AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



EXAM QUESTION PACK

4.2.2 ANIMAL TISSUES, ORGANS AND ORGAN SYSTEMS (PACK 2)

SCORE	PERCENTAGE
/312	%

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Q1.

The circulatory system transports substances such as glucose and oxygen around the body.

(a) Name **two** other substances that the circulatory system transports around the body.

1. _____

2. _____

(2)

(b) (i) Blood is a tissue. Blood contains red blood cells and white blood cells.

Name **two** other components of blood.

1. _____

2. _____

(2)

(ii) The heart is part of the circulatory system.

What type of tissue is the wall of the heart made of?

_____

(1)

(c) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Every year, many patients need to have heart valve replacements.

The table gives information about two types of heart valve.

Living human heart valve	Cow tissue heart valve
• It has been used for transplants for more than 12 years.	• It has been used since 2011.
• It can take many years to find a suitable human donor.	• It is made from the artery tissue of a cow.
• It is transplanted during an operation after a donor has been found.	• It is attached to a stent and inserted inside the existing faulty valve.
• During the operation, the patient's chest is opened and the old valve is removed before the new valve is transplanted.	• A doctor inserts the stent into a blood vessel in the leg and pushes it through the blood vessel to the heart.

A patient needs a heart valve replacement. A doctor recommends the use of a cow tissue heart valve.

Give the advantages and disadvantages of using a cow tissue heart valve compared with using a living human heart valve.

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Use information from the table and your own knowledge in your answer.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(Total 11 marks)

Q2.

Many runners drink sports drinks to improve their performance in races.

A group of students investigated the effects of three brands of sports drink, **A**, **B** and **C**, on the performance of three runners on a running machine. One of the runners is shown in the image below.



© Keith Brofsky/Photodisc/Thinkstock

Table 1 gives information for each drink.

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Table 1

	Brand of sports drink		
Nutrient per dm^3	**A**	**B**	**C**
Glucose in g	63	31	72
Fat in g	9	0	2
Ions in mg	312	332	495

(a) (i) In the investigation, performance was measured as the time taken to reach the point of exhaustion.

Exhaustion is when the runners could not run anymore.

All three runners:
- ran on a running machine until the point of exhaustion
- each drank 500 cm^3 of a different brand of sports drink
- rested for 4 hours to recover
- ran on the running machine again and recorded how much time they ran until the point of exhaustion.

The speed at which the runners ran was the same and all other variables were controlled.

The students predicted that the runner drinking brand **B** would run for the shortest time on the second run before reaching the point of exhaustion.

Use information from **Table 1** to suggest an explanation for the students' prediction.

_____

_____

_____

_____

(2)

(ii) If the balance between ions and water in a runner's body is not correct, the runner's body cells will be affected.

Describe **one** possible effect on the cells if the balance between ions and water is **not** correct.

_____

_____

(1)

(b) When running, a runner's body temperature increases.

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Describe how the brain monitors body temperature.

_____

_____

_____

_____

_____

_____

(3)

(c) (i) **Table 2** is repeated here to help you answer this question.

Table 2

	Brand of sports drink		
Nutrient per dm^3	**A**	**B**	**C**
Glucose in g	63	31	72
Fat in g	9	0	2
Ions in mg	312	332	495

People with diabetes need to be careful about drinking too much sports drink.

Use information from **Table 2** to explain why drinking too much sports drink could make people with diabetes ill.

_____

_____

_____

_____

_____

_____

(3)

(ii) Other than paying attention to diet, how do people with diabetes control their diabetes?

_____

_____

(1)

(Total 10 marks)

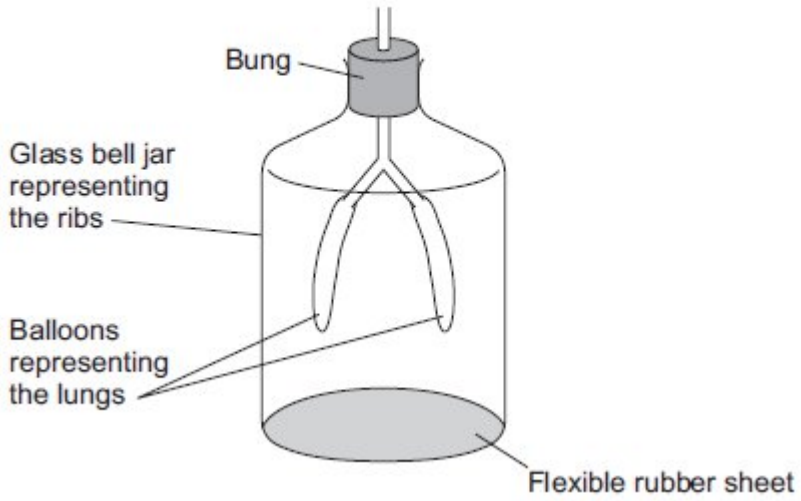
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Q3.

Figure 1 shows a model representing the human breathing system.

The different parts of the model represent different parts of the human breathing system.

Figure 1



(a) (i) Which part of the human breathing system does the flexible rubber sheet represent?

_____

(1)

(ii) Explain why the balloons inflate when the flexible rubber sheet is pulled down.

_____

_____

_____

_____

_____

_____

(3)

(b) (i) During breathing, oxygen moves into the blood.

Explain how oxygen moves into the blood.

_____

_____

_____

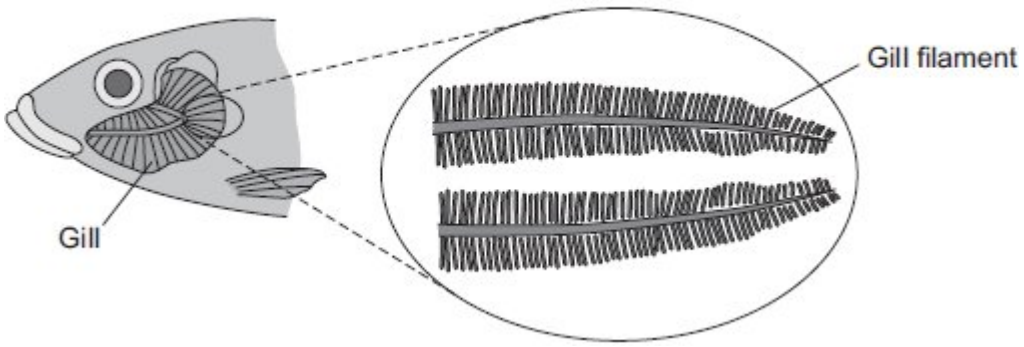
_____

(2)

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(ii) **Figure 2** shows a fish head and gill.

Figure 2



Fish absorb oxygen from the water. Oxygen is absorbed through the gills of the fish.

Explain **one** way in which the gills are adapted for rapid absorption of oxygen.

_____

_____

_____

_____

(2)

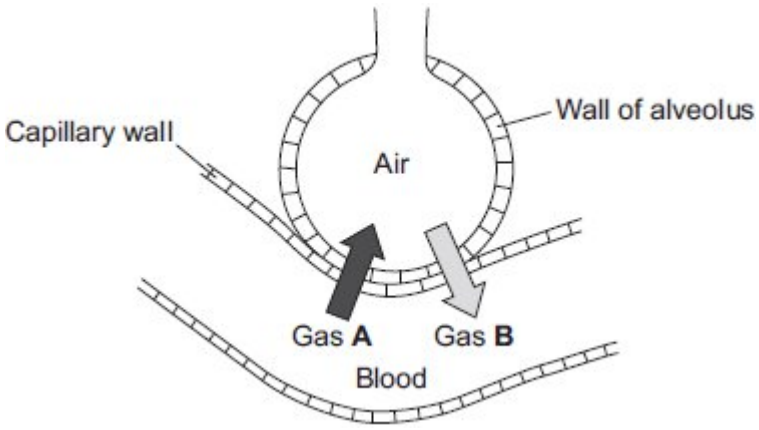
(Total 8 marks)

Q4.

Gas exchange takes place in the lungs.

The diagram shows an alveolus next to a blood capillary in a lung.

The arrows show the movement of two gases, **A** and **B**.



(a) (i) Draw a ring around the correct answer to complete the sentence.

Gases **A** and **B** move by | diffusion. |

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osmosis.
respiration.

(1)

(ii) Gas **A** moves from the blood to the air in the lungs.

Gas **A** is then breathed out.

Name Gas **A**.

_____

(1)

(iii) Which cells in the blood carry Gas **B**?

Draw a ring around the correct answer.

platelets **red blood cells** **white blood cells**

(1)

(b) The average number of alveoli in each human lung is 280 million.

The average surface area of 1 million alveoli is 0.25 m^2.

Calculate the total surface area of a human lung.

_____

Answer _____ m^2

(2)

(c) An athlete trains to run a marathon. The surface area of each of the athlete's lungs has increased to 80 m^2.

Give **one** way in which this increase will help the athlete.

_____

_____

(1)

(Total 6 marks)

Q5.

The photograph shows a fossil of a prehistoric bird called *Archaeopteryx*.

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(a) Describe **three** ways fossils can be made.

_____

_____

_____

_____

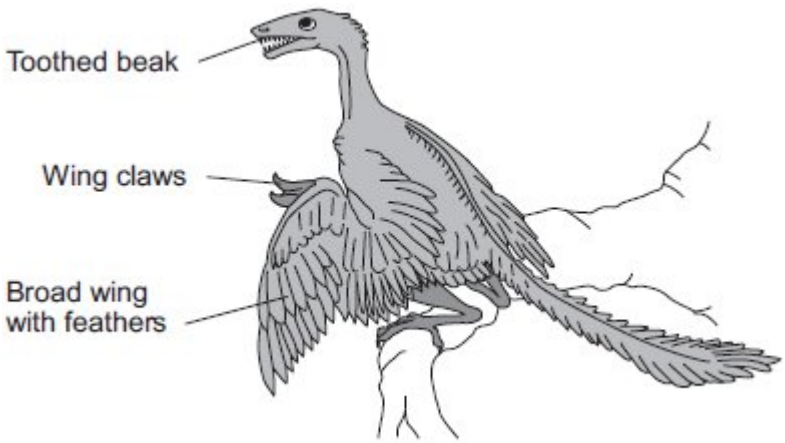
_____

_____

(3)

(b) The drawing shows what an *Archaeopteryx* might have looked like when it was alive.

Scientists think that *Archaeopteryx* was a predator.



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(i) Look at the drawing.

Write down **three** adaptations that might have helped *Archaeopteryx* to catch prey.

How would **each** adaptation have helped *Archaeopteryx* to catch prey?

Adaptation 1 _____

How it helps _____

_____

Adaptation 2 _____

How it helps _____

_____

Adaptation 3 _____

How it helps _____

_____

(3)

(ii) *Archaeopteryx* is now extinct.

Give **two** reasons why animals may become extinct.

1. _____

_____

2. _____

_____

(2)

(Total 8 marks)

Q6.

(a) High-fructose corn syrup (HFCS) is used instead of sucrose as a sweetener in many types of food.

Table 1 shows the relative sweetness of different types of sugar.

Table 1

Sugar	Relative sweetness
Fructose	173
Glucose	74
Lactose	16

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Sucrose	100

(i) One of the sugars was used as a 'standard' measure of sweetness.

The sweetness of all the other sugars was compared with this.

Which sugar was used as the standard of sweetness?

_____

(1)

(ii) Fructose is used instead of sucrose in many types of food.

Suggest why.

Use information from **Table 1** in your answer.

_____

_____

_____

_____

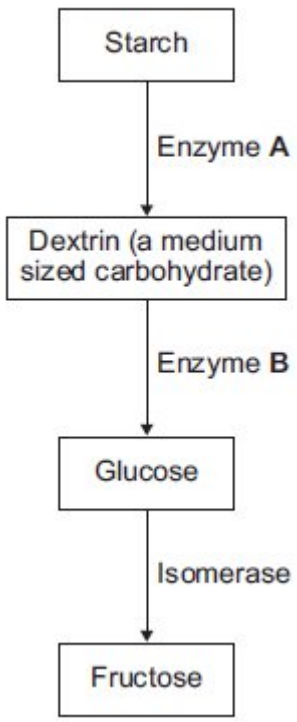
_____

_____

(3)

(b) **Diagram 1** shows the main stages in the industrial production of fructose for use in HFCS.

Diagram 1



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(i) **A** and **B** are two enzymes that digest carbohydrates.

What general name do scientists give to enzymes like **A** and **B**?

Tick (✓) **one** box.

carbohydrases ☐

lipases ☐

proteases ☐

(1)

(ii) The enzymes in **Diagram 1** come from bacteria that live in hot springs.

The enzymes work best at a temperature of 60 °C.

What would happen to most enzymes at a temperature of 60 °C?

_____

_____

(1)

(iii) It is an advantage to carry out these reactions in the industrial production of HFCS at 60 °C.

Suggest why.

_____

_____

_____

_____

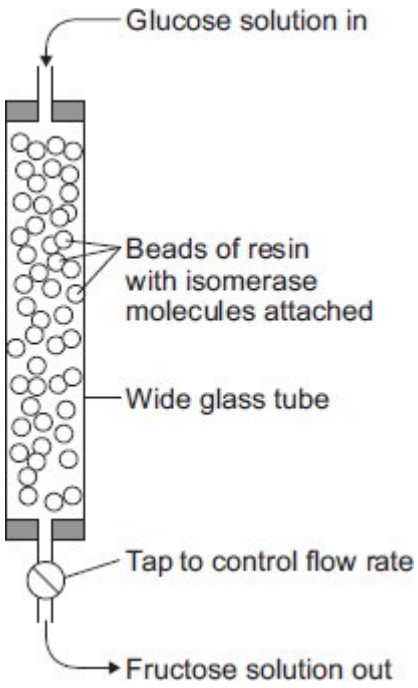
(2)

Isomerase is used in an immobilised form in the production of HFCS. Isomerase molecules are immobilised by attaching them to beads made of resin in a glass tube.

