

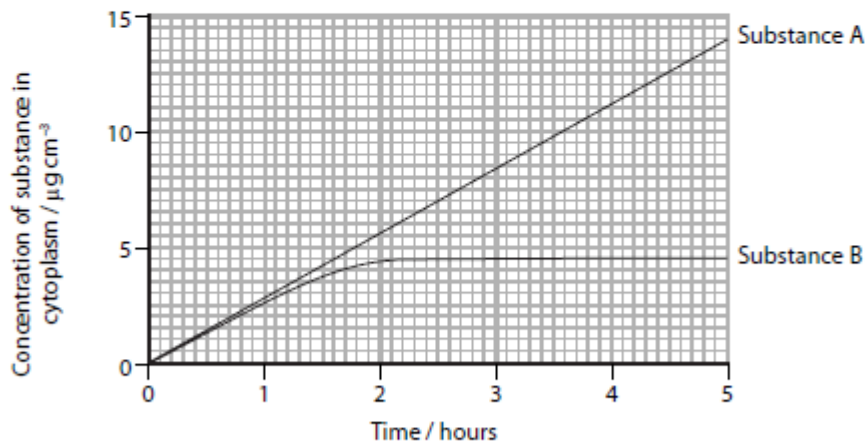
1)

Amoeba is a single-celled aquatic organism. Substances in the water can enter the cell by a variety of mechanisms.

An experiment was carried out to compare the uptake into *Amoeba* of substance A and substance B.

Some of these organisms were placed in a solution containing equal concentrations of both substances and kept at 25 °C. The concentration of substances A and B, in the cytoplasm of these organisms, was measured every 30 minutes over a period of 5 hours.

The results of this experiment are shown in the graph below.



(a) Using the information in the graph, compare the uptake of substance A with the uptake of substance B during this period of 5 hours. (3)

*(b) Substance B enters the cells by diffusion. Describe and explain how the results of this experiment support this statement. (4)

- (c) Substance A enters the cells by active transport. Give **two** differences between active transport and diffusion. (2)

2)

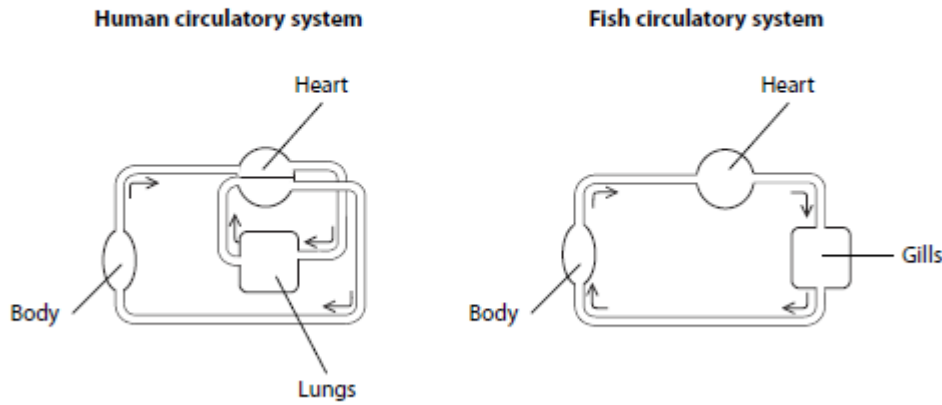
Many animals have hearts that pump blood through a network of blood vessels.

(a) The table below refers to blood flow in the four major blood vessels of the human heart. If the statement is correct, place a tick (✓) in the appropriate box and if the statement is incorrect, place a cross (✗) in the appropriate box. (4)

Name of blood vessel	Carries blood away from the heart	Carries oxygenated blood
Aorta		
Vena cava		
Pulmonary artery		
Pulmonary vein		

- (b) Humans and fish are both animals that have a heart and a network of blood vessels. However, there are some differences in their circulatory systems.

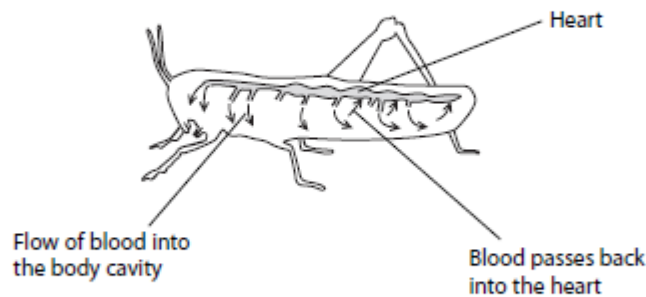
The diagrams below illustrate a human circulatory system and the circulatory system in a fish.



