Q1.

Carbohydrates are needed as part of a balanced diet.

(a) Which formula shows glucose?

Tick (✓) one box.

| | |
|---|---|
| $C_6H_{12}O_6$ | ☐ |
| $CO_2$ | ☐ |
| $H_2O$ | ☐ |
| $O_2$ | ☐ |

(1)

(b) Which type of enzyme breaks down starch?

Tick (✓) one box.

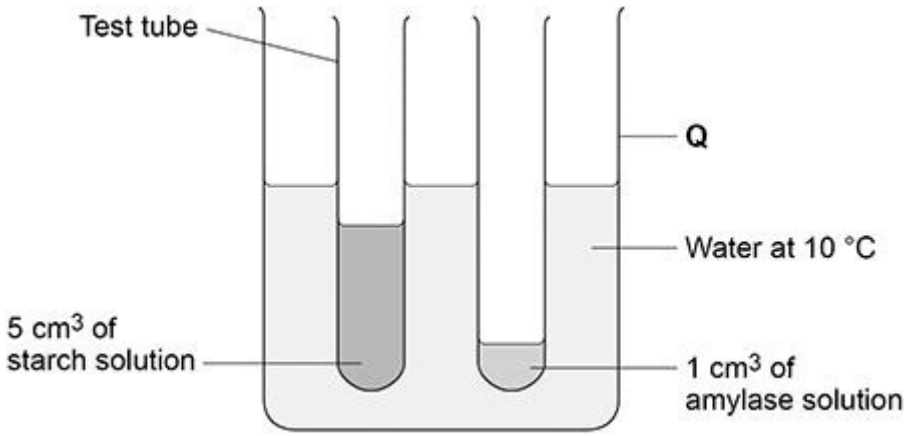
| | |
|---|---|
| Carbohydrase | ☐ |
| Lipase | ☐ |
| Protease | ☐ |

(1)

A student investigated the effect of temperature on the activity of the enzyme amylase.

Figure 1 shows the apparatus used.

Figure 1




This is the method used.

1. Set up the apparatus as shown in Figure 1.
2. After 5 minutes, pour the starch solution into the amylase solution and mix.
3. Remove one drop of the amylase-starch solution mixture and place onto a spotting tile.
4. Immediately add two drops of iodine solution to the amylase-starch solution mixture on the spotting tile.
5. Record the colour of the iodine solution added to the amylase-starch solution mixture.
6. Repeat steps 3 to 5 every minute until the iodine solution is yellow-brown.

(c) Name apparatus Q in Figure 1.

_____

(1)

(d) Why were the starch solution and the amylase solution left for five minutes before mixing them together?

Tick (✓) one box.

So that both solutions could reach 10 °C ☐

So that the student could calculate a mean ☐

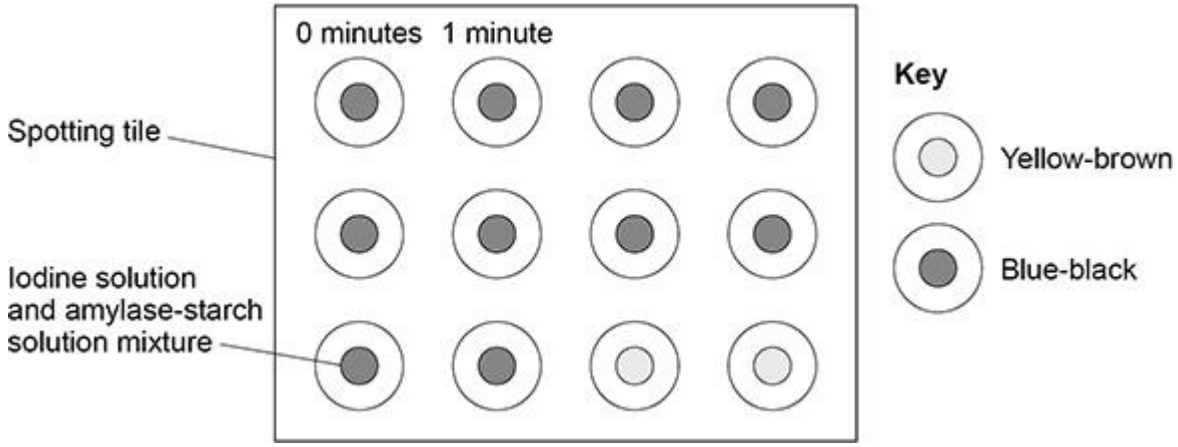
So that the student could repeat the investigation ☐

So that the student had time to draw a table of results ☐

(1)

Figure 2 shows the results.

Figure 2




(e) How many minutes did it take until the iodine solution and amylase-starch solution mixture was yellow-brown?

Use Figure 2.

_____ minutes

(1)

(f) How could a more accurate time be obtained?

Tick (✓) one box.

| | |
|---|---|
| Add more iodine solution to the spotting tile. | ☐ |
| Test the mixture with iodine solution every 30 seconds. | ☐ |
| Test the mixture with iodine solution for more time. | ☐ |
| Use two drops of amylase-starch solution mixture in each test. | ☐ |

(1)

The student repeated the investigation at five different temperatures.

The table below shows the results.

| Temperature in °C | Time taken until iodine solution and mixture was yellow-brown in minutes |
|---|---|

| | |
|---|---|
| 20 | 5 |
| 35 | 2 |
| 50 | 7 |
| 65 | 12 |
| 80 | Remained blue-black |

(g) Which temperature did the enzyme work quickest at?

Tick (✓) one box.

20 °C ☐

35 °C ☐

50 °C ☐

65 °C ☐

(1)

(h) Explain why the iodine solution remained blue-black in the investigation at 80 °C.

_____

_____

_____

_____

(2)

(Total 9 marks)

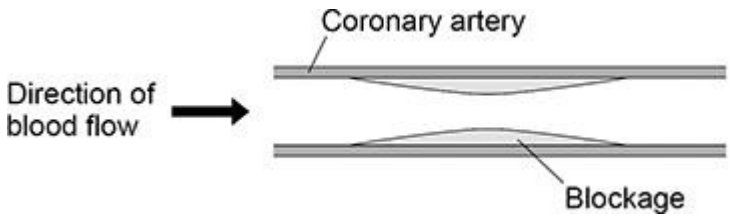
Q2.

A high cholesterol concentration in the blood can lead to blockages inside arteries.

The coronary arteries supply blood to the heart muscle.

Figure 1 shows a coronary artery with a blockage.

Figure 1




(a) Why could the blockage in Figure 1 cause cells in the heart to die?

_____

_____

_____

_____

(2)

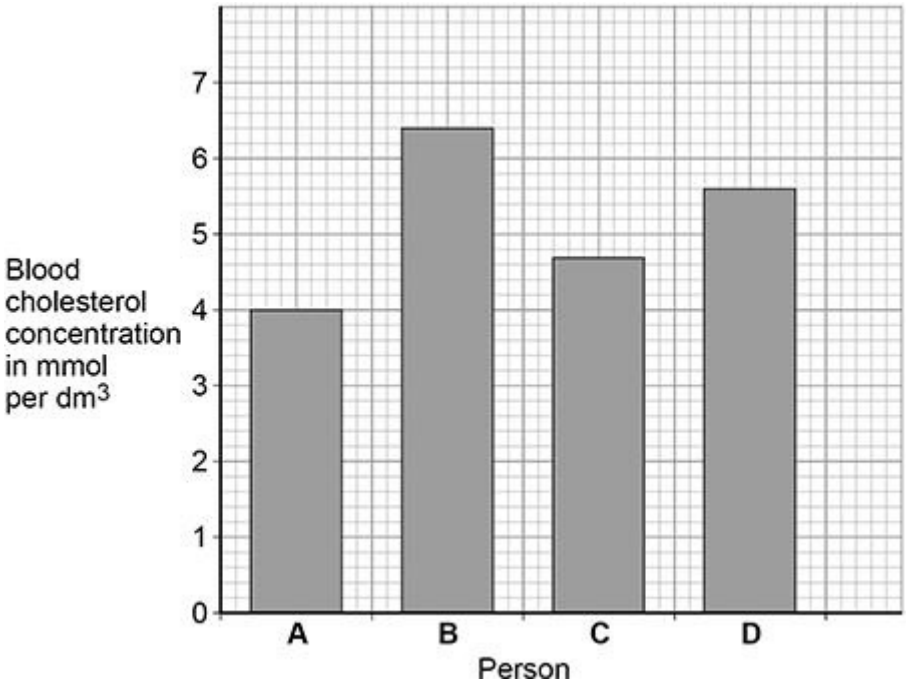
Doctors can measure the concentration of cholesterol in the blood.

The table below shows four different blood cholesterol categories.

| Blood cholesterol concentration in mmol per dm3 | Cholesterol category |
|---|---|
| <4.6 | Low |
| 4.6–5.0 | Normal |
| 5.1–6.1 | Medium |
| 6.2 and above | High |

Figure 2 shows the blood cholesterol concentration of four people.

Figure 2




(b) Which person is in the medium cholesterol category?

Tick (✓) one box.

A ☐ B ☐ C ☐ D ☐

(1)

(c) Which person is most at risk of having a heart attack?

Tick (✓) one box.

A ☐ B ☐ C ☐ D ☐

(1)

(d) Give a reason for your answer to part (c).

_____

_____

(1)

(e) The blood cholesterol concentration of person D is greater than the blood cholesterol concentration of person A.

Calculate how many times greater.

Use Figure 2.

_____

_____

_____

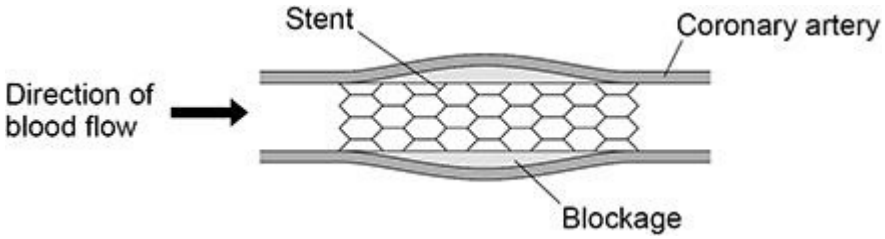
_____

Number of times greater = _____

(2)

Figure 3 shows how a stent can be used to treat a person with a blockage in a coronary artery.

Figure 3




(f) Explain how a stent works as a treatment for a person with a blockage in a coronary artery.

_____

_____

_____

_____

(2)

Patients are given anti-clotting drugs after they have a stent fitted.

The drugs help to prevent clots forming in the blood.

(g) Which part of the blood starts the blood clotting process?

Tick (✓) one box.

Antibodies ☐

Plasma ☐

Platelets ☐

Red blood cells ☐

(1)

(h) When a stent is fitted the doctor gives the patient an injection of anti-clotting drugs.

The patient then takes one anti-clotting tablet every day.

Anti-clotting drugs:

- are very effective
- can take a week to begin working fully
- have been used for over 60 years
- cost very little to make
- do not work effectively if the patient eats certain types of food.

The patient must have their blood tested every few weeks to check that the anti-clotting drugs are working.
Evaluate the use of anti-clotting drugs in patients who have had a stent fitted.

_____

_____

_____

_____

_____

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_____

_____

_____

(4)
(Total 14 marks)

## Q3.

Amylase is an enzyme that breaks down starch.

(a) Amylase is a polymer of smaller molecules.

Name the type of smaller molecule.

_____

(1)

(b) Name the three parts of the human digestive system that produce amylase.

1 _____

2 _____

3 _____

(2)

(c) Explain how amylase breaks down starch.

Answer in terms of the 'lock and key theory'.

_____

_____

_____

_____

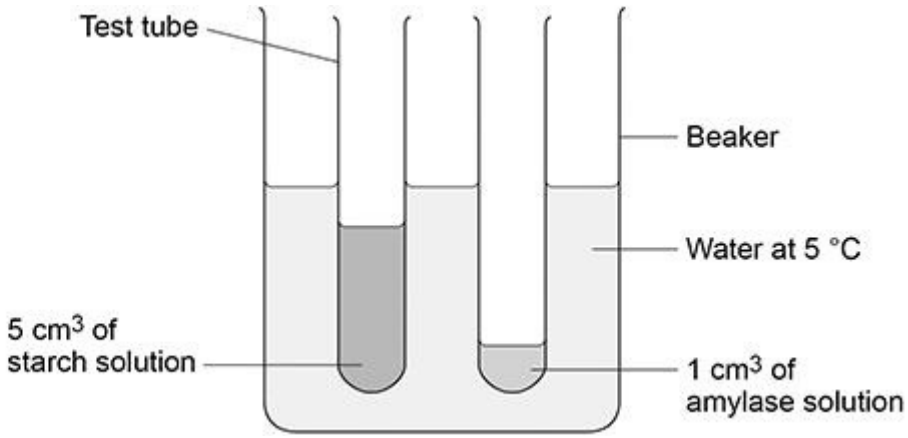
_____

_____

(3)

A student investigated the effect of temperature on the activity of amylase.

The figure below shows the apparatus used.




This is the method used.

1. Set up the apparatus as shown in the figure above.
2. After 5 minutes, pour the starch solution into the amylase solution and mix.
3. Remove one drop of the starch-amylase mixture and place onto a spotting tile.
4. Immediately add two drops of iodine solution to the starch-amylase

mixture
on the spotting tile.

5. Record the colour of the iodine solution added to the starch-amylase mixture.

6. Repeat steps 3 to 5 every minute until the iodine solution stays yellow-brown.

7. Repeat steps 1 to 6 using water at different temperatures.

(d) Name two control variables the student used in the investigation.