Diagram 2 shows how immobilised isomerase is used.

Diagram 2

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(c) An alternative to using immobilised isomerase is to mix isomerase solution with glucose solution in a large container.

Suggest **two** advantages of using immobilised isomerase, rather than isomerase solution, in the production of HFCS for use in human foods.

1. _____

_____

2. _____

_____

(2)

(d) **Table 2** shows some differences between the industrial production of HFCS from glucose using:

- isomerase solution
- immobilised isomerase.

Table 2

	Isomerase solution	**Immobilised isomerase**
Reaction container volume in m^3	1100	15
Time taken for reaction in hours	20	0.5
Temperature in °C	65	60
Number of product refining stages	4	1

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Total production cost in £ per tonne	500	5

Explain how factors given in **Table 2** help to lower production costs when using the immobilised enzyme.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(e) **Table 3** gives information about the half-life of isomerase in the two processes.

The **half-life** of the enzyme is the time it takes for the enzyme's activity to fall to half its starting value.

The **active life** of the enzyme is the time for which it can be used before it is thrown away.

Table 3

	Isomerase solution	**Immobilised isomerase**
Half-life of enzyme in hours	30	1500
Active life of enzyme in half-lives	0.7	3

(i) Using the information from **Table 3**, we can calculate that the active life, in hours, of isomerase solution is 21 hours.

Calculate the active life, in hours, of **immobilised isomerase**.

_____

_____

Active life of immobilised isomerase = _____ hours

(2)

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(ii) A high active life of isomerase is important in lowering the production costs of HFCS.

Explain why.

_____

_____

_____

_____

(2)

(Total 17 marks)

Q7.

(a) A person cut his finger. A small amount of blood flowed from the cut but soon stopped due to blood clotting.

The following sentences describe what happens when a person has a small cut and a blood clot is formed.

Draw a ring around the correct answer to complete each sentence.

(i) The tiny blood vessels near the surface of the skin that are damaged

are

arteries.
capillaries.
veins.

(1)

(ii) Blood clotting is stimulated by

platelets.
red blood cells.
white blood cells.

(1)

(iii) During blood clotting

fibrinogen changes to fibrin.
haemoglobin changes to oxyhaemoglobin.
lipid changes to fatty acids.

(1)

(b) A blood transfusion is when a person is given blood from a donor.

A person has lost a lot of blood and needs a blood transfusion.

It is important to use blood of the correct blood group. If blood of the wrong blood group is used, the transfusion will not be safe.

The person giving the blood is called the **donor**.

The person receiving the blood is called the **recipient.**

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Complete the table to show which transfusions are safe and which are unsafe.

Some of the table has been completed for you as an example.

Use the following symbols:

✓ = a safe transfusion

✗ = an unsafe transfusion

Donor blood group and antigens

Recipient blood group and antibodies

Recipient \ Donor	Group A only A antigens	Group B only B antigens	Group AB A + B antigens	Group O no antigens
Group A anti-B antibodies	✓	✗	✗	✓
Group B anti-A antibodies	✗			
Group AB no antibodies	✓			
Group O anti-A + anti-B antibodies	✗			

(3)

(c) (i) **Anti-B** antibodies will bind only to the **B** antigen. They will not bind to the **A** antigen.

Explain why.

_____

_____

_____

_____

(2)

(ii) Red blood cells have a diameter of about 8 micrometres.

Some capillaries have an internal diameter of about 10 micrometres.

Red blood cells, with antibodies bound to them, stick together.

B antigens are found on the surface of red blood cells in people who have blood group **B**.

Use this information to explain why transfusion of group **B** blood into a person of blood group **A** is unsafe.

_____

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_____

_____

_____

_____

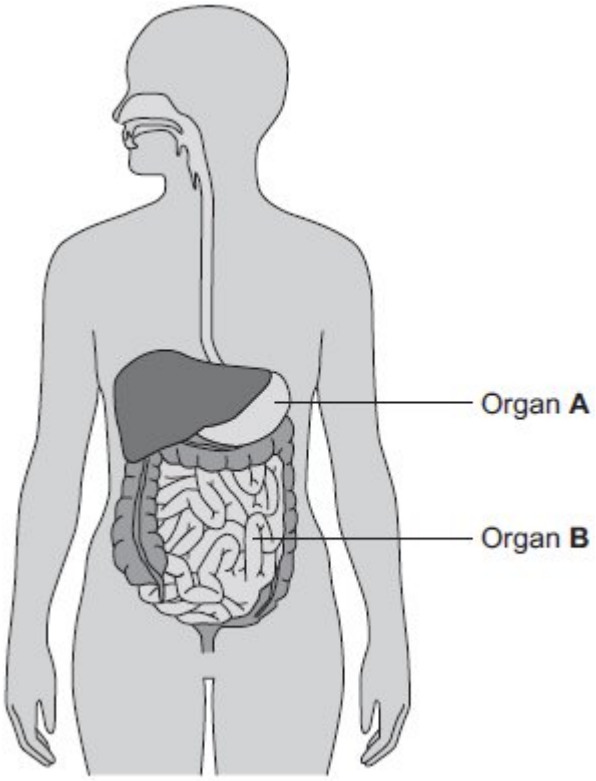
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(3)

(Total 11 marks)

Q8.

The diagram below shows the human digestive system.



(a) (i) What is Organ **A**?

Draw a ring around the correct answer.

gall bladder **liver** **stomach**

(1)

(ii) What is Organ **B**?

Draw a ring around the correct answer.

large intestine **pancreas** **small intestine**

(1)

(b) Digestive enzymes are made by different organs in the digestive system.

Complete the table below putting a tick (✓) or cross (✕) in the boxes.

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The first row has been done for you.

		Organ producing enzyme			
		salivary glands	**stomach**	**pancreas**	**small intestine**
Enzyme	**amylase**	✓	×	✓	✓
	lipase				
	protease				

(2)

(c) The stomach also makes hydrochloric acid.

How does the acid help digestion?

_____

_____

(1)

(d) Draw **one** line from each digestive enzyme to the correct breakdown product.

Digestive enzyme	**Breakdown products**
	amino acids.
Amylase breaks down starch into……	
	bases.
Lipase breaks down fats into…	
	fatty acids and glycerol.
Protease breaks down proteins into…	
	sugars.

(3)

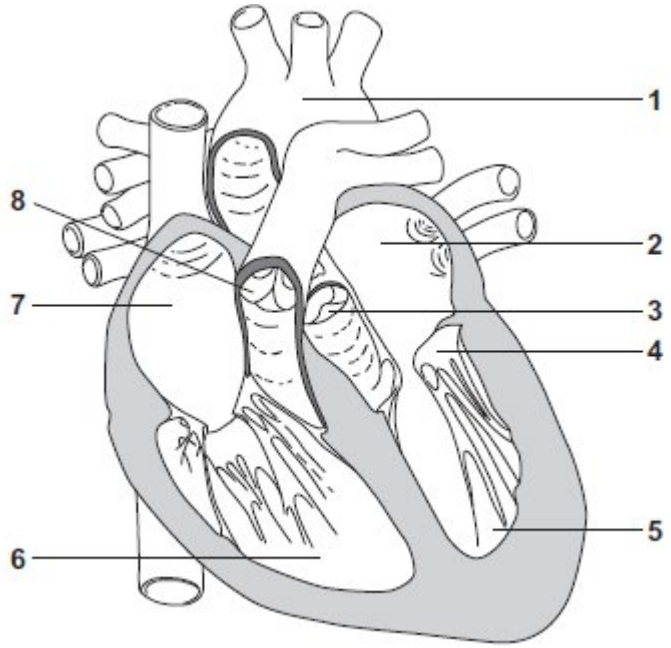
(Total 8 marks)

Q9.

The diagram in **Figure 1** shows a section through the human heart, seen from the front.

Figure 1

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(a) Draw a ring around the correct answer to complete each sentence.

(i) The wall of the heart is made mostly of

epithelial
glandular
muscular

tissue.

(1)

(ii) The resting heart rate is controlled by the pacemaker.

The pacemaker is located at position

1.
6.
7.

(1)

(iii) If a person's heart rate is irregular, the person may be fitted with an artificial pacemaker.

The artificial pacemaker is

an electrical device.
a pump.
a valve.

(1)

(b) (i) Write a number, **2**, **5**, **6** or **7**, in **each** of the three boxes to answer this question.

Which chamber of the heart:

pumps oxygenated blood to the head and body ☐

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receives deoxygenated blood from the head and body ☐

receives oxygenated blood from the lungs? ☐

(3)

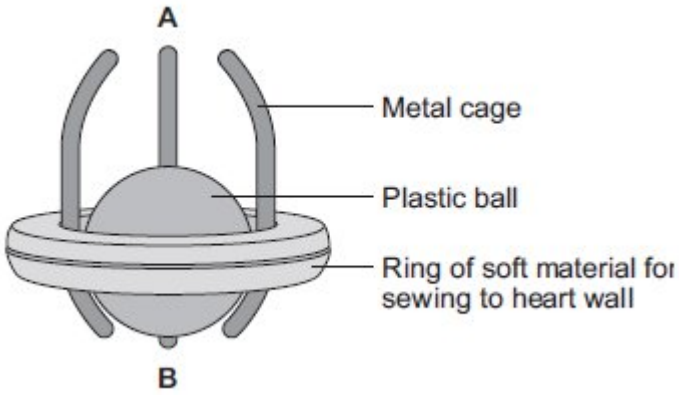
(ii) Give the number, **3**, 4 or **8**, of the valve that closes when the blood pressure in the aorta is greater than the blood pressure in the left ventricle.

Write the correct answer in the box. ☐

(1)

(c) The diagram in **Figure 2** shows one type of artificial heart valve. The plastic ball is in the closed position.

Figure 2



This type of artificial valve could be used to replace a faulty valve in the heart.

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

_____

_____

(1)

(ii) The artificial valve could be used to replace valve **4** shown in **Figure 1**.

The artificial valve opens to let blood through when the ball is moved towards **A**.

Which end of the valve, **A** or **B**, should point towards chamber **5**?

Explain your answer.

_____

_____

_____

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_____

_____

_____

_____

(3)

(d) (i) The artificial heart valve may cause blood clots to form on its surface.

Describe what happens during blood clotting.

_____

_____

_____

_____

(2)

(ii) Read the information in the passage.

> Replacing a damaged heart valve can dramatically improve the blood circulation and the supply of oxygen to the body's tissues. The operation to replace a heart valve is a long one during which the patient's blood goes through a bypass machine.
> Sometimes the artificial valve can fail to work. If the surface of the valve becomes rough, small blood clots can form on its surface then break away and be carried around the body by the blood.

Evaluate the advantages and disadvantages of artificial heart valves.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 17 marks)

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Q10.

A healthy diet contains the right balance of different foods and the right amount of energy.

(a) An unbalanced diet can lead to health problems.

One problem caused by an unbalanced diet is being overweight.

Name **one** health problem, other than being overweight, that is linked to an unbalanced diet.

_____

(1)

(b) Sugar is a type of carbohydrate.

(i) Eating too much sugar can make a person overweight.

Suggest why.

_____

_____

(1)

(ii) Which other substance in food is linked to people being overweight?

Draw a ring around the correct answer.

fat **mineral ions** **vitamins**

(1)

(c) Sugar substitutes taste sweet.
Taking sugar substitutes helps to reduce the chance of becoming overweight.

The table below gives information about four sugar substitutes, **A**, **B**, **C** and **D**.

Sugar substitute	Number of times sweeter than sugar	Effects on health
A	× 200	Harmful to some people
B	× 250	Not known
C	× 600	Not known
D	× 500	None

(i) Which sugar substitute, **A**, **B**, **C** or **D**, is the sweetest? ☐

(1)

(ii) A person is advised to use sugar substitute **D** and **not** sugar substitutes **A, B** or **C**.

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Suggest a reason why.

_____

_____

(1)

(iii) A food has a sugar substitute in it.

Why must it say on the packet which sugar substitute it is?

_____

_____

(1)

(Total 6 marks)

Q11.

Drugs affect the human body.

(a) Draw **one** line from each drug to the correct information about the drug.

Drug	Information
Cannabis	Used to boost heart rate
Steroid	Used to treat leprosy
Stimulant	May cause mental illness in some people
Thalidomide	Used to increase muscle growth
	Used to treat measles

(4)

(b) New drugs must be tested and trialled before being used.

(i) New drugs are tested in a laboratory before they are trialled on people.

What are new drugs tested on in a laboratory?

_____

(1)

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(ii) Why is it important that drugs are trialled before doctors give them to patients?

Tick (✓) **two** boxes.

To check that the drug works ☐

To check the cost of the drug ☐

To find out if the drug is legal ☐

To find the best dose to use ☐

(2)

(iii) In a double blind drug trial, only some people know which patients have been given the drug.

Who knows which patients have been given the drug?

Tick (✓) **one** box.

