

Animal tissues, Organs, and Organ systems

These practice questions can be used by students and teachers and is suitable for GCSE AQA Biology topic Questions 8641

Level: GCSE AQA Biology 8641

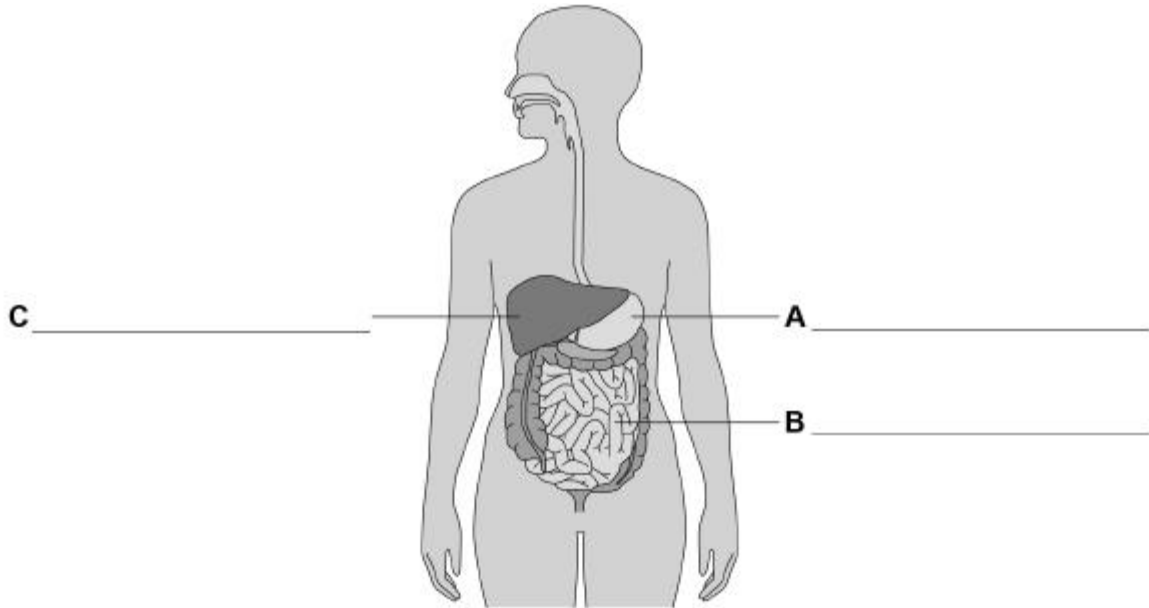
Subject: Biology

Exam board: GCSE AQA

Topic: Animal tissues, Organs, and Organ systems

Q1.

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.

Q2.

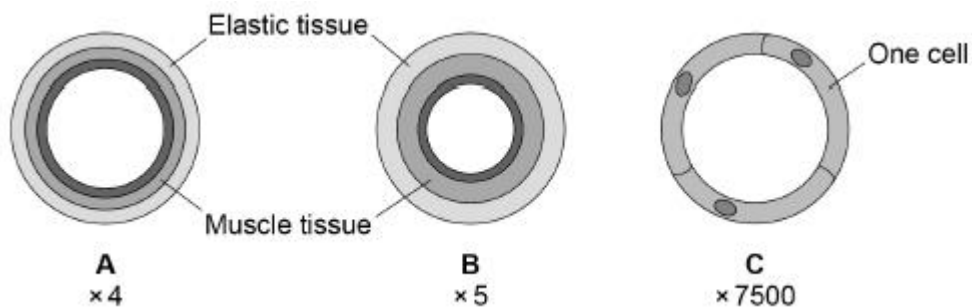
This question is about the circulatory system.

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

Blood Component	Function
Platelet	Destroys microorganisms
Red blood cell	Helps the blood to clot
White blood cell	Transports glucose around the body
	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 $\text{cm}^3 / \text{minute}$
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 = _____ $\text{cm}^3 / \text{minute}$

(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 dm^3 .

Volume of blood in 1 hour = _____ dm^3

(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	When only one blockage is present	When multiple blockages are present



recommended		
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)

Q3.

Earthworms are small animals that live in soil. Earthworms have no specialised gas exchange system and absorb oxygen through their skin.

(a) What is the name of the process in which oxygen enters the skin cells?

Tick **one** box.

- Active transport
- Diffusion
- Osmosis
- Respiration

(1)

The table below shows information about four skin cells of an earthworm.

Cell	Percentage of oxygen	
	Outside cell	Inside cell
A	9	8
B	12	8
C	12	10
D	8	12

(b) Which cell has the smallest difference in percentage of oxygen between the outside and the inside of the cell?

Tick **one** box.

A		B		C		D	
----------	--	----------	--	----------	--	----------	--

(1)

(c) Which cell will oxygen move **into** the fastest?

Tick **one** box.

A		B		C		D	
---	--	---	--	---	--	---	--

(1)

- (d) Earthworms have a large surface area to volume ratio.

Suggest why a large surface area to volume ratio is an advantage to an earthworm.

(1)

- (e) The earthworm uses enzymes to digest dead plants.

Many plants contain fats or oils.

Which type of enzyme would digest fats?

(1)

- (f) Earthworms move through the soil.

This movement brings air into the soil.

Dead plants decay faster in soil containing earthworms compared with soil containing **no** earthworms.

Explain why.

(3)

- (g) When earthworms reproduce, a sperm cell from one earthworm fuses with an egg cell from a different earthworm.

Name the process when an egg cell and a sperm cell fuse.

(1)

- (h) Some types of worm reproduce by a process called fragmentation.

In fragmentation, the worm separates into two or more parts. Each part grows into a new worm.

What type of reproduction is fragmentation?

(1)

(Total 10 marks)

Q4.

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

Table 1

	Value per 500 cm ³	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)

Q5.

A person with Type 1 diabetes cannot make enough insulin.

(a) Which organ makes insulin?

Tick **one** box.

Adrenal gland	<input type="checkbox"/>
Pancreas	<input type="checkbox"/>
Pituitary gland	<input type="checkbox"/>
Thyroid	<input type="checkbox"/>

(1)

(b) A person with Type 1 diabetes can control the concentration of glucose in the blood by injecting insulin.

Complete the sentences.

Choose answers from the box.

DNA	glycogen	kidney
liver	protein	skin

Insulin acts on an organ called the _____ .

This organ then takes in excess glucose from the blood and changes the glucose into _____ .

(2)

- (c) Insulin cannot be taken as a tablet. This is because insulin is a type of protein.
What would happen to the insulin in the tablet if it reached the stomach?

(1)

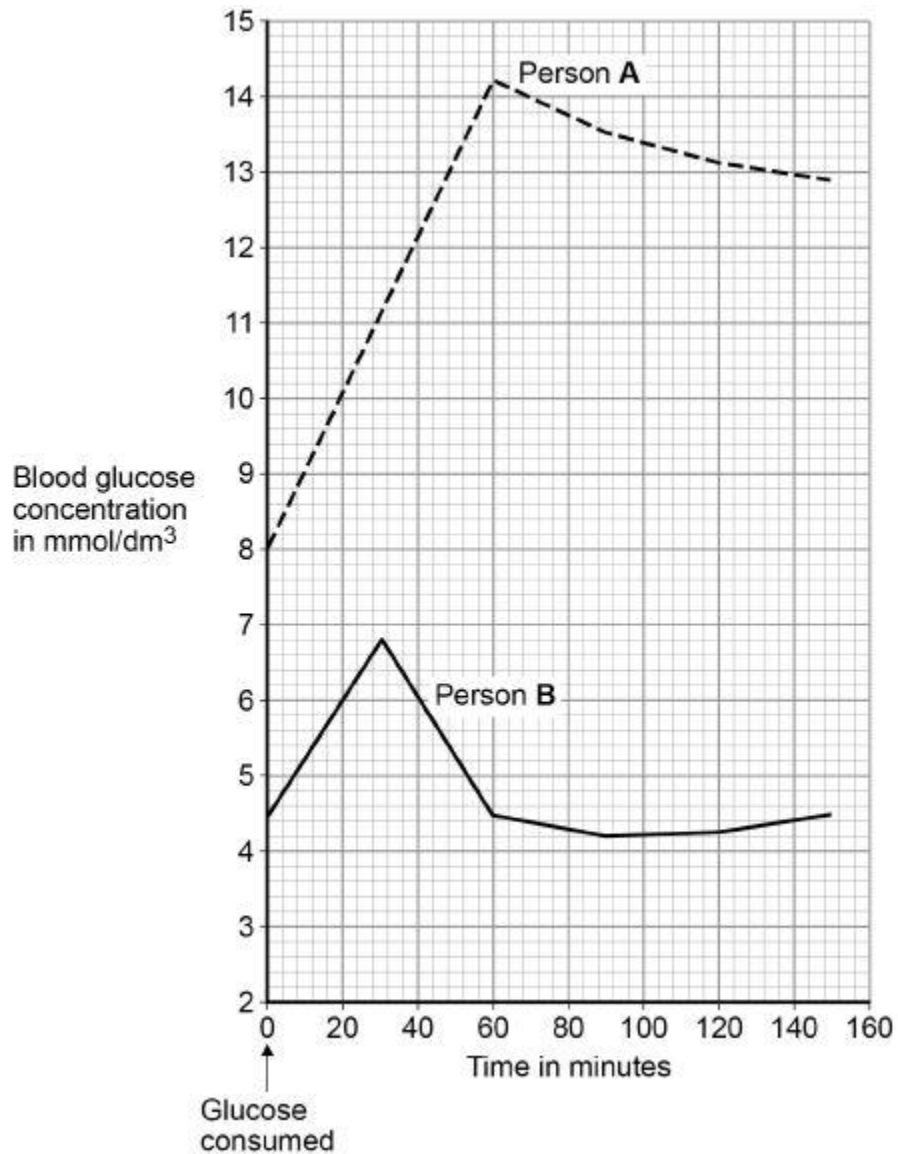
Two people each drank the same volume of a glucose drink.

Person **A** has Type 1 diabetes.

Person **B** does **not** have diabetes.

Figure 1 shows how the concentration of glucose in their blood changed.

Figure 1



- (d) How much higher was the **highest** concentration of glucose in the blood of person **A** than the **highest** concentration in person **B**?

Use information from **Figure 1**.

Answer = _____ mmol/dm³

(2)

- (e) Describe **one** other way that the results for person **A** were different from the results for person **B**.

Use information from **Figure 1**.

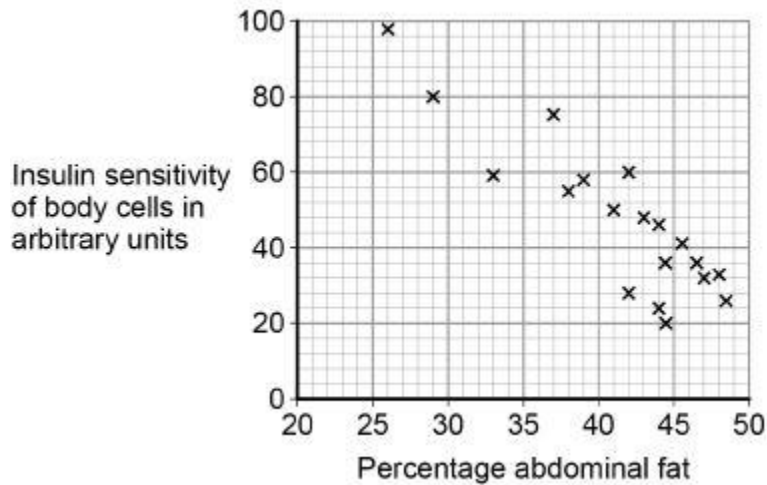
(1)

Type 2 diabetes is another form of diabetes. Type 2 diabetes is common in obese people.

People with Type 2 diabetes make enough insulin, but still cannot control their blood glucose concentration. This is because the body cells are not sensitive to the insulin.

Figure 2 shows information about abdominal fat and insulin sensitivity in body cells.

Figure 2



- (f) What type of relationship is shown in **Figure 2**?

Tick **one** box.

A negative correlation



No correlation

A positive correlation

(1)

(g) A person is at risk of developing Type 2 diabetes.

Suggest **two** ways the person could lower the chance of developing Type 2 diabetes.

1.

2.

(2)

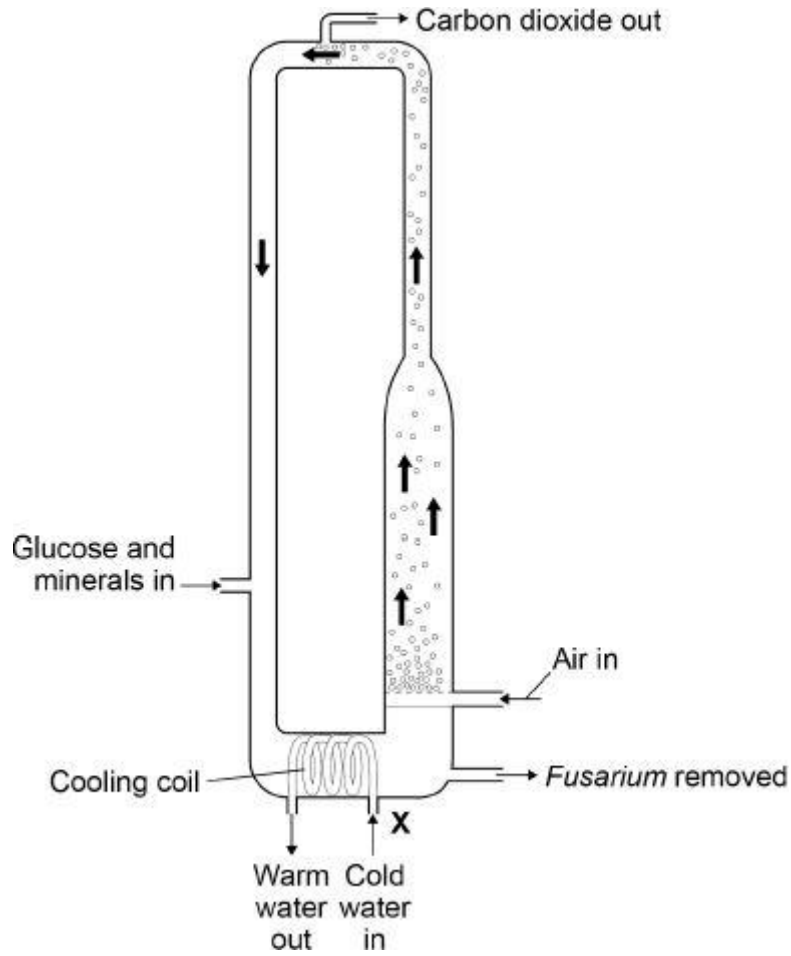
(Total 10 marks)

Q6.

Mycoprotein is a protein-rich food.

Mycoprotein is made from the fungus *Fusarium*.

The diagram below shows a fermenter used for growing *Fusarium*.



- (a) Explain why the fermenter is sterilised before use.

(2)

- (b) Cold water is pumped through the cooling coil at point X.
This maintains a constant temperature inside the fermenter.
Suggest the temperature at which *Fusarium* grows fastest.

Tick **one** box.

5 °C

20 °C

30 °C

85 °C

(1)

- (c) Glucose and bubbles of air enter the fermenter.

The bubbles of air supply oxygen.

Explain why *Fusarium* needs glucose and oxygen.

(2)

- (d) The bubbles of air also move materials around the fermenter.

Suggest why it is useful for bubbles of air and materials to move around inside the fermenter.

(2)

(e) 100 grams of chicken meat contains 22 grams of protein.

100 grams of mycoprotein contains 11 grams of protein.

A man ate 100 grams of chicken in one meal.

How many grams of mycoprotein would the man need to eat to get the same mass of protein as in 100 grams of chicken?

Tick **one** box.

100 grams	
110 grams	
200 grams	
220 grams	

(1)

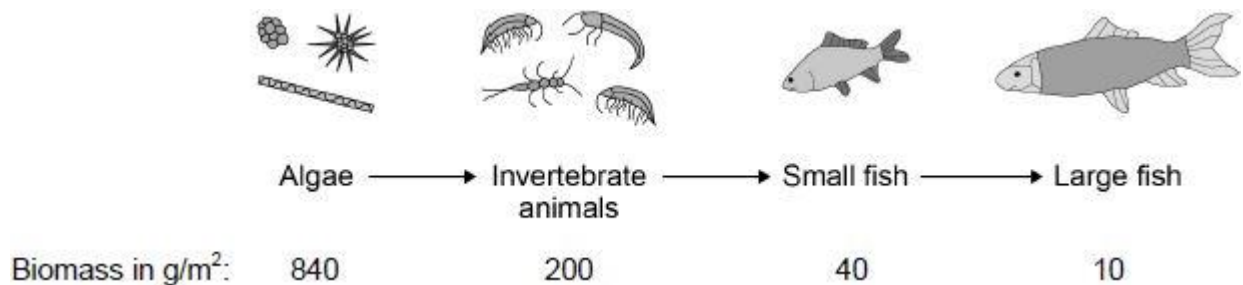
(Total 8 marks)

Q7.

Figure 1 shows:

- a food chain for organisms in a river
- the biomass of the organisms at each trophic level.

Figure 1

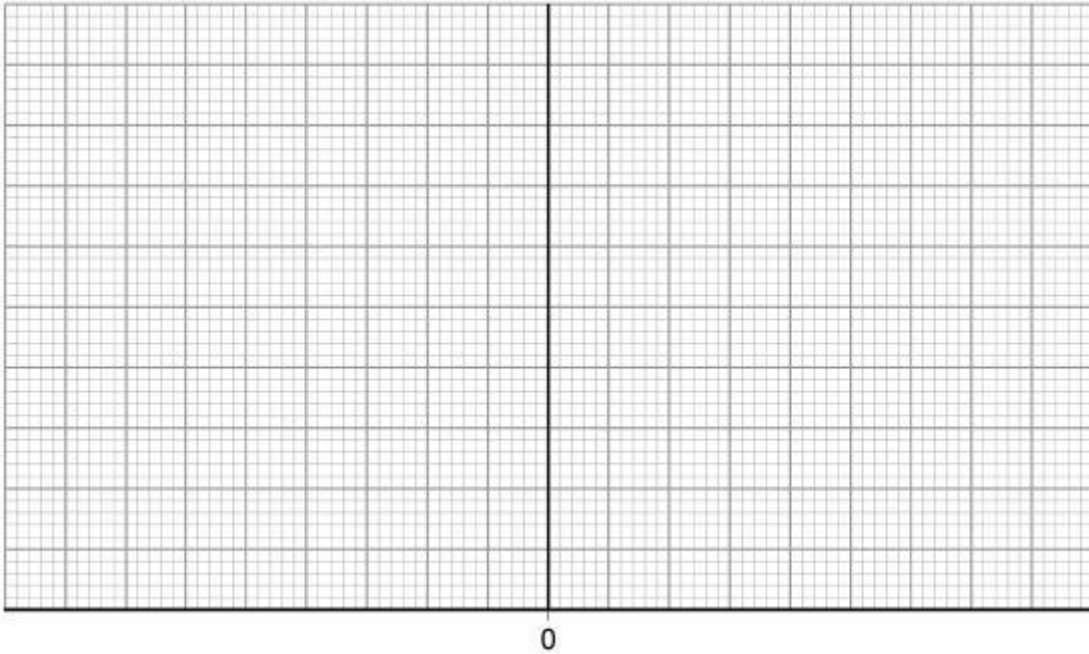


(a) Draw a pyramid of biomass for the food chain in **Figure 1** on **Figure 2**.

You should:

- use a suitable scale
- label the x-axis
- label each trophic level.

Figure 2



(4)

- (b) Calculate the percentage of the biomass lost between the algae and the large fish.

Give your answer to 2 significant figures.

Percentage loss = _____

(3)

- (c) Give **one** way that biomass is lost between trophic levels.

(1)

- (d) A large amount of untreated sewage entered the river. Many fish died.

Untreated sewage contains organic matter and bacteria.

Explain why many fish died.

(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

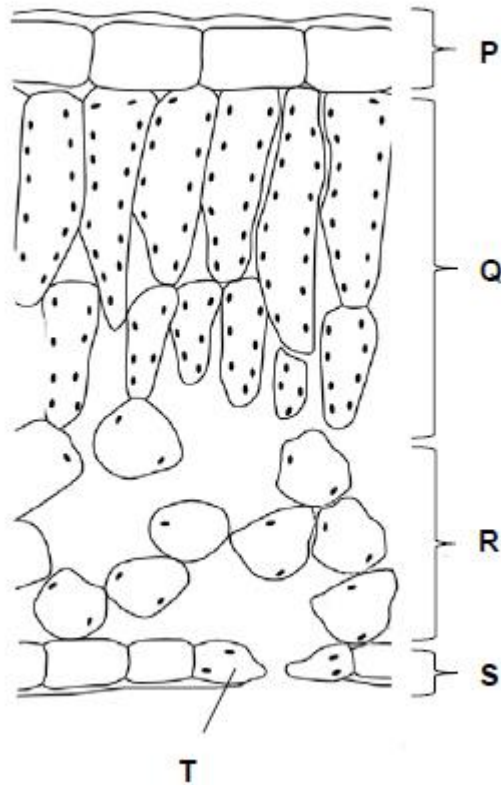
Digestive system

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

(3)

(Total 10 marks)

Q9.

Gases enter and leave the blood by diffusion.

- (a) Define the term diffusion.

(1)

(b) Name the main gases that diffuse into and out of the blood **in the lungs**.

Into the blood _____

Out of the blood _____

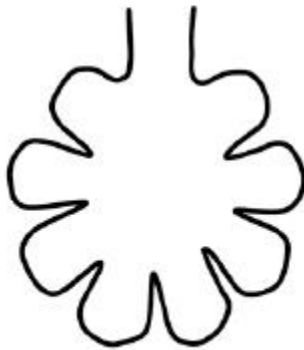
(1)

(c) Smoking can cause emphysema.

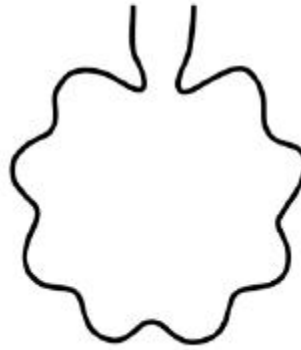
Look at **Figure 1** below.

Figure 1

**Air sac from person
without emphysema**



**Air sac from person
with emphysema**



Emphysema causes the walls of the air sacs in the lungs to break down

Explain how this will affect the diffusion of gases into and out of the blood.

(2)

Smoking during pregnancy can cause low birth mass in babies.

Table 1 shows the World Health Organisation categories for birth mass.

Table 1

Category	Birth mass in g
Above normal birth mass	> 4500
Normal birth mass	2500–4500
Low birth mass	1500–2499
Very low birth mass	1000–1499
Extremely low birth mass	< 1000

(d) Complete **Table 2**.

Use information in **Table 1**.

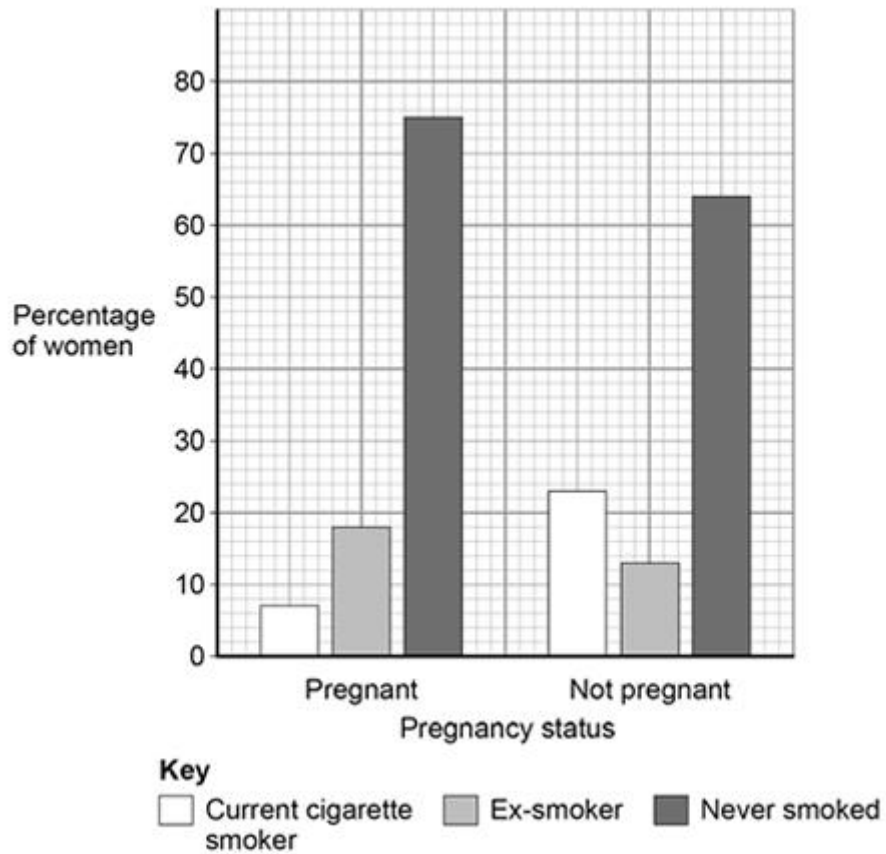
Table 2

Baby	Birth mass in g	Category
A	2678	Normal birth mass
B	1345	
C	991	

(2)

Figure 2 shows data from a study about pregnancy and smoking in women in the UK.

Figure 2



- (e) Sampling from the whole UK population would **not** be appropriate for this study.

Give **one** reason why.

(1)

- (f) Give **three** conclusions that can be made about smoking in pregnant women compared with non-pregnant women.

Use information from **Figure 2**.

1.

2.

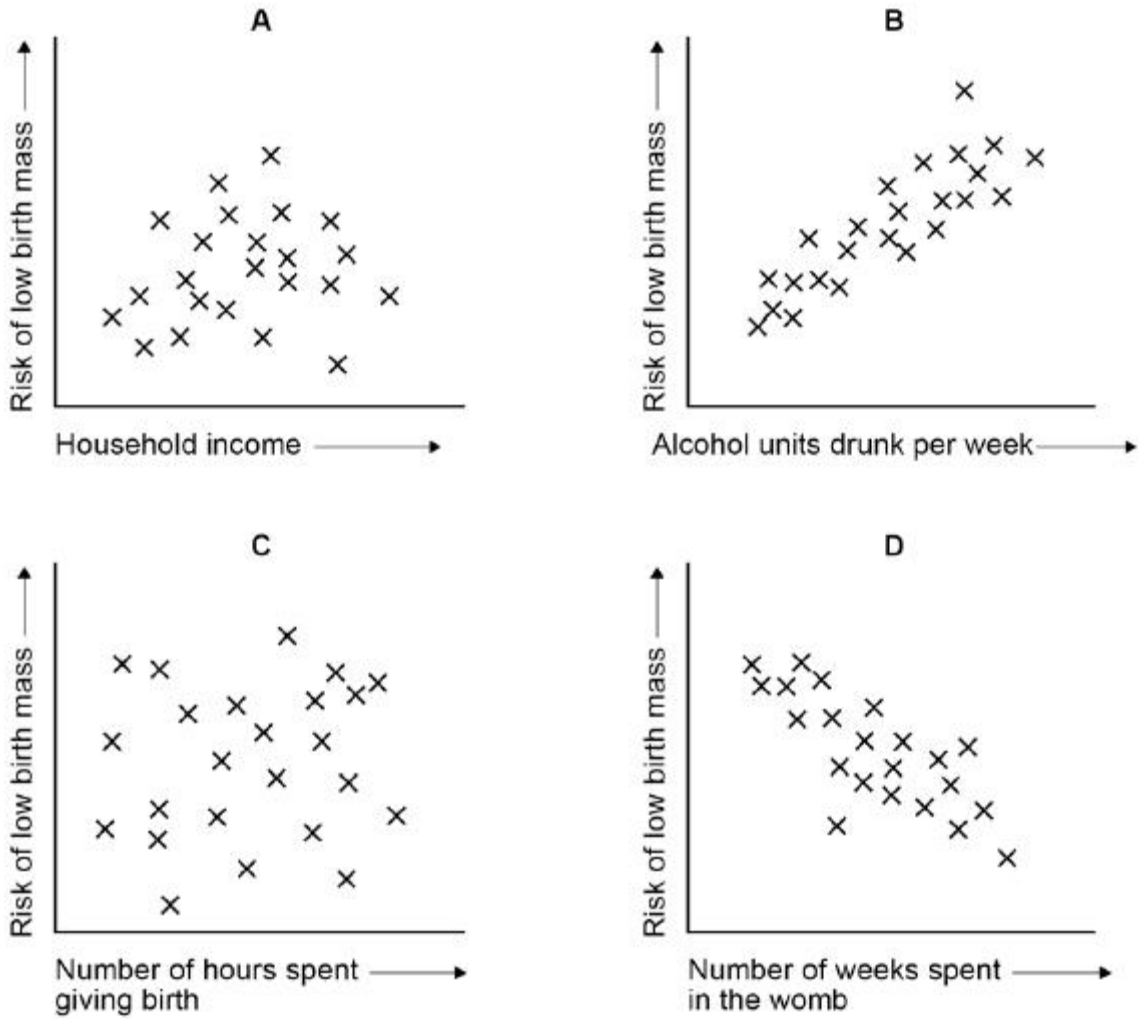
3.

(3)

Other factors can also be linked to low birth mass.

Figure 3 shows the relationship between four of these factors and the risk of low birth mass.

Figure 3



(g) What type of graph is shown in **Figure 3**?

Tick **one** box.

Bar graph

Histogram

Line graph

Scatter graph

(1)

(h) Which of the graphs in **Figure 3** shows a positive correlation?

Tick **one** box.

A B C D

(1)

(i) A student concluded that the longer a woman spends giving birth, the greater the risk of low birth mass.

Give **one** reason why the student's conclusion is **not** correct.

Use evidence from **Figure 3**.

(1)

(Total 13 marks)

Q10.

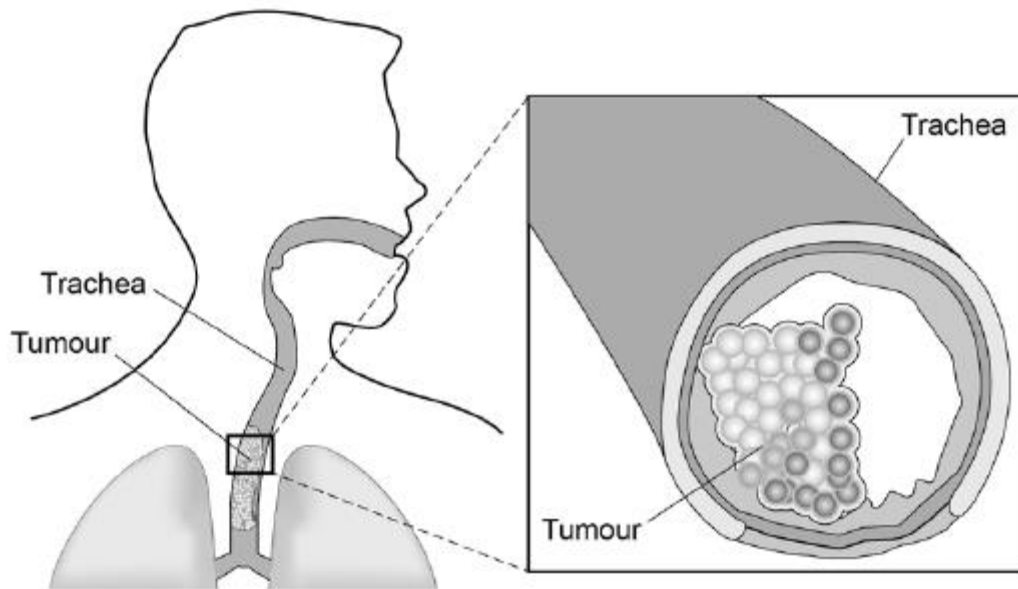
Stem cells can be used to treat some diseases.

(a) What is a stem cell?

(2)

Figure 1 shows a malignant tumour in the trachea of a patient.

Figure 1



(b) Give **one** way a malignant tumour differs from a benign tumour.

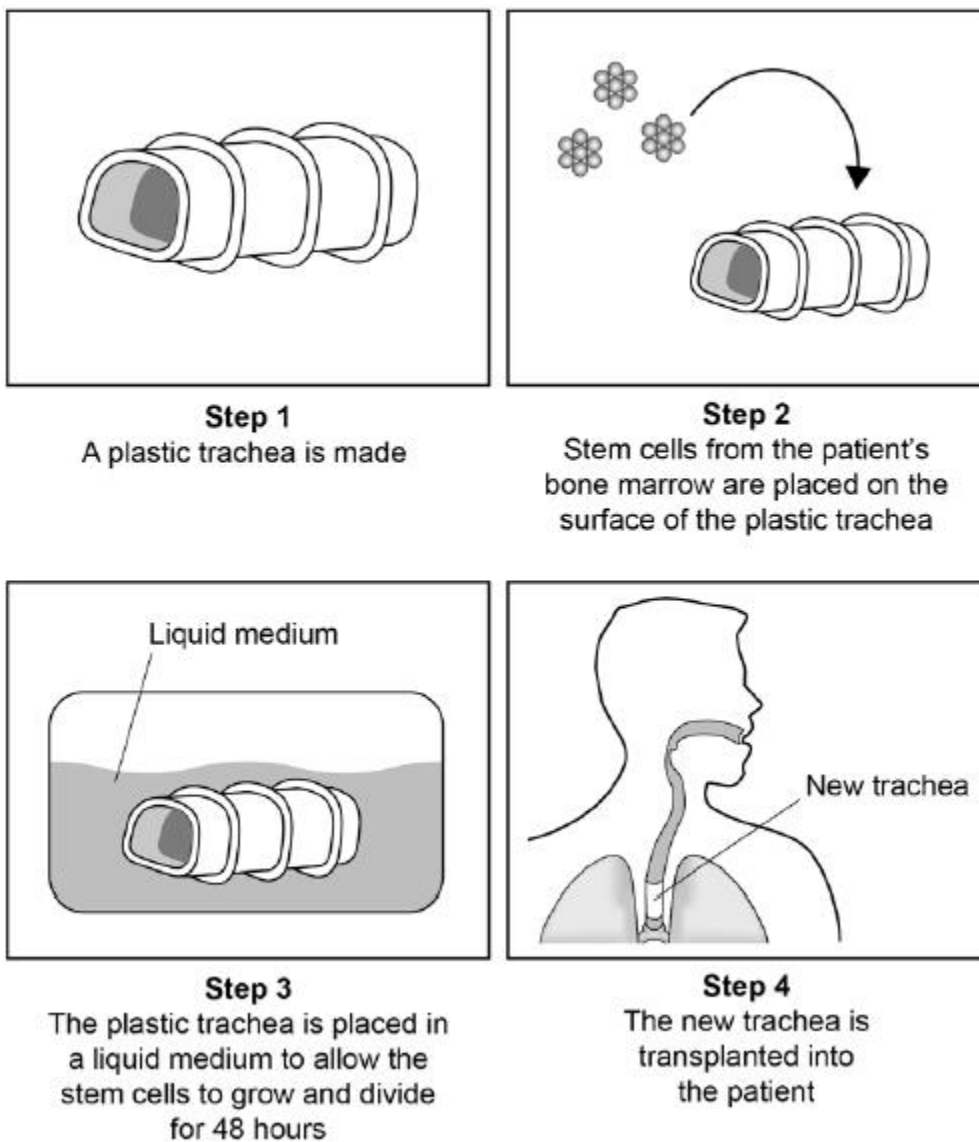
(1)

Scientists can treat the patient's tumour by replacing the trachea with a plastic trachea.

The plastic trachea has a layer of the patient's own stem cells covering it.

Figure 2 shows the procedure.

Figure 2



(c) In **Step 3** the cells are left for 48 hours to divide.

Name the type of cell division in **Step 3**.

(1)

(d) In **Step 3** the cells are given oxygen and water.

Name **two** other substances the cells need so they can grow and divide.

1.

2.

(2)

- (e) Give **two** advantages of using the stem cell trachea compared with a trachea from a dead human donor.

1.

2.

(2)

- (f) Sometimes the stem cell trachea is not strong enough.

Doctors can put a stent into the trachea.

Suggest how a stent in the trachea helps to keep the patient alive.

(2)

- (g) Stem cells can also be obtained from human embryos.

Evaluate the use of stem cells from a patient's own bone marrow instead of stem cells from an embryo.

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

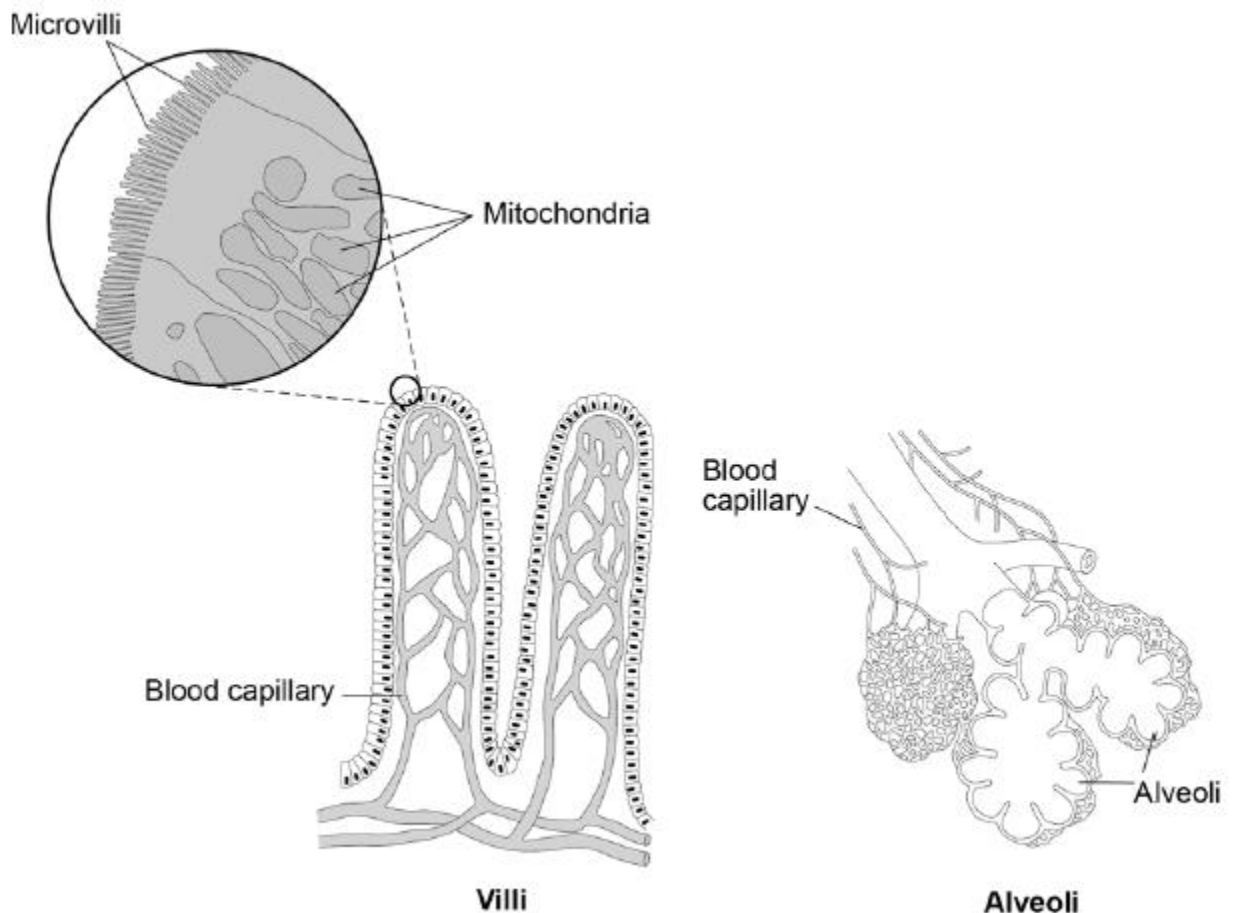
(4)

(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)

Q12.

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 | <input type="checkbox"/> |
| Liver and stomach | <input type="checkbox"/> |
| Salivary glands and pancreas | <input type="checkbox"/> |
| Salivary glands and stomach | <input type="checkbox"/> |

(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

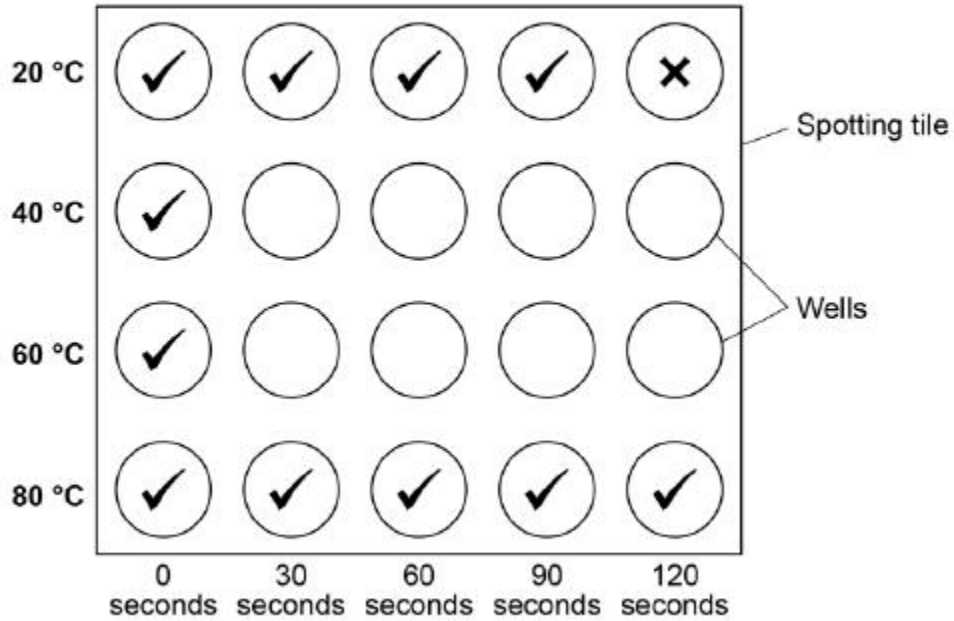
Complete the diagram to show the results you would expect at 40 °C and at 60 °C

You should write a tick or a cross in each well of the spotting tile.

Key

✓ Starch present

✗ Starch **not** present



(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?

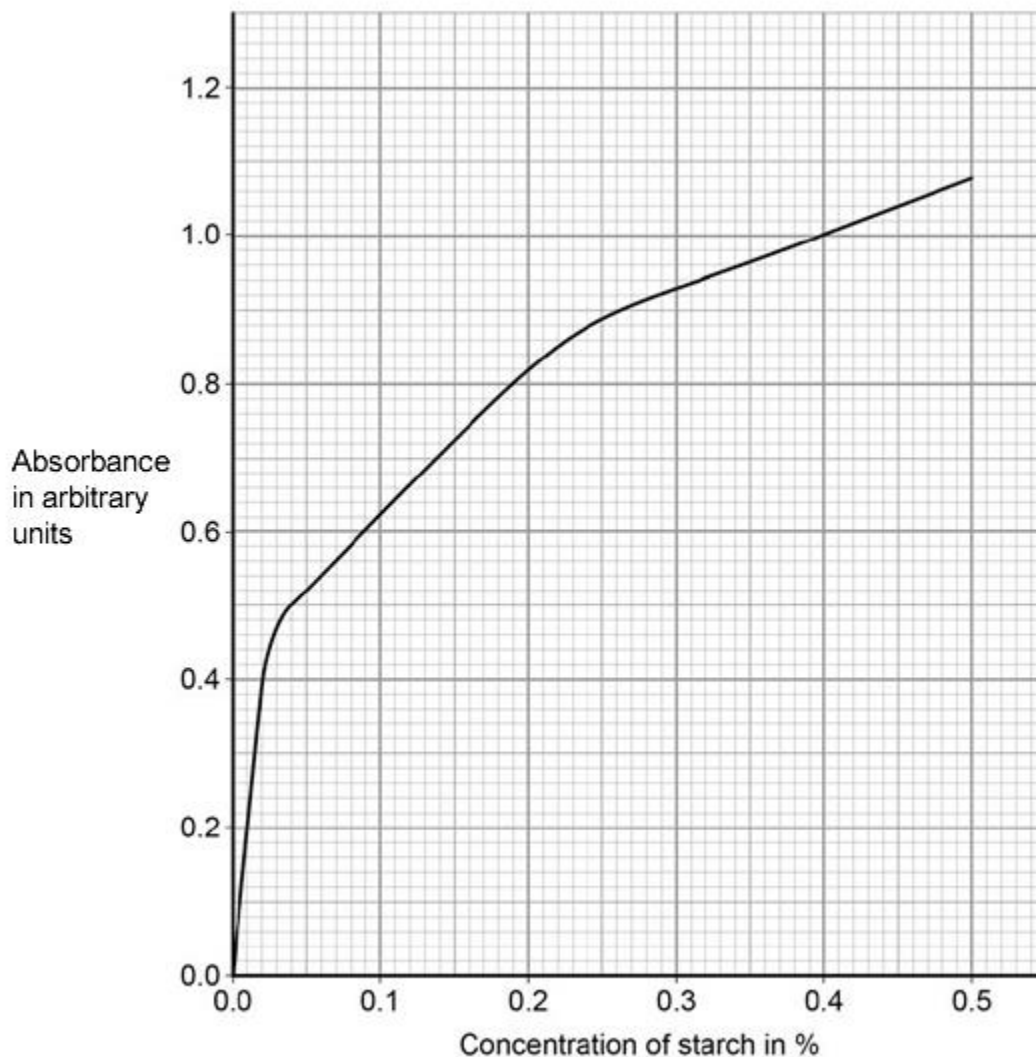
(2)

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)

Q13.

Fresh milk contains bacteria.

Some students investigated decay caused by the bacteria in fresh milk.

This is the method used:

1. Put 200 cm³ of fresh milk in a sterilised flask.
2. Leave the flask for 3 days at 20 °C.

3. Measure the pH of the milk each day using universal indicator paper.

Figure 1 and **Figure 2** show the apparatus the students used.

Figure 1

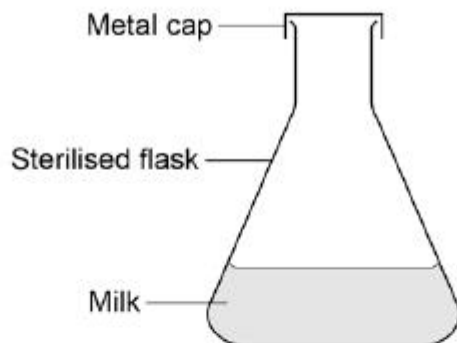
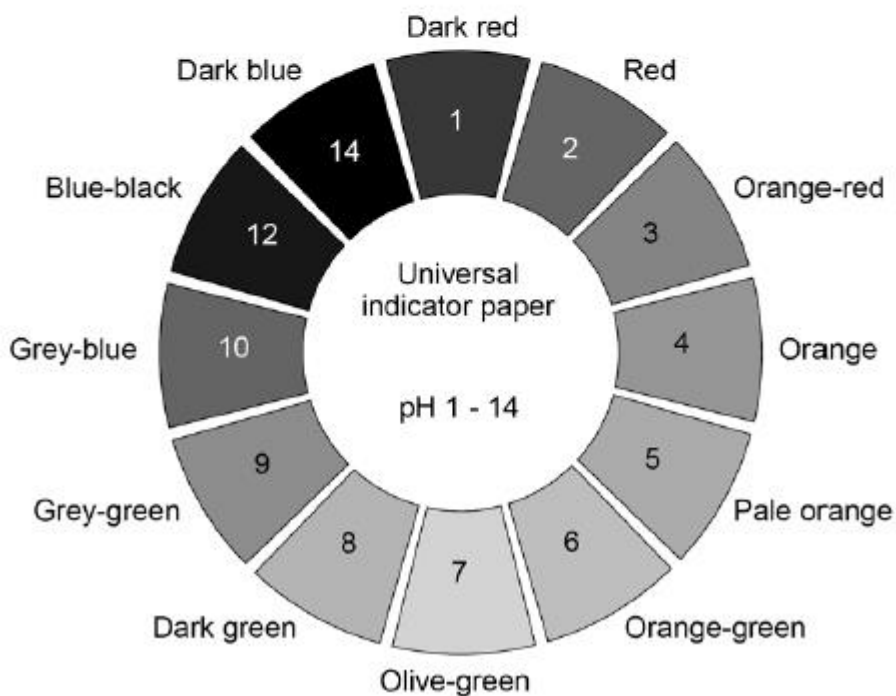


Figure 2



(a) Give **one** reason why the students sterilised the flask before adding the milk.

(1)

(b) Describe how the students could sterilise the flask in a school laboratory.

(2)

(c) Why did the students put a cap on top of the flask?

(1)

(d) The table shows the students' results.

Table 1

Time in days	Colour of universal indicator paper	pH
0	Olive-green	
1	Olive-green	
2	Olive-green	
3	Orange-green	

Complete **Table 1**.

Use information from **Figure 2**.

(1)

(e) The students repeated their investigation with two changes to the method:

- they used a pH meter to measure the pH
- they left the apparatus set up for 6 days instead of for 3 days.

Suggest a reason why each of these changes improves the investigation.

Using a pH meter

Leaving the apparatus set up for 6 days

(2)

Table 2 shows the results of the students' second investigation.

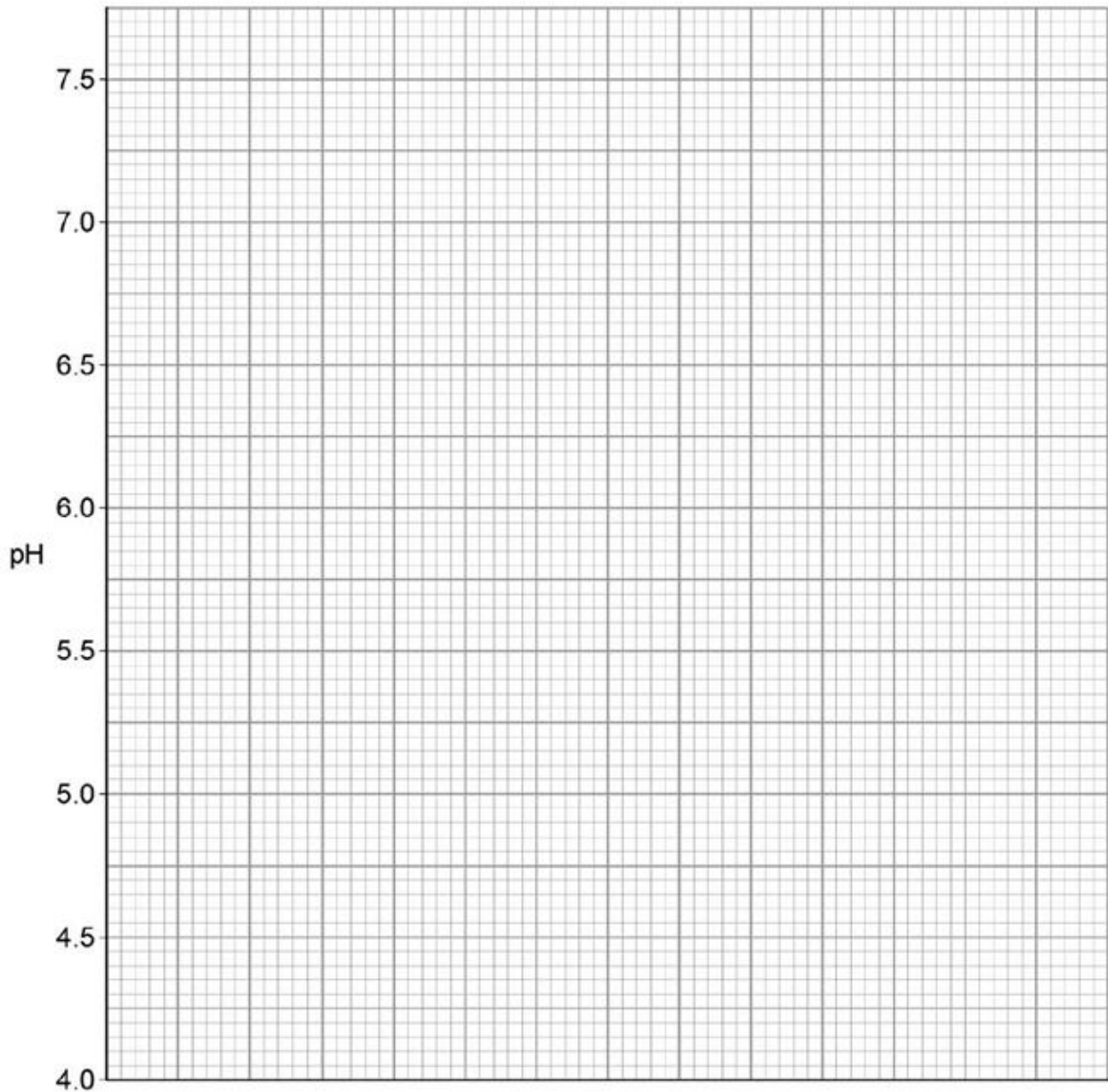
Table 2

Time in days	pH
0	7.0
1	7.0
2	6.7
3	6.0
4	5.0
5	4.5
6	4.5

(f) Complete the graph below.

You should:

- label the x-axis
- plot the data from **Table 2**
- draw a line of best fit.



(4)

(g) Give **one** reason for each of the following.

Use information from **Table 2** and the graph above.

The pH did not change during the first day:

The pH decreased after day 1:

There was no change in pH between days 5 and 6:

(3)

(h) The students did both of their investigations at 20 °C

The students then repeated the investigation with the pH meter, but at 25 °C

Predict how the new results would be:

- similar to the results at 20 °C
- different from the results at 20 °C

Similarity

Difference

(2)

(Total 16 marks)

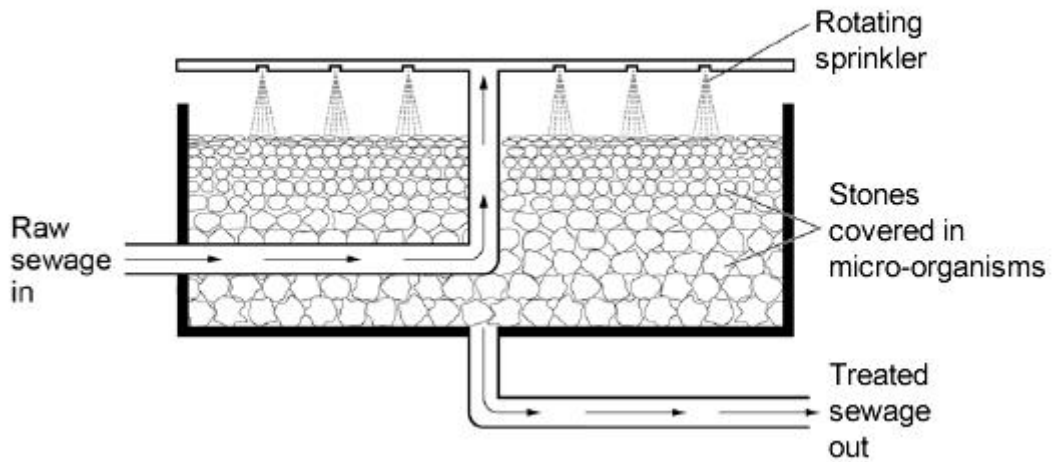
Q14.

Pollution of rivers with untreated sewage can kill plants and animals.

Figure 1 shows a sprinkler bed at a sewage works.

The sewage trickles slowly downwards over the surfaces of the stones.

Figure 1



Some of the microorganisms on the stones feed on organic matter in the sewage.

The treated sewage is safe enough to pass into a river.

(a) Most of the microorganisms in the sprinkler bed respire aerobically.

Describe **two** features of the sprinkler bed that encourage **aerobic** respiration.

Use information from **Figure 1**.

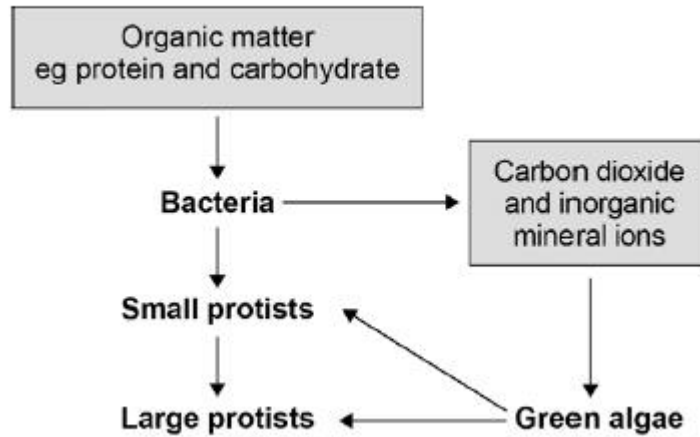
1.

2.

(2)

Figure 2 shows the feeding relationships between the microorganisms in the sprinkler bed.

Figure 2



(b) Which organisms in **Figure 2** are producers?

Tick **one** box.

- | | |
|----------------|--|
| Bacteria | |
| Green algae | |
| Large protists | |
| Small protists | |

(1)

(c) Name **one** organism in **Figure 2** which is both a primary and a secondary consumer.

(1)

(d) The bacteria are decomposers.

Figure 2 shows that the bacteria change organic matter into carbon dioxide and inorganic mineral ions.

Describe how the bacteria do this.

- (b) Apart from the sex chromosomes, how many **other** chromosomes are there in most human body cells?

Tick **one** box.

21 23 44 46

(1)

Stickler syndrome is an inherited disorder that causes damage to the eye.

One of the symptoms of Stickler syndrome is that black spaces can appear in the visual image.

- (c) Which part of the eye is affected by Stickler syndrome?

Tick **one** box.

Ciliary muscles

Iris

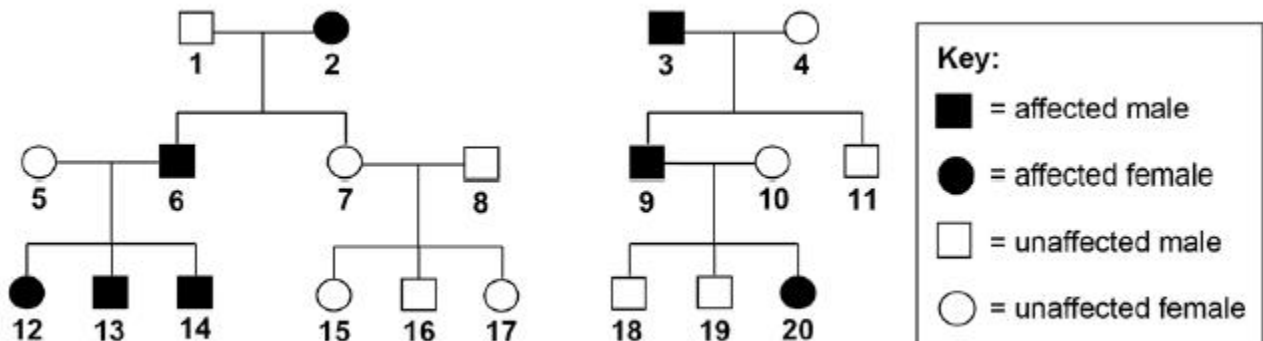
Retina

Suspensory ligaments

(1)

Stickler syndrome is caused by the inheritance of a dominant allele.

The diagram shows the inheritance of Stickler syndrome in two families.



Use the following symbols in your answers to (d) and (e):

A = the dominant allele for Stickler syndrome

a = the recessive allele for unaffected vision.

(d) Explain why none of the children of persons **7** and **8** have Stickler syndrome.

(2)

(e) Person **12** marries person **18**.

Use a Punnett square diagram to find the probability that their first child will be a female with Stickler syndrome.

Probability of a female child with Stickler syndrome =

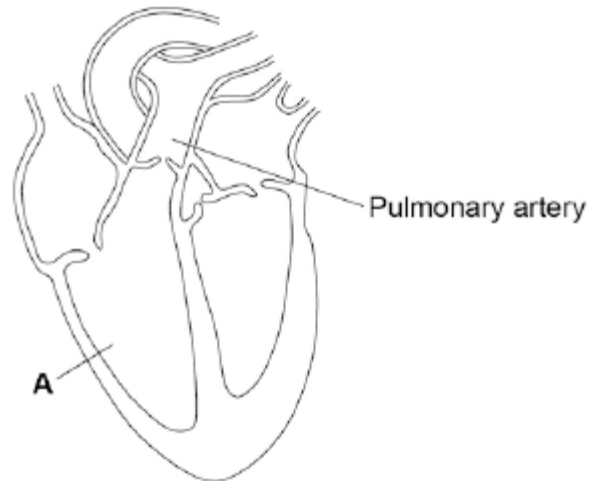
(4)

(Total 9 marks)

Q16.

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)

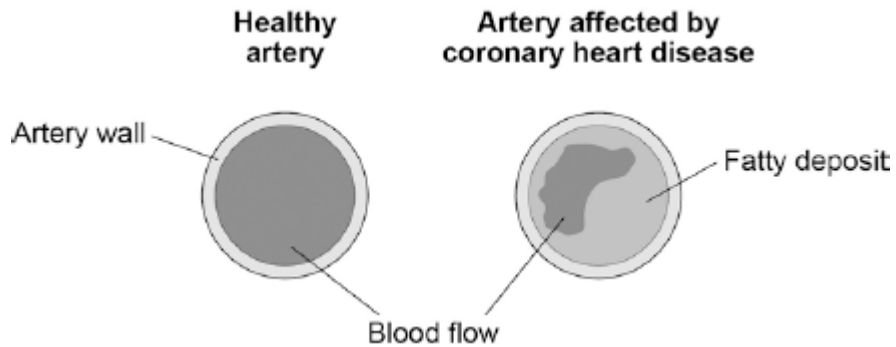
(c) Circle a valve on **Figure 1**.

(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.

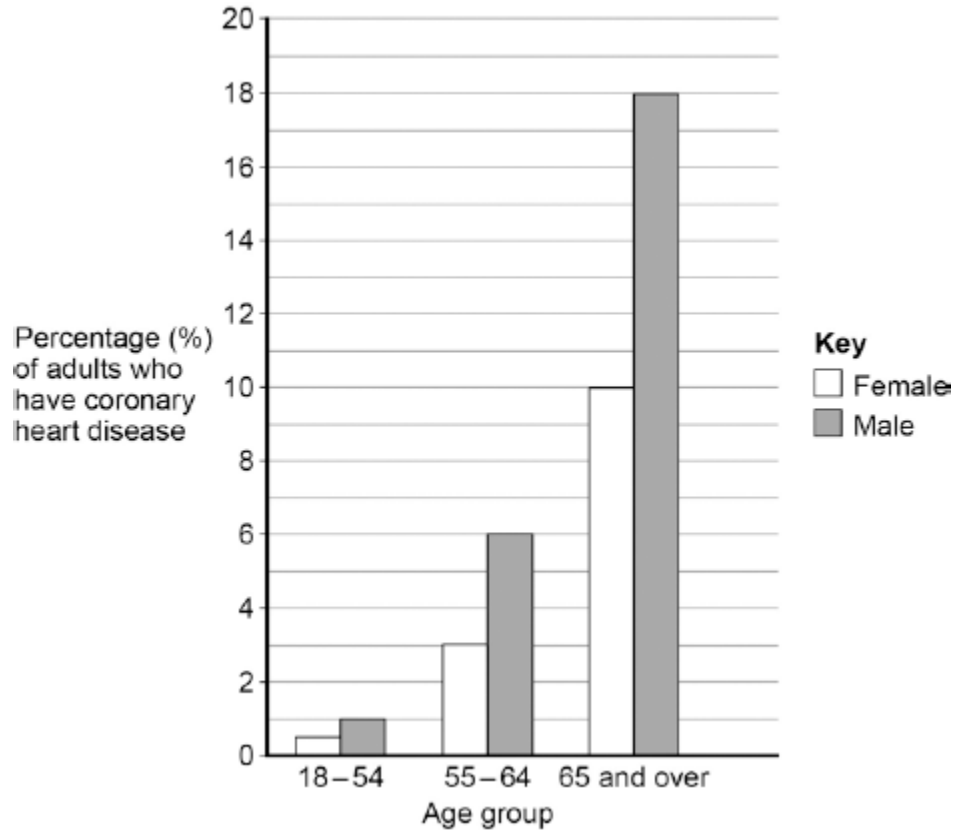
—

—

(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)

Q17.

Catalase is an enzyme.

Catalase controls the following reaction:

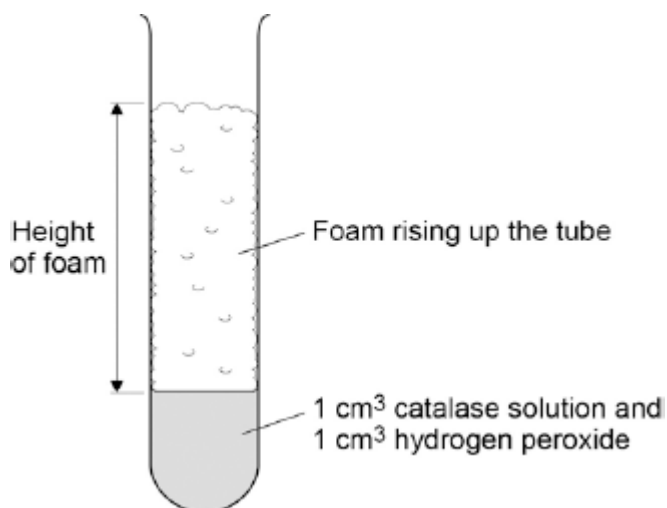


A student did an investigation on catalase activity.

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.

500	250
700	0

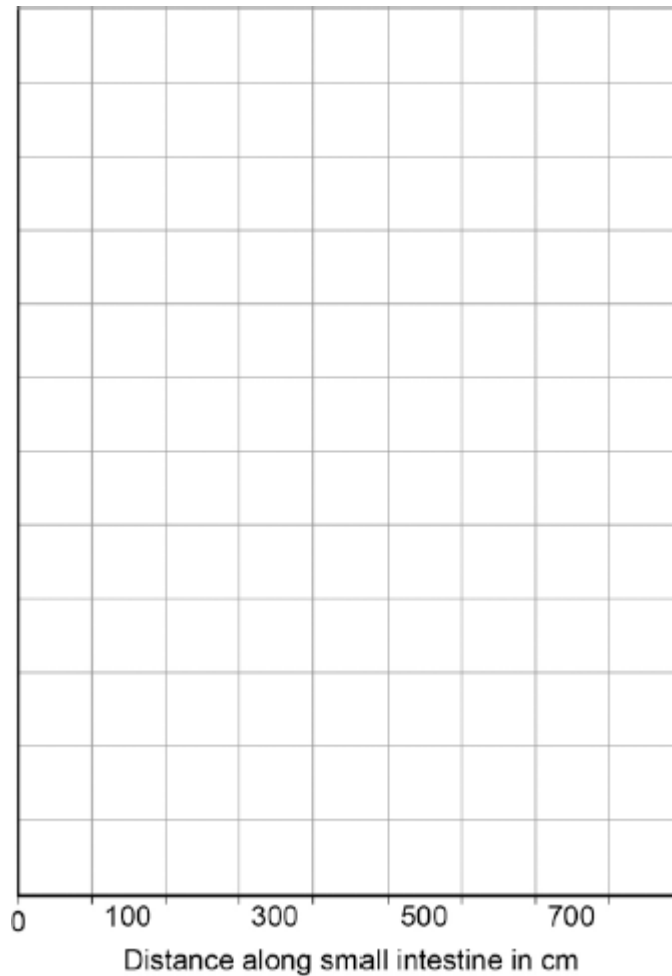
(a) At what distance along the small intestine is the glucose concentration highest?

_____ 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)

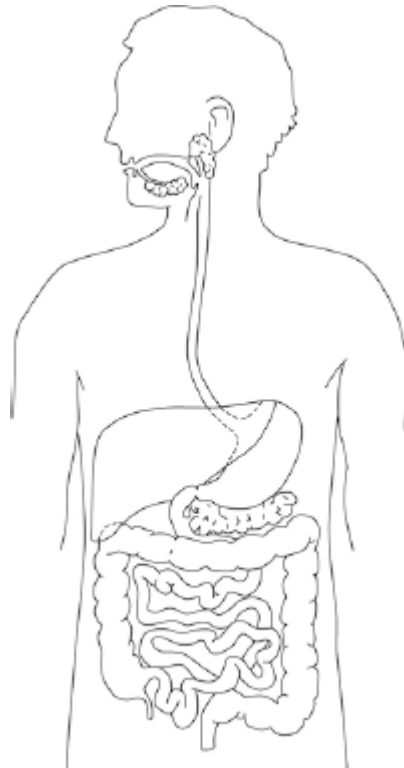
- (e) Explain why the concentration of glucose in the small intestine changes between 300 cm and 700 cm.



(3)
(Total 12 marks)

Q19.

The diagram below shows the human digestive system.



(a) Label the stomach and pancreas on the diagram.

(1)

(b) Many people suffer from stomach ulcers caused by a species of bacteria called *Helicobacter pylori*.

The stomach is lined with a protective lining of mucus.

Helicobacter pylori are acid-tolerant bacteria which can damage this mucus lining.

Suggest how an infection with *Helicobacter pylori* might result in a stomach ulcer developing.

(2)

(c) *Helicobacter pylori* can also cause stomach cancer.

Describe how a person infected with *Helicobacter pylori* could also develop liver cancer.

(3)

(d) Gluten is a form of protein found in some grains.

Describe the test you would use to find out if protein is present in food.

(2)

(e) Coeliac disease is a disease of the digestive system.

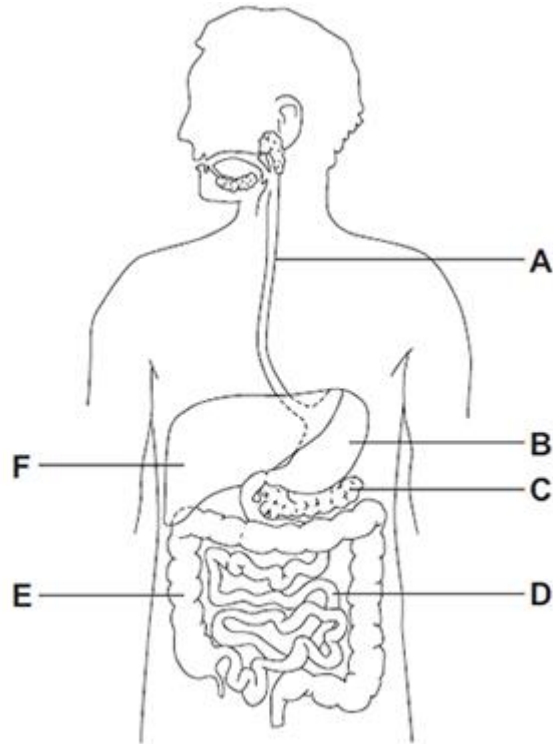
It damages the lining of the small intestine when foods that contain gluten are eaten.

