1)

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.

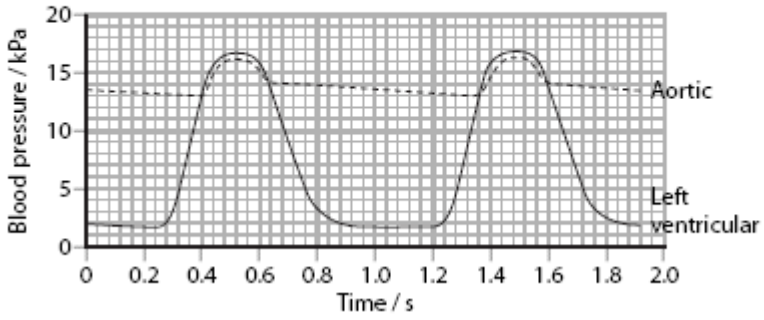
(3)

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.

(4)

(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)

2)

Data on the cholesterol levels and blood pressure for different adult populations in America were collected.
The mean cholesterol level and the percentage of each population with high blood pressure were calculated. The results are shown in the table below.

Adult population (ethnic groups)	**Mean cholesterol level / mg dm^{-3}**	**Percentage of population with high blood pressure (%)**
Black and African American	204	40
White American	206	27
Mexican American	205	29
American Indian and Alaskan Native	Statistically unreliable data	Statistically unreliable data

(a) There could be a causal link or correlation between high blood pressure and the other variables shown in the table.

Distinguish between the terms **causation** and **correlation**.

(2)

(b) (i) Using the information in the table above, describe the relationship between ethnic group, cholesterol levels and the percentage of the population with high blood pressure.

(2)

(ii) Suggest **one** reason why the data on the American Indian and Alaskan Native population are described as statistically unreliable.

(1)

(c) A student concluded from the results for gender, shown in the table below, that higher cholesterol levels cause lower blood pressure.

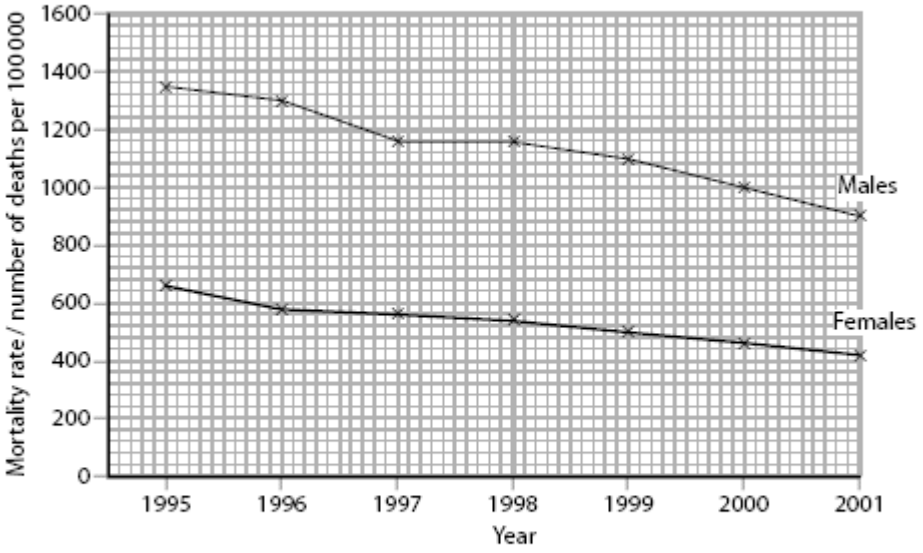
Adult population (gender)	**Mean cholesterol level / mg dm^{-3}**	**Percentage of population with high blood pressure (%)**
Female	207	26
Male	204	30

Using the information in both tables, explain why this is not a valid conclusion.

(3)

3)

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)

(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)

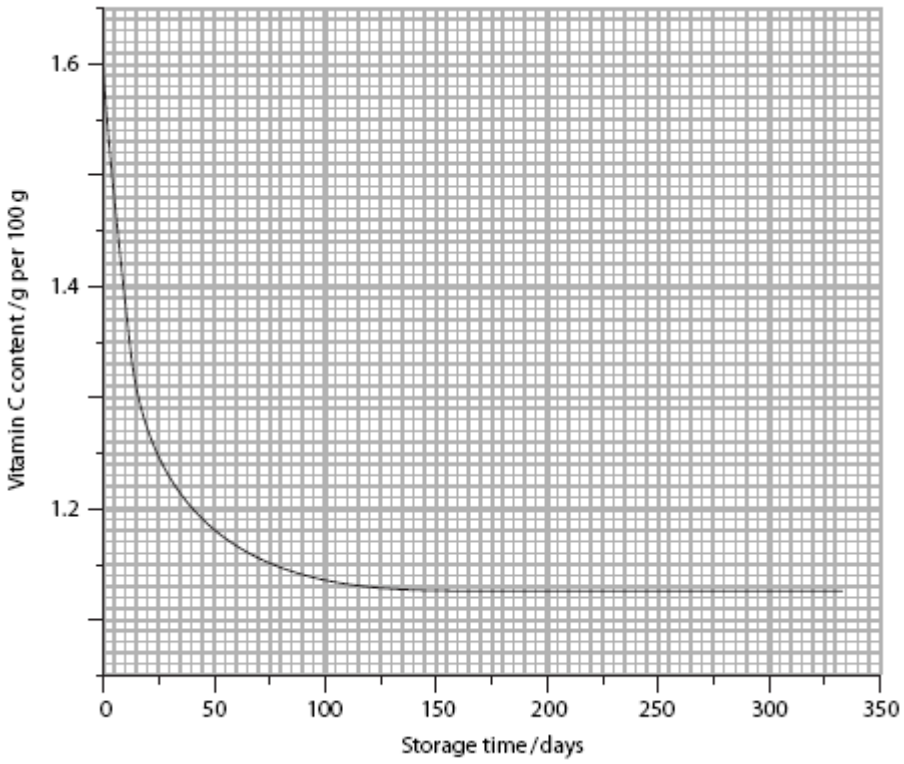
(c) One cause of coronary heart disease is atherosclerosis. Describe how atherosclerosis develops.