The patient and the doctor ☐

Only the doctor ☐

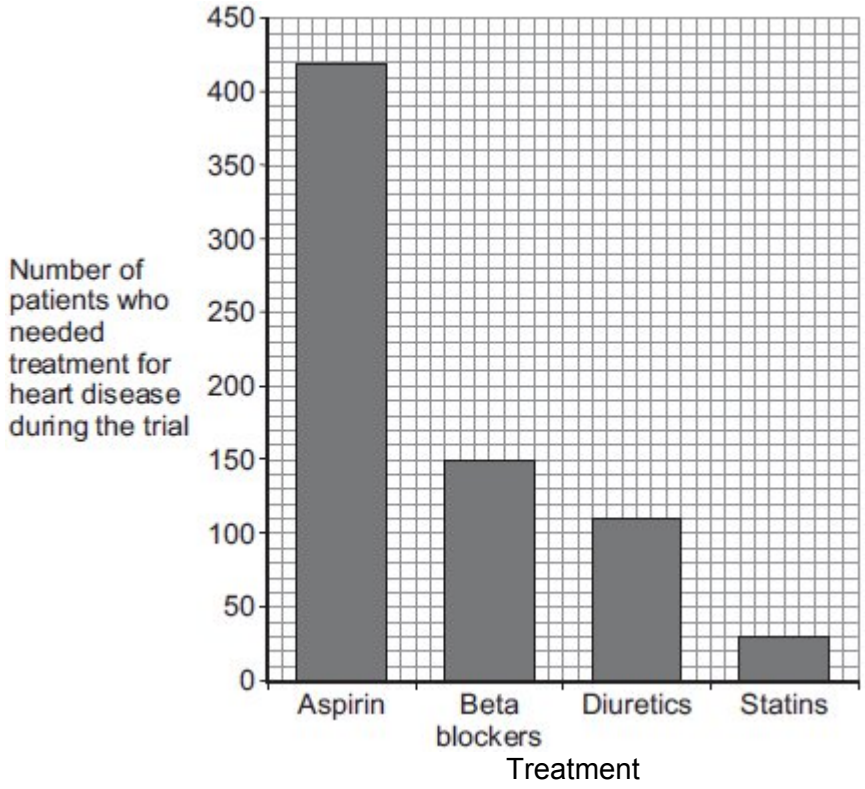
Only scientists at the drug company ☐

(1)

(c) Doctors trialled four different treatments for reducing the risk of heart disease.
Each treatment was trialled on the same number of patients for 5 years.
The patients did **not** have heart disease at the start of the trial.

The graph below shows the results.

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(i) How many patients who took aspirin needed treatment for heart disease during the trial?

Number of patients = _____

(1)

(ii) Based **only** on the evidence in the graph, which would be the best treatment to reduce the risk of developing heart disease?

_____

(1)

(iii) Suggest **one** other factor that a doctor might consider before deciding which treatment to use for a patient.

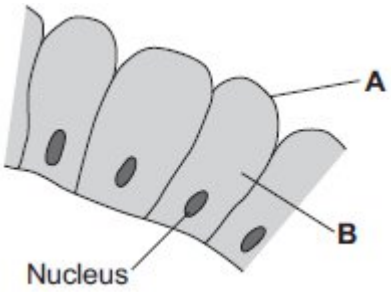
_____

(1)

(Total 11 marks)

Q12.

The image below shows some cells in the lining of the stomach.



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(a) (i) Use words from the box to name structures **A** and **B**.

cell membrane	**chloroplast**	**cytoplasm**	**vacuole**

A _____

B _____

(2)

(ii) What is the function of the nucleus?

Tick (✓) **one** box.

To control the activities of the cell ☐

To control movement of substances into and out of the cell ☐

To release energy in respiration ☐

(1)

(b) Draw **one** line from each part of the human body to its correct scientific name.

Part of human body	**Scientific name**
Layer of cells lining the stomach	An organ
Stomach	An organism
Mouth, stomach, intestines, liver and pancreas	An organ system
	A tissue

(3)

(Total 6 marks)

Q13.

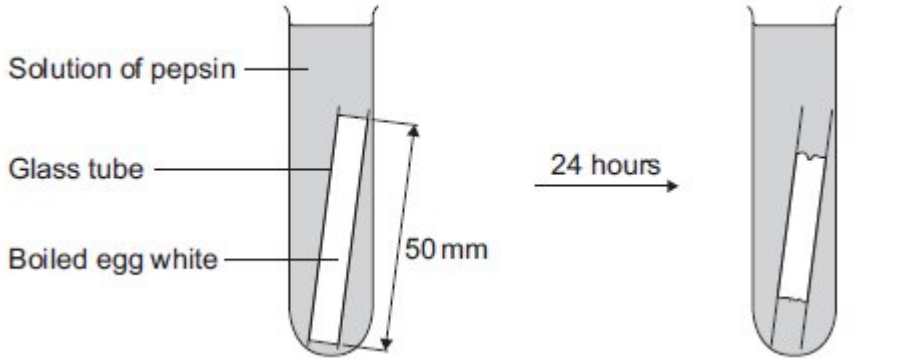
Some students investigated the effect of pH on the digestion of boiled egg white by an enzyme called pepsin. Egg white contains protein.

The students:

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- put a glass tube containing boiled egg white into a test tube
- added a solution containing pepsin at pH 7
- set up six more tubes with solutions of pepsin at different pH values
- left the test tubes for 24 hours at room temperature.

The image below shows one of the test tubes, at the start and at the end of the 24 hours.



(a) (i) Name the product of protein digestion.

_____

(1)

(ii) What type of enzyme digests protein?

Tick (✓) **one** box.

amylase ☐

lipase ☐

protease ☐

(1)

(b) The egg white in each tube was 50 mm long at the start of the investigation.
The table below shows the students' results.

pH	Length in mm of boiled egg white after 24 hours
1	38
2	20
3	34
4	45

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5	50
6	50
7	50

(i) At which pH did the pepsin work best?

pH _____

(1)

(ii) The answer you gave in part **(b)(i)** may not be the exact pH at which pepsin works best.

What could the students do to find a more accurate value for this pH?

_____

_____

_____

_____

(2)

(iii) There was no change in the length of the egg white from pH 5 to pH 7.

Explain why.

_____

_____

_____

_____

(2)

(c) Pepsin is made by the stomach.

Name the acid made by the stomach which allows pepsin to work well.

_____

(1)

(Total 8 marks)

Q14.

(a) (i) Blood is part of the circulatory system.

Draw **one** line from each part of the blood to its correct function.

Part of the blood	**Function**
	carry glucose around

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 White blood cells	the body
 Red blood cells	carry oxygen around the body
 Platelets	help the blood to clot
	destroy microorganisms

(3)

(ii) Name **one** waste product that is transported by the blood plasma.

_____

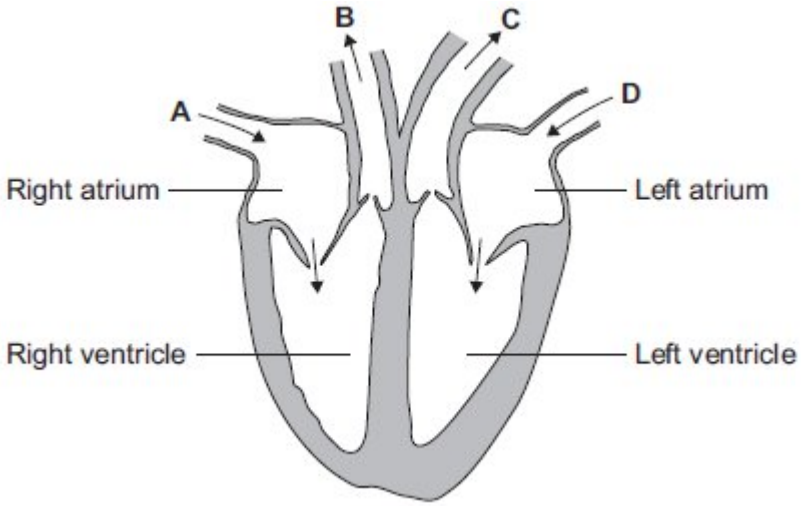
(1)

(b) The heart is also part of the circulatory system.

Figure 1 shows a section through the human heart.

Figure 1

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(i) Which arrow, **A**, **B**, **C** or **D**, shows blood leaving the heart in the pulmonary artery to go to the lungs? ☐

(1)

(ii) Which arrow, **A**, **B**, **C** or **D**, shows blood from the lungs entering the heart in the pulmonary vein? ☐

(1)

(iii) Valves in the circulatory system make sure blood only travels in one direction.

Name the type of blood vessel that has valves.

_____

(1)

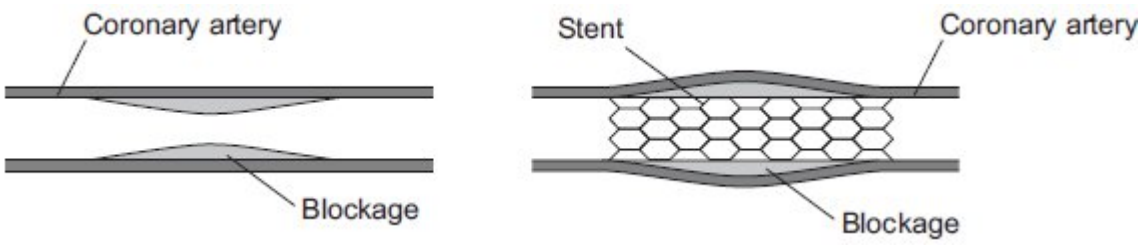
(c) A person's coronary artery has become narrower.

The person has a heart attack.

A doctor puts a stent into the person's coronary artery.

Figure 2 shows a stent inside a coronary artery.

Figure 2



(i) How does the stent help to prevent another heart attack?

Give **one** way.

_____

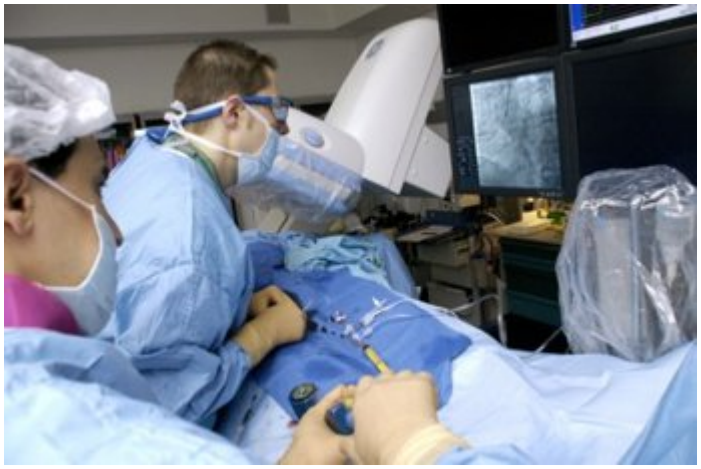
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_____

(1)

(ii) **Figure 3** shows a surgeon putting a stent into a patient.

Figure 3



© Science Photo Library

The surgeon puts the stent into an artery in the leg. He moves the stent through the artery to the coronary artery.

Suggest **two** possible risks of this operation.

1. _____

_____

2. _____

_____

(2)

(Total 10 marks)

Q15.

Blood is part of the circulatory system.

(a) (i) Give **one** function of white blood cells.

_____

_____

(1)

(ii) Which of the following is a feature of platelets?

Tick (✓) **one** box.

They have a nucleus. ☐

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They contain haemoglobin. ☐

They are small fragments of cells. ☐

(1)

(b) Urea is transported by the blood plasma from where it is made to where the urea is excreted.

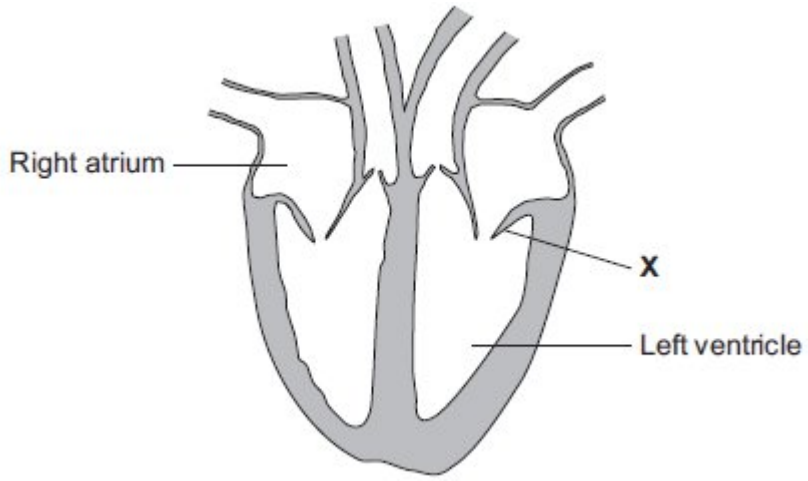
Complete the following sentence.

Blood plasma carries urea from where it is made in the _____

to the _____ where the urea is removed from the blood.

(2)

(c) The illustration shows a section through the human heart.



Structure **X** is a valve. If valve **X** stops working, it may need to be replaced.

A scientist is designing a new heart valve. The scientist knows that the valve must be the correct size to fit in the heart.

Suggest **two** other factors the scientist needs to consider so that the newly designed valve works effectively in the heart.

_____

_____

_____

_____

(2)

(Total 6 marks)

Q16.

LDL is one form of cholesterol found in the blood.