When people with coeliac disease eat foods that contain gluten:

1. their immune system forms antibodies to gluten
2. these antibodies attack the lining of the small intestine
3. this causes inflammation in the intestines and damages the villi.

Symptoms of coeliac disease include poor growth.

Suggest why a person with coeliac disease might have this symptom.



- (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)

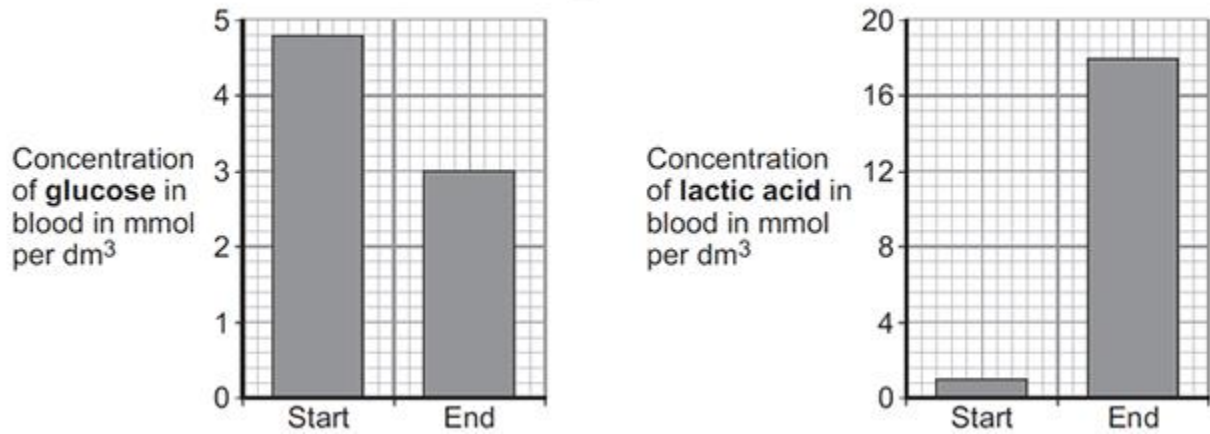
(Total 7 marks)

Q22.

An athlete ran as fast as he could until he was exhausted.

- (a) **Figure 1** shows the concentrations of glucose and of lactic acid in the athlete's blood at the start and at the end of the run.

Figure 1



- (i) Lactic acid is made during anaerobic respiration.

What does anaerobic mean?

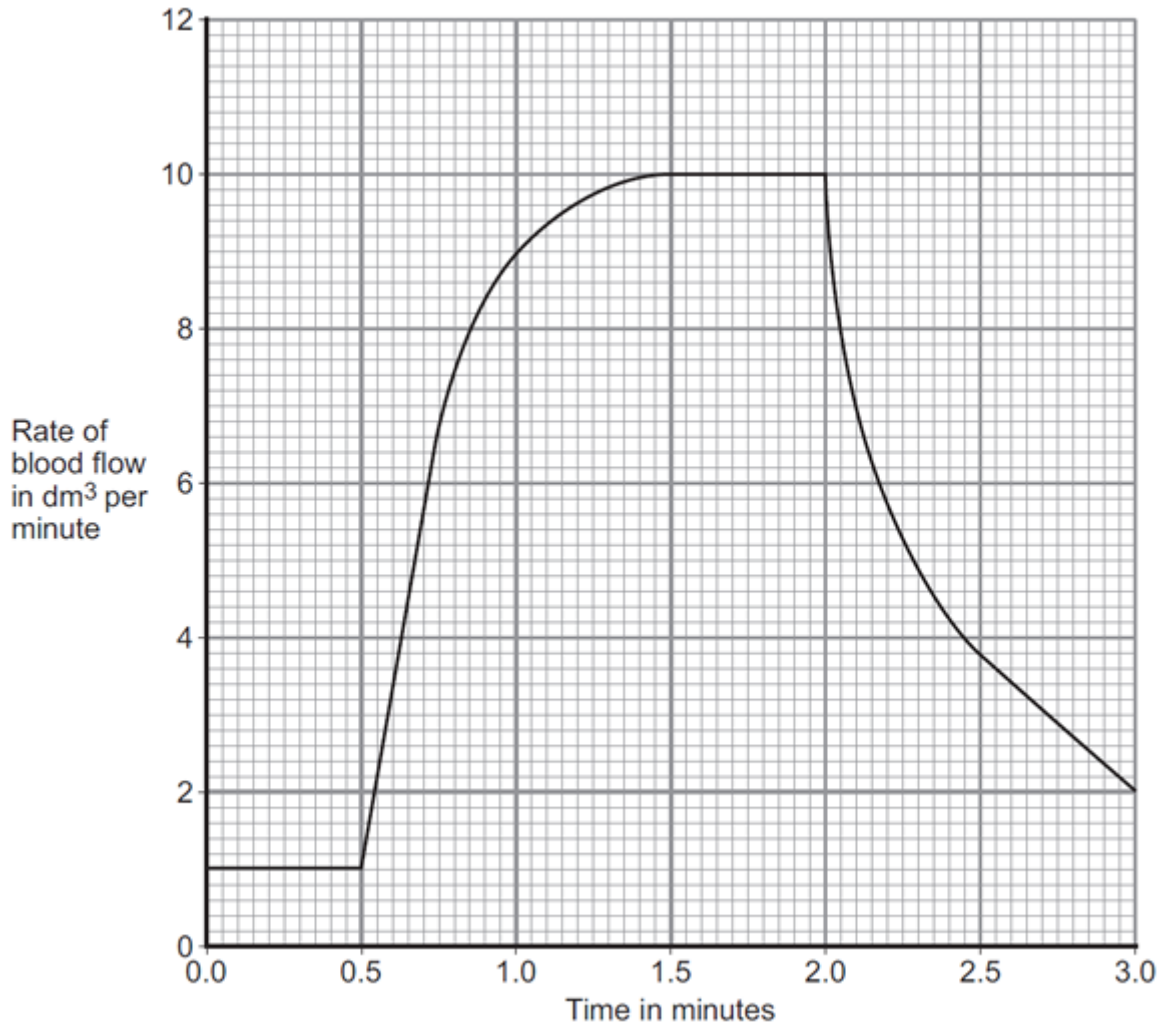
(1)

- (ii) Give evidence from **Figure 1** that the athlete respired anaerobically during the run.

(1)

- (b) **Figure 2** shows the effect of running on the rate of blood flow through the athlete's muscles.

Figure 2



- (i) For how many minutes did the athlete run?

Time = _____ minutes

(1)

- (ii) Describe what happens to the rate of blood flow through the athlete's muscles during the run.

Use data from **Figure 2** in your answer.

(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.

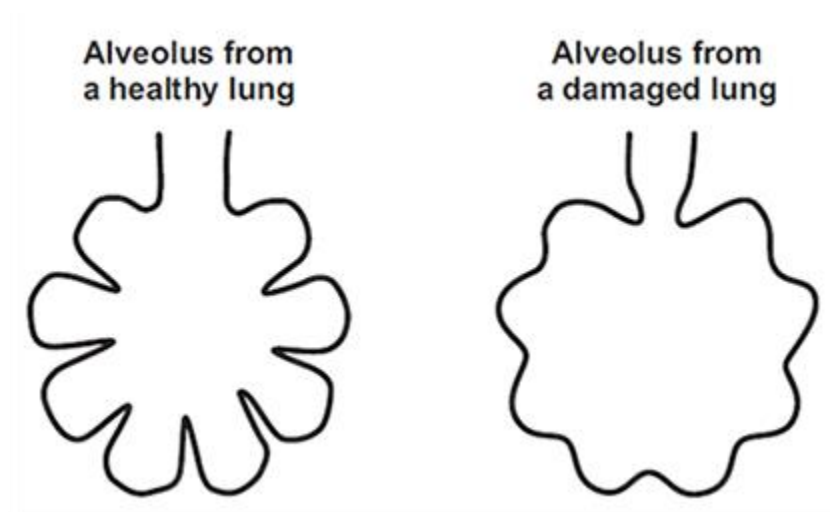
Advantage of hydrogen peroxide and catalase

Disadvantage of hydrogen peroxide and catalase

(2)
(Total 5 marks)

Q24.

The diagram below shows an alveolus from a healthy lung and an alveolus from a damaged lung.



- (a) Which **one** of the following is a difference between the alveolus from the damaged lung and the alveolus from the healthy lung?

Tick (✓) **one** box.

The damaged alveolus has a smaller surface area.

The damaged alveolus has a shorter diffusion pathway.

The damaged alveolus has a better blood supply.

(1)

- (b) A person with damaged alveoli finds exercising difficult.

Which **one** of the following is the reason why the damaged alveoli will make exercising difficult?

Tick (✓) **one** box.

- Less carbon dioxide is taken in.
- Less energy is needed for exercise.
- Less oxygen is taken in.

(1)
(Total 2 marks)

Q25.

The heart is part of the circulatory system.

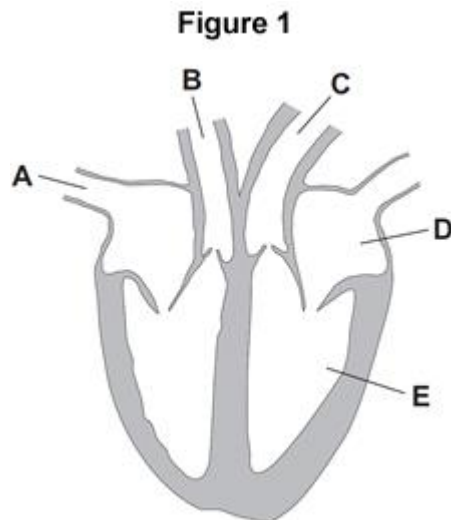
- (a) (i) Name **one** substance transported by the blood in the circulatory system.

(1)

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

(1)

- (b) **Figure 1** shows the human heart.



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

(1)

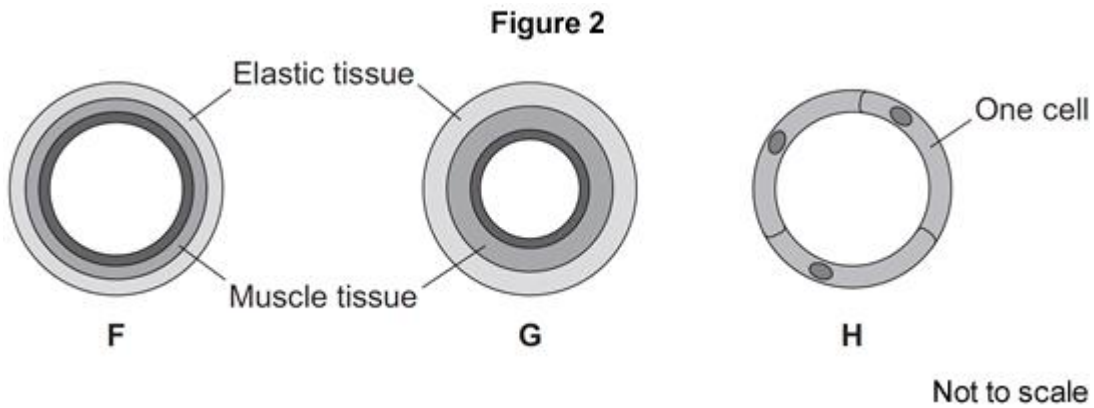
(ii) Name parts **D** and **E** shown in **Figure 1**.

D _____

E _____

(2)

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



(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.

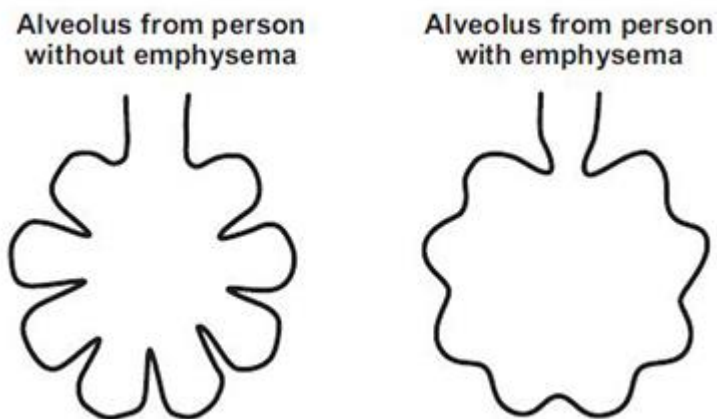
(2)

(Total 9 marks)

Q26.

Emphysema is a disease affecting the lungs. People with emphysema are often short of breath and find exercise difficult.

The diagram below shows an alveolus from a person without emphysema and an alveolus from a person with emphysema.



(a) Describe **one** difference between the alveolus from a person without emphysema and the alveolus from a person with emphysema.

(1)

- (b) Explain how the difference you described in part (a) causes the person with emphysema to find exercise difficult.

(3)

(Total 4 marks)

Q27.

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.

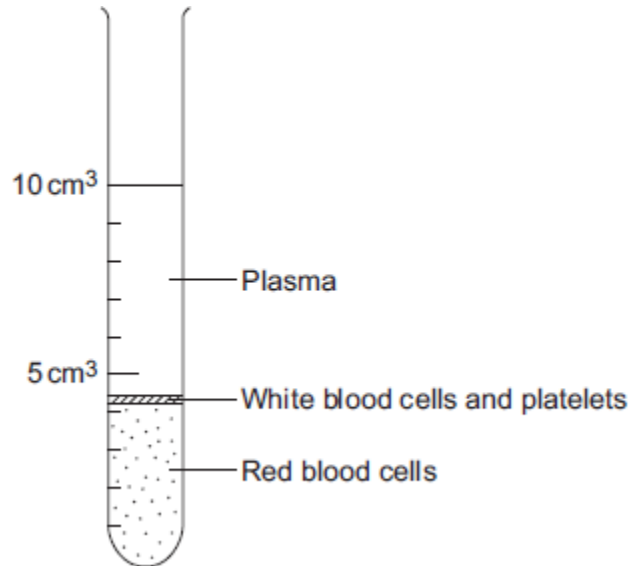
2.

(2)
(Total 6 marks)

Q28.

The parts of the blood can be separated from each other by spinning the blood in a centrifuge.

The image below shows the separated parts of a 10 cm³ blood sample.



(a) Calculate the percentage of the blood that is made up of plasma.

Answer = _____ %

(2)

(b) Name **three** chemical substances transported by the plasma.

1.

2.

3.

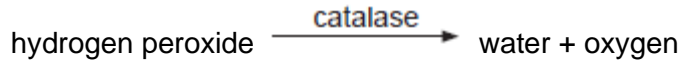
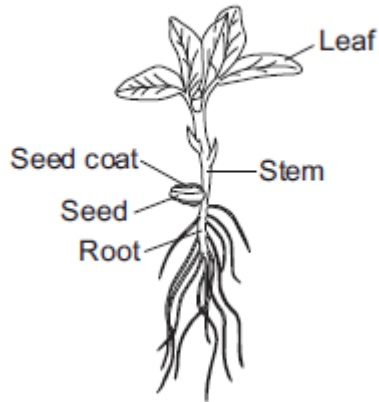


Figure 1 shows a 25-day-old broad bean seedling.

Figure 1



Some students investigated whether different parts of bean seedlings contained different amounts of catalase.

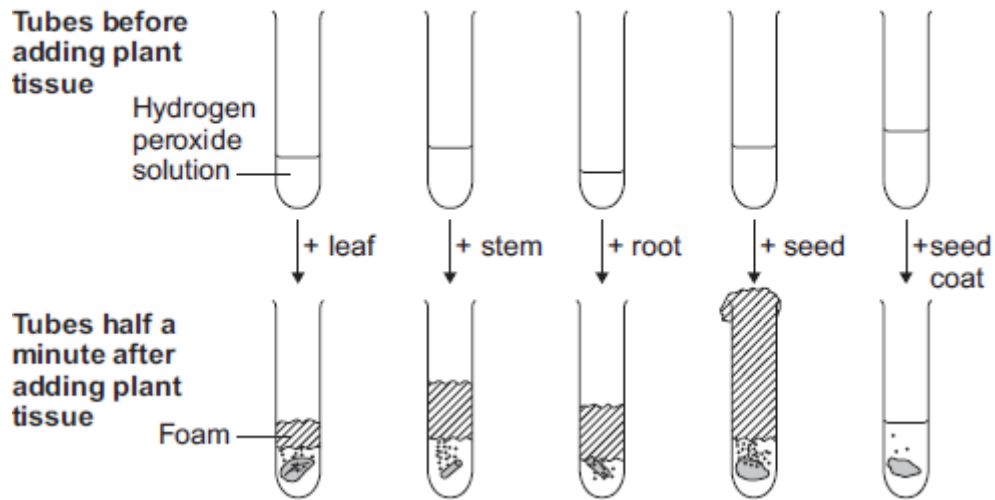
The students:

- put hydrogen peroxide into five test tubes
- added a different part of a bean seedling to each tube
- recorded the results after half a minute.

If there was catalase in part of the seedling, oxygen gas was given off. When oxygen gas is given off, foam is produced in the tubes.

Figure 2 shows the results.

Figure 2



The students made the following conclusions:

- most parts of a bean seedling contain catalase
- the seed contains a lot of catalase
- stems and roots have quite a lot of catalase
- the leaves have a little bit of catalase
- the seed coat has hardly any catalase.

The students' teacher said that the students needed to improve their investigation in order to make valid conclusions.

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

Describe how you would carry out an investigation to compare the amounts of catalase in different parts of bean seedlings.

You should include details of how you would make sure your results give a valid comparison of the amounts of catalase.

Mean = _____ arbitrary units

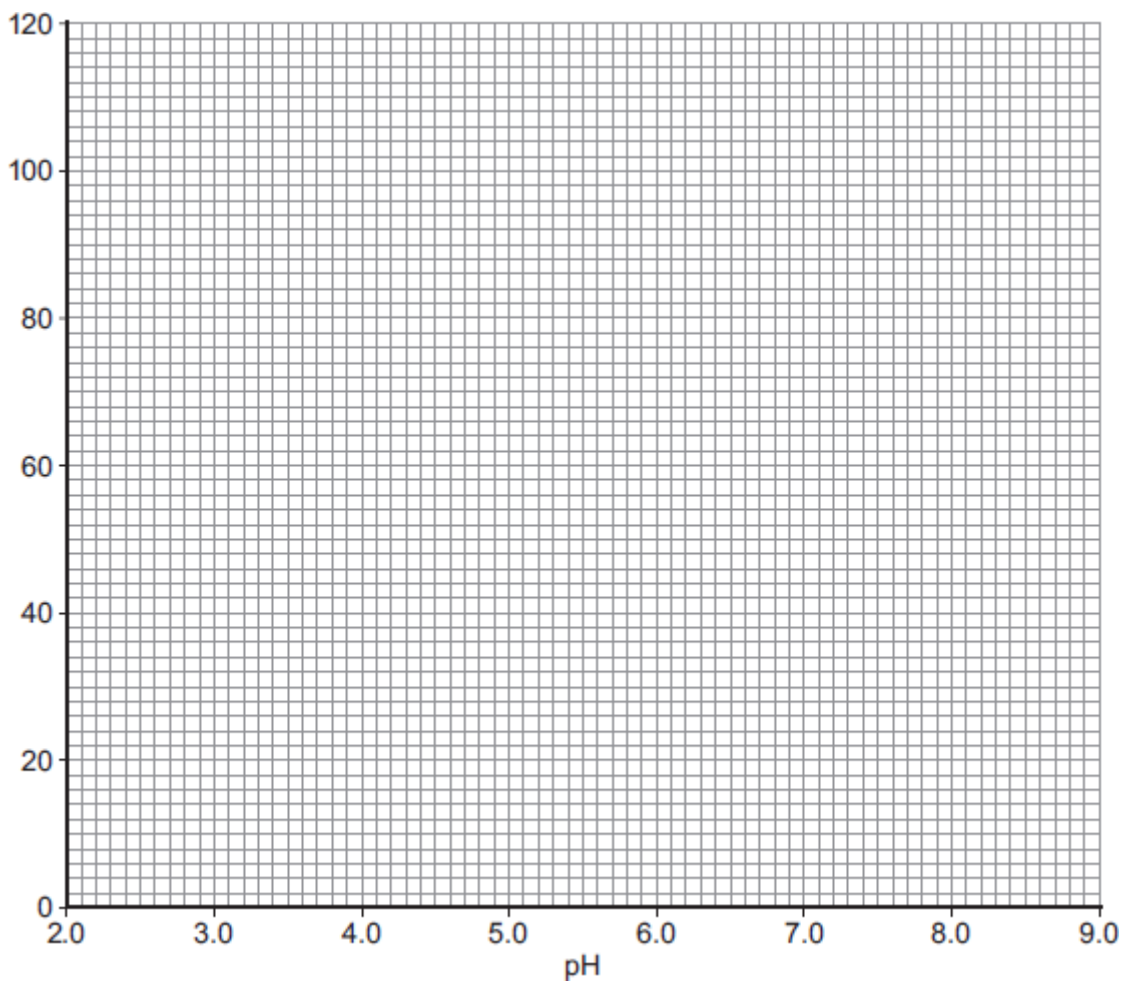
(2)

- (ii) On the graph paper in **Figure 3**, draw a graph to show the scientists' results.

Remember to:

- add a label to the vertical axis
- plot the mean values of enzyme activity
- draw a line of best fit.

Figure 3



(4)

(iii) At what pH does the enzyme work best?

(1)

(iv) Predict the activity of the enzyme at pH 9.0.

_____ arbitrary units

(1)

(v) Suggest why the enzyme's activity at pH 3.0 is zero.

(1)

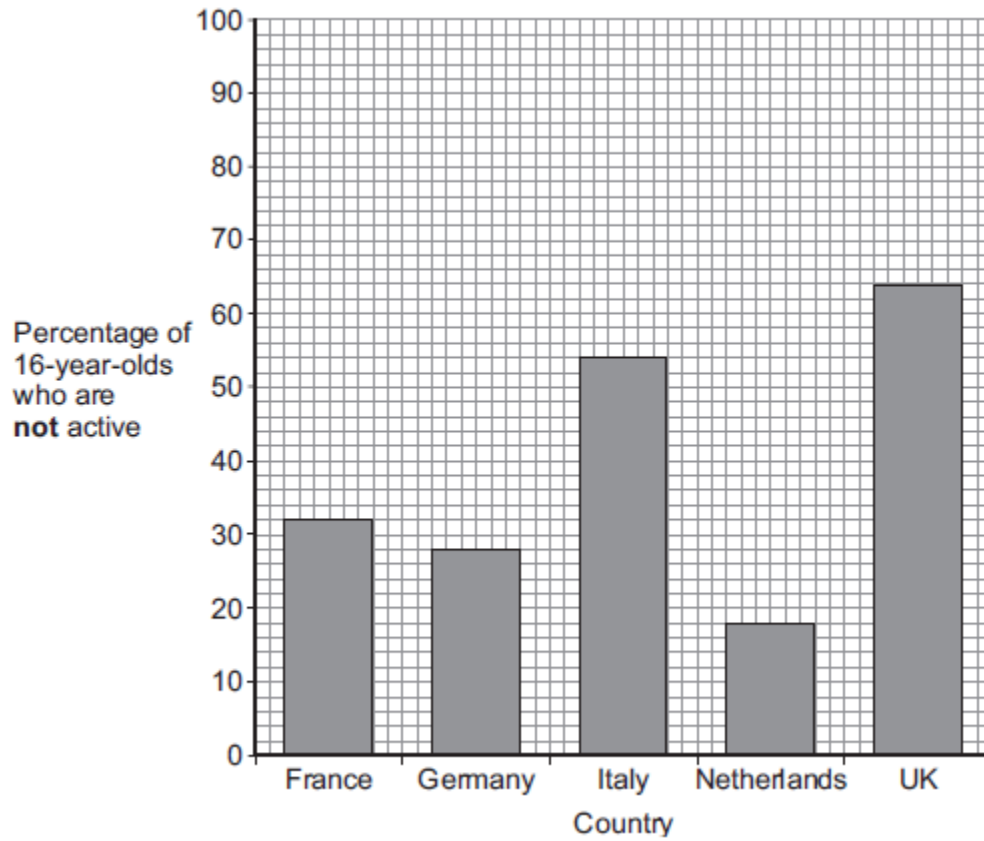
(Total 15 marks)

Q30.

Scientists investigated the effect of different factors on health.

(a) People who are **not** active may have health problems.

The graph shows the percentage of 16-year-olds in some countries who are **not** active.



(i) What percentage of 16-year-olds in the UK are **not** active?
_____ % (1)

(ii) What percentage of 16-year-olds in the UK are **active**?
_____ % (1)

(iii) A newspaper headline states:

People in the UK are the laziest in the world.

Information in **Figure 1** does **not** support the newspaper headline.
Suggest **one** reason why the newspaper headline may be wrong.

(1)

- (b) Doctors gave a percentage rating to the health of 16-year-olds. 100% is perfect health.

The table shows the amount of exercise 16-year-olds do and their health rating.

Amount of exercise done in minutes every week	Health rating as %
Less than 30	72
90	76
180	82
300	92

What conclusion can be made about the effect of exercise on health?

Use information from the table.

(1)

- (c) Inherited factors can also affect health.

Give **one** health problem that may be affected by the genes someone inherits.

Draw a ring around the correct answer.

**being
malnourished**

**having a high
cholesterol level**

**having a
deficiency disease**

(1)

- (d) White blood cells are part of the immune system.

Use the correct answer from the box to complete each sentence.

antibiotics

antibodies

pathogens

vaccines

- (i) When we are ill, white blood cells produce _____
to kill microorganisms. (1)
- (ii) Many strains of bacteria, including MRSA, have developed resistance to
drugs called _____
_____. (1)
- (Total 7 marks)

Q31.

(a) Enzymes are used in body cells.

(i) What is an enzyme?

Draw a ring around the correct answer.

an antibody a catalyst a hormone

(1)

(ii) All enzymes are made of the same type of substance.

What is this substance?

Draw a ring around the correct answer.

carbohydrate fat protein

(1)

(iii) Where is the enzyme amylase produced in the human body?

Draw a ring around the correct answer.

liver salivary glands stomach

(1)

(b) Enzymes are sometimes used in industry.

Draw **one** line from each enzyme to the correct industrial use of that enzyme.

Enzyme	Industrial use
---------------	-----------------------



Carbohydrase	Changes starch into sugars
Isomerase	Removes grease stains from clothes
Protease	Pre-digests proteins in some baby foods
	Changes glucose syrup into fructose syrup

(3)
(Total 6 marks)

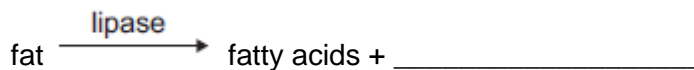
Q32.

Lipase is an enzyme that digests fat.

- (a) (i) Complete the equation to show the digestion of fat.

Use the correct answer from the box.

glucose	glycerol	glycogen
---------	----------	----------



(1)

- (ii) Name **one** organ that makes lipase.

(1)

- (b) Some students investigated the effect of bile on the digestion of fat by lipase.

The students:

- 1 mixed milk and bile in a beaker
- 2 put the pH sensor of a pH meter into the beaker
- 3 added lipase solution
- 4 recorded the pH at 2-minute intervals
- 5 repeated steps 1 to 4, but used water instead of bile.

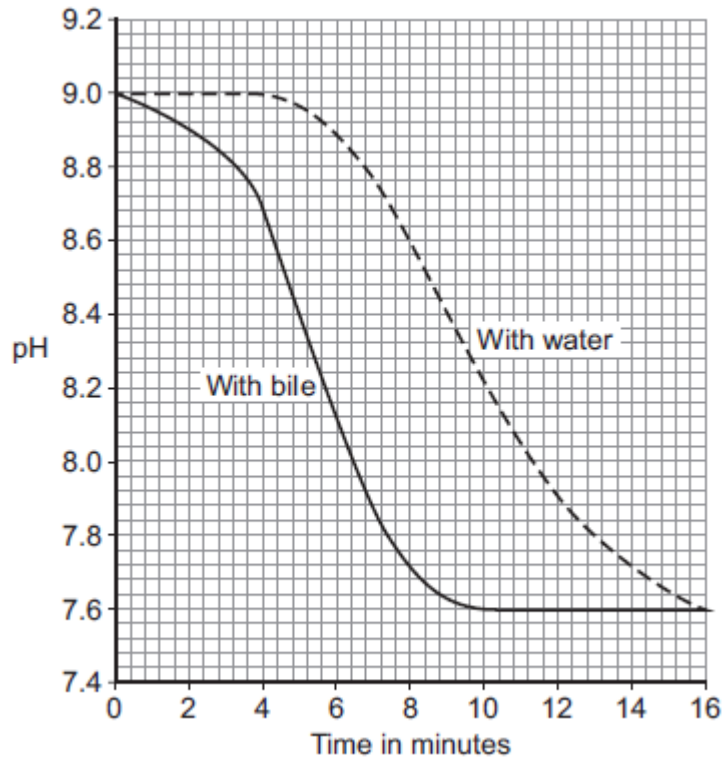
Suggest **two** variables that the students should have controlled in this investigation.

1.

2.

(2)

(c) The graph shows the students' results.



(i) Why did the pH decrease in both investigations?

_____ (1)

- (ii) Bile helps lipase to digest fat.

What evidence is there in the graph to support this conclusion?

(1)

- (iii) Suggest **one** reason why the contents of both beakers had the same pH at the end of the investigations.

(1)

(Total 7 marks)

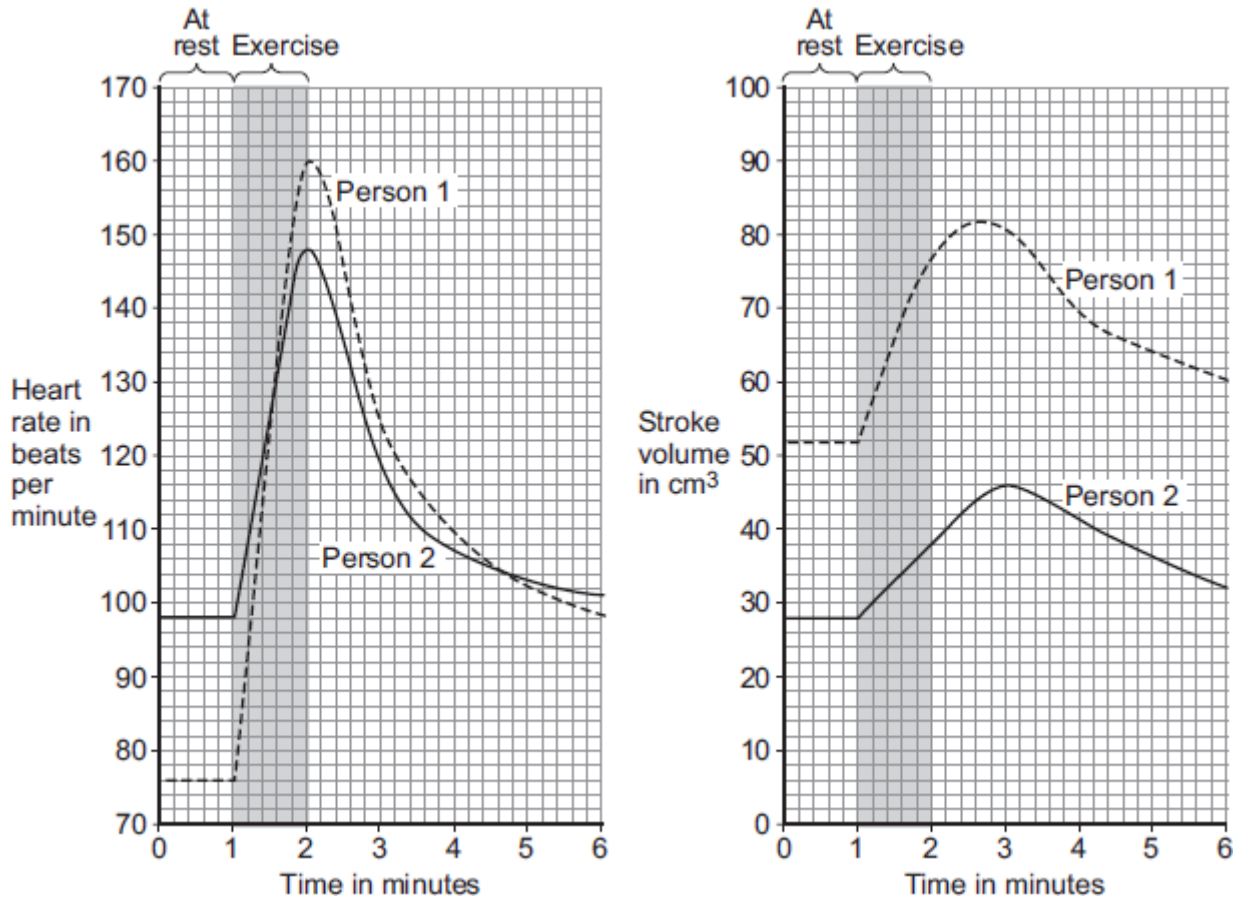
Q33.

During exercise, the heart beats faster and with greater force.

The 'heart rate' is the number of times the heart beats each minute. The volume of blood that travels out of the heart each time the heart beats is called the 'stroke volume'.

In an investigation, **Person 1** and **Person 2** ran as fast as they could for 1 minute. Scientists measured the heart rates and stroke volumes of **Person 1** and **Person 2** at rest, during the exercise and after the exercise.

The graph below shows the scientists' results.



- (a) The 'cardiac output' is the volume of blood sent from the heart to the muscles each minute.

$$\text{Cardiac output} = \text{Heart rate} \times \text{Stroke volume}$$

At the end of the exercise, **Person 1**'s cardiac output = $160 \times 77 = 12\,320 \text{ cm}^3$ per minute.

Use information from the figure above to complete the following calculation of **Person 2**'s cardiac output at the end of the exercise.

At the end of the exercise:

Person 2's heart rate = _____ beats per minute

Person 2's stroke volume = _____ cm^3

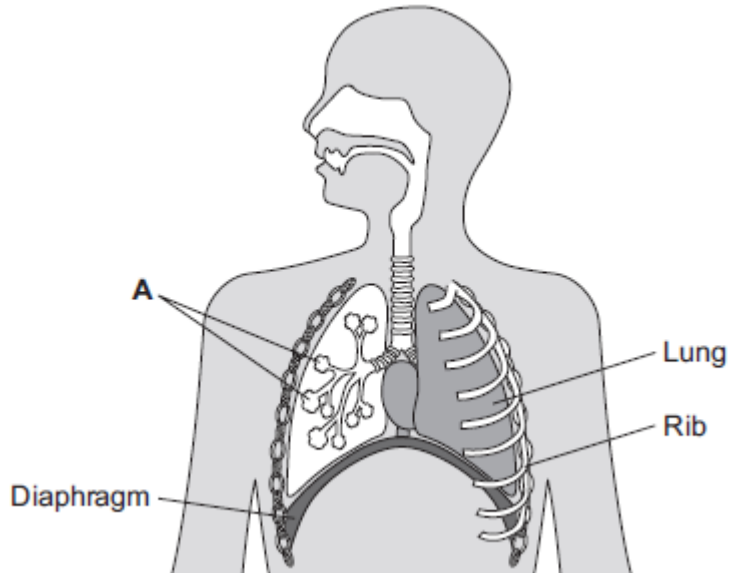
Person 2's cardiac output = _____ cm^3 per minute

(3)

- (b) **Person 2** had a much lower cardiac output than **Person 1**.

- (i) Use information from the figure above to suggest the **main** reason for

The image below shows the human breathing system.



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

(1)

- (ii) Give **one** function of the ribs.

(1)

- (b) (i) Use the correct answer from the box to complete the sentence.

active transport	diffusion	osmosis
-------------------------	------------------	----------------

Oxygen moves from the air inside the lungs into the blood by the process of _____ .

(1)

- (ii) Use the correct answer from the box to complete the sentence.

arteries	capillaries	veins
-----------------	--------------------	--------------

Oxygen moves from the lungs into the blood through the walls

of the _____ .

(1)

(iii) Inside the lungs, oxygen is absorbed from the air into the blood.

Give **two** adaptations of the lungs that help the rapid absorption of oxygen into the blood.

1.

2.

(2)

(Total 6 marks)

Q35.

(a) Humans need to remove waste products from their bodies.

Which organ removes waste carbon dioxide from the body?

Tick (✓) **one** box.

Liver

Lung

Skin

(1)

(b) Kidneys make urine. Urine is stored in the bladder.

Which **one** of the following stages is involved in making urine in a healthy kidney?

Tick (✓) **one** box.

Filtering the blood

Reabsorbing **all** of the ions

Reabsorbing **all** of the water

(1)

(c) A healthy kidney keeps the correct amount of water in the blood.

If there is too much water in the blood, what might happen to the blood cells?

Tick (✓) **one** box.

They will take in water and burst.

There will be no change.

They will lose water and shrink.

(1)

(d) A child has kidney failure.

A doctor recommends dialysis to treat the kidney failure.

Before dialysis starts, the doctor measures the concentration of glucose and of urea in the child's blood.

The concentration of glucose in the dialysis fluid is 6 mmol per dm³.

The results are shown below in the table.

Concentration in the blood before dialysis starts
--

	in mmol per dm ³
Glucose	6
Urea	28

- (i) Suggest what the concentration of glucose in the blood will be **after** the dialysis treatment.

Draw a ring around the correct answer.

less than 6 6 more than 6

(1)

- (ii) Suggest what the concentration of urea in the blood will be **after** the dialysis treatment.

Draw a ring around the correct answer.

less than 28 28 more than 28

(1)

- (iii) Give a reason for your answer to part **(d)(ii)**.

(1)

- (e) (i) Some patients have kidney transplants. Transplanted kidneys may be rejected by the body.

Use the correct answer from the box to complete the sentence.

antibodies	hormones	tissues
-------------------	-----------------	----------------

Transplanted kidneys have proteins on the surface of the cells. These proteins

may be attacked by the patient's _____ .

(1)

- (ii) It is important to prevent rejection of a new kidney.

Which **one** of the following helps to prevent the kidney from being rejected?

Tick (✓) **one** box.

Giving the patient antibodies

Giving the patient painkillers

Tissue typing the donor kidney

(1)
(Total 8 marks)

Mark schemes

Q1.

(a) (A) stomach	1
(B) small intestine	
<i>allow ileum</i>	
<i>ignore intestine unqualified</i>	1
(C) liver	1
(b) soluble	1
catalyse	1
denatured	1
<i>this order only</i>	
(c) amino acids	1
(d) any one from:	
• for growth	
<i>allow for enzymes / hormones / antibodies</i>	
• for repair / replacement (of cells / tissues / organs)	
<i>allow to strengthen bones</i>	
<i>ignore for energy</i>	1
(e) stomach	1
(f) Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3-4
Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1-2
No relevant content	0
Indicative content	
• grinding up the food	
• add Biuret reagent (allow CuSO ₄ and NaOH) to food (sample)	
• protein turns solution (from blue) to purple / lilac	
• wear goggles to protect eyes	

- clean up spills immediately
- Biuret / NaOH is an irritant / corrosive / poisonous

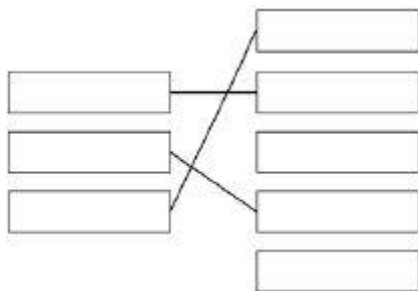
for **level 2** a reference to Biuret, a positive result and reason for a safety precaution is required

- (g) fat 1
- (h) type 2 diabetes 1

[15]

Q2.

(a)



additional line from a blood component negates the mark for that component

- (b) C 1

- (c) (vessel) B 1
- thick walls **or** thick muscle / elastic tissue
do not accept ref to 'cell walls'

- or**
 lumen is small / narrow
allow description of 'lumen'

- (d) 95 1

- (e) (because coronary) arteries / they are narrower
allow (because the coronary) arteries are blocked / clogged (with fat)

- (f) 250 × 60 (= 15 000) 1
- or**

15 000

allow 0.25×60

1

15

allow $\frac{\text{answer to marking point 1}}{1000}$

an incorrect conversion to dm^3 in calculation does not negate marking point 1

1

an answer of 15 scores 2 marks

(g) any **two** from:

- no need to stay as long in hospital (after procedure) **or** can go home sooner / same day

allow only need to stay 2–3 hours in hospital (after procedure)

allow less scarring

allow less chance of infection

allow only a small cut needed

- not as / less invasive **or** no need for a major operation **or** no need for general anaesthetic
- shorter recovery time **or** can get back to normal lifestyle quicker **or** less time needed off work

allow only 7 days recovery

- lower risk of a heart attack (during procedure)

ignore reference to cost

ignore idea that it takes less time overall

2

(h) lower chance of failure (within one year)

allow only a 5% chance of failure

1

only need one operation to treat multiple blockages **or** can treat multiple blockages at one time

ignore ref to anaesthetic or CABG being a long-term treatment

1

[14]

Q3.

(a) diffusion

1

(b) A

1

(c) B

1

- (d) (earthworm) can absorb more oxygen (in a given time)
or
 increases / more gas exchange
allow get / obtain / take in more oxygen
ignore easier absorption of oxygen
ignore references to food 1
- (e) lipase 1
- (f) more oxygen (in soil with earthworms)
allow earthworms bring oxygen to soil 1
- (for) more (aerobic) respiration
*do **not** accept anaerobic respiration* 1
- (of) bacteria / fungi / microorganisms / microbes / decomposers 1
reference to more is only needed once for the first two marking points
- (g) fertilisation
ignore sexual reproduction 1
- (h) asexual (reproduction)
allow cloning 1
- [10]**

Q4.

- (a) (for calcium)
- $$\frac{500}{605} \times 1000 = 826.446281 \text{ (cm}^3\text{)}$$
- allow any correct rounding to minimum 3 significant figures*
allow alternative route with correct rounding 1
- (for vitamin B-12)
- $$\frac{500}{4.5} \times 2.4 = 266.67 \text{ (cm}^3\text{)}$$
- allow alternative route with correct rounding* 1
- 560 / 559.8 / 559.78 / 559 (cm³)
allow only correct answer based on values given for vitamin B-12 and calcium

	1
<i>an answer of 560 / 559.8 / 559.78 / 559 (cm³)</i>	
<i>scores 3 marks</i>	
<i>an incorrect answer for one step does not prevent allocation of marks for subsequent steps</i>	
(b) Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6
Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3
No relevant content	0
Indicative content	
<ul style="list-style-type: none"> • Biuret reagent (allow CuSO₄ and NaOH) tests for protein • add Biuret reagent to milk • solution will turn (from blue) to lilac if positive • iodine solution tests for starch (ignore iodine unqualified) • add iodine solution to milk • solution will turn (from orange / brown) to blue / black if positive • Benedict's reagent tests for sugars • add Benedict's reagent to milk and boil / heat (allow any temperature above 60 °C) • solution will turn (from blue) to (brick) red / brown / orange / yellow / green if positive 	
for level 2 , reference to all three food tests is required	
(c) lipase breaks down fat into fatty acids (and glycerol)	
<i>do not accept if 'glycerol' is contradicted</i>	1
(and) fatty acids lower the pH	1
(and when) fatty acids cause the pH to be below 10 (the indicator becomes colourless)	1
(d) observation of colour change is subjective / based on opinion	
<i>ignore human error unqualified</i>	
<i>ignore experimental error or examples of this</i>	1
(e) bile emulsifies fats	
<i>allow a correct description of emulsification (i.e. breaks fat from large droplets into smaller droplets)</i>	

*do **not** accept a description of chemical breakdown*

1

creates a larger surface area (of fat)

1

(so) lipase can break down fat (to produce fatty acids) more quickly / effectively

allow fatty acids produced by action of lipase more quickly

1

[16]

Q5.

(a) pancreas

1

(b) liver

1

glycogen

1

in this order

(c) would be digested / broken down (by enzymes / protease / pepsin / acid or to amino acids)

allow denatured (by acid)

1

(d) use of 14.2 **and** 6.8

1

7.4

allow an answer of 7.2 or 7.3 (using 14.1 and / or 6.9) for 1 mark

1

an answer of 7.4 scores 2 marks

(e) any **one** from:

- (person A's) results are higher
ignore A peaks at a higher level than B
- (A) increases for a longer time **or** peaks later
- (A) takes longer to decrease **or** takes longer to return to normal
allow other correct comparisons
allow a description using pairs of figures from graph at a given time

1

allow converse comparisons with person B as the subject

- (f) a negative correlation 1
- (g) less carbohydrate / sugar / fat in diet
allow go on a diet
allow eat less
allow balanced / healthy diet
- or**
 lose weight **or** maintain a healthy weight
ignore diet unqualified 1
- (more) exercise
allow examples of exercise 1

[10]

Q6.

- (a) kills microorganisms / bacteria / fungi / viruses / microbes
allow to remove microorganisms / bacteria / fungi / viruses / microbes
ignore germs
allow so mycoprotein is not contaminated 1
- (which) compete for food / oxygen
or
 which make toxins
allow so mycoprotein is safe to eat
- or**
 which are pathogens
or
 which might kill the fungus / *Fusarium* 1
- (b) 30 °C 1
- (c) for (aerobic) respiration
*do **not** accept anaerobic* 1
- (which) releases energy (for growth)
*do **not** accept produces energy*
allow glucose is used to make other organic substances e.g. protein 1
- (d) any **two** from:
 so *Fusarium* can

- grow faster / better
- get sufficient food / glucose / minerals
allow more / enough
- get sufficient oxygen
allow more / enough
- get rid of sufficient carbon dioxide
allow more / enough
allow waste
- be kept at a (suitable) temperature
allow to avoid 'clumping'

2

(e) 200 grams

1

[8]

Q7.

- (a) x-axis: scale + labelled, including units
scale $\geq \frac{1}{2}$ width of graph paper label: biomass in g/m^2

1

bar widths correct

$\pm \frac{1}{2}$ -square each side
allow 1 mark if 3 correct

2

all 4 bars correctly labelled

large fish + small fish + invertebrate (animals) + algae

or

(trophic level) 4 + 3 + 2 + 1

or

tertiary consumer + secondary consumer + primary consumer + producer

ignore bar heights

1

(b)
$$\frac{840 - 10}{840} \times 100$$

allow equivalent calculation

1

98.809523... / 98.810 / 98.81 / 98.8

1

99

allow answer given to two significant figures from an incorrect calculation in step 2

1

an answer of 99 scores 3 marks

- (c) inedible parts / example
allow eaten by other animals or not all organisms eaten

or

egested / faeces
*allow not digested
allow excretion / urine
ignore waste*

or

respiration / as CO₂
*ignore energy losses
ignore movement*

1

- (d) bacteria decay organic matter / sewage / algae / dead plants

1

(by) digestion
*allow example such as starch broken down to sugar
or
protein broken down to amino acids*

1

(and) bacteria respire aerobically
or
respire using oxygen

1

(which) lowers oxygen concentration (in water)
or
fish have less oxygen

allow reduced respiration of fish

1

(so) reduced energy supply causes death of fish
*allow toxins in the sewage kill fish
ignore pathogens or (pathogenic) bacteria cause disease in fish and kills them*

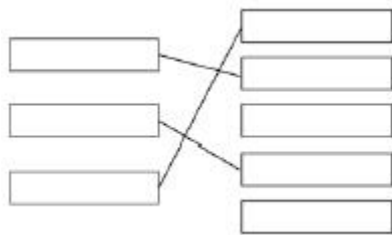
1

[13]

Q8.

- (a) (A) bronchus
*allow bronchi
allow bronchiole*

- 1
- (B) trachea
allow windpipe
- 1
- (C) alveolus
allow alveoli
ignore air sac
- 1
- (b) circulatory system
- 1
- (c) Q
- 1
- (d) guard cell
- 1
- (e) a group of cells with a similar structure / function
- 1



- (f)
- 1 mark for each correct line*
extra line from a tissue negates the mark for that tissue

3
[10]

Q9.

- (a) movement of particles from (an area of) high concentration to (an area of) low concentration
allow movement of particles down a concentration gradient
*do **not** accept along / across a concentration gradient*
- 1
- (b) oxygen
allow O₂
- carbon dioxide
allow CO₂
in this order only
both needed for 1 mark
- 1
- (c) less diffusion

- allow less gas will enter / leave the blood*
allow ecf from (b) 1
- (because of the) reduced / smaller surface area 1
- (d) **(B)** very low birth mass 1
- (C)** extremely low birth mass 1
- (e) any **one** from:
 - men would be included in the study (can't be pregnant)
 - children / older (post-menopausal) women would be included in the study*ignore reference to cost* 1
- (f) any **three** from:
 - higher percentage of pregnant women have never smoked (compared with non-pregnant women)
 - higher percentage of pregnant women are ex-smokers (compared with non-pregnant women)
 - lower percentage of pregnant women currently smoke (compared with non-pregnant women)
 - in both pregnant and non-pregnant women, the highest percentage of women have never smoked*allow converse throughout*
allow appropriate use of correct figures throughout 3
- (g) scatter graph 1
- (h) **B** 1
- (i) there is no correlation (between the variables)
allow (all) the points are widely scattered
allow idea that the person with the longest birth time does not have the highest risk 1

[13]

Q10.

- (a) an undifferentiated / unspecialised cell 1
- that can differentiate / become / change into (many) other cell types 1
- (b) (malignant tumours) invade / spread to other tissues via the blood (benign don't) **or**

- (malignant tumours) form secondary tumours in other organs
ignore cancer unqualified
allow converse
allow metastasises 1
- (c) mitosis
correct spelling only 1
- (d) glucose
answers in any order
ignore sugar 1
- protein / amino acids 1
- (e) no need to wait for a donor
or
 can be done immediately 1
- (so) no risk of rejection
or
 no need for immunosuppressant drugs
if no other marks awarded, allow for 1 mark idea of ethics surrounding the use of tissue from another / dead person 1
- (f) stent opens up the trachea 1
- allowing air to flow through
or
 allowing patient to breathe 1
- (g) **Level 3 (5-6 marks):**
 A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.
- Level 2 (3-4 marks):**
 Some logically linked reasons are given. There may also be a simple judgement.
- Level 1 (1-2 marks):**
 Relevant points are made. They are not logically linked.
- Level 0**
 No relevant content
- Indicative content**
- embryos advantages**
- can create many embryos in a lab

- painless technique
- can treat many diseases / stem cells are pluripotent / can become any type of cell (whereas bone marrow can treat a limited number)

embryos disadvantages

- *harm / death to embryo*
- *embryo rights / embryo cannot consent*
- *unreliable technique / may not work*

bone marrow advantages

- no ethical issues / patient can give permission
- can treat **some** diseases
- procedure is (relatively) safe / doesn't kill donor
- tried and tested / reliable technique
- patients recover quickly from procedure

bone marrow disadvantages

- *risk of infection from procedure*
- *can only treat a few diseases*
- *procedure can be painful*

both procedures advantage

can treat the disease / problem

both procedures disadvantages

- *risk of transfer of viral infection*
- *some stem cells can grow out of control / become cancerous*

[16]

Q11.

- (a) vena cava 1
- (b) 0.5 mm = 0.05 cm 1
- time = $\frac{10.00 - 0.05}{0.4}$ 1
allow alternative correct substitution
- 24.875 1
- 25 (s) 1
an answer of 25 (s) scores 4 marks
allow 24 for 3 marks (no conversion of mm to cm)
allow 23.8 / 23.75 for 2 marks (no conversion of mm to cm and incorrect sf)
- (c) (blood) travels through (the) pulmonary vein 1
 (blood) enters left atrium

(blood) enters (the) left ventricle

1

(blood) leaves the heart via / through (the) aorta

1

allow blood travels through arterioles

allow blood (travels round the body and) reaches the cells / tissues via / in capillaries

1

ignore ref to valves / systole / diastole throughout

(d) **Level 3 (5-6 marks):**

Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

Level 2 (3-4 marks):

Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

Level 1 (1-2 marks):

Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

No relevant content (0 marks)

Indicative content

S = structural F = functional

- (S) both have a large surface area
- (S) villi have many microvilli
- (S) alveolar walls are not flat / are folded
- (F) to maximise diffusion (of gases) / absorption of (food) molecules
- (S) both have many capillaries / good blood supply / capillaries near the surface
- (F) to maintain concentration / diffusion gradient
- (S) both have thin walls / walls that are one cell thick / one cell thick surface
- (F) to provide a short diffusion distance (for molecules to travel)
- (S) villi have many mitochondria
- (F) to provide energy for active transport (of food molecules)
- (S) cells of the villi have microvilli / more projections
- (F) to further increase the surface area / increase the number of proteins in the membrane / to allow more active transport to take place

[15]

Q12.

(a) salivary glands and pancreas

1

(b) starch / substrate fits into active site (of enzyme)

- 1
- shape of active site is unique / complementary to substrate
allow converse
- or**
 substrate is specific to active site / enzyme
allow enzyme has a high specificity for substrate
- 1
- bonds (within starch / substrate
or
 between sugar molecules) are broken
- 1
- (c) converted to new carbohydrates / glycogen / named organic compound (e.g. protein / fat)
- 1
- (d) to allow (the starch and amylase / solutions) to equilibrate (to the temperature of the water bath)
or
 to get the starch and amylase / solutions to the same temperature / 20 °C
or
 to get the starch and amylase / solutions to the (same) temperature of the water bath
- 1
- (e) **40 °C**
 all wells contain a symbol
and
 must contain at least two crossed ^(*) wells at the end
allow final three wells crossed
^(*)
- 1
- 60 °C**
 all wells contain a symbol
and
 must have fewer crossed ^(*) wells at the end than at 40 °C
allow all wells ticked (✓)
*for either mp do **not** allow a crossed well followed by a ticked well*
- 1
- (f) more accurate
allow (so) closer to (the) true value
- 1
- (because) it is a quantitative measure
allow (it's) an actual value as opposed to an opinion
- or**
 less / not subjective
allow colour is only qualitative
- 1

- (g) 0.07 (%) 1
- (h) starch is broken down less quickly (at 20 °C)
allow converse 1
- because, at 20 °C, substrates / enzymes / molecules have less (kinetic) energy 1
- (i) 1.08 (arbitrary units) 1
- at 80 °C, enzyme / amylase has denatured
allow description of denaturation
*do **not** allow enzyme is killed* 1
- so starch is not broken down (at all)
allow the concentration of starch is still 0.5% 1
- [16]**

Q13.

- (a) to kill microorganisms on / in the flask
or
 so only microorganisms in the milk caused the results
allow bacteria / fungi / microbes
*do **not** accept viruses*
ignore germs 1
- (b) heating 1
- to over 100 °C
allow place in oven / pressure cooker
*do **not** accept disinfectant*
allow other suitable method – e.g. use of UV 1
- (c) to prevent microorganisms entering from the air
allow bacteria / fungi / microbes for microorganisms
*do **not** accept viruses*
ignore germs 1

(d)

0	olive-green	7
1	olive-green	7

2	olive-green	7
3	orange-green	6

all correct for 1 mark

1

- (e) (pH meter) – more accurate / more precise
allow more exact
allow can measure to 0.1 pH unit
or *to smaller intervals of pH*

1

(leaving...6 days) – obtain greater pH change
or
 because there was (very) little change in 3 days
allow more acid will be made

1

- (f) scale $> \frac{1}{2}$ of x-axis
and
 x-axis labelled (time in) days

1

points plotted correctly
all 7 correct = 2 marks
5 or 6 correct = 1 mark

2

line of best fit = smooth curve through points
*do **not** accept ruled point-to-point*

1

- (g) (1st day) too few bacteria

1

(after day 1 more bacteria so more) acid made

1

(days 5-6) sugar / food used up
or
 low pH denatures enzymes
or
 low pH kills bacteria
allow enzymes do not work
*do **not** accept enzymes killed*

1

- (h) (similarity) – same start pH /
 pH7 and end pH / pH4.5
or
 same pH change / change = 2.5

1

(difference) – faster

Q14.

(a) any **two** from:

- sprinkled through air
- air spaces between stones
- thin layer over stones (for efficient diffusion)
- slow flow (for efficient diffusion)

2

(b) green algae

1

(c) (large / small) protist

1

(d) **Level 2 (3-4 marks):**

Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

Level 1 (1-2 marks):

Facts, events or processes are identified and simply stated but their relevance is not clear.

No relevant content (0 marks)

Indicative content

digestion:

- (external) enzymes released
- role of enzymes – e.g. amylase / protease / lipase
- substrates & products – e.g. starch → sugar / protein → amino acids / fat → fatty acids

absorption:

- by diffusion / active transport

deamination:

- amino acids → ammonia / ammonium ions

release of other ions:

- e.g. phosphate / nitrate / magnesium

respiration:

- produces carbon dioxide (+ water)
or
equation is given
- release of energy allows other processes to take place e.g. active transport

[8]

Q15.

(a) red blood cell

- (b) 44 1
- (c) retina 1
- (d) **7** and **8** / the parents
do not have **A** (allele)
or only have **a** (allele) or are **aa**
allow converse – if parents had an A (allele) they would have Stickler syndrome 1
- so children cannot inherit **A**
or can only inherit **a**
- or
- the parents show the recessive characteristic
- so must be homozygous
(recessive)
or must be **aa**
or parents cannot have **A** 1
- (e) parental genotypes:
12 = Aa and 18 = aa
or parental gametes:
12 = A + a and 18 = a + a 1
- derivation of offspring genotypes
allow ecf 1
- identification of **Aa** offspring as Stickler 1
- probability = $0.25 / \frac{1}{4} / 1 \text{ in } 4 / 25\% / 1:3$
allow ecf – e.g. 0.5 if 12 = AA
do not accept 3:1
do not accept 1:4 1

[9]

Q16.

- (a) ventricle 1
- (b) lungs 1

- (c) valve circled on heart 1
- (d) no fatty deposit 1
- healthy artery is wider / bigger hole / has more blood flow 1
- (e) statins 1
- stent 1
- (f) any **two** from:
 • smoking
 • high-fat diet
 • lack of exercise
allow:
 • *overweight / obese*
 • *having high blood pressure*
 • *having high cholesterol* 2
- (g) 8 (%) 1
- (h) more males have coronary heart disease than females 1
- [11]**

Q17.

- (a) to show the experiment was more repeatable 1
- (b) (circle) 0.0 at 20 °C 1
- (c) ignored it / did not use it
ignore repeated it 1
- (d) increases the rate of reaction up to 30 °C 1
- (e) 60 °C 1
- (f) do the experiment at 30 °C, 35 °C and 40 °C 1
- (g) **Level 2 (3–4 marks):**
 A detailed and coherent plan covering all the major steps is provided. The method is set

out logically taking into account control variable and appropriate measurements. The plan could be repeated by another person to determine the effect of pH on breakdown of starch by amylase.

Level 1 (1–2 marks):

Simple statements relating to relevant apparatus or steps are made but they may not be in a logical order. The plan would not allow another person to determine the effect of pH on breakdown of starch by amylase.

0 marks:

No relevant content.

Indicative content

- range of at least 3 pH values / use of buffer solutions
- control variables / keep amount or concentration of starch and amylase the same
- keep temperature the same using water bath / electric heater
- use iodine test to make qualitative observations
- observe colour changes at different temperatures
- do repeats at each pH

4

[10]

Q18.

- | | |
|--|---|
| (a) 300 | 1 |
| (b) suitable scale on <i>y</i> -axis | 1 |
| label <i>y</i> -axis | 1 |
| 4 bars drawn correctly
<i>allow 1 mark for 3 correct bars</i> | 2 |
| (c) increases from 50 to 500 | 1 |
| then decreases from 500 to 0 | 1 |
| (d) carbohydrates broken down / digested into sugars | 1 |
| broken down by carbohydrase or amylase | 1 |
| (e) absorption of glucose | 1 |
| into blood | 1 |

by active transport
allow diffusion

1
 [12]

Q19.

- (a) stomach and pancreas correctly labelled 1
- (b) bacteria not killed (by stomach acid / HCl) and so they damage mucus lining 1
 so acid / HCl damages stomach tissue / causes an ulcer 1
allow bacteria infect stomach tissue 1
- (c) if the cancer is malignant 1
 (cancer) cells can spread to other organs 1
 via the blood forming a secondary tumour 1
do not award marking points 2 or 3 without marking point 1 1
- (d) add Biuret reagent to food sample 1
allow sodium / potassium hydroxide (solution) + copper sulfate(solution) 1
 mauve / purple colour shows protein present 1
- (e) damaged villi reduce surface area for absorption (of food molecules) 1
 (therefore) fewer amino acids and glucose absorbed 1
 with less glucose transfer of energy from respiration is reduced 1
 and fewer amino acids available to build new proteins 1

[12]

Q20.

Level 3 (5–6 marks):

A detailed and coherent explanation is provided with most of the relevant content, which demonstrates a comprehensive understanding of the human circulatory system . The response makes logical links between content points.

Level 2 (3–4 marks):

The response is mostly relevant and with some logical explanation. Gives a broad understanding of the human circulatory system. The response makes some logical links between the content points.

Level 1 (1–2 marks):

Simple descriptions are made of the roles of some of the following: heart function, gas exchange, named blood vessels, named blood cells. The response demonstrates limited logical linking of points.

0 marks:

No relevant content.

Indicative content

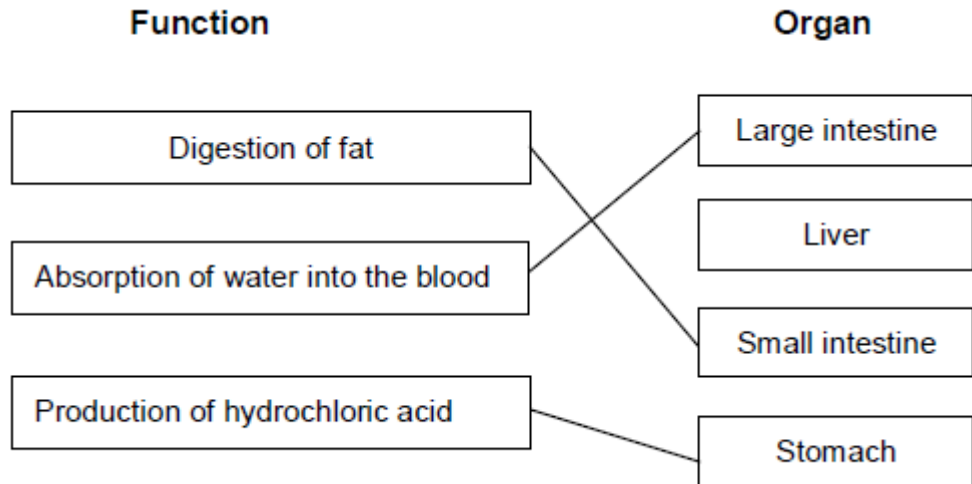
- dual / double circulatory system which means that it has higher blood pressure and a greater flow of blood to the tissues
- heart made of specialised (cardiac) muscle cells which have long protein filaments that can slide past each other to shorten the cell to bring about contraction for pumping blood
- heart pumps blood to lungs in pulmonary artery so that oxygen can diffuse into blood from air in alveoli
- blood returns to heart via pulmonary vein where muscles pump blood to the body via aorta
- oxygen carried by specialised cells / RBCs which contain haemoglobin to bind oxygen and have no nucleus so there is more space available to carry oxygen
- arteries carry oxygenated blood to tissues where capillaries deliver oxygen to cells for respiration and energy release
- thin walls allow for easy diffusion to cells
- large surface area of capillaries to maximise exchange
- waste products removed eg CO₂ diffuse from cells into the blood plasma
- blood goes back to the heart in veins which have valves to prevent backflow
- cardiac output can vary according to demand / is affected by adrenaline

accept annotated diagrams

[6]

Q21.

- | | |
|------------------------------------|---|
| (a) (i) large intestine = E | 1 |
| small intestine = D | 1 |
| stomach = B | 1 |



(ii)

extra lines cancel

3

(b) The concentration in the blood is lower.

1

[7]

Q22.

(a) (i) without oxygen
allow not enough oxygen
ignore air
ignore production of CO₂
ignore energy

1

(ii) more / high / increased lactic acid (at end)
allow approximate figures (to show increase)
ignore reference to glucose

1

(b) (i) 1.5
allow only 1.5 / 1½ / one and a half

1

(ii) increases at first **and** levels off
ignore subsequent decrease

1

suitable use of numbers eg
 rises to 10 / by 9 (dm³ per min)
or
 increases up to 1.5 (min) / levels off after 1.5 (min) (of x axis timescale)
allow answer in range 1.4 to 1.5
or
 after the first minute (of the run)

1

- (iii) supplies (more) oxygen 1
 supplies (more) glucose 1

*need 'more/faster' once only for full marks
 allow removes (more) CO₂ / lactic acid / heat as an
 alternative for either marking point one **or** two, **once** only*

for (more) respiration 1

releases (more) energy (for muscle contraction)
*do **not** allow energy production or for respiration* 1

[9]

Q23.

- (a) a catalyst / speeds up a reaction 1
ignore it is not used up

it is a protein **or** it is specific / described **or** it has an active site
allow it only acts on one molecule 1

- (b) cytoplasm 1

- (c) **Advantage:**

any **one** from:

- heat would denature proteins in milk
 - heat alters texture or flavour of milk
 - catalase / enzyme is specific **or** only affects hydrogen peroxide
 - less energy / fuel / lower temperature used so less expensive **or** less pollution
- 1

Disadvantage:

any **one** from:

- (some pathogens may survive) causing illness
 - catalase / enzyme left in milk **or** may cause allergies **or** may alter taste
- 1

[5]

Q24.

- (a) The damaged alveolus has a smaller surface area. 1

- (b) Less oxygen is taken in. 1

[2]

Q25.

- (a) (i) any **one** from:
- glucose
 - oxygen
 - carbon dioxide
 - urea
 - water
- allow hormones*
allow named example of a product of digestion 1
- (ii) (cardiac) muscle
allow muscular 1
- (b) (i) **B** 1
- (ii) **D** atrium / atria
ignore references to left or right 1
- E** ventricle(s)
ignore references to left or right 1
- (c) (i) a vein 1
- (ii) an artery 1
- (iii) keeps artery open / wider
allow ecf from part cii 1
- (so) blood / oxygen can pass through (to the heart muscle) 1

[9]

Q26.

- (a) (healthy alveolus has a) larger surface area
allow larger SA:Volume ratio
accept converse for alveoli from person with emphysema
allow walls between alveoli disintegrate or fluid accumulation in alveoli 1
- (b) less oxygen into the blood / muscles
less only needed once 1
- (so) less respiration

ignore ref. to anaerobic respiration

1

(and therefore) less energy is released (for exercise)

*do **not** allow energy is produced / made*

*do **not** allow energy **for** respiration*

1

[4]

Q27.

(a) (i) doesn't have valves

allow veins have valves

1

has a thicker wall **or** thicker layer of muscle

allow has a smaller lumen

ignore references to elastic (in walls)

1

(ii) any **two** from:

- (artery has) more oxygen
- (artery has) more glucose
- (artery has) less carbon dioxide
- (artery has) less lactic acid

ignore urea

ignore reference to pressure

accept converse for veins if veins is clearly stated

2

(b) any **two** from:

- no rejection
allow no tissue matching required
- abundant supply
- low risk of infection
allow named example ie HIV, CJD
- longer shelf life
allow less space needed for storage
ignore side effects

2

[6]

Q28.

(a) 55%

2 marks for correct answer alone

accept 54 – 56

5.5 / 10 × 100 alone gains 1 mark

2

(b) any **three** from:

- amino acids
- antibodies
- antitoxins
- carbon dioxide
- cholesterol
- enzymes
- fatty acid
- glucose
- glycerol
- hormones / named hormones
- ions / named ions
- proteins
- urea
- vitamins
- water.

ignore blood cells and platelets

ignore oxygen

max 1 named example of each for ions and hormones

allow minerals

3

- (c) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking Guidance and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1 – 2 marks)

There is a description of pathogens with errors or roles confused.

or

the immune response with errors or roles confused.

Level 2 (3 – 4 marks)

There is a description of pathogens **and** the immune response with some errors or confusion

or

a clear description of either pathogens **or** the immune response with few errors or little confusion.

Level 3 (5 – 6 marks)

There is a good description of pathogens **and** the immune response with very few errors or omissions.

Examples of biology points made in the response:

- bacteria and viruses are pathogens
credit any ref to bacteria and viruses
- they reproduce rapidly inside the body
- bacteria may produce poisons / toxins (that make us feel ill)
- viruses live (and reproduce) inside cells (causing damage).

white blood cells help to defend against pathogens by:

- ingesting pathogens / bacteria / (cells containing) viruses
credit engulf / digest / phagocytosis
- to destroy (particular) pathogen / bacteria / viruses
- producing antibodies
- to destroy particular / specific pathogens
- producing antitoxins
- to counteract toxins (released by pathogens)
credit memory cells / correct description
- this leads to immunity from that pathogen.

6

[11]

Q29.

- (a) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1–2 marks)

The method described is weak and could not be used to collect valid results, however does show some understanding of the sequence of an investigation.

Level 2 (3–4 marks)

The method described could be followed and would enable some valid results to be collected, but lacks detail.

Level 3 (5–6 marks)

The method described could be easily followed and would enable valid results to be collected.

Examples of the points made in the response:

- bean seedlings of same age
- cut material from same part of each organ (for repeats) e.g. top 1 cm of stem / a whole cotyledon / seed
- equal mass of each organ
accept weight for mass
- grind / homogenise
- in equal amounts of water / buffer
- equal volumes of hydrogen peroxide solution
- equal concentrations of hydrogen peroxide solution
- same temperature
- temperature maintained in water bath
- quantitative measure of gas production eg height of foam in mm / collect gas in graduated syringe in cm³
- for same time period
- repetitions (3+ times)
- calculate mean for each.