(4)

4)

Camu-camu are fruit that grow in the Amazon region of South America and are shown in the photograph below. They have a very high vitamin C content.

(a) An investigation was carried out into the effect of storage time on the concentration of vitamin C in camu-camu fruit. The results of this investigation are shown in the graph below.



Using the information in the graph, describe the effect of storage time on the vitamin C content of the camu-camu fruit.

(3)

(b) Paraná state is another region in South America that produces camu-camu fruit. The camu-camu fruit from this region have a different vitamin C content from those grown in the Amazon region.

Describe how an investigation could be carried out to compare the effect of storage time on the vitamin C content of the Paraná state camu-camu fruit with those from the Amazon region.

(5)

5)

In an osmosis investigation, a student prepared five pieces of raw potato of equal mass and a range of sucrose solutions of different concentrations.

One piece of potato was placed in each sucrose solution. After two hours, the potato pieces were removed and blotted dry and the change in mass of each potato piece was calculated.

The results are shown in the table below.

Concentration of sucrose solution / mol dm^{-3}	Change in mass of potato piece / g
0.2	+1.34
0.4	+0.82
0.6	+0.31
0.8	–0.11
1.0	–0.65

(a) Explain the meaning of the term **osmosis**.

(2)

(b) (i) Explain why the piece of potato placed in 0.2 mol dm^{-3} sucrose solution had the largest change in mass.

(3)

(ii) The student suggested that there would be no change in the mass of a piece of potato placed in a sucrose solution of 0.75 mol dm^{-3}. Give an explanation for this suggestion.

(2)

(c) The student repeated this investigation using another potato and the results were different.

The student concluded that there was a difference in water content of the two potatoes. Suggest **two** reasons for this difference in water content.

(2)

(d) A second student wanted to perform this investigation by measuring the change in length of the potato pieces. The student was advised that this method would not be as accurate as weighing the potato pieces.

Suggest **two** reasons why measuring the change in length would not be as accurate as weighing the potato pieces.

(2)

6)

The photograph below shows Ethiopian wolves (*Canis simensis*). They live on isolated mountains at altitudes above 3000 metres. They are one of 19 endemic animal species living in the mountains of Ethiopia.

Magnification ×0.01

(a) Explain what is meant by the term **endemic species**.

(1)

.....

.....

(b) There are estimated to be only 500 Ethiopian wolves left in the wild, living in six separate populations. There are high levels of genetic diversity between these six populations.

The separate populations are geographically isolated. This prevents interbreeding between populations.

Suggest how this may affect the genetic diversity of each individual population.

(2)

(c) Ethiopian wolves are endangered in the wild.

Some scientists have suggested that moving male wolves from one population to another may help the species survive.

Suggest how this strategy of transferring individuals from one population to another could help the species survive.

(2)

(d) (i) The table below shows adaptations of the Ethiopian wolf that enable it to survive in its mountain habitat. Place a cross (✕) in the table that correctly describes whether the adaptation is behavioural, anatomical or physiological.

(3)

Adaptation	Behavioural	Anatomical	Physiological
Small sharp teeth widely-spaced to cope with small prey			
Narrow snout to fit into small gaps when hunting small prey			
Hunting alone, as prey are too small to share with other wolves			

*(ii) Suggest how natural selection has led to the evolution of this species of wolf, adapted for life in the mountains of Ethiopia.

(4)

7)

Lipoprotein lipase is a biological catalyst and is involved in the hydrolysis of triglycerides.

(a) For each of the statements below, put a cross ☒ in the box that corresponds to the correct statement.

(i) A catalyst

☐ **A** decreases the rate of reaction by increasing the activation energy

☐ **B** decreases the rate of reaction by reducing the activation energy

☐ **C** increases the rate of reaction by increasing the activation energy (1)

☐ **D** increases the rate of reaction by reducing the activation energy

(ii) Hydrolysis results in bonds between glycerol and a fatty acid

☐ **A** being broken and water being formed

☐ **B** being broken and water being used

☐ **C** being formed and water being formed (1)

☐ **D** being formed and water being used

(iii) A triglyceride is made from

☐ **A** one glycerol and one fatty acid

☐ **B** one glycerol and three fatty acids

☐ **C** three glycerols and one fatty acid (1)

☐ **D** three glycerols and three fatty acids

(iv) A type of bond found in a triglyceride is

☐ **A** an ester bond

☐ **B** a glycosidic bond

☐ **C** a hydrogen bond (1)

☐ **D** a phosphodiester bond

(b) Some people have a mutation in the gene coding for lipoprotein lipase.

The table below shows the mean concentration of some types of lipid in the blood of people without the mutation and in the blood of people with the mutation.

Type of lipid	Mean concentration of lipid in blood / mg dm^{-3}	
	People without the mutation	People with the mutation
Triglyceride	102	93
LDL cholesterol	121	111
HDL cholesterol	48	49
Total cholesterol	186	179

It has been suggested that people with this mutation may be more at risk of developing cardiovascular disease (CVD).

(i) Give **two** reasons why the information in the table does **not** support this suggestion.

(2)

(ii) Name the type of drug that could be given to people with this mutation, to reduce the risk of developing CVD.

(1)

(iii) State **one** health risk associated with using this type of drug.

(1)