1 _____

2 _____

(2)

(e) Why did the student leave the starch solution and amylase solution for 5 minutes before mixing them?

_____

_____

(1)

The table below shows the results of the investigation.

| Temperature in °C | Time taken until iodine solution stays yellow-brown in minutes |
|---|---|
| 5 | did not become yellow-brown |
| 20 | 5 |
| 35 | 2 |
| 50 | 7 |
| 65 | 14 |
| 80 | did not become yellow-brown |

(f) What conclusion can be made about the effect of temperature on amylase activity between 20 °C and 65 °C?

_____

_____

(1)

(g) Explain the results at 5 °C and at 80 °C.

Use the table above.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(5)

(h) The student investigated the effect of temperature on amylase activity.

Describe how the student could extend the investigation to determine the effect of a different factor on amylase activity.

_____

_____

_____

_____

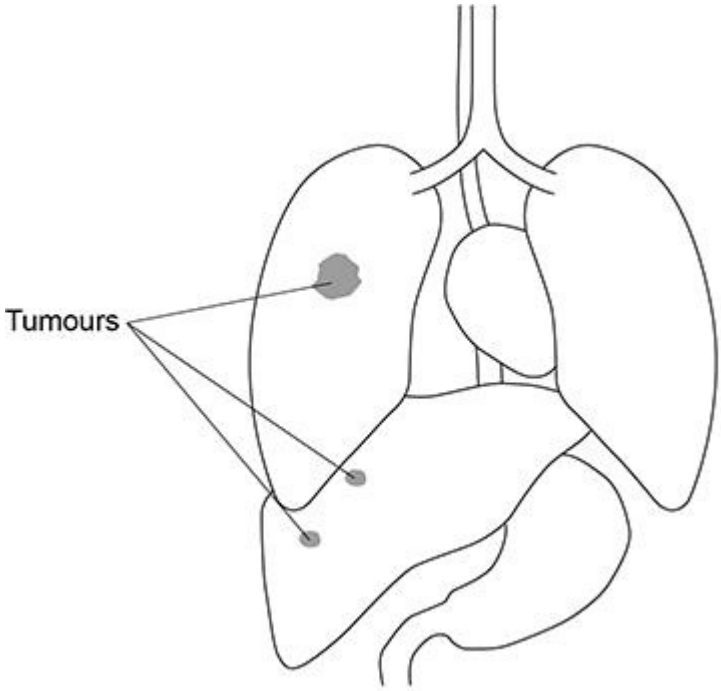
(2)

(Total 17 marks)

Q4.

Figure 1 shows where three of the same type of tumour were found in a patient.

Figure 1




Malignant tumours are cancers.

(a) Describe what happens to cells when a tumour forms.

_____

_____

(1)

(b) What evidence is there in Figure 1 to suggest that the tumour in the lung is malignant?

_____

_____

(1)

(c) Some types of cancer can cause the numbers of blood components in a person's body to fall to a dangerously low level.

A person with one of these types of cancer may experience symptoms such as:

- tiredness
- frequent infections
- bleeding that will not stop after the skin is cut.

Explain how a very low number of blood components in the body can cause these symptoms.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

Some patients with a very low number of blood cells may be given a blood transfusion.

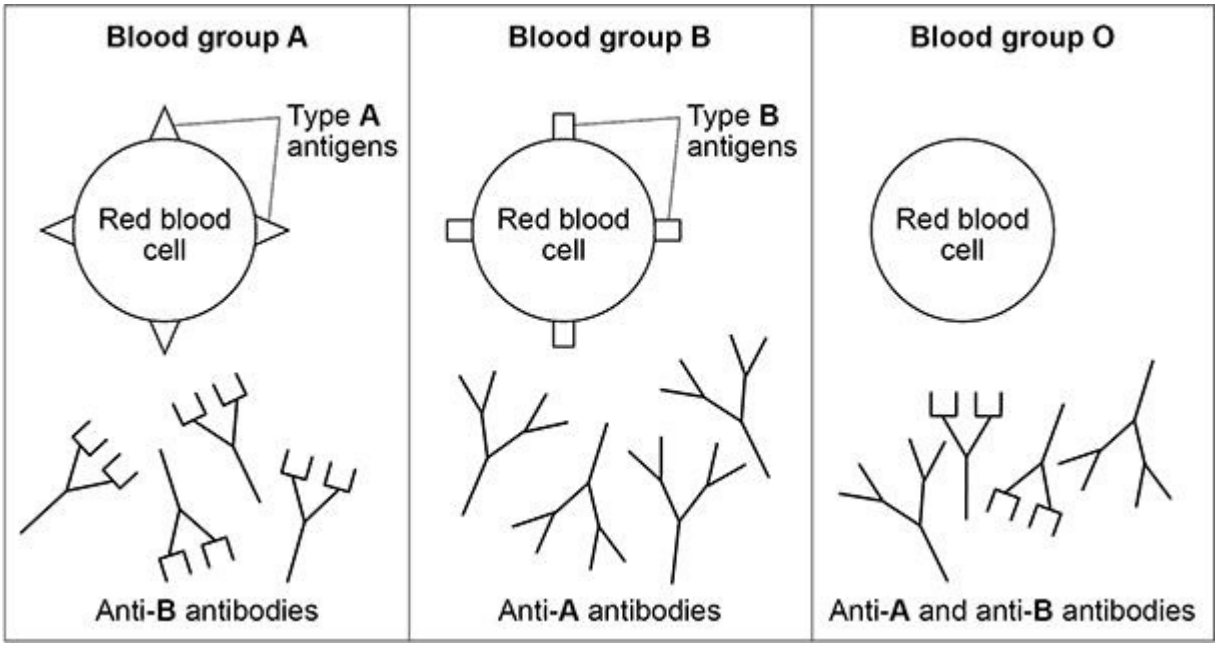
A blood transfusion is where a patient receives blood from a donor.

Different people have different blood groups.

Figure 2 shows:

- the red blood cells found in people with different blood groups
- the antibodies that can be made by people with different blood groups.

Figure 2



Antibodies can bind to antigens that have complementary shapes.

When antibodies bind to the antigens on red blood cells, many red blood cells begin to clump together.
Each red blood cell is about 8 μm in diameter.

Many capillaries have an internal diameter of about 10 μm.

In one type of blood transfusion, only red blood cells from a donor are transferred to the patient.

(d) It is dangerous for a patient with blood group A to receive red blood cells from a donor with blood group B.
Explain why.

_____

_____

_____

_____

_____

_____

_____

(3)

(e) Explain why blood group O red blood cells can be given to patients with any blood group.

_____

_____

_____

_____

(2)

(f) The table below shows some of the risks associated with blood transfusions.

| Risk | Probability of risk occurring |
|---|---|
| Allergic reaction | 0.9 % |
| Hepatitis B infection | 1 in (3 × 105) |

| | |
|---|---|
| Hepatitis C infection | $6.7 \times 10^{-7}$ |
| Kidney damage | 1 in 70 000 |

Which risk has the lowest probability of occurring?

Tick (✓) one box.

Allergic reaction ☐

Hepatitis B infection ☐

Hepatitis C infection ☐

Kidney damage ☐

(1)

(g) A person has a tumour blocking the tube leading from the gall bladder to the small intestine.

Explain why this person would have difficulty digesting fat.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(5)

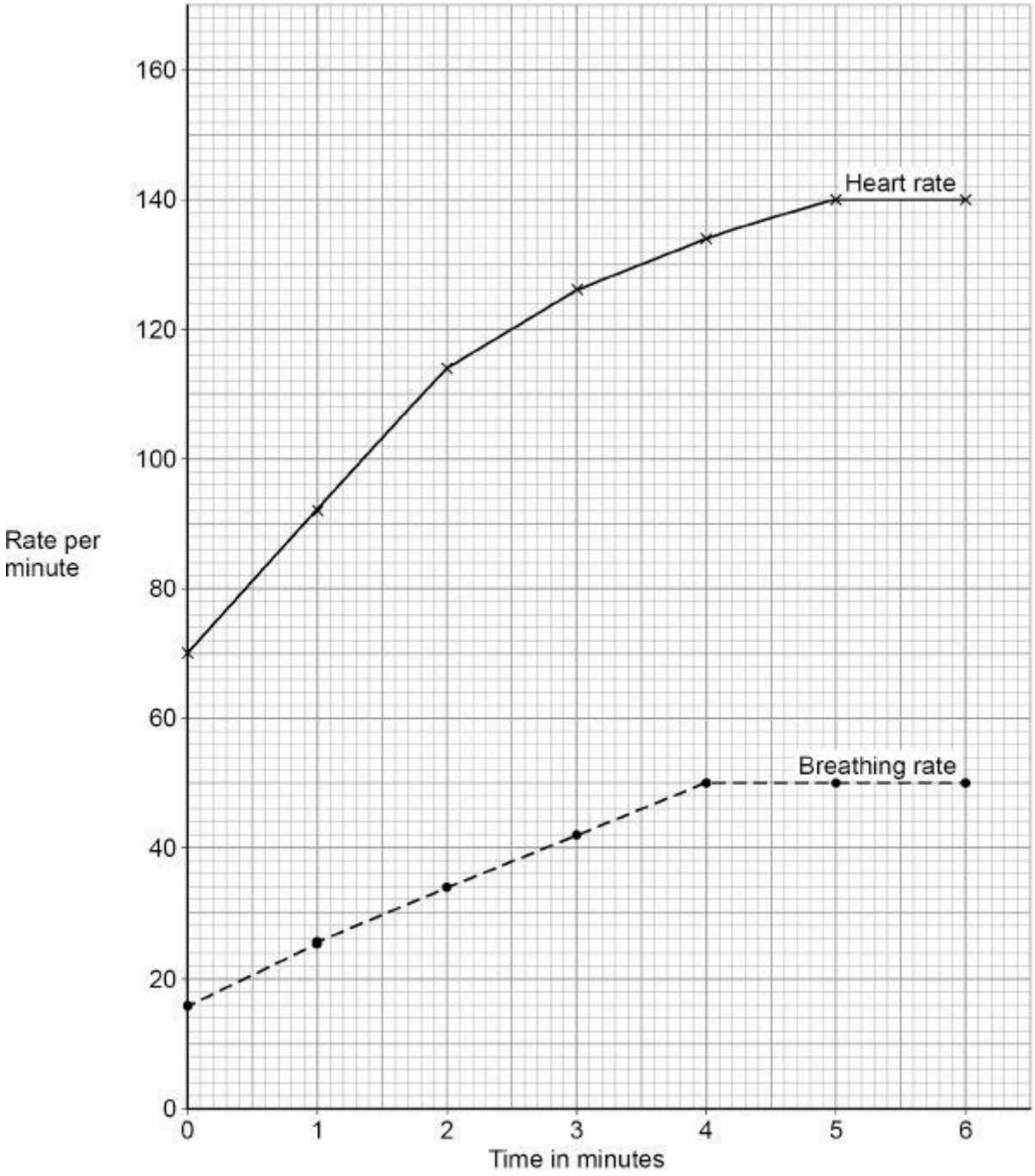
(Total 19 marks)

Q5.

A 45-year-old man exercised on a rowing machine for six minutes.

A fitness monitor recorded his heart rate and breathing rate every minute.

The graph below shows the results.




(a) Describe the trend for breathing rate shown in graph.

Use data from the graph in your answer.

_____

_____

_____

_____

_____

_____

(3)

(b) The safe maximum heart rate for a person exercising can be calculated using the equation:

safe maximum heart rate = 220 – age in years

Calculate the safe maximum heart rate for the man.

_____

Safe maximum heart rate = _____ beats per minute

(1)

(c) What is the man's maximum heart rate?

Use the graph above.

Man's maximum heart rate = _____ beats per minute

(1)

(d) The man concluded that he was exercising at a safe heart rate.

Give the reason for his conclusion. Use your answers from part (b) and part (c)

_____

_____

(1)

(e) Explain the ways the man's body has responded to the exercise.

Use information from the graph above.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

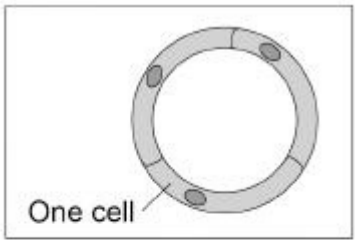
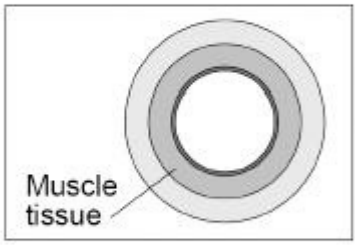
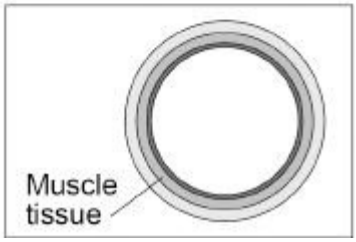
(6)

(Total 12 marks)

## Q6.

Blood is transported around the body in blood vessels.

(a) Draw one line from each type of blood vessel to the structure of the blood vessel.

| Type of blood vessel | Structure of blood vessel |
| --- | --- |
| Artery |   |
| Capillary |   |
| Vein |   |

(2)

(b) Explain how the structure of an artery is related to its function.