6

- (b) (i) correct answer: 40

1 mark for 45 as the anomalous result has been included in the calculation

or

$$\frac{(38 + 41 + 42 + 39)}{4}$$

1 mark for 4

$$\frac{160}{4}$$

or 4

2

- (ii) vertical axis correctly labelled:
'Enzyme activity in arbitrary units'

allow ecf from (b)(i)

1

points plotted correctly ± 1 mm

deduct 1 mark for each incorrect plot

2

suitable line of best fit

not feathery, not point to point

1

- (iii) 6.0 / 6

allow ± 0.1

if 6.0 not given, allow correct for candidate's graph ± 0.1

1

- (iv) in range 0 to 14 units

allow correct for candidate's graph

1

- (v) enzyme denatured / enzyme (active site) shape changed

allow substrate no longer fits (active site)

ignore reference to temperature

do not allow enzyme dies

1

[15]

Q30.

- (a) (i) 64

1

- (ii) 36

allow e.c.f from (i) i.e. 100 – answer given in (a)(i)

1

- (iii) any **one** from:

- only considers 16-year-olds

ignore lack of evidence

allow does not refer to all ages

- only about some / 5 countries

allow does not refer to all countries.

- (b) the more exercise done the healthier a person is
allow the more exercise done the higher the health rating
allow the less exercise done the lower the health rating
- (c) having a high cholesterol level
- (d) (i) antibodies
- (ii) antibiotics

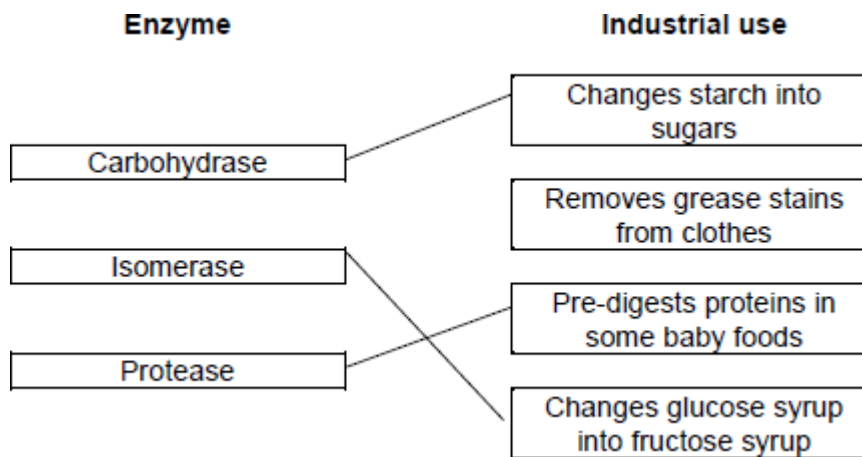
1
1
1
1
1

[7]

Q31.

- (a) (i) a catalyst
- (ii) protein
- (iii) salivary glands
- (b)

1
1
1



extra lines from any enzyme cancels that mark

3

[6]

Q32.

- (a) (i) glycerol
- (ii) pancreas / small intestine

1

accept duodenum / ileum
ignore intestine unqualified

1

(b) any **two** from:

- type of milk
- volume / amount of milk
- vol. bile equals vol. water
- volume of lipase
- concentration of lipase
- temperature

ignore time interval

ignore solution unqualified

*do **not** allow pH*

ignore starting pH

ignore volume / amount of bile / water

ignore concentration of bile

accept amount of lipase if neither volume nor concentration given

2

(c) (i) fatty acid (production)

1

(ii) faster reaction / digestion (with bile)

or

pH decreases faster (with bile)

or

takes less time (with bile)

or

steeper fall / line (with bile)

allow use of data

ignore easier

1

(iii) all fat / milk digested

or

same amount of fatty acids present

or

(lower pH) denatures the enzyme / lipase

allow all reactants used up

ignore reference to neutralisation

allow enzyme won't work at low pH

*do **not** allow enzyme killed*

1

[7]

Q33.

(a) 5624

allow 2 marks for:

- correct HR = 148 **and** correct SV = 38 plus wrong

answer / no answer

or

- only one value correct **and** ecf for answer

allow 1 mark for:

- incorrect values **and** ecf for answer

or

- only one value correct

3

- (b) (i) **Person 2** has low(er) stroke volume / SV / described
eg **Person 2** pumps out smaller volume each beat
do **not** allow **Person 2** has lower heart rate

1

- (ii) **Person 1** sends more blood (to muscles / body / lungs)

1

(which) supplies (more) oxygen

1

(and) supplies (more) glucose

1

(faster rate of) respiration **or** transfers (more) energy for use

ignore aerobic / anaerobic

allow (more) energy release

*allow aerobic respiration transfers / releases more energy
(than anaerobic)*

do not allow makes (more) energy

1

removes (more) CO₂ / lactic acid / heat

allow less oxygen debt

or less lactic acid made

or (more) muscle contraction / less muscle fatigue

if no other mark awarded,

allow person 1 is fitter (than person 2) for max 1 mark

1

[9]

Q34.

- (a) (i) alveoli / alveolus
allow air sacs
allow phonetic spelling

1

- (ii) any **one** from:
- protection (of lungs / heart)
 - help you breathe / inflate lungs.

1

- (b) (i) diffusion 1
- (ii) capillaries 1
- (iii) any **two** from:
- (have many) alveoli
allow air sacs
 - large surface / area
 - thin (exchange) surface **or** short diffusion pathway
accept only one / two cell(s) thick
 - good blood supply / many capillaries
allow (kept) ventilated or maintained concentration gradient.
- 2
- [6]**

Q35.

- (a) Lung 1
- (b) Filtering the blood 1
- (c) They will take in water and burst 1
- (d) (i) 6 1
- (ii) less than 28 1
- (iii) urea not reabsorbed
or
dialysis (fluid) has removed urea 1
- (e) (i) antibodies 1
- (ii) Tissue typing the donor kidney 1
- [8]**

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
<ul style="list-style-type: none"> • It has been used for transplants for more than 12 years. • It can take many years to find a suitable human donor. • It is transplanted during an operation after a donor has been found. • During the operation, the patient's chest is opened and the old valve is removed before the new valve is transplanted. 	<ul style="list-style-type: none"> • It has been used since 2011. • It is made from the artery tissue of a cow. • It is attached to a stent and inserted inside the existing faulty valve. • 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.

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.

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 cm³ 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.

Describe how the brain monitors body temperature.

(3)

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

Table 2

Nutrient per dm ³	Brand of sports drink		
	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?

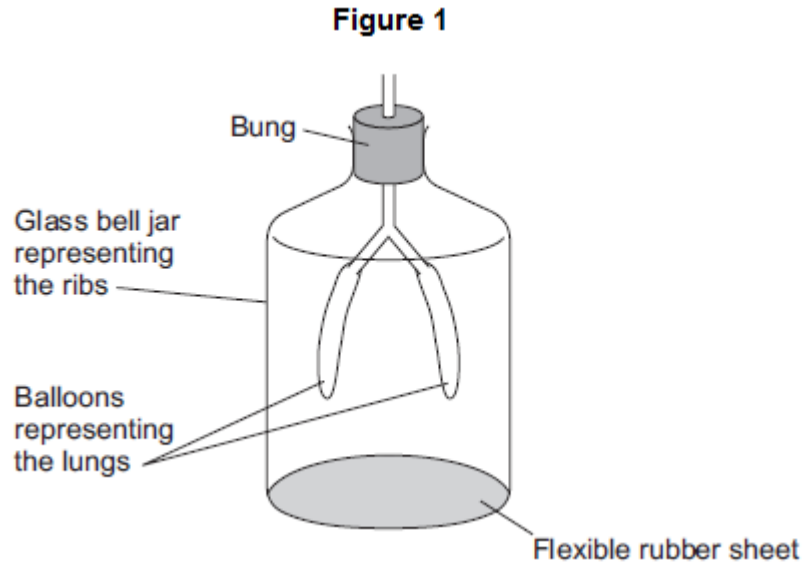
(1)

(Total 10 marks)

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.



- (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.

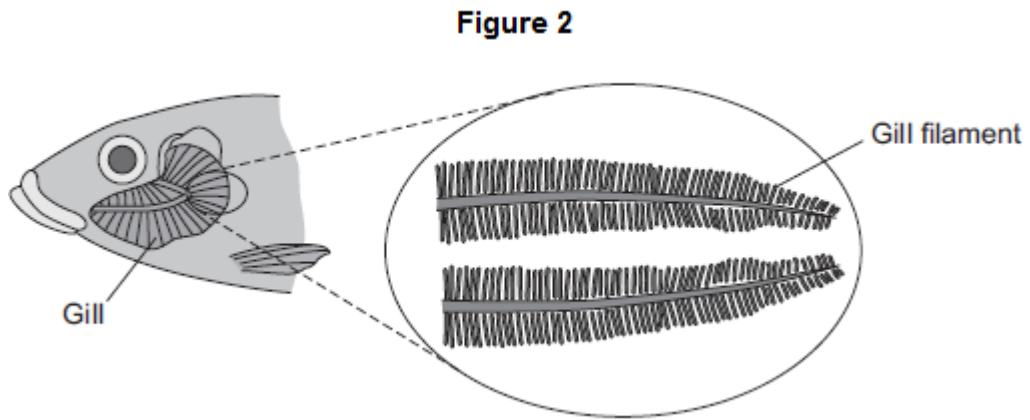
(3)

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

Explain how oxygen moves into the blood.

(2)

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



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)

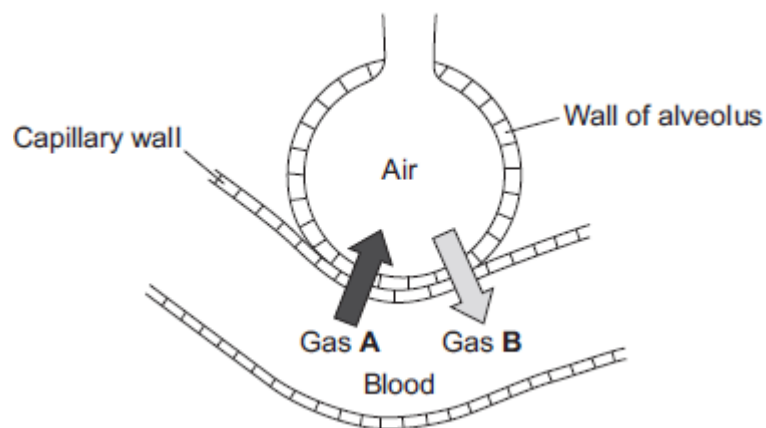
(Total 8 marks)

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.
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 m².

Calculate the total surface area of a human lung.

Answer _____ m²

(2)

- (c) An athlete trains to run a marathon. The surface area of each of the athlete's lungs has increased to 80 m².

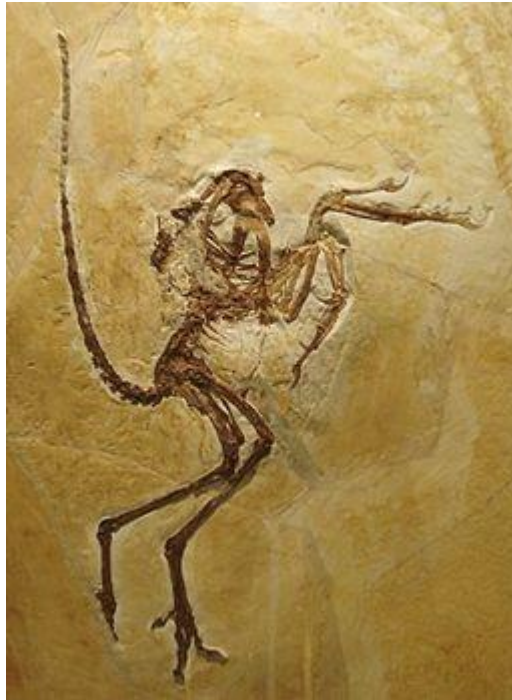
Give **one** way in which this increase will help the athlete.

(1)

(Total 6 marks)

Q5.

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



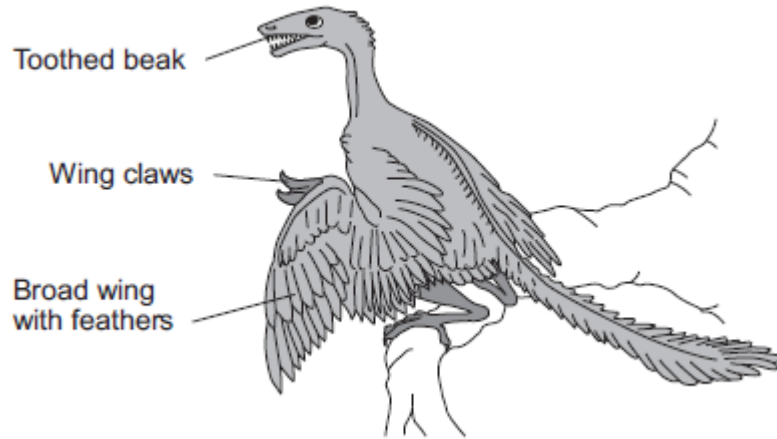
By Ghedoghedo (own work) [CC-BY-SA-3.0 (<http://creativecommons.org/licenses/by-sa/3.0>) or GFDL (<http://www.gnu.org/copyleft/fdl.html>)], via Wikimedia Commons; By Steenberg from Ripon, United Kingdom (Small Fishing Boat In North Sea) [CC-BY-2.0 (<http://creativecommons.org/licenses/by/2.0>)], via Wikimedia Commons.

(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.



(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
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.

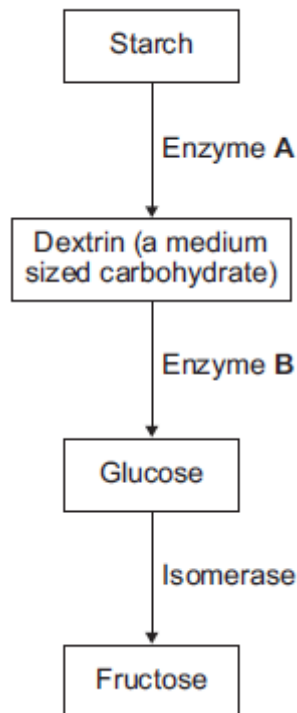
Suggest why.

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



- (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.

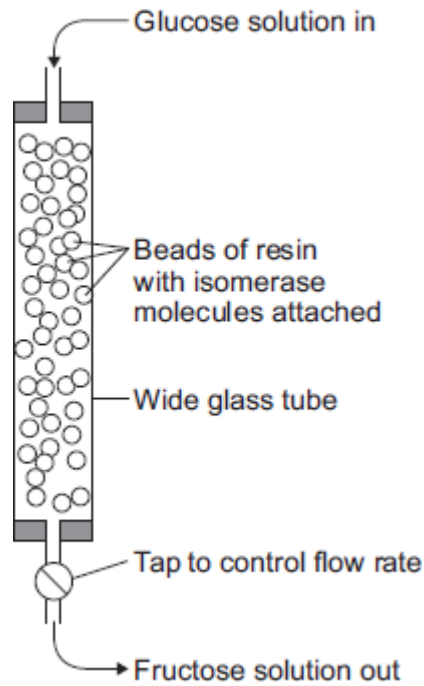
Suggest why.

(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



- (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
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)

- (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

<p>arteries.</p> <p>capillaries.</p> <p>veins.</p>
--

(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**.

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

	Donor	Group A only A antigens	Group B only B antigens	Group AB A + B antigens	Group O no antigens
Recipient blood group and antibodies	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**.

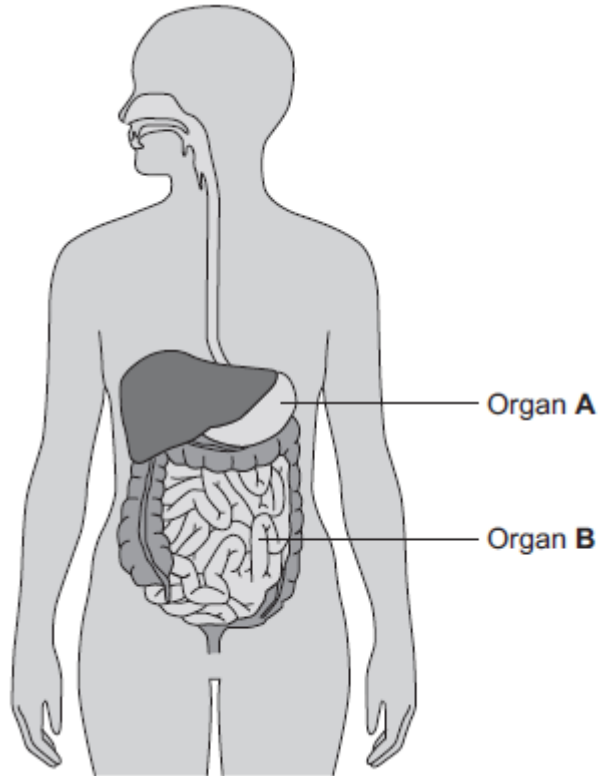
Use this information to explain why transfusion of group **B** blood into a person of blood group **A** is unsafe.

(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.

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
Amylase breaks down starch into.....	amino acids.
Lipase breaks down fats into...	bases.
Protease breaks down proteins into...	fatty acids and glycerol.
	sugars.

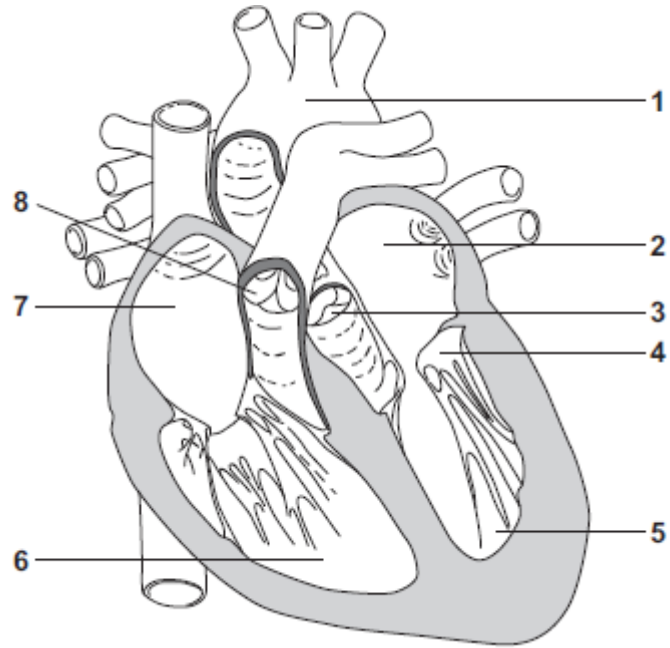
(3)

(Total 8 marks)

Q9.

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

Figure 1



(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
- receives deoxygenated blood from the head and body
- receives oxygenated blood from the lungs?

(3)

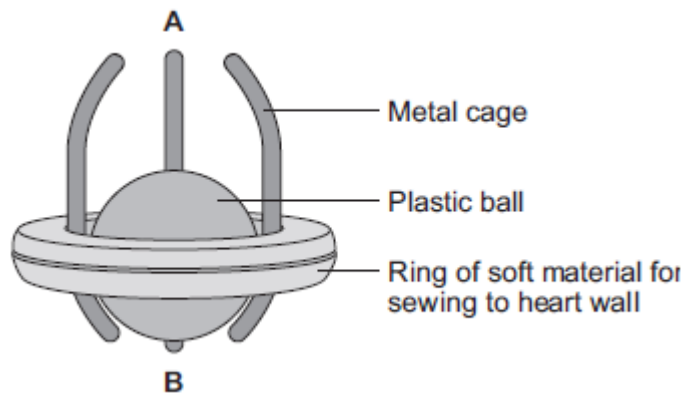
- (ii) Give the number, **3**, **4** or **8**, of the valve that closes when the blood pressure in the aorta is greater than the blood pressure in the left ventricle.

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.

(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)

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**.

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
	Used to increase muscle growth

Thalidomide

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)

(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

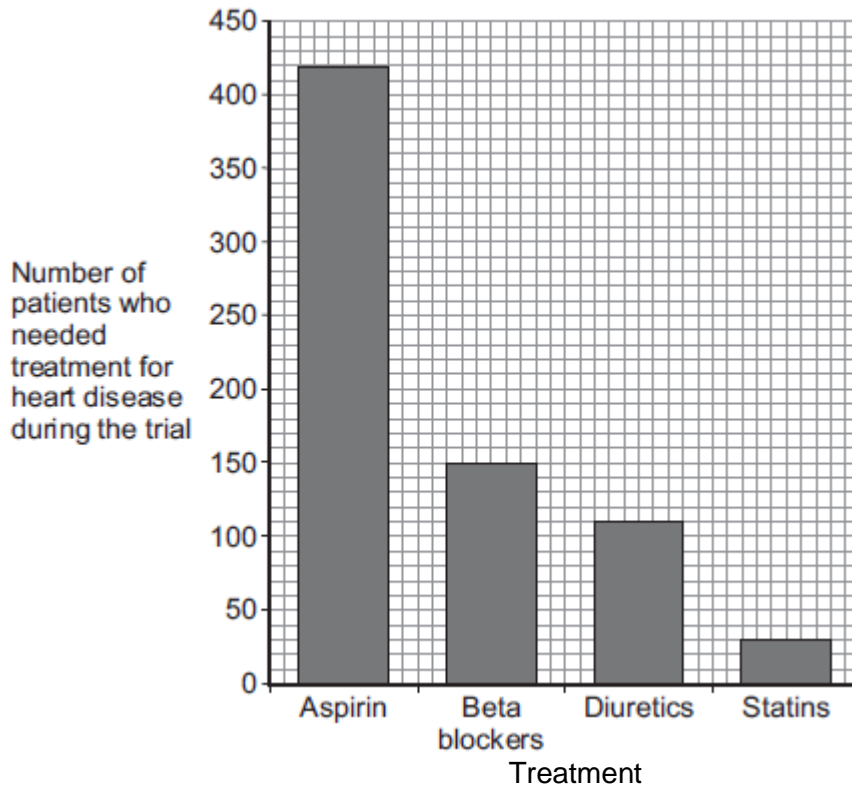
Only the doctor

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.



- (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)

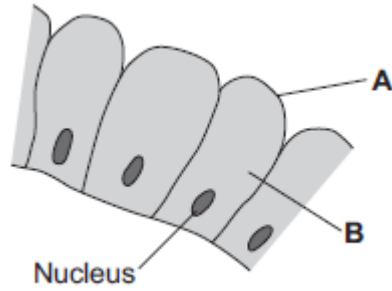
- (iii) Suggest **one** other factor that a doctor might consider before deciding which treatment to use for a patient.

(1)

(Total 11 marks)

Q12.

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



(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)

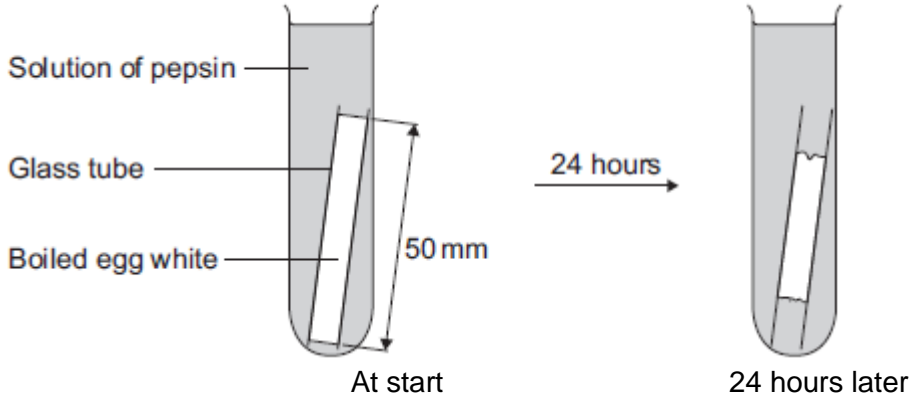
Q13.

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:

- 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
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)

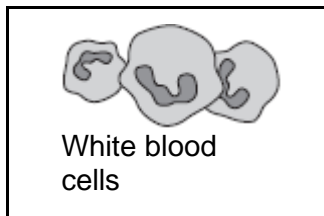
Q14.

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

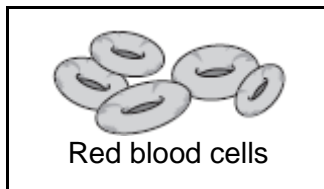
Draw **one** line from each part of the blood to its correct function.

Part of the blood

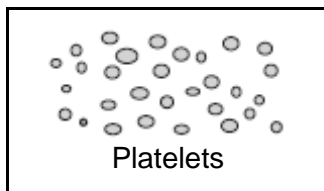
Function



carry glucose around the body



carry oxygen around the body



help the blood to clot

destroy microorganisms

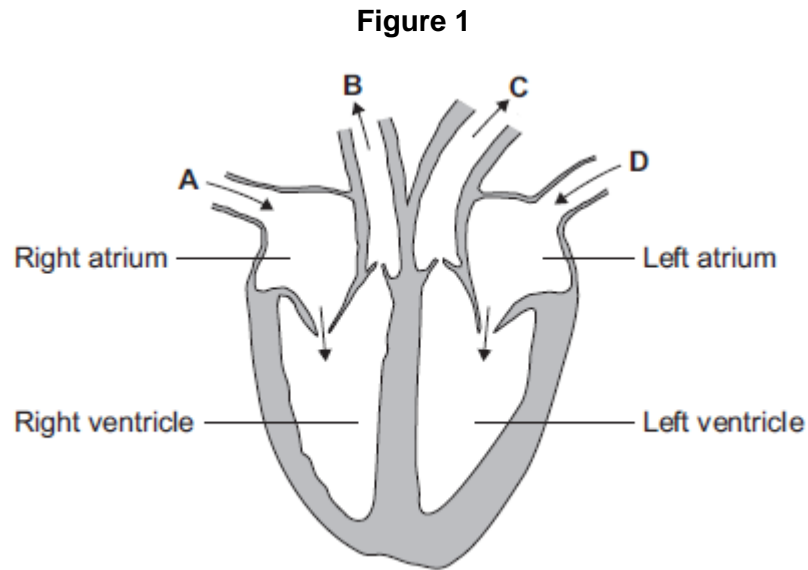
(3)

(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.

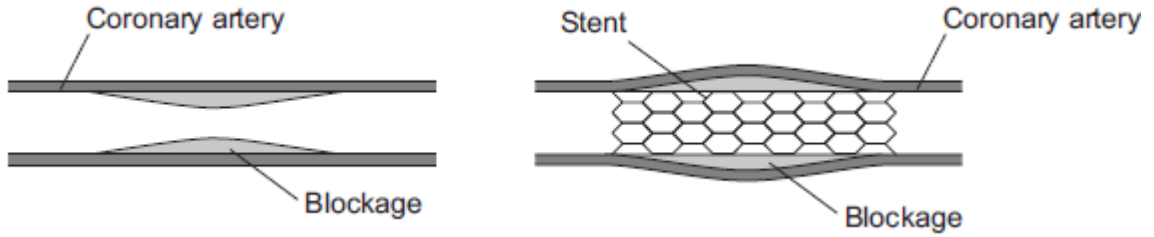


- (i) Which arrow, **A**, **B**, **C** or **D**, shows blood leaving the heart in the pulmonary artery to go to the lungs? (1)
- (ii) Which arrow, **A**, **B**, **C** or **D**, shows blood from the lungs entering the heart in the pulmonary vein? (1)
- (iii) Valves in the circulatory system make sure 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.

(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.

They contain haemoglobin.

They are small fragments of cells.

(1)

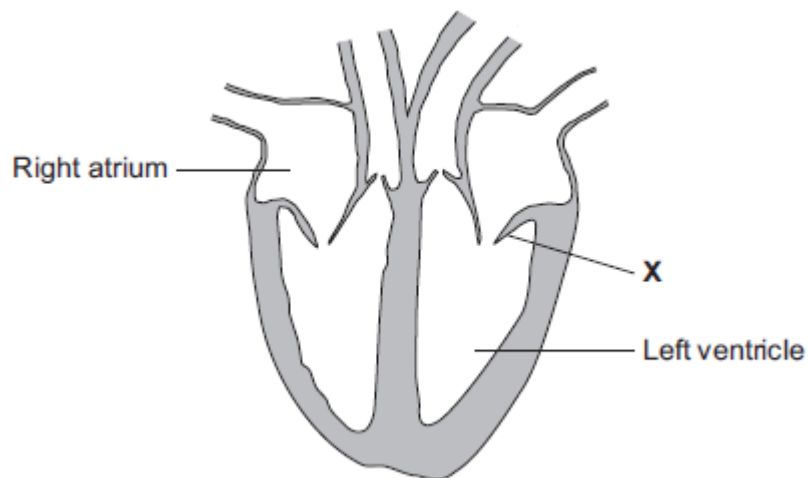
- (b) Urea is transported by the blood plasma from where it is made to where the urea is excreted.

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.

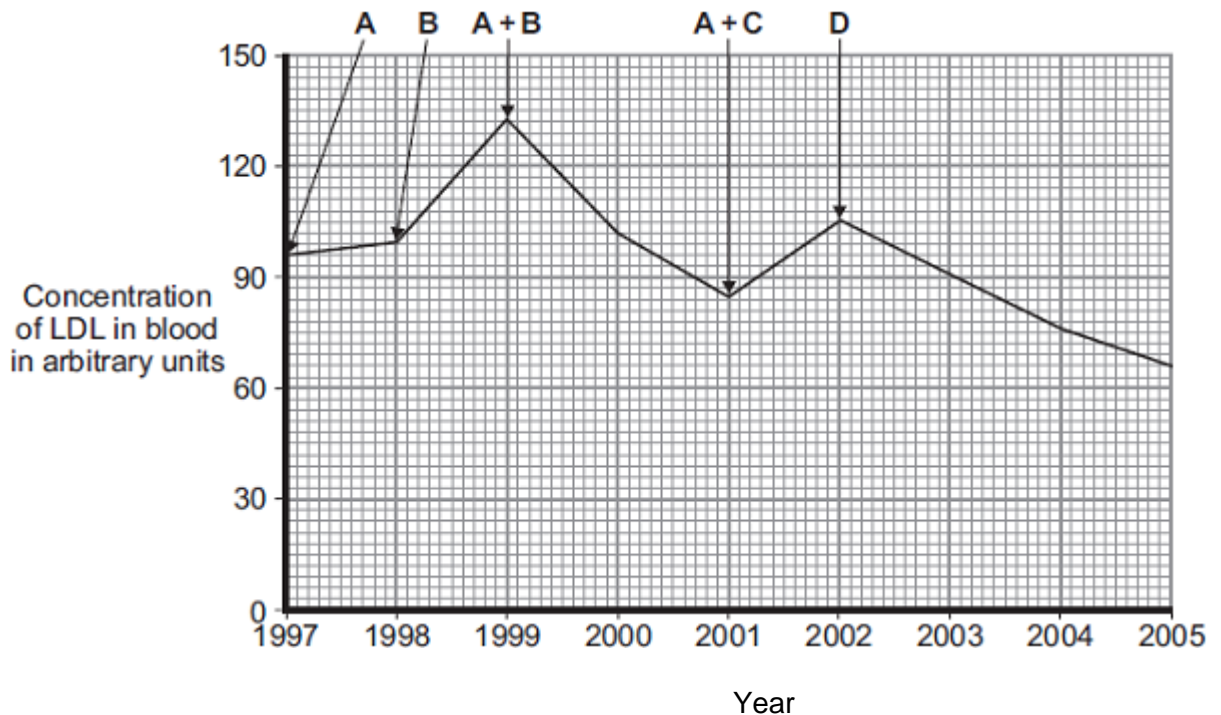
LDL is one form of cholesterol found in the blood.

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.

(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.

Which organ? _____

(1)

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

Answer = _____ cm³ 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

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)

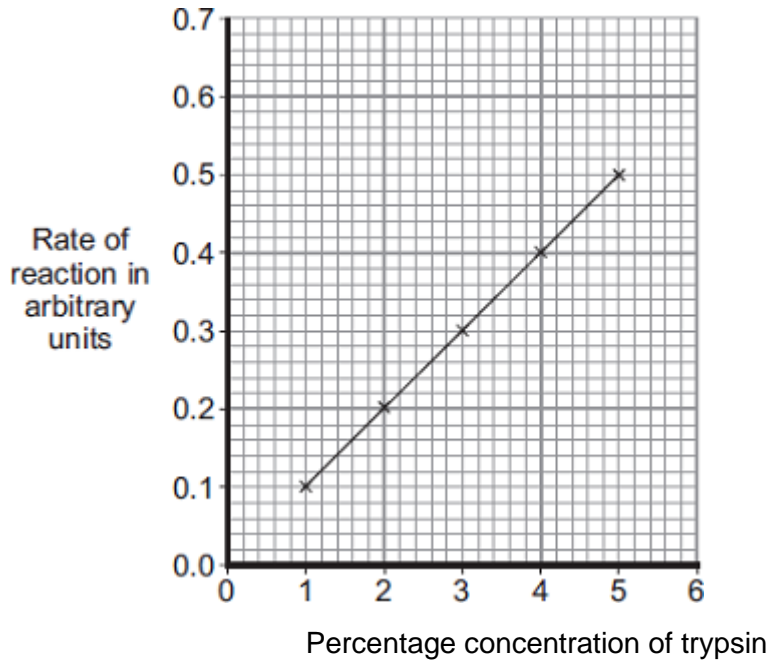
Q18.

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.

(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.

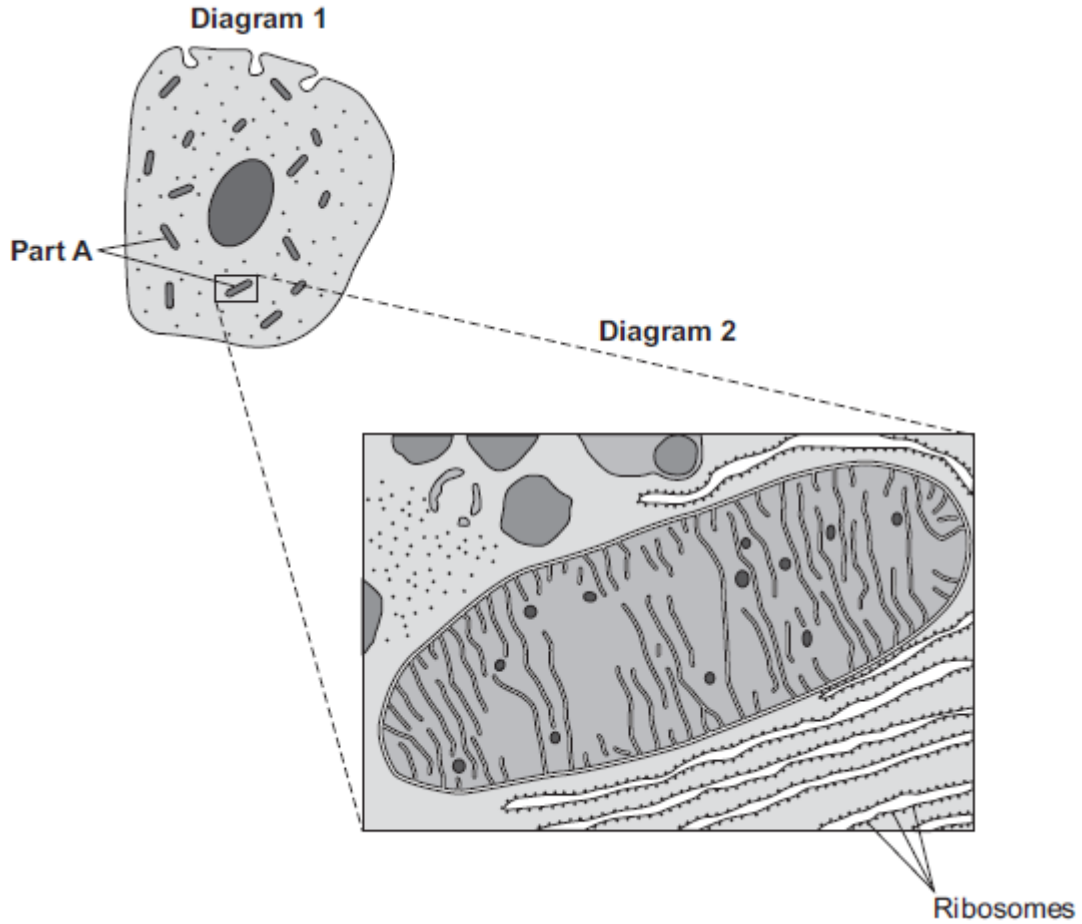
(2)

(Total 11 marks)

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.



(2)

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

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

(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.

- 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

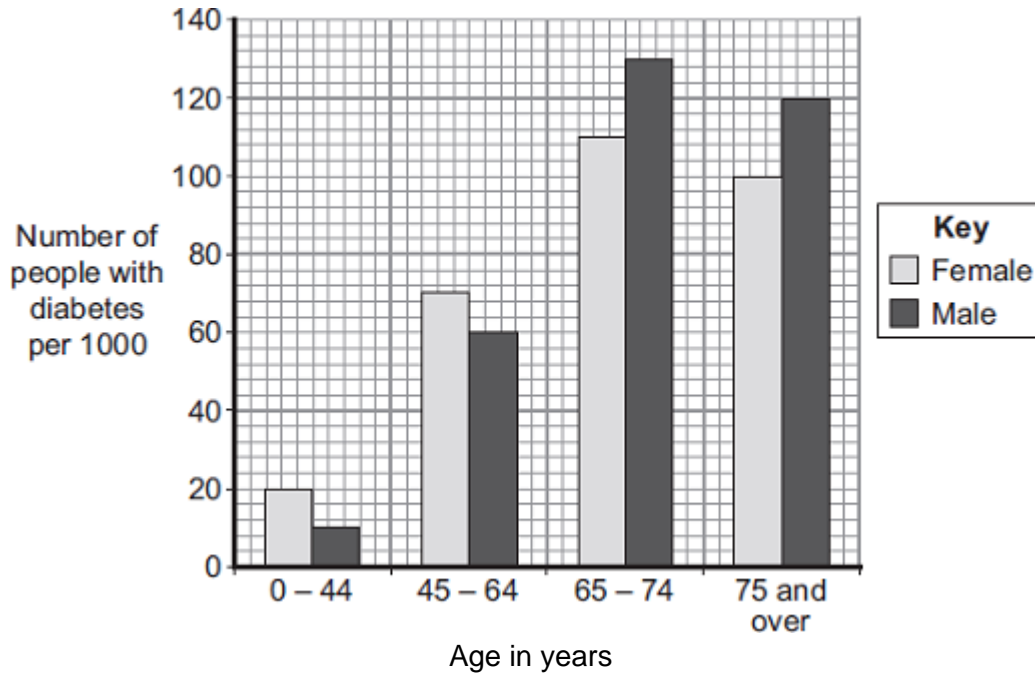
protein

(1)

- (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

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)

(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

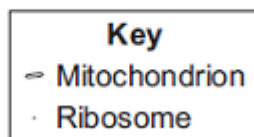
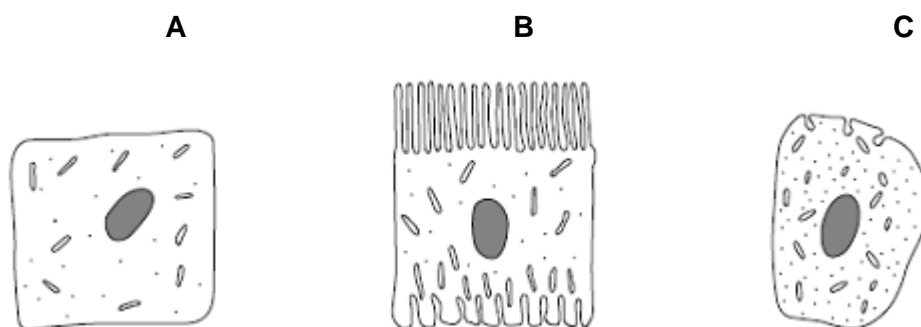
protease

(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.

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

Table 2
Effect of temperature

Temperature in °C	Time taken to digest lactose in minutes
25	20
30	14
35	11

7.0	7
8.0	5
9.0	6

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.

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.

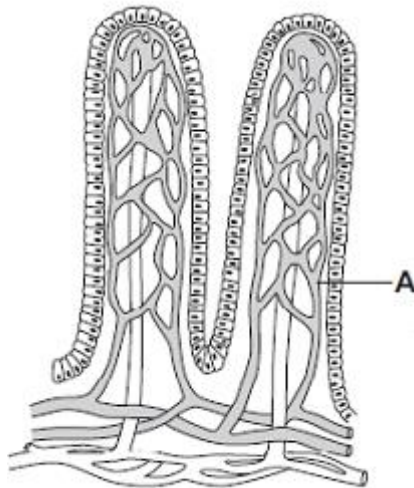
(2)
(Total 7 marks)

Q25.

Villi are found in some parts of the digestive system.

Diagram 1 shows two villi.

Diagram 1



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

(i) Structure **A** is a

muscle.
nerve.
capillary.

(1)

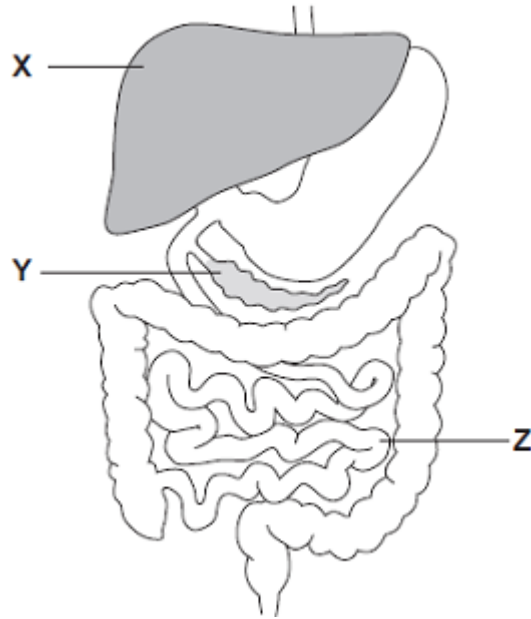
(ii) The villi absorb the products of digestion by

dialysis.
diffusion.
osmosis.

(1)

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

Diagram 2



- (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?

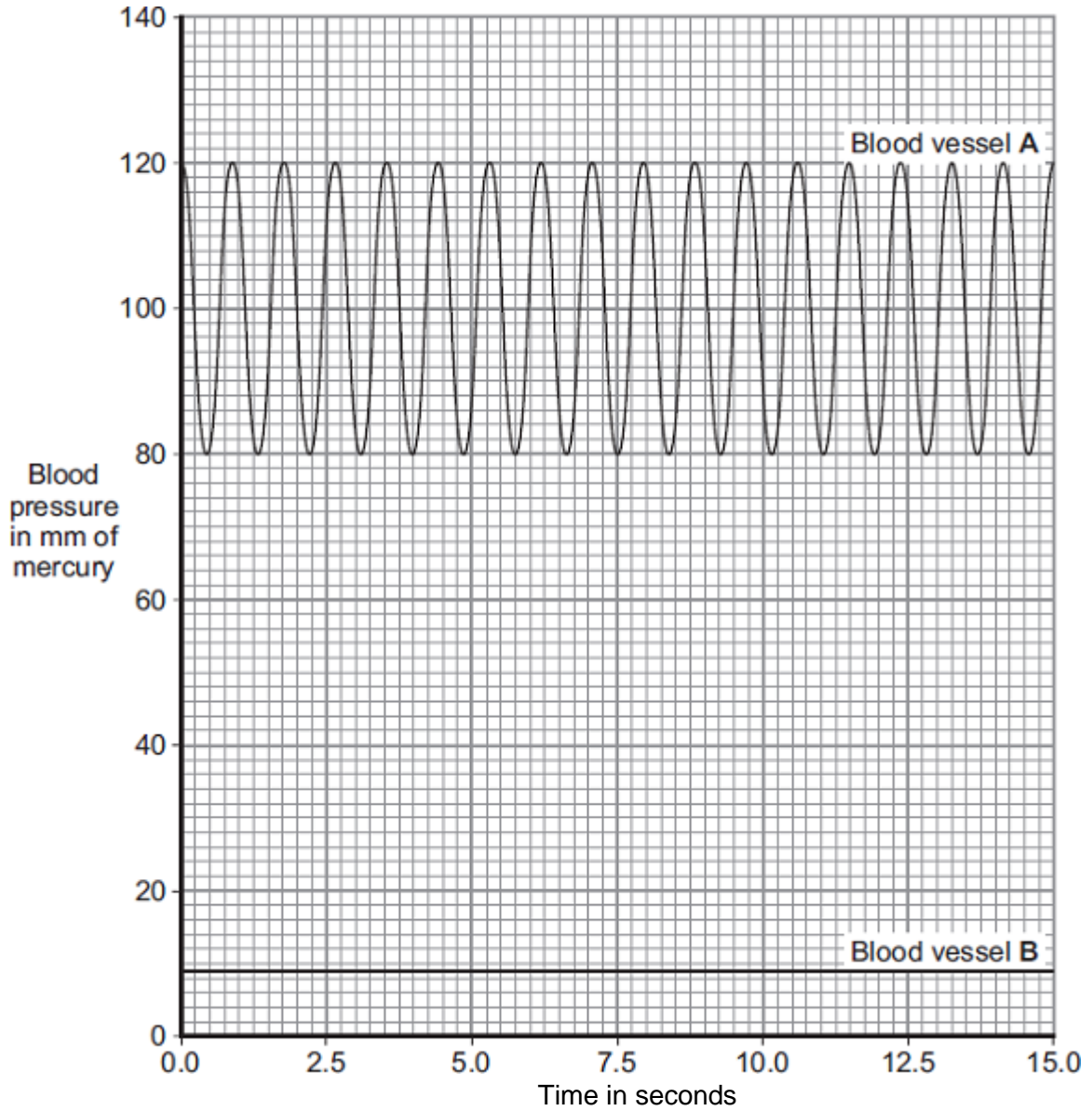
(1)

(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.



- (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? _____

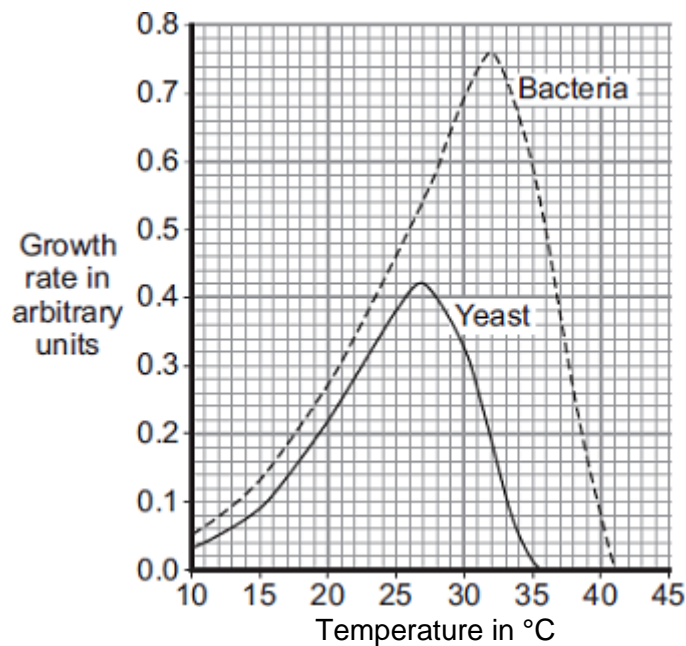
(1)

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.



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

Use information from the graph to explain why.

(2)

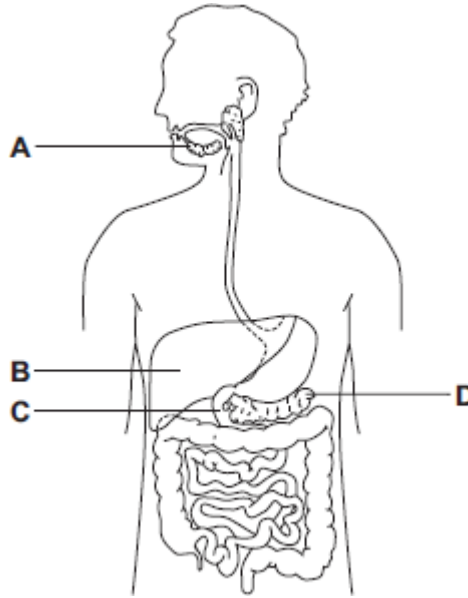
- (ii) The bread tastes most sour if it rises at 32°C.

Use information from the graph to explain why.

(2)
(Total 7 marks)

Q28.

The diagram shows part of the human digestive system.



(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**.

(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 cm³ of a food substance in each of 6 test tubes
- added 1 cm³ 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)

- (ii) Tumours can be malignant or benign.

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

(1)

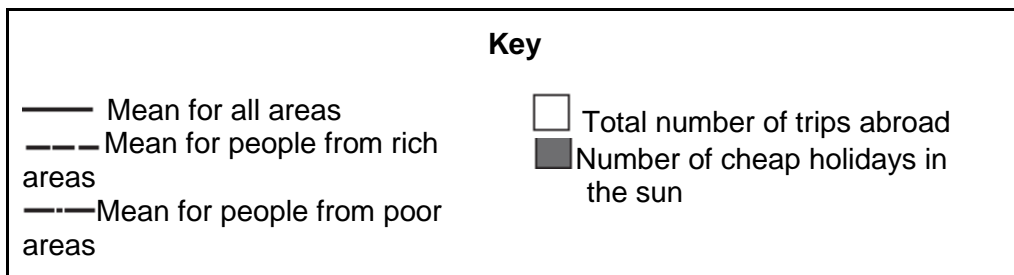
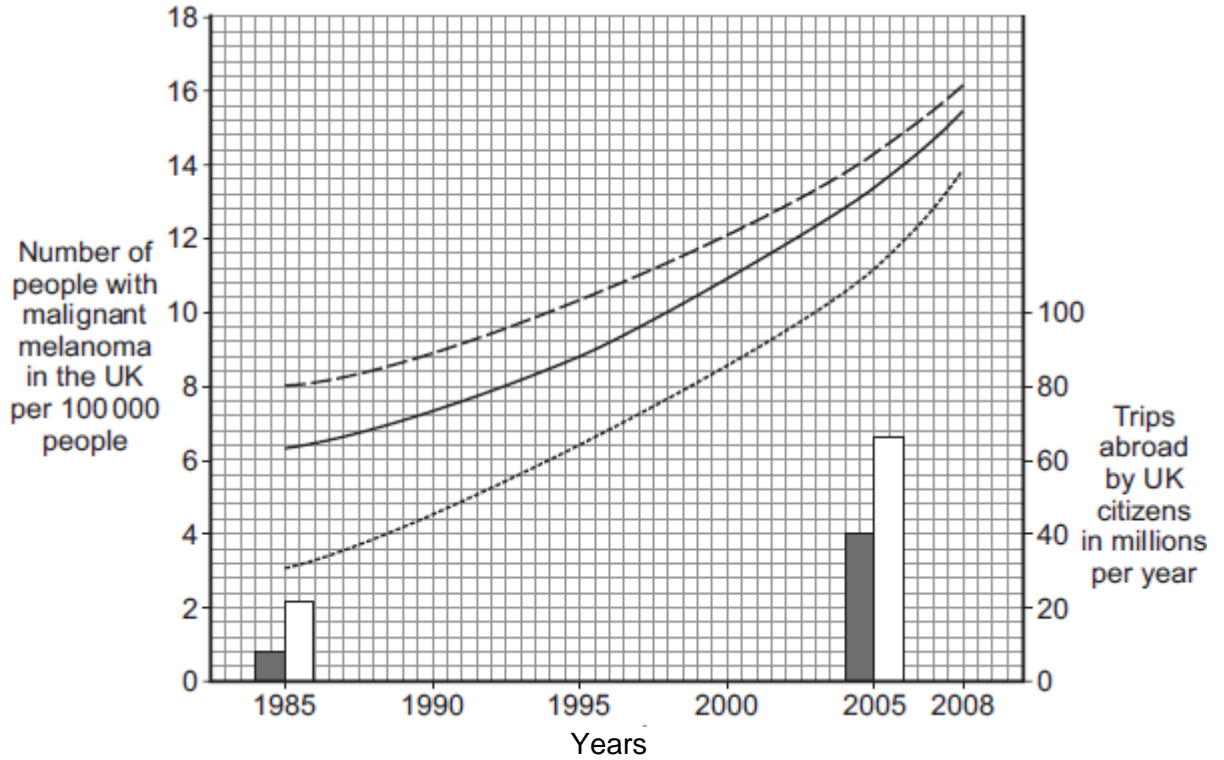
- (b) Describe how some tumours may spread to other parts of the body.

(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.



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

(3)

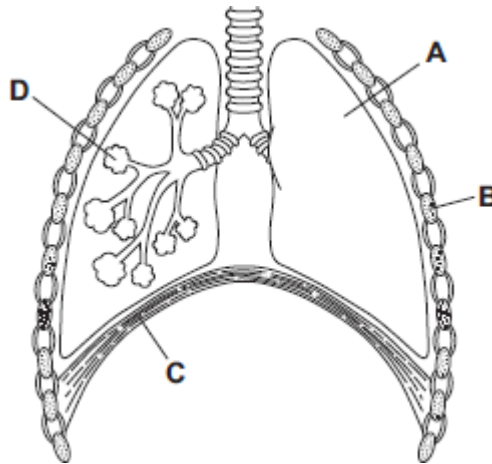
- (ii) Use the data about the number of trips abroad to suggest an explanation for the trends you have described in part (c)(i).

(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** _____
- C** _____
- D** _____

(4)

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

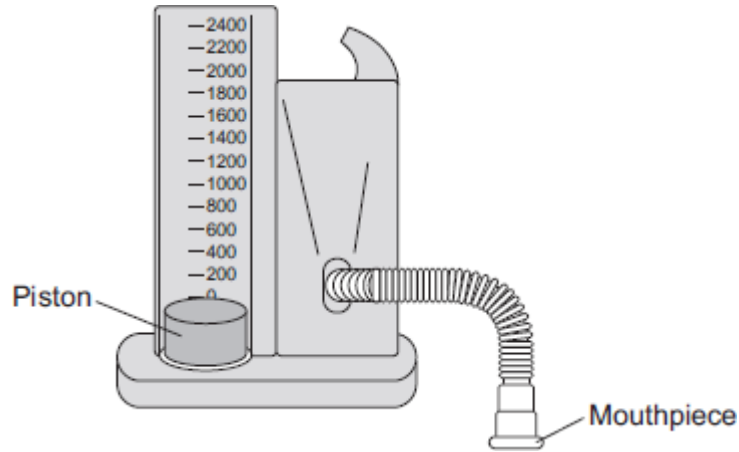
Part **B** moves _____

Part **C** moves _____

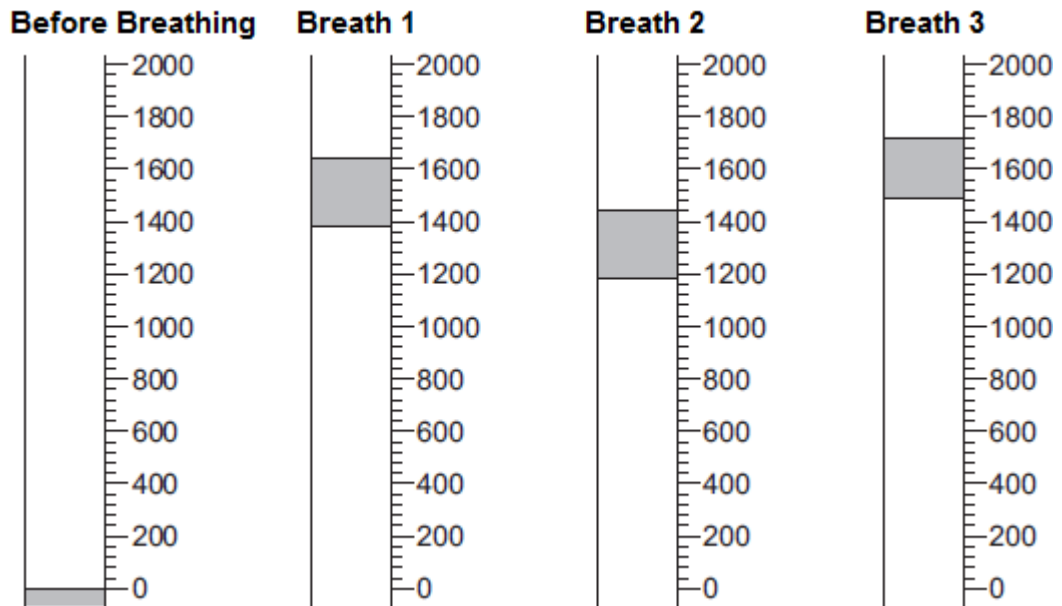
(2)

(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 .



(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



© 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.

(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.

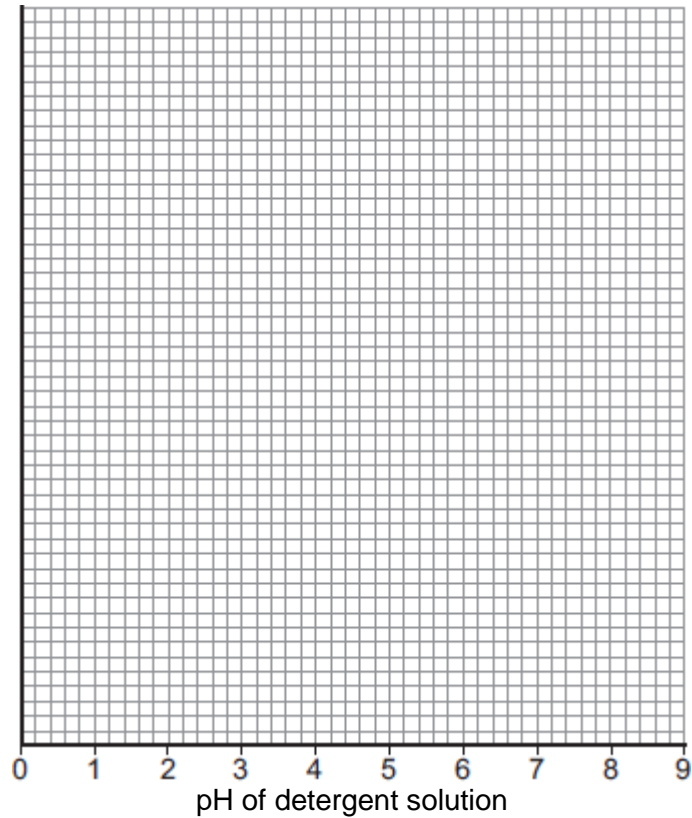
(6)

- (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.



(4)

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

pH _____

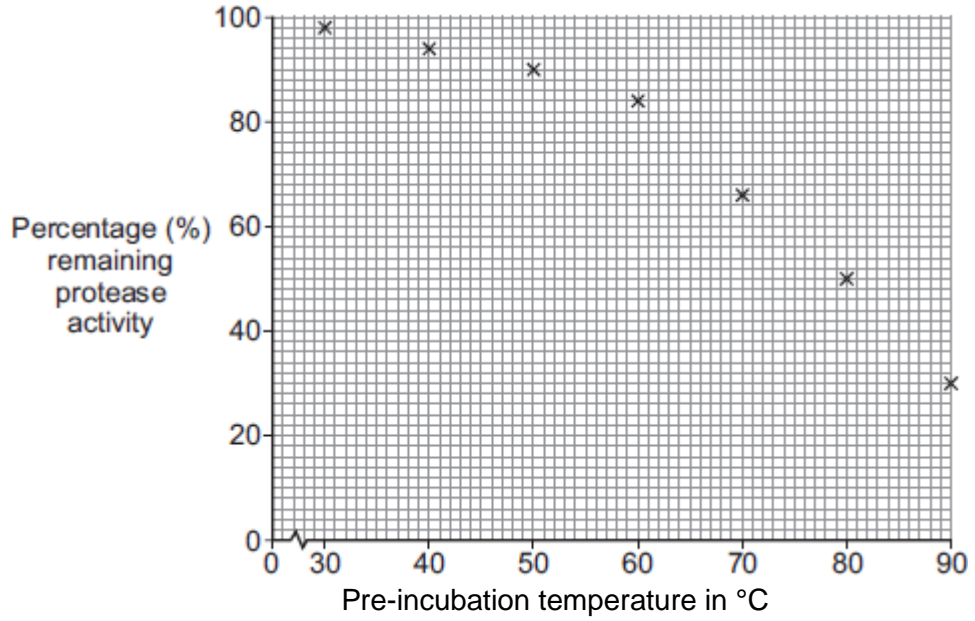
(1)

(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.



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.

(6)

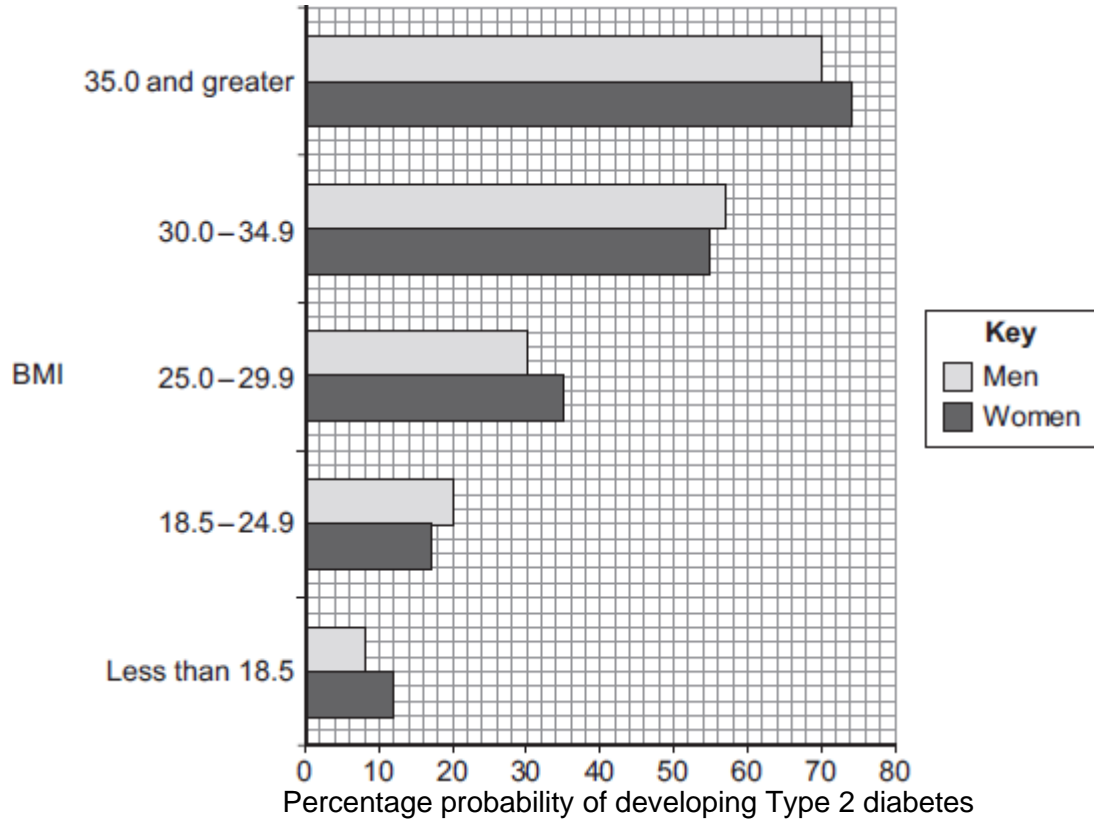
(b) What is Type 2 diabetes?

(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

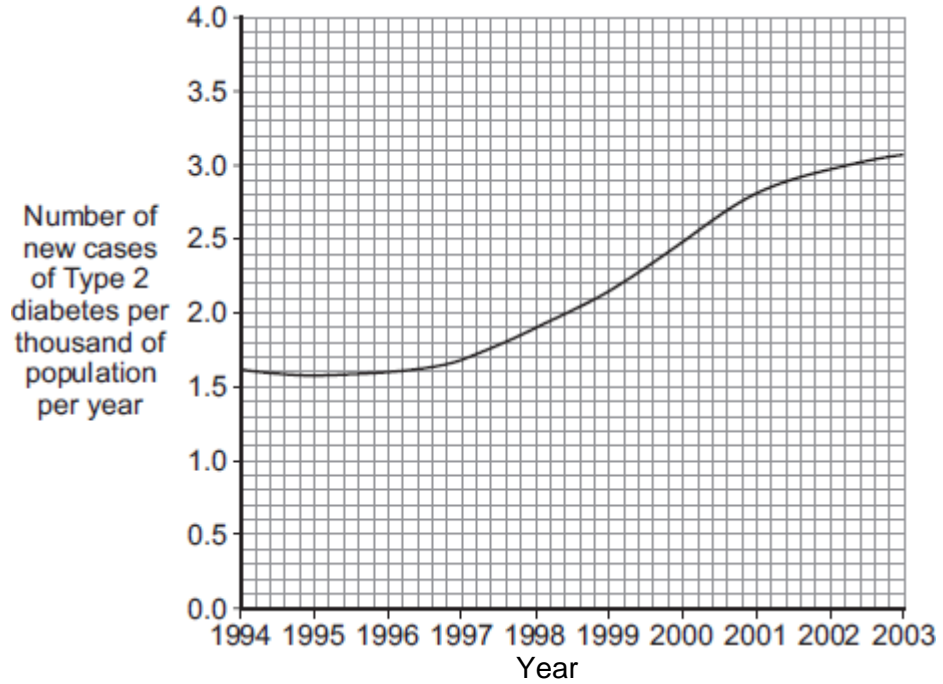


Suggest an explanation for the relationship between BMI and the risk of developing Type 2 diabetes.

(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**.

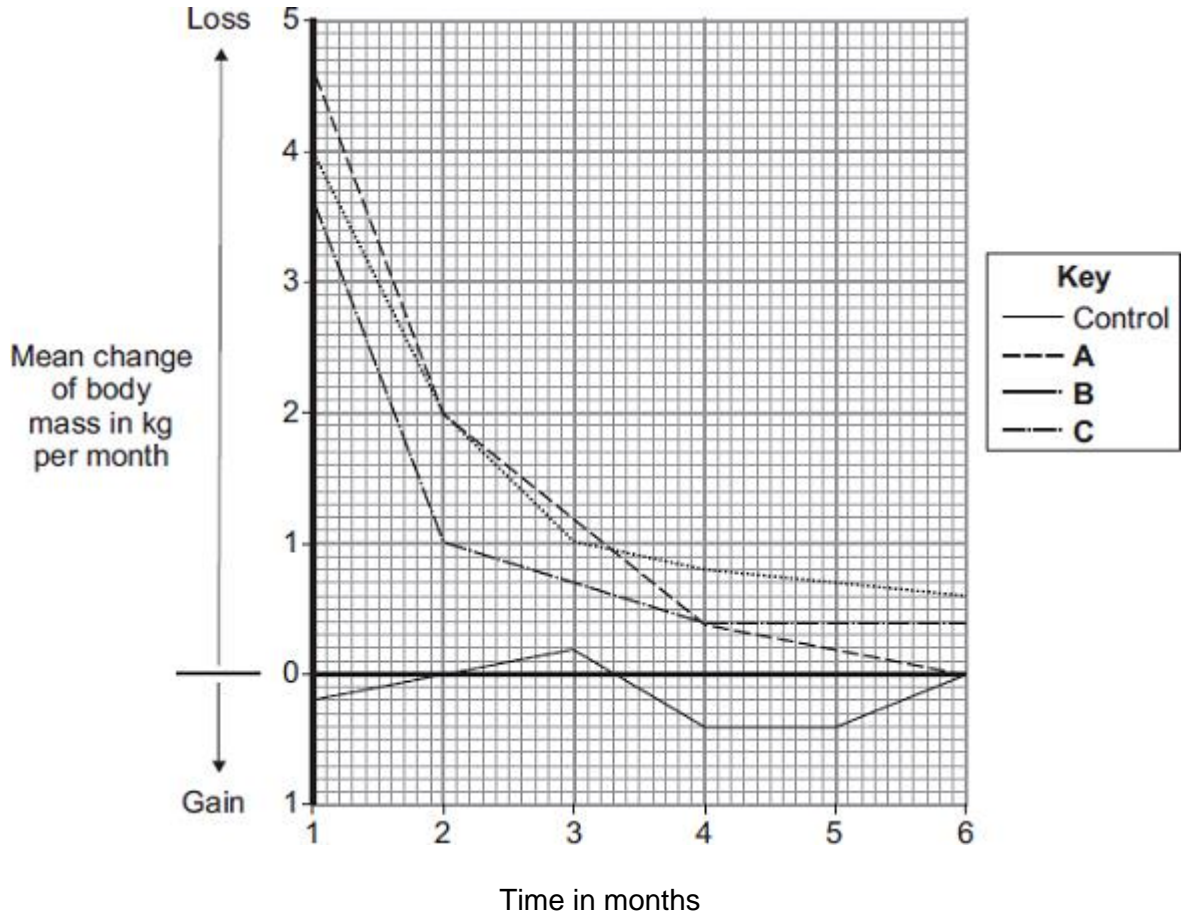
(3)
(Total 12 marks)

Q33.

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

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.