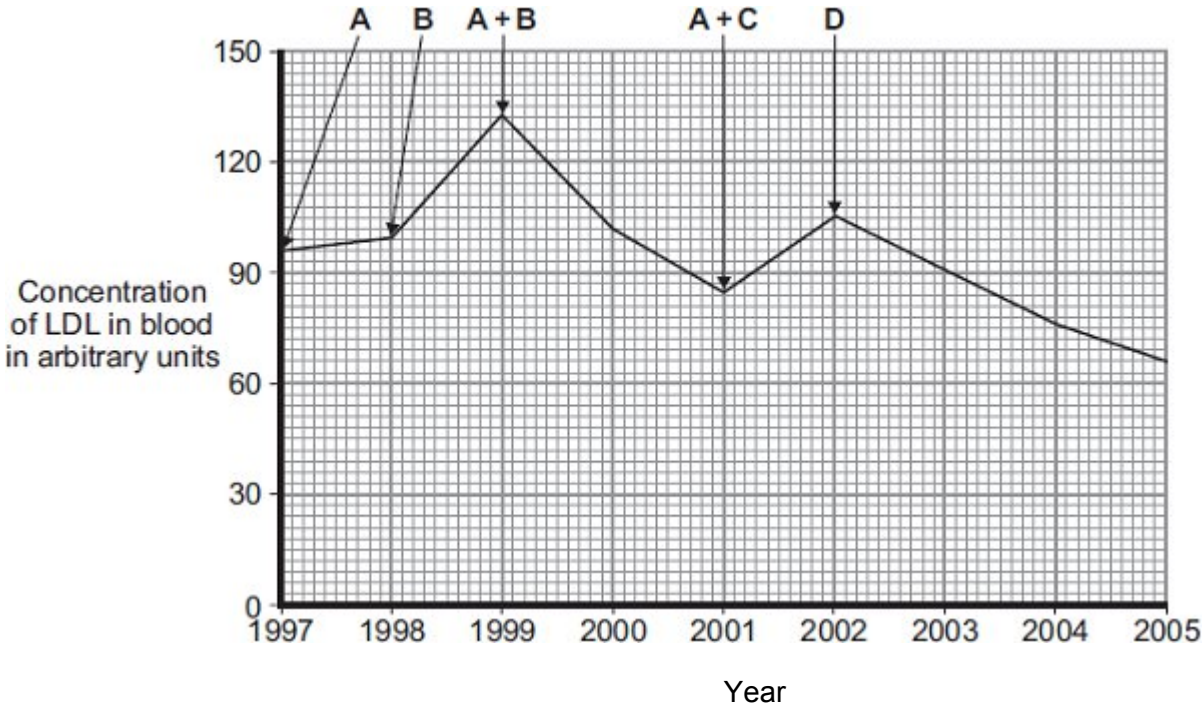
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People with a high concentration of LDL in their blood may be treated with drugs called statins.

A high concentration of LDL cholesterol in the blood may result in an increased risk of heart and circulatory diseases.

The graph shows the effects of the treatment of one person with four different statins, **A**, **B**, **C** and **D**, over a period of 8 years. The arrows show when each new treatment was started.

Each treatment was continued until the next treatment was started.



Compare the effectiveness of the five treatments in reducing the risk of heart and circulatory diseases for this person.

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_____

(Total 4 marks)

Q17.

Scientists investigated how exercise affects blood flow to different organs in the body.

The scientists made measurements of blood flow to different organs of:

- a person resting in a room at 20°C
- the same person, in the same room, doing vigorous exercise at constant speed on an exercise cycle.

The table shows the scientists' results.

Organ	Blood flow in cm^3 per minute whilst …	
	resting	doing vigorous exercise
Brain	750	750
Heart	250	1000
Muscles	1200	22 000
Skin	500	600
Other	3100	650

(a) In this investigation, it was better to do the exercise indoors on an exercise cycle than to go cycling outdoors on the road.

Suggest **two** reasons why.

Do **not** include safety reasons.

1. _____

_____

_____

2. _____

_____

_____

(2)

(b) Blood flow to **one** organ did **not** change between resting and vigorous exercise.

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Which organ?_____

(1)

(c) (i) How much more blood flowed to the muscles during vigorous exercise than when resting?

_____

_____

Answer = _____ cm^3 per minute

(2)

(ii) Name **two** substances needed in larger amounts by the muscles during vigorous exercise than when resting.

1. _____

2. _____

(2)

(iii) Tick (✓) **one** box to complete the sentence.

The substances you named in part (c)(ii) helped the muscles to

make more lactic acid. ☐

respire aerobically. ☐

make more glycogen. ☐

(1)

(iv) The higher rate of blood flow to the muscles during exercise removed larger amounts of waste products made by the muscles.

Which **two** substances need to be removed from the muscles in larger amounts during vigorous exercise?

Tick (✓) **two** boxes.

Amino acids ☐

Carbon dioxide ☐

Glycogen ☐

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Lactic acid ☐

(2)

(d) The total blood flow was much higher during exercise than when resting.

One way to increase the total blood flow is for the heart to pump out a larger volume of blood each beat.

Give **one** other way to increase the blood flow.

_____

_____

(1)

(Total 11 marks)

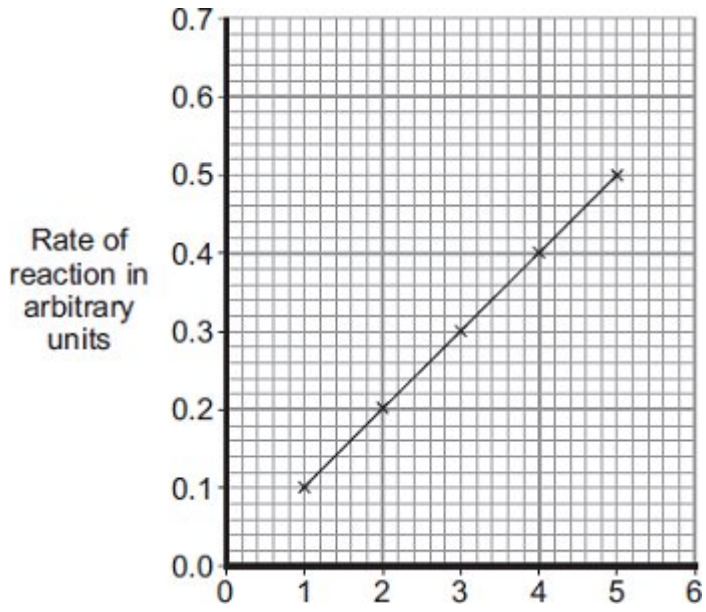
Q18.

Trypsin is a protease enzyme. Trypsin will digest a protein called gelatine which covers the surface of photographic film.

Some students investigated the time taken to digest the gelatine with trypsin.
The students used five different concentrations of trypsin.

The rate of reaction was calculated from the time taken for the gelatine to be digested.

The graph shows the students' results.



(a) (i) Describe the relationship between the concentration of trypsin and the rate of reaction.

_____

_____

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_____

_____

(2)

(ii) Use the graph to predict the rate of reaction with 6% trypsin.

_____ arbitrary units

(1)

(b) In industry, trypsin is used to pre-treat some baby foods.
In their experiment, the students used 1–5% trypsin at 20°C.
The baby food manufacturers make most profit if they use 0.5% trypsin at 35°C.

Suggest why the manufacturers make most profit with these conditions.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(c) (i) Describe the effect trypsin would have on the baby food.

_____

_____

_____

_____

(2)

(ii) Apart from protease enzymes, give **one** other use of a **named** enzyme in industry.

_____

_____

_____

_____

(2)

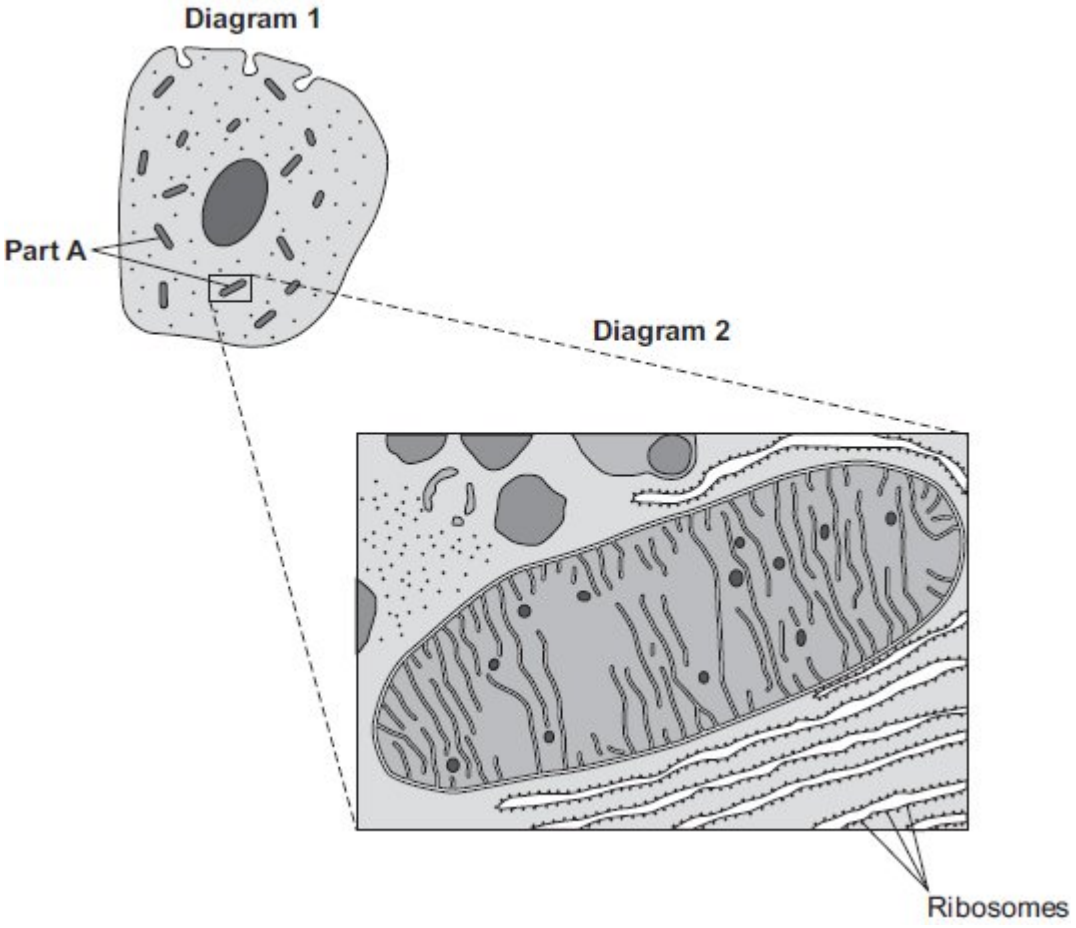
(Total 11 marks)

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Q19.

Diagram 1 shows a cell from the pancreas.

Diagram 2 shows part of the cell seen under an electron microscope.



Part **A** is where most of the reactions of aerobic respiration happen.

(a) (i) Name part **A**.

_____

(1)

(ii) Complete the equation for aerobic respiration.

glucose + oxygen ⟶ _____ + _____ (+ energy)

(2)

(iii) Part **A** uses oxygen.

Explain how oxygen passes from the blood to part **A**.

_____

_____

_____

_____

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_____

_____

_____

_____

(3)

(b) The pancreas cell makes enzymes.

Enzymes are proteins.

Describe how the ribosomes and part **A** help the cell to make enzymes.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 9 marks)

Q20.

Scientists have produced many different types of GM (genetically modified) food crops.

(a) Use words from the box to complete the sentence about genetic engineering.

clones	**chromosomes**	**embryos**	**genes**

GM crops are produced by cutting _____ out of the

_____ of one plant and inserting them into the cells of a crop plant.

(2)

(b) Read the information about GM food crops.

- Herbicide-resistant GM crops produce higher yields.
- Scientists are uncertain about how eating GM food affects our health.
- Insect-resistant GM crops reduce the total use of pesticides.

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- GM crops might breed naturally with wild plants.
- Seeds for a GM crop can only be bought from one manufacturer.
- The numbers of bees will fall in areas where GM crops are grown.

Use this information to answer these questions.

(i) Give **two** reasons why some farmers are in favour of growing GM crops.

1. _____

_____

2. _____

_____

(2)

(ii) Give **two** reasons why many people are against the growing of GM crops.

1. _____

_____

2. _____

_____

(2)

(Total 6 marks)

Q21.

Diabetes is a disease in which the concentration of glucose in a person's blood may rise to fatally high levels.
Insulin controls the concentration of glucose in the blood.

(a) Where is insulin produced?

Draw a ring around **one** answer.

gall bladder **liver** **pancreas**

(1)

(b) People with diabetes may control their blood glucose by injecting insulin.

(i) If insulin is taken by mouth, it is digested in the stomach.

What type of substance is insulin?