_____

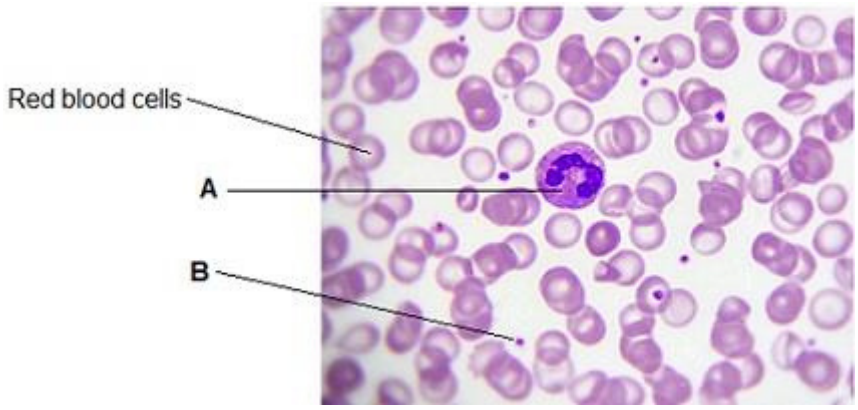
_____

_____

_____

(2)

The image below shows blood viewed through a microscope.




(c) Name A and B in the image.

A _____

B _____

(2)

(d) A red blood cell:

- has no nucleus
- contains a red pigment called haemoglobin.

Suggest how these adaptations help the red blood cell carry out its function.

No nucleus

_____

_____

Haemoglobin

_____

_____

(2)

(e) The blood components are carried around the body in the liquid part of the blood.

What is the liquid part of the blood called?

Tick (✓) one box.

Cell sap ☐

Plasma ☐

Saliva ☐

Urine ☐

(1)

The table below shows the results of a man's blood test.

| Blood component | Patient results | Normal range |
|---|---|---|
| Red blood cells | 4.8 | 4.5 to 6.5 |
| Lymphocytes | 2.6 | 1.0 to 4.0 |
| Neutrophils | 5.1 | 1.8 to 7.5 |
| Platelets | 50 | 140 to 400 |

(f) Which component of the man's blood is not within the normal range?

_____

(1)

(g) Suggest a symptom the man might show.

_____

_____

(1)

(Total 11 marks)

Q7.

Diffusion is an important process in animals and plants.

(a) What is meant by the term diffusion?

_____

_____

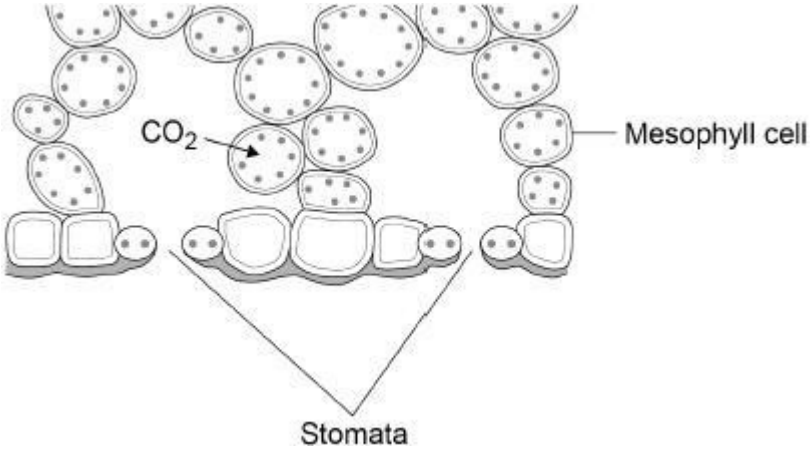
_____

_____

(2)

(b) Figure 1 shows part of a leaf.

Figure 1




Molecules of carbon dioxide diffuse from the air into the mesophyll cells.

Which two changes will increase the rate at which carbon dioxide diffuses into the mesophyll cells?
Tick (✓) two boxes.

- Decreased number of chloroplasts in the cells ☐
- Decreased surface area of cells in contact with the air ☐
- Increased carbon dioxide concentration in the air ☐
- Increased number of stomata that are open ☐

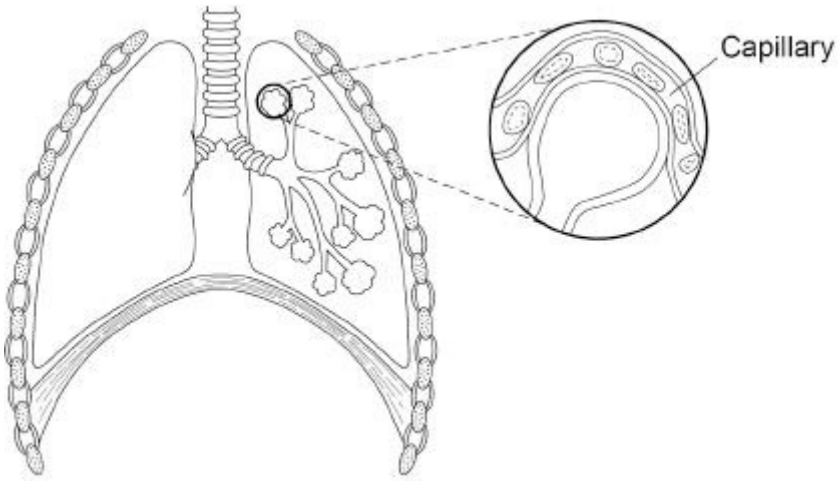
Increased oxygen concentration in the air ☐

(2)

(c) Diffusion also happens in the human lungs.

Figure 2 shows the human breathing system.

Figure 2




Explain how the human lungs are adapted for efficient exchange of gases by diffusion.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

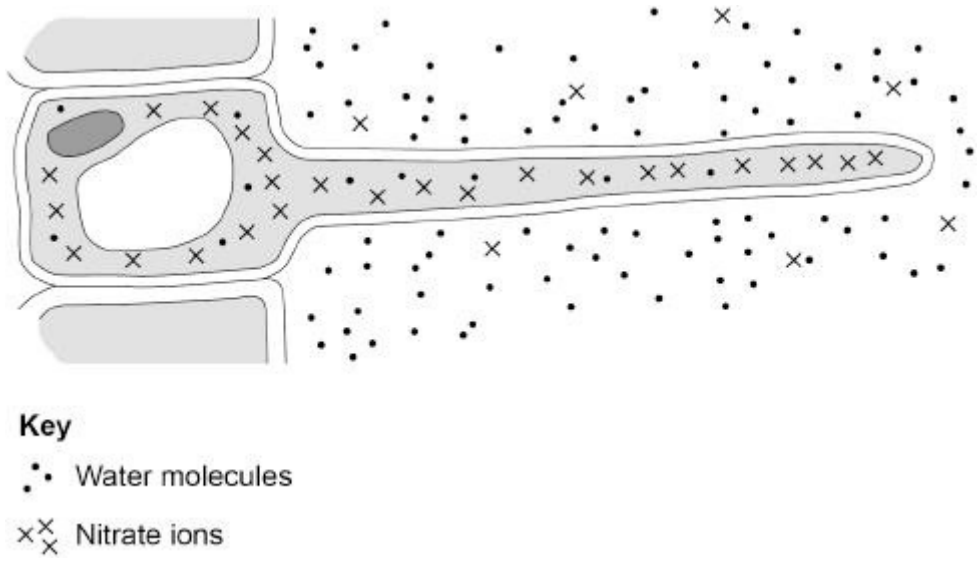
_____

_____

(6)

Figure 3 shows a root hair cell.

Figure 3




(d) Name the process by which water molecules enter the root hair cell.

_____

(1)

(e) Nitrate ions need a different method of transport into the root hair cell.

Explain how the nitrate ions in Figure 3 are transported into the root hair cell.

Use information from Figure 3 in your answer.

Name of process

_____

Explanation

_____

_____

_____

_____

_____

(3)

(Total 14 marks)

Q8.

Lipases break down lipids.

(a) Which two products are formed when lipids are broken down?

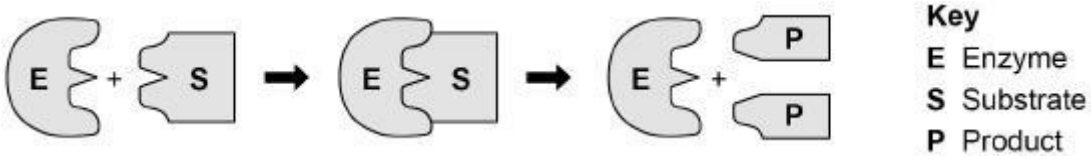
Tick (✓) two boxes.

| | |
|---|---|
| Amino acids | ☐ |
| Fatty acids | ☐ |
| Glucose | ☐ |
| Glycerol | ☐ |
| Glycogen | ☐ |

(2)

One model used to explain enzyme action is the 'lock and key theory'.

The diagram below shows a model of the theory.




(b) Explain the 'lock and key theory' of enzyme action.

Use information from the diagram above in your answer.

_____

_____

_____

_____

_____

_____

_____

(3)

(c) There are many different types of lipase in the human body.

Why does each different type of lipase act on only one specific type of lipid molecule?

_____

_____

Students investigated the presence of starch and glucose in the leaves of geranium plants.
This is the method used.

1 Place two identical geranium plants on a bench near a sunny window for two days.

2 After two days:
- leave one plant near the window for two more days.
- place one plant in a cupboard with no light for two more days.

3 Remove one leaf from each plant.

4 Crush each leaf to extract the liquid from the cells.

5 Test the liquid from each leaf for glucose and for starch.

(1)

(d) Describe how the students would find out if the liquid from the leaf contained glucose.

_____

_____

_____

_____

_____

_____

(3)

(e) Describe how the students would find out if the liquid from the leaf contained starch.

_____

_____

_____

_____

(2)

The table below shows the students' results.

| Test | Leaf from plant kept in light for four days | Leaf from plant kept in light for two days and then no light for two days |
|---|---|---|
| Glucose | Strong positive | Weak positive |
| Starch | Positive | Negative |

(f) Explain why the leaf in the light for four days contained both glucose and starch.

_____

_____

_____

_____

(2)

(g) Explain why the leaf left in a cupboard with no light for two days did contain glucose but did not contain starch.

_____

_____

_____

_____

_____

_____

(3)

(h) Suggest one way the students could develop the investigation to find out more about glucose and starch production in plants.

_____

_____

(1)

(Total 17 marks)

Q9.

Data from 'The Million Women' survey in the UK was collected for over 15 years.

Scientists analysed the data to study the effect of consuming alcohol on liver disease.
The scientists:

- included 400 000 women who regularly consumed alcohol
- included 400 000 women who did not consume alcohol
- excluded women who already had a liver disease.

(a) Age and gender were two factors controlled in this analysis.

Many other factors were also controlled.

Suggest two other factors which the scientists would have controlled.

1 _____

_____

2 _____

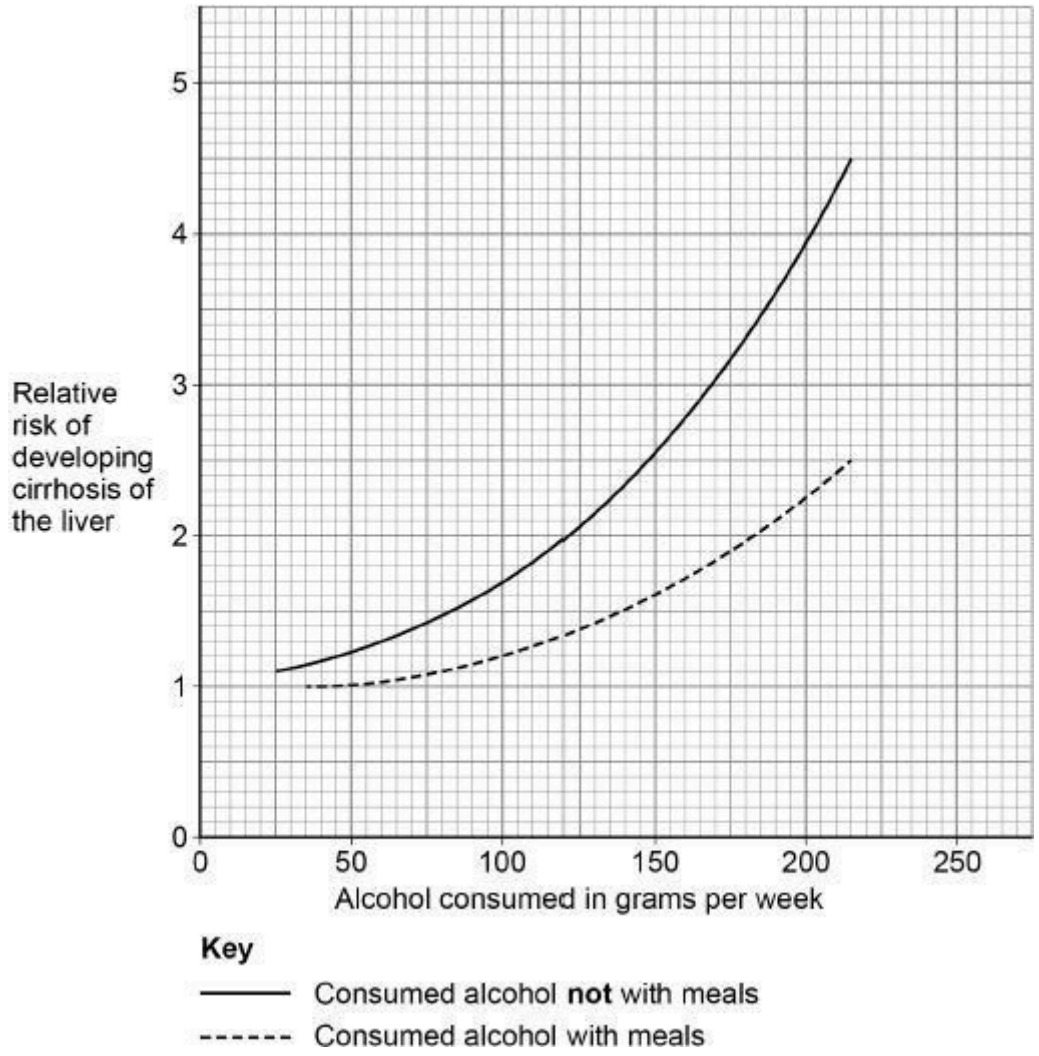
_____

(2)

The data was analysed for:

- women who drank alcohol with meals
- women who drank alcohol not with meals
- women who did not drink alcohol.