(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. _____

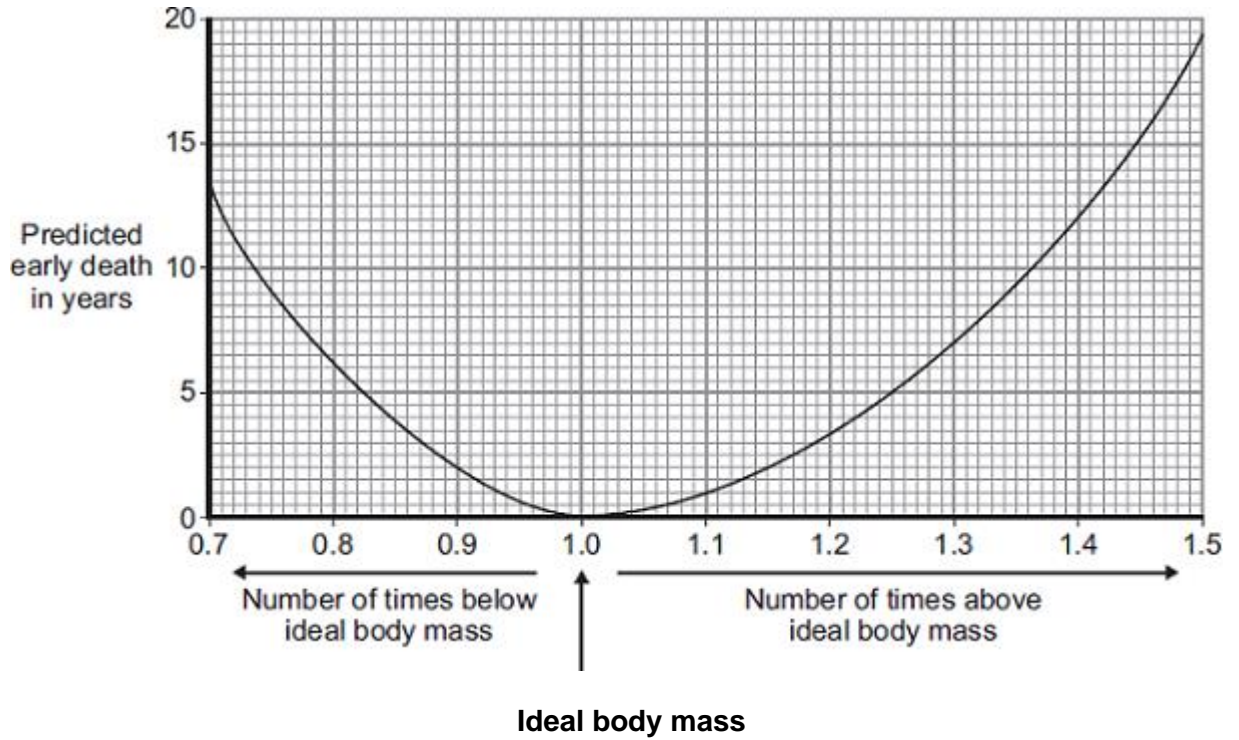
2. _____

(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.



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)

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
<p>Statins are only available on prescription from doctors.</p> <p>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%.</p> <p>Approximately 0.1% of the patients suffered serious muscle damage and 0.01% suffered kidney failure.</p> <p>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.</p>	<p>Aspirin can be bought over the counter. Treatment with aspirin costs up to £15 per year.</p> <p>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.</p> <p>There was a slightly increased risk of damage to the blood vessels in the brain in older patients.</p> <p>Aspirin was found to reduce the risk of non-fatal heart attacks by 31%.</p>

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.

Mark schemes

Q1.

- (a) any **two** from:
- carbon dioxide / CO₂
 - urea
 - protein
 - water / H₂O
 - hormones / insulin.
- ignore food / waste / alcohol / drugs / enzymes*
ignore glucose and oxygen
*allow **two** correct hormones for 2 marks*
*allow **two** correct food components for 2 marks*
allow antibodies
allow antitoxins
- 2
- (b) (i) plasma
- 1
- platelets
- 1
- (ii) (cardiac) muscle
- allow muscular*
- 1
- (c) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking Guidance and apply a 'best-fit' approach to the marking.
- 0 marks**
No relevant content
- Level 1 (1–2 marks)**
There is a description of at least one advantage of the cow tissue valve
or
 a description of at least one disadvantage of the cow tissue valve.
- Level 2 (3–4 marks)**
There is a description of at least one advantage of the cow tissue valve
and
 at least one disadvantage of the cow tissue valve.
- Level 3 (5–6 marks)**
There is a description of the advantages and disadvantages of the cow tissue valve
or
 a description of several advantages of the cow tissue valve and at least one disadvantage.

Examples of the points made in the response

Advantages of cow tissue valve:

- abundant supply of cows
- so shorter waiting time
ignore can take many years to find a suitable human donor
- no need for tissue typing
- quicker operation
- less invasive **or** shorter recovery time
- cheaper operation costs
- less operation / anaesthetic risks.

Disadvantages of cow tissue valve:

- made from cow so possible objections on religious grounds
ignore ethical arguments
- new procedure so could be unknown risks
allow possible transfer of disease from cow
- risks of using a stent eg. blood clots, stent breaking or valve tearing
- not proven as a long term treatment
- may be rejected
ignore information copied directly from the table without value added.

6

[11]

Q2.

- (a) (i) has the least amount of glucose
*allow least amount of fat **or** no fat*

1

- (to) transfer energy (for the run)
allow (to) release energy (for the run)
*do **not** allow produces energy*
*do **not** allow 'energy for respiration'*

1

- (ii) any **one** from:
- cells will work inefficiently
 - absorb too much water / swell / overhydrate
 - lose too much water / shrink / dehydrate
- ignore turgid / flaccid*
cells burst is insufficient
allow cramp in muscle.

1

- (b) any **three** from:
- thermoregulatory centre
 - (has temperature) receptors
 - (which) monitor blood temperature (as it flows through the brain)

- (temperature) receptors in the skin
 - (receptors) send impulses to the brain
ignore vasoconstriction / vasodilation / sweating
allow hypothalamus
impulses sent to the thermoregulatory centre = 2 marks. 3
- (c) (i) (sports drinks) contain a lot of glucose 1
- (a person with diabetes) does not produce insulin **or** does not produce enough insulin
allow (person with diabetes) has cells which do not respond to insulin
*do **not** allow insulin produced by liver* 1
- so blood glucose / sugar levels will rise too high **or** to a dangerous level 1
- (ii) inject insulin
or
 have an insulin pump (fitted)
*do **not** allow swallow insulin*
accept exercise
accept inhale insulin
*accept take metformin **or** other correctly named drug*
allow pancreatic transplant 1
- [10]**
- Q3.**
- (a) (i) diaphragm
accept phonetic spelling 1
- (ii) (because) the volume (inside the jar) increases
*maximum **two** marks if no reference to correct part of model* 1
- (causing) the pressure to decrease 1
- (and) air enters the balloon
allow oxygen 1
- (b) (i) (so it moves by) diffusion
*do **not** allow osmosis or active transport* 1
- from a high concentration (of oxygen) to a low concentration

*allow down its / oxygen concentration gradient from the air
or to the blood*

or

(because) there is a high(er) concentration (of oxygen) in the air **or** there is a low(er) concentration of oxygen in the blood

ignore reference to amount of oxygen

1

(ii) many gill filaments

must be in the correct pairs to gain 2 marks

1

(give a) large surface / area

*do **not** allow surface area to volume ratio*

or

thin

(so) short diffusion pathway

or

good blood supply

(to) maintain the concentration gradient

or

water continually flows over them / continually ventilated

(to) maintain the concentration gradient

1

[8]

Q4.

(a) (i) diffusion

1

(ii) carbon dioxide

accept CO₂ / CO₂

*do **not** accept CO²*

1

(iii) red blood cells

1

(b) 70

if no / incorrect answer then

70 000 000

or

280 x 0.25 gains 1 mark

ignore doubling the answer

2

(c) allows more gas / oxygen / CO₂
(exchange)

*do **not** accept air*

1

[6]

Q5.

(a) any **three** from:

- parts of organisms have not decayed
accept in amber / resin
allow bones are preserved
- conditions needed for decay are absent
accept appropriate examples, eg acidic in bogs / lack of oxygen
- parts of the organism are replaced by other materials as they decay
accept mineralised
- or other preserved traces of organisms, eg footprints, burrows and rootlet traces
allow imprint or marking of organism

3

(b) (i) teeth for biting (prey)

must give structure + explanation

1

claws to grip (prey)

accept sensible uses

1

wing / tail for flight to find (prey)

1

(ii) any **two** from:

- new predators
- new diseases
- better competitors
- catastrophe eg volcanic eruption, meteor
- changes to environment over geological time
accept climate change
allow change in weather
- prey dies out **or** lack of food
allow hunted to extinction

2

[8]

Q6.

(a) (i) sucrose

1

(ii) fructose is sweeter than sucrose

1

can use less fructose (for same sweetness)

1

cheaper / can use in slimming food

- allow 'less calories '*
accept 'better for diabetics'
- 1
- (b) (i) carbohydrases
- 1
- (ii) denatured / shape changed
ignore 'inactivated'
allow 'enzyme / shape destroyed'
- 1
- (iii) faster reaction
- 1
- so more product made / product made in shorter time
allow '60 °C will kill microorganisms'
- 1
- (c) any **two** from:
- enzyme can be re-used / not wasted
 - constant-flow system
 - can be automated
 - product (= food) not contaminated by enzyme / enzyme may give allergic reaction / no need to separate P from E
- allow 'people do not want to eat enzymes'*
- 2
- (d) any **three** from:
- volume is smaller so costs less to heat / to maintain temperature / to build
 - temperature is cooler so costs less to heat / to maintain temperature / loses less heat to surroundings
 - reaction time is shorter so reduces running costs (re. heating / stirring) or can make more product in time
 - 1-stage product refining c.f. 4 stages, leading to reduced labour / time cost
- need to qualify each point with respect to how it lowers costs*
- 3
- (e) (i) 4500
- correct answer = 2 marks*
allow 1 mark for: 1500 x 3
- 2
- (ii) enzyme used for longer / less enzyme needed
- 1
- less money spent on enzyme
- 1

Q7.

- (a) (i) capillaries 1
- (ii) platelets 1
- (iii) fibrinogen changes to fibrin 1

(b)

✓	x	x	✓
x	✓	x	✓
✓	✓	✓	✓
x	x	x	✓

1 mark per correct row

or

1 mark per correct column

whichever is greater

3

- (c) (i) antibody / antigen has specific shape 1
ignore active site
- antibody fits antigen / has shape complementary to antigen 1
- (ii) group A has anti-B antibodies which bind to B-antigens 1
- join / clump RBCs together so too big to pass through capillary / block capillary 1
- any **one** consequence: lack of O₂ / food / blood supply to body cells or cells can't respire 1
ignore 'cells die' / 'person dies' - look for cause

[11]

Q8.

- (a) (i) stomach 1
- (ii) small intestine 1

(b)

	salivary glands	stomach	pancreas	small intestine
amylase	✓	×	✓	✓
lipase	×	×	✓	✓
protease	×	✓	✓	✓

1 mark per correct row

or

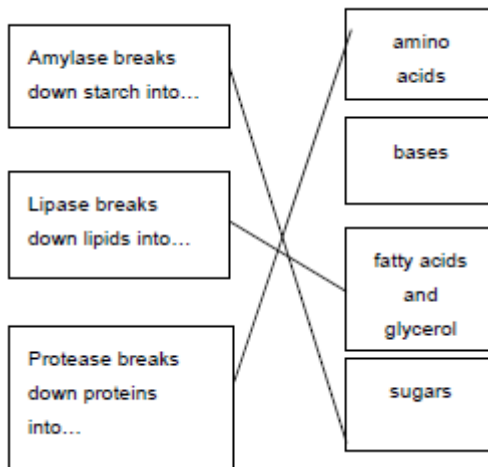
if no correct row max 1 mark for any one correct column

2

- (c) enzyme / protease / pepsin most effective in acid conditions / low pH
 accept optimum / correct pH
 do not accept ref to incorrectly named enzymes
 ignore killing bacteria
 ignore acid breaks down food

1

- (d) **Enzyme** **Breakdown products**



3

[8]

Q9.

- (a) (i) muscular
 (ii) 7
 (iii) an electrical device
- (b) (i) in sequence:

1

1

1

5

- 1
- 7 1
- 2 1
- (ii) 3 1
- (c) (i) prevent backflow (of blood) / allow flow in only one direction / in the correct direction 1
- (ii) A 1
- no mark, but max 2 marks if incorrect*
- 2 / atrium contracts / pressure in 2 increases 1
- blood pushes ball (down / towards ventricle / towards 5) 1
- allow this point even if valve in wrong part of heart*
- (opens valve which) allows blood into 5 / ventricle 1
- or converse points re closing the valve*
- (d) (i) involvement of platelets / eg platelets 'trigger' clotting process / release enzyme(s) / release 'clotting factors' 1
- fibrinogen to fibrin
- or**
- meshwork formed (which traps blood cells) 1
- (ii) any **four** from:
- to gain 4 marks candidates should include at least:*
- one advantage and one disadvantage**
- Advantages**
- (improved circulation / O₂ supply) provides:
- more cell respiration
 - more energy released
 - (more) active life / not so tired / more physical activity
- Disadvantages**
- danger of surgery / operation
 - infection from surgery / operation
 - valve may need replacing
 - clots may form and block blood vessels

- *may need to take anti-coagulants – eg warfarin*
clots may cause heart attacks / strokes

4

[17]

Q10.

- (a) (Type 2) diabetes / heart disease / deficiency disease / named
allow a relevant health problem
*ignore obesity **or** over / under weight / anorexia*

1

- (b) (i) provides more (energy / sugar) than is used
idea of sugar being high in / having a lot of energy eg
contains a lot of calories
*allow it is turned to fat **or** stored (as fat)*

1

- (ii) fat

1

- (c) (i) C

1

- (ii) no health problems
allow as others (may) have (possible) health problems
ignore reference to sweetness

1

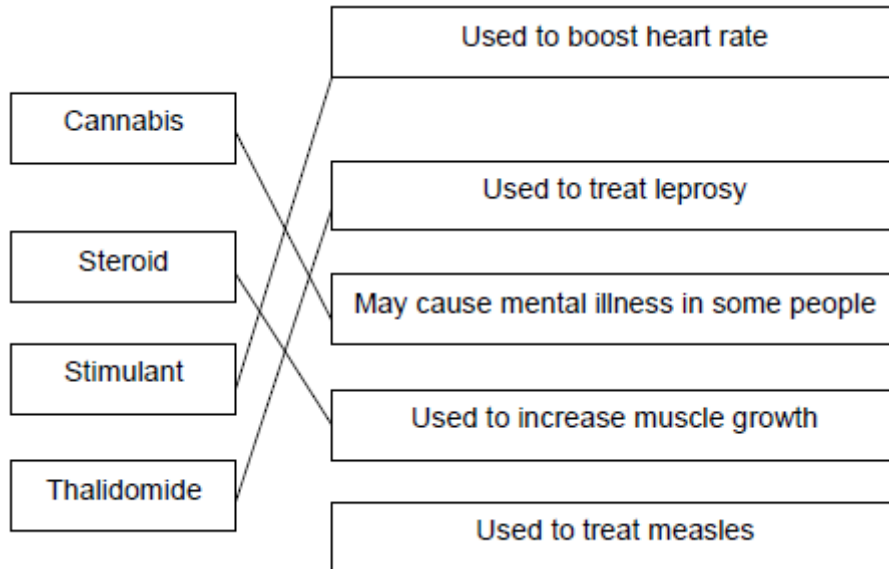
- (iii) idea of informed choice
eg in case you have health problems / allergies
allow legal requirement
ignore diabetes

1

[6]

Q11.

- (a)



extra line from any drug cancels that mark

4

(b) (i) any **one** from:

- (live) animals
accept named examples, eg mice
ignore people / volunteers
- cells
- tissues
*do **not** allow plants*

1

(ii) to check that the drug works

1

to find the best dose to use

1

(iii) only scientists at the drug company

1

(c) (i) 420

1

(ii) statin(s)

1

(iii) any **one** from:

- side effects
allow cost
- other medication
allow patient choice
- other (medical) conditions
*allow family history **or** age*

1

[11]

Q12.

(a) (i) A = (cell) membrane

1

B = cytoplasm

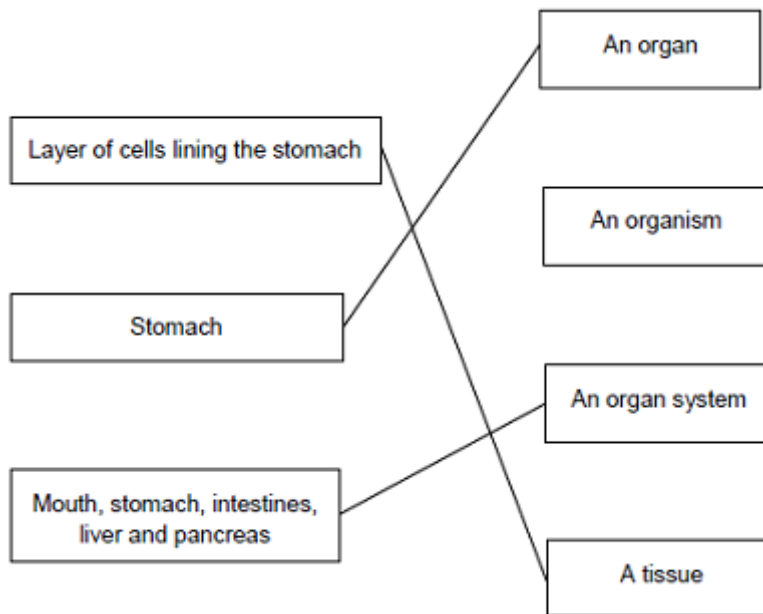
do not accept cytoplasm

1

(ii) To control the activities of the cell

1

(b)



extra lines cancel

3

[6]

Q13.

(a) (i) amino acid(s)

accept peptide(s)

do not allow polypeptide(s)

1

(ii) protease

1

(b) (i) 2

1

(ii) repeat

do not allow other enzyme / substrate

1

using smaller pH intervals between pH1 and pH3

allow smaller intervals on both sides of / around pH2

allow smaller intervals on both sides of / around answer to

(b)(i)

1

(iii) enzyme / pepsin denatured / shape changed

do **not** allow enzyme killed

allow enzyme 'destroyed'

1

enzyme / pepsin no longer fits (substrate)

allow enzyme / pepsin does not work

1

(c) hydrochloric (acid)

allow phonetic spelling

accept HCl

allow HCL

ignore hcl

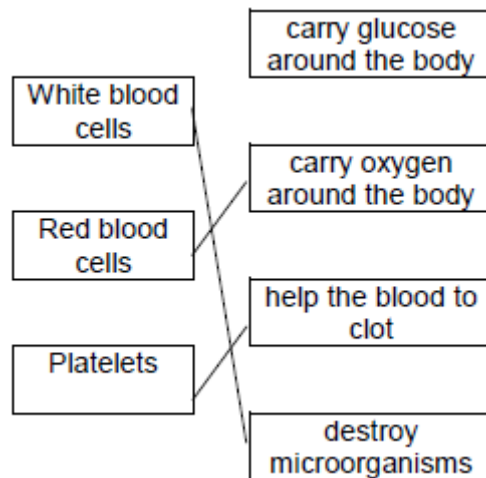
do **not** allow incorrect formula –e.g. H_2Cl / HCl_2

1

[8]

Q14.

(a) (i)



one mark for each line

extra line negates a mark

3

(ii) any **one** from:

- carbon dioxide / CO_2
- urea

do **not** allow urine

ignore water

ignore ions

1

(b) (i) B

- | | | |
|-----------------|---|-------------|
| | | 1 |
| (ii) | D | 1 |
| (iii) | vein
<i>accept correct named examples</i> | 1 |
| (c) | (i) any one from: | 1 |
| | <ul style="list-style-type: none"> • keeps artery / blood vessel open or widens artery / blood vessel • allows (more) blood to heart / cardiac muscle • (allows) blood to flow more easily • allows (more) oxygen to heart / cardiac muscle | 1 |
| | (ii) any two from: | 2 |
| | <ul style="list-style-type: none"> • bleeding
<i>allow blood clots</i> • infection • damaging blood vessels • damaging the heart • risk from anaesthetic | 2 |
| | | [10] |
|
Q15. | | |
| (a) | (i) defence against or destroy pathogens / bacteria / viruses / microorganisms
<i>do not allow 'destroy disease'</i>
<i>accept engulf pathogen / bacteria / viruses / microorganism</i>
<i>accept phagocytosis</i>
<i>accept produce antibodies / antitoxins</i>
<i>allow immune response</i> | 1 |
| | (ii) they are small fragments of cells | 1 |
| (b) | liver

<i>in this order only</i> | 1 |
| | kidney(s) | 1 |
| (c) | any two from: | 1 |
| | <ul style="list-style-type: none"> • that it doesn't cause an immune response or isn't rejected / damaged by white blood cells • whether it is a long lasting material / doesn't decompose / corrode / inert • if it is strong (to withstand pressure) | 1 |

- it will open at the right pressure
- that it doesn't cause clotting
- that it doesn't leak **or** it prevents backflow
- non toxic

ignore correct size

2

[6]

Q16.

A + B most effective (treatment)

ignore descriptions of LDL levels

1

D is (the most) effective (treatment)

D is the best single (treatment)

1

neither A nor B (alone) are effective

allow increase risk of heart disease instead of not effective

1

can't tell if C is effective

OR

A + C is not effective

1

[4]

Q17.

(a) any **two** from:

or allow converse for outdoors

- constant speed
 - *variable speed*
- constant effort
 - *variable terrain*
- constant temperature
 - *traffic conditions*
 - *variable temperature*
 - *wind (resistance)*
 - *rain / snow*

allow weather

allow pollution only if qualified by effect on body function but ignore pollution unqualified

if no other marks obtained allow variable conditions outdoors

2

- (b) Brain 1
- (c) (i) 20 800
correct answer with or without working gains 2 marks
if answer incorrect, allow 1 mark for use of 1200 and 22 000 only 2
- (ii) oxygen
apply list principle 1
*do **not** accept other named substances eg CO₂ water*
- glucose / sugar
allow glycogen
ignore food / carbohydrate 1
- (iii) respire aerobically 1
- (iv) carbon dioxide 1
- lactic acid 1
- (d) increased heart rate
ignore adrenaline / drugs
accept heart beats more but not heart pumps more 1
- [11]**

Q18.

- (a) (i) directly proportional
gains full marks
- or**
 0.1 rise in rate for 1% rise in concentration
*accept increased concentration: increased rate **or** positive correlation **or** proportional for 1 mark* 2
- (ii) 0.6
allow ± 0.01 1
- (b) (0.5% trypsin) cheaper
ignore more profit 1
- (35°C) faster reaction

allow (35°C) optimum / best temperature

1

so takes less time to make product

1

extra heating cost outweighed by savings on enzyme cost

1

(c) (i) any **two** from:

- breaks down / digests food
allow pre-digests protein / food
allow easier for baby to digest
- from protein into amino acids / peptides
- makes soft(er) / runni(er)
allow description of texture change
allow make (more) soluble

2

(ii) correct named enzyme

1

correct function

to gain 2 marks function must relate to correctly named enzyme

Eg

carbohydrase

accept amylase / maltase / lactase

1

starch → sugar **or** lactose → glucose **or** making sugar syrup

or

isomerase

glucose → fructose **or** making slimming foods

or

lipase

fats / oils → fatty acids **or** removal of grease stains

accept other correct example

[11]

Q19.

(a) (i) mitochondrion / mitochondria

must be phonetically correct

- (ii) carbon dioxide / CO₂ 1
- water / H₂O 1
- in either order*
- accept CO₂ but **not** CO²*
- accept H₂O **or** HOH but not H²O*
- (iii) diffusion 1
- high to low concentration
- allow down a concentration gradient* 1
- through (cell) membrane **or** through cytoplasm
- do **not** accept cell wall* 1
- (b) ribosomes make proteins / enzymes 1
- using amino acids 1
- part A / mitochondria provide the energy for the process
- allow ATP*
- do **not** accept produce or make energy* 1

[9]

Q20.

- (a) genes 1
- chromosomes 1
- (b) (i) higher yield 1
- less use of pesticides 1
- (ii) any **two** from:
- uncertain about effects on health
 - fewer bees
 - might breed with wild plant

- seeds only from one manufacturer 2

[6]

Q21.

- (a) pancreas 1
apply list principle

- (b) (i) protein 1
apply list principle

- (ii) any **one** from: 1
- (controlling / changing) diet
accept sugar(y foods) / named eg
ignore references to starch / fat / protein / fibre
 - exercise
accept example, eg go for a run
 - pancreas transplant
accept named drug eg metformin

- (c) (i) increase 1
ignore reference to women

then fall 1

relevant data quote (for male) 1
eg max at ages 65–74 or starts at 10 (per thousand) or max at 130 (per thousand) or ends at 120 (per thousand)
accept a difference between any pairs of numbers in data set
accept quotes from scale eg '130' or '130 per thousand' but
***not** '130 thousand'; to within accuracy of +/- 2 (per thousand)*

- (ii) (between 0 and 64) more females (than males) **or** less males (than females) 1
ignore numbers
allow eg females more diabetic than males

(over 65) more males (than females) or less females (than males) 1
allow eg males more diabetic than females

[8]

Q22.

(a) (i) any **two** from:

- fibres not damaged
- machines last longer / machines not damaged by stones

Only **one** from:

- shorterer time or quickerer
- lowerer temperature
uses less energy or cheaper for energy as an alternative to shorter time / lower temperature, if neither of these given no mark for cheaper unqualified

2

(ii) any **two** from:

- different enzymes (for different dyes)
- enzymes expensive
no mark for expensive alone
- enzymes have to be removed (from denim material) (after washing / treatment)

2

(b) protease

apply list principle

1

[5]

Q23.

(a) **B**

*no mark for "B" alone, the mark is for B **and** the explanation.*

large(r) surface / area **or** large(r) membrane

accept reference to microvilli

ignore villi / hairs / cilia

accept reasonable descriptions of the surface eg folded membrane / surface

*do **not** accept wall / cell wall*

1

(b) (i) any **one** from:

- (salivary) amylase
- carbohydrase

1

- (ii) many ribosomes
do **not** mix routes. If both routes given award marks for the greater.

1

ribosomes produce protein
accept amylase / enzyme / carbohydrase is made of protein

or

(allow)

many mitochondria (1)

mitochondria provide energy to build / make protein (1)
accept ATP instead of energy

1

[4]

Q24.

- (a) stomach is acidic / has low pH
allow any pH below 7
ignore stomach is not alkaline

1

lactase works best / well in alkali / high pH / neutral / non-acidic conditions
allow any pH of 7 and above
accept works slowly in acid conditions
allow figures from table with a **comparison**
ignore reference to temperature

1

- (b) any **three** from:
- (below 40°C) increase in temperature increases rate / speed of reaction
 - reference to molecules moving faster / colliding faster / harder / more collisions
 - enzyme optimum / works best at 40°C
allow value(s) in range 36 – 44
ignore body temperature unless qualified
 - high temperatures (above 40°C) / 45°C / 50°C enzyme denatured
allow synonyms for denaturation, but do **not** allow 'killed'
denaturation at high and low temperature does **not** gain this mark
ignore references to time / pH

3

- (c) any **two** from:

- acid neutralised or conditions made neutral / alkali
accept bile is alkaline
- (allow) emulsification / greater surface area (of lipid / fat)
allow description of emulsification eg fat broken down / broken up into droplets
*do **not** accept idea of chemical breakdown*
- lipase / enzymes (in small intestine) work more effectively / better
allow better for enzymes
ignore reference to other named enzymes

2

[7]

Q25.

- (a) (i) capillary
- (ii) diffusion
- (b) (i) Z
ignore any names
- (ii) large / increased surface / area
allow all food absorbed
- or** to absorb more food
or improved diffusion

1

1

1

1

[4]

Q26.

- (a) A
- no mark - can be specified in reason part*
if B given - no marks throughout
if unspecified + 2 good reasons = 1 mark

high(er) pressure in A
allow opposite for B
*do **not** accept 'zero pressure' for B*

pulse / described in A
accept fluctuates / 'changes'
allow reference to beats / beating
ignore reference to artery pumping

2

- (b) (i) 17

- (ii) 68 1
accept correct answer from student's (b)(i) × 4 1
- (c) oxygen / oxygenated blood
allow adrenaline
ignore air
- glucose / sugar
extra wrong answer cancels - eg sucrose / starch / glycogen
/ glucagon / water
allow fructose
ignore energy
ignore food 2

[6]

Q27.

- (a) (i) A = (cell) wall 1
ignore cellulose
- B = cytoplasm 1
- (ii) any **one** from:
accept has DNA instead of a nucleus, but not just has DNA
- bacterial cell / it has no nucleus
allow no mitochondria
 - DNA free in cytoplasm
ignore size
 - has no vacuole / no vesicles
ignore strands of DNA 1
- (b) (i) yeast grows best / better / well **or** optimum temperature for yeast / more yeast present 1
allow yeast works best / better / well
- (yeast) makes CO₂ **or** respire / respiration
allow fermentation 1
- (ii) bacterium grows best / better / well / more bacteria present **or** optimum temperature for bacterium
ignore microorganisms / microbes

allow works / respire best / better / well

1

(bacterium) makes (lactic) acid
do **not** allow wrong acid

1

[7]

Q28.

(a) **A** – saliva(ry) gland

1

B – liver

1

C – duodenum

ignore small intestine

1

D – pancreas

accept phonetic spellings

1

(b) (i) any **three** from:

- chewing / muscle contraction / mechanical digestion
allow churning
- protease enzymes
allow pepsin / trypsin
- in stomach / small intestine / duodenum / from pancreas
- (break down protein) into amino acids
allow (poly)peptides

3

(ii) neutralises acid pH / makes conditions alkaline

1

so lipase can work

1

emulsifies fat

1

to give large(r) surface area for lipase / enzyme action

1

(c) (i) starch

ignore carbohydrate

1

(ii) breakdown stops

allow slows down

1

because stomach produces / contains acid / has low pH

1

and amylase cannot work in acid / low pH
accept amylase is denatured / changes shape

1

[15]

Q29.

(a) (i) (as a result of) uncontrolled / abnormal growth / division of cells
ignore mutation
allow cells dividing with no contact inhibition

1

(ii) benign tumours do not invade / spread to other tissues / do not form
secondary tumours
accept converse for malignant
accept benign tumours do not metastasise

1

(b) via the blood / circulatory system
accept via lymphatic system

1

(c) (i) incidence is increasing

1

more rapidly (over the years)
ignore figures

1

difference between rich and poor areas is getting less

or

the incidence is rising fastest in people from poor areas
accept converse for people from rich areas

1

(ii) risk factor is UV from sunlight
ignore ionising radiation

1

more UK citizens going abroad or taking holidays in the Sun

or

poorer people can afford holidays in the Sun

or

more poorer people are taking holidays in the Sun

1

[8]

Q30.

- (a) (i) **A** lung 1
- B** rib 1
- C** diaphragm 1
- D** alveolus / alveoli 1
- (ii) (**B** moves) up(wards) / out / up and out 1
- (**C** moves) down(wards) / flattens
*do **not** allow inwards*
ignore outwards
if neither mark gained allow 1 mark for correct reference to muscle contraction 1
- (b) (i) 1640 1
- 1440 1
- 1720
allow max 1 for 3 correct values using of bottom of piston:
1380 + 1180 + 1480 to 1485 1
- (ii) 1600
correct answer gains 2 marks
if answer incorrect allow 1 mark for evidence of
(1640 + 1440 + 1720) ÷ 3
*allow ecf from **(b)(i)***
allow use of two numbers divided by two if one is considered anomalous:

$$\frac{(1640 + 1720)}{2} = 1680$$
for 2 marks 2
- (c) two groups of students – one group sports activity participants, other not
allow students as a group 1
- fair test eg groups same height / same mass / same sex 1
- measure air breathed in by each student / repeat previous experiment then
calculate mean for group

- 1
- (d) pointer remains still after breathing / cylinder will move down after breathing (in) 1
- error reading volume less likely
allow more accurate / reliable 1
- (e) (i) operator squeezes bag 1
- air forced / pushed into lungs
- or**
- positive pressure ventilator 1
- (ii) any **two** from:
- air pressure / volume not regulated
 - operator will tire / must be present at all times / variable intervals
 - too much / too little air
- allow may 'overbreathe' the patient* 2

[20]

Q31.

- (a) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best – fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1 – 2 marks)

The method described is weak and could not be used to collect valid results however does show some understanding of the sequence of an investigation.

Level 2 (3 – 4 marks)

The method described could be followed and would enable some results to be collected but lacks detail.

Level 3 (5 – 6 marks)

The method described could be easily followed and would enable valid results to be collected.

examples of biology points made in the response:

- (use of measuring cylinder to) measure equal volumes of detergent solution
- (use of dropping bottle to) apply same number of drops / amount of stain to each piece of cloth
- include stainless cloth as control

- use of forceps to transfer cloths
 - use of test tubes as containers for detergent solution + stained cloth
 - use water bath to provide a range of temperatures
 - cloths left in detergent solution at each temperature
 - for same length of time or measure time taken to remove stain
 - repetition
 - assessing the stain removal
- 6
- (b) (i) y axis: labelled 'Time (taken to remove stain in) minutes' plus suitable scale
- data spread greater than half of grid*
- 1
- points or bars plotted correctly to within ± 1 mm
- deduct 1 mark for each incorrect plot up to a maximum of 2*
- 2
- one suitable line of best fit drawn on graph
- not feathery*
- not extrapolated to (0,0)*
- not point to point as on this occasion it is inappropriate*
- 1
- (ii) 6 ± 0.1
- accept ecf from student graph*
- 1
- (c) activity of enzyme still very high / 84% / over 80%
- or**
- only lost 15% / 16% activity
- allow above 60 °C marked decrease in activity*
- allow 85%*
- 1
- any **two** from:
- rate of reaction high at 60 °C / higher than at lower temperatures
 - allow in terms of reaction kinetics / collisions*
 - higher temperatures would increase (energy) costs
 - or**
 - might damage cloth
 - ignore enzyme denaturation*
 - higher temperatures / 60 °C is better (than lower temperatures) to remove other stains / named stains
- or**
- better for killing bacteria / infection control
- eg grease*
- 2

[14]

Q32.

- (a) any **six** from:
- hormone(s) / named produced by pancreas
 - if blood glucose levels are too high, insulin is produced / released
 - allowing glucose to move from the blood into the cells / named eg liver
 - glucose is converted to glycogen
 - if blood glucose levels fall, glucagon is produced / released
 - glycogen is converted to glucose
 - causing glucose to be released into the blood
- 6
- (b) diabetes that occurs when the body (cells) do not respond / are less responsive to insulin
- 1
- (c) (i) higher BMIs due to increase in mass / weight (relative to height) / obesity
- 1
- obesity / being overweight / being fat is a (significant) risk factor for Type 2 diabetes
- allow causes Type 2 diabetes*
- 1
- (ii) any **three** from:
- related to described change in diet eg fast foods
 - and less exercise
 - which increases the chance of obesity / increases BMI
 - increased awareness has helped to slow the increase
- 3
- [12]

Q33.

- (a) (i) idea of 'normal' food / diet
- e.g. 'the same as usual' or 'the same as before'*
- allow balanced diet*
- allow none of the slimming programmes*
- ignore healthy diet*
- 1
- (ii) for comparison
- accept to show the test is valid*
- allow to show the effect of the slimming programmes*
- allow to see if the slimming programmes work*
- ignore idea of fair test / reliable*
- do **not** allow accurate / precise*
- 1
- (b) (i) (at first) large / rapid (loss / change of body mass)
- 1
- then small (loss / change) / levelling off
- accept 'loss of mass decreased' for 2 marks*

- 1
- (ii) all lost body mass (compared to the control group) 1
- [5]
- Q34.**
- (a) (i) rate of chemical reactions (in the body) 1
- (ii) any **two** from:
- heredity / inheritance / genetics
 - proportion of muscle to fat **or** (body) mass
allow (body) weight / BMI
 - age / growth rate
 - gender
accept hormone balance or environmental temperature
ignore exercise / activity 2
- (b) (i) 77
correct answer with or without working gains 2 marks
*allow 1 mark for 70 / 56 **or** 1.25 **or** 5* 2
- (ii) increase exercise
accept a way of increasing exercise 1
- reduce food intake
accept examples such as eat less fat / sugar
*allow go on a diet **or** take in fewer calories*
ignore lose weight
ignore medical treatments such as gastric band / liposuction 1
- [7]
- Q35.**
- (a) (substance / chemical) that affects body chemistry / chemical reactions in the body 1
- (b) statin / aspirin / neither recommended
no mark, may be implied. If no recommendation or implication, max 4 marks
answers should be comparative
- any **five** from:

- argued evaluation in favour of aspirin or statin or neither

answers could include reference to

*accept converse for statins / aspirin but **not** as advantage of one **and** disadvantage of other*

for statins:

- more people in studies
- so data / findings more repeatable
accept reliable for repeatable
ignore accurate / precise
- reduces cholesterol but aspirin doesn't
allow reduces cholesterol but no evidence about aspirin
- aspirin (may) causes bleeding / poor clotting but statins do not
allow aspirin causes bleeding / poor clotting but no evidence about statins
- smaller (total) percentage suffer side-effects
- monitored by doctor, aspirins not

for aspirin:

- cheaper
- can be bought over the counter rather than prescribed
- statins cause serious damage / muscle damage / kidney failure but aspirins do not

similarities:

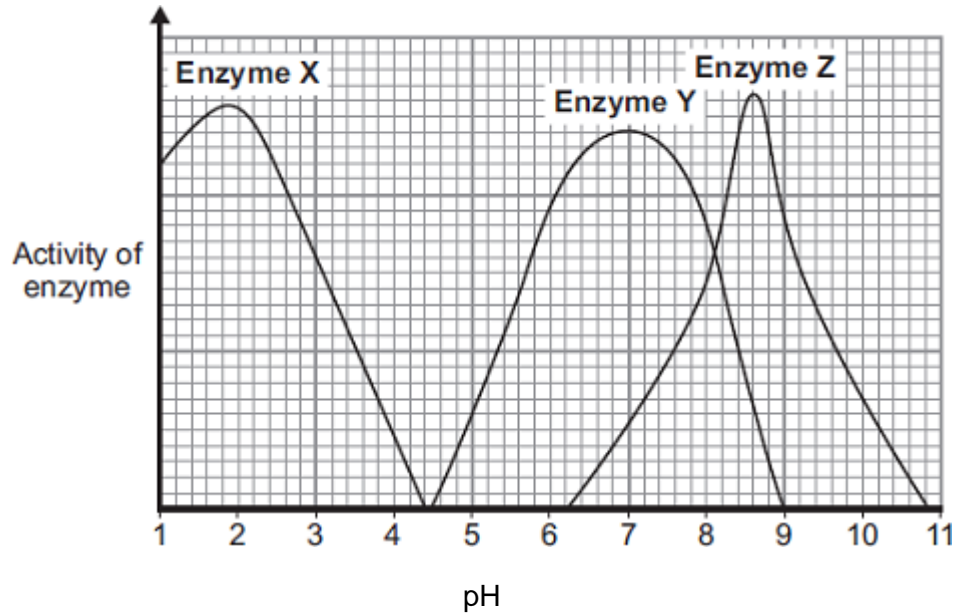
- both have similar effect on reducing (non-fatal) heart attacks
- incidence of side-effects low in both
allow (for aspirin) higher reduction of risk of heart attack

5

[6]

Q1.

- (a) The graph shows the effect of pH on the activities of three enzymes, **X**, **Y** and **Z**. These enzymes help to digest food in the human digestive system. Each enzyme is produced by a different part of the digestive system.



(i) What is the optimum (best) pH for the action of enzyme Z?

(1)

(ii) The stomach makes a substance that gives the correct pH for enzyme action in the human stomach.

Name this substance. _____

(1)

(iii) Which enzyme, X, Y or Z, will work best in the human stomach?

(1)

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

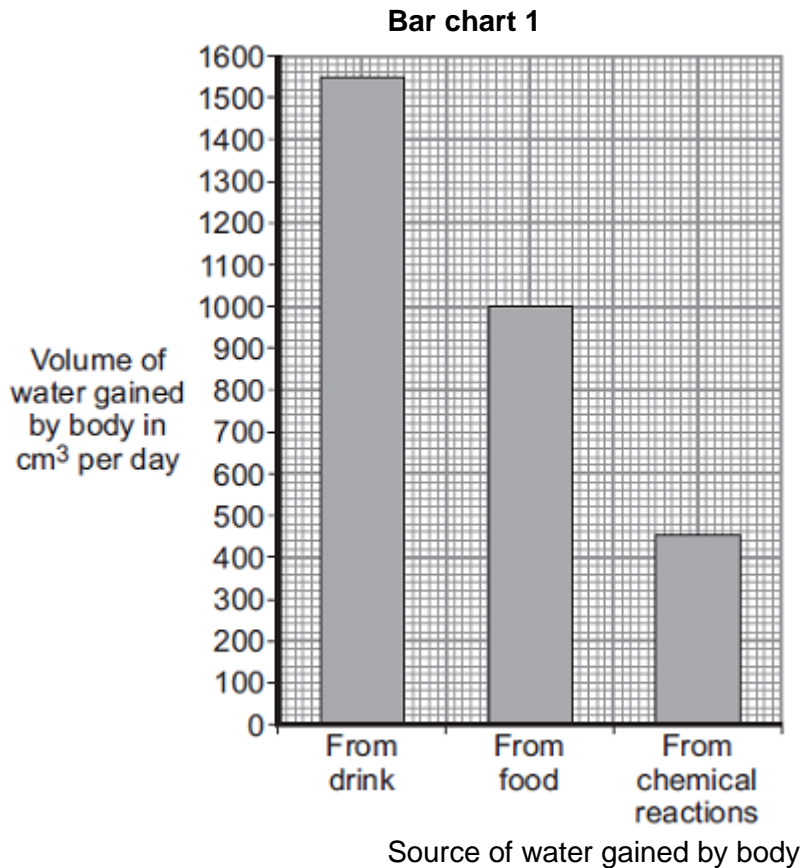
Different parts of the human digestive system help to break down molecules of fat so that they can be absorbed into the body.

Describe how.

To gain full marks you should refer to:

- the enzyme and where the enzyme is produced
- the products of digestion
- any other chemicals involved.

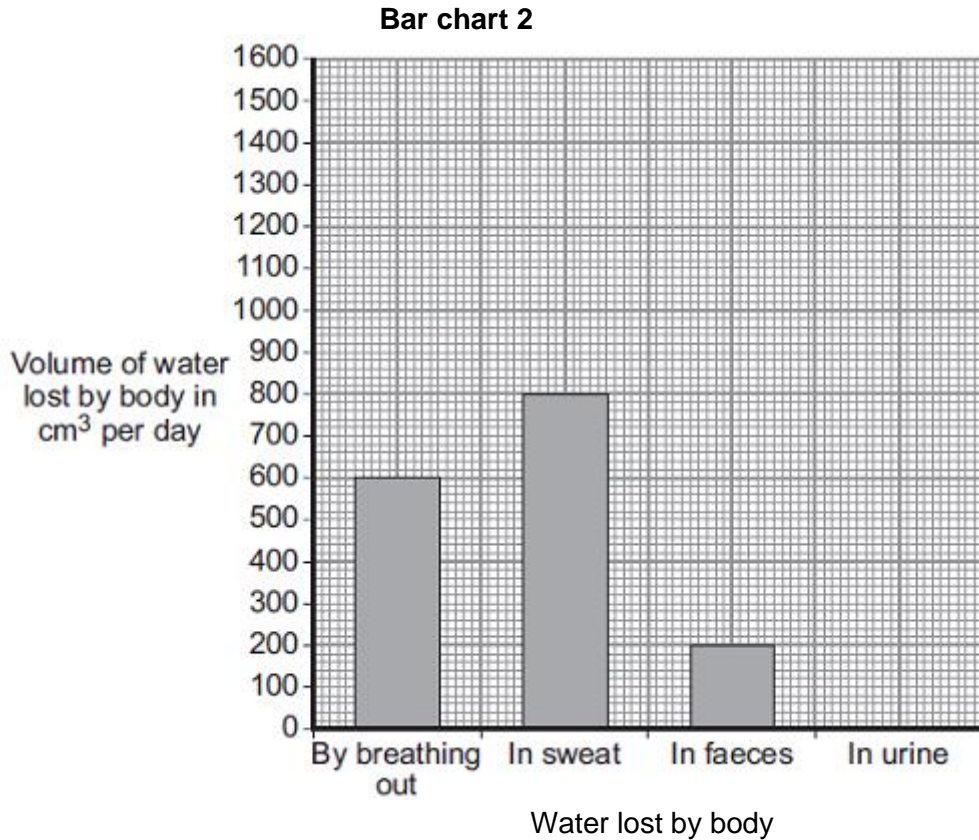
- (a) Which organ labelled on the diagram:
- (i) produces urine _____ (1)
 - (ii) stores urine _____ (1)
 - (iii) produces urea _____ (1)
 - (iv) gets rid of carbon dioxide _____ (1)
 - (v) helps to control body temperature? _____ (1)
- (b) **Bar chart 1** shows the volume of water the human body gains each day.



- (i) Calculate the total volume of water the body gains each day.
- _____
- _____
- _____
- Total volume of water gained = _____ cm³

(2)

Bar chart 2 shows the volume of water lost each day by breathing out, in sweat and in faeces.



- (ii) Calculate the total volume of water lost each day by breathing out, in sweat and in faeces.

Volume = _____ cm³

(1)

- (iii) The volume of water the body loses must balance the volume of water the body gains.

Use your answers to part (b)(i) and part (b)(ii) to calculate the volume of water lost in urine.

Volume of water lost in urine = _____ cm³

(1)

(iv) Plot your answer to part (b)(iii) on **Bar chart 2**.

(1)

(v) After taking some types of recreational drugs, the kidneys produce very little urine.

What happens to the body cells if the kidneys produce very little urine?

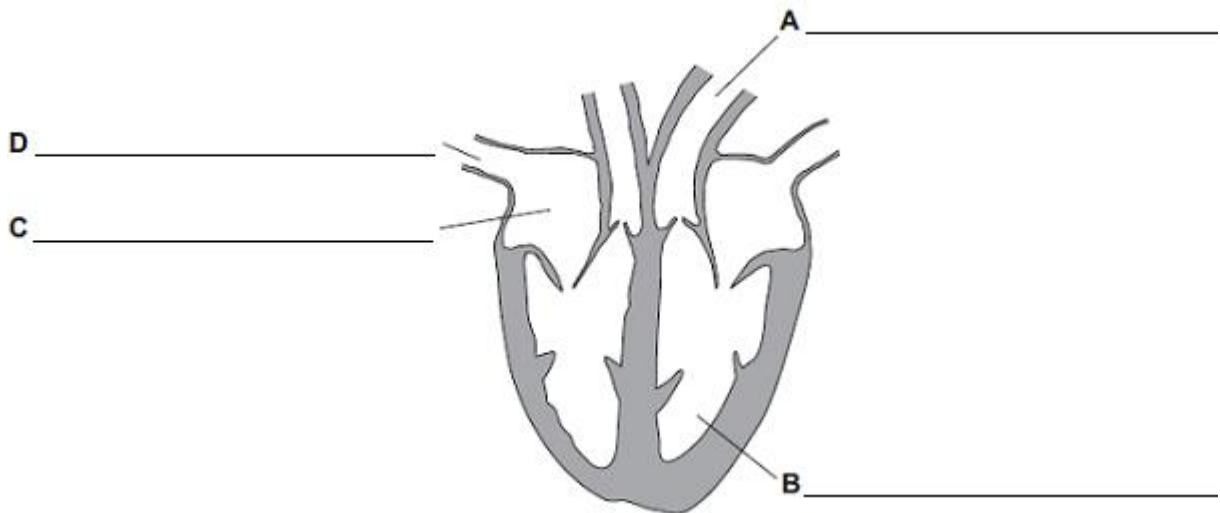
(1)

(Total 11 marks)

Q3.

Diagram 1 shows a section through the heart.

Diagram 1



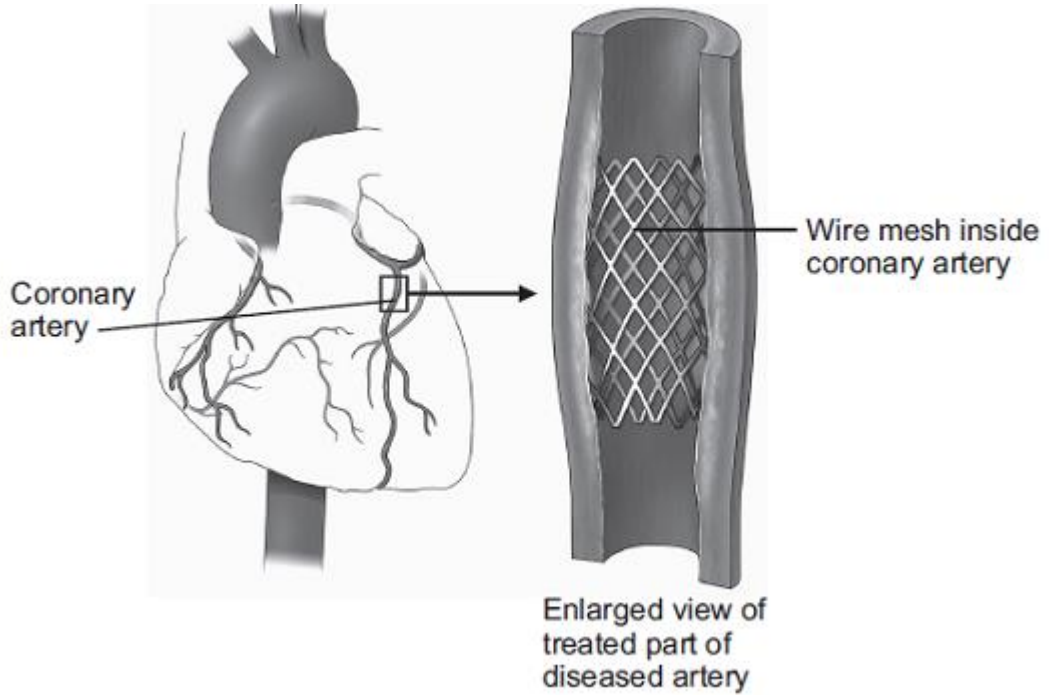
(a) Use words from the box to label parts **A**, **B**, **C** and **D**.

artery	atrium	capillary	platelet	vein	ventricle
--------	--------	-----------	----------	------	-----------

(4)

(b) **Diagram 2** shows one treatment for a diseased coronary artery.

Diagram 2



© Nucleus Medical Art/Visuals Unlimited/Corbis

- (i) Name the treatment shown in **Diagram 2**.

_____ (1)

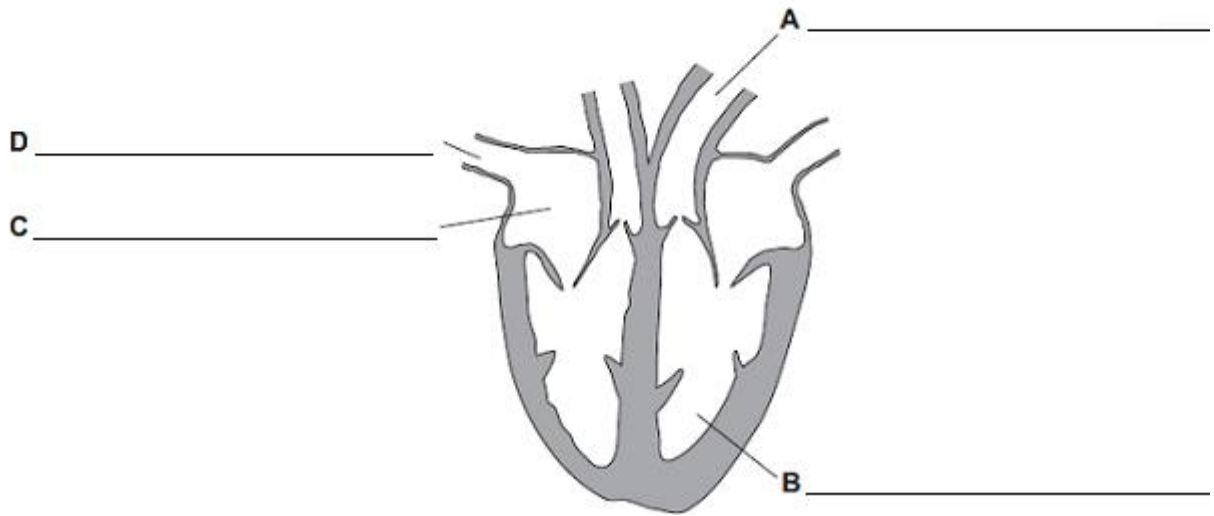
- (ii) Explain how the treatment works.

(2)
(Total 7 marks)

Q4.

Diagram 1 shows a section through the heart.

Diagram 1



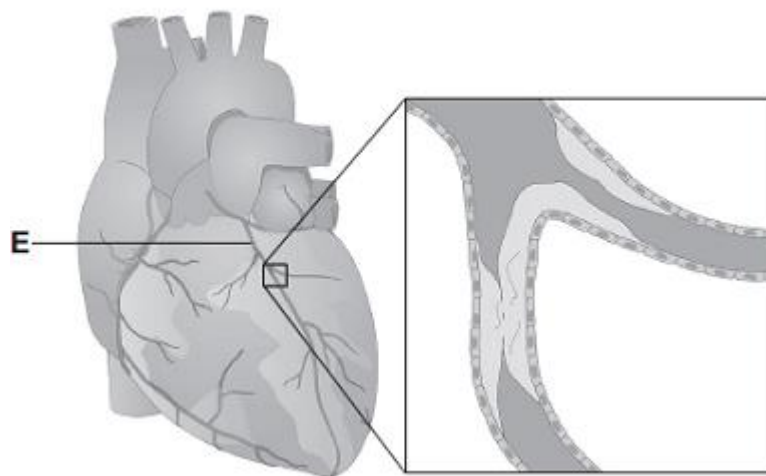
(a) On the diagram, name the parts labelled **A**, **B**, **C** and **D**.

(4)

(b) **Diagram 2** shows the blood vessels that supply the heart muscle.

Part of one of the blood vessels has become narrower.

Diagram 2



© Peter Gardiner/Science Photo Library

(i) Name blood vessel **E**.

(1)

(ii) Give **one** method of treating the narrowed part of blood vessel **E**.

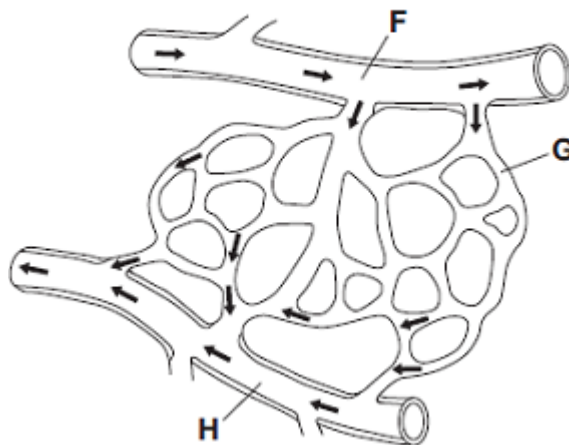
(1)

(iii) Explain how the method of treatment works.

(2)

(c) **Diagram 3** shows part of the blood supply in the lungs.

Diagram 3



(i) Name the types of blood vessel labelled **F**, **G** and **H**.

F _____

G _____

H _____

(3)

(ii) Give **one** way in which the composition of the blood in vessel **F** is different from the composition of the blood in vessel **H**.

(1)

(Total 12 marks)

Q5.

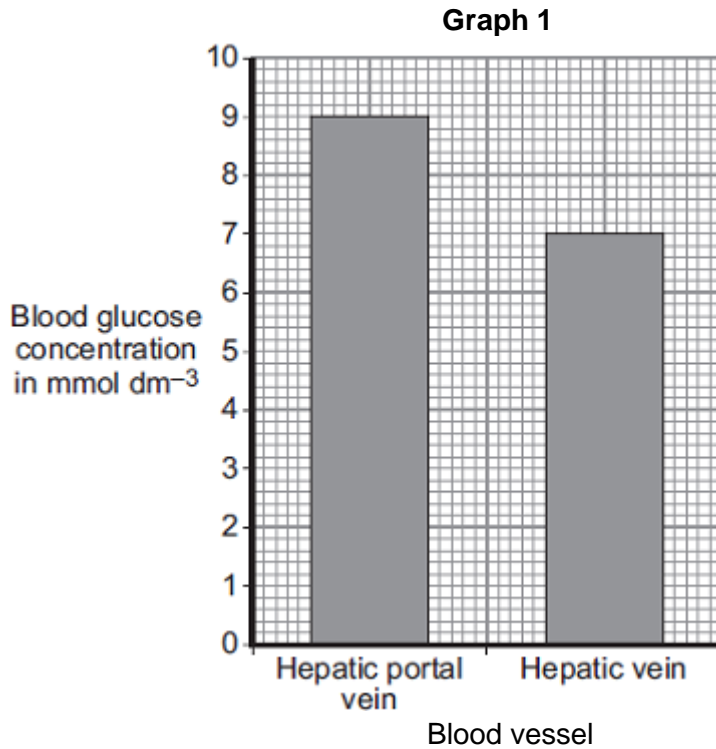
The pancreas and the liver are both involved in the control of the concentration of glucose in the blood.

The liver has two veins:

- the hepatic portal vein taking blood from the small intestine to the liver
- the hepatic vein taking blood from the liver back towards the heart.

Scientists measured the concentration of glucose in samples of blood taken from the hepatic portal vein and the hepatic vein. The samples were taken 1 hour and 6 hours after a meal.

Graph 1 shows the concentration of glucose in the two blood vessels 1 hour after the meal.

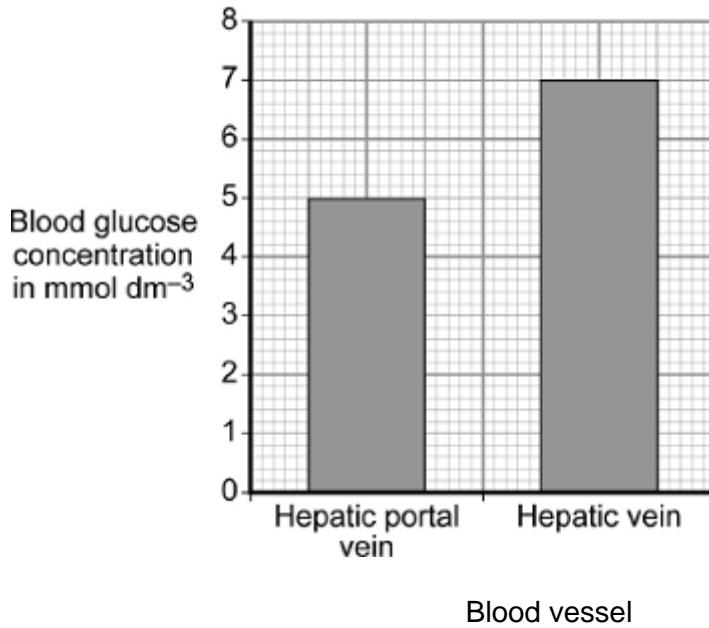


- (a) The concentration of glucose in the blood of the two vessels is different. Explain why.

(3)

- (b) **Graph 2** shows the concentration of glucose in the two blood vessels 6 hours after the meal.

Graph 2



- (i) The concentration of glucose in the blood in the hepatic portal vein 1 hour after the meal is different from the concentration after 6 hours.

Why?

(1)

- (ii) The person does **not** eat any more food during the next 6 hours after the meal.

However, 6 hours after the meal, the concentration of glucose in the blood in the hepatic vein is higher than the concentration of glucose in the blood in the hepatic portal vein.

Explain why.

(3)

(Total 7 marks)

Q6.

The table is from a packet of biscuits.

Average values	Per 100 g	Per biscuit	UK guideline daily amounts	
			Adults	Children (5 – 10 years)
Energy	1974 kJ	446 kJ	8500 kJ	7500 kJ
Protein	7.1 g	1.1 g	45 g	24 g
Carbohydrate	62.8 g	9.3 g	230 g	220 g
Fat	21.3 g	3.2 g	70 g	70 g
Sodium	3.6 g	0.5 g	2.4 g	1.4 g

One day a ten-year-old child ate a whole packet of the biscuits. The biscuits in the pack had a mass of 400 g.

- (a) (i) How many grams of carbohydrate did the child eat?

Number of grams _____

(2)

- (ii) The amount of carbohydrate you calculated in part (a)(i) was more than the UK guideline daily amount for the child.

How much more?

Number of grams _____

(1)

- (b) Give **two** possible health effects on the child of eating so many biscuits every day.

1. _____

2. _____

(2)

(Total 5 marks)

Q7.

Nicotine is a drug in tobacco smoke. Smoking tobacco is harmful.

- (a) (i) Many smokers find it difficult to stop smoking.

Complete the sentence.

It is difficult to stop smoking because nicotine is very _____ .

(1)

- (ii) Nicotine affects synapses in the brain.

What is a synapse?

(1)

- (b) A drug company has developed a new drug, Drug **A**, to help people stop smoking.

Doctors tested the drug in a double-blind trial with over 2000 volunteers who were smokers.

The volunteers wanted to stop smoking.

The volunteers were divided into three groups. Each volunteer took a tablet once a day for 12 weeks:

- group 1 took Drug **A**
- group 2 took Drug **B** (a drug already in use to stop people smoking)
- group 3 took a placebo.

The smoking habits of each group were recorded for a year.

- (i) What is a placebo?

(1)

- (ii) Why is a placebo group used in drug trials?

(1)

- (iii) Which people knew what was in each tablet, in this trial?

Tick (✓) **one** box.

Both doctors and volunteers

Doctors but not volunteers

Neither doctors nor volunteers

(1)

(iv) It is important that the three groups of volunteers should be similar.

Give **two** factors that should be similar in the groups of volunteers.

1. _____

2. _____

(2)

(c) The table shows the results of the trials.

Tablet	Percentage of volunteers who had stopped smoking	
	After 12 weeks	After 1 year
Drug A	44	23
Drug B	30	15
Placebo	18	10

A doctor looked at the results of the tests.

The doctor suggested that a smoker who wanted to give up smoking should use Drug **A**.

Why?

(1)

(Total 8 marks)

Q8.

The concentration of cholesterol in the blood affects people's health.

(a) Give **two** factors that affect the concentration of cholesterol in the blood.

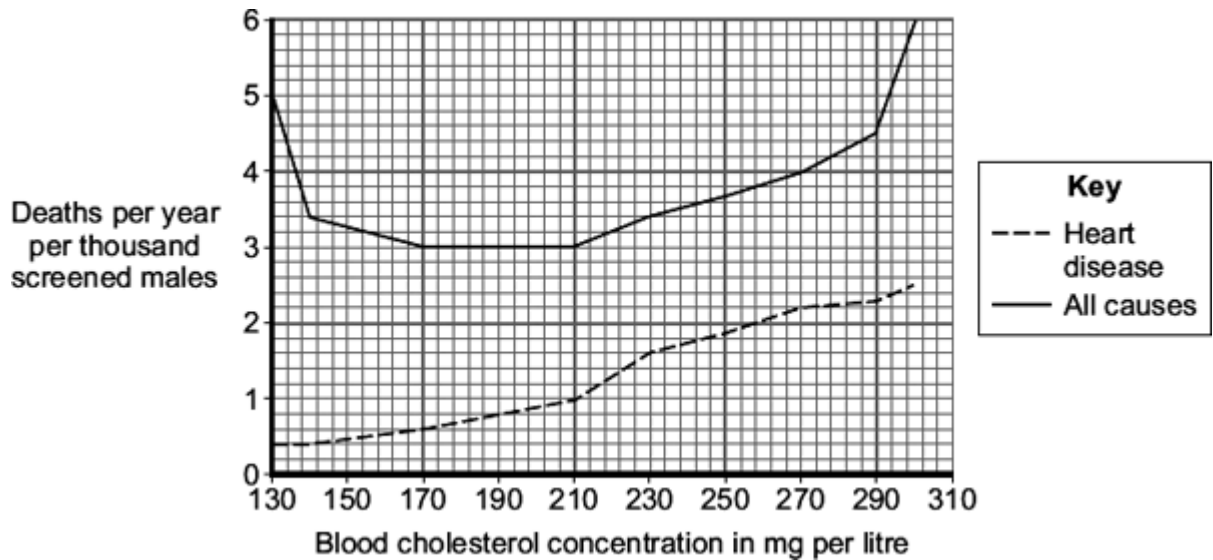
1. _____

2. _____ (2)

(b) Doctors screened men for blood cholesterol concentration.

The doctors then compared death rates from heart disease with deaths from all causes in this screened group.

The graph shows the results.



(i) Which is the best conclusion that can be drawn from the data?

Tick (✓) **one** box.

There is a positive correlation between blood cholesterol concentration and deaths from all causes.

There is a negative correlation between blood cholesterol concentration and deaths from all causes.

Blood cholesterol concentration is only one of several factors affecting death from all causes.

(1)

(ii) Based on the data in the graph **only**, which is the ideal range for blood cholesterol concentration?

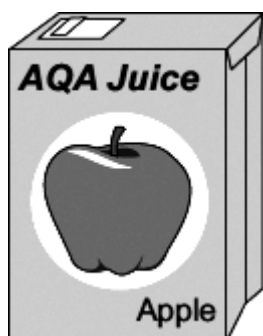
Range _____ to _____ mg cholesterol per litre.

(1)

(Total 4 marks)

Q9.

Fruit is crushed to release fruit juice.



More juice can be collected if the plant cell walls in the fruit are broken down.

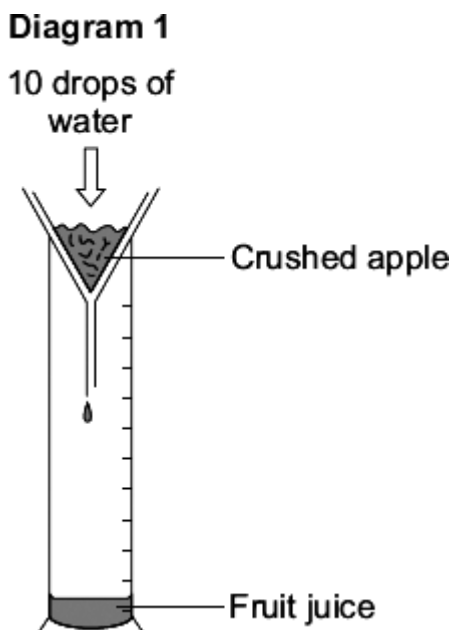
Some students tested the effect on the volume of fruit juice that they could collect of:

- **either** boiling the fruit
- **or** adding the enzyme pectinase to the fruit
- **or** adding the enzyme amylase to the fruit.

In their first experiment the students:

- crushed 20 g of apple
- added 10 drops of water
- measured the volume of fruit juice that they collected.

Diagram 1 shows how they collected the fruit juice.

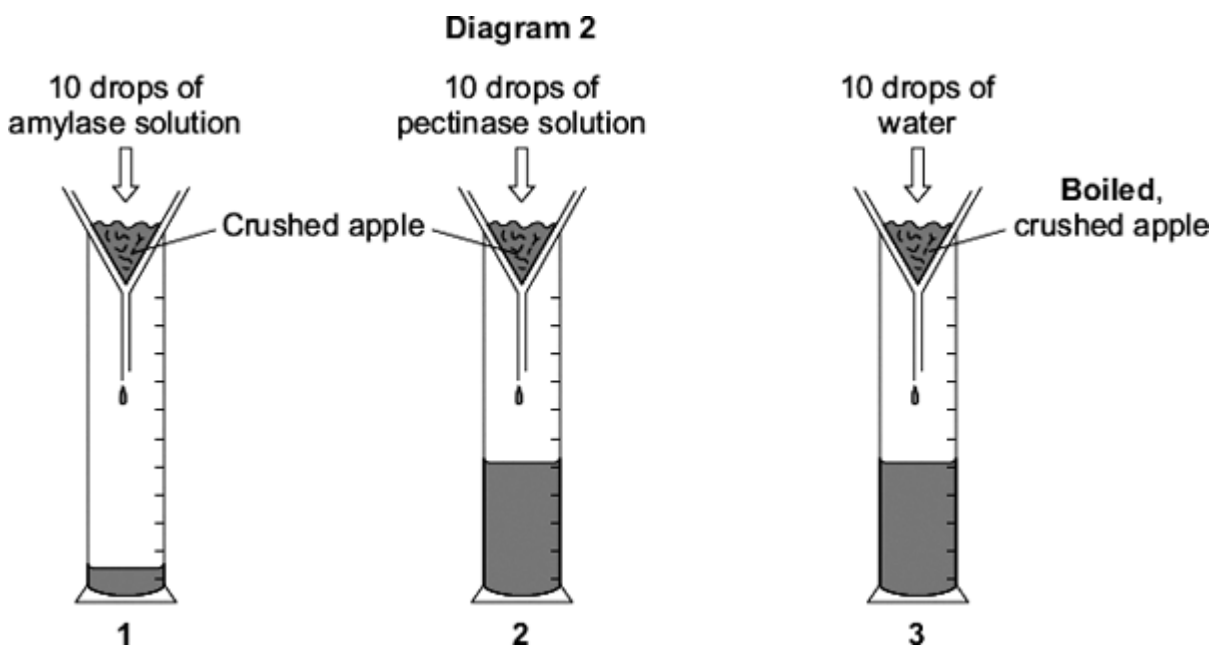


The students did three more experiments.

- 1 They added 10 drops of amylase solution to 20 g of crushed apple.
- 2 They added 10 drops of pectinase solution to 20 g of crushed apple.

3 They added 10 drops of water to 20 g of **boiled**, crushed apple.

Diagram 2 shows these experiments.



(a) Give **one** control variable in this investigation.

(1)

(b) Using drops to measure the volume of water and enzyme added might lead to inaccurate results.

Give **one** reason why.

(1)

(c) The students' results are shown in the table.

What was added to the crushed apple	Was the apple boiled?	Volume of juice collected in cm ³
10 drops of water	No	1.2
10 drops of amylase solution	No	1.2
10 drops of pectinase solution	No	11.3
10 drops of water	Yes	11.6

Explain as fully as you can the students' results shown in the table.

Use all the information given to help you answer this question.

(3)

(d) One student said:

'If we add 10 drops of pectinase solution to crushed apple *while it is boiling*, we should collect more juice than if we add 10 drops of water to boiled apple.'

This is **not** correct.

What volume of juice would you predict the students would collect if 10 drops of pectinase solution were added to crushed apple *while it was boiling*?

Draw a ring around **one** answer.