The arrows show the direction of blood flow.

- (i) Using the information in the diagram, describe the circulation of blood in a fish. (3)
- (ii) Using the information in both diagrams, suggest the advantages that the human circulatory system has compared with that of a fish. (2)
- (c) The heart of an insect is a long tube. It pumps blood into the body cavity so that blood surrounds the cells. The blood then passes back into the heart from the body cavity.

The diagram below illustrates the circulatory system of an insect.



Suggest why the insect does not need blood vessels to transport its blood around the body. (2)

3)

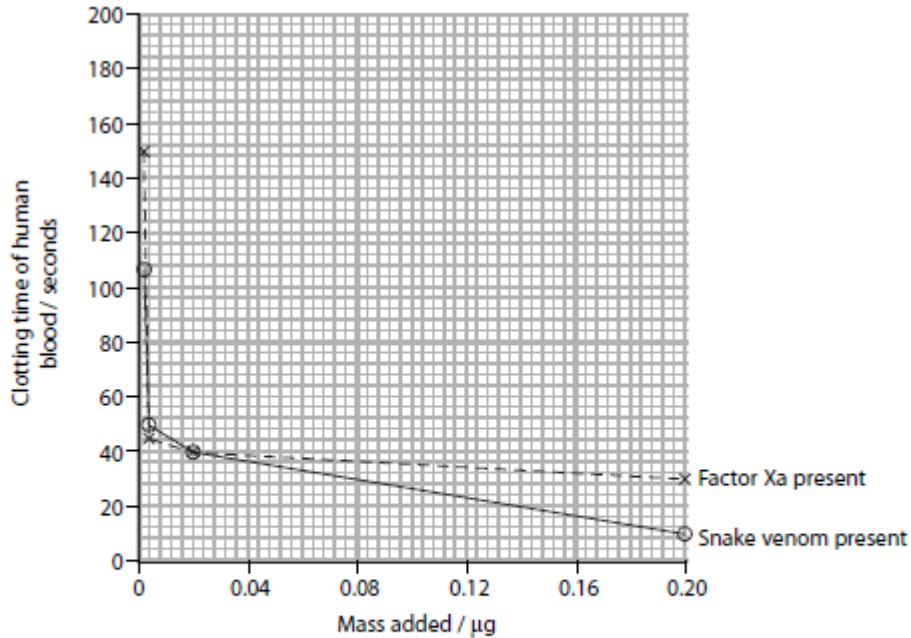
There are many venomous (poisonous) snakes in the world. Many of the venoms from these snakes affect the blood clotting process.

- *(a) Describe the blood clotting process. (4)

(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.

(3)

(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)

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

(i) Describe the structure of an enzyme.

(3)

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

(2)

4)

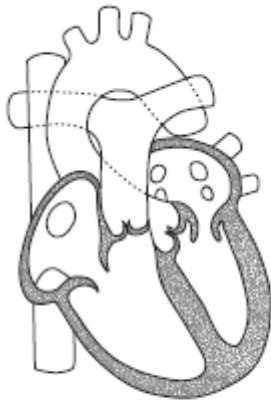
- (a) Read through the following passage about the heart and its major blood vessels, then write on the dotted lines the most appropriate word or words to complete the passage.

(5)

The mammalian heart consists of four chambers, two upper chambers called and two lower chambers called ventricles.

The carries oxygenated blood away from the ventricle to the cells of the body and the pulmonary carries deoxygenated blood to the lungs. The returns deoxygenated blood back to the heart from the body.

- (b) The diagram below shows the structure of the heart.



Suggest which stage of the cardiac cycle is shown in the diagram and give a reason for your answer.