During the survey approximately 1500 women developed a liver disease called cirrhosis of the liver.
Scientists calculated the relative risk of developing cirrhosis of the liver for each group who consumed alcohol.
A relative risk of 1.0 means there was no statistical difference between the groups who did consume alcohol and the group who did not consume alcohol.
The below graph shows a summary of the results.




(b) A woman drinks 150 g of alcohol per week not with meals. The woman decides to change to drinking 150 g of alcohol per week with meals.

Calculate the percentage decrease in relative risk of developing cirrhosis of the liver for this woman.

_____

_____

_____

_____

Percentage decrease = _____ %

(2)

(c) One glass of wine contains 12 g of alcohol.

A different woman drinks two glasses of wine each day with her meals.

Calculate the relative risk of developing cirrhosis of the liver for this woman.

_____

_____

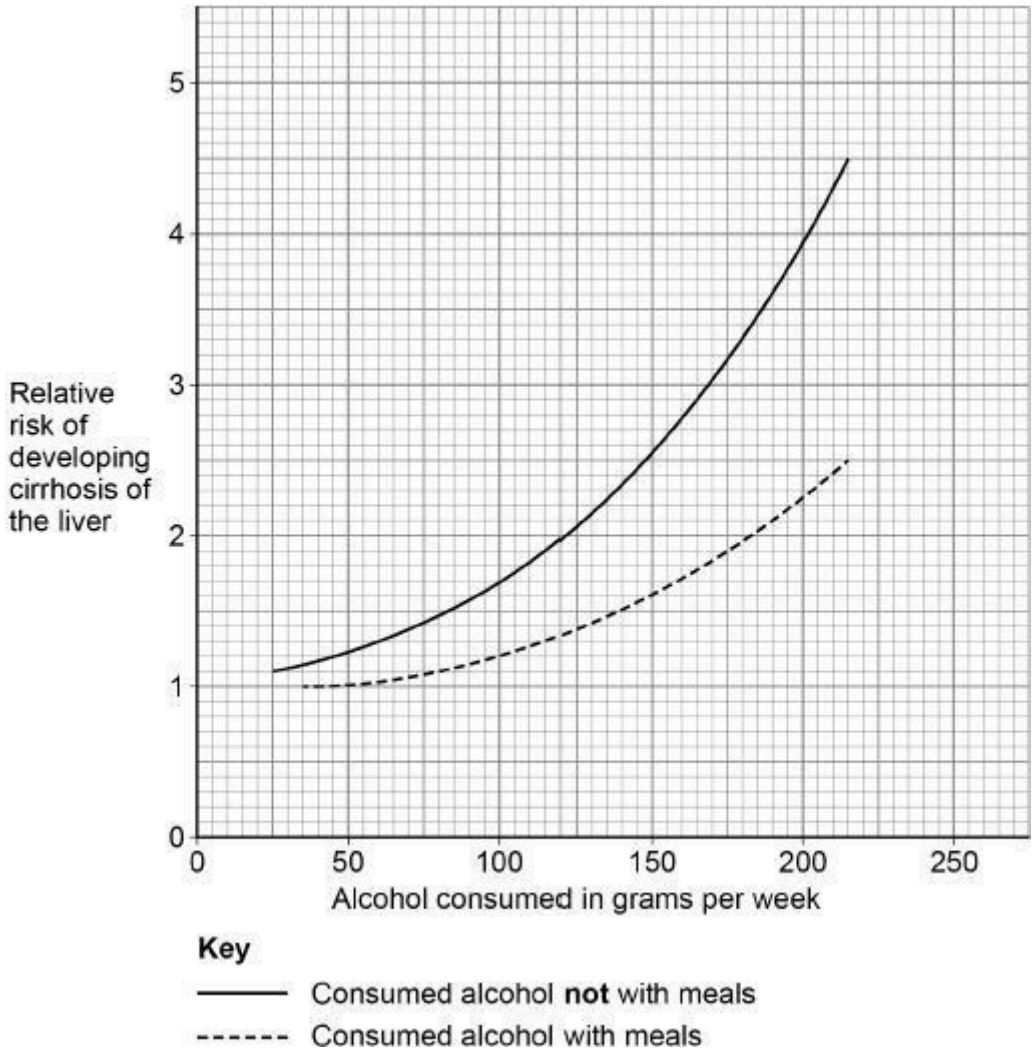
_____

_____

Relative risk = _____

(2)

The graph is repeated below.




(d) Consuming alcohol with meals instead of not with meals decreases the relative risk of developing cirrhosis of the liver.

Give two other conclusions about the relative risk of developing cirrhosis of the liver related to alcohol consumption.

Use data from the graph in your answer.

1 _____

_____

_____

2 _____

_____

_____

(2)

(e) Suggest two reasons why the data is considered to be valid.

1 _____

_____

2 _____

_____

(2)

(f) Suggest one aspect of the survey which might reduce validity.

_____

_____

(1)

(g) Cirrhosis of the liver leads to liver failure.

Describe the effects of liver failure on the human body.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

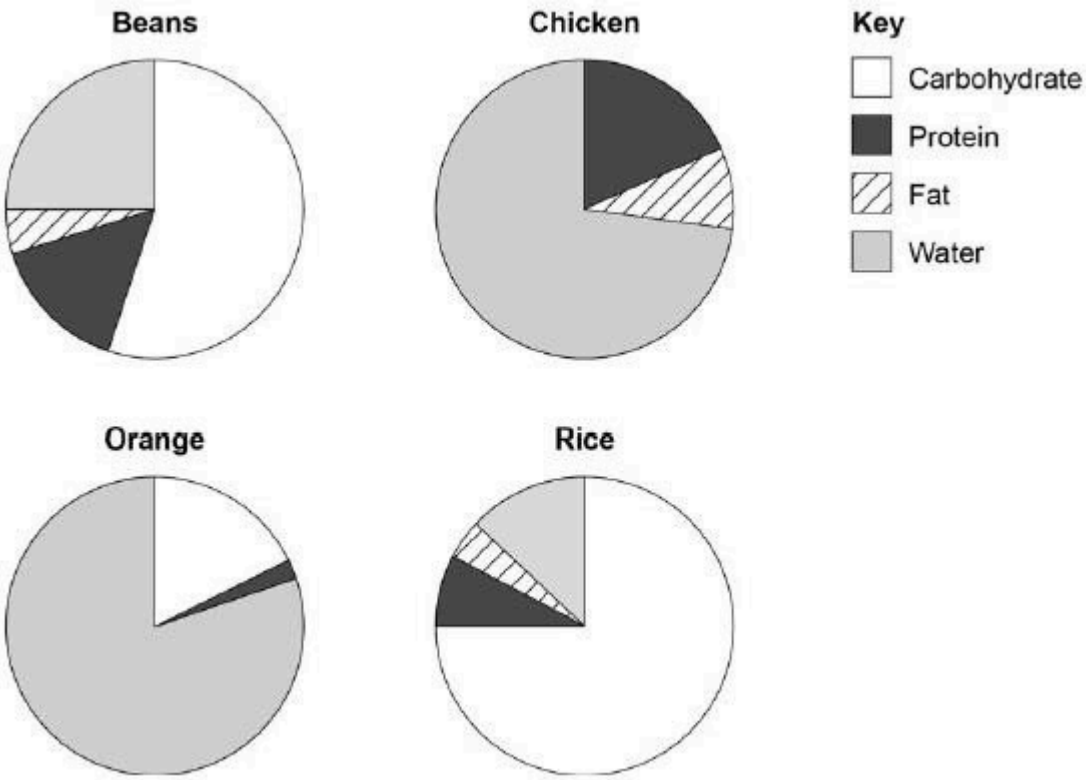
(Total 15 marks)

## Q10.

Many foods contain carbohydrates.

Figure 1 shows information about four different foods.

Figure 1




(a) Which food contains the highest percentage of carbohydrate?

Tick (✓) one box.

Beans ☐

Chicken ☐

Orange ☐

Rice ☐

(1)

(b) Estimate the percentage of water found in beans.

Percentage = _____ %

(1)

(c) Look at Figure 1.

Why would eating only beans provide a more balanced diet than eating only chicken?

_____

_____

(1)

(d) Sugars are produced when enzymes break down starch.

What is the name of the enzyme which breaks down starch to produce sugars?
Tick (✓) one box.

Amylase ☐

Bile ☐

Lipase ☐

Protease ☐

(1)

(e) Which chemical could be used to test for glucose?

Tick (✓) one box.

Benedict's reagent ☐

Biuret reagent ☐

Iodine solution ☐

Sulfuric acid ☐

(1)

(f) What colour change would be seen in a positive test for glucose?

From blue to _____ .

(1)

(g) People with diabetes have difficulty controlling the concentration of glucose in their blood.

The blood of four people was tested.

Table 1 shows the results.

Table 1

| Person | Concentration of glucose in blood in arbitrary units |
|---|---|
| A | 4.2 |
| B | 6.9 |
| C | 7.1 |
| D | 5.1 |

Table 2 shows the information used to help decide if a person has diabetes.

Table 2

| Concentration of glucose in blood in arbitrary units | Conclusion |
|---|---|
| <5.6 | No diabetes |
| 5.6 to 7.0 | Mild diabetes |
| >7.0 | Severe diabetes |

Which person has severe diabetes?

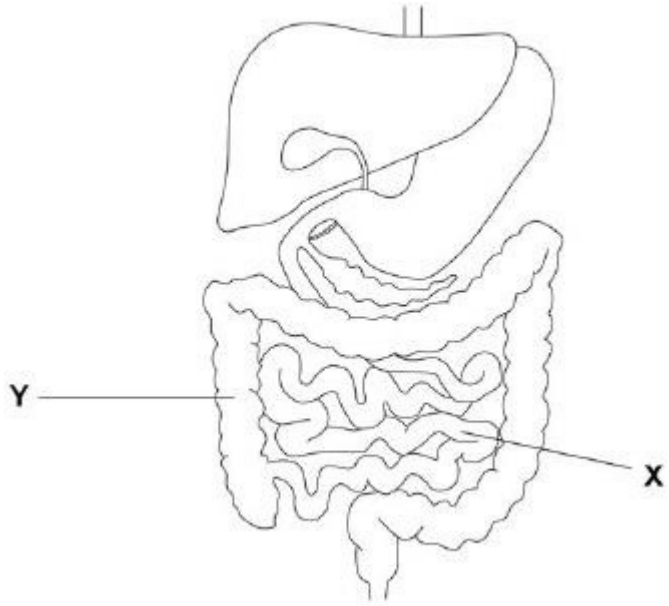
Tick (✓) one box.

A ☐ B ☐ C ☐ D ☐

(1)

Figure 2 shows part of the human digestive system.

Figure 2




(h) Glucose is absorbed into the bloodstream in part X.

Name part X.

_____

(1)

(i) Complete the sentences.

Choose answers from the box.

| | | |
|---|---|---|
| active transport | digestion | excretion |
| osmosis | respiration | |

Some glucose is absorbed into the bloodstream against the concentration gradient

by the process of _____ .

Water moves out of part Y and into the bloodstream by

the process of _____ .

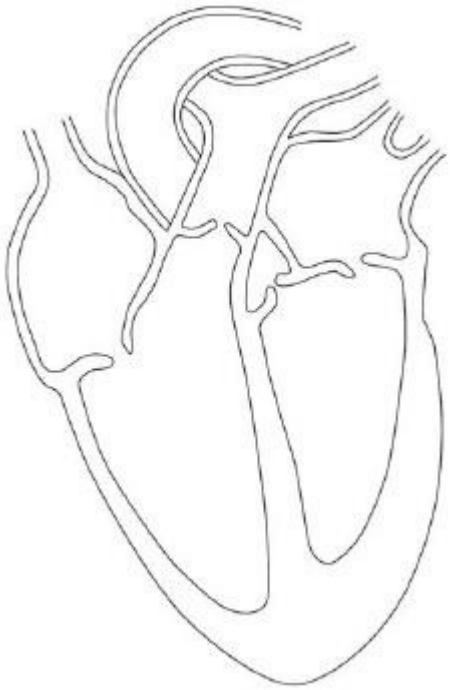
(2)

(Total 10 marks)

Q11.

Figure 1 shows the internal structure of the human heart.

Figure 1



(a) Which organ system is the heart a part of?

_____

(1)

(b) Draw a ring around one valve on Figure 1.

(1)

(c) What is the function of the valves in the heart?

_____

_____

(1)

(d) Valves are also found inside some blood vessels.

Which type of blood vessel contains valves?

_____

(1)

Sometimes a valve in the heart can begin to leak.

A leaking heart valve may be replaced with either:

- a mechanical valve
- a biological valve from a pig.

Table 1 shows information about the replacement valves.

Table 1

| Mechanical valve | Biological valve from a pig |
|---|---|
| Made of plastic or metal | Made from living tissue |
| Can cause the blood to clot around the valve | No risk of blood clotting around the valve |
| No need for another replacement valve after 5 years | Sometimes another replacement valve is needed after 5 years |

(e) Suggest two reasons why a patient may choose a mechanical valve and not a biological valve from a pig.

1 _____

_____

2 _____

_____

(2)

(f) Suggest one reason why a patient may choose a biological valve from a pig and not a mechanical valve.