Draw a ring around **one** answer.

carbohydrate **fat** **protein**

(1)

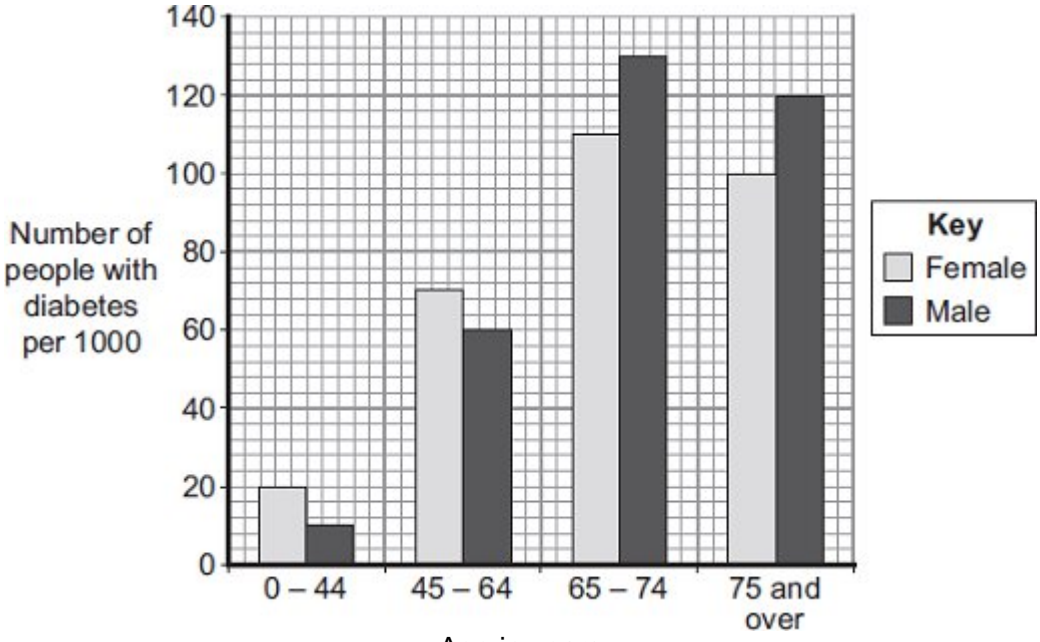
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(ii) Apart from using insulin, give **one** other way people with diabetes may reduce their blood glucose.

_____

(1)

(c) The bar chart shows the number of people with diabetes in different age groups in the UK.



(i) Describe how the number of males with diabetes changes between the ages of 0 – 44 years and 75 years and over.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(ii) Compare the number of males and females with diabetes:

between the ages of 0 and 64 years

_____

_____

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_____

over the age of 65 years.

_____

_____

_____

(2)

(Total 8 marks)

Q22.

Denim jeans can be coloured with blue dye. The dye joins onto the fibres of the material. Some people like their denim jeans to look faded. The faded look is called ‘stonewashed’. There are two different ways to make denim material look faded.

Traditional stonewashing

- Denim material is put in a slowly spinning container with large stones.
- Very hot water is added.
- Washing takes up to five hours.
- Washing breaks some of the fibres and lets the dye come out from the fibres.
- Washing will work with any dye.

Bio-stonewashing

- Denim material is washed with enzymes in warm water.
- Washing takes half an hour.
- The enzymes let the dye come out from the fibres.
- Different enzymes are needed for different dyes.
- The enzymes are expensive.
- After treatment the enzymes have to be removed from the denim.

(a) Use **only** the information above to answer these questions.

(i) Suggest **two** advantages of using the bio-stonewashing method instead of the traditional stonewashing method.

1. _____

_____

2. _____

_____

(2)

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(ii) Suggest **two** disadvantages of using the bio-stonewashing method instead of the traditional stonewashing method.

1. _____

_____

2. _____

_____

(2)

(b) Some blue dyes are made of protein.

What type of enzyme would be used to remove these blue dyes from denim?

Draw a ring around **one** answer.

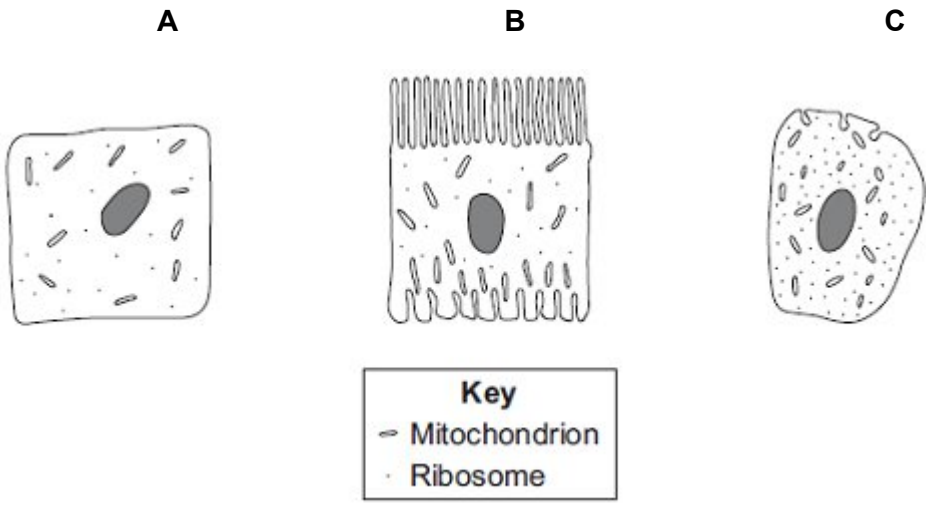
carbohydrase **lipase** **protease**

(1)

(Total 5 marks)

Q23.

Diagrams **A**, **B** and **C** show cells from different parts of the human body, all drawn to the same scale.



(a) Which cell, **A**, **B** or **C**, appears to be best adapted to increase diffusion into or out of the cell? ☐

Give **one** reason for your choice.

_____

_____

(1)

(b) (i) Cell **C** is found in the salivary glands.

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Name the enzyme produced by the salivary glands.

_____

(1)

(ii) Use information from the diagram to explain how cell **C** is adapted for producing this enzyme.

_____

_____

_____

_____

(2)

(Total 4 marks)

Q24.

Fresh milk is a mixture of compounds including lipid, protein and about 5% lactose sugar.

Lactose must be digested by the enzyme lactase, before the products can be absorbed.

Lactase can be added to fresh milk to pre-digest the lactose. This makes 'lactose-free' milk, which is suitable for people who do not produce enough lactase of their own.

A student investigated the effect of changing pH and temperature on the digestion of lactose in milk.

The results are shown in **Tables 1** and **2**.

Table 1
Effect of pH

pH	Time taken to digest lactose in minutes
4.0	20
5.0	18
6.0	13
7.0	7
8.0	5
9.0	6

Table 2
Effect of temperature

Temperature in °C	Time taken to digest lactose in minutes
25	20
30	14
35	11
40	6
45	29
50	No digestion

(a) The label on a carton of lactose-free milk states:

'Lactase is normally produced in the stomach of mammals.'

The results in **Table 1** suggest that this statement is **not** true.

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Explain how.

_____

_____

_____

_____

(2)

(b) Explain, as fully as you can, the results shown in **Table 2** .

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(c) Bile is produced in the liver and is released into the small intestine.

Bile helps the digestion of lipid in the milk.

Describe how.

_____

_____

_____

_____

(2)

(Total 7 marks)

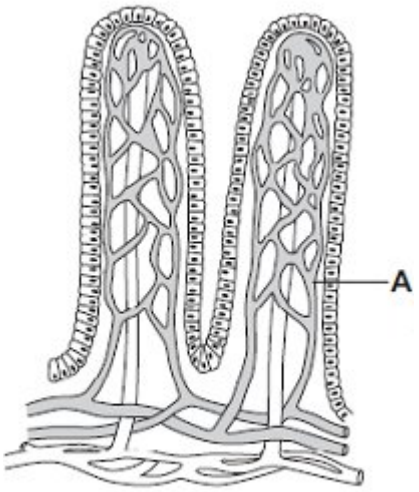
Q25.

Villi are found in some parts of the digestive system.

Diagram 1 shows two villi.

Diagram 1

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(a) Draw a ring around the correct answer to complete each sentence.

(i) Structure **A** is a

muscle.

nerve.

capillary.

(1)

(ii) The villi absorb the products of digestion by

dialysis.

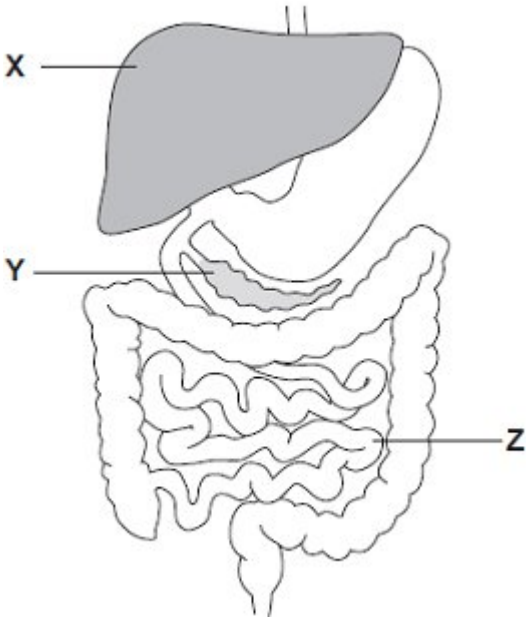
diffusion.

osmosis.

(1)

(b) **Diagram 2** shows the digestive system.

Diagram 2



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(i) In which part of the digestive system, **X**, **Y** or **Z**, are most villi found?

(1)

(ii) There are about 2000 villi in each cm^2 of this part of the digestive system.

Why is it helpful to have lots of villi?

_____

_____

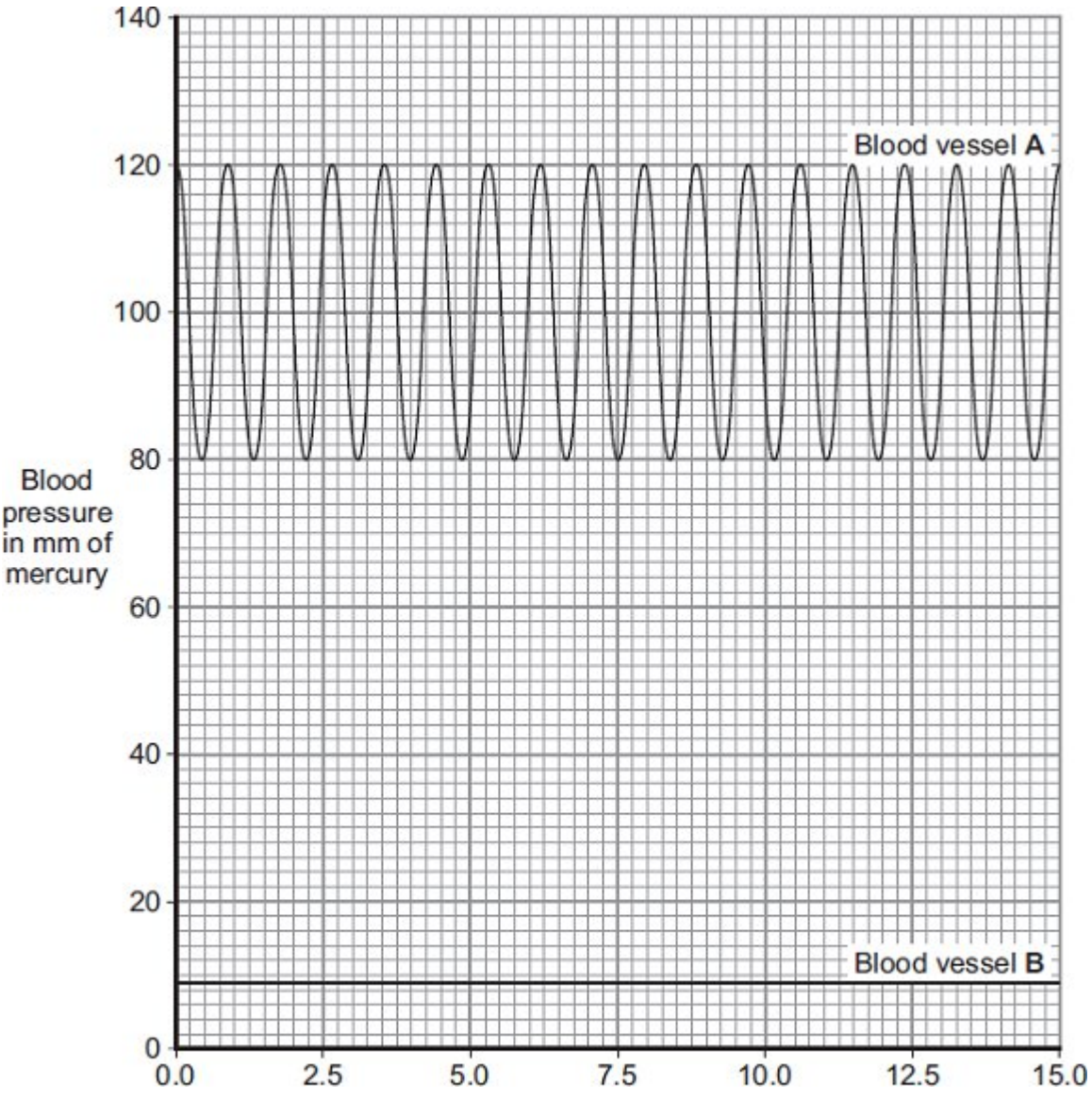
(1)

(Total 4 marks)

Q26.

The heart pumps the blood around the body. This causes blood to leave the heart at high pressure.

The graph shows blood pressure measurements for a person at rest.
The blood pressure was measured in an artery and in a vein.



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Time in seconds

(a) Which blood vessel, **A** or **B**, is the artery?

Blood vessel _____

Give **two** reasons for your answer.

Reason 1 _____

_____

Reason 2 _____

_____

(2)

(b) Use information from the graph to answer these questions.