1.2 cm³

11.3 cm³

11.6 cm³

22.9 cm³

(1)

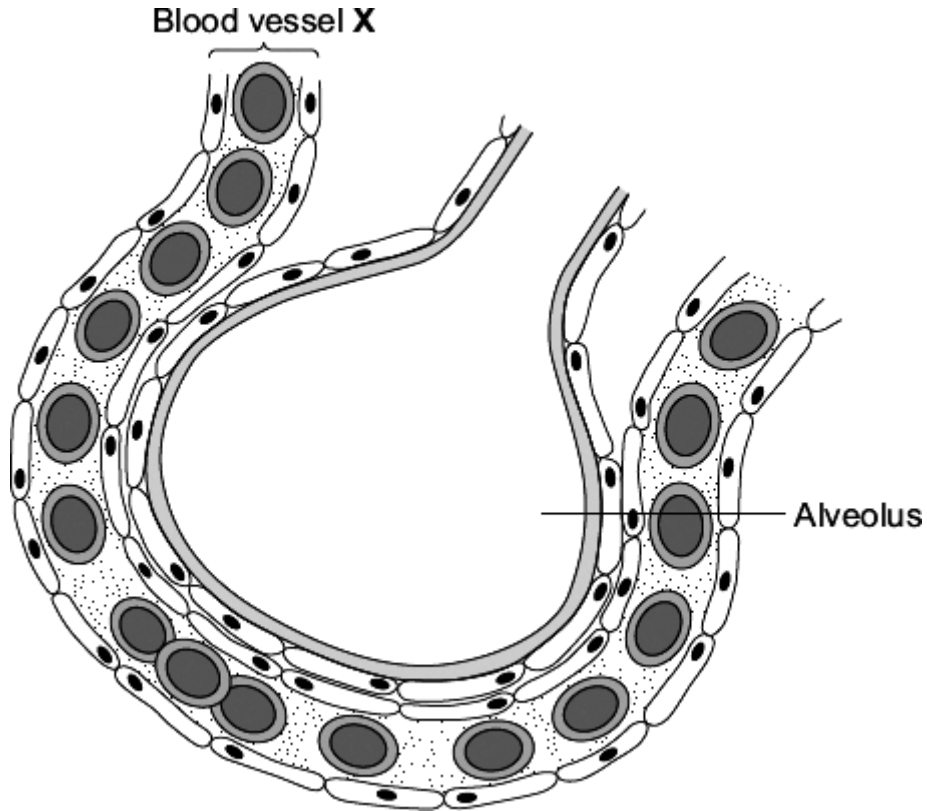
Explain your answer.

(2)

(Total 8 marks)

Q10.

The diagram shows an alveolus and a blood vessel in the lung.



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

(i) Blood vessel X is

- an artery.
 a capillary.
 a vein.

(1)

(ii) Gases pass across the wall of the alveolus by

- diffusion.
 evaporation.
 fermentation.

(1)

(iii) The table compares the concentrations of some gases in inhaled air and exhaled air.

Complete the table.
 Write 'lower' or 'higher' in each box.
 One line has been completed for you as an example.

Gas	Concentration	
	Inhaled air	Exhaled air
Oxygen	higher	lower
Carbon dioxide	lower	higher
Water vapour	lower	higher

Water vapour	lower	higher
Carbon dioxide		
Oxygen		

(2)

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

(i) Oxygen is carried in the blood mainly in

blood plasma. red blood cells. white blood cells.

(1)

(ii) In the blood, the oxygen combines with

carbon dioxide. haemoglobin. urea.
--

(1)

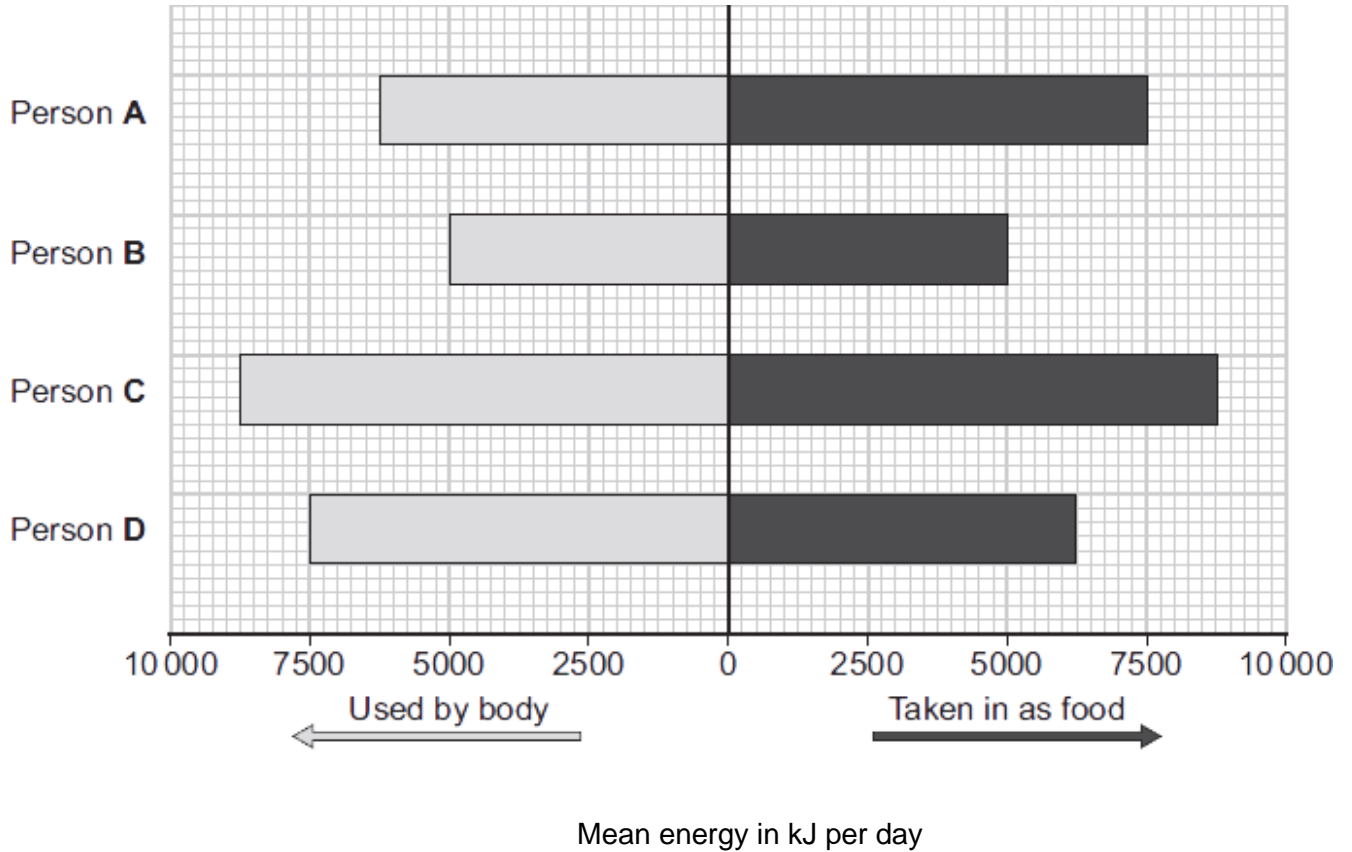
(Total 6 marks)

Q11.

Scientists measured the amount of energy used by four people, **A**, **B**, **C** and **D**.

The scientists also measured the amount of energy taken in as food by each person.

The chart shows the scientists' results.



(a) (i) What was the mean amount of energy used by **D**?

_____ kJ per day (1)

(ii) The amount of energy used by **D** is different from the amounts of energy used by **A**, **B** and **C**.

Suggest **two** reasons why.

(2)

(b) The data in the bar chart was collected over twelve months.

Which person, **A**, **B**, **C** or **D**, would gain body mass over the twelve months?

Give a reason for your answer.

(2)

- (c) In the UK many people are obese.
Doctors advise obese people to lose mass.

Suggest **two** different ways an obese person could lose mass.

(2)

(Total 7 marks)

Q12.

Thalidomide is a drug that was developed in the 1950s.
In the 1950s some pregnant women took thalidomide to prevent morning sickness during pregnancy.

Today, thalidomide is **not** used to prevent morning sickness.

- (a) (i) Give **one** medical use of thalidomide, today.

(1)

- (ii) Today, before a woman is given thalidomide, she is

- checked to see if she is pregnant
- told to use two different methods of contraception at the same time.

Give the reason why:

the woman is checked to see if she is pregnant

the woman is told to use two different methods of contraception at the same time

(2)

(b) The information is about two types of contraceptive pill used by women.

Combined pill

- contains two hormones
- is taken for 21 days, then no pills are taken for 7 days
- > 99 % effective at preventing pregnancy
- increases chance of headaches
- increases chance of breast cancer
- decreases chance of cancer of the ovary

Mini-pill

- contains one hormone
- must be taken at the same time every day
- < 99 % effective at preventing pregnancy
- increases chance of breast cancer

(i) Which **two** hormones does the combined pill contain?

Draw a ring around **two** answers.

LH **oestrogen** **progesterone** **FSH**

(2)

(ii) Give **two** advantages of taking the combined pill and **not** the mini-pill.

(2)

(iii) Give **one** advantage of taking the mini-pill and **not** the combined pill.

(1)

(Total 8 marks)

Q13.

Scientists at a drug company developed a new pain-killing drug, drug X.

(a) Painkillers do **not** cure infectious diseases.

Why?

(1)

- (b) The scientists compared drug **X** with two other pain-killing drugs, drug **A** and drug **B**.

In their investigation the scientists:

- chose 600 volunteers. The volunteers were all in pain
- gave 200 of the volunteers a standard dose of drug **A**
- gave 200 of the volunteers a standard dose of drug **B**
- gave 200 of the volunteers a standard dose of drug **X**.

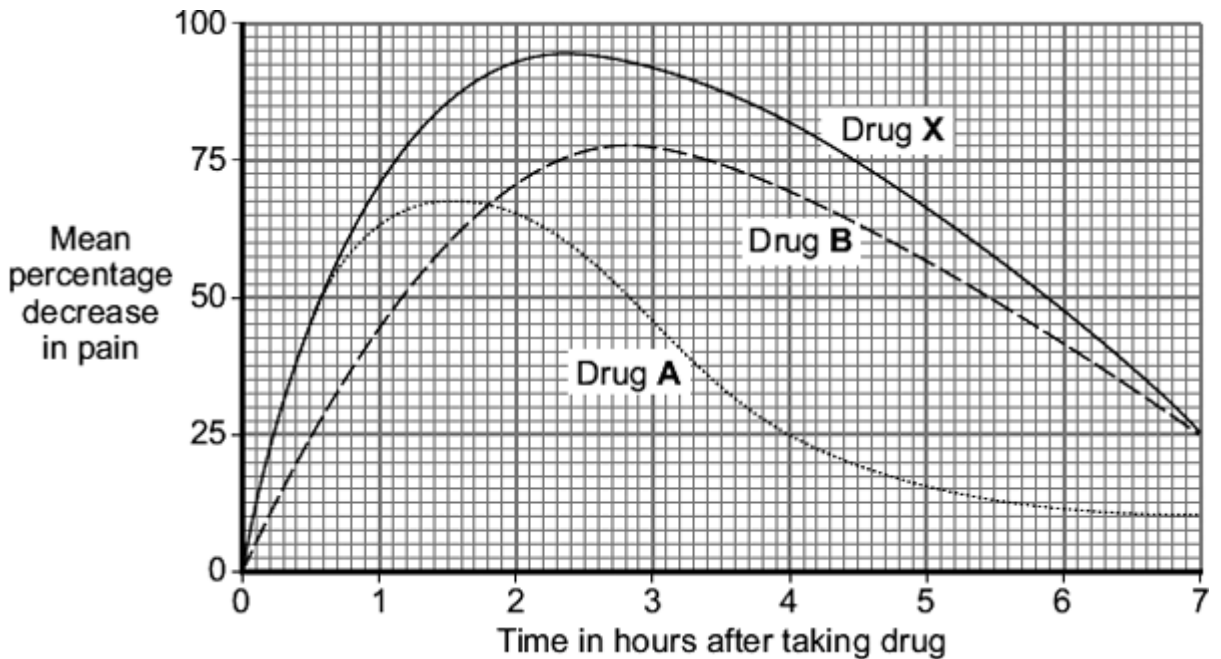
Over the next seven hours the volunteers recorded how much pain they felt.

To get valid results the three groups of volunteers should be matched for as many factors as possible.

Suggest **two** of the factors that should be matched.

(2)

- (c) The graph shows the results of the investigation.



- (i) How much pain did the volunteers still feel, four hours after taking drug **A**?

_____ percent

(1)

- (ii) Give **one** advantage of taking drug **A** and **not** drug **B**.

(1)

(iii) Give **two** advantages of taking drug **B** and **not** drug **A**.

(2)

(d) Drug **X** is much more expensive than both drug **A** and drug **B**.

A pharmacist advised a customer that it would be just as good to take drug **A** and drug **B** together instead of drug **X**.

Do you agree with the pharmacist's advice?

Give reasons for your answer.

(3)

(Total 10 marks)

Q14.

In a living organism, the cells are organised into organs, systems and tissues.

(a) Use words from the box to complete the list of these structures in order of size.

organs systems tissues

The smallest structure is at the top of the list and the largest is at the bottom.

1 **cells**

2 _____



(1)

- (b) **List A** gives three tissues found in the human body.
List B gives four functions of tissues.

Draw a straight line from each tissue in **List A** to its correct function in **List B**.

List A – Tissue

Muscular tissue

Glandular tissue

Epithelial tissue

List B – Function

Covers many parts of the body

Contracts to cause movement

Divides by meiosis

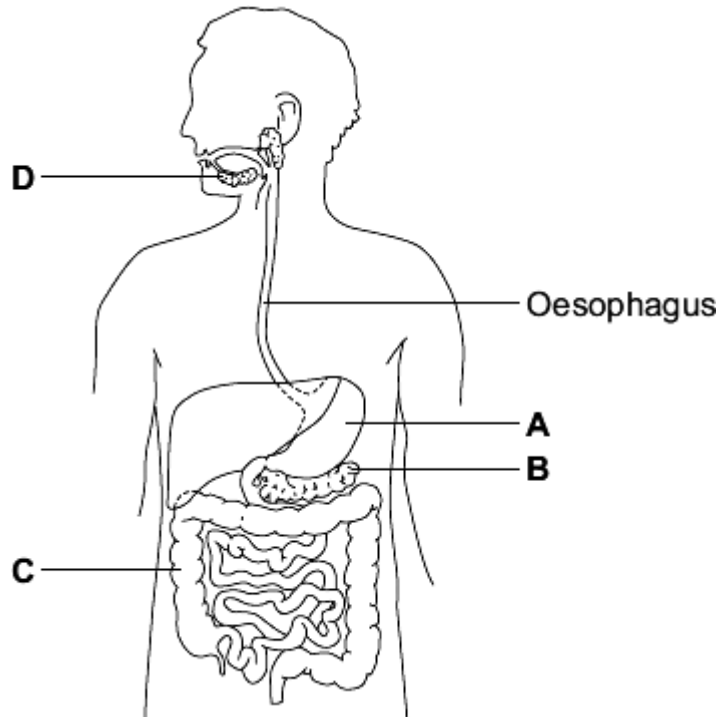
Releases hormones or enzymes

(3)

(Total 4 marks)

Q15.

The diagram shows the human digestive system.



(a) *Heartburn* is a burning feeling caused when acid enters the oesophagus. The acid comes from the stomach.

(i) Which letter on the diagram shows the stomach?

(1)

(ii) Name the acid the stomach produces.

(1)

(iii) Medicines taken to treat *heartburn* contain chemicals that neutralise excess stomach acid.

What type of chemical will neutralise stomach acid?

(1)

(b) Use words from the box and your own knowledge to describe how carbohydrates are digested.

amylase	starch	sugars
---------	--------	--------

(5)

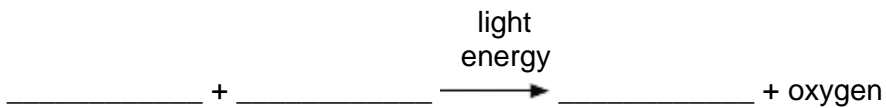
(c) Where in the body are the products of digestion absorbed?

(1)

(Total 9 marks)

Q16.

(a) Complete the equation for photosynthesis.



(2)

(b) Scientists investigated how temperature affects the rate of photosynthesis. The scientists grew some orange trees in a greenhouse. They used discs cut from the leaves of the young orange trees.

The scientists used the rate of oxygen production by the leaf discs to show the rate of photosynthesis.

(i) The leaf discs did not produce any oxygen in the dark.

Why?

(1)

(ii) The leaf discs took in oxygen in the dark.

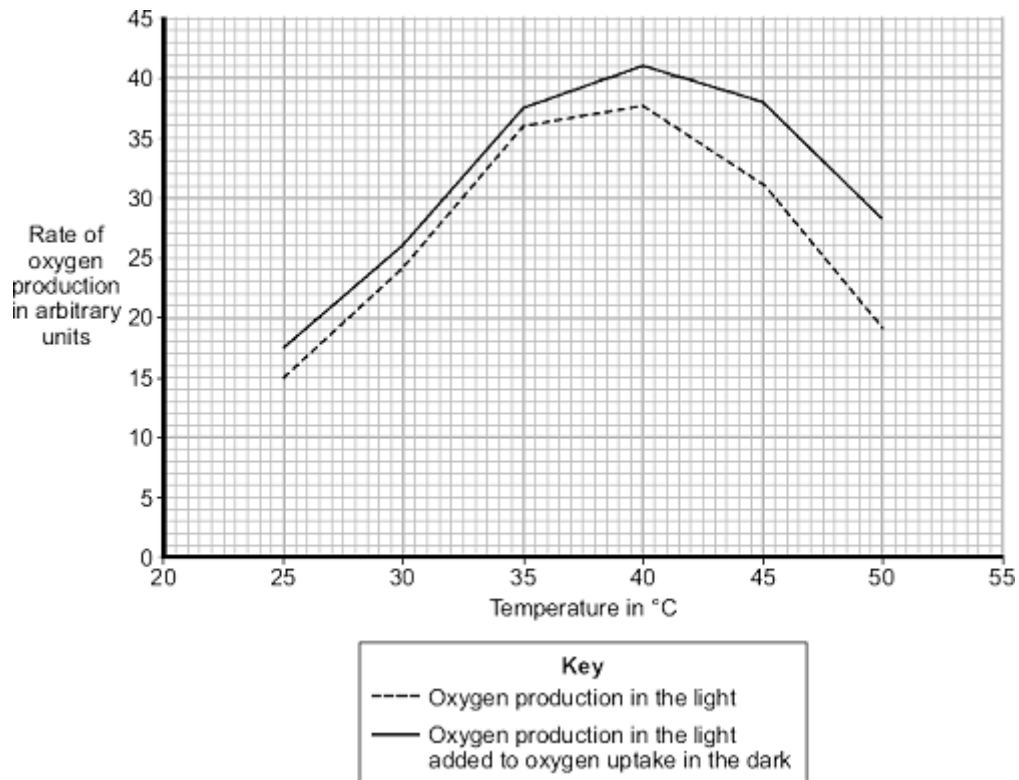
Explain why.

(2)

- (c) In their investigation, the scientists measured the rate of oxygen release by the leaf discs in the light. The scientists then measured the rate of oxygen uptake by the leaf discs in the dark.

The graph shows the effect of temperature on

- oxygen production in the light
- oxygen production in the light added to oxygen uptake in the dark.



Use the information from the graph to answer each of the following questions.

- (i) Describe the effect of temperature on oxygen production in the light.

(2)

- (ii) Explain the effect of temperature on oxygen production in the light when the

temperature is increased:

from 25 °C to 35 °C

from 40 °C to 50 °C.

(2)

- (d) A farmer in the UK wants to grow orange trees in a greenhouse. He wants to sell the oranges he produces at a local market. He decides to heat the greenhouse to 35 °C.

Explain why he should **not** heat the greenhouse to a temperature higher than 35 °C. Use information from the graph in your answer.

(3)

(Total 12 marks)

Q17.

Obesity is linked to several diseases.

- (a) Name **two** diseases linked to obesity.

1. _____

2. _____ (2)

(b) Scientists trialled a new slimming drug.

The table shows their results after one year.

Percentage change in mass of each volunteer	Number of volunteers
gained mass or lost 0 to 3.9 %	1900
lost 4.0 to 4.9 %	1100
lost 5.0 to 9.9 %	1500
lost 10 % or more	1500

(i) Calculate the proportion of the volunteers who lost 10 % or more of their mass.

You should first calculate the total number of volunteers, then work out the proportion.

Proportion of volunteers = _____

(2)

(ii) The National Health Service (NHS) gave permission for the drug to be used.

Use information from the table to suggest a reason why the NHS gave permission for the drug to be used.

(1)

(Total 5 marks)

Q18.

The table shows the mass of carbon dioxide passed into the atmosphere in one year.

	Mass of carbon dioxide passed into the atmosphere in billions of tonnes per year
Animals	45

Plants	15
Microorganisms	60
Human activity	9

- (a) (i) Calculate the total mass of carbon dioxide passed into the atmosphere in one year.

Answer = _____ billion tonnes

(1)

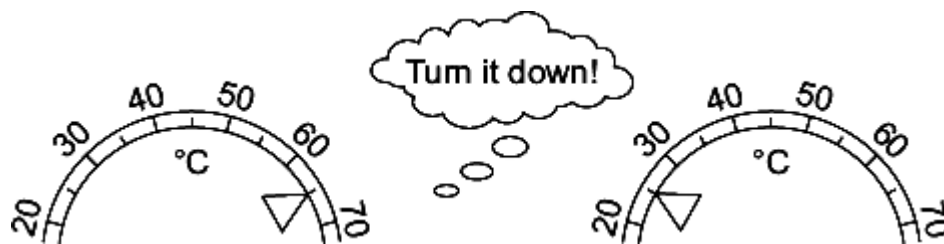
- (ii) Plants take 120 billion tonnes of carbon dioxide out of the atmosphere per year.

Use your answer to part (a)(i) to calculate the change in the mass of carbon dioxide in the atmosphere in one year.

Answer = _____ billion tonnes

(1)

- (b) The drawing shows part of a campaign to encourage householders to reduce the temperature of the water used to wash clothes.



Give **two** advantages to the environment of reducing the temperature of the water used to wash clothes.

1. _____

2. _____

(2)

- (c) A householder reduces the temperature of the water he uses to wash clothes. He finds that some stains are not removed at the new temperature. He decides to use a biological washing powder. Biological washing powders contain enzymes.
- (i) Draw a line from each enzyme in **List 1** to the type of stain the enzyme will remove, in **List 2**.

List 1 Enzyme	List 2 Type of Stain
Protease	Starch
Lipase	Fat
	Protein

(2)

- (ii) The biological washing powder would **not** have removed the stains from clothes if the water had been at 65 °C.

Use **one** word from the box to complete the sentence.

killed	denatured	diffused
--------	-----------	----------

At 65 °C the enzymes would be _____

(1)

(Total 7 marks)

Q19.

A patient has a disease. The disease damages his pancreas.

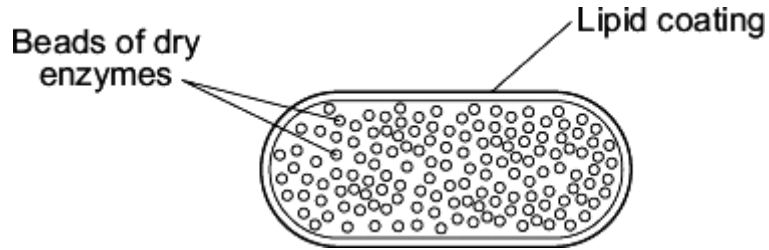
A doctor prescribes a course of treatment for the patient:

'Take one capsule with each meal.'

Each capsule contains hundreds of small, dry beads.

The beads are made of enzymes. The pancreas normally produces these enzymes.

The outer coating of the capsule is made of lipid.



- (a) One enzyme in the beads is lipase.

In a healthy person, lipase is made in the pancreas.

Name **two** other enzymes made in the pancreas of a healthy person.

1. _____

2. _____

(2)

- (b) The lipid coating on the capsule makes sure that the enzymes are not released until the capsule reaches the small intestine.

Explain how.

(2)

- (c) The lipase in the beads does **not** digest the lipid coating around the capsule.

Suggest why.

(1)

(Total 5 marks)

Q20.

- (a) **List A** gives four structures in the human body.

List B gives the functions of some structures in the body.

Draw a straight line from each structure in **List A** to the correct function in **List B**.

List A – Structure

Alveoli

Veins

Villi

Ribs

List B – Function

Surround and protect the lungs

Filter the blood

Carry blood towards the heart

Absorb digested food

Allow oxygen to enter the blood

(4)

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

In the lungs, oxygen enters the blood from the air by

diffusion.
filtration.
respiration.

(1)

(Total 5 marks)

Q21.

Scientists estimate that about one third of cancers in the UK may be linked to obesity.

Name **two** diseases linked to obesity.

Do **not** give cancer as one of your answers.

1. _____

2. _____

(Total 2 marks)

Q22.

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

Traditional stone washing

- 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 denim 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 the treatment the enzymes have to be removed from the denim.

(a) Use **only** the information above to answer this question.

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

1. _____

2. _____

(2)

(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.

There are enzymes in biological washing powders. Biological washing powder has to be used at temperatures below 45 °C.

- (a) The enzymes in biological washing powders do **not** work on the stains on clothes at temperatures above 45 °C.

Explain why.

(2)

- (b) Some bacteria, called thermophilic bacteria live in hot springs at temperatures of 80 °C.

Scientists have extracted enzymes from these thermophilic bacteria. These enzymes are being trialled in industrial laundries.

The laundries expect to increase the amount of clothes they can clean by using enzymes from thermophilic bacteria instead of using the biological washing powders the laundries use now.

- (i) The laundries expect to be able to increase the amount of clothes that they can clean each day.

Suggest why.

(2)

- (ii) Using washing powders with enzymes from thermophilic bacteria may be more harmful to the environment than using the biological washing powders that laundries use now.

Suggest why.

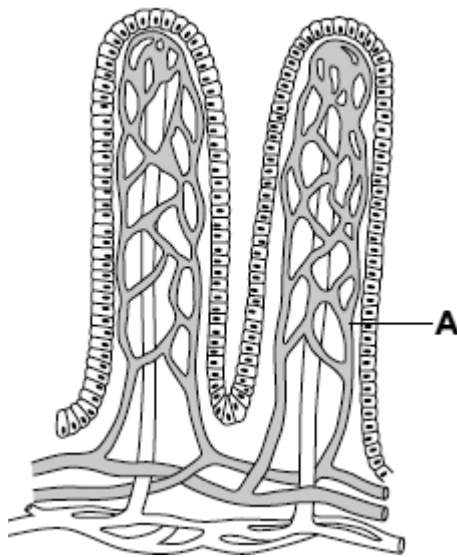
(2)
(Total 6 marks)

Q24.

Villi are found in some parts of the digestive system.

Diagram 1 shows two villi.

Diagram 1



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

- (i) Structure **A** is a

muscle.
nerve.
capillary.

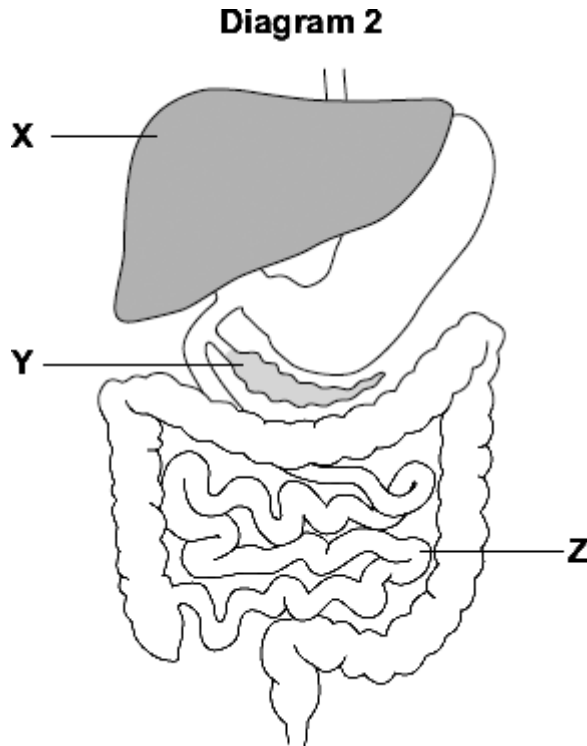
(1)

(ii) The villi absorb the products of digestion by

- dialysis.
diffusion.
osmosis.

(1)

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



(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.

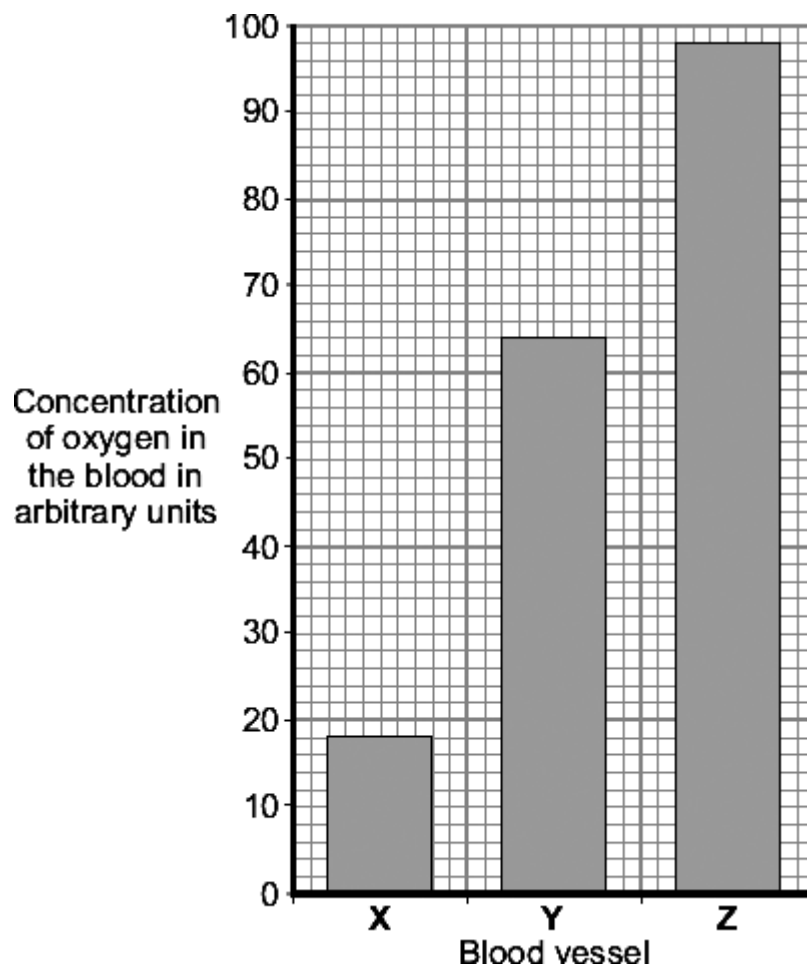
Why is it helpful to have lots of villi?

(1)

(Total 4 marks)

Q25.

The bar chart shows the concentration of oxygen in the blood in three different blood vessels, **X**, **Y** and **Z**.



- (a) (i) What is the concentration of oxygen in blood vessel X?

Answer _____ arbitrary units.

(1)

- (ii) Which blood vessel, X, Y or Z, carries blood from the lungs to the heart?

(1)

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

- (i) Most of the oxygen in the blood is carried by the

plasma.
red blood cells.
white blood cells.

(1)

- (ii) Oxygen combines with a coloured pigment in the blood.

This coloured pigment is called

- alveoli.
- haemoglobin.
- lactic acid.

(1)
(Total 4 marks)

Q26.

The table shows the volume of blood flowing through different organs at three levels of exercise.

Organ(s)	Volume of blood flowing through organ(s) in cm ³ per minute		
	Light exercise	Moderate exercise	Heavy exercise
Gut	1 100	600	300
Kidneys	900	600	250
Brain	750	750	750
Heart muscles	350	750	1 000
Skeletal muscles	4 500	12 500	22 000
Skin	1 500	1 900	600
Other	400	500	100
Total	9 500	17 600	25 000

(a) (i) Which organ has a constant flow of blood through it?

_____ (1)

(ii) Which organ has the greatest reduction in the volume of blood supplied during heavy exercise compared with light exercise?

_____ (1)

(iii) What proportion of the blood flows through the heart muscle during heavy exercise?

_____ (1)

- (b) The volume of blood flowing through the skeletal muscles increases greatly during exercise.

Give **two** ways in which the body brings about this increase.

1. _____

2. _____

(2)

- (c) During exercise, the concentration of carbon dioxide in the blood increases.

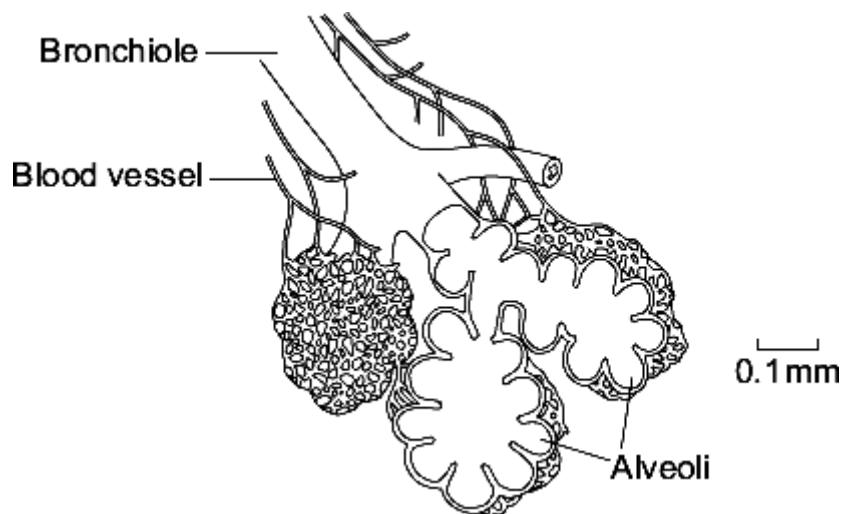
Explain what causes this increase.

(3)

(Total 8 marks)

Q27.

The human lung has about 80 million alveoli.
The diagram shows some alveoli in a human lung.



- (a) Give **three** features of the alveoli that allow large amounts of oxygen to enter the blood.

1. _____

2. _____

3. _____

(3)

(b) (i) Name the process by which oxygen passes from the air into the blood.

(1)

(ii) Breathing allows large amounts of oxygen to enter the blood.

Explain how breathing does this.

(2)

(Total 6 marks)

Q28.

Scientists have trialled a new statin called rosuvastatin.

- 17 802 people took part in the trial.
- All of these people had high levels of a protein called CRP in their blood.
- The higher the level of CRP in the blood, the higher the risk of a heart attack.
- None of these people had heart conditions at the beginning of the investigation.
- None of these people had high LDL (low density lipoprotein) levels.
- All of these people were aged 50 or above.
- Half the people were given a rosuvastatin tablet each day; the other half were given a placebo.
- The trial was stopped 7 months early when it was found that the people given rosuvastatin were 54% less likely to have a heart attack than people given the placebo.

- (a) Give **two** control variables in this investigation.
1. _____
2. _____
- (2)
- (b) What would the placebo be in this investigation?
- _____
- _____
- (1)
- (c) The trial gave reliable results.
- Give **one** reason why.
- _____
- _____
- (1)
- (d) The trial was stopped 7 months early.
- Give **one** reason why.
- _____
- _____
- (1)
- (e) The manufacturers of rosuvastatin paid for the trial.
- However, the manufacturers took no part in the trial.
- Suggest **one** reason why the manufacturers did not take part in the trial.
- _____
- _____
- (1)
- (f) The table shows some of the results of the trial.

Substance	Concentration in blood in mg per 100 cm ³ after 3 years of trial	
	People given rosuvastatin	People given placebo
LDL cholesterol	53	106

HDL cholesterol	50	49
Saturated fats	106	123

Rosuvastatin reduces the risk of heart attacks.

Use the data in the table to explain why.

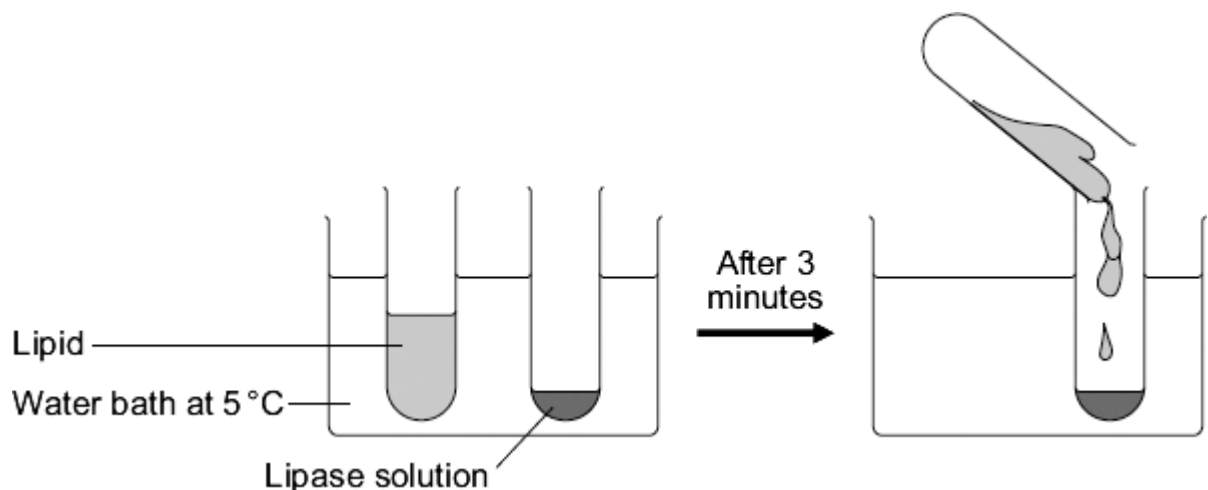
(2)
(Total 8 marks)

Q29.

A group of students investigated the effect of temperature on the action of the enzyme lipase.

The students:

- put 1 cm³ of lipase solution into a test tube
- put 5 cm³ of lipid into a different test tube
- put both tubes in a water bath at 5 °C for 3 minutes
- mixed the lipid with the lipase solution.



Every five minutes the students tested a sample of the mixture for lipid, until no lipid remained.

The students repeated the experiment at different temperatures.

- (a) To make their investigation fair the students needed to control some variables.

Give **one** variable the students controlled in their investigation.

(1)

- (b) The tubes of lipase solution and lipid were kept separately in the water bath for 3 minutes before mixing. Why?

Tick (✓) **one** box.

So that the lipase broke down the lipid quickly

So that the lipase and the lipid reached the right temperature

To give enough time for the lipase to break down the lipid

To give enough time for the water bath to heat up

(1)

The table shows the students' results.

Temperature in C	Time taken until no lipid remained in minutes
5	40
20	15
35	5
50	30
95	lipid still there after 120 minutes

- (c) Describe the effect on the breakdown of the lipid of increasing the temperature from 5 °C to 50 °C.

(2)

- (d) Suggest **two** ways in which the students could have improved their investigation.

Use information from the students' method and the results table to help you.

1. _____

2. _____

(2)

- (e) (i) The lipase did **not** break down the lipid at 95 °C.

Why?

(1)

- (ii) At 35 °C the lipase broke down the lipid after 5 minutes.

What new substances will be in the tube?

Draw a ring around **one** answer.

amino acids

fatty acids and glycerol

sugars

(1)

(Total 8 marks)

Q30.

Mycoprotein is produced from the fungus *Fusarium*. Mycoprotein is sometimes used instead of meat in foods for vegetarians.

- (a) The table shows the amounts of some substances in mycoprotein and in chicken.

Substance	Mass in grams per 100 grams	
	Mycoprotein	Chicken
Protein	11.8	22.0
Dietary fibre	4.8	0.0
Fat	3.5	6.2
Carbohydrate	2.0	0.0

Cholesterol	0.0	0.1
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- (i) Draw a ring around the correct answers to complete the sentence.

Eating mycoprotein instead of chicken helps to lower the risk of heart disease because

mycoprotein contains no

fat
carbohydrate
cholesterol

 and

mycoprotein contains less

dietary fibre.
fat.
carbohydrate.

(2)

- (ii) A body-builder ate 4 kilograms of chicken each week to help him build up his muscles.

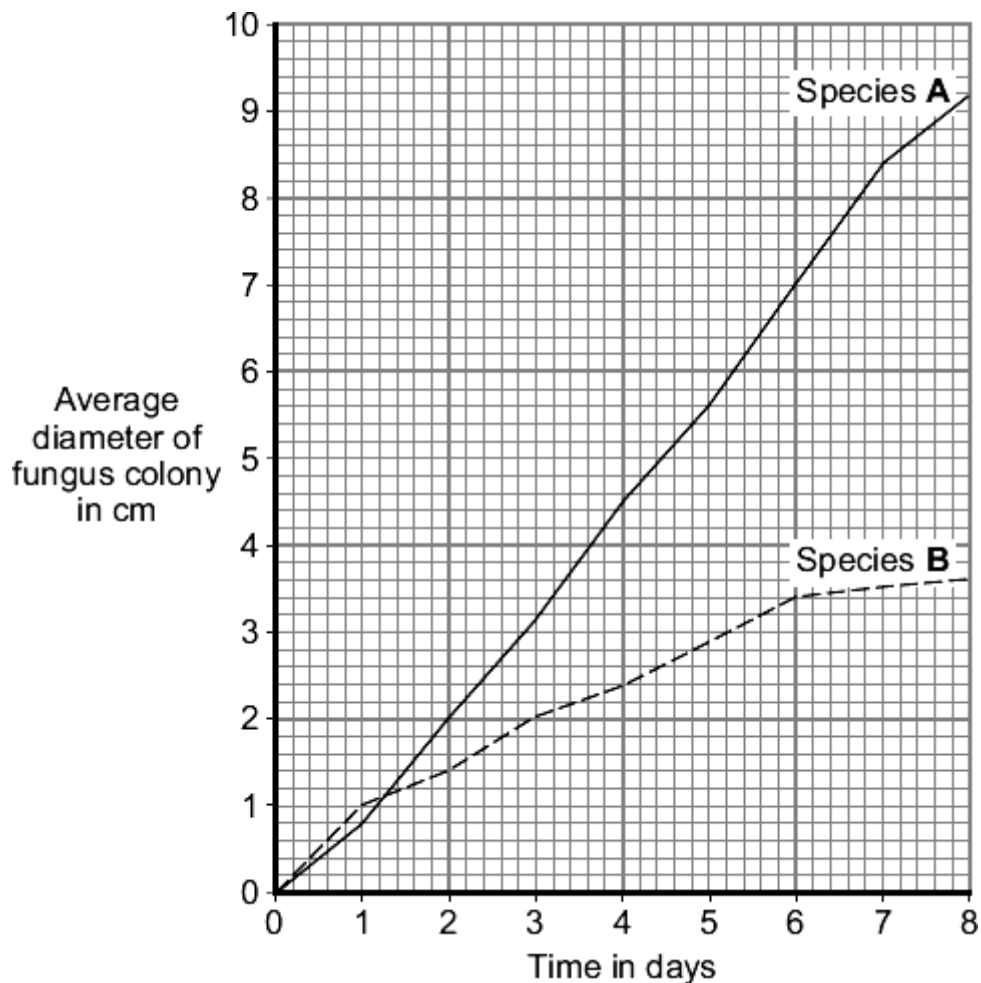
If he ate mycoprotein instead of chicken, he would need to eat about twice as much to have the same effect.

Use information from the table to give **one** reason why.

(1)

- (b) Scientists investigated the growth of two species, **A** and **B**, of the fungus *Fusarium*. The scientists grew the fungus on agar jelly in Petri dishes. They measured the diameter of a colony of each fungus every day for 8 days.

The graph shows the results.



- (i) Describe how the diameter of the colony of species **A** changed between day 0 and day 8.

(2)

- (ii) Give **one** difference between the results for species **A** and the results for species **B**.

(1)

- (c) Both Petri dishes contained the same nutrients.
Both Petri dishes were kept at 25 °C.

When *Fusarium* is grown in an industrial fermenter, other factors also need to be controlled.

Give **two** of these other factors.

1. _____

2. _____

(2)

(Total 8 marks)

Q31.

Oxygen is transported round the body by the blood.

Blood leaving the human lung can carry about 250 milligrams of oxygen per litre. However, only 7 milligrams of oxygen will dissolve in one litre of water at body temperature.

(a) Suggest an explanation for the difference.

(2)

(b) Blood leaving the skeletal muscles during exercise may contain only 30 milligrams of oxygen per litre.

Explain what causes the difference in oxygen concentration between the blood leaving the lungs and the blood leaving the skeletal muscles.

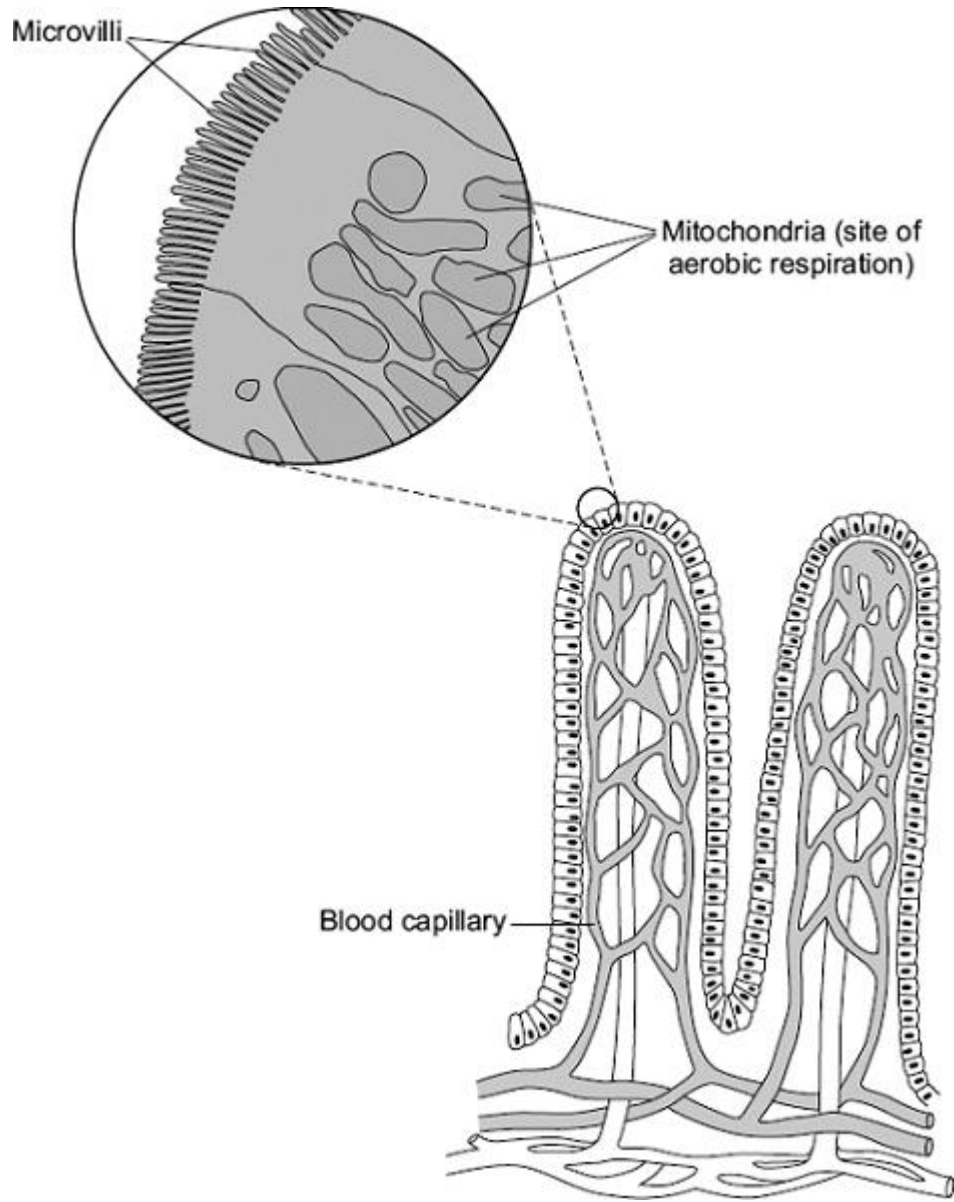
(4)

(Total 6 marks)

Q32.

The villi of the small intestine absorb the products of digestion.

The diagram shows two villi. It also shows parts of some of the surface cells of a villus, as seen with an electron microscope.



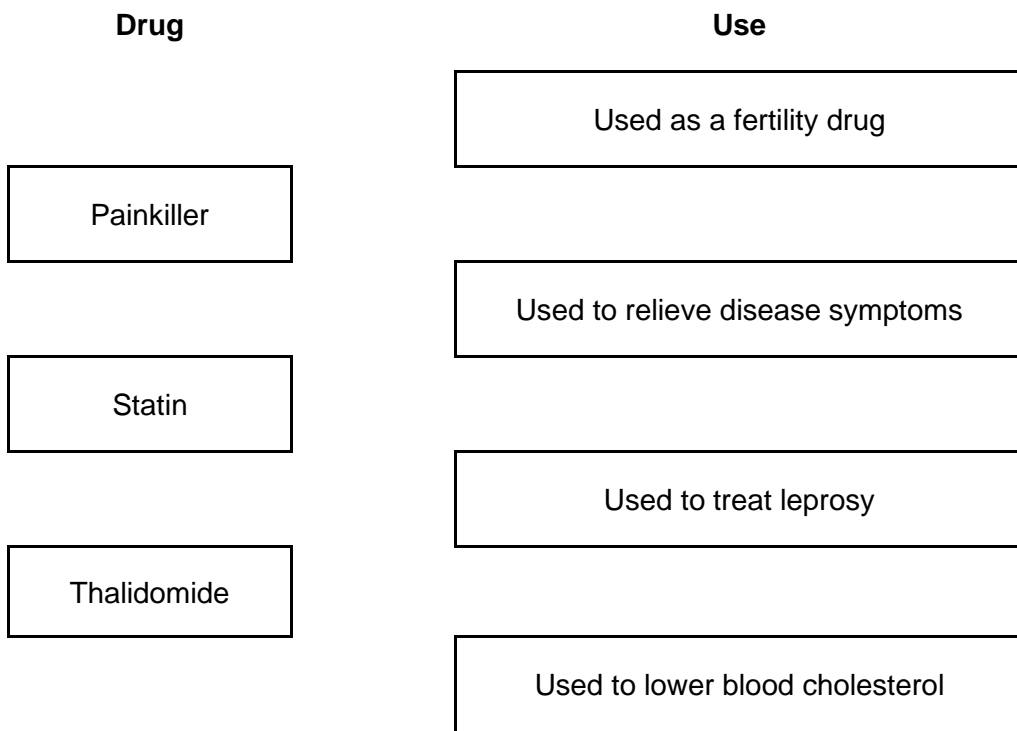
Describe and explain how the villi are adapted to maximise the rate of absorption of the products of digestion.

(Total 5 marks)

Q33.

Medicinal drugs are used to treat diseases.

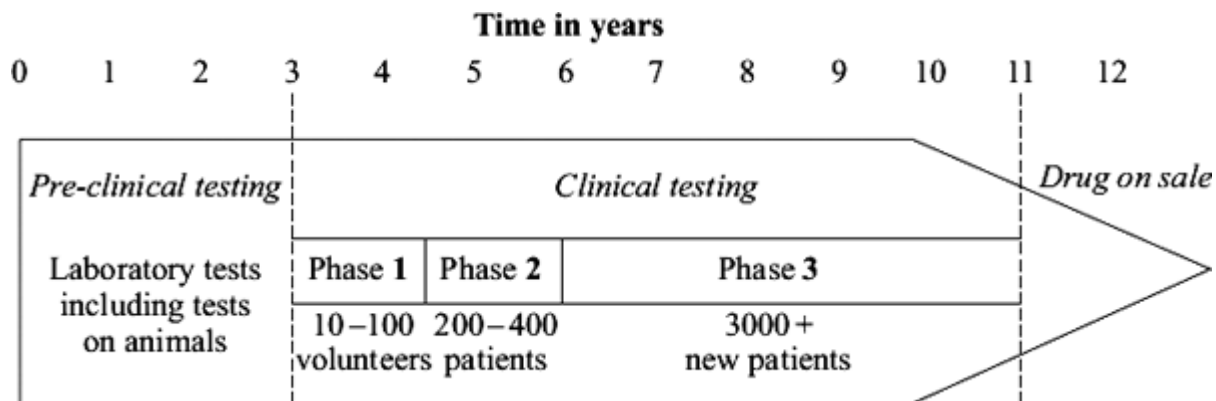
(a) Draw **one** line from each drug to its correct use.



(3)

(b) New drugs need to be tested before going on sale.

The diagram shows a time line for the testing of a new drug.



(i) How long do trials on humans take? _____ years (1)

(ii) What is the minimum number of humans the drug is tested on throughout *clinical testing*? _____ (1)

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

(i) A new drug is first tested in the laboratory to find if it is toxic.
if it is cost effective.
the optimum dose. (1)

(ii) The drug is then tested on a few volunteers to find if it is cost effective.
if it has side effects.
the optimum dose. (1)

(Total 7 marks)

Q34.

A group of pupils investigated the digestion of fat by the enzyme lipase.

(a) What **two** substances are produced when fats are digested?

Tick (✓) **two** box.

Glucose

Fatty acids

Glycerol

Amino acids

(2)

In the investigation:

- the pupils set up five test tubes
- each tube contained 1 cm³ of fat and 10 cm³ of lipase solution
- each tube was kept at a different temperature for 24 hours.

(b) (i) Give **one** control variable in this investigation.

(1)

(ii) What was the independent variable being investigated?

(1)

(c) The pH of the solution in each tube was tested at the beginning of the investigation and after 24 hours.

The results of the pupils' investigation are shown in the table.

Tube	Temperature in °C	pH at the beginning	pH after 24 hours
1	0	Neutral	Neutral
2	20	Neutral	'Weak' acid
3	40	Neutral	'Strong' acid
4	60	Neutral	'Weak' acid
5	80	Neutral	Neutral

One pupil said, "We might **not** have found the best temperature for the lipase to work".

What more could they do to find the best temperature?

(1)
(Total 8 marks)

Q35.

Starch is broken down into sugar by amylase. Amylase is produced in the salivary glands.

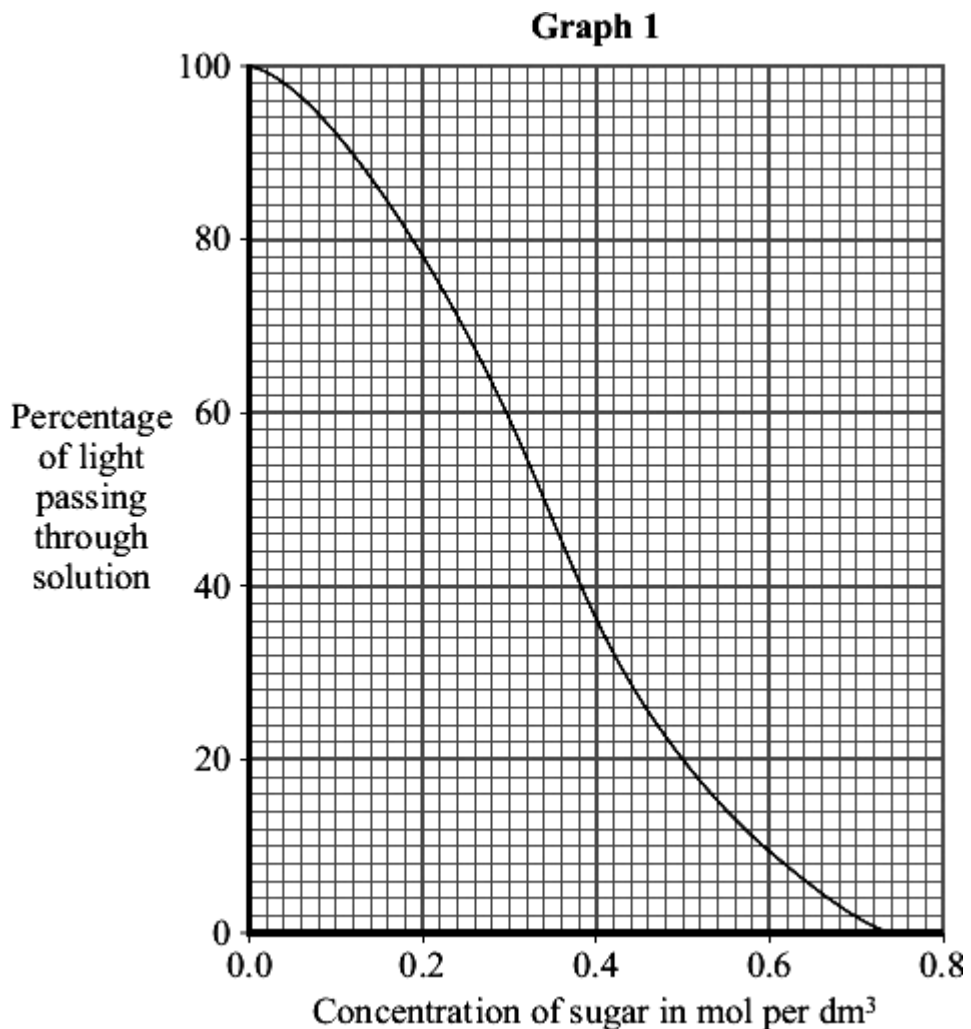
- (a) Name **two** other organs in the digestive system which produce amylase.

_____ and _____

(2)

- (b) A colorimeter measures colour intensity by measuring the percentage of light that passes through a solution.

Graph 1 shows the percentage of light passing through sugar solutions of different concentrations to which a test reagent has been added.



Students used a colorimeter to compare the starch-digesting ability of amylase enzymes obtained from two organs, **P** and **Q**.

- The students collected 5 cm³ samples of amylase from **P** and **Q** and placed them into a water-bath at 40 °C.
- Two test tubes containing 10 cm³ samples of starch solution were also placed into the water-bath.
- All the tubes were left in the water-bath for 10 minutes.
- Each amylase sample was added to one of the tubes containing the starch solution.
- The test tubes were placed back into the water-bath.
- Every minute, a few drops were taken from each tube, the test reagent was added and the percentage of light passing through this solution was measured in the colorimeter.

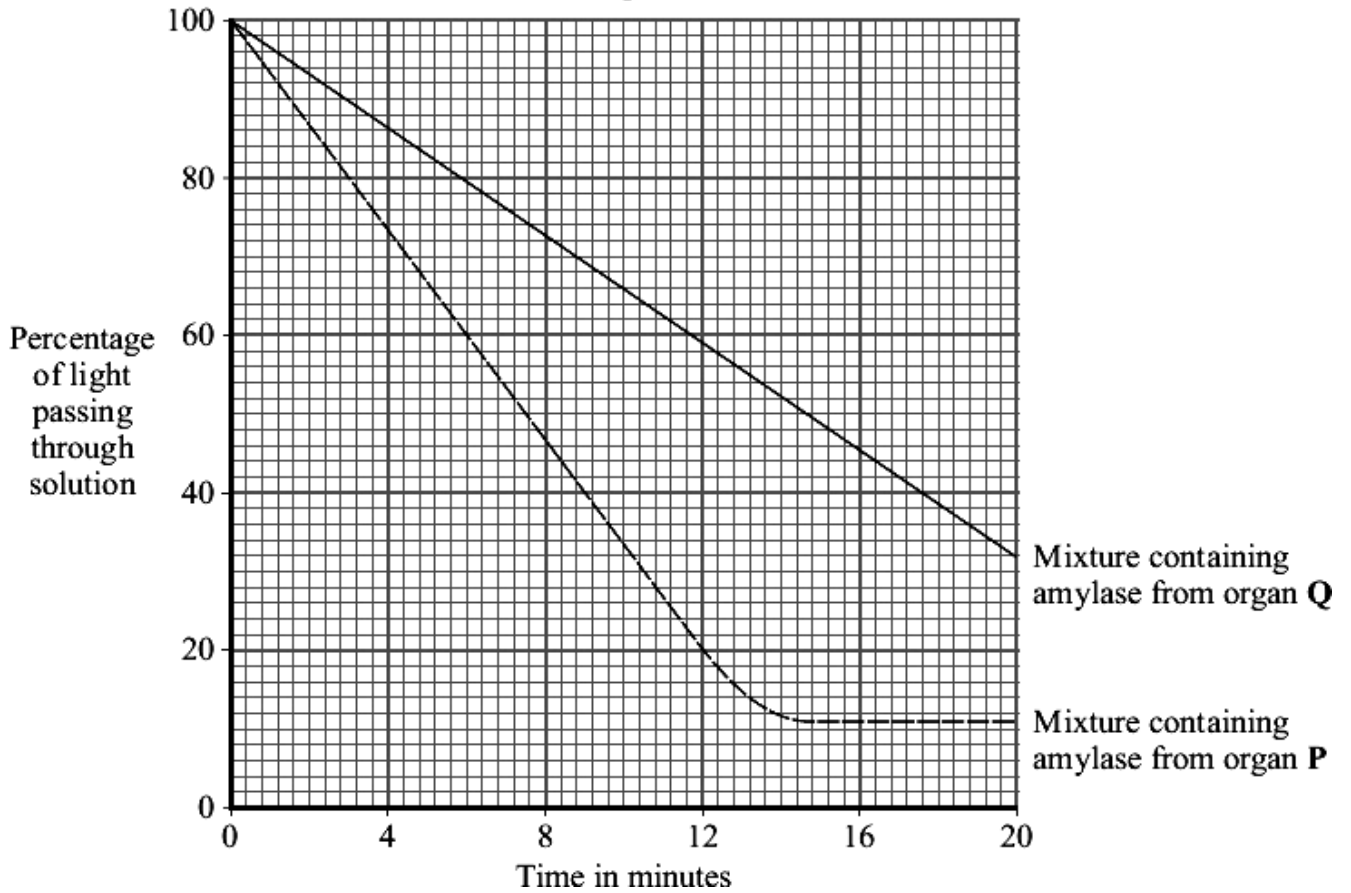
The tubes containing amylase samples and starch solution were left in the water-bath for ten minutes before the amylase was added to the starch.

Explain why.

(2)

- (c) **Graph 2** shows how the readings from the colorimeter changed over the next 20 minutes.

Graph 2



- (i) Use **Graph 1** and **Graph 2** to determine the concentration of sugar in the mixture from organ **Q** after 20 minutes.

Answer _____ mol per dm³

(1)

- (ii) Use your answer to (c)(i) to calculate the rate at which sugar was produced in the mixture containing amylase from organ **Q**.

Show clearly how you work out your answer.

Answer _____ mol per dm³ per minute

(2)

- (iii) Suggest why the amount of light passing through the mixture from organ **P** did not change after 16 minutes.

(1)

- (iv) One of the students suggested that they could have completed their experiment more quickly if the temperature of the water-bath had been set at 80 °C.

This would **not** have been the case.

Explain why.

(2)

(Total 10 marks)

Mark schemes

Q1.

- (a) (i) 8.6
accept value in range 8.5 to 8.7 1
- (ii) hydrochloric acid / HCl
accept HCL
accept hydrogen chloride
ignore hcl / etc. 1
- (iii) X 1
- (b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the [Marking guidance](#).

0 marks

No relevant content.

Level 1 (1-2 marks)

There is a simple description of part of a process or a reference to at least one of: mechanical digestion, lipase, product of enzyme action, bile, site of production or site of digestion

Level 2 (3-4 marks)

There is a description of at least one process linking ideas

Level 3 (5-6 marks)

There is a clear description of the process including reference to the majority of: mechanical digestion, lipase, bile, where they are produced, products, function of bile and site of digestion / absorption

Examples of biological points made in the response:

- mechanical breakdown in mouth / stomach
- fats → fatty acids and / or glycerol
- by lipase
- (produced by) pancreas
- and small intestine
- fat digestion occurs in small intestine
- bile
- produced by liver

- neutralises acid from stomach
- produces alkaline conditions in intestine
- refs. to increased surface area related to emulsification or chewing
- products are small molecules / water-soluble
- products absorbed by small intestine

6

[9]

Q2.

- | | | | |
|-----|-------|--|---|
| (a) | (i) | kidney | 1 |
| | (ii) | bladder | 1 |
| | (iii) | liver | 1 |
| | (iv) | lung(s) | 1 |
| | (v) | skin | 1 |
| (b) | (i) | 3000
<i>allow 2970 to 3030</i>
<i>correct answer gains 2 marks with or without working</i>
<i>if answer incorrect allow 1 mark for evidence of 1550 + 450 + 1000 (allow tolerance of + or - ½ square on each)</i> | 2 |
| | (ii) | 1600
<i>allow 1570 to 1630</i> | 1 |
| | (iii) | 1400
<i>allow (b)(i) – (b)(ii)</i> | 1 |
| | (iv) | correct plot from (b)(iii)
<i>tolerance ½ square ignore width</i> | 1 |
| | (v) | cells swell / overhydrated /
damaged
<i>accept poisoned (by urea)</i> | 1 |

[11]

Q3.

- (a) **A** artery
allow aorta 1
- B** ventricle
ignore references to left and right 1
- C** atrium
ignore references to left and right
allow atria 1
- D** vein
allow vena cava 1
- (b) (i) stent 1
- (ii) keeps (artery) open 1
- so (more) blood can flow through
allow blood can flow (more) easily
ignore ref to blood clots 1

[7]

Q4.

- (a) **A** aorta
ignore left and right 1
- B** ventricle 1
- C** atrium
allow atria 1
- D** vena cava 1
- (b) (i) (coronary) artery
allow arteriole 1
- (ii) stent / description
accept (coronary) by-pass operation
allow statins
allow diets low in cholesterol

- allow balloon (angioplasty)* 1
- (iii) (stent) keeps artery open
must relate to (b)(ii) 1
- or**
ignore reference to capillary / vein
- (by-pass) new blood vessel / vein connecting around narrowed region;
- or**
(statins / low cholesterol diet) remove some of the cholesterol blockage
- or**
(balloon) widens / opens the blood vessel 1
- which allows (more) blood through or allows blood to go around the blockage
- (c) (i) F artery
accept arteriole / branch of pulmonary artery 1
- G capillary 1
- H vein
H accept venule / branch of pulmonary vein; 1
- (ii) F (Pulmonary artery) has less oxygen / more carbon dioxide / more glucose / sugar
accept F (Pulmonary artery) is deoxygenated
accept converse for H (Pulmonary vein)
'It' refers to F 1
- [12]

Q5.

- (a) (concentration high) in the hepatic portal vein is blood with glucose absorbed from the intestine 1
- concentration is lower in the hepatic vein because insulin 1
- (has caused) glucose to be converted into glycogen 1

or

allows glucose into liver cells

- (b) (i) (after 6 hours) most of the glucose has been absorbed from the intestine
or from food into the blood

1

- (ii) because glucagon (made in the pancreas) causes
if biological terms incorrectly spelt they must be phonetically accurate
do **not** accept glucagon made / produced by the liver

1

glycogen to be converted into glucose

1

glucose released into blood

allow the liver maintains the correct / constant level of glucose in the blood

1

[7]

Q6.

- (a) (i) 251.2

*award 2 marks for correct answer, irrespective of working.
if incorrect or no answer 62.8×4 or equivalent gains 1 mark*

2

- (ii) 31.2

allow ecf from (a)(i); answer to (a)(i) – 220

1

- (b) any **two** from:

- overweight / obesity **or** increased BMI
allow get fat
ignore get heavier
- (Type 2) diabetes
allow high blood sugar
- high blood pressure
- cardiovascular / heart disease **or** heart problems **or** disease of blood vessels **or** clogged arteries
- high cholesterol
- arthritis / worn joints
- tooth decay

2

Q7.

- (a) (i) addictive
allow addicting / addict / addicted / addiction or similar
allow phonetic spelling
*do **not** accept / additive / addition* 1
- (ii) junction / gap / space between neurones
allow nerve cells / nerves for neurones
allow idea where neurones /
nerve cells / nerves meet / join 1
- (b) (i) tablet with no drug
accept answers that convey this idea eg fake / dummy /
sugar pill
allow injection with no drug
ignore drugs that don't work. 1
- (ii) for comparison
accept to see if drug / it works
*allow to see psychological effect **or** make sure, it is not all in*
the mind
allow as a control
ignore 'to make test fair / unbiased' 1
- (iii) Neither doctors nor volunteers 1
- (iv) any **two** from:
 - age (range)
 - sex / gender (mix)
 - previous smoking habits **or** eg number smoked (before trial)
or length of time smoked
 - number in the group
 - other drugs being taken **or** general health **or** height / weight /
 BMI / lifestyle / fitness
ignore factors already controlled
*ignore reference to all smokers **or** all want to give up*2
- (c) higher percentage / number of smokers who had stopped smoking (than Drug B)

*answers must refer to data and be comparative
allow best results / most effective
ignore best drug unqualified
ignore references to 12 weeks / 1 year*

1

[8]

Q8.

(a) any **two** from:

- diet
*ignore exercise
accept any reasonable reference to diet
do **not** accept salt / blood pressure
ignore age / gender / HDL / LDL*
- heredity / genes / genetic makeup
- reference to cholesterol production by liver

2

(b) (i) Blood cholesterol concentration is only one of several factors affecting death from all causes

1

(ii) 170 – 210
accept 210 - 170

1

[4]

Q9.

(a) any **one** from:

*ignore control variables that are not given in the method,
such as 'equally crushed' **or** same time
do **not** accept volume of apple juice*

- 20 g (of apple) **or** (same) mass / amount / weight of apple
ignore volume / size
- crushed (apple)
- 10 drops (of solution) **or** (same) number / amount / volume of drops
*do **not** accept 10 drops of amylase alone*
- apple **or** type of fruit
ignore type of apple

1

(b) (may) have different volume / amount / sizes
ignore reference to human error

ignore don't know / can't measure size of drop

1

- (c) amylase has no / little effect on cell / walls / apple
accept ideas that refer to shape of enzyme being 'incorrect'

or amylase does not breakdown / digest cell / walls / apple
accept amylase only breaks down / digests starch

1

pectinase breaks down cell / walls / apple
allow digest for breakdown
allow shape of pectinase fits cell / walls / apple

1

boiling breaks down cell / walls / apple

1

- (d) 11.6

1

enzyme / pectinase destroyed / denatured / damaged / broken down
*do **not** allow kill*

1

only effect of boiling (relevant)

1

[8]

Q10.

- (a) (i) capillary

1

- (ii) diffusion

1

(iii)

Carbon dioxide	low(er)	high(er)
----------------	---------	----------

1

Oxygen	high(er)	low(er)
--------	----------	---------

1 mark for each correct row

1

- (b) (i) red blood cells

1

- (ii) haemoglobin

1

[6]

Q11.

- (a) (i) 7500
ignore units 1
- (ii) any **two** from
if examples given they must be correct
(differences in)
- age
 - gender / sex
 - activity /amount of exercise
allow job / lifestyle
ignore fitness / health / medication
 - metabolism / metabolic rate
allow BMR
 - genetic differences
 - body weight / mass / size / physique
allow BMI
 - pregnancy
 - proportion of muscle to fat 2
- (b) **A**
if box empty, allow in explanation 1
- more energy taken in than used
accept more food taken in than used
allow correct numbers if comparative
ignore incorrect numbers if comparison correct 1
- (c) eat less (food / carbohydrates / fat / calories)
accept a medical treatment such as gastric band / slimming pills / liposuction
ignore balanced / healthy / diet
allow go to weight watchers etc.
ignore burn off more 1
- exercise (more) **or** go to the gym 1

[7]

Q12.