_____

_____

(1)

(g) A person may develop other medical conditions.

Draw one line from each medical condition to the correct treatment.

| Medical condition | Treatment |
|---|---|
| High blood cholesterol | Antibiotics |
| | Artificial pacemaker |
| | Insulin |
| Irregular heart rate | Statins |

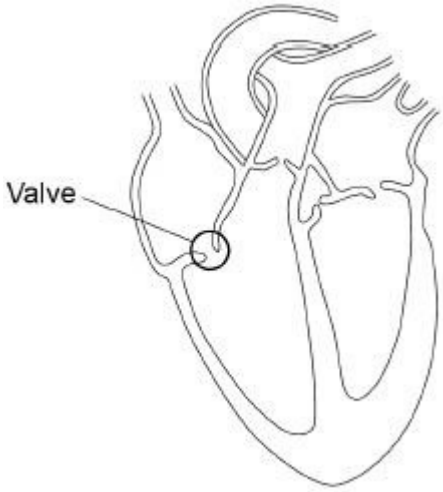
(2)

(Total 9 marks)

Q12.

The figure below shows the internal structure of the human heart.

One of the heart valves is labelled.




Sometimes a valve in the heart can start to leak.

(a) Explain why a person with a leaking heart valve has difficulty exercising.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

A patient with a leaking heart valve may have the valve replaced.

A study compared two different types of replacement heart valve:

- mechanical valves

- biological valves from pigs.

The data used in the study was collected from female patients aged 50–69.

The following table shows the data.

| | Type of replacement heart valve | |
|---|---|---|
| | Mechanical | Biological |
| Number of patients given the valve | 2852 | 1754 |
| Number of patients who died from heart-related problems after valve replacement | 180 | 178 |
| Percentage of patients alive after 5 years | 91 | 89 |
| Percentage of patients needing a second valve replacement within 6 years | 2.2 | 5.2 |
| Percentage of patients who had a blood clot on the brain after surgery | 5.8 | 0.1 |

(b) Give one conclusion about the death of patients from heart-related problems after a valve replacement.
Include calculations to support your answer.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(c) One risk of mechanical valves is that blood clots can form on the surface of the valve.

Name the component of the blood that starts the process of blood clotting.

_____

(1)

(d) Evaluate the use of mechanical replacement heart valves and biological replacement heart valves.

Use information from the table above and your own knowledge.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(Total 14 marks)

Q13.

A small animal called an axolotl lives in water. The axolotl has a double circulatory system.

(a) Define the term double circulatory system.

_____

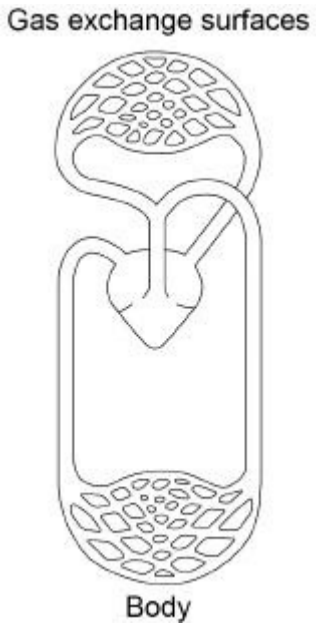
_____

_____

(1)

Figure 1 shows the double circulatory system of the axolotl.

Figure 1




(b) The heart of the axolotl has only one ventricle.

Label the ventricle on Figure 1.

(1)

(c) Explain why having only one ventricle makes the circulatory system less efficient than having two ventricles.

_____

_____

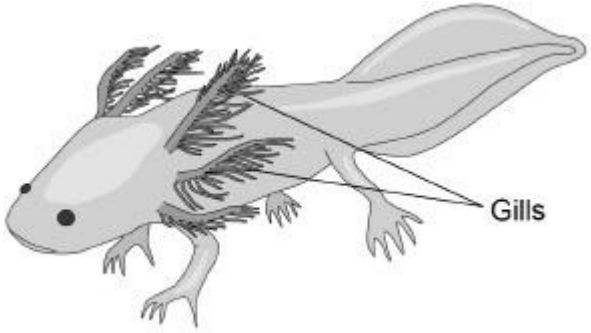
_____

_____

(2)

Figure 2 shows an axolotl.

Figure 2




(d) Explain why an axolotl may die in water with a low concentration of oxygen.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

If a gill of an axolotl is removed, a new gill will grow in its place.

Scientists hope to use information on how axolotls grow new gills to help with regenerating human tissue.

(e) Name the type of cell that divides when a new gill grows.

_____

(1)

(f) Name one condition that could be treated using regenerated human tissue.

_____

(1)

(g) Suggest one reason why an axolotl is a suitable animal for research in the laboratory.

_____

_____

(1)

(h) An axolotl may not be a suitable animal to study when researching regeneration in human tissue.

Suggest one reason why.

_____

_____

(1)

(Total 12 marks)

Q14.

Pancreatic cancer develops when a malignant tumour grows inside the pancreas.

(a) The pancreas produces digestive enzymes.

What is an enzyme?

_____

_____

_____

_____

(2)

(b) Carbohydrase is an enzyme produced by the pancreas.

Name two other organs in the digestive system that produce carbohydrase.

1 _____

2 _____

(2)

(c) One symptom of pancreatic cancer is weight loss.

Explain how pancreatic cancer may cause a person to lose weight. Do not refer to hormones in your answer.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

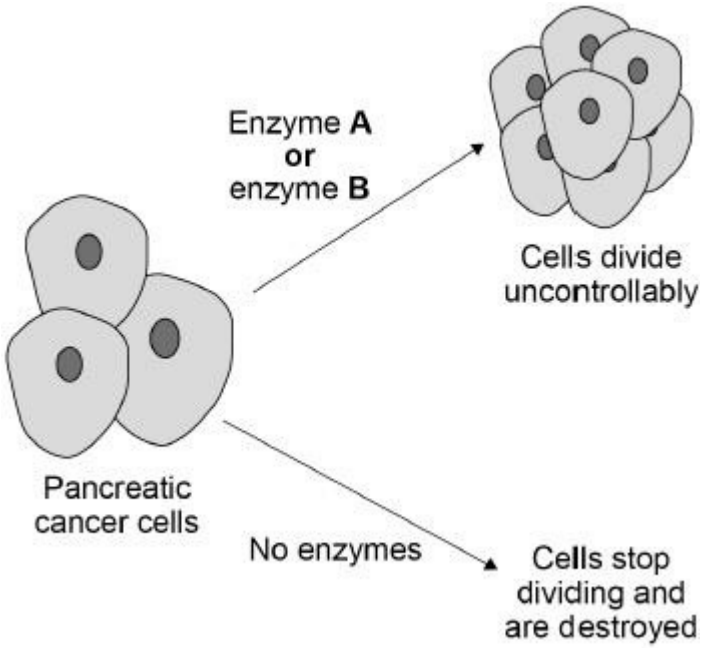
(4)

Enzyme A and enzyme B are involved in controlling cell division in pancreatic cancer cells.

Most cancer cells produce both enzyme A and enzyme B.

Some people have a gene mutation that stops cancer cells producing enzyme B.

The following figure shows how cell division is controlled in pancreatic cancer cells.




Scientists have developed a drug that inhibits enzyme A.

The drug is given to pancreatic cancer patients who have the gene mutation that stops cancer cells producing enzyme B.
The drug only targets cancer cells.

(d) Explain why the drug can be used to treat pancreatic cancer in patients with the gene mutation.
Use information from the figure above.

_____

_____

_____

_____

_____

_____

(3)

(e) Explain why the drug could not be used to treat pancreatic cancer in a patient that produces both enzyme A and enzyme B.

_____

_____

_____

_____

(2)

(f) The drug was trialled before it was licensed for use.

To improve validity of the results in the trial:

- some patients were given a placebo
- a double-blind trial was used.

Give reasons why a placebo and a double-blind trial were used.

A placebo _____

_____

_____

A double-blind trial _____

_____

_____

(2)

(g) One stage in a drug trial is to test the drug on healthy volunteers.

What is the next stage in the drug trial?

Tick (✓) one box.

| | |
|---|---|
| Testing on all patients with the disease | ☐ |
| Testing on human tissue | ☐ |
| Testing on live animals | ☐ |
| Testing on volunteers with the disease | ☐ |

(1)

(h) A monoclonal antibody has been produced to treat pancreatic cancer.

Explain how the monoclonal antibody works to treat pancreatic cancer.

_____

_____

_____

_____

_____

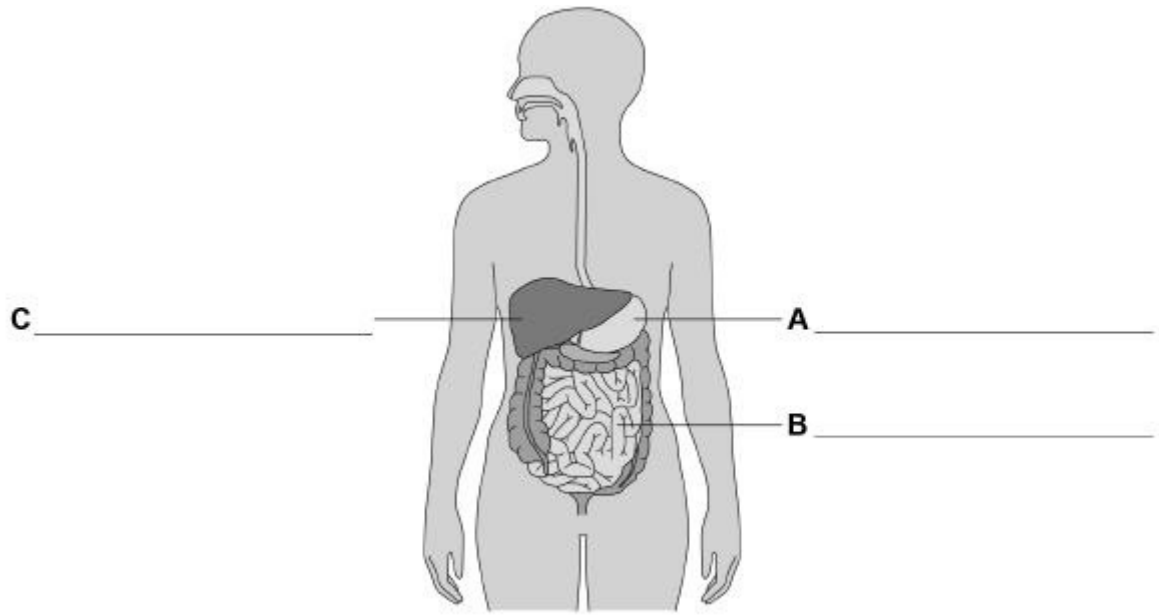
_____

(3)

(Total 19 marks)

Q15.

The diagram below shows the human digestive system.




(a) Label organs A, B and C.

(3)

(b) Complete the sentences.

Choose the answers from the box.

| | | | |
|---|---|---|---|
| catalyse | denatured | digest | energise |
| excreted | ingested | insoluble | soluble |

Digestion is the process of breaking down large food molecules into smaller

molecules that are _____ .

Enzymes help to break down food because they

_____
chemical reactions.

If the temperature of an enzyme gets too high, the enzyme is

_____ .

(3)

(c) Protease is an enzyme.

Protease breaks down protein.

What is protein broken down into?

Tick one box.

Amino acids ☐

Fatty acids ☐

Glucose ☐

Glycerol ☐

(1)

(d) Why is protein needed by the body?

_____

_____

(1)

(e) Which organ in the human digestive system produces protease?

Tick one box.

Gall bladder ☐

Large intestine ☐

Liver ☐

Stomach ☐

(1)

(f) Describe how you would test a sample of food to show it contains protein.

Give the reason for any safety precautions you would take.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(g) Complete the sentence.

Choose the answer from the box.

| fat | fibre | minerals | vitamins |
|---|---|---|---|

Obesity can be caused by a diet high in _____ .

(1)

(h) Complete the sentence.

Choose the answer from the box.

| skin cancer | type 1 diabetes | type 2 diabetes |
|---|---|---|

Obesity is a risk factor for _____ .

(1)

(Total 15 marks)

## Q16.

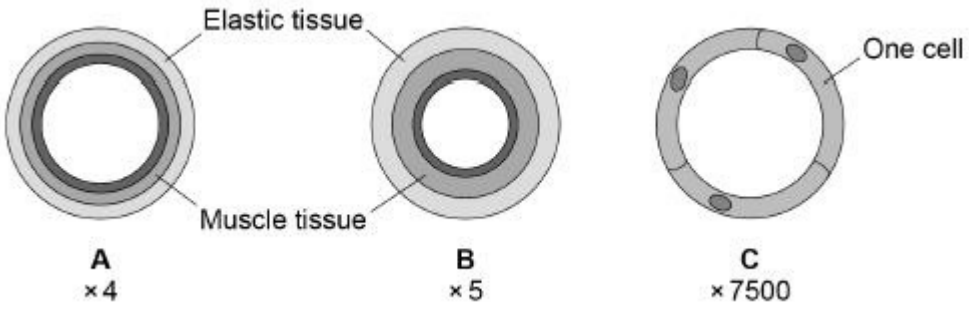
This question is about the circulatory system.

(a) Draw one line from each blood component to its function.

| Blood Component | Function |
| --- | --- |
| | Destroys microorganisms |
| Platelet | Helps the blood to clot |
| Red blood cell | Transports glucose around the body |
| White blood cell | Transports oxygen around the body |
| | Transports urea |

(3)

(b) The diagram below shows cross sections of the three main types of blood vessel found in the human body. Each blood vessel is drawn to the scale shown.




