to investigate the time taken for human blood to clot in the presence of different masses of Factor Xa. The experiment was repeated using snake venom in place of Factor Xa.

The graph below shows the results of these experiments.

(i) Using the information in the graph, describe the effect of the snake venom on the clotting time of human blood.

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(ii) Suggest why the clotting time of the human blood with snake venom added was compared with the clotting time in the presence of Factor Xa.

(1)

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(c) The component of the snake venom that affects blood clotting is an enzyme.

(i) Describe the structure of an enzyme.

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(ii) Suggest how the enzyme in the snake venom could be involved in the blood clotting process.

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(Total for Question 1 = 13 marks)

2 Obesity is a significant problem in western countries and an increasing problem in other parts of the world. An obese person has a greater risk of developing heart disease.

Body Mass Index (BMI) is one measure used to help decide if a person's weight is reasonable for their height. The BMI can be calculated by dividing mass in kilograms by height in metres squared. A table is then used to judge if the BMI is reasonable or not. A copy of this table is shown below.

BMI range	Less than 18.5	18.5 to 24.9	25.0 to 29.9	30.0 to 39.9	40.0 or above
Description	Underweight	Healthy weight	Overweight	Obese	Morbidly obese

(a) A man was concerned that he was overweight and could be at risk from coronary heart disease. He was 1.8 m tall and had a mass of 83.0 kg.

   (i)   Calculate this man's body mass index (BMI) using the formula below.

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

(2)

Answer ....

   (ii)   Using the information in the table, interpret this man's BMI.

(2)

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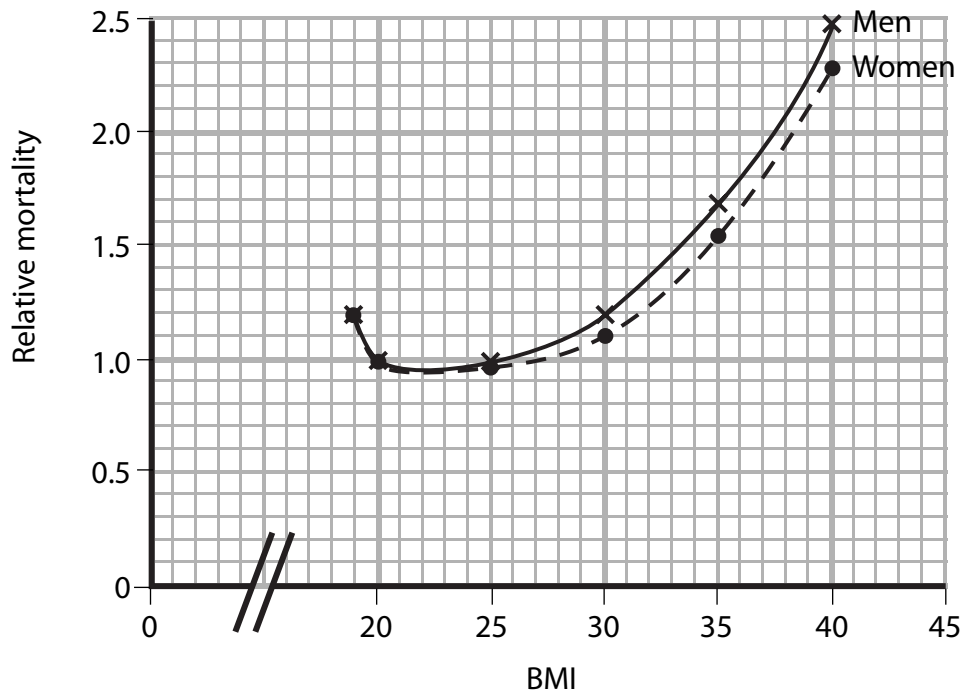..

(b) The graph below shows one analysis of relative mortality compared with BMI, for men and women.

Compare the effect of BMI on relative mortality for men and women.

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(c) (i) A relative mortality of 1.2 or less indicates a low risk of dying. Using the information given, discuss whether or not a woman with a BMI of 32.5 should be concerned about her risk of dying.

(2)

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*(ii) Cardiovascular disease (CVD) is responsible for many deaths.

Describe two changes that this woman may be able to make to her lifestyle, to reduce her risk of dying from CVD. Explain how each change would reduce the risk.

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(Total for Question 2 = 13 marks)

3 The cardiac cycle involves the contraction and relaxation of heart muscle. This brings about changes in blood pressure within the heart.

(a) The table below refers to the three phases of the cardiac cycle. Complete the table by stating whether the atria and ventricles are **contracted** or **relaxed** in each of these three phases.

(3)

Phase of cardiac cycle	Atria	Ventricles
Atrial systole		
Ventricular systole		
Diastole		

(b) Describe the roles of the atrioventricular (bicuspid and tricuspid) valves during the cardiac cycle.