(i) How many times did the heart beat in 15 seconds? _____

(1)

(ii) Use your answer from part (b)(i) to calculate the person's heart rate per minute.

_____

_____

Heart rate = _____ beats per minute

(1)

(c) During exercise, the heart rate increases.

The increased heart rate supplies useful substances to the muscles at a faster rate.

Name **two** useful substances that must be supplied to the muscles at a faster rate during exercise.

1. _____

2. _____

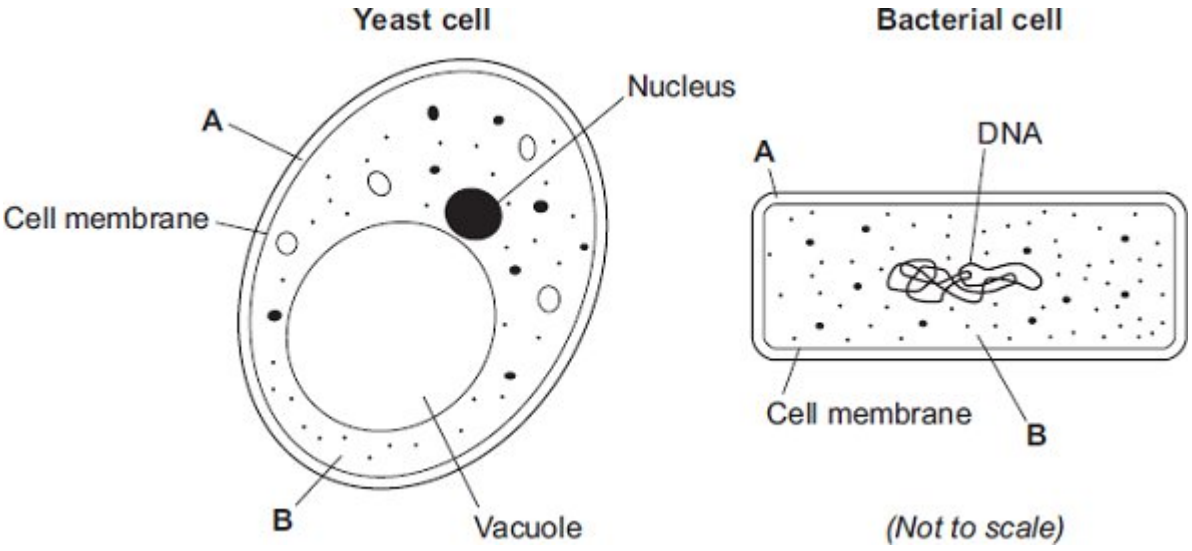
(2)

(Total 6 marks)

Q27.

(a) The diagrams show the structures of a yeast cell and a bacterial cell.

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(i) Both the yeast cell and the bacterial cell have structures **A** and **B**.

Name structures **A** and **B**.

A _____

B _____

(2)

(ii) The yeast cell and the bacterial cell have different shapes and sizes.

Give **one** other way in which the structure of the bacterial cell is different from the structure of the yeast cell.

_____

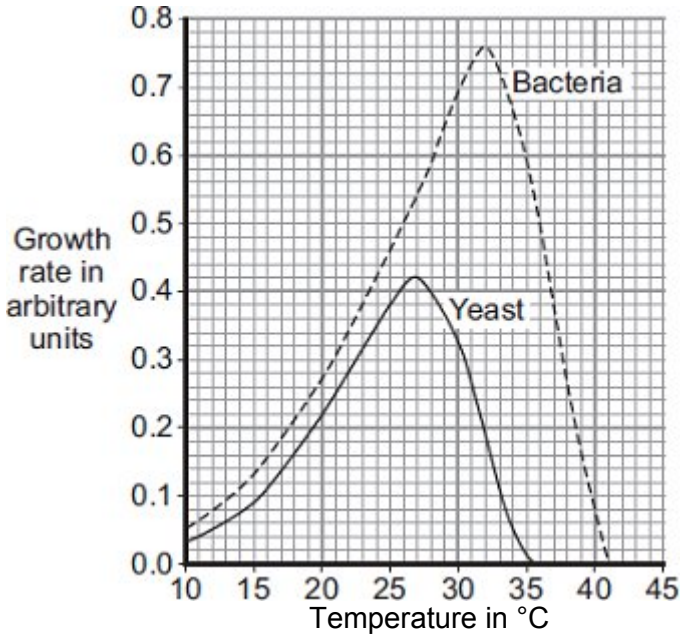
_____

(1)

(b) Sourdough bread is light in texture and tastes slightly sour. The bread is made using two types of microorganism, a yeast and a bacterium. The bacterium can make acids such as lactic acid. The acid makes the bread taste sour.

The graph shows how the growth rates of the yeast and the bacteria change with temperature.

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(i) Sourdough bread rises fastest at 27°C.

Use information from the graph to explain why.

_____

_____

_____

_____

(2)

(ii) The bread tastes most sour if it rises at 32°C.

Use information from the graph to explain why.

_____

_____

_____

_____

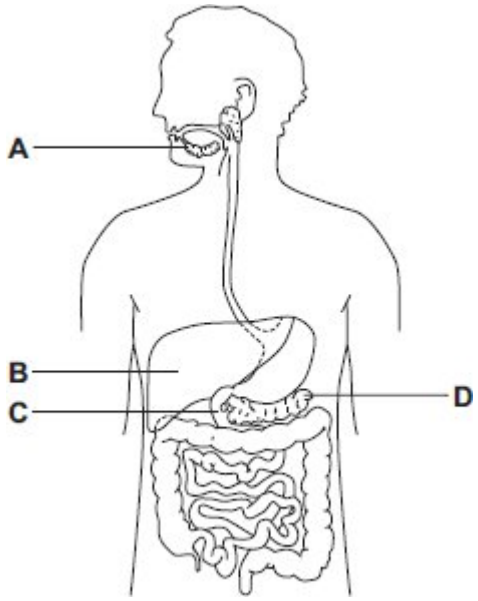
(2)

(Total 7 marks)

Q28.

The diagram shows part of the human digestive system.

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(a) Name the parts of the digestive system labelled **A**, **B**, **C** and **D**.

A _____

B _____

C _____

D _____

(4)

(b) A student has eaten a steak for dinner. The steak contains protein and fat.

(i) Describe how the **protein** is digested.

_____

_____

_____

_____

_____

_____

(3)

(ii) Explain **two** ways in which bile helps the body to digest **fat**.

_____

_____

_____

_____

_____

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_____

(4)

(c) A group of students investigated the action of salivary amylase.
The students:

- collected a sample of salivary amylase
- put a different pH solution and 5 cm^3 of a food substance in each of 6 test tubes
- added 1 cm^3 of salivary amylase to each of the 6 test tubes
- recorded the amylase activity after 10 minutes.

The results are shown in the table.

pH	7	6	5	4	3	2
Amylase activity in arbitrary units	12	10	3	0	0	0

(i) Name the food substance that amylase breaks down.

_____

(1)

(ii) Suggest what happens to the breakdown of this substance when food reaches the stomach.

Use information from the table to help you to answer this question.

_____

_____

_____

_____

_____

_____

(3)

(Total 15 marks)

Q29.

The number of people in the UK with tumours is increasing.

(a) (i) Describe how tumours form.

_____

_____

(1)

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(ii) Tumours can be malignant or benign.

What is the difference between a malignant tumour and a benign tumour?

_____

_____

(1)

(b) Describe how some tumours may spread to other parts of the body.

_____

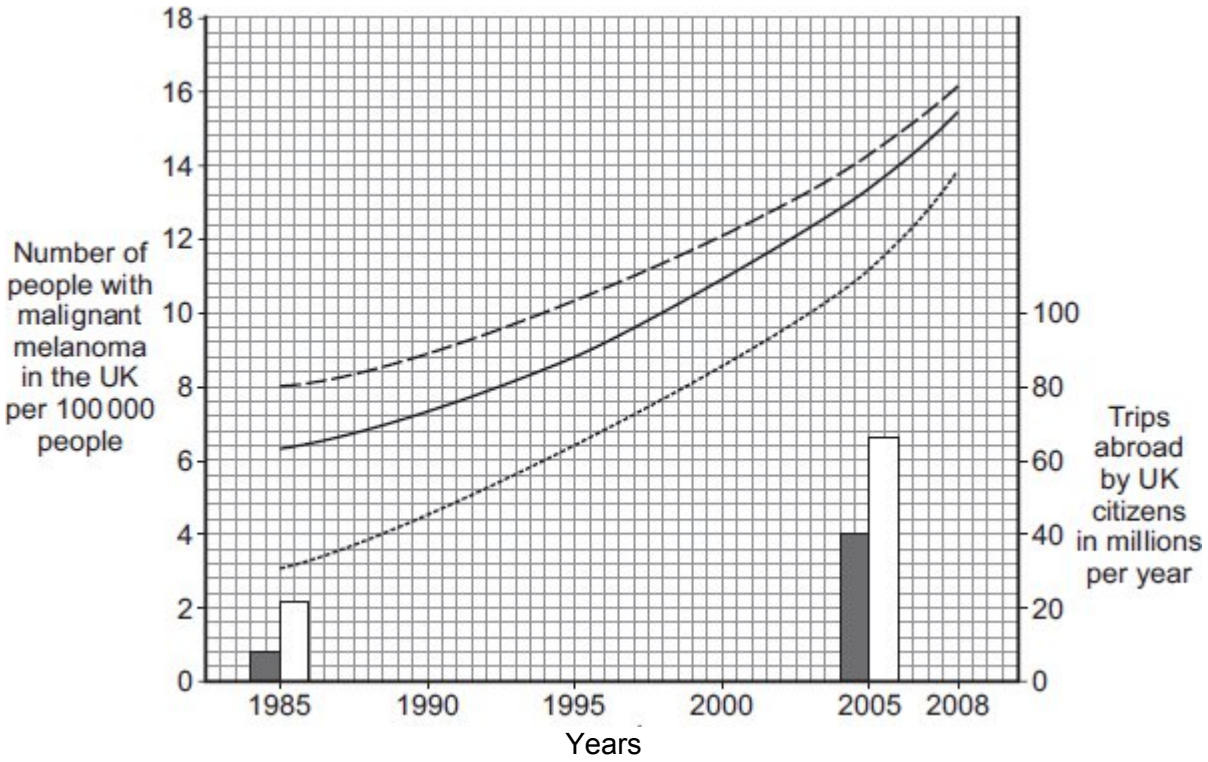
_____

(1)

(c) People from Northern Europe have fair skin and many people have malignant melanoma skin cancer.

The graph shows how the number of people in the UK with malignant melanoma changed between 1985 and 2008.

The bars on the graph show the number of people in the UK who travelled abroad and the number who took cheap holidays in the sun in 1985 and 2005.



Key

Mean for all areas

Mean for people from rich areas

Mean for people from poor areas

Total number of trips abroad

Number of cheap holidays in the sun

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(i) Describe the trends in the number of people with malignant melanoma skin cancer between 1985 and 2008.

_____

_____

_____

_____

_____

_____

(3)

(ii) Use the data about the number of trips abroad to suggest an explanation for the trends you have described in part **(c)(i)**.

_____

_____

_____

_____

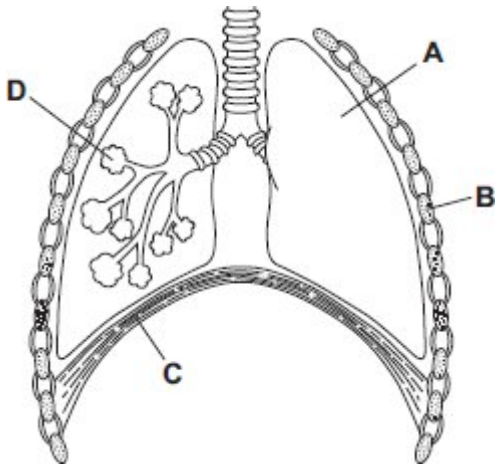
(2)

(Total 8 marks)

Q30.

(a) **Diagram 1** shows part of the breathing system.

Diagram 1



(i) Use words from the box to name the parts labelled **A**, **B**, **C** and **D**.

alveolus	**diaphragm**	**lung**	**rib**	**trachea**

A _____

B _____

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C _____

D _____

(4)

(ii) Parts **B** and **C** move when we breathe **in**.