Which blood vessel has the smallest diameter?

Tick one box.

A ☐ B ☐ C ☐

(1)

(c) Which blood vessel in the figure above is an artery?

Give one reason for your answer.

Blood vessel: _____ Reason:

_____

_____

(2)

Table 1 gives information about the blood flow in two people.

Table 1

| Person | Blood flow through the coronary arteries in cm3 / minute |
|---|---|
| A – does not have coronary heart disease | 250 |
| B – has coronary heart disease | 155 |

(d) Calculate the difference in blood flow between person A and person B.

_____

_____

Difference = _____ cm3 / minute

(1)

(e) Suggest why blood flow through the coronary arteries is lower in people with coronary heart disease.

_____

_____

(1)

(f) Calculate the volume of blood flowing through the coronary arteries of person A in 1 hour.

Give your answer in dm3.

_____

_____

_____

_____

_____

Volume of blood in 1 hour = _____ dm3

(2)

Coronary heart disease can be treated by:

- inserting a stent
- using a Coronary Artery Bypass Graft (CABG).

Table 2 gives information about each method.

Table 2

| | Stent | CABG |
|---|---|---|
| Procedure | The patient is awake during the procedure. A small cut is made in the skin. A wire mesh is inserted into the coronary artery via a blood vessel in the arm or leg. | The patient is not awake during the procedure. The chest is cut open. A section of blood vessel from the arm or leg is removed. It is used to create a new channel for blood to bypass the blockage in the coronary artery. |
| When procedure is recommended | When only one blockage is present | When multiple blockages are present |
| Time spent in hospital after procedure | 2-3 hours | at least 7 days |
| Recovery time after procedure | 7 days | 12 weeks |
| Risk of heart attack during procedure | 1% | 2% |
| Chance of failure within one year | 40% | 5% |

(g) Give two advantages of using a stent instead of CABG.

1.
_____
_____

2.
_____
_____

(2)

(h) Give two advantages of using CABG instead of a stent.

1.
_____
_____

2.
_____
_____

(2)
(Total 14 marks)

## Q17.

Table 1 shows information about some food components in cow's milk.

Table 1

| | Value per 500 cm3 | Recommended Daily Allowance (RDA) for a typical adult |
|---|---|---|
| Energy in kJ | 1046 | 8700 |
| Fat in g | 8.4 | 70.0 |
| Salt in g | 0.5 | 6.0 |
| Calcium in mg | 605 | 1000 |
| Vitamin B-12 in µg | 4.5 | 2.4 |

(a) How much more milk would a typical adult have to drink to get their RDA for calcium compared with the amount of milk needed to get their RDA for vitamin B-12?

_____
_____
_____
_____
_____
_____

Volume of milk = _____ cm3

(3)

(b) Describe how a student could test cow's milk to show whether it contains protein and different types of carbohydrate.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

A scientist investigated the effect of bile on the breakdown of fat in a sample of milk.

The scientist used an indicator that is colourless in solutions with a pH lower than 10, and pink in solutions with a pH above 10.

This is the method used.

1. Add 1 drop of bile to a test tube and one drop of water to a second test tube.

2. Add the following to each test tube:
   - 5 cm3 of milk
   - 7 cm3 of sodium carbonate solution (to make the solution above pH 10)
   - 5 drops of the indicator
   - 1 cm3 of lipase.

3. Time how long it takes for the indicator in the solutions to become

colourless.

The results are shown in Table 2.

Table 2

| | Time taken for the indicator to become colourless in seconds |
|---|---|
| Solution with bile | 65 |
| Solution without bile | 143 |

(c) Explain why the indicator in both tubes became colourless.

_____

_____

_____

_____

_____

_____

(3)

(d) Give the reason why the measurement of the time taken for the indicator to become colourless might be inaccurate.

_____

_____

(1)

(e) Explain the difference in the results for the two test tubes in Table 2.

_____

_____

_____

_____

_____

_____

(3)

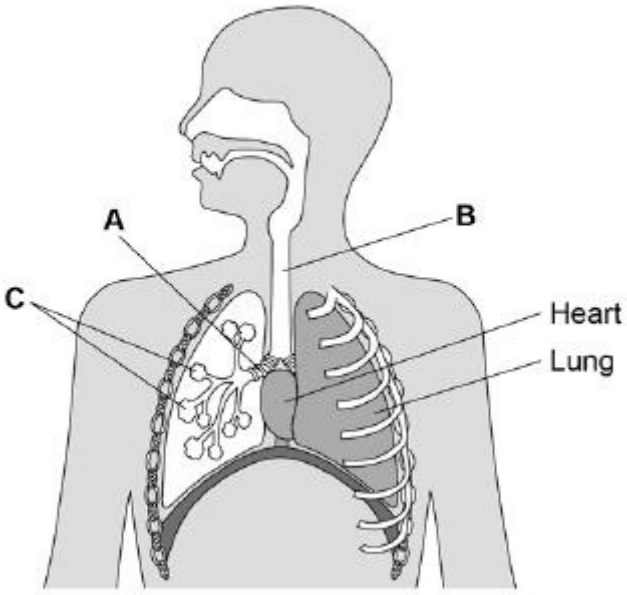
(Total 16 marks)

## Q18.

Animals and plants contain organs and tissues.

Figure 1 shows some organs in the human thorax.

**Figure 1**




(a) Name parts A, B and C. A

_____ B

_____ C

_____

(3)

(b) Which organ system is the heart part of?

Tick one box.

Breathing system ☐

Circulatory system ☐

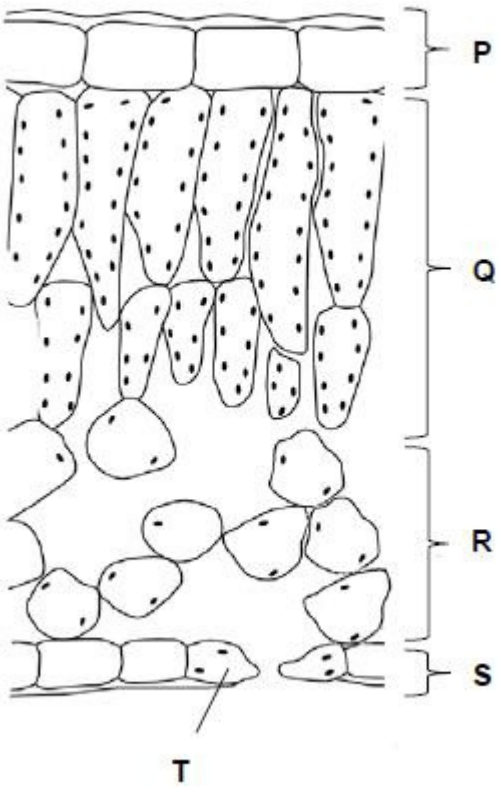
Digestive system ☐

Excretory system ☐

(1)

Figure 2 shows a cross section of a leaf.

**Figure 2**




(c) In which part of the leaf does most photosynthesis take place?

Tick one box.

P ☐ Q ☐ R ☐ S ☐

(1)

(d) What is part T?

Tick one box.

Guard cell ☐

Phloem ☐

Stoma ☐

Xylem ☐

(1)

(e) A leaf is an organ made of tissues. What is a tissue?

_____

_____

(1)

(f) Draw one line from each tissue to its function.

| Tissue | Function |
| --- | --- |
| | Allows diffusion of gases through the leaf |
| Epidermis | Allows light through to the photosynthesising parts of the leaf |
| Phloem | Allows water into the leaf |
| Spongy mesophyll | Transport sugars around the plant |
| | Transports water around the plant |

(3)

(Total 10 marks)

Q19.

The heart pumps blood to the lungs and to the cells of the body.

(a) Name the blood vessel that transports blood from the body to the right atrium.

_____

(1)

(b) The aorta transports blood from the heart to the body.

In a person at rest:

- blood travels at a mean speed of 10 cm/s in the aorta
- blood travels at a mean speed of 0.5 mm/s in the capillaries
- the speed of blood decreases at a rate of 0.4 cm/s2 as blood travels from the aorta to the capillaries.

Calculate the time it takes for blood to travel from the aorta to the capillaries.

Assume that the speed of blood decreases at a constant rate.

Use the equation:

$$\text{rate of decrease in speed} = \frac{\text{change in speed}}{\text{time}}$$

Give your answer to 2 significant figures.

_____

_____

_____

_____

_____

_____

_____

Time = _____ s

(4)

(c) Describe the route taken by oxygenated blood from the lungs to the body cells.

_____

_____

_____

_____

_____

_____

_____

_____

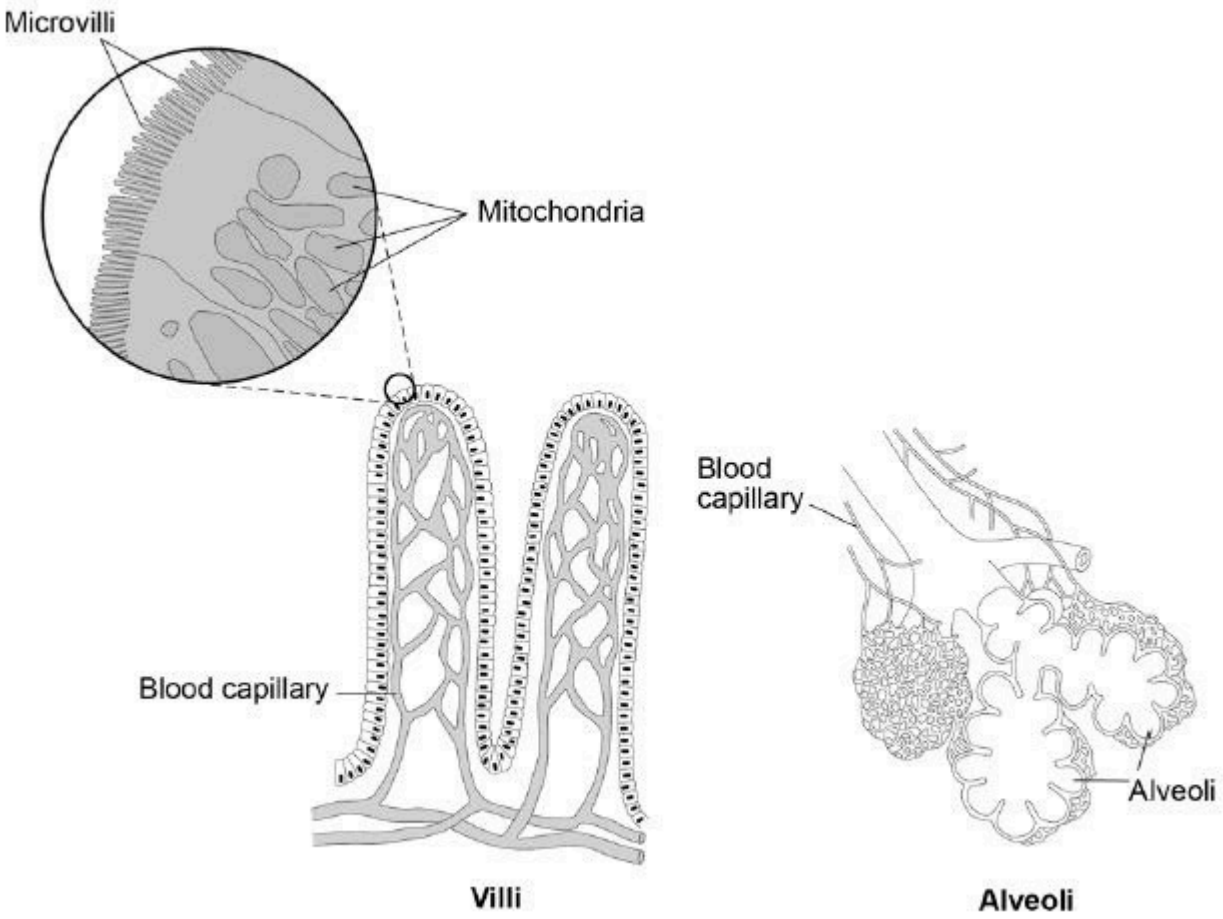
(4)

(d) The digestive system and the breathing system both contain specialised exchange surfaces.

- In the digestive system, digested food is absorbed into the blood stream in structures called villi.
- In the breathing system, gases are absorbed into

the blood stream in the alveoli.

The diagram below shows the structure of villi and alveoli.




Explain how the villi and the alveoli are adapted to absorb molecules into the bloodstream.

(6)

(Total 15 marks)

## Q20.

Amylase is an enzyme found in the human body.

Amylase breaks down starch into sugars.

(a) Where is amylase produced in the human body?

Tick one box.

Liver and pancreas ☐

Liver and stomach ☐

Salivary glands and pancreas ☐

Salivary glands and stomach ☐

(1)

(b) Enzymes speed up chemical reactions. Explain how amylase breaks down starch.

_____

_____

_____

_____

_____

_____

(3)

(c) One sugar in the body is glucose.

Glucose is used for respiration.

Give one other use for glucose in the body.

_____

(1)

(d) A student investigated the effect of temperature on the activity of human amylase.

This is the method used.

1. Put 2 cm3 of 1% starch solution into a boiling tube.
2. Put 2 cm3 of amylase solution into a second boiling tube.
3. Put both boiling tubes into a water bath at 20 °C.
4. After 5 minutes, mix the amylase and the starch together in one boiling tube.
5. After 30 seconds, add a drop of the starch and amylase mixture to a drop of iodine solution in one well of a spotting tile.
6. Repeat step 5 until the iodine solution no longer changes colour.
7. Repeat steps 1 – 6 at 40 °C and at 60 °C and at 80 °C

Why did the student leave the starch and amylase solutions in the water

bath for 5 minutes in step 3?