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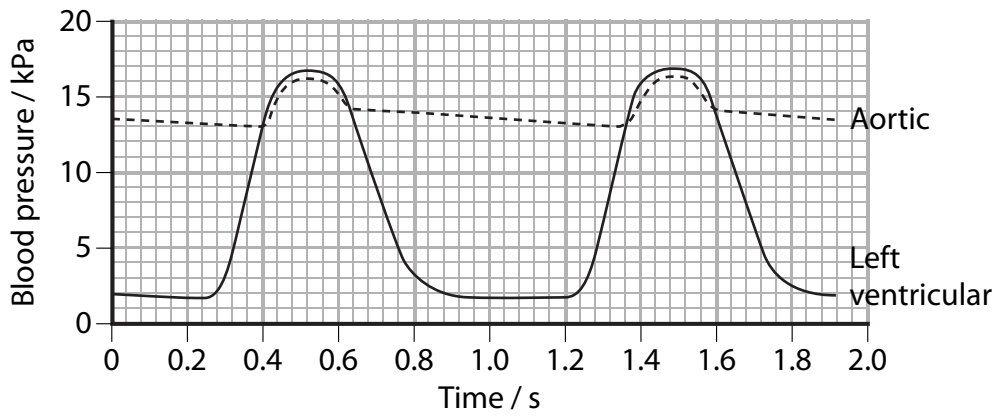
(c) The graph below shows changes in the blood pressure in the aorta and the left ventricle during two complete cardiac cycles.

(i) Use the information in the graph to calculate the heart rate. Show your working.

(3)

Answer ....

(ii) During the cardiac cycle, the pressure in the right ventricle rises to a maximum of about 3.3 kPa. Suggest reasons for the difference between this pressure and the maximum pressure in the left ventricle, as shown in the graph.

(3)

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(Total for Question 3 = 13 marks)

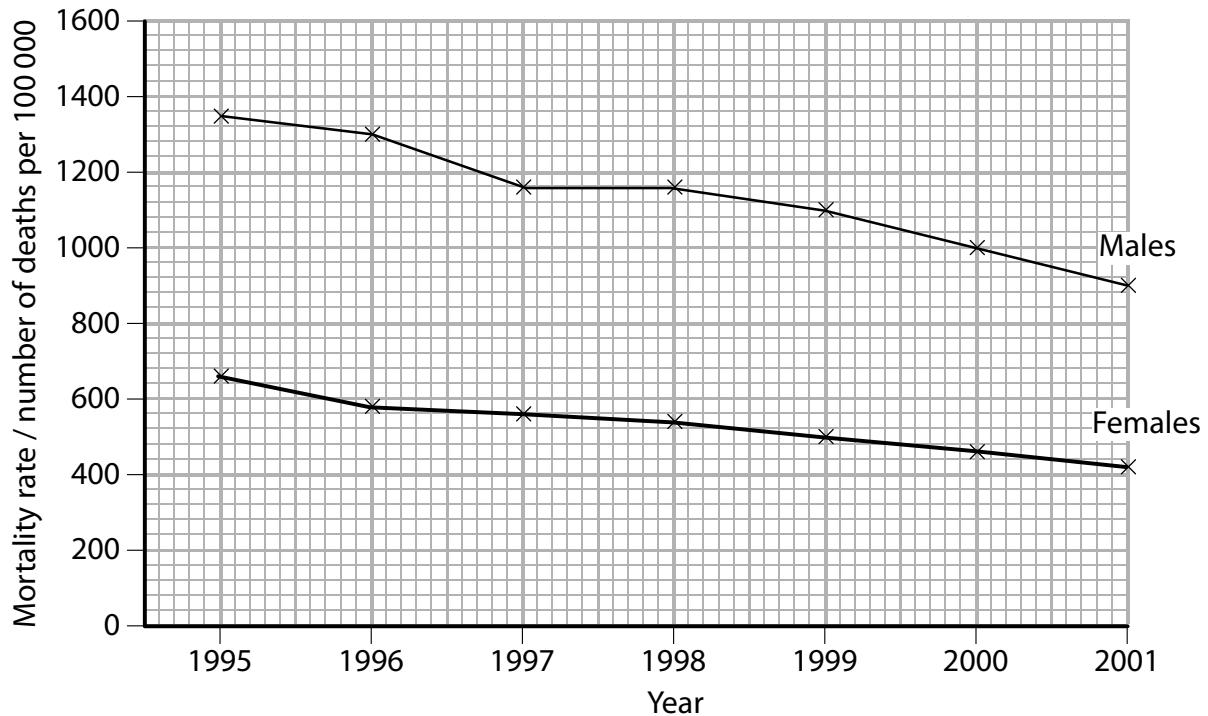**4** The graph below shows the mortality rate (number of deaths per 100 000) from coronary heart disease in people aged between 65 and 74 in Scotland between 1995 and 2001.

(a) Compare the mortality rate from coronary heart disease in males with that of females, between 1995 and 2001.

(3)

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(b) The graph shows a change in the number of deaths from coronary heart disease between 1995 and 2001. Suggest **three** reasons for this change.

(3)

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(c) One cause of coronary heart disease is atherosclerosis. Describe how atherosclerosis develops.

(4)

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(Total for Question 4 = 10 marks)