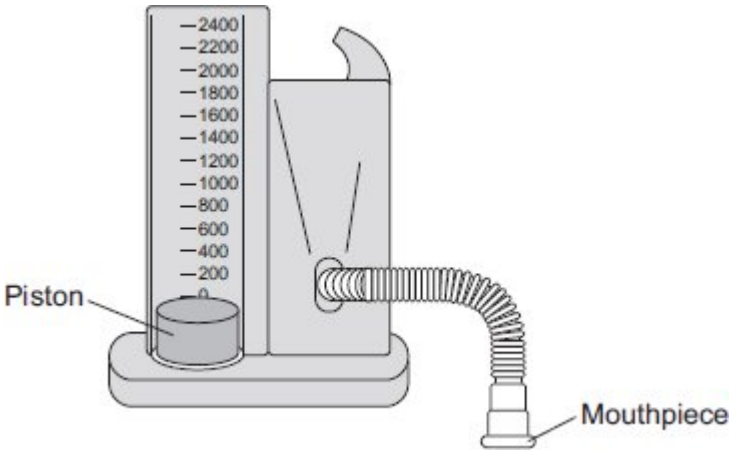
Part **B** moves _____

Part **C** moves _____

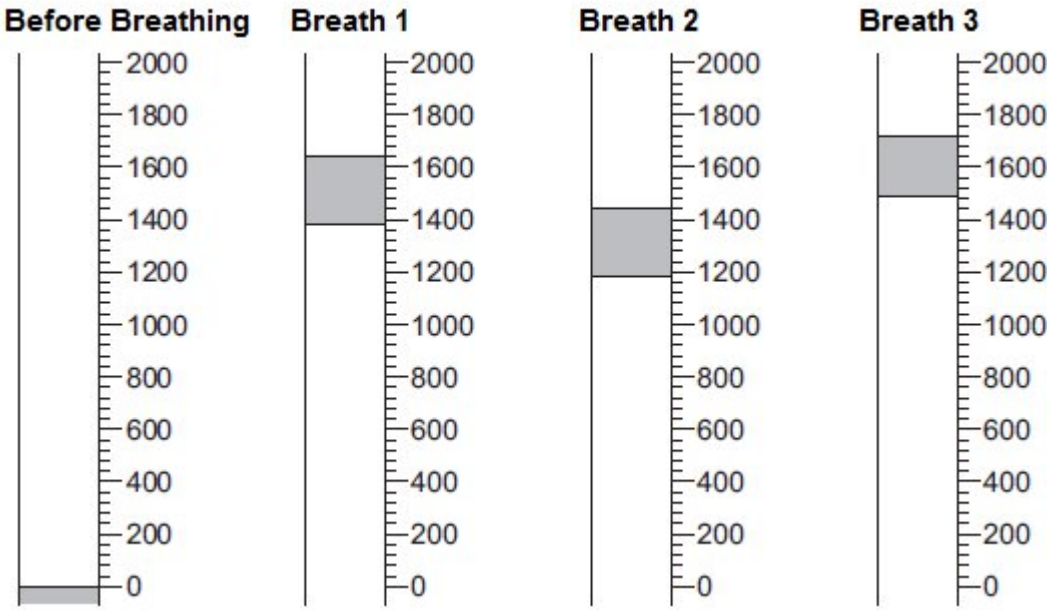
(2)

(b) A student used the apparatus shown in **Diagram 2** to measure the maximum volume of air that he could breathe in one breath.
When the student breathes in, the piston moves upwards.
The piston moves back down after the student has breathed out.

Diagram 2



The student breathes in through the apparatus three times.
The drawings show the position of the piston after each of the three breaths.
The volumes are measured in cm^3.



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(i) Read the volume of each breath and write the volume in the table.

	Breath 1	Breath 2	Breath 3
Volume in cm^3	_____	_____	_____

(3)

(ii) Calculate the mean volume of air breathed in.

_____

_____

Mean volume of air breathed in = _____ cm^3

(2)

(c) A teacher asks the student to investigate if students who take part in sports activities can breathe in a larger volume of air than students who do not take part.

Describe briefly how the student could use the **same** apparatus to do the investigation.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(d) **Photograph 1** shows a different piece of apparatus used to measure the volume of air that a person can breathe in one breath.

Photograph 1

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© Digital Vision/Photodisc

When the student breathes out through the apparatus the pointer on the scale moves. The pointer stays in the same position when the student has finished.

Explain **one** advantage, apart from size, of using this apparatus rather than the apparatus described in part **(b)**.

_____

_____

_____

_____

(2)

(e) **Photograph 2** shows one type of mechanical ventilator.

Photograph 2



© Emine Donmaz/iStock

(i) Use information from **Photograph 2** to suggest how this type of ventilator works.

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_____

_____

_____

_____

(2)

(ii) Use information from **Photograph 2** to suggest two disadvantages of this type of ventilator.

1. _____

_____

2. _____

_____

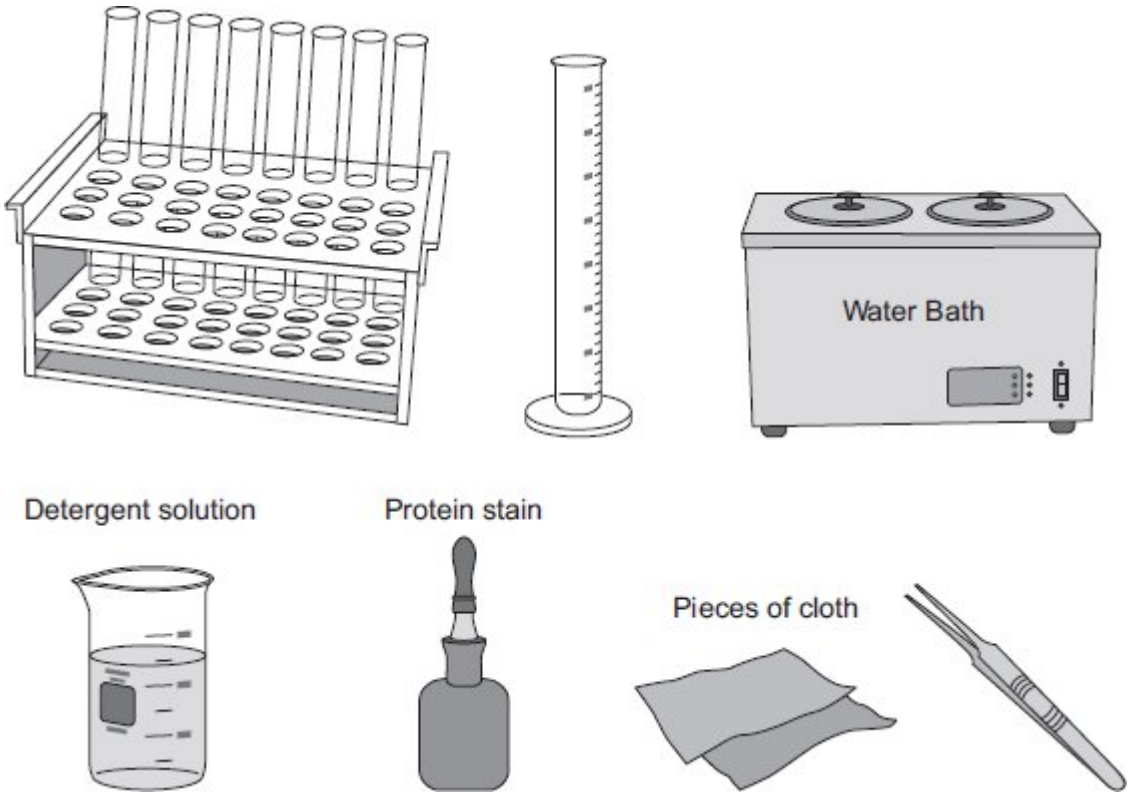
(2)

(Total 20 marks)

Q31.

Biological detergents contain protease enzymes.

(a) The drawings show some apparatus and materials.



In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe how you would use the apparatus and materials shown in the drawings to find the best temperature for removing stains from clothing.

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You should include how you would make the investigation a fair test.

(6)

(b) In a similar investigation a student investigated the effect of pH on the time taken to remove a stain from pieces of cloth.

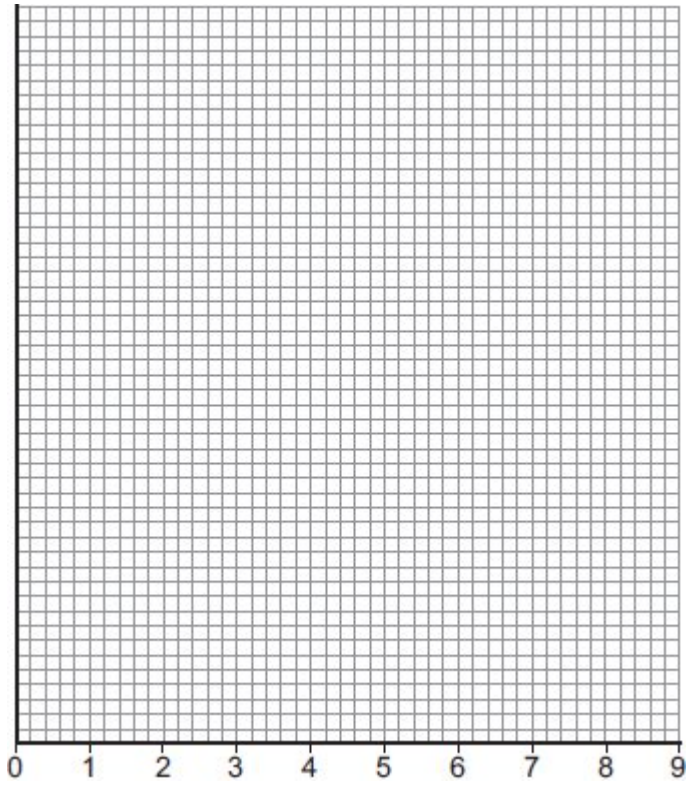
The table shows the student's results.

	pH of detergent solution								
	1	2	3	4	5	6	7	8	9
Time taken to remove stain in minutes	20	19	17	14	10	4	8	12	16

(i) On the graph paper below draw a graph to show the student's results.

- Add a suitable scale and label to the y axis.
- Plot the student's results.
- Draw a line of best fit.

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(4)

(ii) Which is the best pH for using the detergent?

pH _____

(1)

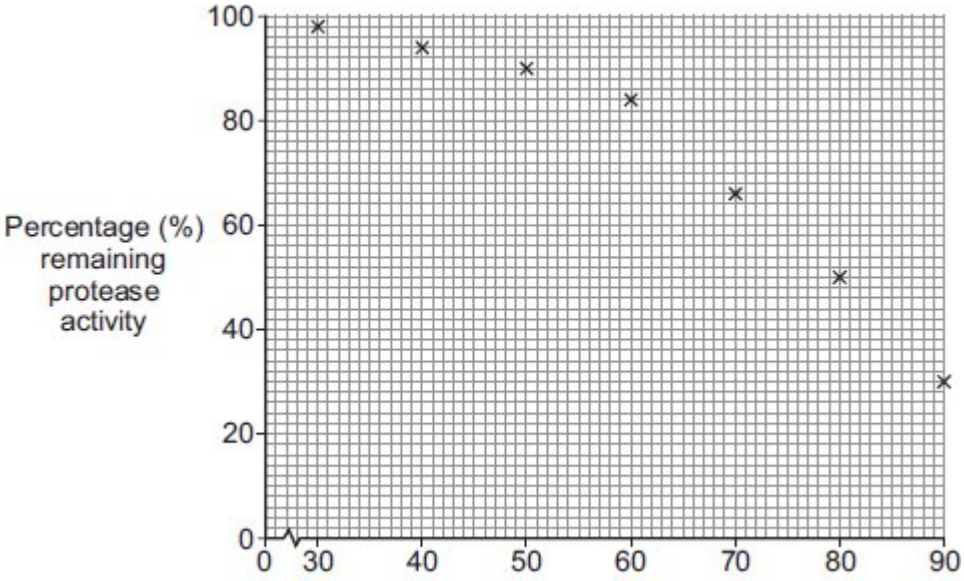
(c) Scientists investigated the stability of a protease enzyme. The protease enzyme was extracted from plants.

The scientists:

- pre-incubated samples of the enzyme at various temperatures for 30 minutes
- put each sample on ice for a further 10 minutes
- measured the percentage (%) remaining activity of the enzyme in each sample.
  This was done by incubating each sample with protein at 37 °C for 6 hours.

The graph shows the scientists' results.

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The scientists recommended that the enzyme could be used in detergents at a temperature of 60 °C.

Suggest why the scientists recommended a temperature of 60 °C.
Use information from the graph and your own scientific knowledge in your answer.

_____

_____

_____

_____

_____

_____

(3)

(Total 14 marks)

Q32.

The number of cases of Type 2 diabetes in the UK is increasing rapidly.

(a) Describe how insulin and glucagon help control the blood sugar concentration in a healthy person.

_____

_____

_____

_____

_____

_____

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_____

_____

_____

_____

_____

_____

_____

_____

(6)

(b) What is Type 2 diabetes?