(2)

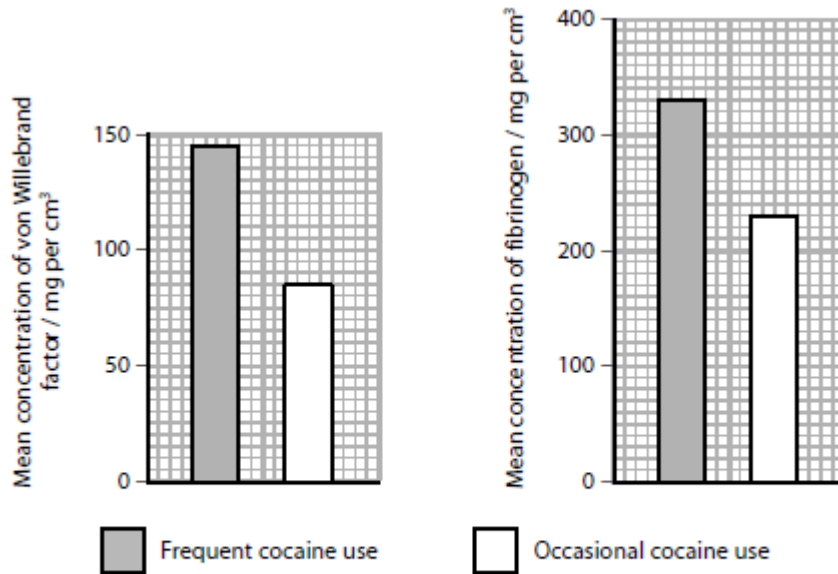
5)

Cocaine use increases the risk of a heart attack.

Cocaine also affects the levels of a number of blood components, including von Willebrand factor and fibrinogen. These two components are involved in blood clotting.

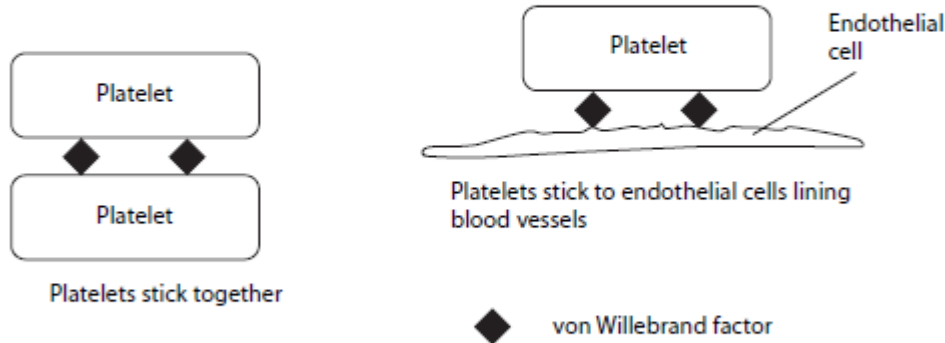
- (a) The normal range for von Willebrand factor is 50 to 150 mg per cm^3 and for fibrinogen is 150 to 300 mg per cm^3 .

The graphs below show the effects of frequent and occasional cocaine use on the mean concentration of von Willebrand factor and fibrinogen in the blood.



- (i) Describe the effects of frequent and occasional cocaine use on the mean concentrations of von Willebrand factor and fibrinogen in the blood. (3)
- (ii) Using the information given, explain why conclusions cannot be made about the effect of occasional cocaine use on the concentrations of these blood components. (1)

* (b) The diagram below shows two functions of von Willebrand factor.



Using the information in this diagram and your own knowledge of the blood clotting process, suggest why frequent cocaine use could increase the risk of a blood clot forming. (4)

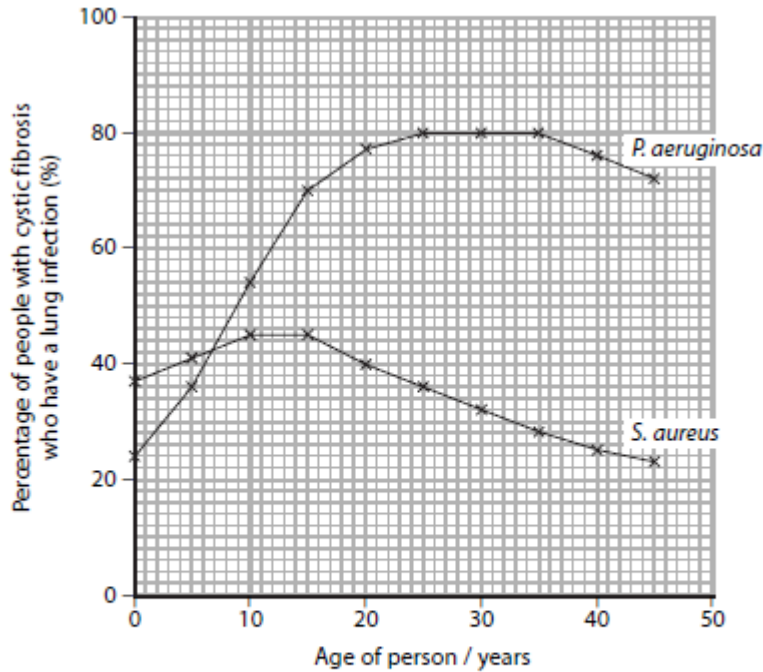
6)

Cystic fibrosis is a genetic disease that can affect many body systems, including the respiratory system.