- (a) (i) any **one** from:
ignore cancer / AIDS
- as a sleeping pill
*do **not** accept morning sickness*
 - treating leprosy
- 1
- (ii) thalidomide causes birth defects / abnormalities / described
in this order
ignore kill / harm / damage baby
- 1
- to be (more) sure of not getting pregnant
*allow to be certain there is no baby **or** in case one doesn't work*
- 1
- (b) (i) oestrogen
- 1
- progesterone
- 1
- (ii) any **two** from:
- reduce chances of ovarian cancer
 - more effective (in preventing pregnancy)
 - no pills (to remember) for 7 days (out of every 28)
allow only taken for 21 days (out of 28)
 - doesn't have to be taken at the same time every day
- 2
- (iii) less chance of headaches
ignore won't get headaches
- or**
 less chance of forgetting
allow lower dose of hormone
allow fewer side effects
ignore only contains one hormone
- 1

[8]

Q13.

- (a) don't kill pathogens / bacteria / viruses / microbes / microorganisms
allow don't contain antibiotics
ignore antibodies / attack / fight

allow only treat symptoms / pain
ignore kill disease / germs

1

(b) any **two** from:

- age
- gender
- extent / severity of pain
or how long had pain before trial
- type of pain / illness / site of pain
accept 'the pain' for 1 mark, if neither extent or type given
ignore pain threshold
- (body) mass / weight / height
allow body size / physique
- other medical issues / drugs taken / health / fitness
- ethnicity

2

(c) (i) 75

ignore calculations / %

1

- (ii) faster pain relief / decrease
allow pain relief sooner
or *it works quicker*

or *more pain relief at start / in first $1 / 1\frac{3}{4}$ hours*

1

- (iii) decrease of pain higher / more

ignore more effective unless qualified by time $> 1\frac{3}{4}$ hours
allow effect lasts longer

1

decrease of pain is longer lasting

1

(d) any **three** from:

ignore yes or no

(Yes because)

- rapid pain relief (from A)
- long lasting pain relief (from B)

- and it costs less
- the sum of the pain relief (from A + B) is greater (than X)

(No because)

- drug X gives more pain relief
- (A + B / they) might interact with each other
- could result in overdose
- could be more / new side effects

*if neither points gained
allow (more) dangerous*

3

[10]

Q14.

(a) in sequence:

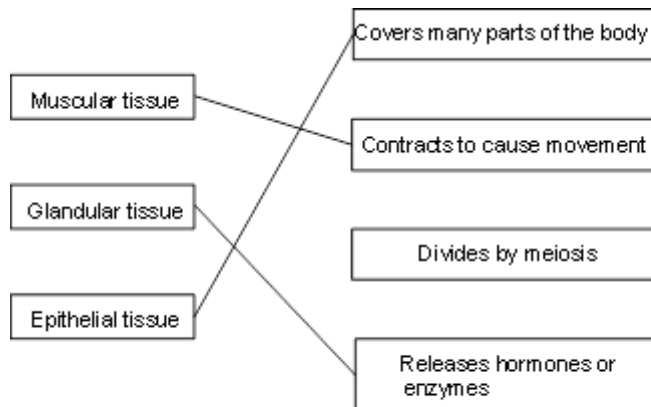
2 = tissue(s)

3 = organ(s)

4 = system(s)

1

(b)



*1 mark for each correct line
extra line(s) from one tissue cancel*

3

[4]

Q15.

(a) (i) A

1

- (ii) hydrochloric (acid) / HCl 1
- (iii) alkali / suitable named example
accept sodium hydrogen carbonate / sodium bicarbonate / milk of magnesia / other brand names
allow bile (salts)
ignore antacid 1
- (b) • amylase breaks down starch 1
- (broken down) into sugars / glucose 1
- digestion of starch in the mouth 1
- (also) starch broken down in small intestine 1
- amylase produced in salivary glands / small intestine / pancreas 1
- (c) small intestine 1
allow ileum / duodenum
*do **not** accept large intestine*

[9]

Q16.

- (a) LHS: carbon dioxide **AND** water
in either order
*accept CO₂ **and** H₂O*
allow CO₂ and H₂O
if names given ignore symbols
*do **not** accept CO² / H²O / Co / CO*
ignore balancing 1
- RHS: sugar(s) / glucose / starch / carbohydrate(s)
accept C₆H₁₂O₆
allow C₆H₁₂O₆
*do **not** accept C⁶H¹²O⁶* 1
- (b) (i) light is needed for photosynthesis
- or**
- no photosynthesis occurred (so no oxygen produced) 1

- (ii) oxygen is needed / used for (aerobic) respiration
full statement
*respiration occurs **or** oxygen is needed for anaerobic respiration gains 1 mark* 2
- (c) (i) (with increasing temperature) rise then fall in rate 1
- use of figures, ie
- max. production at 40 °C
or maximum rate of 37.5 to 38 1
- (ii) 25 – 35 °C
- either** faster movement of particles / molecules / more collisions
or particles have more energy / enzymes have more energy 1
- or** temperature is a limiting factor over this range
- 40 – 50 °C
- denaturation of proteins / enzymes
ignore denaturation of cells
ignore stomata 1
- (d) above 35 °C (to 40 °C) – little increase in rate
or > 40 °C – causes decrease in rate 1
- so waste of money **or** less profit / expensive 1
- because respiration rate is higher at > 35 °C
or
 respiration reduces the effect of photosynthesis 1

[12]

Q17.

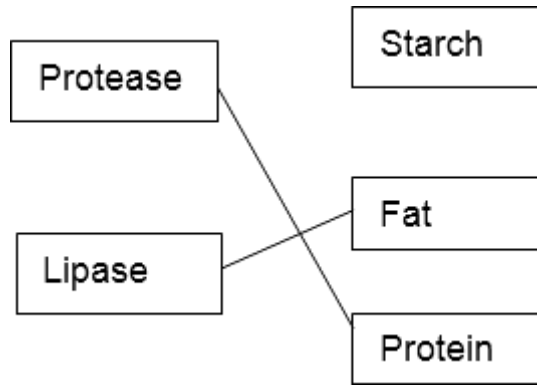
- (a) any **two** from:
- ignore eating disorder*
ignore cancer
- arthritis
accept worn joints
 - diabetes
accept high blood sugar

- high blood pressure
ignore cholesterol
 - heart disease / heart condition / heart attack / blood vessel disease
allow blood clots / strokes
- 2
- (b) (i) $\frac{1}{4}$ or 0.25 or 25%
correct answer gains 2 marks
if answer incorrect, evidence of $1500 \div 6000$ gains 1 mark
25 without % gains 1 mark
- 2
- (ii) majority / most / high proportion of people in trial lost mass / weight
ignore good results / it worked
- 1

[5]

Q18.

- (a) (i) 129
- 1
- (ii) 9
accept calculated difference between answer to (a)(i) and 120
- 1
- (b) less energy / power used
allow less fuel / named fuel used
ignore cost
- 1
- less pollution / carbon dioxide
or less hot water / less heat released
allow less global warming / carbon emissions or reduced carbon footprints
*do **not** accept secondary effects alone, eg less melting of ice caps*
- 1
- (c) (i)



1 mark for each correct line
*do **not** accept two lines from an enzyme*

2

(ii) denatured

if no answer on the line accept a clear indication of correct answer in the box

1

[7]

Q19.

(a) protease

allow trypsin / peptidase
*do **not** allow pepsin*

1

carbohydrase / amylase

*do **not** allow sucrase / maltase / lactase*

1

(b) no lipase produced / found

1

in stomach / mouth / before small intestine

OR

accept lipase only produced / found (1)

in small intestine / pancreas (1)

*if no other mark is awarded lipid is not broken down in the stomach **or** lipid is digested in small intestine gains 1 mark*

1

(c) enzymes only work in solution / when dissolved

or

because enzyme / lipase / it is dry

*allow enzymes only work in presence of water **or** enzymes do not work when dry*

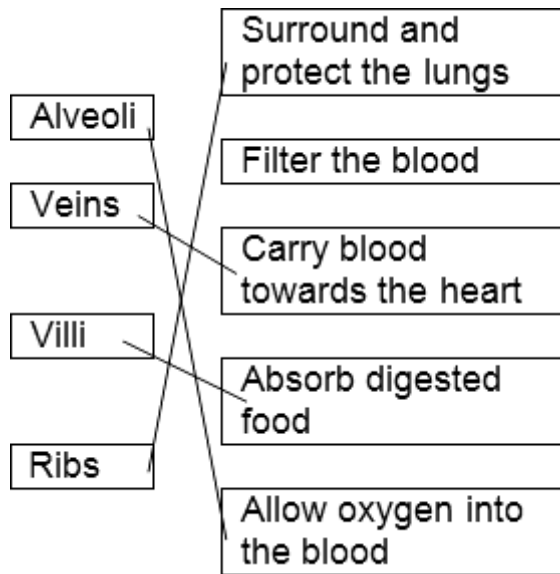
ignore other physical conditions

1

[5]

Q20.

(a)



4 correct = 4 marks

3 correct = 3 marks

2 correct = 2 marks

1 correct = 1 mark

extra line from a structure cancels the mark

4

(b) diffusion

1

[5]

Q21.

any **two** from:

- arthritis
ignore descriptions
- diabetes
- high blood pressure
- heart / blood vessel disease
ignore cholesterol

[2]

Q22.

(a) (i) any **two** from:

- fibres not damaged
- machines last longer / machines not damaged by stones

- shorterer time **or** quicker
 - lowerer temperature
allow cheaper / uses less energy as an alternative to shorter time / lower temperature, if these not given
- 2

(ii) any **two** from:

- different enzymes (for different dyes)
 - enzymes expensive
no mark for expensive alone
 - enzymes have to be removed (from denim material) (after washing / treatment)
- 2

(b) protease

1

[5]

Q23.

- (a) shape changed / destroyed (above 45 °C)
accept denatured
accept active site changed
*do **not** accept enzyme killed*

1

(shape) doesn't fit (other molecules / stain)

1

(b) (i) any **two** from:

- can wash the clothes at higher temperature
- so wash / enzyme action will be quicker
*do **not** accept idea of bacteria working faster*
- enzyme not destroyed at high temperature / 80 °C
accept denaturation or description

2

(ii) high(er) temperature / 80 °C uses more energy / fuel

1

more pollution / named (eg carbon dioxide / global warming) (from electricity production)

or

increased release of hot water (into the environment)

1

[6]

Q24.

- (a) (i) capillary 1
- (ii) diffusion 1
- (b) (i) Z
ignore any names 1
- (ii) large / increased surface / area / **or** to absorb more food **or** improved diffusion
allow all food absorbed 1

[4]

Q25.

- (a) (i) 18 1
- (ii) Z 1
- (b) (i) red blood cells 1
- (ii) haemoglobin 1

[4]

Q26.

- (a) (i) brain 1
- (ii) skin 1
- (iii) 1/25 **or** 4% **or** 0.04 **or** 1 in 25 **or** 1:25 **or** 1 out of 25
allow $\frac{1000}{25000}$ 1
- (b) any **two** from:
- increased / high heart rate / pulse rate
*do **not** allow pumps more blood unqualified*
 - dilation / widening of arteries / arterioles (to skeletal muscles)
accept vasodilation unqualified
*do **not** accept reference to veins / capillaries*

or
less blood flow to other organs

- increased stroke volume / described 2

(c) *ignore references to breathing*

more respiration / description

or
more energy required **or** to provide more energy 1

respiration / process described → CO₂
*do **not** accept anaerobic respiration* 1

CO₂ diffuses into blood 1

[8]

Q27.

(a) large surface / large area 1

thin / short distance (from air to blood) / one cell thick / two cells thick 1

good blood supply / many capillaries / capillary network / many blood vessels
ignore moist surface 1

(b) (i) diffusion
ignore gaseous exchange 1

(ii) brings (more) oxygen / air into the lungs / alveoli 1

keeps O₂ level high in alveoli

or

maintains concentration difference (between alveoli and blood) / keeps O₂ concentration in alveoli > O₂ concentration in blood gains **2** marks 1

[6]

Q28.

(a) any **two** from:

- (high) CRP / protein
- (no) heart condition

allow health

- (not high) LDL
- over 50 / age
- number of tablets (each day)
ignore time
ignore placebo / rosuvastatin
ignore number of people

2

(b) any **one** from:

- tablet with no drug
allow fake (pill) / dummy (pill) / sugar / chalk (pill)
- tablet that has no effect
allow drug that has no effect
- tablet without chemicals
ignore vitamin / mineral pill
- tablet that people thought contained statin **or** reference to psychological effect
ignore control / different statin

1

(c) 17802 / large number of people **or** enough people

ignore control group / fair test / control variables
ignore time / repeats

1

(d) any **one** from:

ignore cost

- placebo group at risk of heart attack **or** to allow statin to be given to everyone
- statin group 54% less likely to get heart attack **or** showed that statin worked **or** showed trial (very) successful
ignore reliable
- sufficient information gained / results conclusive
ignore got results early
- unethical / unfair to carry on trial

1

(e) to avoid bias **or** show impartiality **or** show results independent

allow manufacturers could cheat
ignore reliability
ignore could be sued / blamed if trial went wrong
ignore manufacturer would know which group got statin /

placebo

1

(f) any **two** from:

- reduction in LDL
allow improves LDL:HDL balance or LDL and HDL concentrations equal
ignore less cholesterol
ignore more HDL
*do **not** accept less HDL*
- reduction in (saturated) fats
- reduces deposition of fat / cholesterol / LDL in walls of blood vessels
or
 blood vessels less likely to be blocked with fat / cholesterol / LDL

2

[8]

Q29.

(a) any **one** from:

ignore reference to recording results every 5 minutes or concentrations of lipid / lipase

- (same) volume / amount / 1 cm³ lipase
allow amount of solution
- (same) volume / amount / 5 cm³ lipid
allow keep same volumes in the test tubes
- mixed after 3 minutes / same time before mixing
*do **not** accept temperature*

1

(b) so that the lipase and the lipid reached the right temperature

1

(c) any **two** from

ignore explanations

- decrease in time **or** faster (breakdown)
- then increase in time **or** then slower (breakdown)
- fastest / least time / optimum at 35°C

2

(d) any **two** from:

ignore 'test at more temperatures' unqualified

- test more regularly eg test every minute

any interval < 5min

- test at smaller temperature intervals
any value < 15°C
allow test more temperatures in the range
- test between 50 (°C) and 95 (°C)
any value in range, eg test at 70
- repeat at same temperatures
or repeat the investigation
or compare results with others
*allow do **it** again*

2

- (e) (i) (lipase / it) denatured / destroyed / changed shape
allow damaged / deformed
*do **not** accept killed*
ignore broken (down)

1

- (ii) fatty acids and glycerol

1

[8]

Q30.

- (a) (i) cholesterol

1

fat

in this order

1

- (ii) mycoprotein has (approx) half amount of protein / has 11.8 (g) protein while chicken has 22.0 (g)
accept has less protein
ignore less fat

1

- (b) (i) increased

1

(±) constant rate **or** (from 0) to 9.2 / by 9.2(cm) **or** about 1 cm a day **or** increase slower at the beginning and / or at the end

1

- (ii) species **A** grows faster / more than species **B**
or
species **A** has larger diameter **or** is bigger
or
the growth of species **B** slows down after 6 weeks
accept use of approximate figures

1

(c) any **two** from:

- pH / acidity / alkalinity
ignore references to carbon dioxide / waste products
- (speed of) stirring
ignore time in the fermenter
- oxygen (concentration) / aeration
ignore initial amount of Fusarium
- ion concentration / named eg -NH_4^+
allow ammonia
- pressure

2

[8]

Q31.

(a) blood has red (blood) cells / haemoglobin

1

haemoglobin combines with / carries oxygen

ignore 'mix'

NB Blood can form oxyhaemoglobin = **2** marks

1

(b) blood gains oxygen / becomes oxygenated (in the lungs)

idea of acquiring oxygen must be unambiguous

1

blood loses oxygen to the muscles / cells

1

because muscles are respiring (aerobically)

1

to provide energy (for exercise)

1

[6]

Q32.

D – *many* microvilli (1)

Ex – provide large surface area (1)

five points made

max 3 descriptions

max 3 explanations

D – *many* capillaries / *good* blood supply (1)

Ex – maintain concentration / diffusion gradient **or** quickly removes food (1)

D – thin wall / one cell thick surface / capillaries near surface (1)

allow villi are thin
ignore villi are one cell thick

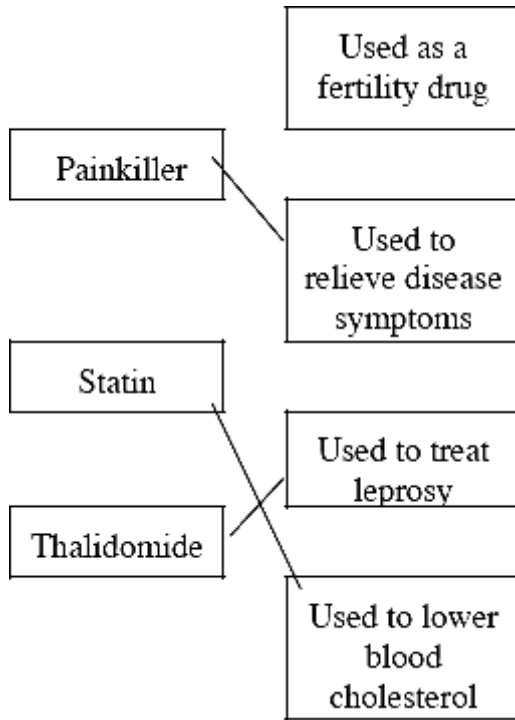
Ex – short distance for food to travel (1)

D – *many mitochondria* (1)

Ex – provide energy / ATP for active uptake / transport (1)

[5]

Q33.



(a)

all three correct = 3 marks
two correct = 2 marks
one correct = 1 mark
extra line from a statement cancels the mark

3

(b) (i) 8

1

(ii) 3210

1

(c) (i) if it is toxic

1

(ii) if it has side effects

1

[7]

Q34.

- (a) fatty acids 1
- glycerol 1
- (b) (i) any **one** from:
- (same) amount / 1 cm^3 fat
 - (same) amount / 10 cm^3 lipase / enzyme
 - (kept for) 24 hours **or** (same length of) time
- 1
- (ii) temperature
allow heat / warmth
- 1
- (c) (carry out experiments) using more temperatures / smaller intervals
ignore repeat unqualified
do not accept longer time
- 1
- between 20 and 60 °C / around 40 °C
accept extra single temperature in range 20 °C – 60 °C but
cannot be 20 °C, 40 °C or 60 °C
- 1
- (d) (i) 'strong' acid
- 1
- (ii) enzyme works / not destroyed / not denatured / not damaged
*do **not** accept enzyme not killed*
accept any indication that the fat is digested
accept same as tube 3 / tube at 40 °C
accept optimum temperature / at or near body temperature
- 1

[8]

Q35.

- (a) pancreas
either order
- 1
- small intestine
- 1
- (b) any **two** from:
- to give them time to come to temperature of the water-bath
accept so (they / both) are at the same temperature
 - at / near body temperature / best / optimum temperature

- otherwise reaction would take place at a series of different temperatures
or sensible statement about control / fair test 2

- (c) (i) 0.42 1
allow in range 0.42 to 0.425

- (ii) 0.021 2
correct answer with or without working
allow ecf from (c)(i) ie (c)(i) ÷ 20 correctly calculated for 2 marks
if answer incorrect 0.42 ÷ 20 or (c)(i) ÷ 20 gains 1 mark

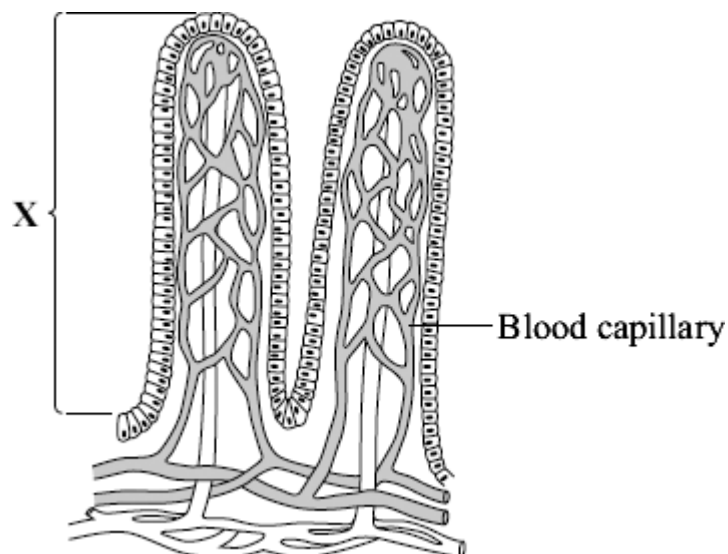
- (iii) (all) starch digested / gone / used up / turned to sugar 1
allow the amount of sugar stays the same / maximum

- (iv) any **two** from 2
allow reference to active site once only as alternative to first or second bullet point
 - enzyme destroyed / denatured / damaged / shape changed
do not accept killed
 - unable to fit (starch molecule)
 - starch can't be digested
enzymes don't work is insufficient

[10]

Q1.

The diagram shows part of the lining of the small intestine.



(a) (i) Name structure **X**.

Draw a ring around **one** answer.

alveolus

thorax

villus

(1)

(ii) Choose **three** ways in which structure **X** is adapted to help the absorption of soluble food.

Tick (✓) **three** boxes.

It is ventilated.

Its outer surface is one cell thick.

It has a large surface area.

It contains a layer of muscle.

It has a good blood supply.

Its cells contain haemoglobin.

(3)

(b) Name the process by which soluble food enters the blood.

Draw a ring around **one** answer.

diffusion

fermentation

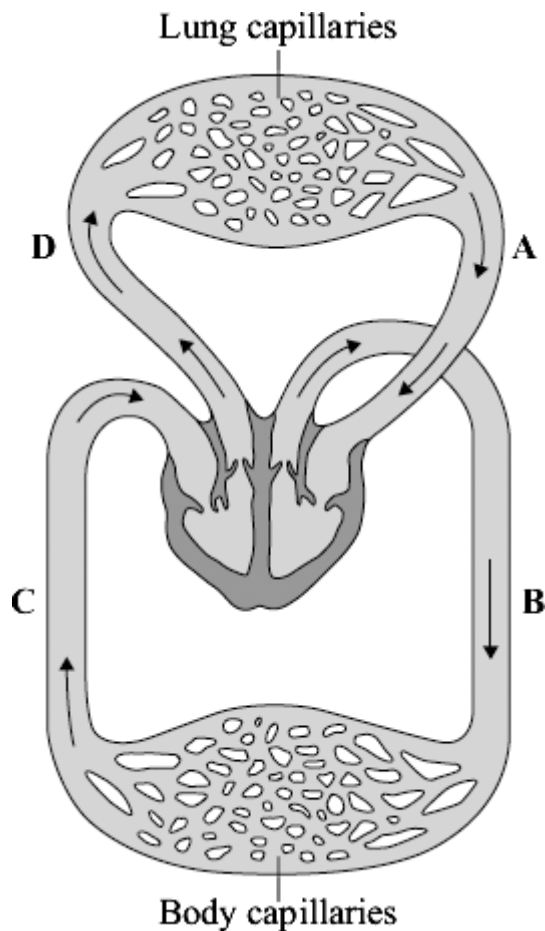
transpiration

(1)

(Total 5 marks)

Q2.

The diagram shows the human circulation system.



(a) (i) Give the letter of **one** blood vessel that is an artery.

(1)

(ii) Give the letter of **one** blood vessel that carries oxygenated blood.

(1)

(b) During exercise, the heart rate increases.

Explain, as fully as you can, why this increase is necessary.

(4)
(Total 6 marks)

Q3.

Diet and exercise affect health.

- (a) Many people are obese (very overweight).

Obesity can lead to heart disease.

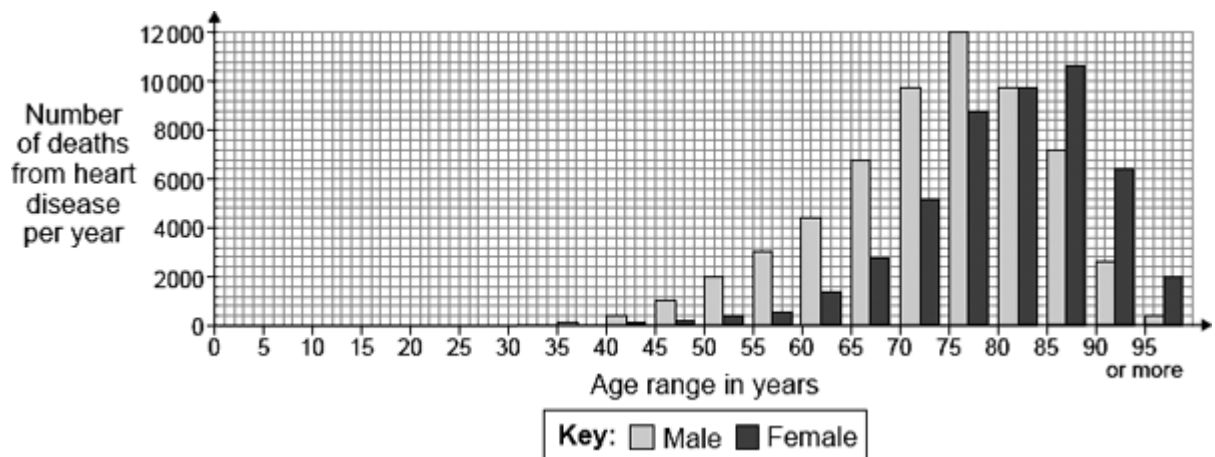
Other than heart disease, name **two** conditions which are linked to obesity.

1. _____

2. _____

(2)

- (b) The graph shows the number of deaths from heart disease each year in the UK.



The pattern for deaths from heart disease in men is different from the pattern in women.

- (i) Give **two** differences between the patterns for men and women.

1. _____

2. _____

_____ (2)

(ii) Suggest **two** reasons for the difference in the number of deaths from heart disease in men and women between the ages of 40 and 60.

1. _____

2. _____

_____ (2)

(c) Scientists have developed drugs to reduce the concentration of cholesterol in the blood.

Give the **three** main stages in testing a new drug before it is sold to the public.

1. _____

2. _____

3. _____

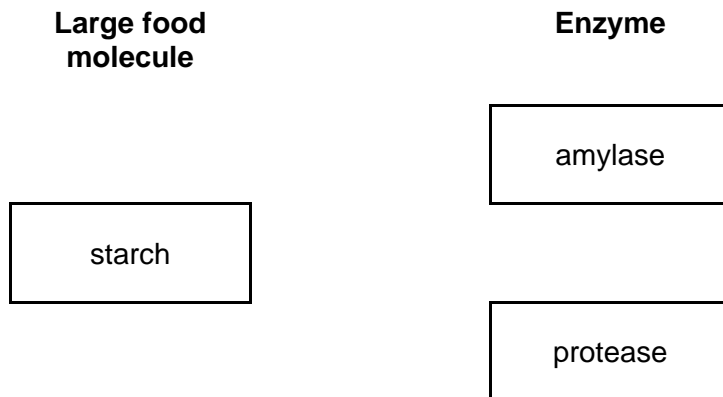
_____ (3)

(Total 9 marks)

Q4.

The body uses enzymes to digest (break down) large food molecules into smaller molecules.

(a) (i) Draw **one** line from **each** large food molecule to the enzyme that acts on it.



fat

protein

lipase

isomerase

(3)

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

Starch is broken down into

amino acids.
fatty acids and glycerol.
sugars.

Fat is broken down into

amino acids.
fatty acids and glycerol.
fructose.

Protein is broken down into

amino acids.
fructose.
sugars.

(3)

(b) Bile helps digestion.

Where is bile produced?

Draw a ring around **one** answer.

liver

mouth

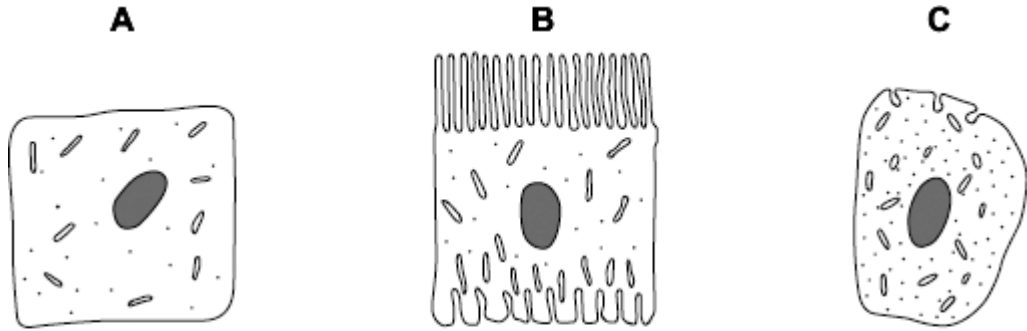
stomach

(1)

(Total 7 marks)

Q5.

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



Key - Mitochondrion · Ribosome

(a) Which cell, **A**, **B** or **C**, appears to have adaptations to increase diffusion into or out of the cell?

Give **one** reason for your choice.

(1)

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

Name **one** useful substance produced by the pancreas.

(1)

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

(2)

(Total 4 marks)

Q6.

Fresh milk is a mixture of compounds including fat, 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
30	20
35	14
40	11
45	6
50	12
55	23

- (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** show that this statement is unlikely to be true.

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.

Explain how bile helps the digestion of milk.

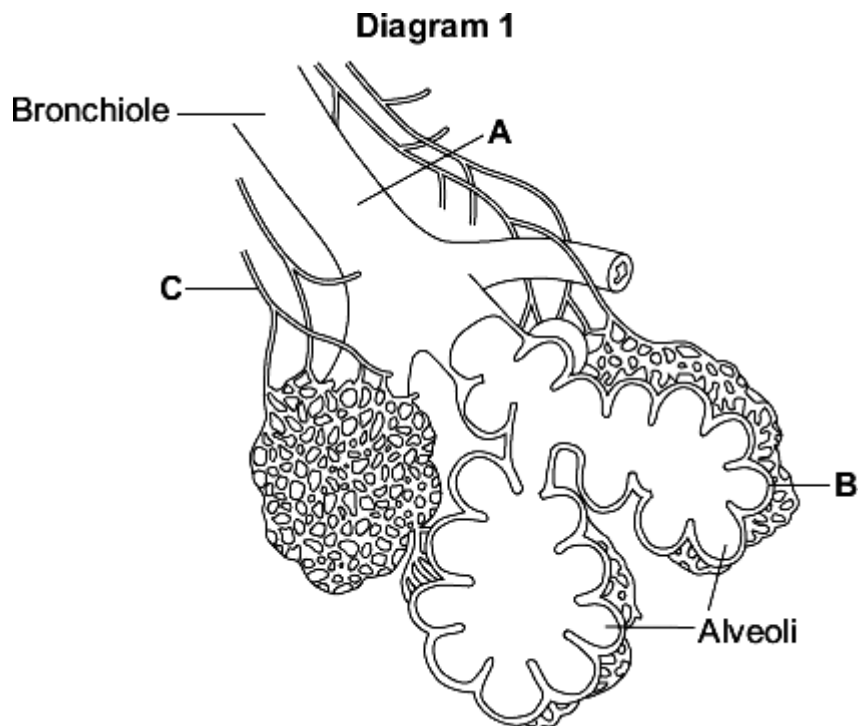
(2)

(Total 7 marks)

Q7.

People with asthma sometimes find it difficult to breathe.

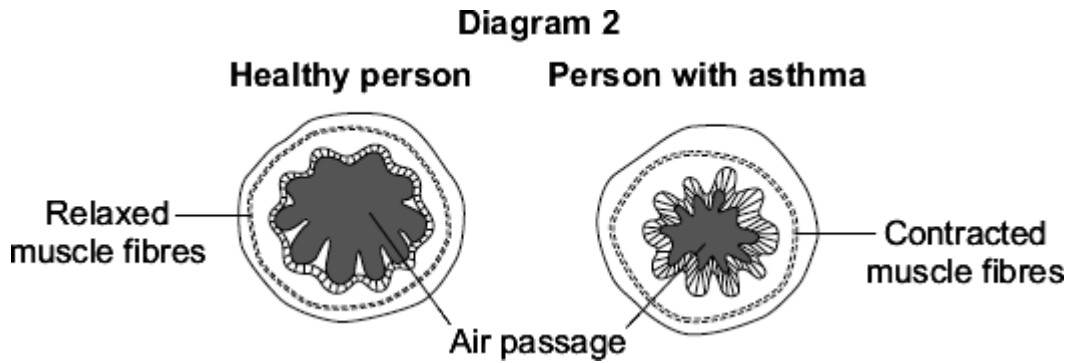
Diagram 1 shows part of a human lung. Bronchioles are tubes that carry air to the alveoli.



(a) Which letter, **A**, **B** or **C**, shows where oxygen enters the blood?

(1)

- (b) **Diagram 2** shows a section through a bronchiole of a healthy person and of a person suffering from asthma.

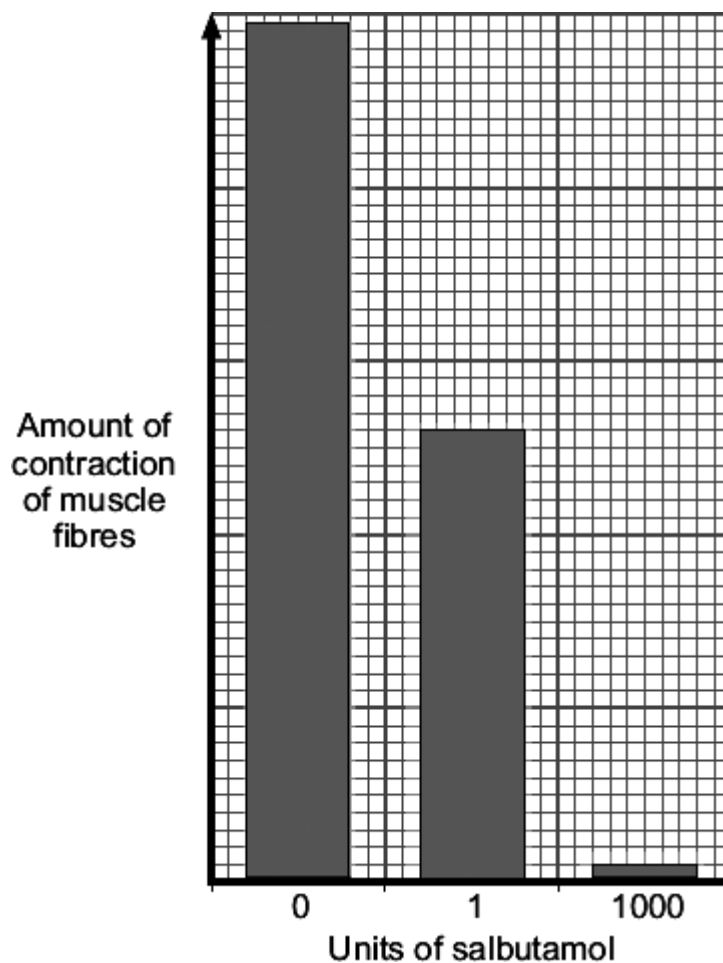


The person with asthma may find it difficult to breathe.

Use information from **Diagram 2** to give the reason for this.

(1)

- (c) A person has asthma. The bar graph shows the effect of the drug salbutamol on the contraction of the muscle fibres in the wall of this person's bronchioles.



- (i) Describe the effect of salbutamol on the person's muscle fibres.

(1)

- (ii) How does salbutamol help this person?

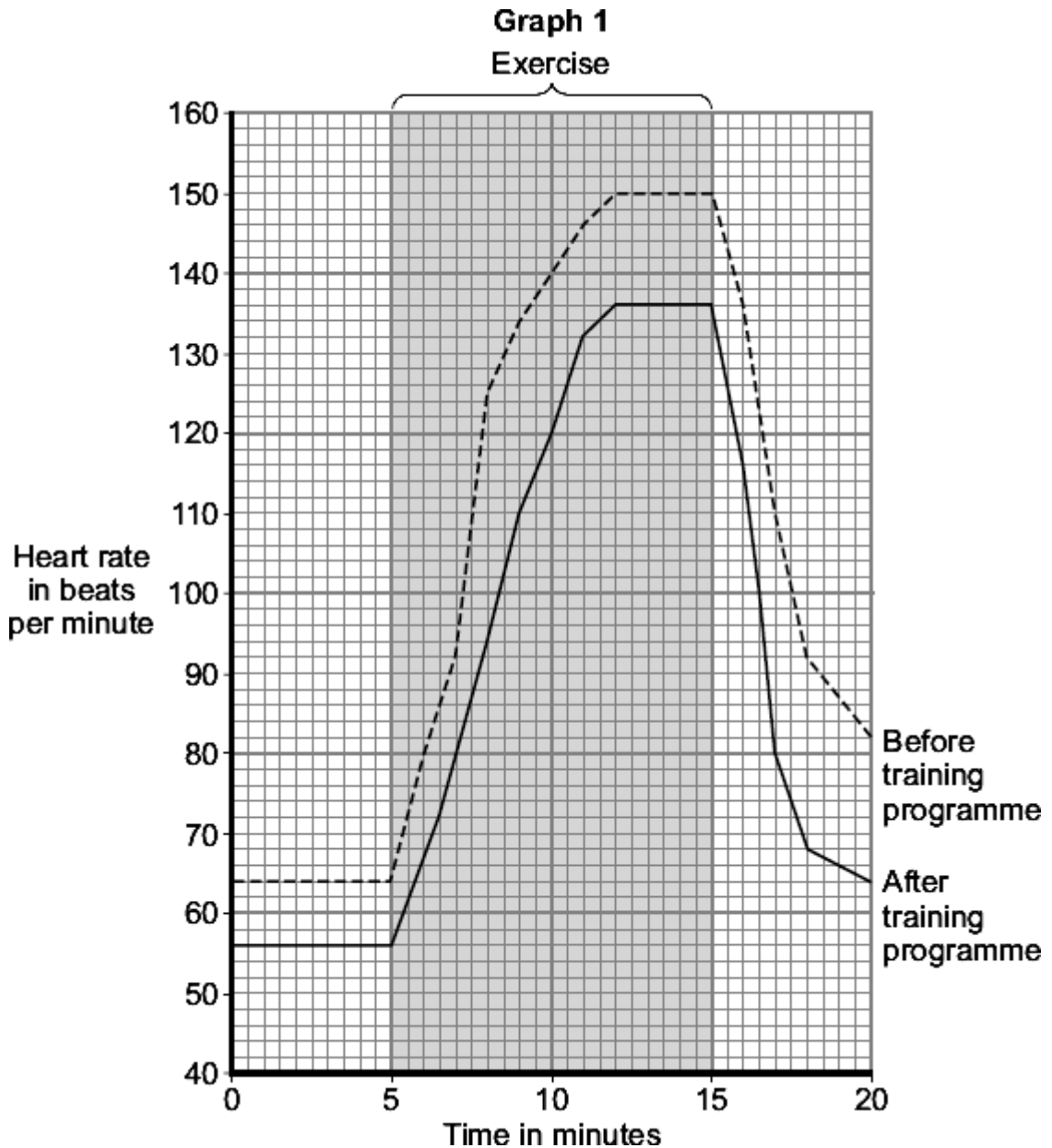
(1)

(Total 4 marks)

Q8.

An athlete carried out a 6-month training programme.

Graph 1 shows the effect of the same amount of exercise on his heart rate before and after the training programme.



- (a) (i) Use **Graph 1** to find the heart rate of the **trained** athlete 5 minutes after the start of the exercise.

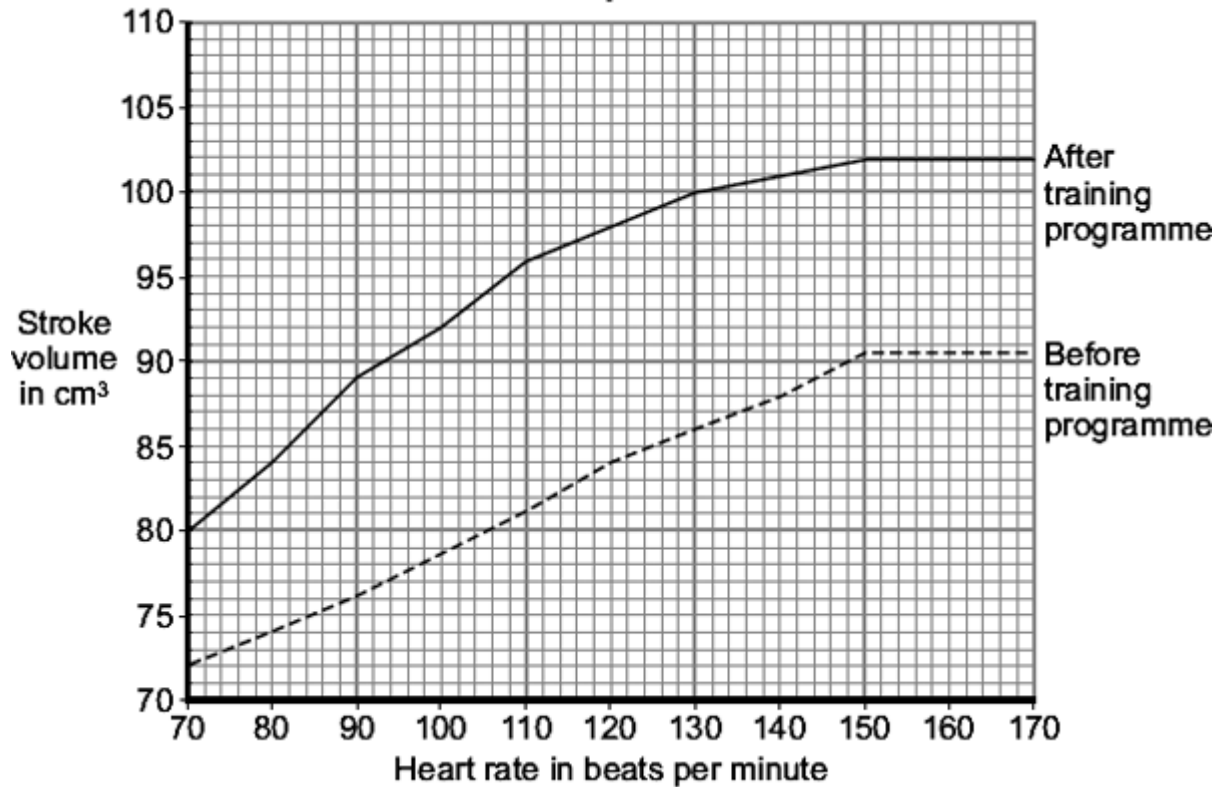
Heart rate = _____ beats per minute

(1)

The stroke volume of the heart is the volume of blood pumped out of the left side of the heart in one heart beat.

Graph 2 shows the relationship between the stroke volume and the heart rate before and after the athlete did the training programme.

Graph 2



(ii) The *cardiac output* is defined as

$$\text{cardiac output} = \text{heart rate} \times \text{stroke volume}$$

Calculate the cardiac output of the **trained** athlete 5 minutes after the start of the exercise. Use your answer to part (a)(i), and information from **Graph 2**.

Show clearly how you work out your answer.

Cardiac output = _____ cm³ blood per minute

(2)

(b) **Graph 1** shows that, for the same amount of exercise, the heart of the trained athlete was beating more slowly than it did before the training programme.

Use information from **Graph 2** to explain why.

(2)

- (c) An increased cardiac output will provide more oxygen and more glucose to the working muscles.

Explain how this helps the athlete during exercise.

(4)
(Total 9 marks)

Q9.

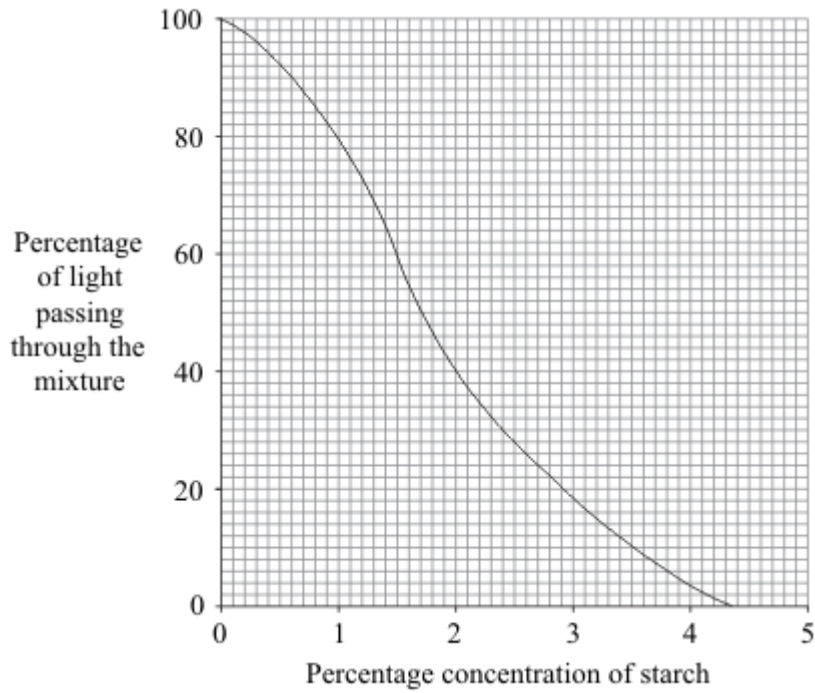
A manufacturer of slimming foods is investigating the effectiveness of carbohydrases from different microorganisms.

Iodine solution is a pale golden brown, transparent solution. Starch reacts with iodine to form a dark blue mixture.

Known concentrations of starch are added to iodine solution. The mixture is placed in a colorimeter which measures the percentage of light passing through the mixture.

Graph 1 shows the results.

Graph 1



- (a) Explain why less light passes through the mixture when the starch is more concentrated.

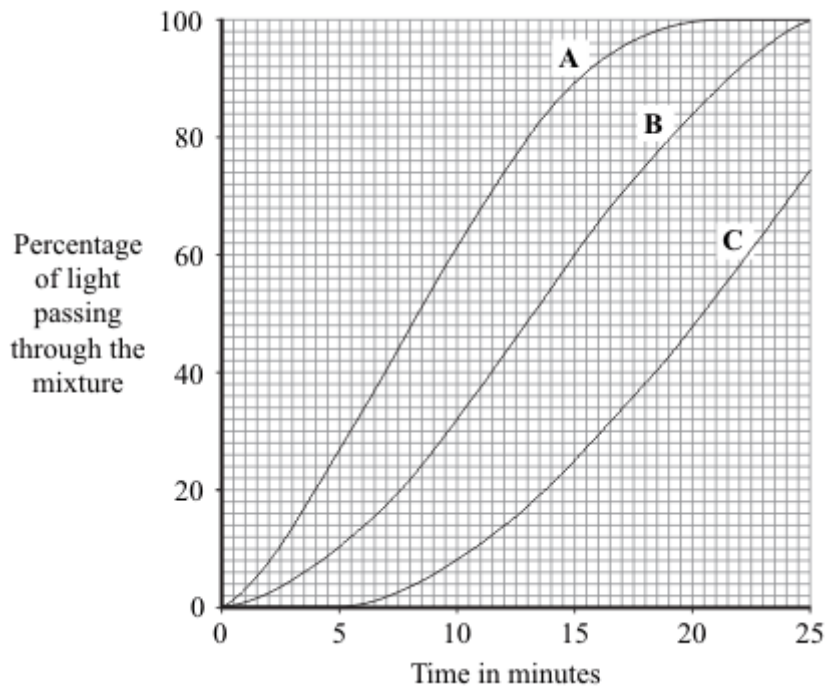
(1)

- (b) The manufacturer adds carbohydrase from each of three different microorganisms, **A**, **B** and **C**, to starch in flasks at 40 °C.

Every minute a sample of the mixture is added to iodine solution and placed in the colorimeter.

Graph 2 shows these results.

Graph 2



- (i) When the concentration of starch reaches 2 %, digestion is considered to be sufficient for the next stage in the manufacture of the slimming food.

How long does this take for the most effective carbohydrase?

Show clearly how you work out your answer.

_____ minutes

(2)

- (ii) Explain why the manufacturer carried out the investigation at 40 °C.

(2)

- (c) Carbohydrases convert starch into glucose. To complete the manufacture of the slimming food the glucose should be converted into fructose.

- (i) Name the enzyme which would be used to convert glucose into fructose.

(1)

(ii) Explain why fructose, rather than glucose, is used in slimming foods.

(2)

(Total 8 marks)

Q10.

(a) Draw a ring around **one** word to answer each of the following questions.

(i) Which type of blood vessel carries blood out of the heart?

artery **capillary** **vein**

(1)

(ii) Which type of blood vessel allows substances to enter and leave the blood?

artery **capillary** **vein**

(1)

(b) Use words from the box to complete the sentences.

alveoli	cell membrane	nucleus
plasma	red blood cells	villi

Oxygen enters the blood through the walls of the _____ .

Most of the oxygen transported by the blood is carried in the _____ .

A red blood cell is different from other body cells because it does not have a _____ .

(3)

(Total 5 marks)

Q11.

(a) The table shows the effect of exercise on the action of one person's heart.

	At rest	During exercise
Heart rate in beats per minute	72	165
Volume of blood leaving the heart in each beat in cm ³	75	120
Heart output in cm ³ per minute	5400	

(i) Calculate the heart output for this person during exercise.

Show clearly how you work out your answer.

Answer = _____ cm³ per minute

(2)

(ii) During exercise, more oxygen is carried to the working muscles.

Explain why this is helpful during exercise.

(2)

(b) Give **two** other changes in the body that help to increase the amount of oxygen delivered to the working muscles during exercise.

1. _____
- _____
2. _____
- _____

(2)
(Total 6 marks)

Q12.

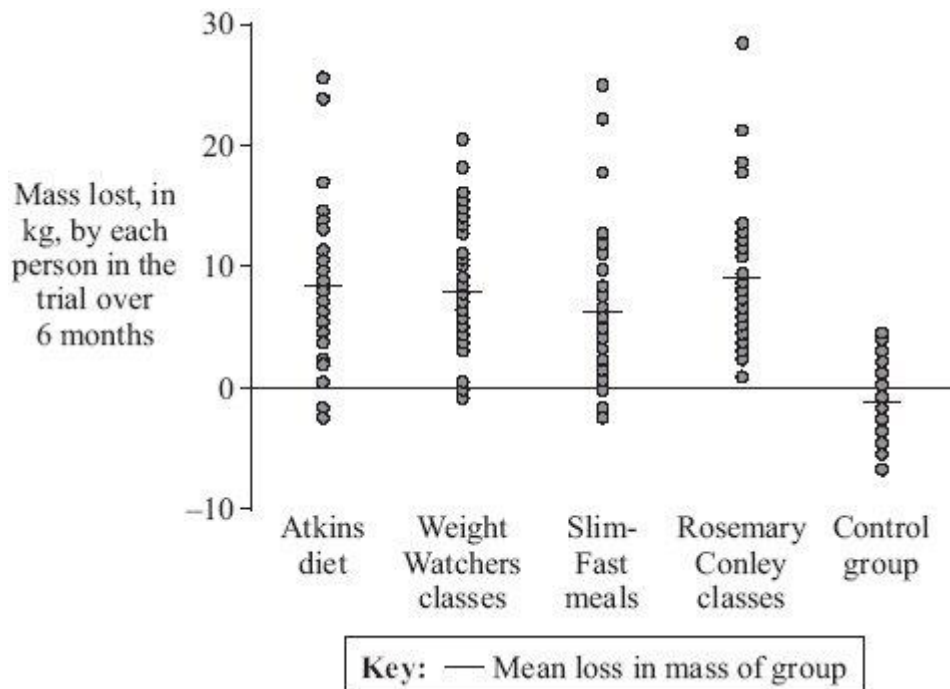
Many people who are overweight try slimming programmes.

A research study evaluated four different slimming programmes over 6 months.

Scientists selected a group of 40 people for each slimming programme and a control group.

Each of the five groups was matched for age, gender and mass.

The graph shows the results of the study.



Adapted from British Medical Journal, 2006, volume 332, pages 1309 –1314.

(a) Give **two** control variables that were used in this study.

1. _____
2. _____

(2)

(b) Give **two** conclusions that can be drawn from the results of this study.

1. _____
2. _____

(2)

(c) The costs of the four programmes were:

- Atkins book cost £3
- Rosemary Conley classes cost £140 for 6 months
- Weight Watchers classes cost £170 for 6 months
- Twice-daily Slim-Fast meal replacements cost £240 for 6 months.

Use this information and the graph to answer this question.

Which is the most cost effective of the four programmes?

Explain the reason for your answer.

(2)

(d) Some slimming programmes include daily exercise.

Explain how daily exercise helps a person to lose mass.

(2)

(Total 8 marks)

Q13.

A manufacturer is trying to improve the quality of the biological detergent he produces.

Scientists at his company carried out the following experiments on enzymes:

- Samples of lipase were collected from five different types of bacterium, **A**, **B**, **C**, **D** and **E**.
- The samples were diluted to give the same concentration of lipase.
- Agar jelly containing a lipid was prepared in a dish. This forms a cloudy mixture which becomes clear when the lipid is digested.
- Five small holes were cut into the agar.
- Two drops of lipase solution from bacterium **A** was added to hole **A**.
- This process was repeated for each sample of lipase.

Diagram 1 shows the appearance of the dish.

Diagram 1

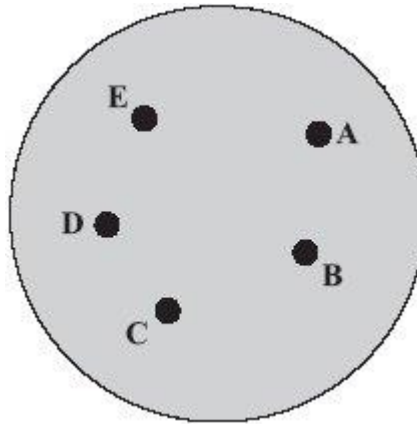
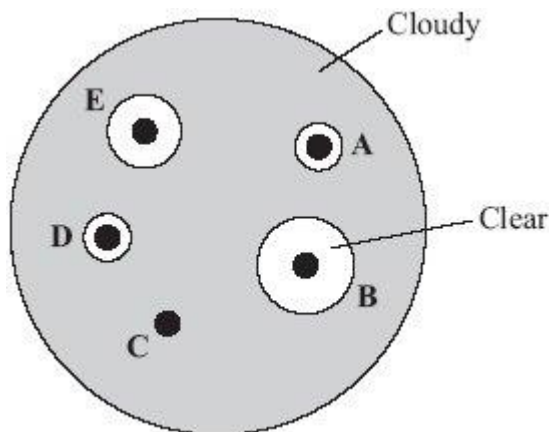


Diagram 2 shows the appearance of the dish 24 hours later.

Diagram 2



- (a) (i) Which type of bacterium, **A**, **B**, **C**, **D** or **E**, produced the most effective lipase in this investigation?

Write your answer, **A**, **B**, **C**, **D** or **E**, in the box.

(1)

- (ii) Explain your answer.

(1)

- (b) The manufacturer plans to add the most effective lipase to the washing powders he produces.

Suggest **two** other factors he should investigate before deciding which lipase is the most effective.

1. _____

2. _____

(2)

(c) Many biological detergents cannot be used at high temperatures.

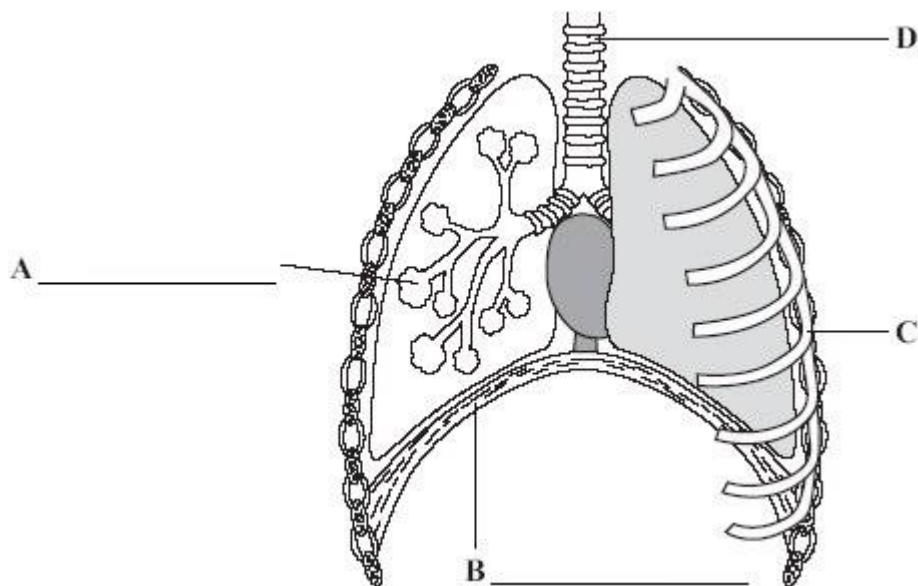
Explain why.

(1)

(Total 5 marks)

Q14.

The diagram shows the human breathing system.



(a) On the diagram, label structures **A** and **B**.

Choose your answers from the words in the box.

alveolus	capillary	diaphragm	rib
----------	-----------	-----------	-----

(2)

In the lungs, oxygen passes from the air into the blood.
Carbon dioxide passes from the blood into the air.

(b) Which letter, **A**, **B**, **C** or **D**, shows where oxygen enters the blood?

(1)

(c) When oxygen enters the blood it combines with haemoglobin.

Draw a ring around the correct word or phrase to complete each sentence.

(i) Haemoglobin is found in the

plasma. red blood cells. white blood cells.

(1)

(ii) Most of the carbon dioxide is carried by the

plasma. red blood cells. white blood cells.

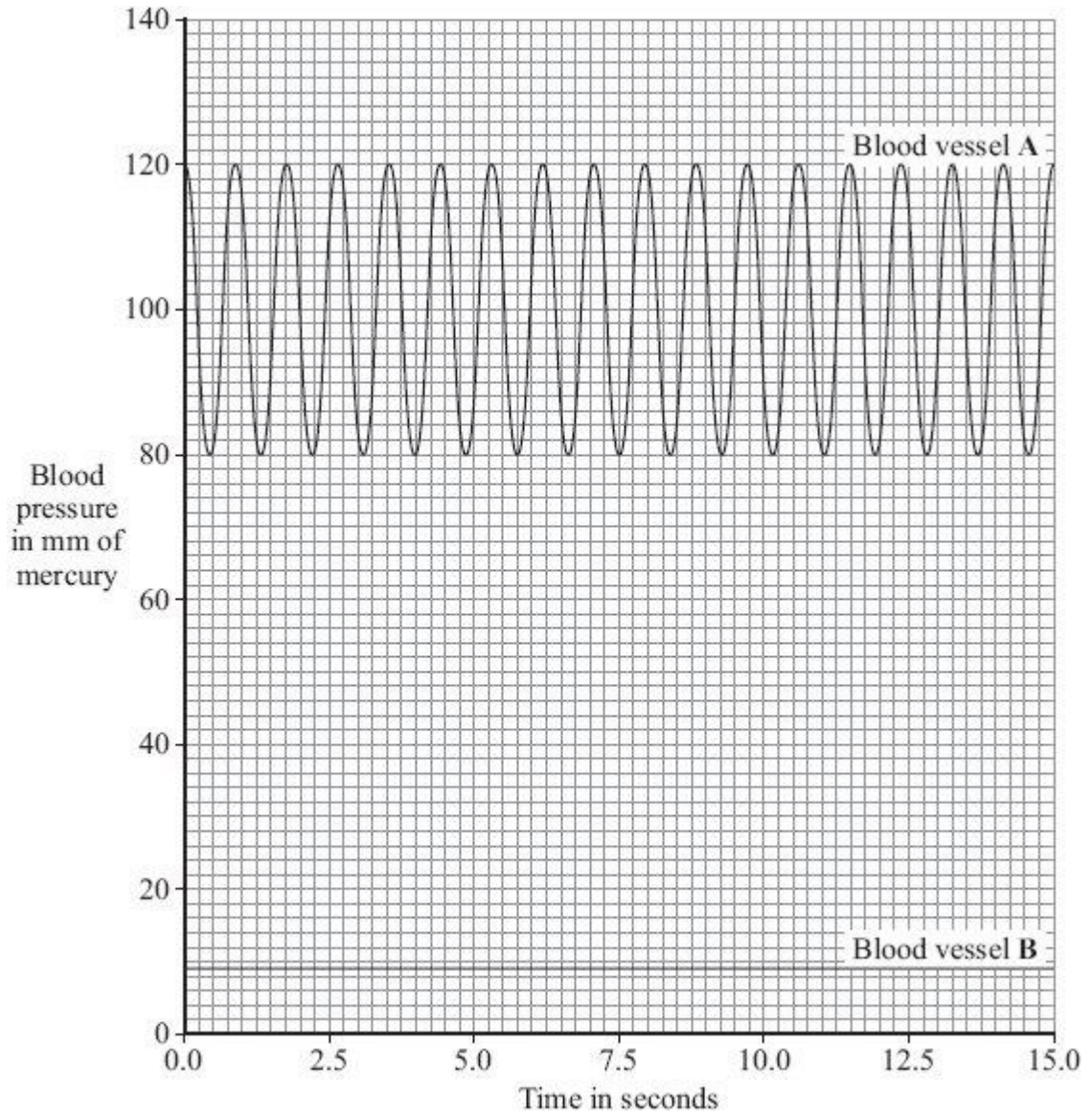
(1)

(Total 5 marks)

Q15.

The heart pumps 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.



(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. This supplies useful substances to the muscles and removes waste materials from the muscles at a faster rate.

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

1. _____

2. _____

(2)

- (ii) Name **one** waste substance that must be removed from the muscles at a faster rate during exercise.

(1)

(Total 7 marks)

Q16.

Bile is produced in the liver, stored in the gall bladder, then released into the small intestine.

- (a) Explain how bile affects the digestion of food in the small intestine.

(2)

- (b) Bile contains bile pigments and cholesterol.

If the diet contains too much cholesterol, some of it may form 'gallstones' in the bile.

These gallstones may prevent bile from moving out of the gall bladder into the small intestine.

Bilirubin is a yellow-brown bile pigment. This pigment is produced by the liver from haemoglobin released by broken-down red blood cells.

Suggest how gallstones may produce the following symptoms:

(i) very pale faeces

(2)

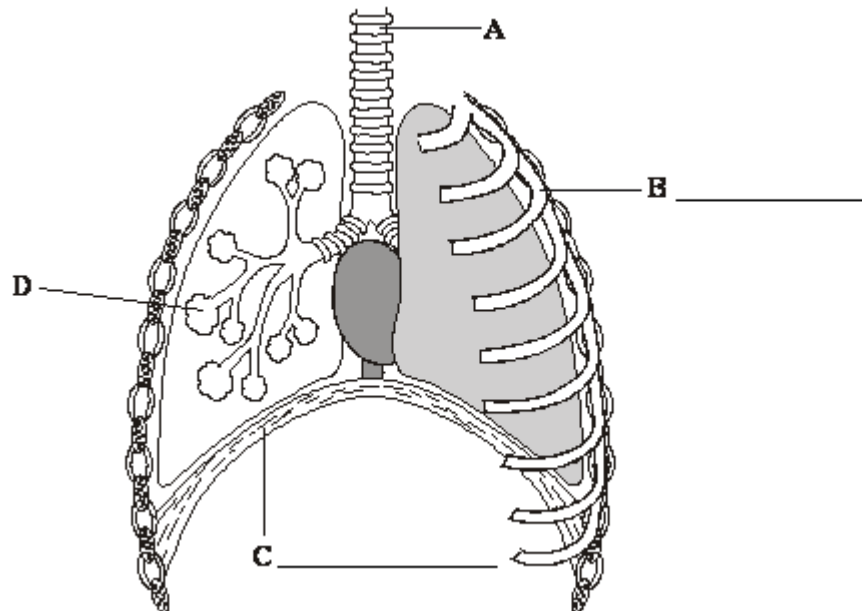
(ii) jaundice (a yellow tinge to the skin).

(2)

(Total 6 marks)

Q17.

The diagram shows the human breathing system.



(a) On the diagram, label structures **B** and **C**.

Choose your answers from the list in the box.

alveoli	diaphragm	rib	trachea
---------	-----------	-----	---------

(2)

- (b) (i) Which letter, **A**, **B**, **C** or **D**, shows the site of gas exchange? _____ (1)
- (ii) Which **one** of the following gases has a higher concentration in exhaled air than in inhaled air?

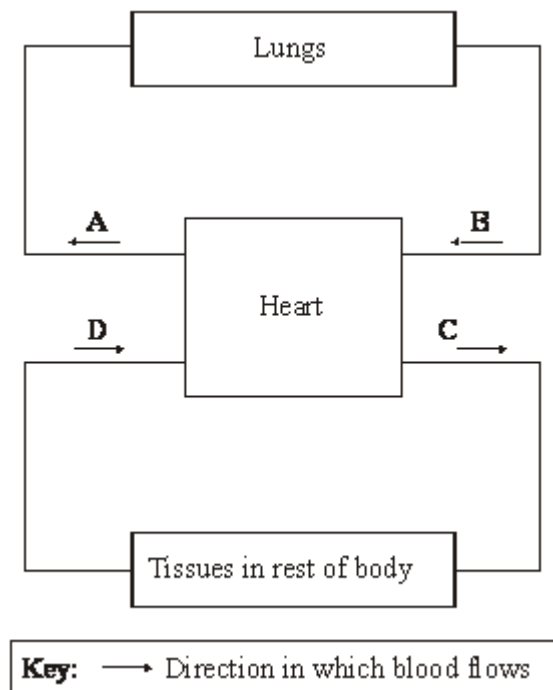
Draw a circle around **one** answer.

carbon dioxide **nitrogen** **oxygen**

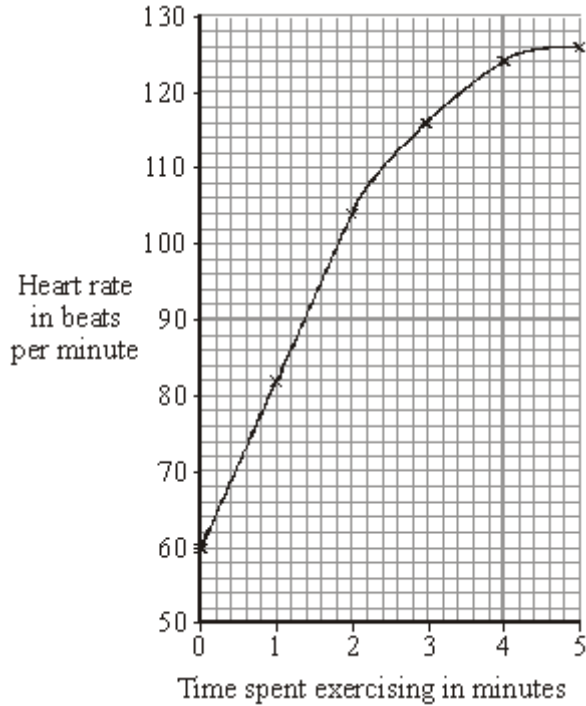
(1)
(Total 4 marks)

Q18.

The diagram represents the human blood circulation system.



- (a) **A**, **B**, **C** and **D** are blood vessels.
- (i) Give the letter of **one** blood vessel that is an artery. _____ (1)
- (ii) Give the letter of **one** blood vessel that is a vein. _____ (1)
- (b) A student pedalled an exercise cycle at constant speed for 5 minutes. The student's heart rate was recorded at one-minute intervals during the exercise. The results are shown in the graph.



(i) What was the student's heart rate before the exercise began?
 _____ per minute (1)

(ii) How long was it before the student's heart rate reached 124 beats per minute?
 _____ minutes (1)

(c) Which of the following parts of the blood carries most oxygen?

Draw a circle around **one** answer.

plasma

red blood cells

white blood cells

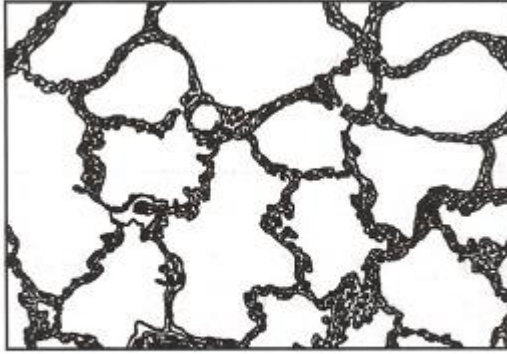
(1)

(Total 5 marks)

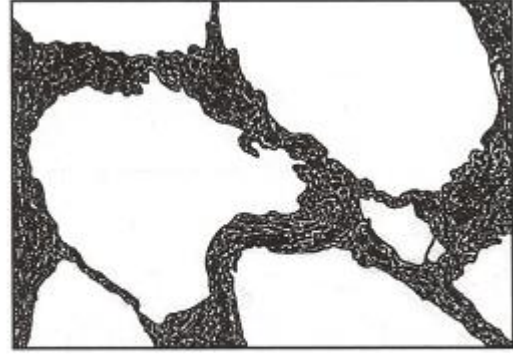
Q19.

Emphysema is a lung disease.

(a) The drawings show sections through the lung of a healthy person and through the lung of a person with emphysema. The drawings are drawn to the same scale.



Section through the lung of a healthy person



Section through the lung of a person with emphysema

Use information from the drawings to answer the questions.

What effect does emphysema have on:

- (i) the thickness of the surface used for gas exchange

(1)

- (ii) the total area available for gas exchange?

(1)

- (b) Two men did the same amount of exercise. One man was in good health. The other man had emphysema.

The results are shown in the table.

	Man with good health	Man with emphysema
Oxygen entering blood in dm ³ per minute	2.1	1.1
Air flow into lungs in dm ³ per minute	90.7	46.0

The man in good health was able to take more oxygen into his blood than the man with emphysema.

Calculate how much more oxygen was taken into the blood per minute by the man in good health. Show your working.