_____

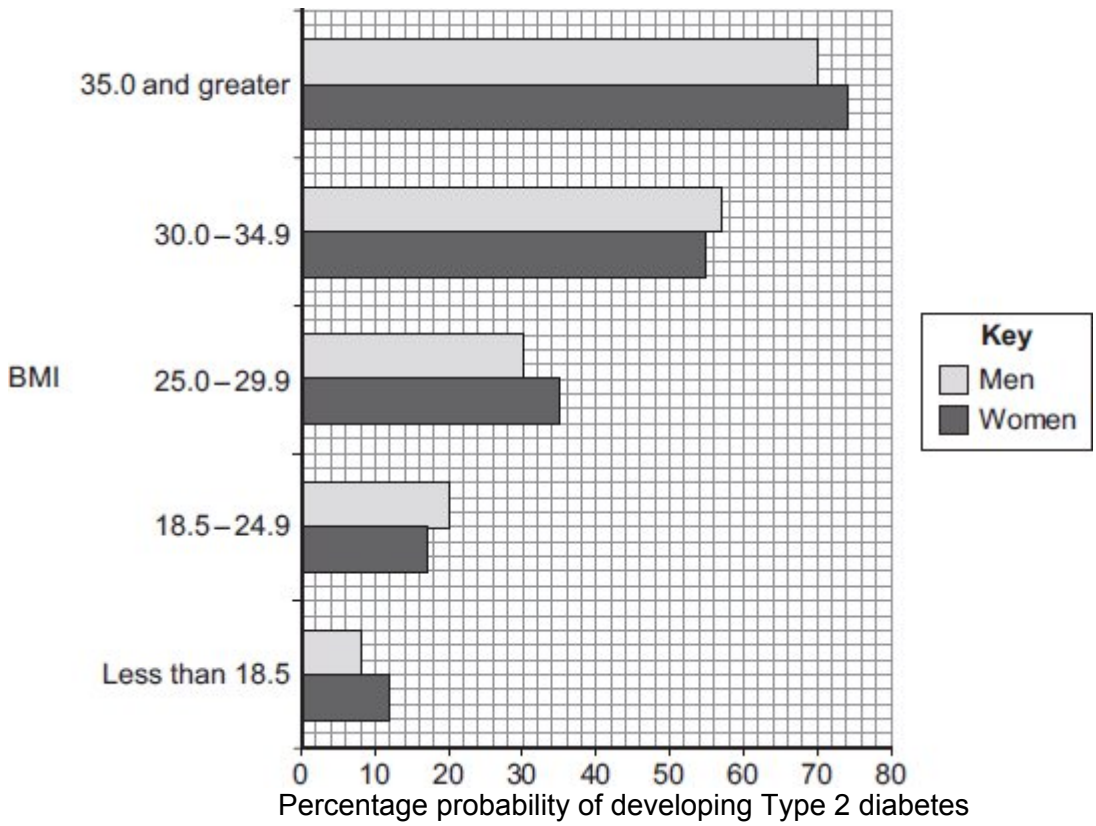
_____

(1)

(c) Body mass index (BMI) is a person's body weight divided by the square of his or her height.

(i) **Graph 1** shows the relationship between BMI and the percentage probability of developing Type 2 diabetes.

Graph 1



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Suggest an explanation for the relationship between BMI and the risk of developing Type 2 diabetes.

_____

_____

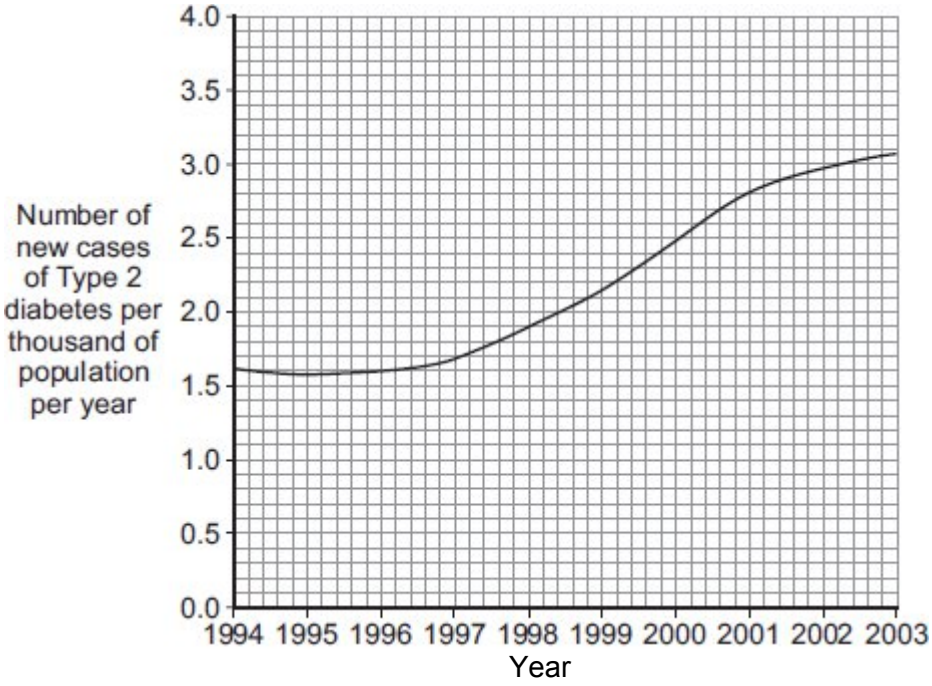
_____

_____

(2)

(ii) **Graph 2** shows changes in the number of new cases of Type 2 diabetes in the UK.

Graph 2



Suggest explanations for the trend shown by the data in **Graph 2**.

_____

_____

_____

_____

_____

_____

(3)

(Total 12 marks)

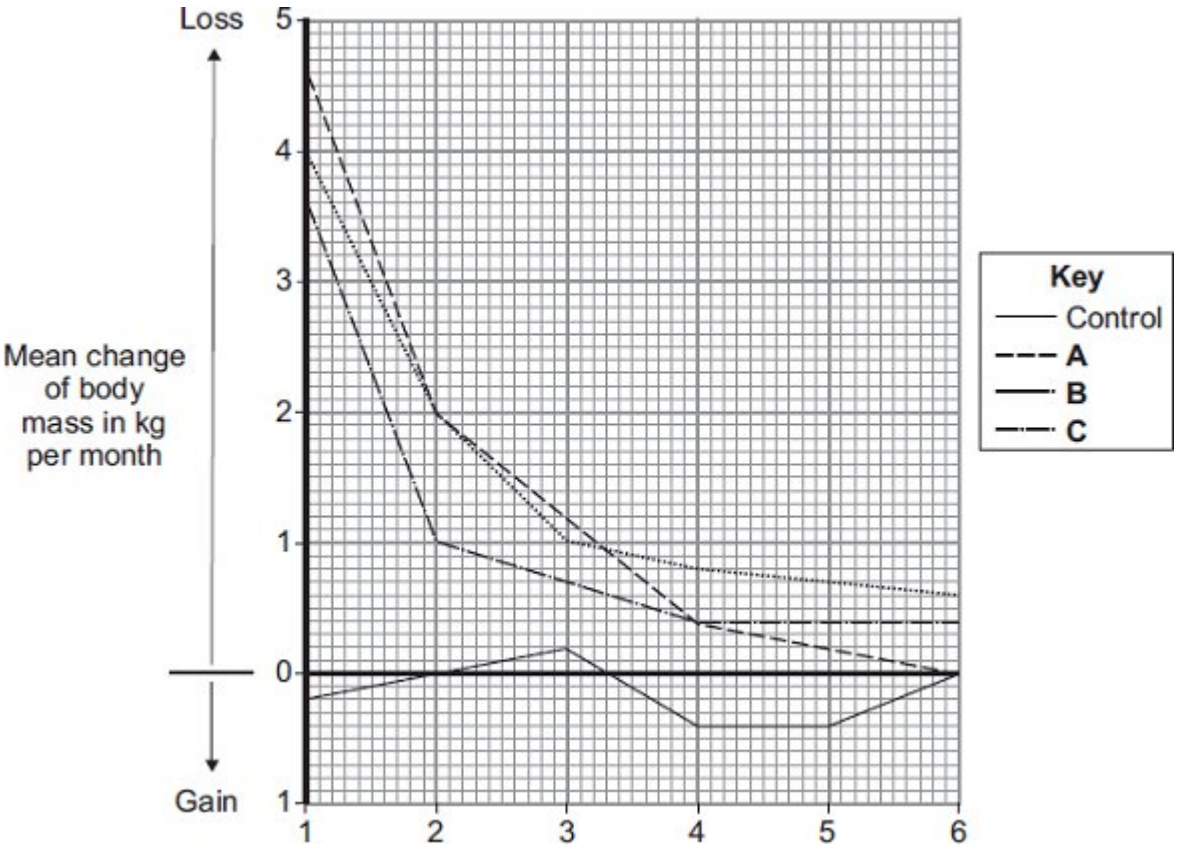
Q33.

Scientists investigated the effectiveness of three slimming programmes, **A**, **B** and **C**.

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The scientists recorded the body mass of four groups of volunteers each month for 6 months. Three of the groups were each given a different slimming programme. The fourth group was a control group.

The graph shows the mean change of body mass each month for all four groups.



(a) (i) What should the control group eat?

_____

_____

(1)

(ii) Why did the scientists include a control group in this study?

_____

_____

(1)

(b) (i) The three groups of volunteers using the slimming programmes each showed a similar pattern of body mass loss over the 6 months.

Describe this pattern.

_____

_____

_____

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_____

(2)

(ii) All the slimming programmes seemed to be effective.

How does the information in the graph show this?

_____

_____

(1)

(Total 5 marks)

Q34.

One factor that may affect body mass is *metabolic rate*.

(a) (i) What is meant by *metabolic rate* ?

_____

_____

(1)

(ii) Metabolic rate is affected by the amount of activity a person does.

Give **two** other factors that may affect a person's metabolic rate.

1. _____

_____

2. _____

_____

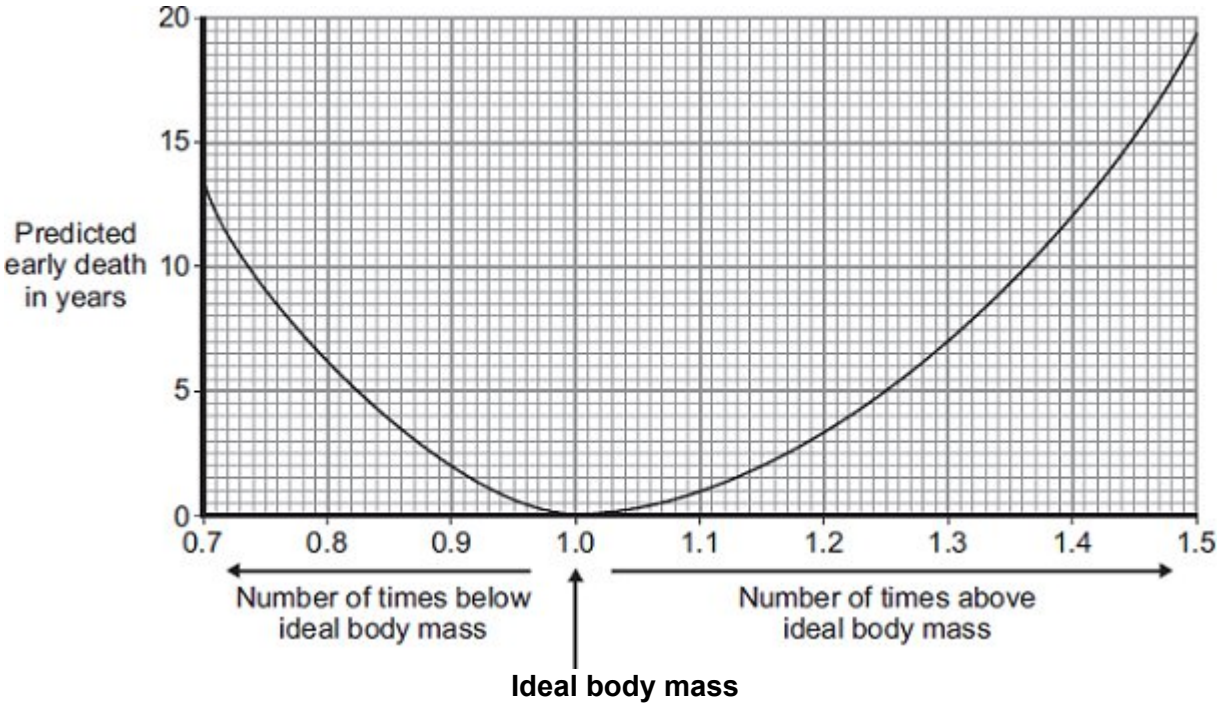
(2)

(b) Predicted early death is the number of years that a person will die before the mean age of death for the whole population. The predicted early death of a person is affected by their body mass.

Scientists have calculated the effect of body mass on predicted early death.

The graph shows the results of the scientists' calculations.

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The number of times above or below ideal body mass is given by the equation:

$$\frac{\text{Actual body mass}}{\text{Ideal body mass}}$$

In the UK the mean age of death for women is 82.

A woman has a body mass of 70 kg. The woman's ideal body mass is 56 kg.

(i) Use the information from the graph to predict the age of this woman when she dies.

_____

_____

_____

Age at death = _____ years

(2)

(ii) The woman could live longer by changing her lifestyle.

Give **two** changes she should make.

1. _____

_____

2. _____

_____

(2)

(Total 7 marks)

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Q35.

Drugs are used to treat cardiovascular diseases (diseases of the heart and blood vessels).

(a) What is a drug?

_____

_____

(1)

(b) People can be treated for cardiovascular diseases with statins or aspirin.

Information about these two drugs is given in the table.

STATINS	ASPIRIN
Statins are only available on prescription from doctors.	Aspirin can be bought over the counter. Treatment with aspirin costs up to £15 per year.
In studies, 30 000 patients were monitored over several years. Statins were found to reduce the rate of non-fatal heart attacks by about 30%.	In a study of 1000 patients, aspirin was found to cause bleeding of the stomach in around 0.5% of patients and there was a slightly increased risk of poor blood clotting at cuts.
Approximately 0.1% of the patients suffered serious muscle damage and 0.01% suffered kidney failure.	There was a slightly increased risk of damage to the blood vessels in the brain in older patients.
Statins reduce blood cholesterol which builds up in the walls of blood vessels. The cost of treating patients with statins can vary between £150 and £500 per year, depending on the type of cardiovascular disease being treated.	Aspirin was found to reduce the risk of non-fatal heart attacks by 31%.

Would you recommend statins or aspirin for the treatment of cardiovascular diseases?

In your answer you should:

- give your recommendation
- use information from the table to support your recommendation by making comparisons of the two drugs.

_____

_____

_____

_____

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(5)
(Total 6 marks)

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