- * (a) Explain how a gene mutation causes a build up of mucus in the respiratory system of a person with cystic fibrosis. (5)

- (b) Lung infections can be caused by bacteria such as *P. aeruginosa* and *S. aureus*. People with cystic fibrosis may develop these lung infections.

The graph below shows the relationship between the percentage of people with cystic fibrosis who have a lung infection and the age of the person.



- (i) Suggest why people with cystic fibrosis are more likely to suffer from these lung infections than people without cystic fibrosis. (2)
- (ii) Using the information in the graph, describe the relationship between the age of a person and the incidence of a lung infection due to *P. aeruginosa*. (3)
- (iii) Using the information in the graph, give **two** differences between the percentages of people with infections due to *P. aeruginosa* and infections due to *S. aureus*. (2)

7)

Plant statins are used in the treatment of cardiovascular disease (CVD). Some fungi can produce chemicals that can be used as statins. One example is a chemical referred to as drug S.

One study into the effect of drug S on the health of people taking it involved 20 000 people and ran for a period of 5 years. One group of people was given drug S and the other group was given a placebo. Each group had 10 000 people in it.

The table below shows some of the findings from this study.

Event	Percentage of people (%)	
	Taking drug S	Taking the placebo
Death	12.9	14.7
CVD	8.7	11.8
Stroke	4.3	5.7

(a) (i) Name **two** factors that increase the risk of CVD. (1)

(ii) Suggest why it was necessary to have so many people involved in this study. ... (2)

(b) Suggest what the placebo could be in this study. (1)

(c) Suggest why this study had to run for a number of years. (1)

(d) Using the data in the table, what is the evidence that drug S is safe for people to take? (2)

(e) (i) Calculate how many more people given the placebo had CVD compared with those given drug S. (3)

Answer

(ii) Explain why drug S could be a potential statin. (1)

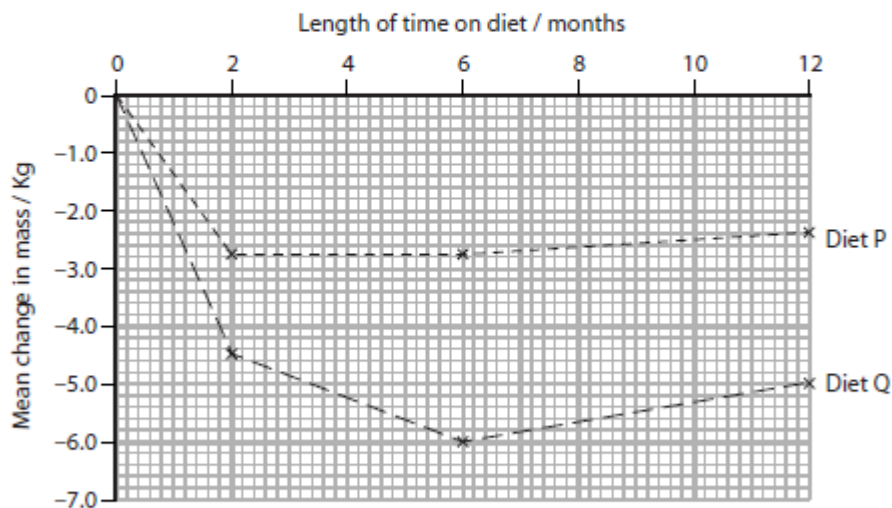
8)

Many different diets are available for people who want to lose weight. There is a lot of confusion over the merits of each one.

A scientist carried out an investigation to compare the effects of diet P and diet Q, on volunteers.

The changes in mass of two groups of volunteers on each of these diets were monitored over a 12-month period.

The graph below shows the mean changes in mass for each group of volunteers.



(a) (i) Compare the mean change in mass, over the first 6 months, for these two groups of volunteers. (3)

- (ii) Suggest why there was an increase in the mean mass of the volunteers on both diets between 6 months and 12 months. (1)
- (iii) State **two** variables that the scientist needed to control in this investigation. (2)
- (b) Suggest why exercise is usually included as part of a weight loss programme. (3)