Answer = _____ dm³ per minute

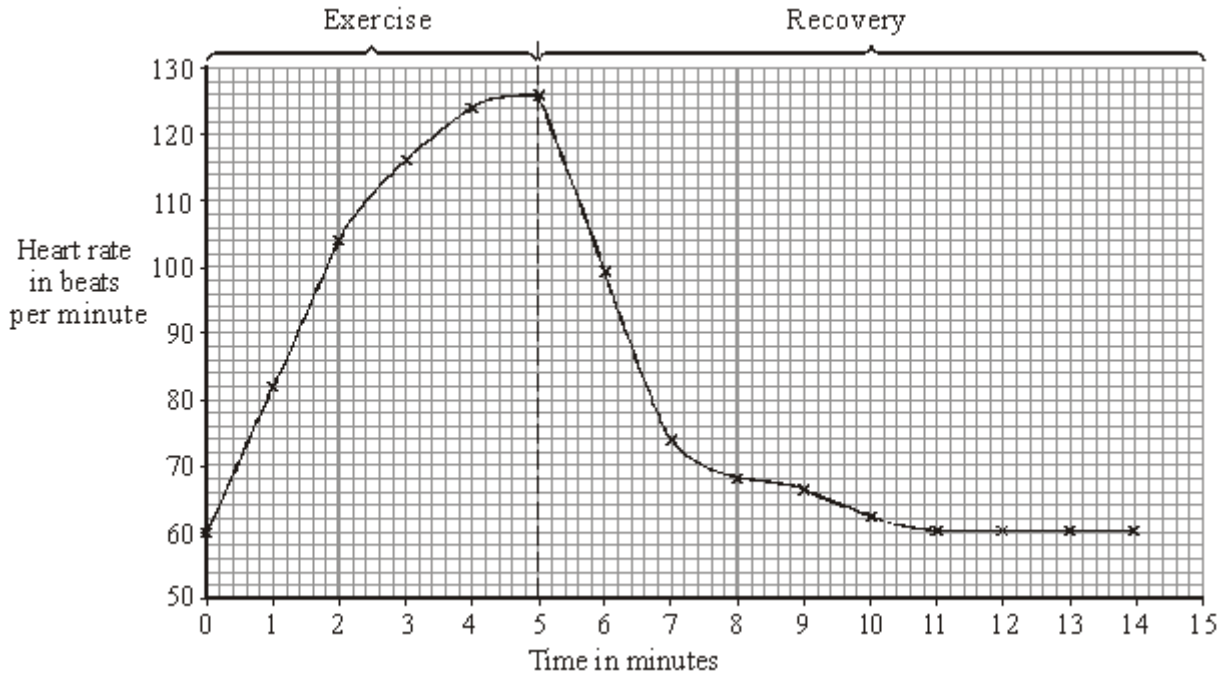
(2)

(Total 4 marks)

Q20.

A student pedalled an exercise cycle at constant speed for 5 minutes. The student's heart rate was recorded at one-minute intervals during the exercise and also during recovery.

The results are shown in the graph.



- (a) Describe, in as much detail as you can, the changes in heart rate between 0 and 14 minutes.

(3)

- (b) How do arteries supplying the leg muscles alter the rate of blood flow through them during exercise?

(1)

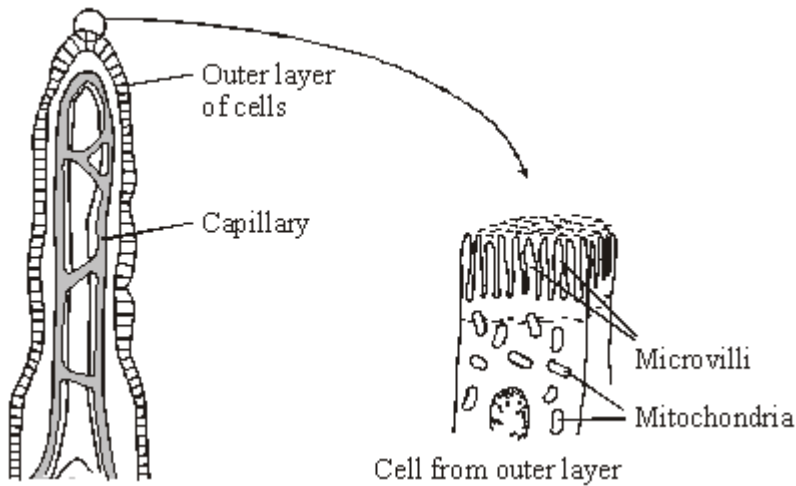
(c) Explain how an increase in heart rate helped the student during exercise.

(4)

(Total 8 marks)

Q21.

The small intestine is lined with millions of villi.
The diagram shows the structure of a villus.



In the small intestine, some of the products of digestion are absorbed into the blood by *active transport*.

(a) Explain what is meant by *active transport*.

(2)

- (b) How do microvilli and mitochondria help in the active transport of the products of digestion from the small intestine into the blood?

Microvilli _____

Mitochondria _____

(2)

(Total 4 marks)

Q22.

A popular diet book claims that a low-carbohydrate diet results in quicker weight loss and a more healthy body than a low-fat diet.

Scientists carried out an investigation to see if this claim is true.

- They used 120 overweight volunteers divided into two equal groups.
- **Group 1** was given a diet containing less than 20 g of carbohydrate per day.
- **Group 2** was given a low-fat diet. This contained less than 30% of energy from fat and less than 300 mg of cholesterol per day.
- Both groups were given the same exercise programmes and a weekly information meeting.
- Both groups were allowed only 2000 kilocalories per day.

The results after 24 weeks are shown in the table.

	Group 1 Low-carbohydrate diet	Group 2 Low-fat diet
Proportion of volunteers who completed the trial	76%	57%
Mean change in body mass	-12.9%	-6.7%
Mean change in body fat mass	-9.4 kg	-4.8 kg
Mean change in blood HDL concentration	+55 mg per litre	-16 mg per litre
Mean change in blood	+16 mg per litre	-74 mg per litre

LDL concentration		
-------------------	--	--

- (a) What was the independent variable in this investigation?

(1)
- (b) Give **one** variable that the scientists tried to control in this investigation.

(1)
- (c) Give **two** ways in which the method used by the scientists could have led to unreliable data.
1. _____

2. _____

(2)
- (d) Does the data support the claim in the book?
Draw a ring around your answer. **Yes / No**
Give **two** reasons for your answer.
1. _____

2. _____

(2)
- (Total 6 marks)**

Q23.

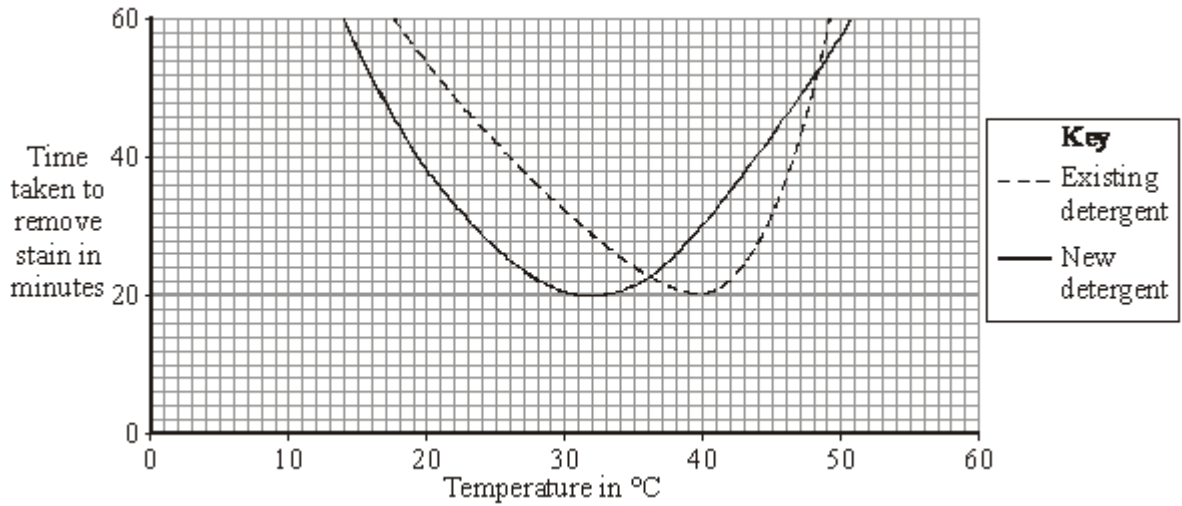
Enzymes are used in biological detergents.

- (a) Name the type of enzyme that digests stains containing fats.

(1)
- (b) A new detergent is marketed as being 'environmentally-friendly'.
Scientists compared the performance of this new detergent with an existing detergent.

They measured the time taken by the two detergents to remove a fat stain at different temperatures.

The graph shows their results.



- (i) Describe the effect of increasing the temperature on the time taken by the existing detergent to remove the stain.

(2)

- (ii) The new detergent works at a lower temperature than the existing one.

Is the new detergent likely to be more 'environmentally-friendly' than the existing detergent?

Draw a ring around your answer. **Yes / No**

Explain the reason for your answer.

(2)

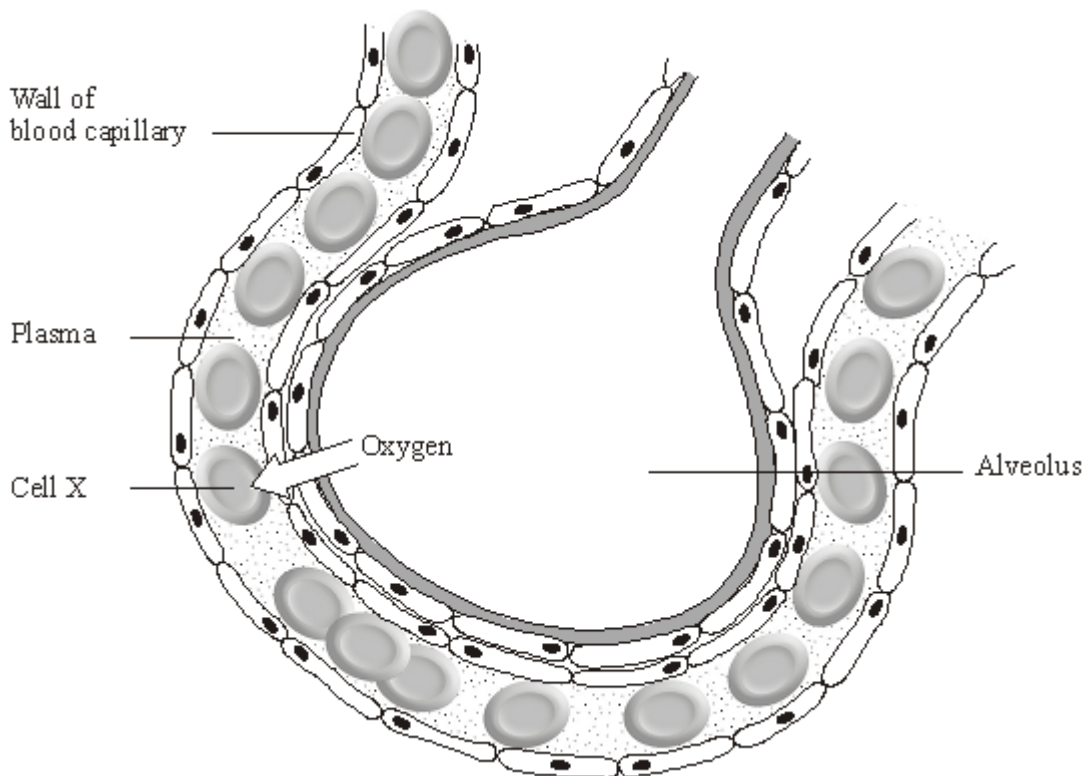
- (c) Neither detergent works well at 60 °C.

Explain why.

(2)
(Total 7 marks)

Q24.

The diagram shows a small part of a lung.



- (a) The arrow on the diagram shows the movement of oxygen from the air in the alveolus to cell X.

Complete the sentences by drawing a ring around the correct answer.

- (i) Cell X is a

platelet

red cell

white cell

(1)

(ii) Oxygen moves from the air in the alveolus into cell X by

- diffusion
filtration
respiration

(1)

(iii) The substance in cell X that combines with oxygen is called

- glycogen
haemoglobin
lactic acid

(1)

(iv) Cell X does **not** have

- a cell membrane
cytoplasm
a nucleus

(1)

(b) **On the diagram**, draw an arrow to show the movement of carbon dioxide during gas exchange.

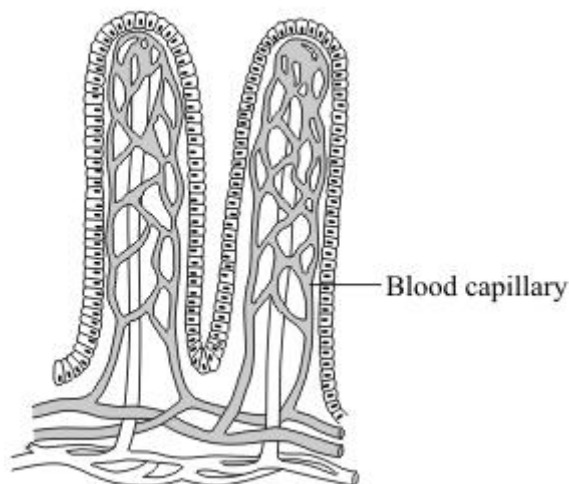
(1)

(Total 5 marks)

Q25.

Diagram 1 shows two villi in the small intestine of a healthy person.

Diagram 1



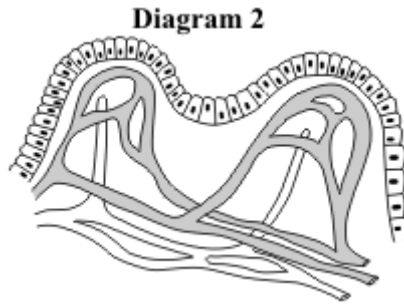
(a) Describe **two** features of the villi which help the small intestine to function.

1. _____

2. _____

(2)

- (b) **Diagram 2** shows two villi in the small intestine of a person with coeliac disease.



- (i) How do the villi of the person with coeliac disease differ from those of a healthy person?

(1)

- (ii) Suggest how this difference might affect how well the small intestine functions.

(1)

(Total 4 marks)

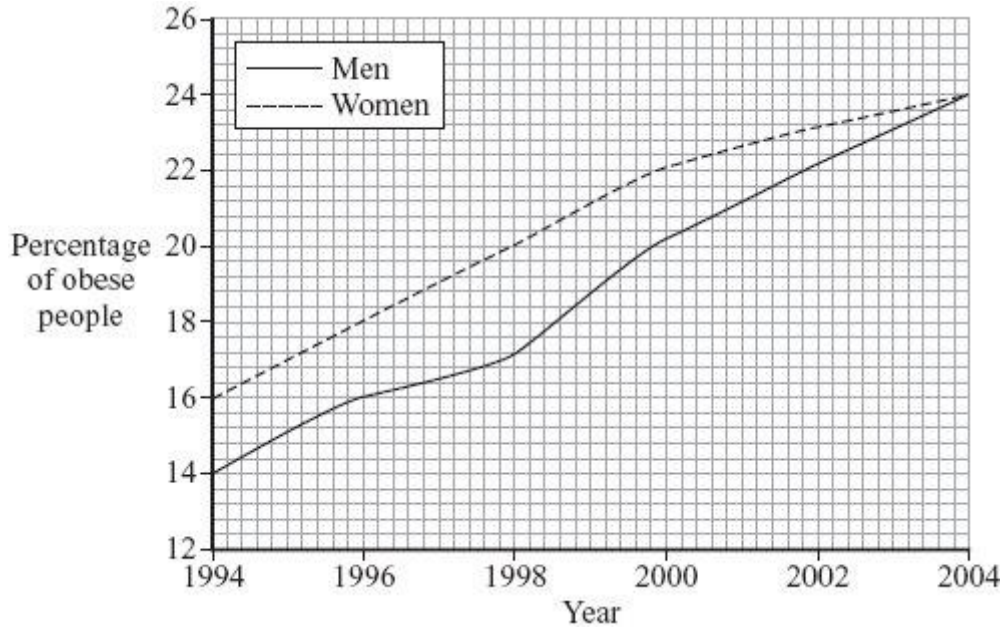
Q26.

Obesity is a factor that affects Coronary Heart Disease (CHD).

- (a) What is meant by *obesity*?

(1)

- (b) The graph shows how the percentages of obese men and women in the UK changed between 1994 and 2004.



(i) Describe how the percentage of obese women changed between 1994 and 2004.

(2)

(ii) The percentage of obese men changed between 1994 and 2004.

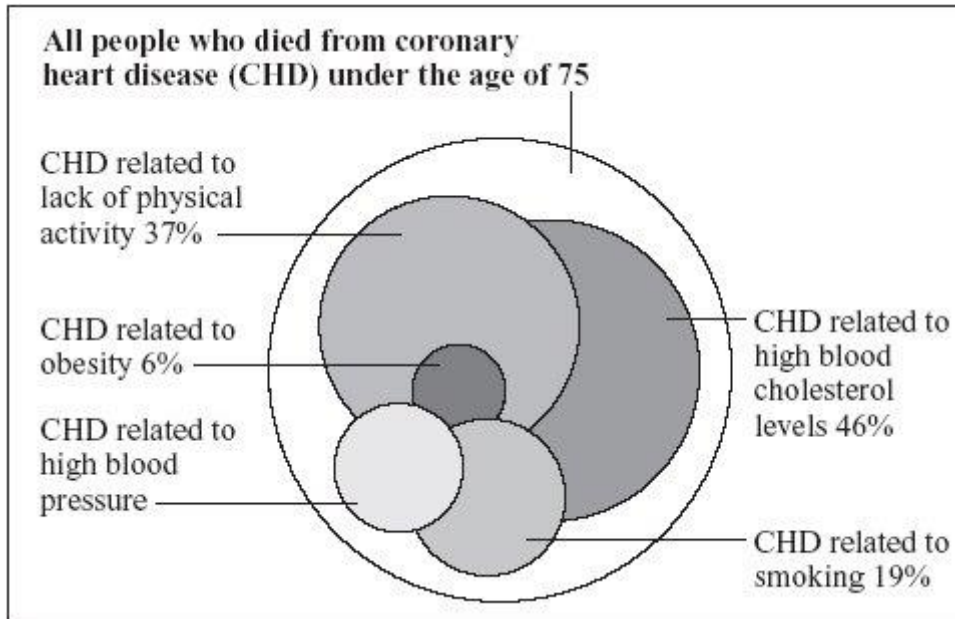
Suggest **two** reasons for this change.

1. _____

2. _____

(2)

(c) The chart below is published by the British Heart Foundation. It shows how death from CHD is related to a number of different factors.



copyright National Heart Forum

Each factor is represented by a circle.

The bigger the circle, the more people are affected by the factor.

- (i) What is the main factor causing death from CHD?

_____ (1)

- (ii) Estimate the percentage of deaths from CHD related to high blood pressure.

_____ % (1)

- (iii) The data are shown as overlapping circles instead of a bar chart. The percentages of deaths related to the different factors add up to more than 100%.

What does this tell you about some of the people who died from CHD?

 _____ (1)
(Total 8 marks)

Q27.

It is legal in the UK to use certain recreational drugs but illegal to use others.

- (a) Tobacco is a legal drug. Pregnant women are strongly advised not to smoke.

Explain how a fetus may be affected if the mother smokes tobacco.

(2)

(b) Illegal drugs are classified as Class **A**, **B** or **C**. Class **A** drugs are the most dangerous. The use of Class **A** drugs attracts the most serious punishments and fines.

- Cannabis is a Class **C** drug.
- These are some facts about cannabis.
- It is less addictive than amphetamines, tobacco or alcohol.
- It may cause mental illness.
- It does not seem to cause major social problems.
- It may be a 'gateway' drug to more harmful substances.
- It has a higher tar content than tobacco.
- It has an effect on the heart, similar to the effects of exercise.
- It can upset the control of blood pressure.

Use the above information to answer these questions.

(i) Give **two** reasons why many people think that cannabis should be classified as a Class **A** or Class **B** drug.

1. _____

2. _____

(2)

(ii) Give **two** reasons why many people think that cannabis should not be classified as an illegal drug.

1. _____

2. _____

(2)
(Total 6 marks)

Q28.

(a) We control many conditions inside our bodies.

Name **three** conditions which are controlled inside our bodies.

- 1. _____
- 2. _____
- 3. _____

(3)

(b) Hormones are used to control fertility in women.

Use words from the box to complete the sentences.

antibiotic	contraceptive drug	fertility drug	vaccine
-------------------	---------------------------	-----------------------	----------------

A woman can prevent pregnancy by taking a _____

A woman can be helped to become pregnant by taking a _____

(2)

(c) Some drugs are addictive.

(i) Name **one** addictive drug.

(1)

(ii) Explain why it is very difficult to give up using an addictive drug.

(2)

(Total 8 marks)

Q29.

Complete the table to show which part of the blood carries out each function.

Choose your answers from the list.

plasma platelet red blood cell white blood cell

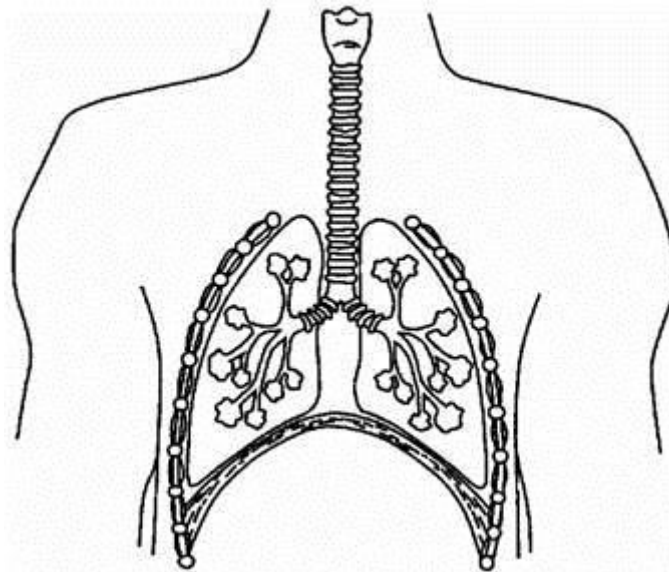
The first answer has been done for you.

Function	Part of the blood
Transports most of the carbon dioxide	<i>plasma</i>
Transports most of the oxygen	
Helps blood to clot at a wound	
Defends the body against microorganisms	
Transports the products of digestion	

(Total 4 marks)

Q30.

The diagram shows the human breathing system.



- (a) Place on the diagram:
- (i) a letter **X** where oxygen enters the blood; (1)
 - (ii) an arrow showing the direction the diaphragm moves when we breathe in. (1)
- (b) List the following structures in the order the air passes through them when we breathe in.

alveoli bronchi bronchioles trachea

1. _____

2. _____
3. _____
4. _____

(1)

- (c) By what process does oxygen enter the blood? Draw a ring around your answer.

diffusion digestion osmosis respiration

(1)

(Total 4 marks)

Q31.

Bread contains starch, protein and fat.

- (a) Complete each sentence by choosing the correct words from the box.

amino acids	protein
fat	starch
fatty acids	sugar

Amylase speeds up the digestion of _____. The product of this digestion is _____. Protease speeds up the digestion of _____. The product of this digestion is _____.

(4)

- (b) Why do molecules of starch, protein and fat need to be digested?

(2)

- (c) In which part of the digestive system does the digestion of starch begin? Draw a ring around your answer.

large intestine mouth small intestine stomach

(1)

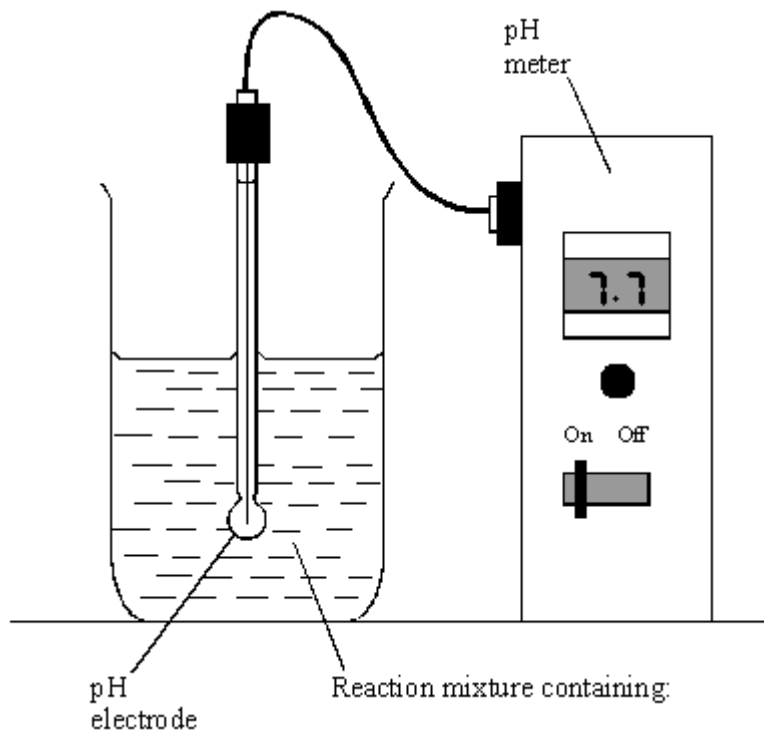
- (d) What do we call substances like amylase and protease which speed up chemical reactions?

(1)

(Total 8 marks)

Q32.

The diagram shows the apparatus used to investigate the digestion of milk fat by an enzyme. The reaction mixture contained milk, sodium carbonate solution (an alkali) and the enzyme. In Experiment 1, bile was also added. In Experiment 2, an equal volume of water replaced the bile. In each experiment, the pH was recorded at 2-minute intervals.



Either:	Experiment 1	or:	Experiment 2
	milk (contains fat) sodium carbonate solution bile enzyme		milk (contains fat) sodium carbonate solution water enzyme

The results of the two experiments are given in the table.

Time in minutes	pH	
	Experiment 1: with bile	Experiment 2: no bile
0	9.0	9.0
2	8.8	9.0
4	8.7	9.0
6	8.1	8.8
8	7.7	8.6
10	7.6	8.2

- (a) Milk fat is a type of lipid. Give the name of an enzyme which catalyses the breakdown of lipids.

(1)

- (b) What was produced in each experiment to cause the fall in pH?

(1)

- (c) (i) For Experiment 1, calculate the average rate of fall in pH per minute, between 4 minutes and 8 minutes. Show clearly how you work out your final answer.

_____ pH units per minute

(2)

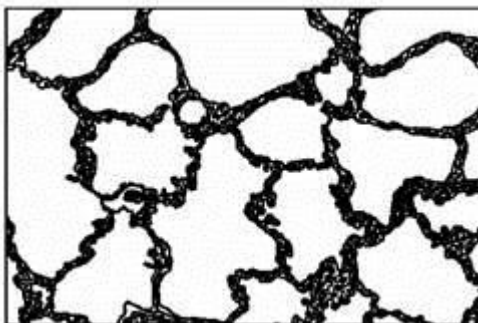
- (ii) Why was the fall in pH faster when bile was present?

(1)

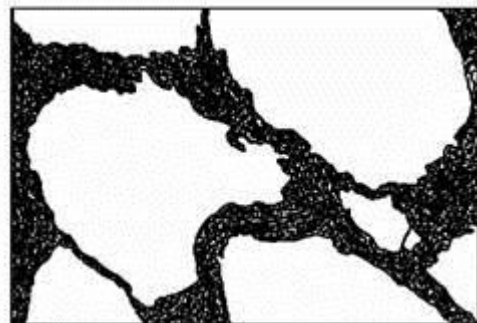
(Total 5 marks)

Q33.

Emphysema is a disease of the lungs. People who smoke cigarettes are more likely to suffer from emphysema. The diagrams show lung tissue from a healthy person and lung tissue from a person with emphysema. The diagrams are drawn to the same scale.



Lung tissue from a healthy person
emphysema



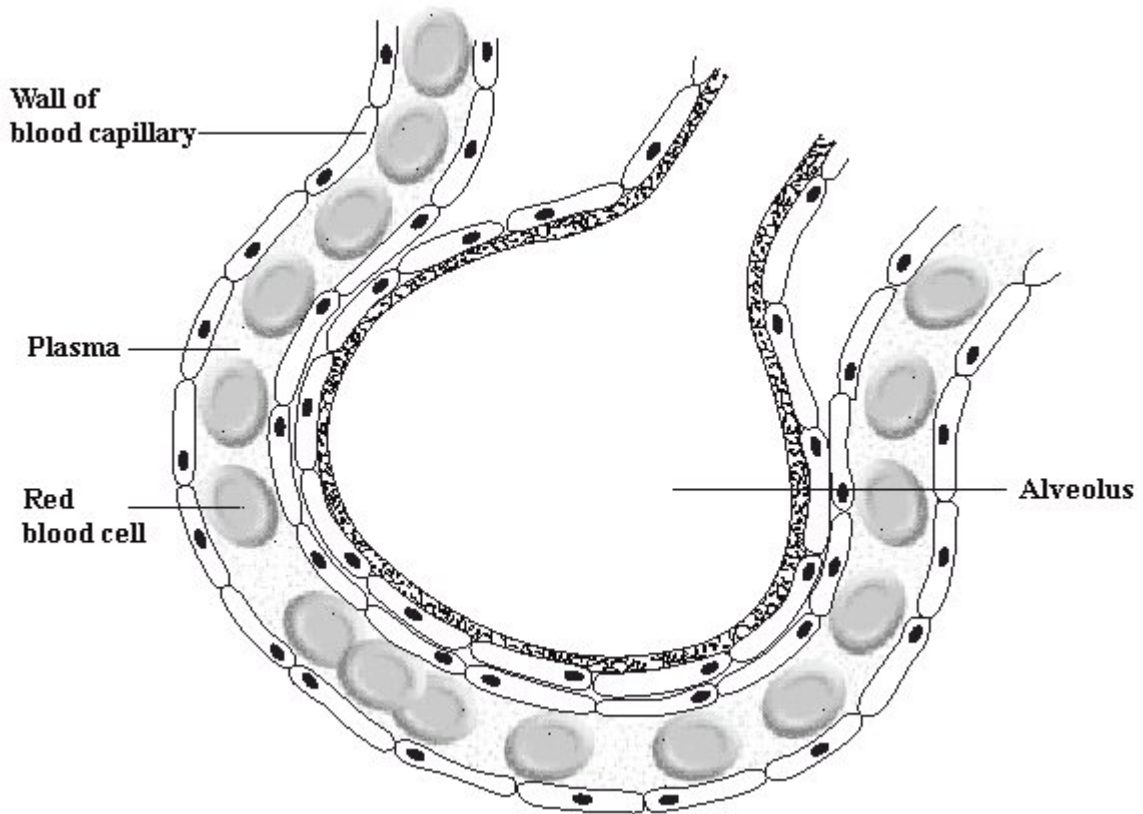
Lung tissue from a person with
emphysema

Explain how emphysema reduces the amount of oxygen which diffuses into the blood

(Total 2 marks)

Q34.

The diagram shows an alveolus and a blood capillary in the lung.



- (i) During gaseous exchange, oxygen and carbon dioxide are exchanged across the wall of the alveolus. **On the diagram**, carefully draw **two** arrows to show the paths taken by oxygen and by carbon dioxide during this process. **Label each arrow.**

(3)

- (ii) Name the process by which oxygen moves across the wall of the alveolus.

(1)

- (iii) Each lung contains about 350 million alveoli. How does this help gaseous exchange?

(1)

(Total 5 marks)

Q35.

- (a) (i) What name is given to an enzyme which catalyses the breakdown of protein?

(1)

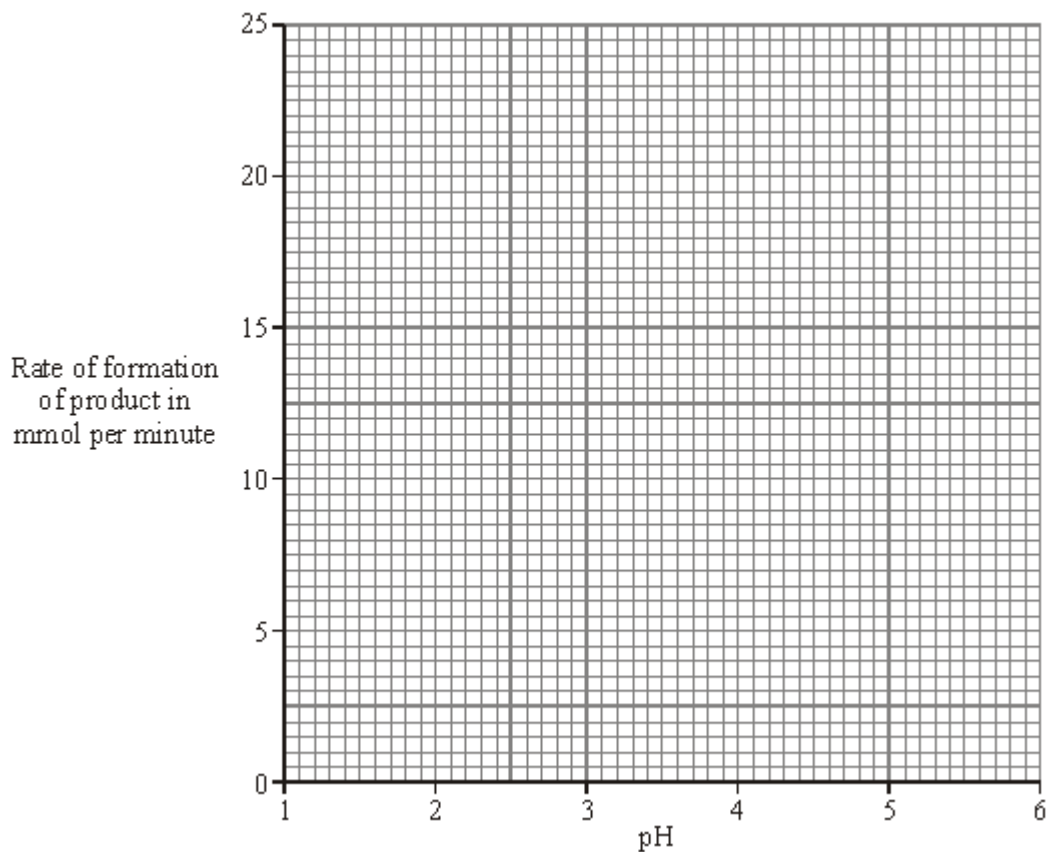
- (ii) What product is formed when protein is broken down by the enzyme?

(1)

The table shows the effect of pH on the activity of an enzyme which catalyses the breakdown of protein.

pH	1.0	2.0	3.0	4.0	5.0
Rate of formation of product in mmol per minute	10.5	23.0	10.5	2.5	0.0

- (b) Draw a graph of the data in the table.



- (c) The enzyme is produced by the human digestive system. (3)
- (i) At what pH does this enzyme work best? _____ (1)
- (ii) Suggest which part of the digestive system produces this enzyme.
_____ (1)
- (d) Why is it necessary to break down proteins in the digestive system?

_____ (3)

(Total 10 marks)

Mark schemes

Q1.

- | | |
|--|---|
| (a) (i) villus | 1 |
| (ii) its outer surface is one cell thick
<i>cancel 1 mark for each extra box ticked</i> | 1 |
| it has a large surface area | 1 |
| it has good blood supply | 1 |
| (b) diffusion | 1 |

[5]

Q2.

- | | |
|--|---|
| (a) (i) B or D | 1 |
| (ii) A or B | 1 |
| (b) any four from:
<i>more / faster must be implied at least once for full marks</i> | |
| • increased blood (flow)
<i>ignore reference to breathing</i> | |
| • (more) oxygen supplied or aerobic respiration
<i>allow less anaerobic (respiration) or and prevents oxygen debt</i> | |
| • (more) glucose / sugar / food supplied
<i>ignore feeding</i> | |
| • (higher rate of) respiration | |
| • (more) energy needed / released
<i>allow made</i> | |
| • (more) carbon dioxide <u>removed</u> | |
| • (muscles) doing (more) work or muscles contracting | |
| • remove heat / cooling | |
| • remove lactic acid or less lactic acid formed | |

Q3.

(a) any **two** from:

- arthritis
allow damaged joints
- diabetes
accept high blood sugar
- high blood pressure
- strokes
allow blocked blood vessels / thrombosis
- allow breathing difficulties
ignore cancer
ignore high cholesterol

2

(b) (i) any **two** from:

to gain marks there must be a comparison
ignore comparison at single age

- lower number of women deaths up to age of 75-80
- higher number of women deaths after 80
ignore women die older or men die younger
- men's peak higher
- men's peak at an earlier age
- men's death start earlier than women
- more men than women die of heart disease

2

(ii) any **two** from:

- men smoke more (cigarettes)
ignore alcohol
- more men smoke
- men under more stress
- men less active
- more men overweight / eat more / less diet conscious **or** different fat distribution

ignore reference to body size

- genetic factors
- men might have lower metabolic rate
ignore references to hormones
- men less likely to visit doctor even though they have symptoms

2

(c) *points can be in any order*

laboratory tests / tests on tissues

or

tests on animals

or

tests for toxicity

ignore computer simulations

1

tests for side effects on volunteers / healthy people / small numbers

1

widespread testing

or

testing for optimum dose

or

test on patients / sick people

or

test to see if it is effective

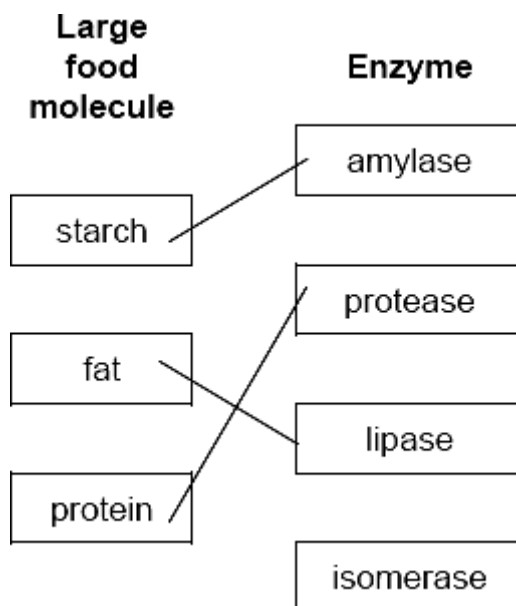
accept use of placebo

1

[9]

Q4.

(a) (i)



all three correct = 3 marks
two correct = 2 marks
one correct = 1 mark
extra line from a large food molecule cancels the mark

3

(ii) sugars

1

fatty acids and glycerol

1

amino acids

must be in this order

1

(b) liver

1

[7]

Q5.

(a) B

no mark for ÉBÉ, alone

large(r) surface / area **or** large(r) membrane

accept reference to microvilli

accept reasonable descriptions of the surface

*do **not** accept wall / cell wall*

ignore villi / hairs / cilia

1

(b) (i) any **one** from:

- insulin / hormone

if named hormone / enzyme must be correct for pancreas

- enzyme / named enzyme

1

(ii) many ribosomes

1

(ribosomes) produce protein

accept insulin / hormone / enzyme named is (made of) protein

or

allow many mitochondria (1)

provide energy to build protein **or** to make protein (1)

accept ATP for energy

1

Q6.

- (a) stomach is acidic / has low pH

allow any pH below 7

ignore stomach is not alkaline

1

lactase works best / well in alkali / high pH / neutral / non-acidic conditions

allow any pH of 7 and above

accept works slowly in acid conditions

*allow figures from table with a **comparison***

ignore reference to temperature

1

- (b) any **three** from

- (below 45(°C)) increase in temperature increases rate / *speed* of reaction
- reference to molecules moving faster / colliding faster / harder / more collisions
- optimum / best at 45(°C)
allow value(s) in range 41 - 49
- high temps / above 45(°C) (rate slows due to) denaturation of enzyme /lactase
*allow synonyms of denaturation but **not** killed*
*denaturation at high **and** low temperature does **not** gain this mark*
ignore body temperature
ignore references to time / pH

3

- (c) any **two** from

- acid neutralised **or** conditions made neutral / alkali
accept bile is alkaline
- (allow) emulsification / greater surface area of fat / lipid
allow description of emulsification eg fat is broken down / broken up into droplets
- enzymes (in small intestine) work (more effectively / better)
allow better for enzymes

2

Q7.

- (a) B

1

- (b) Narrow(er) small(er) / thin(ner)(air) passages / bronchioles

*allow muscle fibres are contracted
allow oxygen instead of air*

or less air can pass through

ignore reference to surface area

or harder for air to enter

1

(c) (i) salbutamol causes relaxation / reduces contraction

1

(ii) widens / enlarges / bronchioles / (air) passages

allow oxygen instead of air

or allows air through more easily

or allows person to breathe more easily

1

[4]

Q8.

(a) (i) 120

1

(ii) 11 760 **or**

correct answer from candidate's answer to (a)(i)

correct answer with or without working

if answer incorrect

*120 × 98 **or***

candidate's answer to (a)(i) × corresponding SV gains 1 mark

*if candidate uses dotted line / might have used dotted line(bod) in (a)(i) **and** (a)(ii) no marks for (a)(i) but allow full ecf in (a)(ii) eg 140 × 88 = 12320 gains 2 marks*

2

(b) trained athlete has higher stroke volume / more blood per beat

1

same volume blood expelled with fewer beats

or for same heart rate more blood is expelled

1

(c) increased aerobic respiration

or

decreased anaerobic respiration

allow correct equation for aerobic respiration

accept don't have to respire anaerobically

1

- increased energy supply / need 1
- less lactic acid formed
- or** to breakdown lactic acid **or** less O₂-debt 1
- can do more work **or** can work harder / faster / longer
accept muscle contraction for work
- or** less fatigue / cramp / pain 1

[9]

Q9.

- (a) opaque / less transparent / blue
allow mixture becomes dark / black
ignore thicker 1
- (b) (i) 7 (minutes) **or** in range 6.7 to 7
award 2 marks for correct answer
- if answer is incorrect evidence of selection of
 40(% light intensity) either in working **or** in graph
 2 for 1 mark 2
- (ii) any **two** from:
- slower / takes longer at lower temperatures
 - (40°C is) optimum / best temperature
allow near to 37°C / body
temperature where enzymes work best
 - enzyme denatured / destroyed / damaged at higher temperatures
allow description of denaturation 2
- (c) (i) isomerase
allow phonetic spelling 1
- (ii) fructose is sweeter than glucose
 needed in smaller quantities **or** less is needed 2

[8]

Q10.

- | | |
|-----------------|---|
| (a) (i) artery | 1 |
| (ii) capillary | 1 |
| (b) alveoli | 1 |
| red blood cells | 1 |
| nucleus | 1 |

[5]

Q11.

- | | |
|---|---|
| (a) (i) 19 800 | |
| <i>for correct answer ignore working or lack of working
165 × 120 but no answer / wrong answer = 1 mark (<u>ignore extras</u>)</i> | |
| | 2 |
| (ii) any two from: | |
| • for respiration
<i>ignore oxygen debt</i> | |
| • energy released
<i>allow energy produced</i> | |
| • prevents anaerobic respiration | |
| • prevents build-up of lactic acid | |
| | 2 |
| (b) any two from: | |
| • increased breathing rate(*) | |
| • increased depth of breathing or deep breathing(*)
<i>(*)more breathing is max 1 mark
ignore increase in heart rate
allow heavier breathing
do not allow harder breathing</i> | |
| • dilation of arteries / vasodilation
<i>allow blood vessels dilate
do not allow veins / capillaries dilate</i> | |
| • blood diverted from elsewhere | |

ignore name of organ

2

[6]

Q12.

(a) any **two** from:

- age
- gender
- mass
- number in group
- time

2

(b) any **two** from:

- highest (mean) mass loss on Rosemary Conley **or** Rosemary Conley most effective
- least (mean) mass loss in control group **or** mean

2

(c) (Atkins)

costs least

1

mass loss very similar to other diets **or** second highest mass loss **or** as effective as other diets

1

(d) any **two** from:

- (exercise) increases metabolic rate / respiration
ignore sweating
- (exercise) needs / uses energy / calories
allow burns fat / calories
*do **not** accept energy for respiration*
- (this) energy comes from food / fat
- less food / energy/ calories converted to fat

2

[8]

Q13.

(a) (i) B

1

(ii) any **one** from:

- largest area of / most digestion (of lipid)
allow agar / jelly / mixture broken down / digested
*do **not** allow digestion of bacteria / lipase*
*ignore digestion **by** bacteria*
- largest clear area

1

(b) any **two** from:

- effect of pH / pH described
- effect of temperature
- effect on different types of lipid / fat
- cost **or** allergic reactions **or** effect on skin / fabrics / **or** environment **or** interaction with other chemicals in powder **or** shelf life

2

(c) enzymes / named enzyme denatured / destroyed

allow active site(of enzyme) altered

1

[5]

Q14.

(a) A = alveolus

allow air sac / alveoli

1

B = diaphragm

ignore labelling of C and D

1

(b) A

1

(c) (i) red blood cells

1

(ii) plasma

1

[5]

Q15.

(a) A

no mark – can be specified in reason part

if B given = no marks throughout

if unspecified plus two good reasons = 1 mark

- high(er) pressure in A
allow opposite for B
do not accept 'zero pressure' for B 1
- pulse / described in A
accept fluctuates / 'changes'
allow reference to beats / beating
ignore reference to artery pumping 1
- (b) (i) 17 1
- (ii) 68
accept correct answer from candidate's (b)(i) × 4 1
- (c) (i) oxygen / oxygenated blood
allow adrenaline
ignore air 1
- glucose / sugar
extra wrong answer cancels eg
sucrose / starch / glycogen / glucagons / water
allow fructose as an alternative to glucose
ignore energy
ignore food 1
- (ii) carbon dioxide / CO₂ / lactic acid
allow CO₂ / CO²
ignore water 1
- [7]

Q16.

- (a) any **two** from:
- neutralises acid / makes conditions alkaline / raises pH
 - enzymes (in small intestine) work (more/most effectively)
or stop/prevents enzymes being denatured
 - emulsifies fats/lipids **or** description of emulsification
*do **not** accept breakdown unqualified*
 - larger surface area
- 2
- (b) (i) bile / bilirubin / pigment / broken down haemoglobin /

substance / cholesterol linked to movement **or** effect 1

does **not** get to the intestine / food / faeces
or cannot leave liver **or** effect not happening (in intestine) 1

(ii) bilirubin / pigment / broken down haemoglobin
not 'bile' alone 1

(deposited) in skin
only award if bilirubin / pigment / broken down haemoglobin given
allow carried in the blood 1

[6]

Q17.

(a) B = rib 1

C = diaphragm 1

(b) (i) D
allow lower case 1

(ii) carbon dioxide 1

[4]

Q18.

(a) (i) A **or** C
allow lower case 1

(ii) B **or** D
allow lower case 1

(b) (i) 60 1

(ii) 4 1

(c) red blood cells 1

[5]

Q19.

- (a) (i) increased / thick(er)
allow more / wide(r) / broad 1
- (ii) decreased 1
- (b) 1
- IGNORE working or lack of working
correct figures from table 2.1 and 1.1 but no answer / wrong
answer = 1 mark* 2

[4]

Q20.

- (a) any **three** from:
- rose rapidly (during exercise) / use of approximate figures
 - then more slowly (during exercise)
accept rate (of increase) slows down
 - to max 126 / at 5 minutes / end of exercise
 - rapid fall (during recovery) **or** use of approximate numbers
 - then less rapid fall / use of approximate numbers
 - returned to resting rate (60 bpm) by 11 minutes
- 3
- (b) arteries dilate / widen
accept muscle in wall relaxes 1
- (c)
- any **four** from:
- muscles using more energy **or** more energy released
 - muscles respire faster
 - supply more oxygen
 - supply more glucose / sugar
 - remove more CO₂
 - remove lactic acid
 - remove heat / to cool
- do **not** accept energy produced
- allow for aerobic respiration
or to prevent anaerobic respiration
- ‘more’ needed ONCE
only for full marks

4

Q21.

- (a) any **two** from:
- transport up / against concentration gradient / low to high concentration
 - uses energy
 - use of protein / carrier
- 2
- (b) microvilli – large(r) surface area
accept have carriers
- 1
- mitochondria – release energy **or** make ATP
*do **not** accept 'makes energy'*
- 1

Q22.

- (a) diet **or** description
- 1
- (b) exercise
or group meetings
or same number of kilocalories per day
or time
or group size
- 1
- (c) any **two** from: eg
- scientists didn't observe amount of exercise
or volunteers cheated on exercise(*)
 - scientists didn't observe the amount of food
or volunteers cheated on food(*)
()if no marks awarded for first 2 bullet points allow don't stick to plan **or** cheated for 1 mark*
 - mass of subjects not controlled
 - age of subjects not controlled
 - gender of subjects not controlled
 - occupation of subjects not controlled
 - different proportions of subjects completed course

allow not all completed course

- low number of subjects
ignore not repeated

2

(d) any **two** from: (yes)

- low carbohydrate / Group 1 / people / they lost more mass
ignore more people lost weight
allow greater change in mass
- low carbohydrate / Group 1 / people / they lost more body fat
ignore more people lost body fat
allow greater change in body fat
- low carbohydrate diet / Group 1 / people / they resulted in more HDL
allow better HDL to LDL balance
allow greater change in HDL

2

[6]

Q23.

(a) lipase

allow phonetic spelling
allow lipidase

1

- (b) (i) fall **then** rise owtte eg down **then** up
*allow faster **then** slower*
ignore explanations

1

minimum / least / fastest / best / optimum at 39–41(°C)

allow it falls to 40(°C)

if no other marks gained, 'falls to an optimum' gains 1 mark

1

- (ii) (yes)

there is no mark for circling 'yes'
maximum 1 mark if No is circled

any **two** from:

- less heat / energy / electricity / power required / used / wasted
ignore lower temperature
- conserves fuel supplies
or less fuel used
- less pollution from power stations

owtte

accept less global warming

or

less CO₂ / carbon emissions / greenhouse gases

or

less SO₂ / acid rain

NB *only direct effects*

less pollution only is not enough

2

(c) any **two** from:

max 1 mark for reference to cell

- enzyme / lipase
accept any named enzyme
- destroyed / denatured
allow damaged / broken down
not 'killed'
- reference to (specific) shape changed
ignore detergent / it

2

[7]

Q24.

(a) (i) red cell

1

(ii) diffusion

1

(iii) haemoglobin

1

(iv) a nucleus

1

(b) (on diagram) arrow from any part of blood to air

1

[5]

Q25.

(a) any **two** from:

- large surface / area **or** many villi **or** have microvilli
accept big surface / area
- thin surface **or** thin wall **or** surface 1-cell thick **or**
capillaries near surface **or** permeable **or** partially permeable

accept they are thin
*do **not** allow thin **cell** wall*

- many blood vessels **or** many capillaries **or** capillary network
or good blood supply
ignore 'constant blood flow' owtte
ignore extras eg moist or reference to gases
- have enzymes
ignore release enzymes
 - *accept reference to lacteal as 5th point*
 - *allow reference to having mitochondria*

2

- (b) (i) small(er) (surface area) / flat(ter) / short(er)
or not as folded
or fewer capillaries owtte

allow small(er) lacteal
ignore references to wide / thick / spread out etc

1

- (ii) less absorption (of digested food) / less digestion / diffusion
accept slower for less
accept description of less digestion
accept less food can get in
*do **not** allow zero absorption*
*do **not** allow 'collection' of nutrients*

1

[4]

Q26.

- (a) being overweight
*do **not** accept fat unqualified*
allow BMI over 25

1

- (b) (i) rose

1

by 8% / from 16% to 24% / by 50% / rapidly then more slowly

1

- (ii) any **two** reasonable suggestions

e.g. less active

*accept e.g.s like fewer jobs / more cars / less physically
demanding employment OWTTE*

more food / take-aways / fast food

2

- (c) (i) high (blood) cholesterol
*do **not** accept combination of 2 labels*
ignore references to LDL and HDL 1
- (ii) answer in range 8-17 inclusive 1
- (iii) some deaths related to more than one factor 1

[8]

Q27.

- (a) any **two** from:
- birth mass / growth reduced
 - smoke contains carbon monoxide
ignore references to poison
 - blood carries less oxygen / fetus receives less oxygen
*do **not** accept harder for fetus to breathe* 2
- (b) (i) it may cause mental illness 1
- it may be a 'gateway' drug to more harmful substances
three answers max 1
three answers max 0 1
- (ii) it is less addictive than amphetamines, tobacco or alcohol 1
- it is not associated with major sociological problems
three answers max 1
four answers max 0 1

[6]

Q28.

- (a) any **three** from:
- water
allow breathing / oxygen / carbon dioxide
 - ions / minerals / salts
allow sodium / chloride, other ions neutral
 - temperature

	<i>allow heat</i>	
	• blood sugar	
	• heart rate	
	• blood pressure	
	<i>ignore urea</i>	3
(b)	contraceptive drug	1
	fertility drug	1
(c)	(i) eg nicotine, alcohol, cocaine, heroin, painkillers, tranquilisers, LSD	
	<i>allow cannabis / weed or other alternative names</i>	
	<i>allow tobacco</i>	
	<i>ignore smoking / ecstasy</i>	1
	(ii) alters body chemistry or craving / needing / dependence	
	<i>allow psychological dependence</i>	1
	withdrawal symptoms on stopping	
	<i>allow withdrawal described</i>	
	<i>allow 'feel ill without it'</i>	1
		[8]

Q29.

	red (blood cell)	1
	platelet	1
	white (blood cell)	1
	plasma	1
		[4]

Q30.

- (a) correctly labelled on diagram
- (i) 'X' on an alveolus
*centre of X on the alveolus wall or
 inside the alveolus*

- not if the centre is outside* 1
- (ii) arrow pointing downwards
accept anywhere but must point down 1
- (b) in sequence
- 1 trachea
- 2 bronchi
- 3 bronchioles
- 4 alveoli 1
- (c) diffusion
accept positive indicator 1
- [4]

Q31.

- (a) in sequence
- starch 1
- sugar 1
- protein 1
- amino acids 1
- (b) (too) large **or** insoluble
- do not accept "breaking up"*
- do not accept complex*
- accept 'need to make molecules smaller / soluble' – reverse argument* 1
- cannot be absorbed **or**
- cannot enter blood **or**
- cannot pass through wall / lining of intestine / gut or villi
- "body" not enough*
- not large intestine* 1
- (c) mouth

- accept positive indication* 1
- (d) enzymes
- allow catalysts*
- do **not** accept catalase* 1

[8]

Q32.

- (a) lipase 1
- (b) fatty acid
- ignore glycerol* 1
- (c) (i) 0.25 or $\frac{1}{4}$

if correct answer ignore working or lack of working

$$\frac{(8.7 - 7.7)}{4}$$
for 1 mark

2

- (ii) fats emulsified **or** described re. Small droplets **or** large S.A.
 (for enzyme action) **or** fats 'mix' better with water
- do **not** allow breakdown / breakup unqualified* 1

[5]

Q33.

- thicker surface 1
- reduced surface area
- accept fewer alveoli* 1

[2]

Q34.

- (i) On diagram:
- oxygen arrow to blood from air **and** CO₂ arrow to air from blood 1
- oxygen arrow to red blood cell

- 1
- CO₂ arrow from plasma 1
- (ii) diffusion 1
- (iii) large surface **or** large area 1
do not accept space

[5]

Q35.

- (a) (i) protease 1
accept peptidase or named protease
e.g. pepsin / trypsin
allow 'proteinase'

- (ii) amino acids 1
accept peptides / polypeptides / peptones

- (b) points plotted accurately 2
 $\pm \frac{1}{2}$ square
deduct 1 mark per error

- best fit curve **or** ruled point-to-point 1
if double line within $\frac{1}{2}$ square
allow sharp apex
do not allow single straight line
if no points line defines points
if (5,0) not plotted only penalise 1 mark
bar graph wide bars – no marks
bar graph $\pm \frac{1}{2}$ square max 2 for points

- (c) (i) 2 **or** correct from candidate's graph 1
 $\pm \frac{1}{2}$ square

- | | |
|--|---|
| (ii) stomach | 1 |
| (d) proteins are large / product is small | 1 |
| proteins (may be) insoluble / product is soluble | 1 |
| cannot be absorbed / cannot enter blood or cannot pass through gut lining
<i>accept reverse referring to product</i> | 1 |

[10]

Q1.

The photograph shows a red blood cell in part of a blood clot. The fibres labelled **X** are produced in the early stages of the clotting process.



- (a) Suggest how the fibres labelled **X** help in blood clot formation.

(1)

- (b) The average diameter of a real red blood cell is 0.008 millimetres.
On the photograph, the diameter of the red blood cell is 100 millimetres.

Use the formula to calculate the magnification of the photograph.

$$\text{Diameter on photograph} = \text{Real diameter} \times \text{Magnification}$$

Magnification = _____

(2)

(c) Some blood capillaries have an internal diameter of approximately 0.01 millimetres.

(i) Use information given in part (b) to explain why only one red blood cell at a time can pass through a capillary.

(1)

(ii) Explain the advantages of red blood cells passing through a capillary one at a time.

(3)

(Total 7 marks)

Q2.

Complete the table by writing the correct process next to its description.

Choose your answers from the list in the box

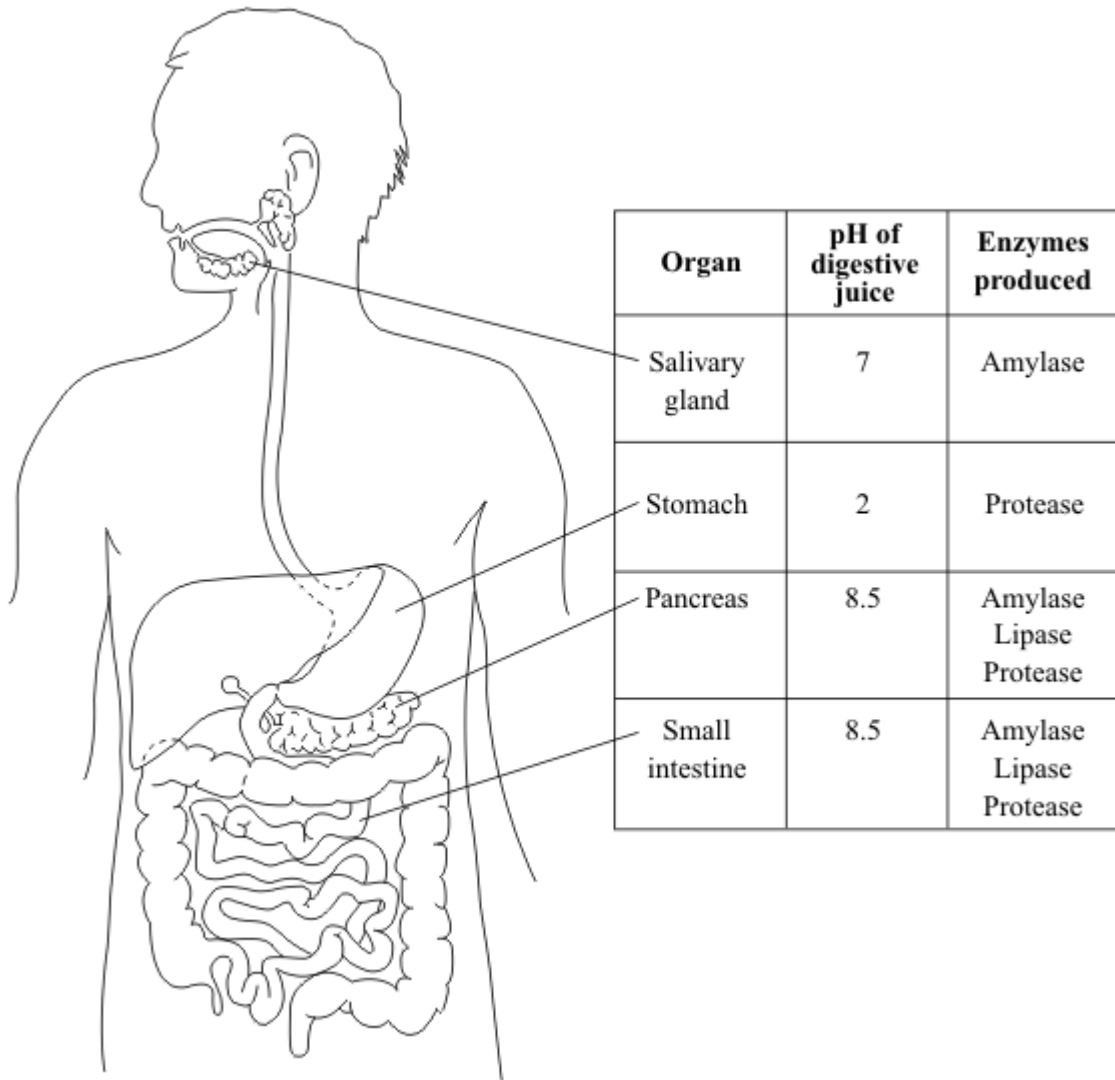
breathing	diffusion	digestion	osmosis	respiration
------------------	------------------	------------------	----------------	--------------------

Description	Process
Moving air in and out of the lungs	
The movement of particles of a substance from high to low concentration	
The release of energy from glucose	

(Total 3 marks)

Q3.

The diagram gives information about some parts of the human digestive system.



(a) (i) Name the organ which **makes** bile.

_____ (1)

(ii) Label this organ with the letter **X** on the diagram.

(1)

Information in the table may help you to answer parts (b) and (c).

(b) Name **two** parts of the digestive system where protein is digested.

1. _____

2. _____

(2)

(c) Suggest **two** reasons why starch is not digested in the stomach.

1. _____

2. _____

(2)
(Total 6 marks)

Q4.

(a) (i) Name the red pigment found in red blood cells.

_____ (1)

(ii) Describe, in detail, the function of this red pigment.

_____ (2)

(b) Describe **one** other way in which the structure of a red blood cell is different from the structure of a white blood cell.

_____ (1)
(Total 4 marks)

Q5.

Complete each sentence about the heart by choosing the correct words from the box.

an artery	an atrium	a cuspid valve
a semi-lunar valve	a vein	

A ventricle fills with blood by the contraction of _____ .

When a ventricle contracts, blood is forced into _____ .

When a ventricle relaxes, the backflow of blood into it is prevented by the closing of _____ .

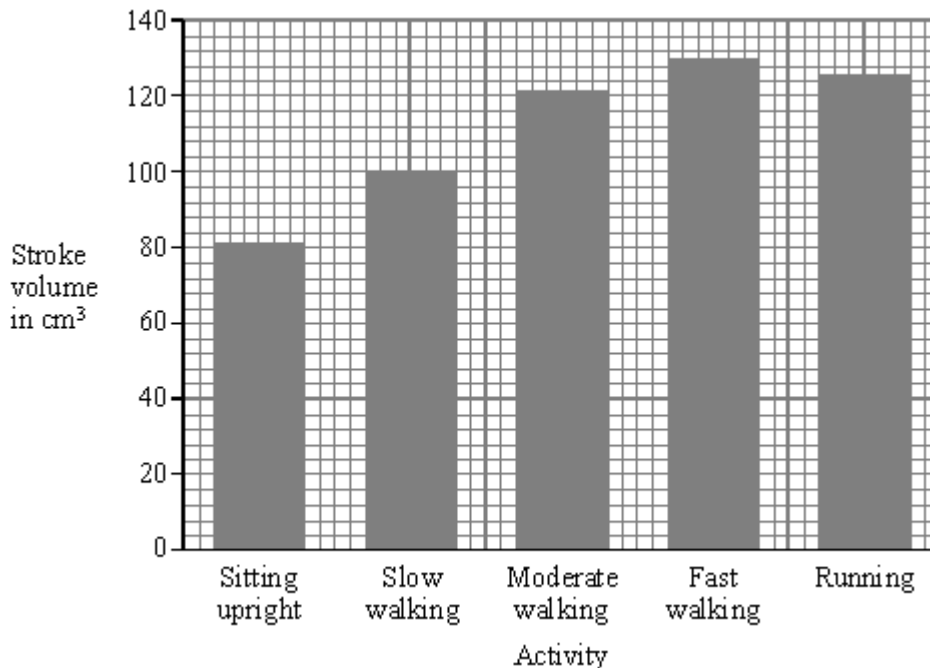
(Total 3 marks)

Q6.

A person did five different activities in turn. These activities needed increasing amounts of energy. For each activity two measurements were made. These were the rate of contraction of the left ventricle and its stroke volume (the volume of blood pumped at each beat). From these measurements the cardiac volume was calculated.

Some of these results are shown in the table and the bar chart.

Activity	Rate of contraction of left ventricle in beats per minute	Cardiac output in cm ³ per minute
Sitting upright	68	5 500
Slow walking		8 000
Moderate walking	98	12 000
Fast walking	130	17 500
Running	150	19 000



- (a) (i) Describe how a person can count the rate of beating of the left ventricle.

(1)

- (ii) Calculate the rate of ventricle contraction in beats per minute when the person

was walking slowly. Show clearly how you work out your final answer.

Rate of ventricle contraction _____ beats per minute.

(2)

- (iii) The pattern of results for stroke volume shows an anomalous result when the person is running. In what way is it anomalous?

(1)

- (iv) There was a change in cardiac output when the person's movement changed from fast walking to running. How did the heart produce this change?

(1)

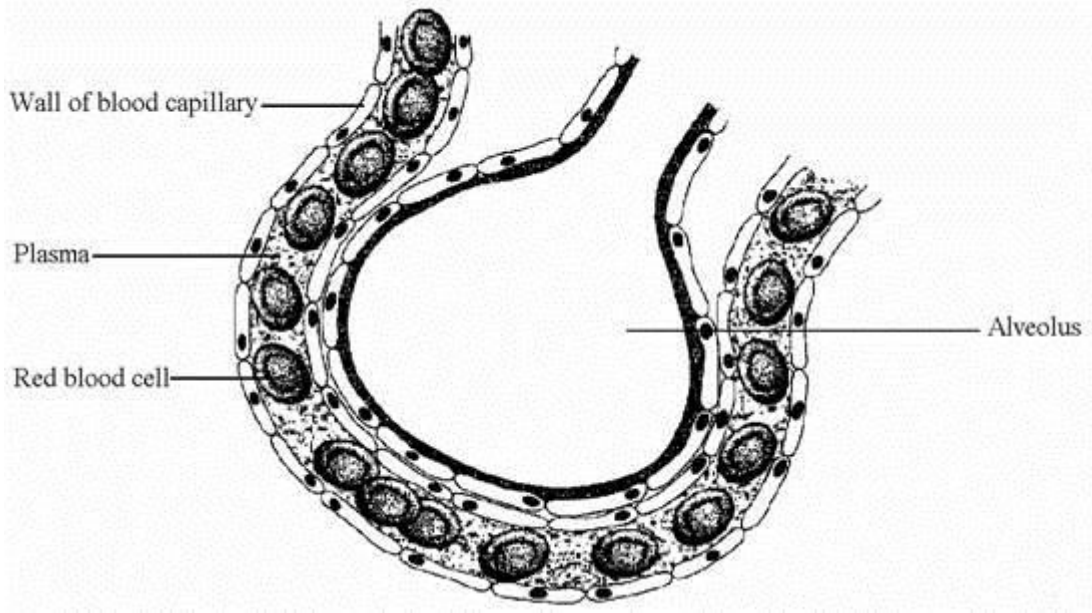
- (b) Over a period of time, regular exercise can strengthen the heart muscle. This change in the heart muscle enables a person to run for longer before lactic acid build up occurs. Explain the reason for this.

(2)

(Total 7 marks)

Q7.

The diagram shows a part of a lung that is involved in gaseous exchange in a human.



(i) Draw and label, on the diagram, **one** arrow to show the direction of movement of oxygen between the alveolus and capillary.

(1)

(ii) Draw and label, on the diagram, **one** arrow to show the direction of movement of carbon dioxide, between the alveolus and capillary.

(1)

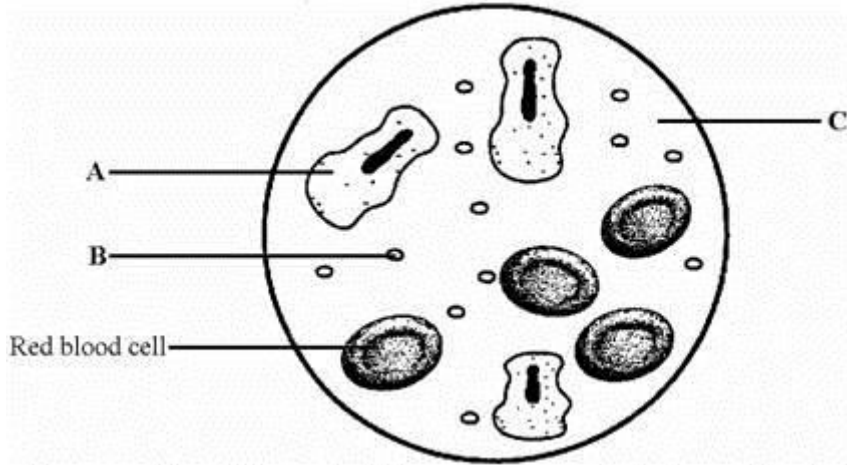
(iii) Give the function of the red blood cell in this process.

(1)

(Total 3 marks)

Q8.

The diagram shows four parts of blood.



(a) Complete the table to give the name and function of the parts labelled **A**, **B** and **C**.

Letter	Name	Function
A	_____	_____ _____
B	_____	_____ _____
C	_____	_____ _____

(6)

(b) Red blood cells contain haemoglobin. Explain how this enables red blood cells to pick up oxygen from the alveoli and release it to cells in other parts of the body.

(4)

(Total 10 marks)

Q9.

(a) What type of blood vessels join arteries to veins?

_____ (1)

(b) How are oxygen and carbon dioxide carried in the blood?

_____ (2)

(c) List **three** things that are carried around the body in the blood plasma.

1. _____
2. _____
3. _____ (3)

(Total 6 marks)

Q10.

The following sentences are about the blood system. Choose words from the list in the box to complete these sentences. You may use a word once or not at all.

diffuse	lowered	narrow	one
raised	spread	two	wide

Capillaries have thin walls which are _____ .cell thick. This allows nutrients from digested food to _____ through and reach the cells of organs. Capillaries are very _____ .and so blood flow through an organ is slowed down and blood pressure is _____ .

(Total 4 marks)

Q11.

(a) Complete the table to give one site where digestive substances are made.

Digestive substance	One site of production
bile	
amylase	
lipase	
protease	

(4)

(b) Describe **two** ways that the mouth can break down starchy foods.