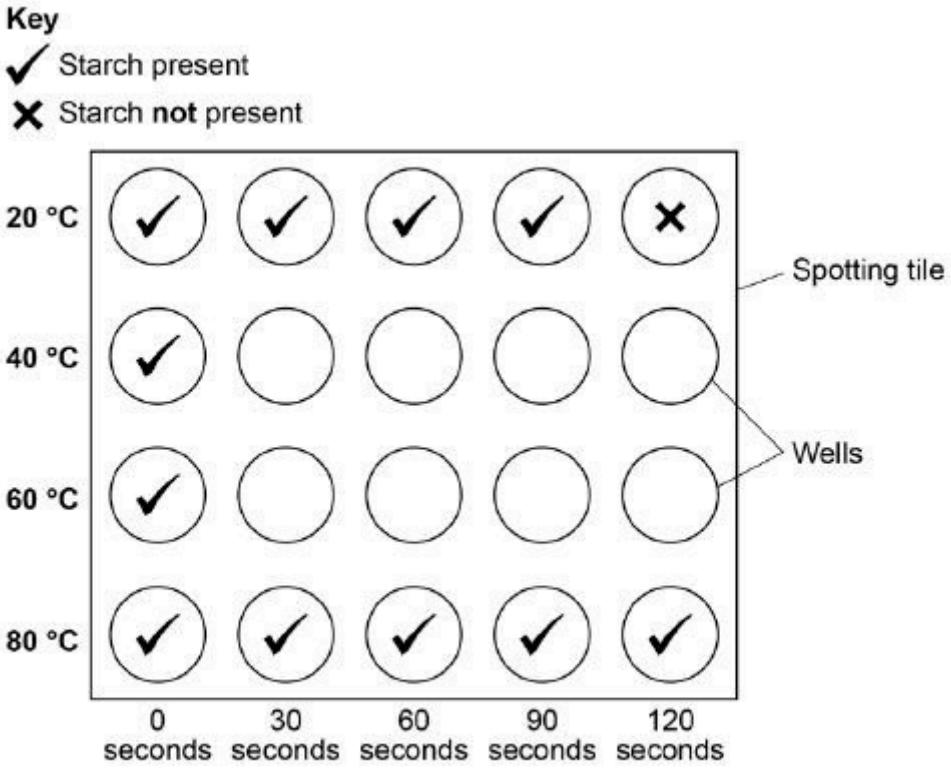
_____

_____

(1)

(e) The temperature of the human body is 37 °C

The diagram below shows the results of the investigation at 20 °C and at 80 °C
Complete the diagram to show the results you would expect at 40 °C and at 60 °C
You should write a tick or a cross in each well of the spotting tile.




(2)

(f) There are different ways to investigate the breakdown of starch by amylase.

One other method is to measure the concentration of starch present in the solution every 30 seconds.
Why is this method better than the method the student used?

_____

_____

_____

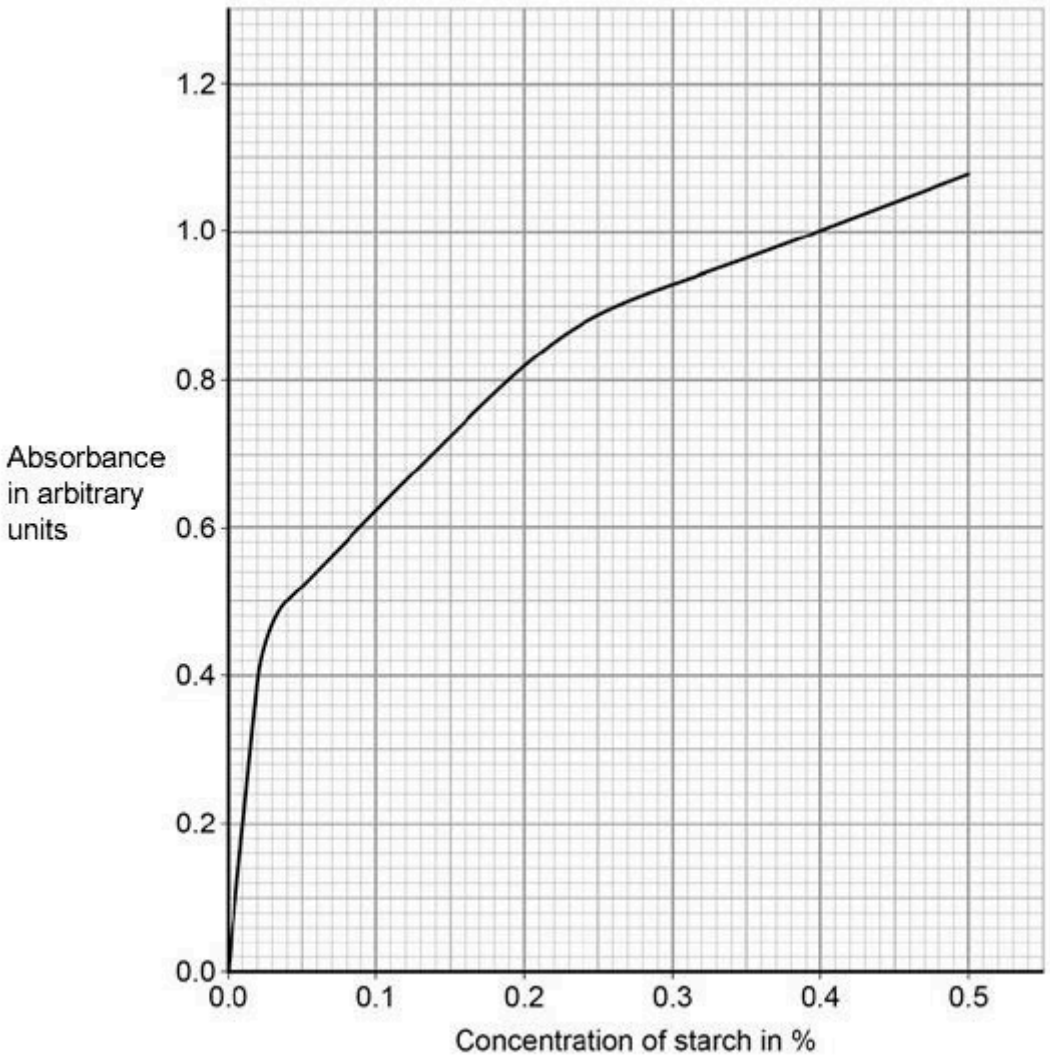
_____

(2)

A colorimeter can be used to measure the concentration of starch present in the solution every 30 seconds.

A colorimeter measures the amount of light that cannot pass through a solution.
This is known as absorbance.

Below shows a graph of absorbance against concentration of starch.




(g) The absorbance of the solution at 40 °C was 0.56 arbitrary units after 30 seconds.

What was the concentration of starch in this solution?

_____

Concentration of starch = _____ %

(1)

(h) The concentration of starch in the solution at 20 °C after 1 minute is different from the concentration at 40 °C after 1 minute.

Explain why.

_____

_____

_____

_____

(2)

(i) Predict the absorbance for the solution at 80 °C after 30 seconds. Give a reason for your answer. Absorbance = _____ arbitrary units Reason

_____

_____

_____

_____

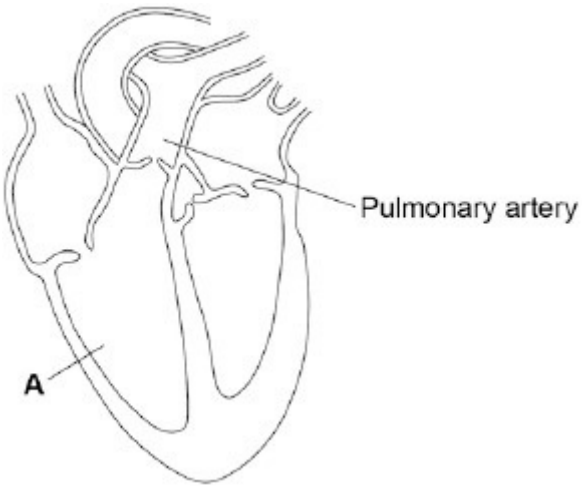
(3)

(Total 16 marks)

## Q21.

Figure 1 shows a diagram of the human heart.

Figure 1



(a) What part of the heart is labelled A?

Tick one box.

Aorta ☐

Atrium ☐

Valve ☐

Ventricle ☐

(1)

(b) Where does the pulmonary artery take blood to?

Tick one box.

Brain ☐

Liver ☐

Lungs ☐

Stomach ☐

(1)

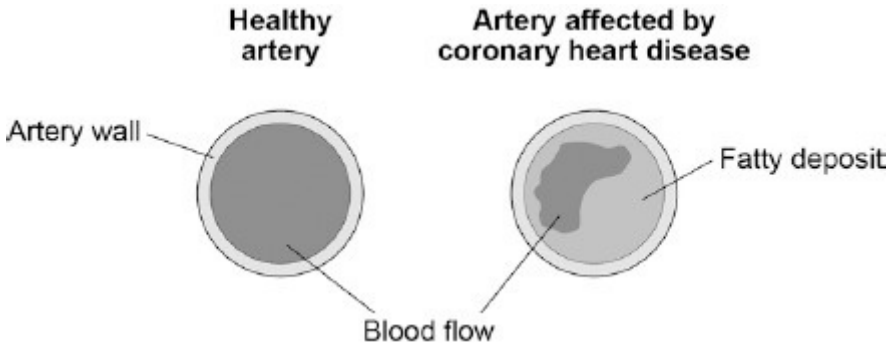
(c) Circle a valve on Figure 1.

(1)

(d) The coronary arteries supply blood to the heart.

Figure 2 shows two coronary arteries.

Figure 2




Describe two ways the healthy artery is different from the artery affected by coronary heart disease.

1.

_____

_____

2.

_____

_____

(2)

(e) What can be used to treat people with coronary heart disease?

Tick two boxes.

| | |
|---|---|
| Antibiotics | ☐ |
| Hormones | ☐ |
| Statins | ☐ |
| Stent | ☐ |
| Vaccination | ☐ |

(2)

(f) Suggest two risk factors for coronary heart disease.

1.

_____

_____

2.

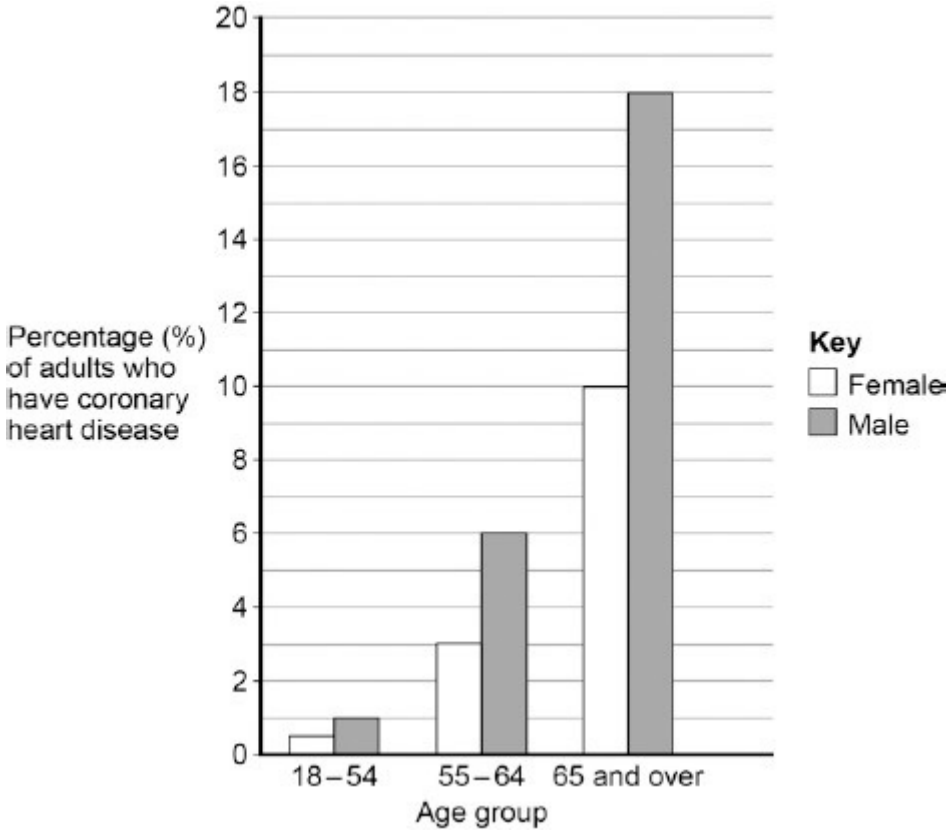
_____

_____

(2)

(g) Figure 3 shows the percentages of adults in the UK who have coronary heart disease.

Figure 3




Calculate the difference in the percentage of male and female adults aged 65 and over who have coronary heart disease.

_____ %

(1)

(h) Which is the correct conclusion for the data in Figure 3?

Tick one box.

Children do not suffer from coronary heart disease ☐

More males suffer from coronary heart disease than females ☐

More younger people suffer from coronary heart disease than older people ☐

(1)

(Total 11 marks)

## Q22.

Catalase is an enzyme.

Catalase controls the following reaction:

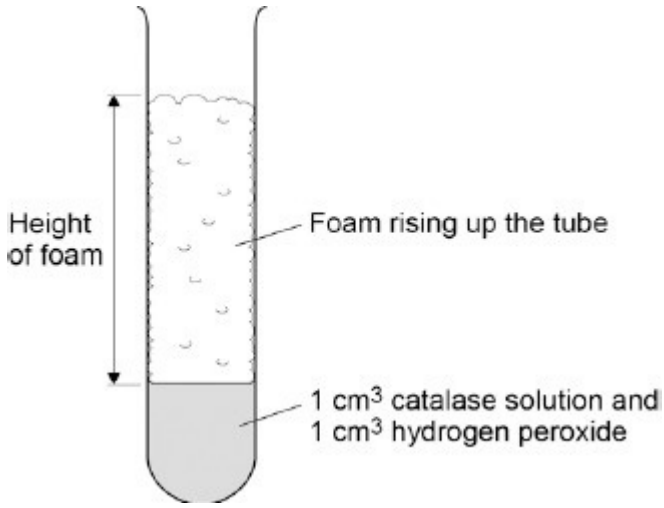
hydrogen peroxide ⟶ water + oxygen

A student did an investigation on catalase activity.

This is the method used.

1. Put 1 cm3 hydrogen peroxide solution in a test tube.
2. Add 1 cm3 of catalase solution.
   - Bubbles of oxygen are produced.
   - Bubbles cause foam to rise up the tube.
3. Measure the maximum height of the foam.

The diagram below shows the experiment.




The experiment is carried out at 20 °C.

The table below shows some results from the investigation.

| Temperature in °C | Maximum height of foam in cm | | | |
|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Mean |
| 10 | 1.3 | 1.1 | 0.9 | 1.1 |
| 20 | 0.0 | 3.3 | 3.1 | 3.2 |
| 30 | 5.2 | 5.0 | 5.3 | 5.2 |
| 40 | 4.2 | 3.5 | 4.4 | 4.0 |
| 50 | 2.1 | 1.9 | 2.3 | 2.1 |

| | | | | |
|---|---|---|---|---|
| 60 | 0.0 | 0.0 | 0.0 | 0.0 |

(a) Why did the student carry out the experiment three times at each temperature?

Tick one box.

To make the experiment more accurate ☐

To prove the experiment was correct ☐

To show the experiment was more repeatable ☐

(1)

(b) The student thought one result was an anomaly.

Circle the anomaly in the table above.

(1)

(c) What did the student do with the anomalous result?

_____

_____

(1)

(d) Look at the table above.

What conclusion can be made as the temperature increases?

Tick one box.

Decreases the rate of reaction up to 30 °C ☐

Decreases the rate of reaction up to 40 °C ☐

Increases the rate of reaction up to 30 °C ☐

Increases the rate of reaction up to 40 °C ☐

(1)

(e) At which temperature was catalase denatured?

Tick one box.

10 °C ☐

30 °C ☐

40 °C ☐

60 °C ☐

(1)

(f) The student thought the optimum temperature for catalase activity was between 30 °C and 40 °C.

How could the investigation be improved to find a more precise value for the optimum temperature?

Tick one box.

Do the experiment at 70 °C and 80 °C ☐

Do the experiment at 30 °C, 35 °C and 40 °C ☐

Use less hydrogen peroxide solution ☐

Use more catalase solution ☐

(1)

(g) Amylase is the enzyme that controls the breakdown of starch to glucose.

Describe how the student could investigate the effect of pH on the breakdown of starch by amylase.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 10 marks)

## Q23.

After a meal rich in carbohydrates, the concentration of glucose in the small intestine changes.

The table below shows the concentration of glucose at different distances along the small intestine.

| Distance along the small intestine in cm | Concentration of glucose in mol dm−3 |
|---|---|
| 100 | 50 |
| 300 | 500 |
| 500 | 250 |
| 700 | 0 |

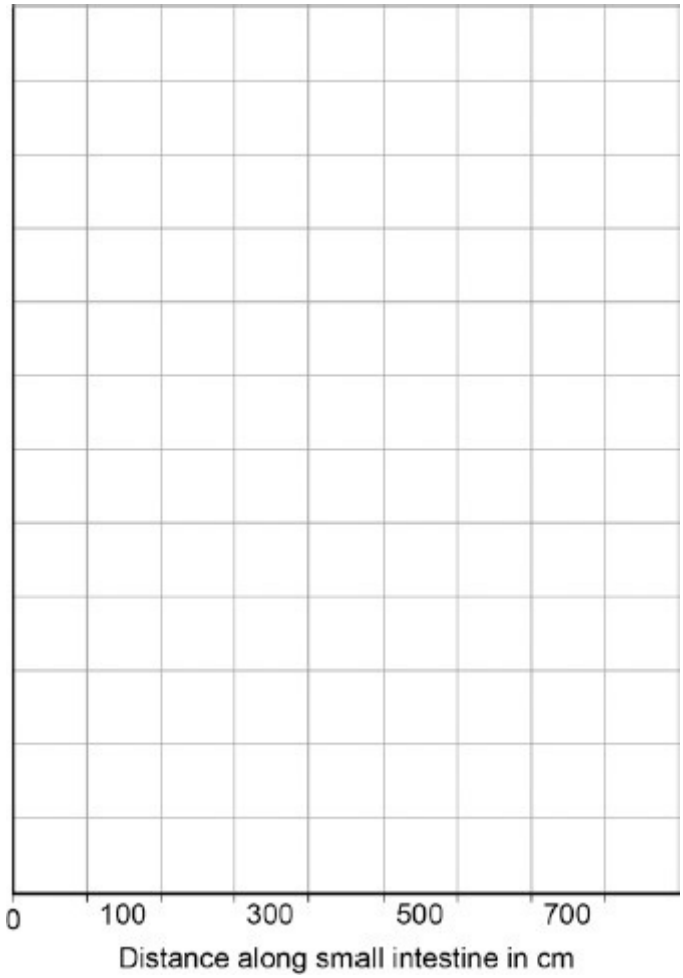
(a) At what distance along the small intestine is the glucose concentration highest?

_____ cm

(1)

(b) Use the data in the table to plot a bar chart on the graph below.

- Label the *y*-axis.
- Choose a suitable scale.




(4)

(c) Look at the graph above. Describe how the concentration of glucose changes as distance increases along the small intestine.

_____

_____

_____

_____

(2)

(d) Explain why the concentration of glucose in the small intestine changes between 100 cm and 300 cm.

_____

_____

_____

_____

_____

_____

(2)

(e) Explain why the concentration of glucose in the small intestine changes between 300 cm and 700 cm.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 12 marks)

Q24.

Explain how the human circulatory system is adapted to:

- supply oxygen to the tissues
- remove waste products from tissues.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

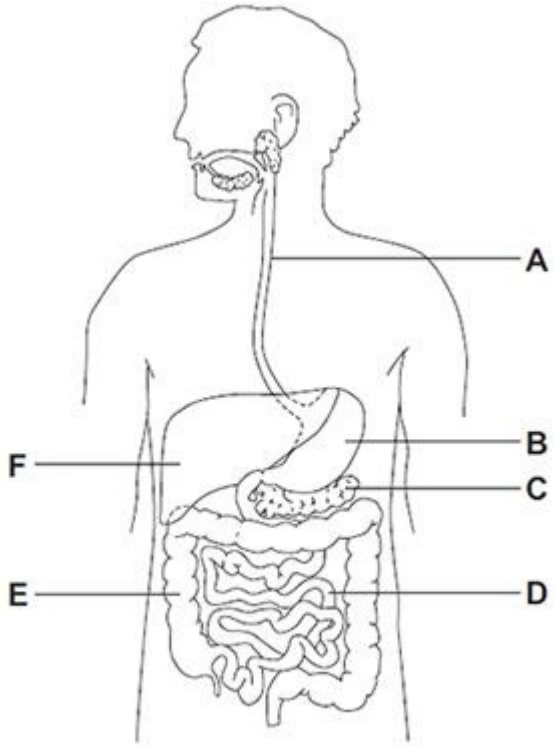
(Total 6 marks)

Q25.

The digestive system breaks down food into small molecules.

The small molecules can be absorbed into the blood.

The diagram below shows the human digestive system.




(a) (i) Which letter, A, B, C, D, E or F, shows each of the following organs?

Write one letter in each box.

large intestine ☐

small intestine ☐

stomach ☐

(3)

(ii) Different organs in the digestive system have different functions.

Draw one line from each function to the organ with that function.

| Function | Organ |
| --- | --- |
| Digestion of fat | Large intestine |
| Absorption of water into the blood | Liver |
| Production of hydrochloric acid | Small intestine |
| | Stomach |

(3)

(b) Glucose is absorbed into the blood in the small intestine.

Most of the glucose is absorbed by diffusion.

How does the glucose concentration in the blood compare to the glucose concentration in the small intestine?

Tick (✓) one box.

The concentration in the blood is higher. ☐

The concentration in the blood is lower. ☐

The concentration in the blood is the same. ☐

(1)

(Total 7 marks)

## Q26.

Enzymes are made and used in all living organisms.

(a) What is an enzyme?

_____

_____

_____

_____

(2)

(b) Many enzymes work inside cells.

In which part of a cell will most enzymes work?

Draw a ring around the correct answer.

cell membrane cytoplasm nucleus

(1)

(c) We can also use enzymes in industry. Hydrogen peroxide is a chemical that can be used to preserve milk. Adding a small amount of hydrogen peroxide to the milk kills the bacteria that cause decay. Hydrogen peroxide does not kill all disease-causing bacteria.

The enzyme catalase can be added later to break down the hydrogen peroxide to oxygen and water.
A different way of preserving the milk is by heating it in large machines to 138 °C for a few seconds.
Suggest one advantage and one disadvantage of using hydrogen peroxide and catalase to preserve milk instead of using heat treatment.
Advantage of hydrogen peroxide and catalase

_____
_____

_____

Disadvantage of hydrogen peroxide and catalase

_____
_____

_____

(2)
(Total 5 marks)

## Q27.

The heart is part of the circulatory system.

(a) (i) Name one substance transported by the blood in the circulatory system.

_____

(1)

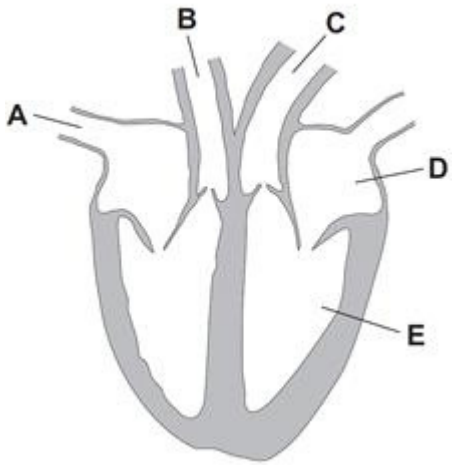
(ii) What is the main type of tissue in the heart wall?

_____

(1)

(b) Figure 1 shows the human heart.

**Figure 1**




(i) Which blood vessel, A, B or C, takes blood to the lungs?

(1)

(ii) Name parts D and E shown in Figure 1. D

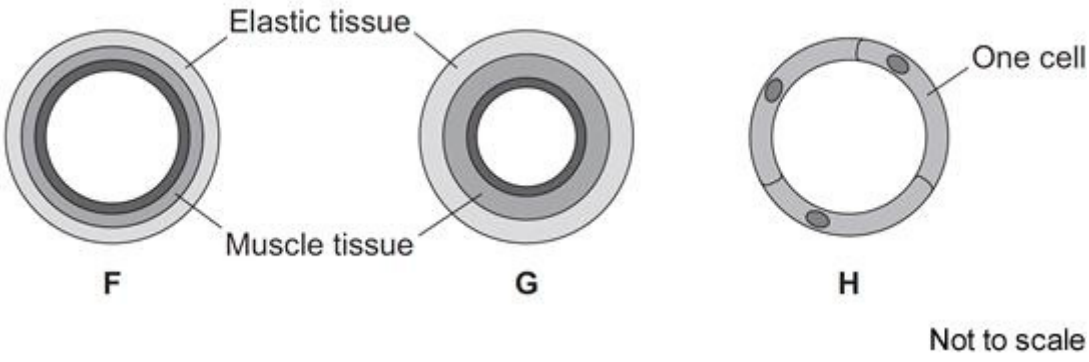
_____ E

_____

(2)

(c) Figure 2 shows three types of blood vessel, F, G and H.

**Figure 2**




(i) What type of blood vessel is F?

Tick (✓) one box.

an artery ☐

a capillary ☐

a vein ☐

(1)

(ii) A man needs to have a stent fitted to prevent a heart attack.

In which type of blood vessel would the stent be placed?

Tick (✓) one box.

an artery ☐

a capillary ☐

a vein ☐

(1)

(iii) Explain how a stent helps to prevent a heart attack.

_____

_____

_____

_____

(2)

(Total 9 marks)

## Q28.

The circulatory system contains arteries and veins.

(a) (i) Describe how the structure of an artery is different from the structure of a vein.

_____

_____

_____

_____

(2)

(ii) A comparison is made between blood taken from an artery in the leg and blood taken from a vein in the leg.

Give two differences in the composition of the blood.

1.

_____

_____

2.

_____

_____

(2)

(b) During operations patients can lose a lot of blood. Patients often need blood transfusions to keep them alive.

The text shows information about a new artificial blood product.

**Sea worms give hope for people in need of blood transfusions**

Scientists have carried out a five-year trial using a new artificial blood product. The scientists have used a protein from sea worms to create the new artificial blood and the results from the trial are very positive. Thousands of sea worms can be grown and collected.

During the trial, mice were given blood transfusions of the artificial blood. The bodies of the mice tolerated the artificial blood and the artificial blood did not cause any side effects.

Suggest two possible advantages of using the new artificial blood, instead of using human blood for a transfusion in humans.

1.

_____

_____

2.

_____

_____

(2)

(Total 6 marks)