(2)

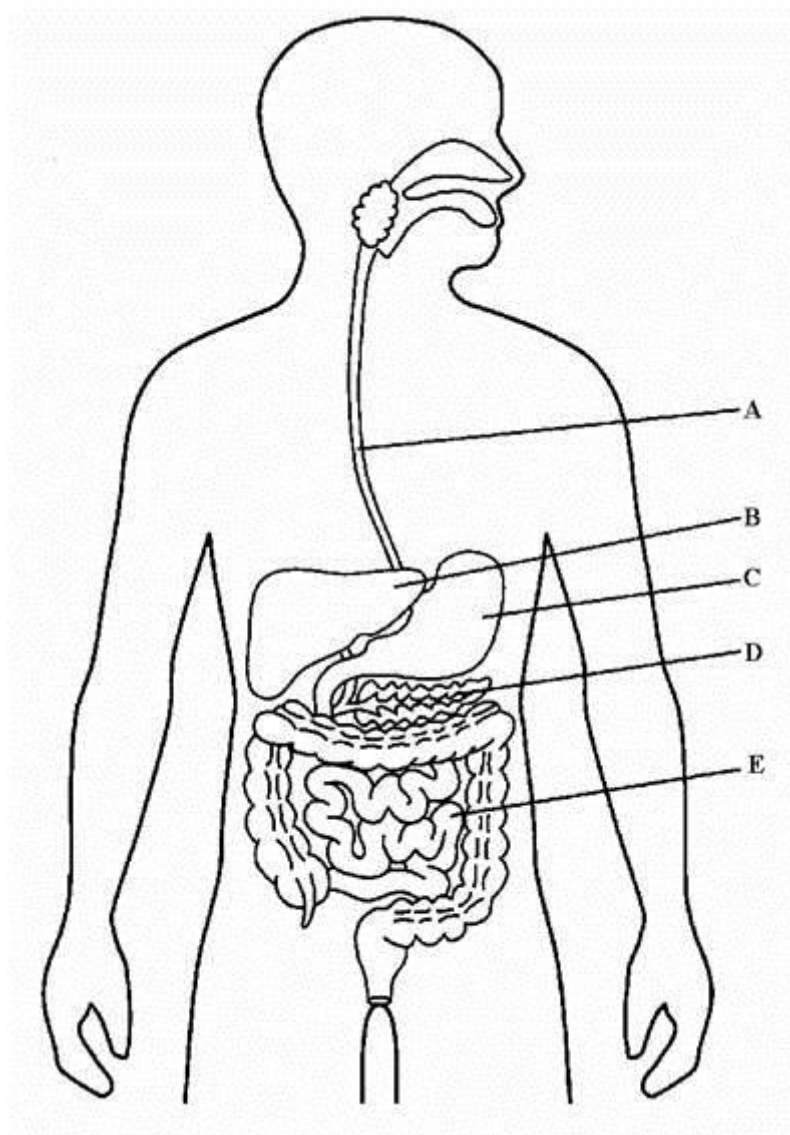
(c) Describe how the liver helps to digest fats.

(2)

(Total 8 marks)

Q12.

The diagram shows part of the human digestive system.



(i) Name part **B**.

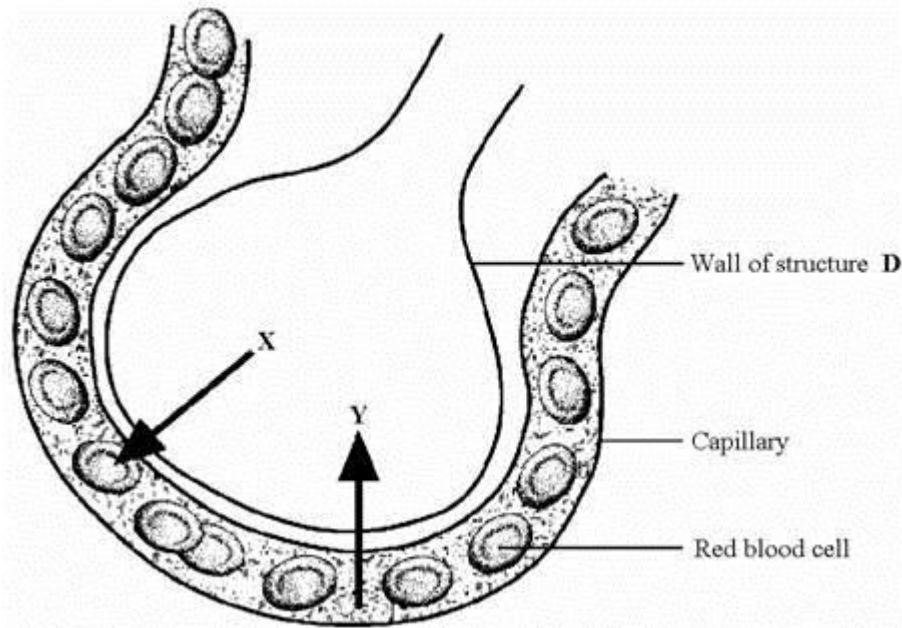
_____ (1)

(ii) Describe the role of **B** and **D** in reducing blood sugar levels.

(2)
(Total 3 marks)

Q13.

The diagram shows an enlargement of structure **D**.



The arrows show the direction of the gases exchanged in this structure. Name gas **X** and gas **Y**.

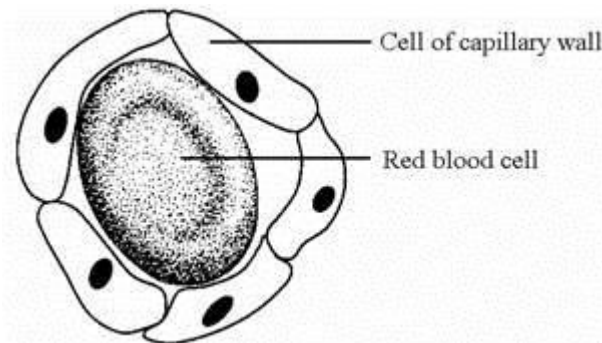
X _____

Y _____

(Total 2 marks)

Q14.

Capillaries are blood vessels in the body which join the arteries to the veins. They have walls which are one cell thick and so are able to exchange substances with the body cells.



(i) Name **two** substances that travel from the muscle cells to the blood in the capillaries.

1. _____

2. _____

(2)

- (ii) Glucose is one substance that travels from the blood in the capillaries to the body cells. Explain how this happens.

(2)
(Total 4 marks)

Q15.

- (a) Describe, as fully as you can, the job of

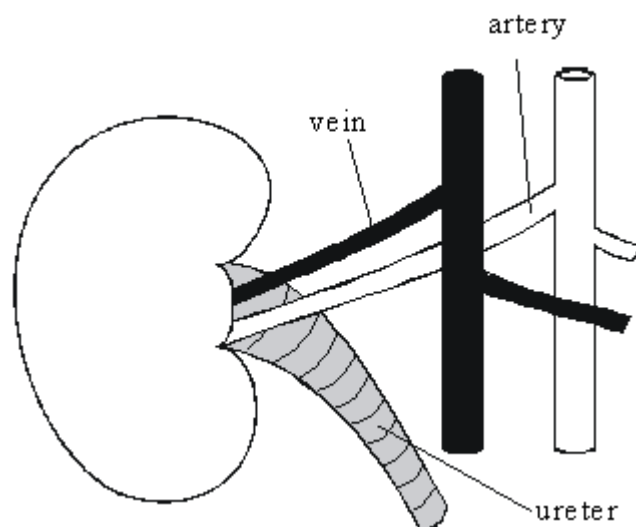
- (i) the circulatory system.

(2)

- (ii) the digestive system.

(3)

- (b)



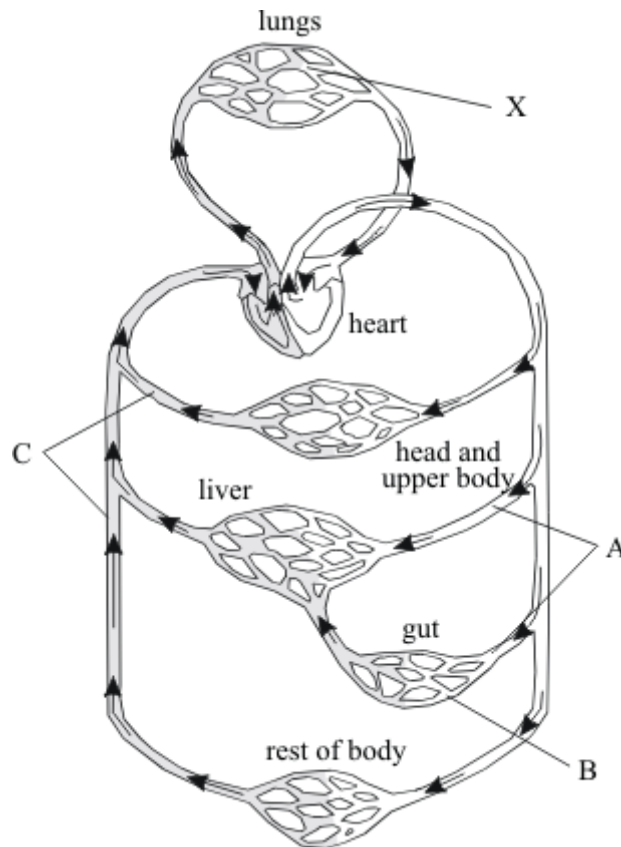
The drawing shows a kidney, its blood supply and the ureter (a tube which carries urine from the kidney to the bladder). The amount and composition of the urine flowing down the ureter change if the blood in the artery contains too much

water. Describe these changes and explain how they take place.

(4)
(Total 9 marks)

Q16.

The diagram shows part of the circulatory system.



(a) Name the types of blood vessel labelled A, B and C on the diagram.

A _____

B _____

C _____

(3)

(b) What is the job of the circulatory system?

(1)

(c) Give **two** ways in which the composition of blood changes as it flows through the vessels labelled X on the diagram.

1. _____

2. _____

(2)

(Total 6 marks)

Q17.

A dog runs across the road in front of a car. The driver slams her foot on the brakes.

(i) Explain how the nervous system brings about this response.

(4)

(ii) Explain why alcohol consumption would affect the driver's response.

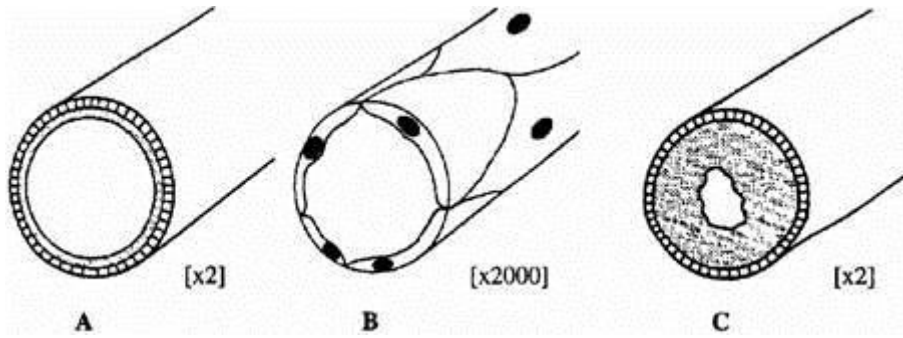
(1)

(Total 5 marks)

Q18.

The drawings show the structure of three types of blood vessel, **A**, **B** and **C**. They are

drawn to the scales indicated.



(a) Name the **three** types of blood vessel.

A _____

B _____

C _____

(3)

(b) Describe the job of blood vessel **B**.

(2)

(Total 5 marks)

Q19.

The table shows the amounts of carbohydrate, fat and protein in 100 g portions of five foods, A - E.

FOOD	MASS IN 100 g PORTION (g)		
	CARBOHYDRATE	FAT	PROTEIN
A	0	1	20
B	50	2	8
C	0	82	0
D	12	0	1
E	20	0	2

- (a) A person eats 50 g of food E.

How much carbohydrate would the person eat?

_____ g

(1)

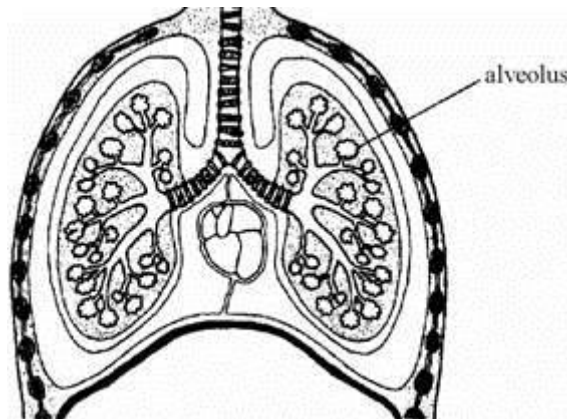
- (b) Describe, in as much detail as you can, what happens to the protein after food A is swallowed.

(4)

(Total 5 marks)

Q20.

- (a) The drawing shows some of the organs in the human thorax.

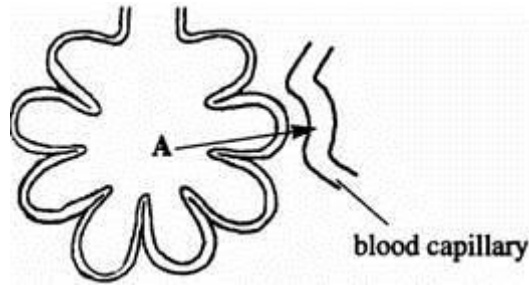


On the drawing, use guidelines to label:

- (i) the heart;
- (ii) a rib;
- (iii) the diaphragm;
- (iv) the trachea.

(4)

- (b) The drawing shows a section through an alveolus.



At **A**, oxygen moves from the air in the alveolus into the blood capillary. Explain, as fully as you can, how oxygen moves into the blood.

(2)
(Total 6 marks)

Q21.

- (a) A food contains protein. Describe, in as much detail as you can, what happens to this protein after the food is swallowed.

(4)

- (b) The table shows the activity of lipase on fat in three different conditions.

CONDITION	UNITS OF LIPASE ACTIVITY PER MINUTE
-----------	-------------------------------------

Lipase + acid solution	3.3
Lipase + weak alkaline solution	15.3
Lipase + bile	14.5

Explain, as fully as you can, the results shown in the table.

(3)
(Total 7 marks)

Q22.

The black pigment in human skin and eyes is called melanin. Production of melanin is controlled by a single pair of genes. A person who is homozygous for a recessive allele of the gene has no melanin and is said to be albino.

- (a) A man is albino. His wife is heterozygous for the melanin-producing allele.
- (i) The fertilised egg cell produced by the couple divides to form two cells.

Name the process of cell division involved.

(1)

- (ii) How many albino genes would there be in each of these two cells?

Explain your answer.

(3)

- (b) (i) Albino people are more likely than people with melanin to suffer mutations that cause cancer in their skin. Suggest why albino people have an increased chance of mutation in their skin cells.

(1)

- (ii) Sometimes, mutation in skin cells leads to cancers in other organs, such as the liver.

Explain how.

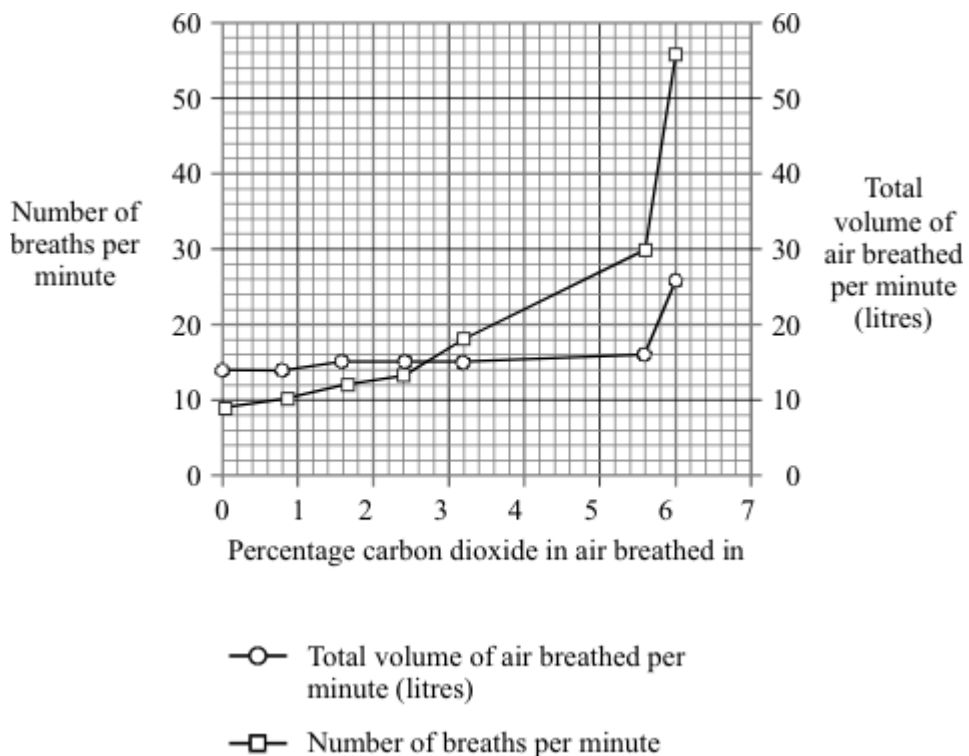
(2)

(Total 7 marks)

Q23.

The graph shows the effect of increasing the carbon dioxide content of the inhaled air on:

- the number of breaths per minute;
- the total volume of air breathed per minute.



- (i) Describe the effect of increasing the percentage of carbon dioxide in the inhaled air on the total volume of air breathed.

(2)

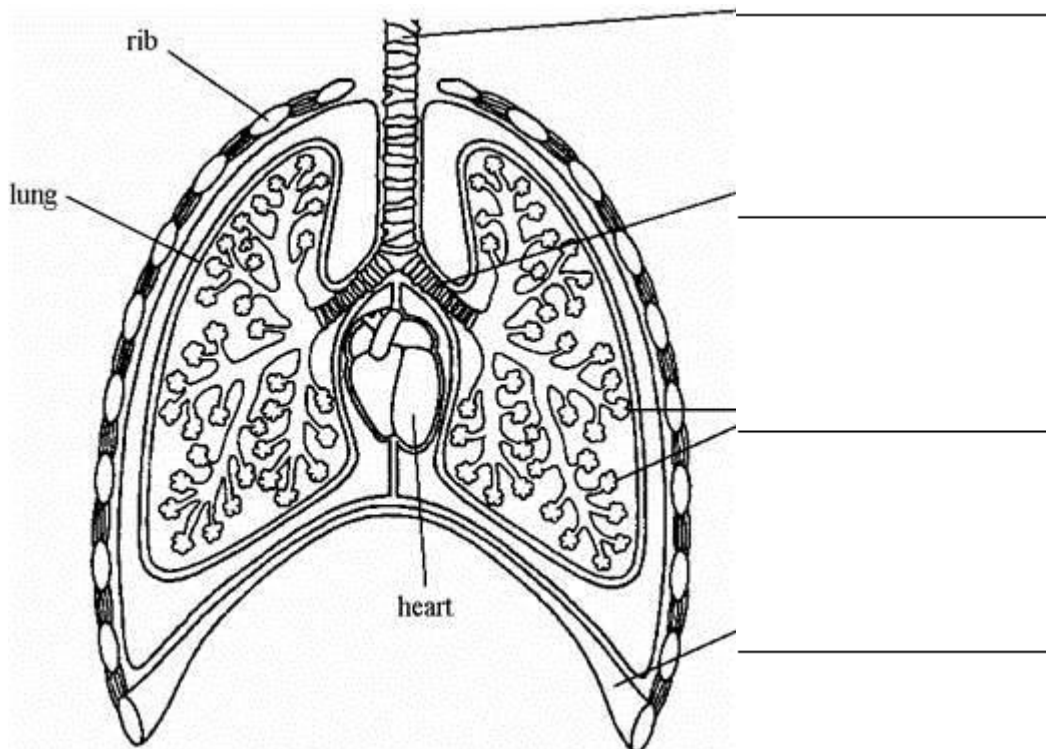
- (ii) Suggest why the total volume of inhaled air is **not** directly proportional to the number of breaths per minute.

(2)

(Total 4 marks)

Q24.

The diagram shows part of the breathing system in a human.



- (a) Use words from the list to label the parts on the drawing.

alveoli bronchiole bronchus diaphragm trachea (windpipe)

(4)

(b) Where in the lungs does oxygen enter the blood?

_____ (1)

(c) Which process in cells produces carbon dioxide?

_____ (1)

(Total 6 marks)

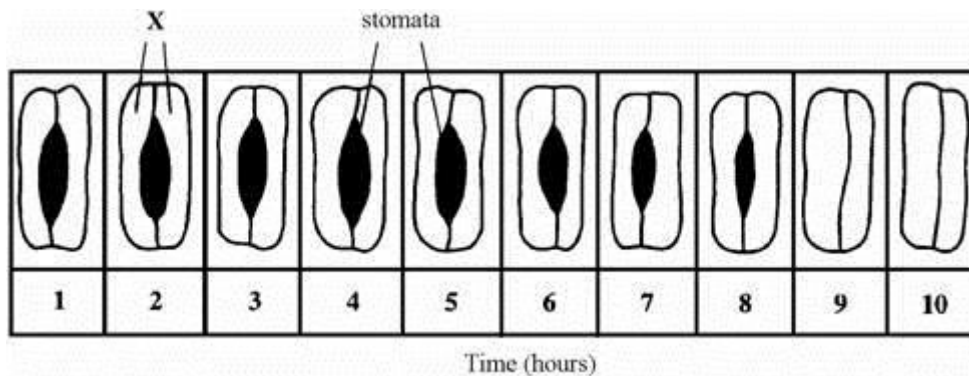
Q25.

Describe the roles of the liver and the pancreas in the digestion of fats.

(Total 5 marks)

Q26.

A potted plant was left in a hot, brightly lit room for ten hours. The plant was not watered during this period. The drawings show how the mean width of stomata changed over the ten hour period.



(a) Why do plants need stomata?

_____ (1)

(b) Name the cells labelled X on the drawing.

_____ (1)

(c) The width of the stomata changed over the ten hour period.
Explain the advantage to the plant of this change.

_____ (2)
(Total 4 marks)

Q27.

The table shows the composition of blood entering and leaving the lungs.

Gas	Concentration in arbitrary units	
	Blood entering lungs	Blood leaving lungs
Oxygen	40	100
Carbon dioxide	46	40

(a) Describe, in as much detail as you can, the changes that take place in the composition of blood as it passes through the lungs.

_____ (3)

(b) Which part of the blood:

(i) transports most carbon dioxide; _____

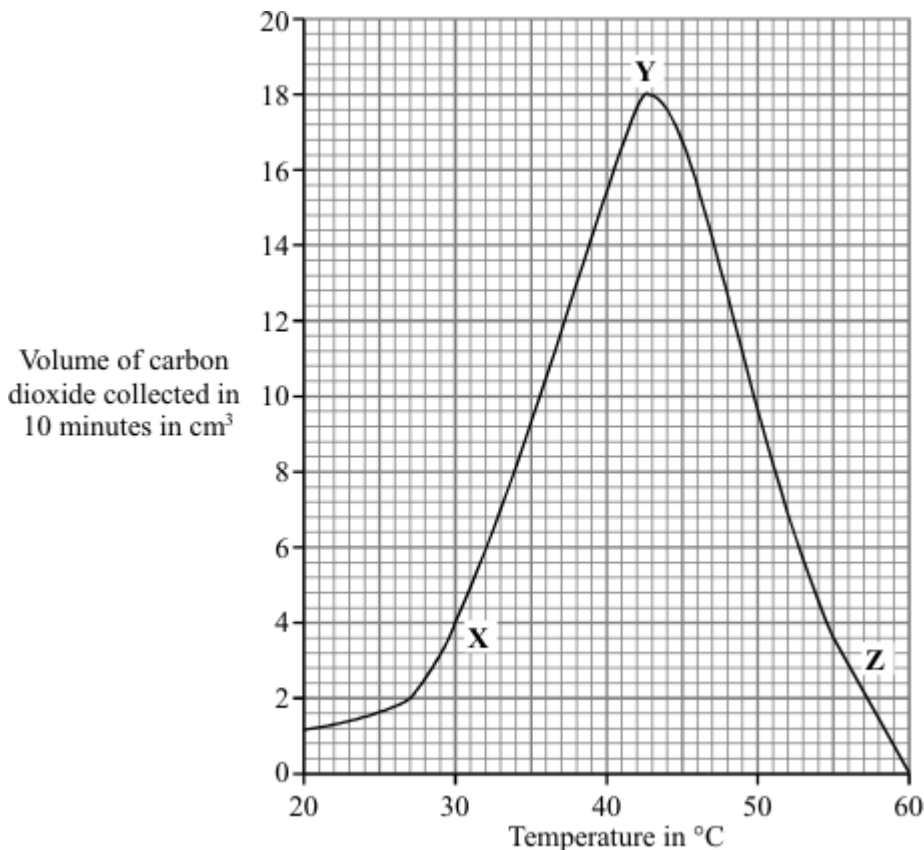
(ii) transports most oxygen? _____

(2)
(Total 5 marks)

Q28.

Fermentation of sugar by yeast produces carbon dioxide.

The graph shows the effect of temperature on the production of carbon dioxide by fermentation.



- (a) By how much did the volume of carbon dioxide collected change when the temperature was raised from 30°C to 40°C?

_____ cm³ (1)

- (b) Complete the sentences to explain the shape of the curve between X and Y.

Raising the temperature _____ the speed of the reacting particles.

These particles collide more _____ and more _____ .

(3)

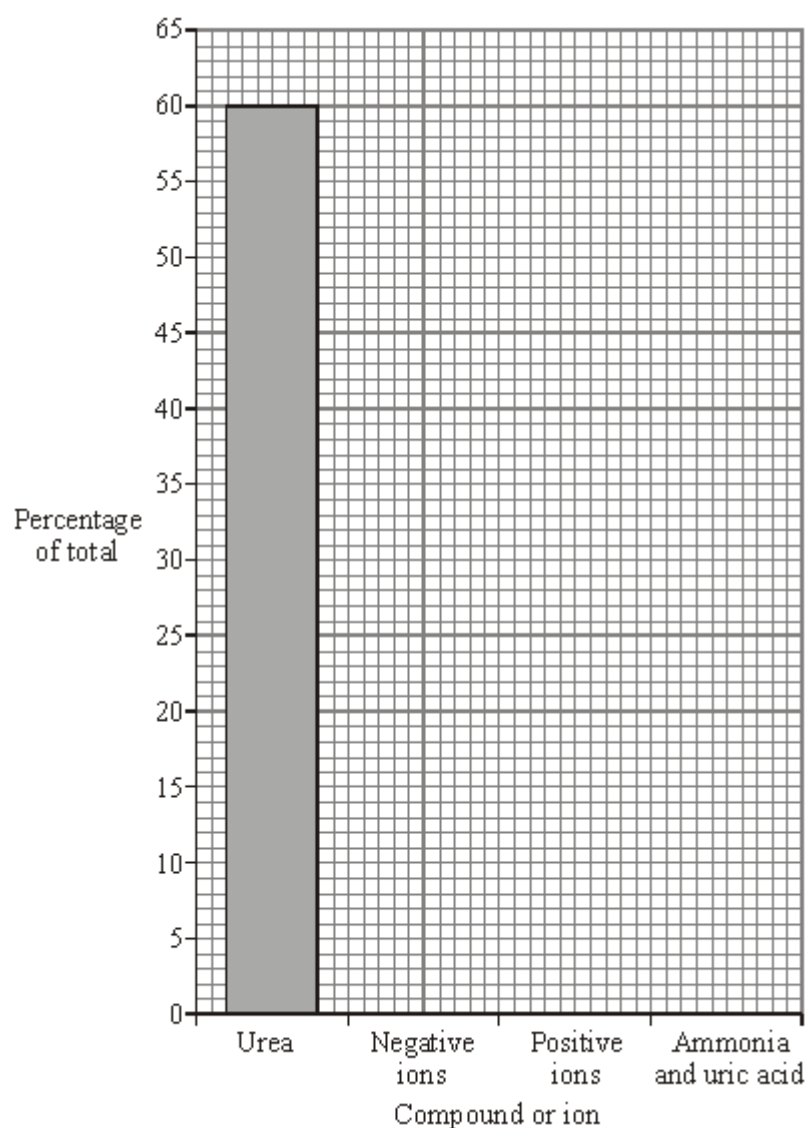
(Total 4 marks)

Q29.

- (a) The table shows the compounds and ions dissolved in a student's urine.

Compound or ion	Percentage of total
urea	60
negative ions	25
positive ions	10
ammonia and uric acid	5

(i) Complete the bar chart. One bar has been drawn for you.



(2)

(ii) There is a total of 10 g of compounds and ions dissolved in a sample of this student's urine. Calculate the mass of urea in the sample. Show clearly how you work out your answer.

Mass of urea _____ g

(2)

- (b) Use words from the box to complete the sentences.

anus bladder kidneys liver lungs

Plasma transports carbon dioxide from the body to the _____ .

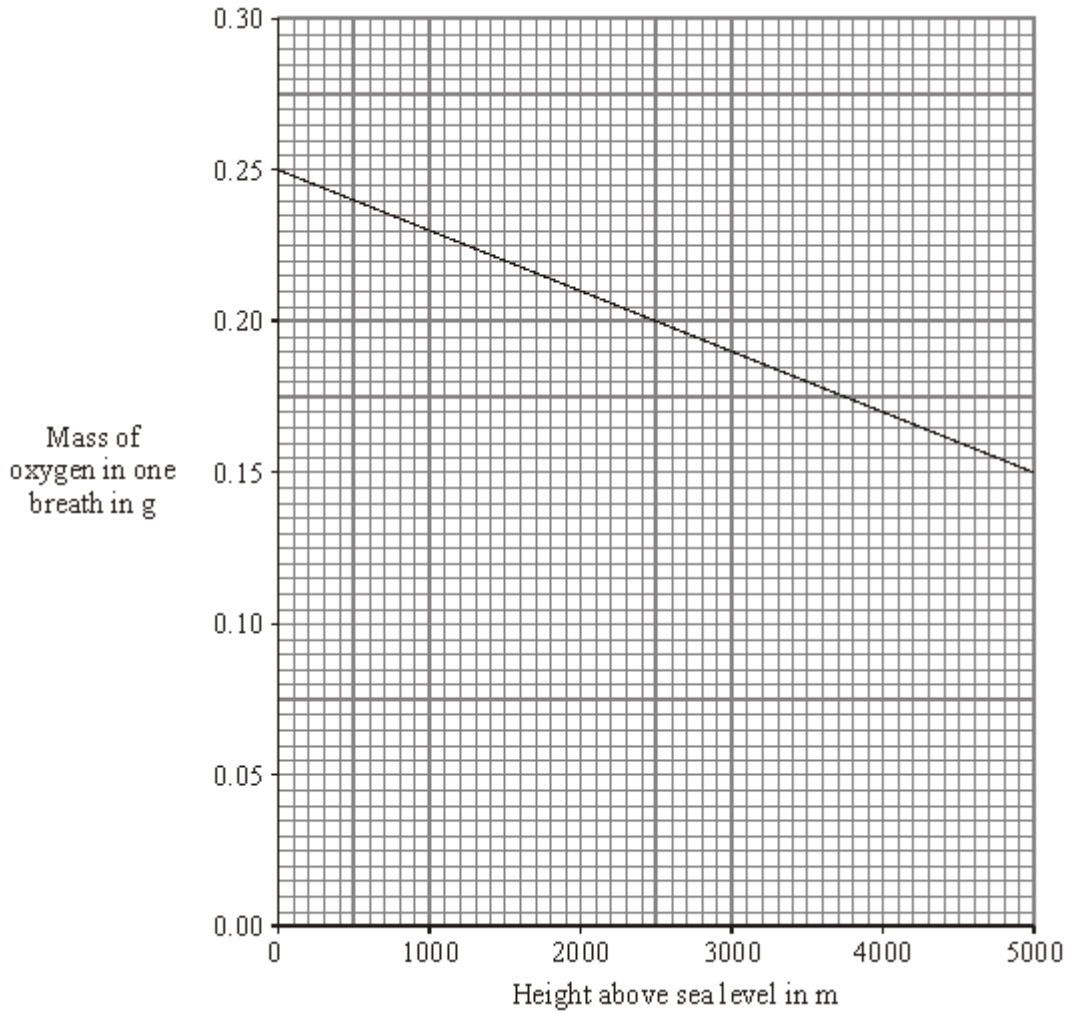
Plasma transports urea from the _____ to the _____ .

(3)

(Total 7 marks)

Q30.

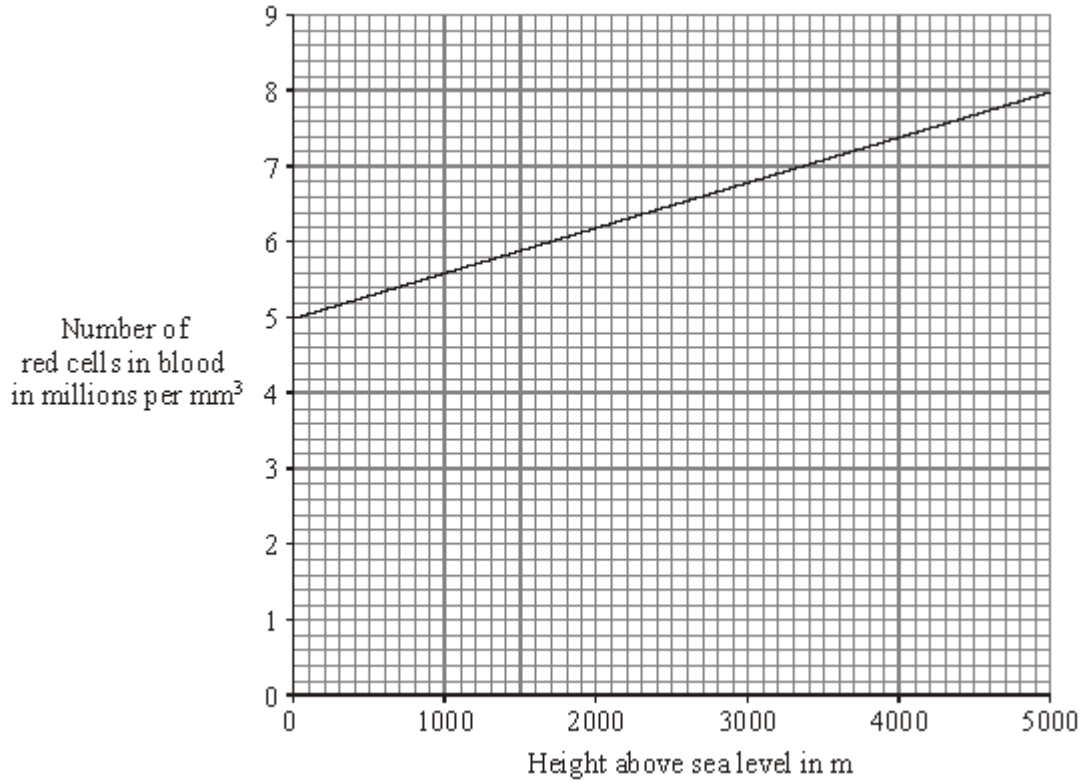
- (a) The graph shows how the mass of oxygen you breathe in changes as you climb up a mountain.



Describe, in as much detail as you can, how the mass of oxygen in one breath changes as you climb from sea level to 3000 m.

(3)

- (b) People who live high up in mountainous areas have more red blood cells than people who live at sea level. The graph below shows how the number of red blood cells changes with height above sea level.



- (i) How many more red blood cells does a person living at 3000 m above sea level have than someone living at sea level? Show clearly how you work out your answer.

Increase in number of red blood cells = _____ millions per m³

(2)

- (ii) What is the advantage of having more red blood cells?

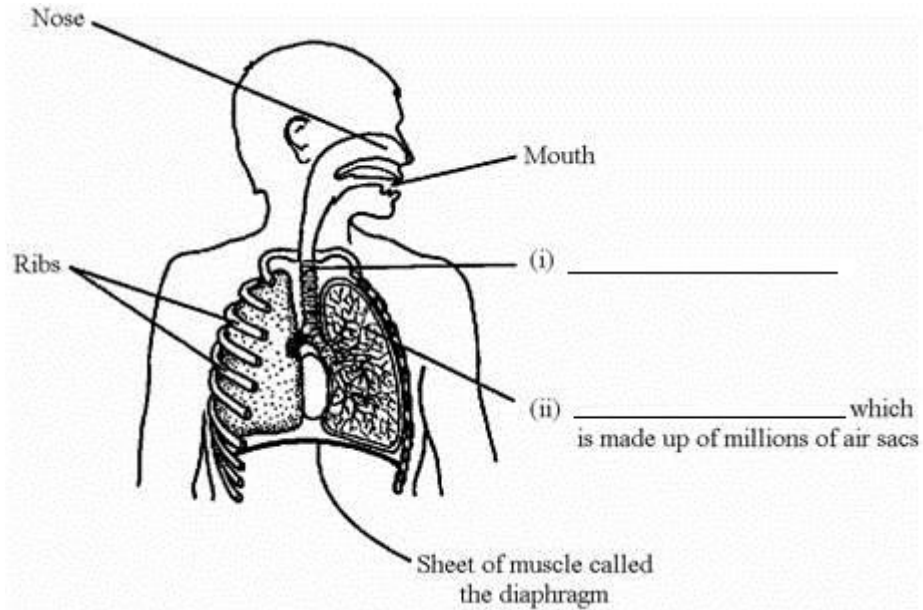
(1)

(Total 6 marks)

Q31.

The diagram shows the human breathing system.

- (a) Complete the labels (i) and (ii).



(2)

(b) Complete the following sentence.

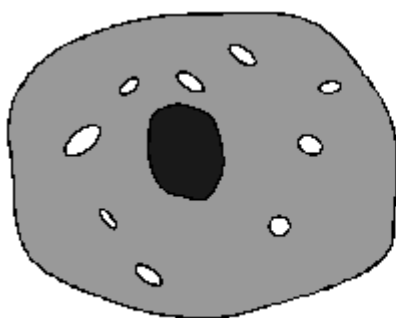
When we breathe out, the mixture of gases which leaves the air sacs contains **more** _____ and **less** _____ than the mixture of gases which enters the air sacs.

(2)

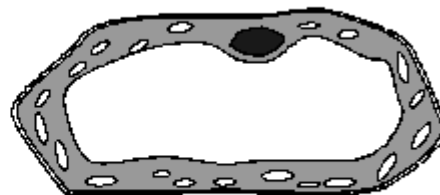
(Total 4 marks)

Q32.

The diagrams show a cheek cell from a human and a leaf cell from a plant.



Cheek cell



Leaf cell

(a) The two cells have a number of parts in common.

(i) On the cheek cell, label **three** of these parts which both cells have.

(3)

(ii) In the table, write the names of the **three** parts you have labelled above and describe the main function of each part.

Part	Function

(3)

- (b) Blood contains white cells and red cells. State the function of each type of cell in the blood.

White cells _____

Red cells _____

(2)

(Total 8 marks)

Q33.

- (a) (i) Complete the word equation for the process of aerobic respiration.

Glucose + _____ → carbon dioxide + water

(1)

- (ii) Which organ removes carbon dioxide from your body?

(1)

- (b) Use names from the box to complete the **two** spaces in the passage.

carbon dioxide	lactic acid	nitrogen	oxygen	water
----------------	-------------	----------	--------	-------

Anaerobic respiration can occur when an athlete does vigorous exercise.

This is because there is not enough _____ in the body.

The product of anaerobic respiration is _____.

(2)

(Total 4 marks)

Q34.

Blood contains plasma, platelets, red cells and white cells. Each has one or more important functions.

In the table below draw a line from each part to its function.

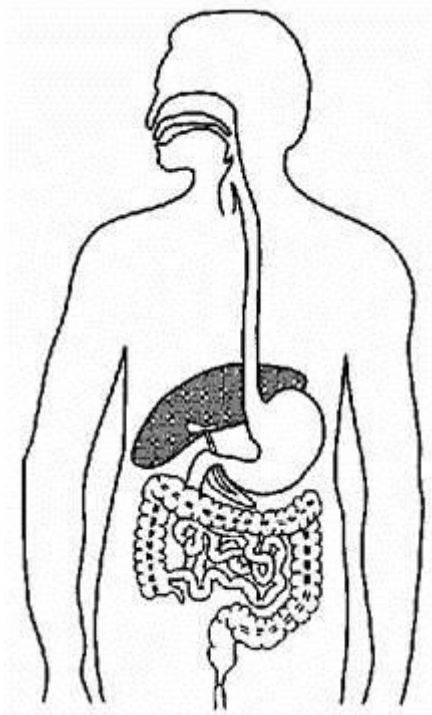
One part has two functions. Draw lines from this part to both functions.

Name of part of blood	Function of part of blood
red cell	fights bacteria
platelet	carries dissolved hormones
plasma	carries dissolved urea
white cell	transports oxygen around the body
	helps blood to clot

(Total 5 marks)

Q35.

The diagram shows the digestive system.



(a) Complete the following sentences about digestive enzymes.

(i) Amylase works in the _____ where it is involved in the digestion of _____ to _____ . (3)

(ii) Lipase works in the _____ where it is involved in the digestion of _____ to _____ . (3)

(b) Which gland produces:

(i) amylase;
_____ (1)

(ii) lipase?
_____ (1)

(Total 8 marks)

Mark schemes

Q1.

- (a) hold cells together **or** prevent flow of cells **or** trap cells 1
- (b) 12500
if correct answer, ignore working / lack of working
 $\frac{100}{0.008}$ for 1 mark
ignore any units 2
- (c) (i) size RBC approximately same size capillary **or**
 no room for more than one cell **or**
only one can fit **or**
 RBC is too big
allow use of numbers
*do **not** accept capillaries are narrow* 1
- (ii) more oxygen released (to tissues) **or**
 more oxygen taken up (from lungs) 1
- and any **two** from:
- slows flow **or** more time available
 - shorter distance (for exchange) **or** close to cells / capillary wall
 - more surface area exposed 2

[7]

Q2.

- in correct sequence:
- breathing 1
- diffusion 1
- respiration 1

[3]

Q3.

- (a) (i) liver 1
- (ii) on diagram:
 'X' on liver
 must be unambiguous (eg not overlapping gall bladder)
 intersection of X in liver 1
- (b) stomach 1
- small intestine
 accept duodenum or ileum
 extra wrong answers cancel the mark,
 eg small intestine (colon) = no marks 1
- (c) amylase not produced by stomach
 accept no starch digesting enzymes in the stomach
 accept correct enzyme not in stomach
 accept only proteases in stomach
 *do **not** accept protease does not digest starch* 1
- acid / low / wrong pH in stomach **or** enzyme would be denatured in stomach **or** amylase only works in neutral / alkaline conditions
 incorrect extra information cancels mark
 *do **not** accept amylase does not work in the stomach* 1

[6]

Q4.

- (a) (i) haemoglobin / oxyhaemoglobin
 must be phonetic 1
- (ii) carries oxygen **or** forms oxyhaemoglobin
 Ignore references to CO₂ / iron
 cancel if extras like food / glucose 1
- from lungs to tissues 1
- (b) no nucleus **or** biconcave disc (described)
 ignore references to size
 ignore vague references to being
 'round' / 'donut' shaped etc. 1

[4]

Q5.

- an atrium 1
- an artery 1
- a semi-lunar valve 1

[3]

Q6.

- (a) (i) count the pulse **or** count beats in artery in wrist neck **or** feel the pulse **or** take the pulse **or** find the pulse
*accept use of heart monitor **or** heart meter* 1
- (ii) 80
*2 marks for correct answer
1f answer incorrect allow 1 mark for showing 8000 divided by 100 **or** indicating cardiac output divided by stroke volume* 2
- (iii) Increased activity stroke volume falls / gets less / should get higher / reach a peak
*accept does not increase **or** changes from 134 cm³ to 127 cm³* 1
- (iv) 1ncreased / more ventricle contractions
*accept heart beat faster **or** it beats faster **or** more powerful contractions* 1
- (b) (stronger heart muscle) increases cardiac output **or** increases stroke volume
*accept pumps more blood (per beat) **or** pumps blood faster
ignore heart bigger* 1
- so more (oxygenated) blood can be sent to muscles
accept more oxygen sent to muscles 1

[7]

Q7.

- (i) oxygen into the blood stream
*arrow **must** start inside alveolus and finish outside the capillary* 1
- (ii) carbon dioxide out of the blood stream

arrow **must** start inside the capillary and finish inside the alveolus

1

- (iii) carries/takes up/releases oxygen or carbon dioxide
accept forms oxyhaemoglobin

1

[3]

Q8.

- (a) **A** white blood cell/leucocytes / phagocytes / lymphocytes
SEPARATE MARKING POINTS

1

make/contain antibodies/antitoxins

or

destroy/engulf/kill bacteria

do **not** accept fight infection

do **not** accept fight disease

1

B platelets

1

help clot the blood

do **not** accept stick together

do **not** accept from scabs

1

C plasma

1

carries/transport all the cells/digested food/waste products/hormones/carbon dioxide/platelets/dissolved minerals/antibodies/antitoxins/water

allows blood to flow

1

- (b) any four from:

(oxygen) diffuses

1

has affinity for/combines with oxygen / forms oxy-haemoglobin

do **not** accept absorbed

1

in areas of high oxygen concentration

n.b. 'pick up oxygen' is stem of question

1

in conditions of low oxygen concentration it breaks down and releases the oxygen

low oxygen concentration can be implied e.g. active muscles

1

Q9.

(a) capillaries 1

(b) (oxygen) in red blood cells **or** haemoglobin 1
*the candidate **must** make clear which substance is which for 2 marks*

(carbon dioxide dissolved in) the plasma
accept in haemoglobin in regions of high carbon dioxide concentration
*accept for 1 mark oxygen + CO₂ is transported by red blood cells **or** haemoglobin*
*do **not** credit red + white blood cells **or** combinations of right + wrong answers* 1

(c) **one** mark for each up to a maximum of **three**

red blood cells
award 1 mark for blood cells if no red or white

white blood cells (or named white blood cell up to 2)

platelets

urea
accept nitrogenous waste
*do **not** credit waste substances **or** products*

minerals (**or** one named mineral)
*accept ions **or** salts*

vitamins

water

hormones (named hormone up to 3)

protein (named blood proteins up to 2)

glucose
accept other named soluble sugar
*do **not** credit sugar(s) **or** blood sugar **or** sucrose*

fatty acids **or** glycerol

amino acids

digested food **or** nutrients (if individual foods not credited)

*do **not** credit starch **or** carbohydrates*

*do **not** credit nutrition **or** food*

*do **not** credit oxygen*

*do **not** credit haemoglobin*

carbon dioxide

accept nitrogen

antibodies

antitoxins

drugs **or** toxins (named up to 2)

bacteria **or** viruses

cholesterol

3

[6]

Q10.

one;

1

diffuse;

1

narrow;

1

lowered;

1

[4]

Q11.

(a) liver

1

mouth or salivary glands **or**
duodenum **or** small intestine **or**
pancreas

1

pancreas

*accept duodenum **or** ileum **or**
small intestine*

*do **not** accept stomach*

1

stomach **or** duodenum **or** ileum **or**
small intestine **or** pancreas

1

(b) teeth breakdown food
accept chewing 1

amylase **or** saliva (breaks down starch) 1

(c) produces bile (salts) 1

emulsifies (fat) **or** produces droplets
or disperses fat) 1

[8]

Q12.

(i) liver 1

(ii) liver **or** B stores glycogen
or pancreas **or** D makes insulin 1

clear description of link 1

[3]

Q13.

X – oxygen
accept O₂

Y – carbon dioxide
accept CO₂

[2]

Q14.

(i) any **two** from:
urea
carbon dioxide
water
lactic acid 2

(ii) higher concentration of glucose **or** more glucose in blood than cells 1

diffuses across 1

[4]

Q15.

- (a) (i) transport of substances **or** named substance **or** blood around the body
each for 1 mark

2

- (ii) breaks down (**not digests**) food absorption (into blood)
each for 1 mark

3

- (b) water filtered from blood
smaller proportion reabsorbed
therefore larger volume
of dilute urine produced
each for 1 mark

4

[9]

Q16.

- (a) A – artery
B – capillary
C – vein

3

- (b) transport OWTTE

1

- (c) increased oxygen decreased carbon dioxide

2

[6]

Q17.

- (i) eyes as sense organs/detector/receptors in eye,
electrical signals (impulses),
to co-ordinator,
then to leg muscles/effector
for 1 mark each

4

- (ii) affects the nervous system and slows down the reactions
for 1 mark

1

[5]

Q18.

- (a) A vein / venule
B capillary
C artery / arteriole
each for 1 mark

- 3
- (b) *idea that* substances or named substance pass in or out / diffuses between blood and tissue
each for 1 mark
e.g. oxygen passes from blood to cells gains 2 marks
- 2
- [5]
- Q19.**
- (a) 10
for 1 mark
- 1
- (b) digested / broken down / made soluble by protease / enzyme in stomach / in small intestine / from stomach / from pancreas into amino acids amino acids/smaller molecules/products of digestion absorbed into blood
any four for 1 mark each
- 4
- [5]
- Q20.**
- (a) correctly labelled structures (i – iv)
each for 1 mark
(allow labels as words or numbers: allow without guidelines if unambiguously labelled)
- 4
- (b) *ideas of* diffusion
 greater concentration of oxygen in alveolus / high to low oxygen concentration membrane / alveolus permeability
any two for 1 mark each
- 2
- [6]
- Q21.**
- (a) digested / broken down / made soluble by protease enzyme in stomach in small intestine / from stomach / from pancreas into amino acids
 amino acids / small molecules absorbed into blood
any four for 1 mark each
- 4
- (b) *ideas that*
 lipase / enzyme works best in alkaline / neutral conditions
 acid denatures or inactivates enzyme / inhibits enzyme activity
 bile emulsifies fat / bile produces larger surface area of fats / bile alkaline for enzyme to work on / which increase activity of enzymes

any three for 1 mark each

3

[7]

Q22.

- (a) (i) mitosis

for 1 mark

1

- (ii) 1

fertilised egg cell has 1 albino gene from father splits to produce identical cells / produced by mitosis

each for 1 mark

3

- (b) (i) less protection from UV light / UV radiation

for 1 mark

1

- (ii) ideas of uncontrolled multiplication of mutated cells reject fast / rapid cell division cells invade of other parts / cells transported in blood

each for 1 mark

2

[7]

Q23.

- (i) increase in CO₂ concentration leads to increase in volume of air inhaled
increase of % carbon dioxide has little effect over most of range / large increase when % carbon dioxide > 5.6 %

each for 1 mark

2

- (ii) *idea that*

depth of breathing changes at low % carbon dioxide, increase in % CO₂ results in volume of each breath increasing without increase / little increase in number of breaths

each for 1 mark

2

[4]

Q24.

- (a) trachea / windpipe
bronchus
alveoli
diaphragm

for 1 mark each

4

- (b) alveoli / air sacs (reject capillaries)

for one mark

1

- (c) respiration
for one mark

1

[6]

Q25.

pancreas produces lipase
which breaks down / digests fats into fatty acids and glycerol
liver produces bile / hydrogen carbonate
which neutralises acids / makes alkaline
provides optimum / best / most effective pH for lipase / enzyme action
bile emulsifies fats / description
increasing the surface area for lipase / enzyme to act on
any five for 1 mark each
(digestion is in stomach / liver / pancreas – penalise only once)

[5]

Q26.

- (a) allow carbon dioxide to enter / gaseous exchange (oxygen neutral)
(transpiration neutral)
for one mark
- (b) guard (cells)
for one mark
- (c) stops / reduces the rate of water loss / transpiration (*reject* if dark initiated)
stops / reduces wilting / description e.g. drooping / maintains turgor
for 1 mark each

1

1

2

[4]

Q27.

- (a) any **three** from

(concentration of) oxygen increases

by 60 (units)
allow oxygen more than doubles for 2 marks

(concentration of) carbon dioxide decreases

from 46 to 40 by 6 units
allow 'by a small amount'
N.B. usually the first 2 marks will be for the change in oxygen and carbon dioxide.
The third mark will be for a quantitative comment on one of

	<i>these changes</i>		3	
(b)	plasma		1	
	red (blood) cell / haemoglobin / oxyhaemoglobin		1	[5]
Q28.				
(a)	11	<i>accept 10.5 – 11.5</i>	1	
(b)	ideas of			
	increase / rises		1	
	frequently / often		1	
	energetically / violently		1	[4]
Q29.				
(a)	(i)	all plots correct		
		<i>Tolerance $\pm \frac{1}{2}$ square</i> <i>allow 1 mark for 2 correct plots</i>	2	
	(ii)	6		
		<i>correct answer with no working = 2</i> <i>allow 1 mark for $(60 \div 100) \times 10$</i> <i>N.B. correct answer from incorrectly</i> <i>recalled relationship / substitution = 0</i>	2	
(b)	lungs		1	
	liver		1	
	kidneys		1	[7]
Q30.				

- (a) falls 1
- from 0.25 1
- to 0.19
 but by 0.06 gains two marks
*if neither figure given, accept steadily /
 at constant rate for one mark
 accept mass of oxygen inversely related
 / negative correlation to height above
 sea level for 2 marks* 1
- (b) (i) 1.8
*accept correct readings from graph for (5 and 6.8) if
 subtraction incorrect for one mark
 allow one mark for correct subtraction from incorrect
 readings* 2
- (ii) (blood can carry) more oxygen 1
- [6]**

Q31.

- (a) (i) trachea
accept windpipe 1
- (ii) (left) lung **or** lungs
do not credit right lung 1
- (b) carbon dioxide **or** water vapour
do not credit just 'water' 1
- oxygen
*answers in terms of used air or fresh air or of temperature
 differences are not acceptable* 1
- [4]**

Q32.

- (a) (i) the three features correctly labelled on
 cheek cell (which are referred to in
 part (ii)
*label lines should touch or end very close to part no marks if
 leaf cell labelled*

nucleus

cytoplasm

cell membrane

mitochondrion

*accept mitochondria or one of these could be labelled
vacuole*

3

(ii) any **three** from

feature	function
nucleus	controls cell <i>accept contains genetic material or genes or chromosomes or stores information do not credit the brain of the cell</i>
cytoplasm occurs	where respiration occurs <i>accept contains food or mitochondria or reactions occurs</i>
membrane chemicals	less water or chemicals <i>accept surrounds the cell or lets some things in but not others do not credit keeps things out or protection in and or out</i>
mitochondria	where energy released <i>ecf from leaf cell labelling accept chloroplasts make sugar or glucose accept vacuole contains sap accept if cell wall mis labelled on cheek cell, support or hold together</i>

3

(b) fight **or** ingest **or** kill bacteria **or**
germs **or** viruses **or** microbes

*accept produce antitoxins or antibodies fight disease
(organisms)
do not credit fungus*

1

(transport) oxygen **or** carry
haemoglobin

accept transport carbon dioxide or helps form scabs

1

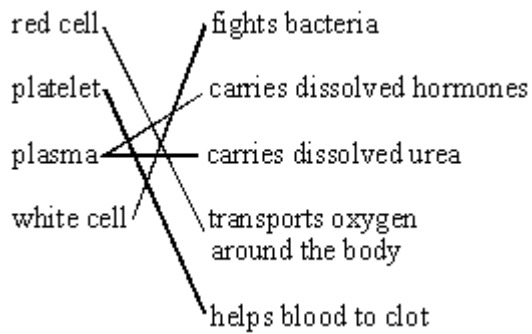
[8]

Q33.

- (a) (i) oxygen
do not credit air 1
- (ii) lung(s)
do not credit blood or nose or windpipe alone but accept as a neutral answer if included with lungs 1
- (b) oxygen 1
- lactic acid
both words required 1

[4]

Q34.



ticks or crosses on the RHS

[5]

Q35.

- (a) (i) mouth **or** saliva
accept small intestine 1
- starch 1
- maltose **or** glucose
do not credit sugar 1
- (ii) small intestine
accept duodenum or jejunum
do not credit intestines 1

- fats **or** lipids **or** oils
 fatty acids **or** glycerol 2
- (b) (i) salivary
 accept pancreas 1
- (ii) pancreas
 accept small intestine or ileum 1

[8]

Q1.

The man uses energy as he walks along. Energy is released in the cells in his body.

- (i) What name is given to this process which occurs in his cells?

Circle the correct name.

circulation reproduction respiration transpiration

(1)

- (ii) What gas is brought to his cells by the blood?

_____ (1)

- (iii) What gas is released by his cells and carried away by the blood?

_____ (1)

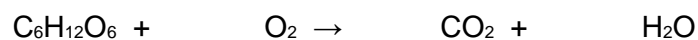
(Total 3 marks)

Q2.

- (a) Respiration is a process which takes place in living cells. What is the purpose of *respiration*?

 _____ (1)

- (b) (i) Balance the equation for the process of respiration when oxygen is available.



(1)

- (ii) What is the name of the substance in the equation with the formula $\text{C}_6\text{H}_{12}\text{O}_6$?

(1)

(c) Oxygen is absorbed through the alveoli in the lungs.

(i) How are the alveoli adapted for this function?

(2)

(ii) Name the gas which is excreted through the alveoli.

(1)

(d) (i) What is the name of the process of respiration when oxygen is **not** available?

(1)

(ii) Describe the process of respiration which takes place in human beings when oxygen is **not** available and give an effect.

(3)

(Total 10 marks)

Q3.

The table shows the percentage of some gases in the air a boy breathed in and out.

Gases	Air breathed in	Air breathed out
carbon dioxide	0.04%	4.0%
oxygen	20.0%	16.0%
water vapour	1.0%	6.0%

(a) What happens in the lungs to change the levels of oxygen and carbon dioxide in

this way?

Oxygen _____

Carbon dioxide _____

(4)

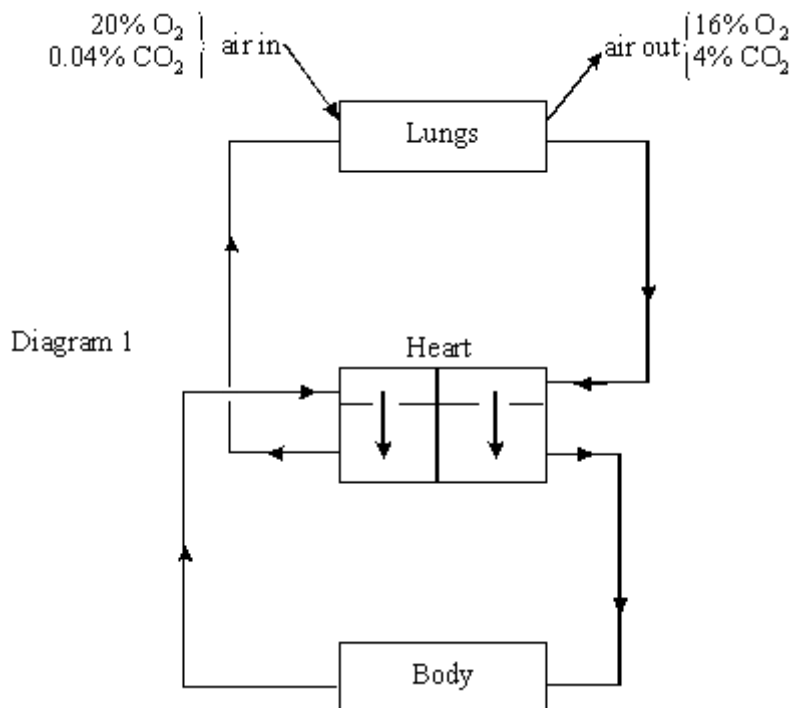
- (b) Compare the percentage of water vapour in the air breathed out with the percentage in air breathed in.

(2)

(Total 6 marks)

Q4.

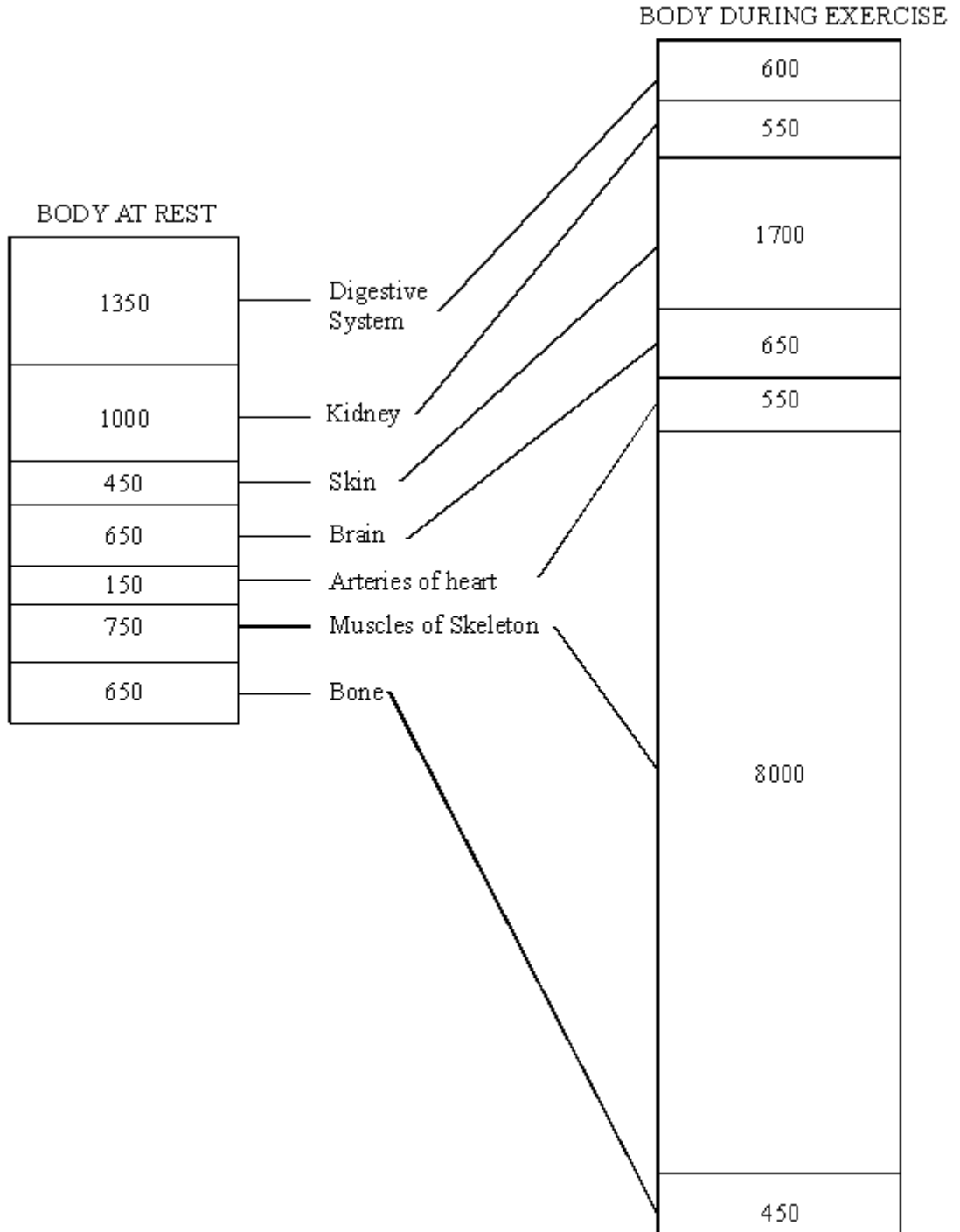
Diagram 1 shows the main features of human blood circulation.



- (a) What changes in the composition of **blood** occur in the lungs?

(2)

Diagram 2 shows how the circulation of blood changes between rest and exercise.



Rate of supply of blood to parts of the body (cm³/min) when at rest and during exercise.

(b) (i) Use the information from Diagram 2 to complete the table below.

Parts of the body to be included:

Digestive System

Skin

Brain

Arteries of Heart

Muscles of Skeleton

Bone

HOW BLOOD SUPPLY CHANGES DURING EXERCISE		
reduced	unchanged	increased
Kidney		

(4)

- (ii) What happens to the rate of supply of blood to the whole body with exercise?
(You should make full use of the information provided.)

(3)

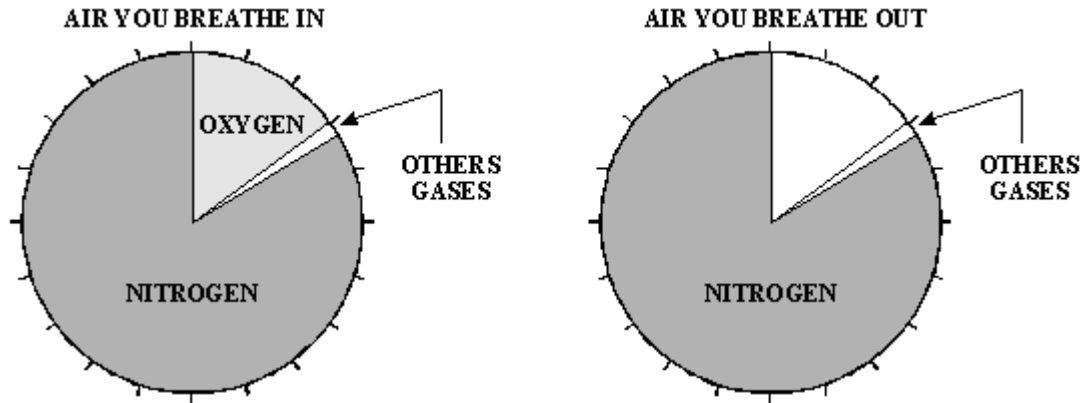
(Total 9 marks)

Q5.

- (a) Breathed-out air is different from breathed-in air.

The two pie-charts show the percentages of different gases in each.

Complete the second pie-chart, using the information from the table.



This air contains less than 1% carbon dioxide. (Too little to show)

Gases in breathed-out air	
nitrogen	79%
oxygen	16%
carbon dioxide	4%
other gases	1%

(3)

(b) Use the information above to complete the following sentences.

The air you breathe out contains more _____ than the air you breathe in.

The air you breathe out contains less _____ than the air you breathe in.

(2)

(Total 5 marks)

Q6.

As they go higher up a mountain, mountaineers take less oxygen into their bodies with each breath.



This is shown in the table below.

	MILLIGRAMS OF OXYGEN TAKEN INTO LUNGS WITH	MILLIGRAMS OF OXYGEN TAKEN INTO BLOOD WITH
--	---	---

	EACH NORMAL BREATH	EACH NORMAL BREATH
At bottom of mountain	300	60
At top of mountain	150	30

- (a) At the top of the mountain, they only take half as much oxygen into their lungs with each breath as they did at the bottom.

How does this affect the amount of oxygen that gets into their blood with each breath?

(2)

- (b) Why do the cells in the mountaineers' bodies need oxygen?

(1)

(Total 3 marks)

Q7.

As they go higher up a mountain, mountaineers take less oxygen into their bodies with each breath, as shown in the table below.

HEIGHT	MILLIGRAMS OF OXYGEN TAKEN INTO LUNGS WITH EACH NORMAL BREATH	MILLIGRAMS OF OXYGEN INTO BLOOD WITH EACH NORMAL BREATH	
		AT FIRST	AFTER STAYING AT 4500 METRES FOR TWO WEEKS
sea-level	300	60	90
1500 metres	250	50	
3000 metres	200	40	
4500 metres	150	30	45

- (a) (i) How does the amount of oxygen taken into the blood with each breath vary with the amount of oxygen breathed into the lungs with each breath?

(2)

- (ii) Use the idea of diffusion to explain why the amount of oxygen taken into the blood varies in this way.

(1)

- (b) (i) How does staying at an altitude of 4500 metres for two weeks affect the mountaineers?

(2)

- (ii) Suggest an explanation for this.

(1)

- (iii) Add the two missing figures to the right-hand column of the table.

(2)

(Total 8 marks)

Mark schemes

Q1.

- (i) respiration 1
- (ii) oxygen **or** O₂
*do not accept O **or** O²* 1
- (iii) carbon dioxide **or** CO₂
do not accept CO² 1

[3]

Q2.

- (a) to transfer / provide / give release energy
or production of ATP / adenosine triphosphate (molecules)
accept to give heat 1
- (b) (i) C₆H₁₂O₆ + 6O₂ → 6CO₂ + 6H₂O
accept any other
n : 6n : 6n : 6n ratio
do not credit if any other changes have been made 1
- (ii) glucose
do not credit sugar / sucrose 1
- (c) (i) any **two** from
large surface
thin (surface)
moist (surface)
(with a good) blood supply 2
- (ii) carbon dioxide
accept water vapour
do not credit just water 1
- (d) (i) anaerobic (respiration) 1
- (ii) any **three** from

in mitochondria

glucose decomposes / breaks down / reacts

or *glucose* → *lactic acid* for (2) marks

to give lactic acid

or *breathing hard*

or *lactic acid* → *CO₂ + water*

causing pain

(leaving an) oxygen debt

(quick) source of energy

(but) less efficient than aerobic respiration

accept less efficient than with oxygen

3

[10]

Q3.

(a) oxygen passes from the air/lungs into the body

gains 1 mark

but

oxygen passes from the air/lungs into the blood

gains 2 marks

carbon dioxide passes from the body into the air/lungs

gains 1 mark

but

carbon dioxide passes from the blood into the air/lungs

gains 2 marks

4

(b) increased/5% more

gains 1 mark

but

6 times more (in air breathed out)

gains 2 marks

2

[6]

Q4.

- (b) carbon dioxide
oxygen

for 1 mark each

Do not allow water vapour.
(Allow correct symbols/formulae)

2

[5]

Q6.

- (a) less / low

gains 1 mark

but

(also) half as much **or** still one fifth of what's breathed in

gains 2 marks

2

- (b) for energy / respiration [credit for movement / to keep warm]

*[Do not allow "to live"]
for 1 mark*

1

[3]

Q7.

- (a) (i) increasing one increases the other

gains 1 mark

but

they increase in proportion/ 1/5 taken in at first / 3/10 taken in after 2 weeks

gains 2 marks

2

- (ii) *idea that* more/faster diffusion with higher concentration

for 1 mark

or

with more oxygen particles/molecules (in same space)

1

- (b) (i) can take more oxygen from (the same) air/changes from 30 to 45/increases by 15

gains 1 mark

but

takes 50% more or 1.5 times as much

gains 2 marks

2

- (ii) more red blood cells develop
or
more haemoglobin in the blood
(*not just 'acclimatises'*)
for 1 mark

1

- (iii) 75
60
each for 1 mark

2

[8]